

Initial Environmental Examination

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India: Assam Solar Project

Output 3, 25 MW Battery Energy Storage System
Output 4, Distribution System Enhancement

Prepared by Assam Power Distribution Company Limited, Government of Assam for the Asian Development Bank (ADB).

CURRENCY EQUIVALENTS

(as of 14 July 2024)

Currency Unit	–	Indian rupee (Rs)
Rs1.00	=	\$ 0.0120
\$1.00	=	INR 83.55

\$ refers in this report to United States Dollars

ABBREVIATIONS

ACSR	aluminum conductor steel reinforced
ADB	Asian Development Bank
AEGCL	Assam Electricity Generation Company Limited
AERC	Assam Electricity Regulatory Commission
AOA	area of assessment
APDCL	Assam Power Distribution Company Limited
ASI	Archaeological Survey of India
BESS	battery energy storage system
CAP	corrective action plan
CEA	Central Electricity Authority
CGWA	Central Ground Water Authority
CNHA	critical and natural habitat assessment
CPCB	Central Pollution Control Board
DFO	district forest officer
EHS	environmental, health and safety
EHSG	environmental, health and safety guidelines
EMF	electromagnetic field
EMoP	environmental monitoring plan
EMP	environmental management plan
EPC	engineering, procurement and construction
ESZ	eco-sensitive zone
GRC	grievance redressal committee
GRM	grievance redress mechanism
IBA	important bird area
IBAT	integrated biodiversity assessment tool
ICNIRP	International Commission for Non-Ionizing Radiation Protection
IEE	initial environmental examination
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
JV	joint venture
KBA	key biodiversity area
MOEF&CC	Ministry of Environment, Forest, and Climate Change
NAAQS	national ambient air quality standards
NABL	National Accreditation Board of Testing and Calibration Laboratories
NBWL	National Board of Wildlife
NGEAL	New Green Energy Assam Limited (JV)
NGT	National Green Tribunal
OHL	overhead line

PAI	project area of influence
PCB	polychlorinated biphenyl
PCR	physical cultural resources
PIU	project implementation unit
PMC	project management consultant
PMU	project management unit
PCBA	Pollution Control Board, Assam
POP	persistent organic pollutant
PPE	personal protective equipment
ROW	right of way
SEIAA	State Environmental Impact Assessment Authority
SPCB	State Pollution Control Board
WHO	World Health Organization
WLS	wildlife sanctuary

WEIGHTS AND MEASURES

dB(A)	-	A-weighted decibel
amp	-	ampere
ckm	-	circuit km
km	-	kilometer (1000 meters)
kV	-	kilo volt
kVA	-	kilo volt ampere (1000 volt ampere)
kWh	-	kilowatt-hour (1000 watts)
kWp	-	kilowatt peak
LV	-	low voltage
m	-	meter
sqm	-	square meter
MVA	-	mega volt ampere (1000 kVA)
MW	-	megawatt (1000 kilowatts)

NOTES

In this report, "\$" refers to US dollars unless otherwise stated.

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EXECUTIVE SUMMARY

I. Government of India has requested the Asian Development Bank (ADB) to finance a project of Assam Power Distribution Company Limited (APDCL), Government of Assam (GoA). The project will be financed through a project loan and have the following outcome: access to clean and reliable electricity in Assam improved. The project will support the creation of a joint venture and development of a 25-megawatt (MW) pilot grid-connected battery energy storage system (BESS) installation at the Kukurmara Mirza transmission substation (Output 3) to meet peak demand and to improve grid stability. Electricity distribution infrastructure in East and West Karbi Anglong districts and in the rural parts of the neighbouring district of Dima Hasao (Output 4) will be upgraded by the project. The project will also support solar photovoltaic electricity capacity (Outputs 1 and 2) which will feed into the grid. The scope of this initial environmental examination (IEE) report is based on the environmental assessment for Output 3 and Output 4, whilst for Output 1 and Output 2 a separate IEE has been prepared.

II. Under Output 3, a pilot grid-connected BESS of 25 MW (100 megawatt-hour) is to be installed on land owned by New Green Energy Assam Limited (NGEAL) – a newly created joint venture (JV) between APDCL and Oil and Natural Gas Corporation Tripura Power Company (OTPC) inside the existing Assam Electricity Grid Corporation Limited (AEGCL) 400kV Kukurmara Mirza transmission substation located in Sathikapara, Mirza in Kamrup District. Land has been contributed to the JV by AEGCL. A bay extension will be required in the substation. Under Output 4, the electricity distribution system in the surrounding areas of the proposed solar site in the East Karbi Anglong and West Karbi Anglong districts and in the rural parts of the neighbouring district of Dima Hasao district will be enhanced, including (a) installation of new power transformer with associated works at the existing 33/11 kV Gunjung substation in Dima Hasao district; installation of additional power transformers with associated works including switchgear in the existing 33/11 kV Baithalangso and 33/11 kV Umpanai substations in West Karbi Anglong district; (b) installation of 88 new 11/0.415 kV distribution transformers (DTR) of 250, 100, 63 and 25 kVA capacities in East and West Karbi Anglong and Dima Hasao districts; (c) installation of 39.4 km of new 11 kV covered conductor and 87.6 km of new low tension (LT) 0.4 kV aerial bundled conductor (ABC) line associated with the installation of the DTRs; (d) reconductoring of 59 km of 11 kV feeder bare conductors using steel poles with covered conductors, and (e) conversion of 360.75 km of existing bare LT 0.4 kV line to ABC line on new pole. Both these project outputs need further environment assessment, as reported in this IEE.

III. The Power (Electricity) Department of Government of Assam (GoA) will be the executing agency and APDCL will be the implementing agency. The project will be implemented, supervised and monitored by the project management unit (PMU) at APDCL respectively, which will be headed by the Project Director. Through an equity contribution financed by the project, the JV management will be responsible for delivering the BESS (Output 3) whilst a Project Manager under the PMU will be responsible for delivering the distribution component (Output 4) supported by a project implementation unit (PIU) team in the field. A Project Management Consultant (PMC) firm will be hired to support APDCL and the JV in implementing Output 3 and Output 4. The project will be implemented over seven years starting October 2024 with a completion date by September 2031 although construction works for the BESS will complete in 12 months and distribution components are anticipated to complete within 36 months.

IV. This initial environmental examination (IEE) is prepared in compliance with ADB's Safeguard Policy Statement (2009), considering the environment, health and safety requirements of Government of India and GoA. As per ADB's Safeguard Policy Statement (2009), the project is categorized as B for environmental safeguards and therefore an IEE was

required. The project is categorized B because its components are unlikely to cause significant adverse irreversible, diverse or unprecedented environmental impacts. For Outputs 3 and 4 there will not be any major, large-scale civil or structural works involved (civil works include foundation installation, building construction and pole erection), with most works are electrical and mechanical. Construction of one new building of up to two floors (200 square foot) for the BESS control room will be the largest civil or structural works. For Output 4, criteria and principles set out in the IEE will be followed to ensure distribution lines with potentially significant impacts are avoided. Overall pre-construction, construction, operation and maintenance of the project is likely to give rise to direct, indirect, cumulative and, induced environmental impacts that are mostly moderate/medium to minor/low in magnitude, site-specific, generally reversible, temporary and of short duration, primarily during construction works. Potential impacts and risks can be easily mitigated through the adoption of international good practices for environmental management as set out in the International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines, including the General Guidelines, and those on Electric Power Transmission and Distribution, as well as wildlife sensitive design features e.g., adequate height, spacing and insulation on distribution lines to prevent electrocution of elephants in elephant movement areas, birds etc. The selection and design of new equipment will comply with national requirements as well as considering international good practice per the IFC EHS Guidelines, particularly with respect to avoiding the use of polychlorinated biphenyl (PCB) oil in the purchase of new transformers (already banned in India) and the use of all asbestos-containing materials in new construction. This IEE has been prepared to document the environmental impacts of Outputs 3 and 4, define the measures required for the mitigation and monitoring of those impacts, and includes the environmental management plan (EMP) for implementation.

V. The BESS site is located at 8.4 km from Deepor Beel wildlife sanctuary (WLS) and inside its eco-sensitive (ESZ) requiring intimation to the Department of Environment and Forests, Assam. The BESS site itself is on modified habitat inside an existing substation supporting no trees. Since only a few saplings, shrubs, herbs and grasses will need to be cleared, no significant habitat loss will result. The distribution component covers three districts supporting six WLS and their ESZs, Key Biodiversity Areas (KBAs), Important Bird Areas (IBAs), Elephant Reserves, and Reserved Forest including District Council Reserved Forest. At least 13 restricted-range species are likely to qualify the three districts as critical habitat. None of the existing substations under Output 4 will impact on these sensitive receptors. Indicative routes for the 11 kV lines have been mapped, but LT lines have yet to be mapped. The indicative 11 kV distribution line routes were observed to be outside the WLS. Application of the criteria and principles set out in the IEE, will further ensure all distribution lines including LT lines are outside them following final route alignment. Some 11 kV and LT distribution lines may however be routed on existing rights of way (RoWs) in the ESZs, KBAs, IBAs, Elephant Reserves, and Reserved Forest after obtaining requisite permissions as identified from mapping the indicative 11 kV distribution line routes and screening the general localities of LT lines against ESZ and internationally recognized site boundaries and forest land data. Site walkovers of the sampled distribution lines and consultations did not identify any flora or fauna species of high biodiversity value with distribution lines mostly routed along road RoWs in modified habitat. It is anticipated significant impacts on natural habitat can be avoided since all the routes will follow existing RoWs albeit with minor diversions. Works at all sites will be carried out following ecological survey to reconfirm no species of high biodiversity value are supported. In and within 500m of areas of high biodiversity value (WLS and ESZs, KBAs, IBAs, Elephant Reserves and Reserved Forests) and supporting natural habitat works will be carried out under ecological supervision to ensure disturbance is minimized. No tree cutting is envisaged but some trimming of lopping following ecology survey to check for nesting or roosting birds and bats may be needed. If required, compensatory reforestation will be provided per government norms for any trees cut. The nearest Archaeological Survey of India (ASI) or GoA protected monument to the BESS and substation sites is at 9 km from Gunjung substation, the Debra Group of monoliths Dubungling ASI. Sampled indicative 11 kV

distribution line routes were observed to be located at least 300m (regulated zone) away from these monuments. Application of the criteria and principles set out in the IEE, will further ensure all distribution lines including LT lines are outside them following final route alignment. There are however locally important cultural heritage resources observed along the indicative distribution line routes and potential for chance find in all districts. All storage areas and any labor camps will be located inside existing substations or outside of the high biodiversity value areas and natural habitat. During construction, damage to locally important cultural heritage resources will be avoided and chance find procedures will be adopted. Once constructed, the BESS and substations will have minimal impact on both biodiversity and cultural heritage resources. Since only covered conductors or ABC and distribution lines high enough to allow passage of elephant are proposed, electrocution risk from the distribution lines will be minimized, although risk of collision for those in proximity to high biodiversity areas will remain.

VI. The detailed route alignments of the various distribution lines under Output 4 will be determined by the contractors upon mobilization. Although 11 kV lines have been screened in this IEE, the impact of the final routings will need to be confirmed. Since they have not been mapped yet, most LT lines and DTR sites cannot be screened by the IEE. The criteria APDCL and their contractors will adopt to ensure significant impacts are avoided by distribution lines including LT lines are: (i) lines and their related equipment in natural habitat will only be installed where significant conversion or degradation of ADB-defined natural habitat can be avoided, (ii) lines and their related equipment in ADB-defined critical habitat (all areas of the districts) will only be installed where site-specific biodiversity assessment demonstrates significant adverse impacts can be avoided, (iii) no lines or related facilities in Wildlife Sanctuaries will be taken up, (iv) no lines or related facilities in Elephant Reserves or Reserved Forests (including District Council Reserved Forests) which are requiring Wildlife or Forest Clearance will be taken up—existing RoWs will only be used if the Forest Clearance has already been granted and a No Objection Certificate is available, (v) in Elephant Reserves and Reserved Forests (including District Council Reserved Forests) only covered conductor 11 kV and ABC LT lines following existing RoWs without minor diversions (unless they remain in existing road RoWs) and not requiring new access track construction will be taken up having first received a written no-objection from the Environment and Forest Department of Assam, (vi) in the eco-sensitive zones (ESZ) of Wildlife Sanctuaries of Assam or Nagaland only covered conductor 11kV and ABC LT lines following existing RoWs without minor diversions (unless they remain in existing road RoWs) and not requiring new access track construction will be taken up with intimation to and the confirmation of the Environment and Forest Department of Assam and Nagaland Forest Department (if applicable) that no further permission is required, (vii) in Key Biodiversity Areas (KBAs) and Important Bird Areas (IBAs) only covered conductor 11kV and ABC LT lines following existing RoWs without minor diversions (unless they remain in existing road RoWs) and not requiring new access track construction will be taken up, (viii) no lines or related facilities in the protected or regulated zone of Archaeological Survey of India and Directorate of Archeology Assam protected monuments will be taken up, and (ix) lines and related facilities will only be installed where significant damage to local physical cultural resources can be avoided and physical cultural resources do not need to be removed from their current location. In addition, APDCL will avoid or minimize damage to existing trees, especially private trees, properties and public utilities. Safety clearances will be met and if there is encroachment into existing RoWs minor diversions will take place to ensuring these are maintained, routing over school compounds, playgrounds or other areas where children as vulnerable members of the community assemble without parental supervision will be avoided. Wildlife sensitive design features will be adopted e.g., adequate height, spacing and insulation on distribution lines to prevent electrocution of elephants, birds etc. Once the 11 kV and LT distribution lines have been mapped by the contractors those not meeting the criteria and principles in the IEE will be immediately dropped.

VII. Since the distribution routes assessed are only indicative and will not be finalized until

the contractors are on board, during project implementation site-specific assessment checklist and consultation proformas will be completed by the contractors, then this IEE and EMP will need to be updated and cleared by ADB with any government clearances or permissions obtained before routings are approved by APDCL and works commence. For the IEE, site visits (reconnaissance surveys) to sample 11kV and LT distribution lines were conducted. Approximately 15 km (15%) or 15 number (14%) of 11 kV lines (including DTR associated new lines and lines for reconductoring with covered conductors) out of a total 98.5 km, and 65 km (18%) of 0.4 kV LT lines out of a total of 448.25 km of low-tension lines (including DTR associated new lines and lines for reconductoring with ABC) were conducted. The main mitigation will be pre-construction ecological checks along all routes for Critical Habitat-qualifying species by an ecologist familiar with the species of Assam, followed by re-routing or micro-siting to avoid any impacts, prior to tree trimming/lopping/vegetation clearing or earthworks. These checks will also involve consultation with local communities since there are individual trees of cultural heritage value to the local communities/Indigenous Peoples that must not be damaged. In addition, mitigation will include prohibiting poaching and firewood collection by construction workers. For all distribution lines, the District Forest Officers will be actively engaged by APDCL and the contractors throughout project implementation. A wildlife identification and rescue protocol will be adopted by the contractors, to be further developed in consultation with Environment and Forest Department of Assam as per site-specific requirements with all vegetation clearance and earthworks undertaken under ecological supervision. Local physical cultural resources were identified along the sample distribution lines, some temples and churches were observed that could be directly impacted if lines pass across or near to them. However, the works will be supervised with fencing used, if required, to avoid damage to those adjacent to the route alignment. Many existing distribution lines to be reconnected, especially LT lines, were observed to be passing over houses/shops/businesses with poles located in private compounds whilst some were seen to cross or be near to school compounds. To uphold safety clearances and minimize community health and safety risks during operation, rerouting is required as part of reconductoring works with great care taken and appropriate health and safety measures implemented in dismantling the existing conductors.

VIII. Other potential environmental impacts were identified in relation to the design, location, construction, operation and maintenance of the BESS and distribution infrastructure and mitigation has been developed in respect of all temporary environment impacts identified. Potential construction impacts relate to disturbance of land in the ROWs of new distribution lines as well as adjacent communities, with pollution, health and safety risks to workers and the community if the construction activities are not well managed by APDCL, the JV and their contractors. The most significant impacts include hazardous waste disposal (including oil and end of life batteries and other electrical equipment) plus traffic congestion, dust and noise when working in semi-urban and dense settlement areas. The community health and safety risk is also significant since many poles and DTRs were also observed to be broken, sagging or low hanging and non-compliant to safety clearances in settlement areas, thus exposing the local community to electrocution risk particularly if a person, tree, or structure is near a live line where the safe horizontal or vertical clearances are compromised. Pollution, health and safety risks to workers, health and safety risks due to working at height and with electricity etc., and the community will remain during operation and maintenance works. It was identified that occupational and community accident records are not kept by ADPCL, and the standard operating procedures of APDCL for health and safety are basic. An environmental audit for the four existing substations (including one AEGCL substation for the BESS bay extension) did not identify any transformers containing PCB oil, based on assessment against United Nations Industrial Development Organization (UNIDO) guidance. However, the project includes the installation of 88 new distribution transformers, some of which will replace existing ones that may contain PCBs. Transformer oil will be tested for PCBs and any handling, temporary removal, packaging, labelling, storage, transport, and reinstatement on fenced, banded plinths of 110% capacity for ground-mounted transformers will be done by the

contractor in accordance with international good practice and the Government of India's regulations with any PCB containing transformers dechlorinated or disposed of in an environmentally sound manner. The Government of India regulations require APDCL to complete the de-chlorination or the removal of all PCB-contaminated transformers before 31 December 2025.

IX. Small informal group community consultations (related to environmental and social concerns) were conducted during preparation of this IEE report at the BESS site, existing substations, and along sample distribution line routes under the project. In total 66 participants (41% female and 59% male) were consulted. The consultations were held in December 2023, February 2024, April 2024 and June 2024 and included Autonomous Council/IP areas. The major issue identified during consultation was the presence of poles and distribution lines in private properties, most of which are sagging or low hanging and a cause of concern for locals. No other significant environmental or social concerns were raised, although major and frequent power cuts, no power in some remote areas, and water availability issues were reported. Overall, all consulted were looking forward to the benefits of improved electricity services. This IEE report will be made available by APDCL to the public and will be disclosed to a wider audience locally (with executive summary translated into Assamese, Karbi and other local languages) via the APDCL website, APDCL offices (Headquarters, Circle and Division), all 3 existing APDCL substations, the BESS site, and construction site offices. The consultation will be continued during implementation to ensure all interested stakeholders and affected local communities are fully engaged, have an opportunity to raise any concerns to APDCL, the JV and the contractors, and can be informed of the development and implementation of final routings of distribution lines, etc. To address project specific issues from affected persons, a Grievance Redress Mechanism (GRM) will be established by APDCL and NGEAL (JV) starting at site level, the details of which will be disseminated to local communities.

X. An EMP has been prepared for Outputs 3 and 4 of the project. The EMP includes (i) corrective action for existing facilities i.e. four existing substations; (ii) mitigation measures for environmental impacts during implementation. It takes into account biodiversity and physical cultural resource measures, high seismic and flood risk in the state, and the need for climate change adaptation measures; upholding safety clearances especially where existing lines pass over houses and rerouting is needed; avoiding passing over school compounds or playgrounds; adhering to electromagnetic field (EMF) exposure, dust and noise guideline levels; drinking water quality for workers; approving contractor's pollution prevention, solid and hazardous waste management, and health and safety management plans prior to works; prohibiting PCB use in new transformers and asbestos containing materials in construction; and, community awareness raising activities by the APDCL and the contractors on the health and safety risks of distribution infrastructure; (iii) an environmental monitoring program, including monitoring of health and safety incidents; (iv) institutional arrangements including capacity building; and (v) the EMP budget required during implementation of Outputs 3 and 4. The responsible entity for mitigation, monitoring, and reporting is APDCL but some responsibilities will be delegated to NGEAL (JV) and contractor. Mitigation measures will be assured by a program of environmental supervision and monitoring to be conducted during the construction and operation stages. Any unanticipated impacts or requirements for corrective action during implementation of the distribution component will be reported by the APDCL to ADB.

XI. APDCL Project Management Unit and NGEAL (JV) will hire/depute environment safeguard officers and health and safety officers—one of each for the BESS component, and, one of each for the distribution component, plus a social safeguard officer for the distribution component, and EHS supervisor for the BESS to support EMP implementation, supervision, and monitoring during construction and operation plus decommissioning for the BESS component. For Output 4 the PMU will be supported by the PIU having adequate numbers of

field staff acting as environment, health and safety supervisors (EHSS) to implement the EMP and undertake day-to-day supervision. Given the limited capacity of APDCL and the newly formed NGEAL JV and to assist with site-specific assessment and provide on-site support, as well as capacity building and trainings, the PMC will include qualified and experienced environmental specialists, ecologists/botanists, health and safety specialists with professional certification, labor experts, residential EHS supervisors for the BESS and distribution components, and other necessary experts. An ESMS consultant will also be hired to prepare an Environmental and Social Management System (ESMS) to allow the NGEAL JV to address environment, health and safety, labor and social safeguard impacts and risks associated with its operations, including policies and procedures for operating the project BESS and implementing all its future BESS development. The PMC will also provide expert capacity building and support in relation to specialist topics such as critical and natural habitat assessment, wildlife sensitive design features, PCB management etc. Further, the Engineering, Procurement and Construction (EPC) Contractors will be required to have suitably qualified and experienced, dedicated full time on-site counterpart staff including a (a) full time Environment Manager; (b) part time Pollution Control, Oil and PCB Expert; (c) full time Health and Safety Manager with NEBOSH/IOSH, supported by several health and safety stewards on-site; (d) full time Labor Manager; (e) full time Social and Community Liaison Officer—distribution component, and (f) full time (lines) part time (BESS/substations) Ecologist/Botanist—distribution component from commencement to closure of the contract. Given the biodiversity and cultural heritage values involved in the distribution component, APDCL will need to adequately budget for and ensure they have sufficient environmental expertise available to be able to address all of the EMP requirements. The PMC will help APDCL and NGEAL JV to develop standard operating procedures (SOP) addressing the environment, health and safety impacts and risks of its operational substations and the BESS, maintenance of these facilities and the distribution lines, including recording of any occupational and community health and safety incidents since they will be responsible for this phase of the project.

XII. This IEE including EMP are considered sufficient to meet the environmental assessment requirements of ADB for the BESS and distribution components. However, as the distribution component is based on an indicative route alignment for only a sample of the new and existing 11kV and LT distribution lines with locations of DTRs still to be finalized it will need to be updated after mobilization of the EPC contractors and finalization of the route alignments. Following detailed route surveys of distribution lines, updating can be done in a phased manner during implementation of Output 4. The commencement of works in respective sections of distribution lines shall only be taken up upon clearance of the updated IEE / addendum to IEE report by ADB. Further, the IEE and EMP will also be updated and revised, if necessary, if there are any unanticipated impacts including a scope or design change. Any changes to the IEE and EMP will be subject to ADB review, clearance, and disclosure.

I. INTRODUCTION

A. Project Background and Rationale

1. Government of India has requested the Asian Development Bank (ADB) to finance a project of Assam Power Distribution Company Limited (APDCL), Government of Assam (GoA). 25-megawatt (MW) pilot grid-connected battery energy storage system (BESS) installation at the Kukurmara Mirza transmission substation to meet peak demand and to improve grid stability. Electricity distribution infrastructure in East and West Karbi Anglong districts and in the rural parts of the neighbouring district of Dima Hasao will be upgraded by the project. The project will also support solar photovoltaic electricity capacity which will feed into the grid. The project will be financed through a project loan and have the following outcome: access to clean and reliable electricity in Assam improved. The project outputs are as follows with Outputs 3 and 4 covered under the scope of this initial environmental examination (IEE) report:

- i. Output 1: Sovereign capacity to generate, manage, and operate solar photovoltaic electricity increased.
- ii. Output 2: Private sector investment in solar photovoltaic capacity enabled.³
- iii. **Output 3: Renewable energy-powered battery storage system piloted.** This output will support the equity contribution of APDCL to set up a joint venture with ONGC Tripura Power Company Ltd. to develop a pilot grid-connected BESS of at least 25 MW (100 megawatt-hour) at the Kukurmara Mirza transmission substation. This storage facility, which will be charged using electricity from the solar PV facilities developed under Output 1, will improve APDCL's ability to meet peak demand and will provide frequency regulation to improve grid stability. 10% of staff of the joint venture company will be recruited from women and other vulnerable groups. The joint venture (JV) is named as New Green Energy Assam Limited (NGEAL).
- iv. **Output 4: Electricity distribution in project areas enhanced.** The electricity distribution system in the surrounding areas of the proposed solar site in Karbi Anglong district and in the rural parts of the neighboring district of Dima Hasao will be strengthened. The project will finance conversion of overhead lines to covered conductor (aerial bundled cable or ABC), and installation of new distribution transformers for capacity enhancement and voltage improvement. Training and awareness programs on safe and efficient use of electricity will be delivered to local communities (including at least 100 women and/or disadvantaged people).

2. Under the Output 3 of this project, a pilot grid-connected BESS of 25 MW (100 megawatt-hour) is to be installed on land owned by New Green Energy Assam Limited (NGEAL) – a newly created joint venture (JV) between APDCL and Oil and Natural Gas Corporation Tripura Power Company (OTPC) inside the existing Assam Electricity Grid Corporation Limited (AEGCL) 400kV Kukurmara Mirza transmission substation located in Sathikapara, Mirza in Kamrup District. Land has been contributed to the JV by AEGCL. A bay extension will be required in the substation.

3. Under the Output 4 of this project, the electricity distribution system in the surrounding areas of the proposed solar site in the East Karbi Anglong and West Karbi Anglong districts and in the rural parts of the neighbouring district of Dima Hasao district will be enhanced, including

- Installation of new power transformers with associated works at the existing Gunjung 33/11 kV substation in Haflong Electrical Subdivision (ESD) of Dima Hasao District.

³ Separate IEE has been prepared covering Outputs 1 and 2, this IEE deals only with Outputs 3 and 4

- Installation of additional power transformers with associated works including switchgear in existing Baithalangso 33/11 kV substation and Umpanai 33/11 kV substation in Donkamokam ESD in West Karbi Anglong District.
- Installation of 88 new 11/0.415 kV distribution transformers (DTR) of 250, 100, 63 and 25 kVA capacities in East and West Karbi Anglong and Dima Hasao Districts.
- Installation of 39.4 km of 11 kV covered conductor and 87.6 km of low tension (LT 0.4 kV) aerial bundled conductor (ABC) new distribution lines associated with the installation of the DTRs.
- Reconductoring of 59 km of 11 kV feeder using steel poles with covered conductor, and
- Conversion of 360.75 km of existing bare LT 0.4 kV line to ABC distribution line on new steel poles.

4. All of the project outcomes need further environment assessment. This IEE deals with the environmental assessment for Output 3 and Output 4, whilst for Output 1 and Output 2 a separate IEE has been prepared.

5. The Power (Electricity) Department of Government of Assam (GoA) will be the executing agency and APDCL will be the implementing agency. The project will be implemented, supervised and monitored by the project management unit (PMU) at APDCL respectively, which will be headed by the Project Director. Through an equity contribution financed by the project, the JV management will be responsible for delivering the BESS (Output 3) whilst a Project Manager under the PMU will be responsible for delivering the distribution component (Output 4) supported by a project implementation unit (PIU) team in the field. A Project Management Consultant (PMC) firm will be hired to support APDCL and the JV in implementing Output 3 and Output 4. The project will be implemented over seven years starting October 2024 with a completion date by September 2031 although construction works for the BESS will complete in 12 months and distribution components are anticipated to complete within 36 months.

B. Initial Environmental Examination

6. Safeguard requirements for all projects funded by ADB are defined under ADB's Safeguard Policy Statement (2009), which establishes an environmental screening, assessment and management process to ensure that projects (i) avoid adverse impacts of projects on the environment and affected people, where possible; (ii) minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and (iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks. All ADB projects must comply with the requirements of ADB's Safeguard Policy Statement, 2009 and Operational Manual F1, 2013 to ensure the environmental soundness and sustainability of projects, and to support the integration of environmental considerations into the project decision-making process.

7. For each ADB project, screening and categorization is conducted at the earliest stage of project preparation when sufficient information is available and is undertaken to (i) reflect the significance of potential impacts or risks that a project might present; (ii) identify the level of assessment and institutional resources required for the safeguard measures; and (iii) determine disclosure requirements. ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. For a Category A project, an Environmental Impact Assessment (EIA) including an Environmental Management Plan (EMP) is required. For a Category B project,

an IEE including an EMP is required and for a Category C project, no EIA or IEE is required, although environmental implications need to be reviewed such as through preparation of a due diligence report etc.

8. The Project outputs 3 and 4 are categorized as B for environment safeguards considering the fact these components are unlikely to cause significant adverse irreversible, diverse or unprecedented environmental impacts due to the fact there will not be any major, large-scale civil or structural works involved (civil works include foundation installation, building construction and pole erection), with most works are electrical and mechanical. Construction of one new building of up to two floors (200 square foot) for the BESS control room will be the largest civil or structural works. For Output 4, criteria and principles set out in the IEE will be followed to ensure distribution lines with potentially significant impacts are avoided. With this (i) no components will be located in, or pass through National Parks or Wildlife Sanctuaries or the protected or regulated zones of Archaeological Survey of India (ASI) or Directorate of Archeology of Assam monuments/sites; (ii) components might be located in, or pass through, the eco-sensitive zone (ESZ) of Wildlife Sanctuaries, Elephant Reserves, or Reserved Forests, but only existing RoWs where Forest Clearance has already been granted will be used and with intimation and confirmation of no further permission, or a No Objection Certificate received from the Environment and Forest Department of Assam;⁴ (iii) for powerlines and their related equipment in, or passing through, ESZ, Elephant Reserves, Reserved Forests, Key Biodiversity Areas (KBAs) and Important Bird Areas (IBAs) only covered conductors within existing RoWs will be laid, requiring no access track construction, and only as long as site-specific biodiversity assessment demonstrates that any significant adverse impacts can be avoided; and (iv) powerlines and their related equipment in natural habitat will only be installed where significant conversion or degradation of natural habitat can be avoided. Overall pre-construction, construction, operation and maintenance and decommissioning of Outputs 3 and 4 is likely to give rise to direct and indirect, cumulative and induced environmental impacts that are mostly moderate/medium to minor/low in magnitude, site-specific, generally reversible, temporary and of short duration, primarily during construction works. Potential impacts and risks can be easily mitigated through the adoption of international good practices for environmental management as set out in the International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines, including the General Guidelines, and those on Electric Power Transmission and Distribution, as well as wildlife sensitive design features e.g., adequate height, spacing and insulation on distribution lines to prevent electrocution of elephants in elephant movement areas, birds etc. The selection and design of new equipment will comply with national requirements as well as considering international good practice per the IFC EHS Guidelines, particularly with respect to avoiding the use of polychlorinated biphenyl (PCB) oil in the purchase of new transformers (already banned in India) and avoiding the use of all asbestos-containing materials in the new construction. Since significant adverse irreversible, diverse, or unprecedented environmental impacts are unlikely to arise, this IEE along with an EMP has been prepared covering the potential adverse environmental impacts and risks of the Output 3 and 4 components to ensure they are assessed and mitigated in compliance with ADB's Safeguard Policy Statement 2009.

9. The initial environmental examination (IEE) has been undertaken between December 2023 and May 2024 on behalf of APDCL by a team of ADB-funded technical assistance consultants comprised of: (a) Dibyendu Banerjee, national environment assessment expert; (b) John Pilgrim, international ecological expert with respect to critical and natural habitat screening; and (c) Samarendar Narayan Jena, national social expert for socioeconomic

⁴ The BESS is sited inside an existing substation within modified habitat, although inside the ESZ of Deepor Beel. Its siting within the ESZ is not a cause of concern, as informed by the Environment and Forest Department of Assam during consultation.

surveys.

10. The IEE report describes the direct, indirect, cumulative, and induced impacts and risks of the BESS and distribution components on biological, physical, social, and physical-cultural resources in the study area during the construction and operation and maintenance (O&M) phases. It also covers decommissioning for the BESS. The IEE process involves the identification, scoping and assessment of the potential and perceived environmental, social, health and safety risks and impacts of the project. It also involves the identification of avoidance and mitigating measures and the preparation of the EMP that shall be implemented and monitored to address the identified risks and impacts of the project. The approach and methodology used to conduct the IEE is as follows:

- The general corridor of potential impacts and risks was taken as a 500m radius around the existing substations and BESS site and a 50m buffer either side of the center line along the distribution line alignments.
- The IEE has been undertaken based on a review of the BESS detailed project report (initially from November 2023, then finalized in February 2024) developed by APDCL. For the distribution output, the basis for the assessment was the scope of work (version R1 February 2024, then revised in April 2024 and finalized in May 2024) prepared by APDCL. This included a list of substations and work required, a list of 11 kV and 0.4 kV distribution lines and works required, distribution transformers (DTR) and associated lines, together with indicative lengths and other details. The detailed scope of work was confirmed in discussion with APDCL during field visits and meetings.
- Review of GoI and GoA guidelines, policies, regulations, and ADB Safeguard Policy Statement 2009 requirements. For standards and measures to adopt, international best practice guidelines, including the World Bank Group-IFC Environment, Health and Safety (EHS) general guidelines and the guidelines for Power Transmission and Distribution were used.
- Site visit to the proposed BESS, inside the existing Mirza grid substation area was conducted.
- Site visits (reconnaissance surveys) to sample distribution line alignments included in the scope (**Appendix 1 and Appendix 5**) were conducted based on project scope (February 2024) and sensitivities identified through preparation of a district sensitivity matrix for project districts, desktop and review and Google Earth mapping; the TA consultants visited approximately 15 km (15%) or 15 number (14%) of 11 kV lines (including DTR associated new covered conductor lines and reconductoring with covered conductor lines) out of a total 98.5 km, and 65 km (18%) of 0.4 kV LT lines out of a total of 448.25 km of low-tension lines (including DTR associated new ABC lines and bare to ABC lines).
- Environment audits of four existing substations (including the existing AEGCL 400 kV grid substation where the BESS is to be housed and requiring a bay extension) were conducted. All substations were visited and audited with a corrective action plan developed (**Appendix 2**).
- Site visits to sample sites for new DTRs (10 sites visited) were also undertaken. These sites are tentatively finalized by APDCL.
- Discussions with APDCL, AEGCL, OTPC, consultation with other stakeholders and local community were conducted. Consultations were held with likely affected persons, persons inhabiting the nearby areas of the substations, AEGCL staff inside BESS site, and distribution lines were also conducted. Site visits, audits, and consultations with the public and Forest/Wildlife Officials (DFO/PCCFs) (including neighboring Nagaland state), Heads of Autonomous Council (ADC) of both Karbi Anglong and Dima Hasao, Gram panchayat head (GP for BESS area), and Directorate of Archeology of Assam were also conducted in December 2023, February 2024 and April 2024 by the ADB TA consultants along with APDCL officials.

- Collection of primary and secondary baseline data for the existing substations, BESS site and the indicative distribution lines. Primary baseline data was collected by an external agency for one season (April-May 2024) at pre-selected substations, and the BESS, with respect to physical parameters, whereas secondary baseline data were relied on for the distribution lines, on the basis that impacts would be lesser than those in the substations and BESS due to the transient, short duration of works at each location. The selection of the physical baseline monitoring sites and parameters was based on the presence of sensitive/vulnerable receptors identified from aerial photos and site visits/audits near the substations, and BESS site, and those sites that will involve the most civil works during implementation. Primary data (based on site observations/audit at the substations, BESS site and sample distribution line surveys) plus secondary data including integrated biodiversity assessment tool (IBAT) analysis and a Critical Habitat Screening Report for Assam state (**Appendix 3**) were used for the ecological and biodiversity assessment based on site visit observations, consultations with forest official and locals and desk based research/screening and mapping. Physical cultural resources and heritage site assessment was conducted based on site visit, GIS analysis and screening, using secondary data and in consultation with Directorate of Archaeology, Government of Assam and locals. Socio-economic baseline data was informed by the primary data collection by the socio-economic team (**Appendix 4**) and Government of India, Census 2011 (the last census of Assam was done in 2011 and the next census of 2021 is postponed until late 2024) and observations made during the site visits.
- Identifying, scoping, and evaluating the environmental (physical, biological, socioeconomic, and physical cultural resources) risks and impacts at different stages of implementation (construction and O&M plus decommissioning for the BESS) guided by the national and ADB environment safeguards framework. Impact assessment was informed by site visits, primary and secondary baseline data, and discussion with the APDCL project team.
- Development of mitigation measures based on identified impacts and risk to address the potential adverse impacts and develop an environmental monitoring plan (EMoP), budgeting for EMP implementation, grievance redressal mechanism (GRM) (workers and community), institutional strengthening, capacity building, monitoring, supervision, and reporting plan. The EMP including environmental monitoring plan (EMoP) will be an integral part of all bidding documents and Engineering, Procurement and Construction (EPC) contract documents.

11. The IEE consists of nine sections: (i) Introduction, (ii) Policy, Legal and Administrative Framework, (iii) Description of the Project, (iv) Description of the Environment, (v) Anticipated Environmental Impacts and Mitigation Measures, (vi) Consultations, Participation, and Information Disclosure, (vii) Grievance Redress Mechanism, (viii) Environmental Management Plan, and (ix) Conclusion and Recommendations. The executive summary is also provided at the beginning of the report. The report is supported by appendices including the environmental audit report (**Appendix 2**) which has been completed for the four existing substations, mitigation and monitoring plans.

12. Since distribution line routes and DTR locations are all indicative at project processing stage, following selection of the final alignments, this IEE and EMP will need to be updated and cleared by ADB before the commencement of works. The IEE and EMP will also be updated and revised, if necessary, if there are any unanticipated impacts including a scope or design change. Any changes to the IEE and EMP will be subject to ADB review, clearance and disclosure.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

13. This chapter is about the applicability of national and state laws and regulations, international agreements, and ADB safeguards requirements to the project. The chapter also lays out the various permissions required for the project from national and state authorities. Further, it considers the environmental, health and safety (EHS) policies and procedures that are presently available within the APDCL, as well as the existing environment safeguards capacity of APDCL with respect to environmental management plan (EMP) implementation.

A. National Environment Regulatory Framework and Standards

14. The environment safeguards framework in India consists of several acts, notifications, rules, and regulations to protect the environment and wildlife as detailed in Table 2.1. In 1976, the 42nd Constitutional Amendment enacted Articles 48A and 51A, placing an obligation on every citizen of the country to attempt to conserve the environment. The Environment (Protection) Act 1986 was enacted with the objective of providing for the protection and improvement of the environment. Various rules are framed under this Act for granting of environmental clearance for any development project, resources conservation and waste management. The most notable legislation with respect to environmental assessment is the Environmental Impact Assessment (EIA) Notification, 2006 and its subsequent amendments. This identifies projects and activities that require Prior Environmental Clearance, (and lays the procedure for obtaining the same). Projects are categorized as Category A or B as per the EIA Notification, 2006 and these require environment clearance. Category A projects are required to conduct EIA and public consultations and obtain EC from the Expert Appraisal Committee of Ministry of Environment, Forests and Climate Change (MoEF&CC). Category B projects are required to obtain environment clearance from the State Environmental Impact Assessment Authority (SEIAA). Category B is further sub-divided into Category B1 projects (require an EIA and public consultation) and Category B2 projects (do not require an EIA or public consultation). However, per Schedule 1, which list out the activities that require prior environmental clearance (EC), power distribution projects are exempted. Unless large scale building and construction is involved, with more than 20,000 square meters in footprint and 150,000 square meters of built-up area, EC is not required for building construction projects. The components of BESS, distribution lines and related activities do not need prior environment clearance.

15. The Forest (Conservation) Act 1980 is also of note as it strictly restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without the prior approval of the Central Government. It provides guidance on the right of way (ROW) and tree cutting beneath distribution lines. For 11 kV line in forest area, the ROW is 7 m. Where routing of distribution lines through the forest areas cannot be avoided, these should be aligned in such a way that it involves the least number of trees being cut. Felling/pollarding/pruning of trees will be done with the permission of the local forest officer whenever necessary to maintain the electrical clearance. One outer strip of 2 m shall be left free of encroachments to permit for maintenance of the power line. No tree cutting is planned for this distribution work. If required after final route design, must be compensated by compensatory afforestation as required by the Environment and Forest Department of Assam.

16. As per published minutes of the meeting⁵ (1 February 2022) of the 66th meeting of the Standing Committee for National Board of Wildlife (NBWL) held on 31 December 2021, MoEF&CC may request details of protected and forest areas with transmission (power) lines and the vegetation, terrain, and periodicity of maintenance of the area while processing for any clearance or NOC. Following this a guideline shall be framed for management of the

⁵ http://forestsclearance.nic.in/writereaddata/Order_and_Release/211312301212166THMinutesofMeeting.pdf

protected or forest areas below transmission (power) lines. Future proposals for laying of transmission (power) lines submitted to the NBWL will need to be accompanied with a management plan for the area below the transmission (power) line. Permission may be granted by NBWL for the laying of transmission (power) lines in protected and forest areas on case-to-case basis. An 11kV transmission line case in Gujarat included the condition that laying of underground lines was required if technically feasible, or else to lay overhead insulated lines, whilst an 11 kV transmission line case in Rajasthan included for the option of laying underground lines to be examined, but that bird diverters were to be fixed per CEA guidelines, indicating NBWL considered it unlikely in both cases the underground lines would be laid.

17. The main regulatory bodies responsible for administration of the environmental policy and legislation pertinent to the distribution component are:

- (i) **Ministry of Environment and Forests, and Climate Change (MOEF&CC).** Responsible for the administration and implementation of Government of India's policy with respect to environmental conservation, management, and pollution control. It formulates and regulates all country level legislations and enforces the regulations in conjunction with various autonomous organizations under MoEF&CC and the states. The ministry also reviews and issues prior environmental clearances through an Expert Appraisal Committee for category A projects as per Government of India's legislation besides according to wildlife and forest diversion clearances. No environmental clearances or forest or wildlife clearance will be required for the existing substations, BESS (which involves battery installation site and control room building (about 200 square meter) on site of about 6000 square meters within an existing grid substation), given their scale and location. Environmental clearance is not needed for the distribution lines. No distribution lines (all existing RoWs) will pass through protected areas so wildlife clearance will also not be needed. No lines or related facilities will be taken up on new right of ways (RoW) in eco-sensitive zones (ESZ) of protected areas of Assam and Nagaland, Elephant Reserves, Reserved Forests (RF) including District Council Reserved Forests (DCRF) and no lines on existing RoWs within these areas are to be taken up without the requisite prior permission in writing from the competent authority.
- (ii) **National Green Tribunal (NGT).** The NGT based out of New Delhi was established in 2010 under the National Green Tribunal Act 2010. This tribunal is headed by a chairman and has both judicial and expert members (having multidisciplinary expertise). It is responsible for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources. It is also responsible for enforcement of any legal right relating to the environment and giving relief and compensation for damages.
- (iii) **Central Pollution Control Board (CPCB).** Statutory authority under the MoEF&CC with headquarters in New Delhi and has several regional offices. Responsibilities include planning and implementing air and water pollution control programs, setting air and water standards; and coordination with the state level pollution control boards (SPCB). The distribution and BESS components shall be required to adhere to the various standards set by CPCB.
- (iv) **Archaeological Survey of India (ASI).** Sitting under the Ministry of Culture, it is responsible for maintenance of ancient monuments and archaeological sites and remains of national importance. It is also responsible for regulating all archaeological activities in the country as per the provisions of the Ancient Monuments and Archaeological Sites and Remains Act, 1958 and Antiquities and Art Treasure Act, 1972. The Guwahati Circle of the ASI is responsible for maintenance of ASI monuments in Assam.
- (v) **Central Ground Water Board (CGWB) and Central Ground Water Authority (CGWA).** CGWB is a multi-disciplinary scientific organization under the Ministry of Jal Sakti, entrusted with providing scientific inputs for the management, exploration,

monitoring, assessment, augmentation, and regulation of ground water resources. Besides advising states on planning and management of ground water resources, it provides technical know-how for scientific ground water exploration, development, and management. CGWA is a sister concern of CGWB engaged in various activities related to regulation of ground water development to ensure its long-term sustainability. A no objection certificate (NOC) is required to be obtained from the CGWA for prior to extraction of ground water. This NOC shall be required if new borewells are installed in any of the existing substations and the BESS or for construction water or if existing tube/borewells are used for construction that were installed for some other purposes as it would augment the use of groundwater.

- (vi) **Central Electricity Authority (CEA).** The CEA is a statutory organization constituted under the Electricity Supply Act 1948, which has been superseded by the Electricity Act of 2003. The authority advises the central government, state governments and regulatory commissions on all policy and technical matters relating to generation, transmission and distribution of electricity and formulates plans for the development of electricity systems. The CEA is also responsible for prescribing the technical standards related to construction of electrical plants, electric lines and connectivity to the grid, installation and operation of meters and safety and grid standards etc. The distribution components and transformers installations and other electrical infrastructure for the BESS, are required to adhere to the safety regulations and standards as prescribed by the CEA.

Table 2.1 Applicable National Environmental Requirements

Sl. No.	Name of Policy / Law / Regulation	Applicability to Outputs 3 and 4	Remarks
1	National Environment Policy (NEP), 2006	Applicable as both construction and operation must adhere to the NEP principles of conservation of environmental resources and abatement of pollution. The IEE process and implementation of the EMP will enable this.	Responsible Authorities: MoEF&CC
2	National Water Policy, 2012	Applicable as there is a need to conserve and manage ground water as it is a community resources held by the state. Recognizes that water is required during construction activities including curing of concrete structures and poles and the utilization should be optimized and an awareness of water as a scarce resource should be fostered.	Responsible Authorities: Ministry of Jal Shakti
3	National Forest Policy, 1988	Policy deals with increasing forest cover and its management by involving local communities in the management of forests. There will be impacts on Reserved Forests/natural habitats (existing ROW may require vegetation clearance/tree trimming if not currently well maintained by APDCL) if identified after final	Responsible Authorities: MoEF&CC, Environment and Forest Department, Assam, DFO, and District Autonomous Council for Tree trimming/lopping, etc. permission

Sl. No.	Name of Policy / Law / Regulation	Applicability to Outputs 3 and 4	Remarks
		alignments and scope is finalized.	
4	National Conservation Strategy and Policy Statement on Environment and Development, 1992	It provides the measures to be taken for prevention and control of pollution and energy efficient devices in the distribution system and BESS facility	Responsible Authorities: MoEF&CC
5	National Resettlement and Rehabilitation Policy, 2007	Applicable as some of the new distribution transformers and poles will need private land for installation. Not applicable for existing infrastructure as all lands in substations, and BESS are owned by APDCL. Distribution line construction does not involve land acquisition.	Responsible Authorities: Ministry of Rural Development
6	The Environmental (Protection) Act, 1986. The Environmental (Protection) Rules, 1987 and its amendments	Both construction and operation of the substations and BESS must comply with the legislation issued under this act and rules. The IEE process and implementation of the EMP will enable this. Construction and operation must also comply with the environmental quality standards as set out in Appendix 6.	Umbrella act under which environmental notifications, rules, schedules, and standards are issued. Responsible Authorities: MoEF&CC, Environment and Forest Department of Assam, CPCB and PCB Assam.
7	The EIA Notification, 2006 as amended to 2016	Not applicable for the distribution lines and BESS as the EIA notification exempts these from obtaining prior environmental clearance. The new BESS control room building could require prior environment clearance from SEIAA as a Category B project, but as the footprint is less than the size included in Schedule 1 of the EIA notification, EC is exempted. Prior EC is applicable for direct sourcing of sand and stone during construction when mineral extraction exceeds the area specified in Schedule 1. However, no new borrow pits or quarries will be opened, instead materials will be sourced by the contractor from existing approved sources. The contractor will need to confirm existing sources used by third party vendors already obtained the requisite EC.	Identifies projects and activities that require Prior environmental clearance and lays the procedure for obtaining the same. The SEIAA is the state level authority for environmental clearances of projects categorized as 'B'. Responsible Authorities: MoEF&CC and SEIAA
8	The Right to Information Act, 2005 and its amendment of 2019	In relation to information disclosure during all stages of implementation, wherein any	Responsible Authorities: Central Public Information Officers of Central Electricity

Sl. No.	Name of Policy / Law / Regulation	Applicability to Outputs 3 and 4	Remarks
		citizen of India may request information after paying a fee from APDCL as a government body and which APDCL is required to respond within thirty days.	Authority (CEA) and State Public Information Officer, Assam
9	The National Environmental Appellate Authority Act, 1997 National Green Tribunal Act, 2010	APDCL will need to comply with any NGT rulings in case of application against it.	NGT has dedicated jurisdiction in environmental matters to provide environmental justice and help reduce the burden of litigation in the higher courts. It is mandated to endeavor for disposal of applications or appeals within 6 months of them being filled. Responsible Authorities: NGT
10	Central Ground Water Authority (CGWA) Notification no. 21-4/Guidelines/CGWA/2009-832 dated 14 October 2009	Applicable as proposed BESS interventions intend to extract ground water through new borewells; if such ground water extraction or augmentation is planned, then prior to construction permission to abstract will be required from CGWA in accordance with this notification.	Responsible Authorities: CGWA and District Autonomous Council
11	Comprehensive Environmental Pollution Index (CEPI) 2018	Not applicable as the project does not fall under any of the industrial clusters nor under the Critically Polluted Areas (CPAs) as per the CEPI	Industrial clusters are categorized under the CEPI as Polluted Industrial Areas giving weight to various pollutants, ambient pollutant concentrations, receptors (that is, the number of people affected) and additional high-risk elements; they are to be remediated seeking compensation from polluting industries, and any expansion or development of new sites in these areas will be rejected. Responsible Authorities: CPCB, SPCB, enforced by NGT
12	The Water (Prevention and Control of Pollution) Act, 1974 The Water (Prevention and Control of Pollution) Rules, 1975 The Water (Prevention and Control of Pollution) Cess Act, 1977 & amendment in 2003	Applicable as CTE and CTO are required from PCB Assam for major construction plant for BESS, to protect against pollution of surface and ground water. Need to adhere to the water quality standards per Appendix 6.	Empowers central and state pollution control boards to establish and enforce water quality and effluent standards, monitor water quality, prosecute offenders, and issue licenses for construction and operation of certain facilities. Responsible Authority: PCB Assam
13	The Air (Prevention and Control of Pollution) Act, 1981	Applicable as CTE and CTO are required for major construction plants to protect against pollution of air.	Empowers state pollution control boards to set and monitor air quality standards and to prosecute offenders,

Sl. No.	Name of Policy / Law / Regulation	Applicability to Outputs 3 and 4	Remarks
	The Air (Prevention and Control of Pollution) Rules, 1982	Need to adhere to the air emission standards per Appendix 6.	excluding vehicular air and noise emission. Responsible Authority: PCB Assam
14	Noise Pollution (Regulation and Control) Act, 2000 and 2010 as amended	Applicable during both construction and operation, distribution and BESS components must adhere to the ambient noise emission standards; any diesel generator sets used by the contractor or APDCL must also be compliant per Appendix 6.	Standards for noise emission for various land uses and equipment have been issued. Responsible Authority: PCB Assam
15	The Motor Vehicle Act. 1988 and its subsequent amendments	Applicable and all vehicles utilized during construction and operation mandatorily require obtaining of a " <i>Pollution Under Control Certificate</i> " (PUC) for the duration of their use to manage the vehicular emissions.	Empowers the State Transport Authority to enforce standards for vehicular pollution and issuance of PUC certificates. Responsible Authority: Motor Vehicles Division under the State Transport Department
16	Indian Forest Act, 1927 Forest (Conservation) Act, 1980 as amended. Forest (Conservation) Rules, 2003 and its amendments	Applicable (when all lines are mapped/finalized) if existing 11kV and low-tension distribution lines pass along existing right of ways in Reserved Forests. Permission is also required for tree felling (if applicable) under the rules.	The act defines the various forest areas and lays down the procedure for diversion of forest land for non-forest activities. Responsible Authorities: MoEF&CC, District Autonomous Council and Environment and Forest Department of Assam
16	Biological Diversity Act, 1992 Biological Diversity Rules, 2004 Wildlife Protection Act, 1972 as amended	The components where locations are finalized (BESS) are not situated within any protected areas (e.g., national park or wildlife sanctuary) or reserved forest. But the BESS site is located inside the notified Eco-sensitive zone (ESZ) of the Deepor Beel protected area and Ramsar site, also an IBA. Potential existing RoWs of project lines are located (East Karbi Anglong) inside the ESZ of the Rangapahar WLS (in Nagaland). In general, felling of trees and widening of roads are regulated in the ESZ. Electrical cables are also regulated, there is a promotion of underground cables. No batching plant or hot mix (or other construction activity that causes pollution) or discharge of effluents or solid waste to water or ground is permitted in the ESZ. MoEF&CC guidelines, plus the criteria and requirements of any	Provides for protection of Protected Areas from non-conservation activities. It also lists (schedules) plants and animals of which sale, trade, or commerce is prohibited. Responsible Authorities: National Board of Wildlife (NBWL), State Board of Wildlife (SBWL), Chief Wildlife Warden of Assam and Nagaland and District Autonomous Council

Sl. No.	Name of Policy / Law / Regulation	Applicability to Outputs 3 and 4	Remarks
		Draft ESZ notification in terms of Prohibited and Regulated activities are to be complied with by APDCL for the distribution component and NGEAL for the BESS site with intimation to Assam or Nagaland as applicable to the WLS of concern. Also applicable in the event workers encounter any scheduled plants and animals since the sale, trade, or commerce of them is prohibited.	
17	Wetlands (Conservation and Management) Rules, 2017	Not applicable. Permission is required if any wetland notified by the Central Government, State Government falls within project site. The Deepor Beel Ramsar site, also an IBA, is about 8.7km from the BESS site.	Responsible Authorities: Wetland Authority; MoEF&CC
18	The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006 The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Rules 2007	Applicable as distribution lines are planned in tribal areas of East and West Karbi Anglong and Dima Hasao (all under Autonomous District Council).	Provides rights related to title, usage, relief, development, and forest management including traditional and customary rights of forest-dwelling scheduled tribes. Responsible Authorities: Department of Tribal Affairs, GoA.
19	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	Applicable as there may be land acquisition involved e.g., for new ground mounted distribution transformers. BESS site (owner is AEGCL) is already acquired by NGEAL JV of OTPC and APDCL.	Provides directions related to fair compensation of any land acquired for public works purpose. Responsible Authorities: Revenue Department and District Administration and District Autonomous Council
20	The Provisions of the Panchayats (Extension to the Scheduled Areas) Act, 1996	Applicable if there is land acquisition involved e.g., for new distribution transformers as well as distribution works in panchayat and tribal areas	Provides directions related to fair compensation of any land acquired for public works purpose. Responsible Authorities: Gram Sabha Panchayat Head and District Administration
21	Indian Treasure Trove Act 1878 (as modified up to September 1949) The Antiquities and Art Treasures Act, 1972	It shall be applicable only if there are any chance finds of physical cultural resources during excavation	Deals with treasures and other artifacts which are of antique value and origin. Responsible Authority: Archaeological Survey of India (ASI) and Directorate of Archaeology, GoA
22	Ancient Monuments Preservation Act 1904 Ancient Monuments and Archaeological Sites and	No components (distribution and BESS) are to be situated within 300m of an ASI notified monument.	Deals with activities that may be permitted and prohibited near the protected monuments. Construction works are

Sl. No.	Name of Policy / Law / Regulation	Applicability to Outputs 3 and 4	Remarks
	Remains Act 1958 and its amendments. Ancient Monuments and Archaeological Sites and Remains (Framing of Heritage Bye laws and Other Functions of Competent Authority) Rules, 2011 National Monument Authority Rules, 2011 Heritage Conservation and Preservation Act, 2010	May be applicable if there is an unanticipated impact (change in scope or design) during project implementation. Otherwise, the acts will only become applicable if there are any chance finds of physical cultural resources during excavation for construction.	prohibited within 100m of a protected monument (prohibited area) and another 200m from the prohibited area (so 300m total distance) is demarcated as the regulated area in which construction is regulated by the competent authority. In event of any chance finds being made they must be notified / surrendered to the competent authority. Responsible Authorities: ASI (Guwahati Circle) and Directorate of Archaeology, GoA
23	The Petroleum Rules 2002	Applicable for the supply and storage of diesel for generator sets and for transformer oils etc.	Deals with the import, transport and storage of petroleum and petroleum products Responsible Authorities: Ministry of Petroleum and Natural Gas, Chief Controller of Explosives
24	Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989	Applicable as there shall be storage of hazardous chemicals including petroleum products (oils etc.) at the substations and potentially the BESS site. The present practice of APDCL is to store redundant PTRs/DTRs in substations until transported elsewhere, this should be avoided in future.	Responsible Authorities: PCB Assam
25	Regulation of Polychlorinated Biphenyls (PCBs) Order, 2016	Applicable. New transformers provided for the substations and DTRs must be PCB free and any existing PCB containing transformers at the existing substations and along distribution lines must be inventoried and removed by the cutoff date of 31 st December 2025. Disposal of PCB containing equipment must be done as per Hazardous and Other Wastes (Management, & Trans-boundary Movement) Rules.	Provides guidance on the usage of PCBs and prohibits the usage of PCBs in any form by 31 December 2025. Responsible Authority: PCB Assam
26	Ozone Depleting Substances (Regulation and Control) Rules, 2000 and its amendments	Prohibition on usage of ozone depleting substances during construction and operation period e.g., for servicing of fire extinguishers	Provide direction on the regulation of ozone depleting substances. Responsible Authorities: PCB Assam
27	Construction and Demolition Waste Management Rules, 2016	Construction and demolition waste will be generated and will need to be managed and	Deals with safe disposal of construction wastes generated due to construction and demolition activities.

Sl. No.	Name of Policy / Law / Regulation	Applicability to Outputs 3 and 4	Remarks
		disposed of in accordance with these rules during construction.	Responsible Authorities: PCB Assam
28	Solid Waste Management Rules 2016	Solid waste will be generated and will need to be managed and disposed of in accordance with these rules during construction and operation.	Deals with safe disposal of municipal solid wastes generated due to construction and operation Responsible Authorities: PCB Assam, Municipalities and Panchayats
29	The Plastic Waste Management Rules, 2016 and Plastic Waste Management Amendment Rules, 2021	Plastic will be generated for disposal in the wastes from packaging materials during both construction and operation period	The rules apply to “every waste generator, local body, Gram Panchayat, manufacturer, Importers and producer”. Wastes to be segregated and disposed as per Solid Waste Management Rules, 2016. The 2021 amendment prohibits identified single use plastic items by 2022. Thickness of plastic carry bags increased from 50 to 75 microns from 30 th September 2021 and to 120 microns with effect from the 31 st December 2022. Responsible Authorities: PCB Assam, and Village Panchayats/Gaon Bura
30	Hazardous and Other Wastes (Management, & Trans-boundary Movement) Rules, 2016 as amended in 2019	Applicable in relation to the management and disposal of hazardous wastes (used transformer oils, batteries, solvent-soaked rags etc.) that are used during construction and operation, especially in relation to operation of the substations, and BESS. The BESS JV will comply with the requirements under Hazardous and other Waste (Management and Transboundary Movement) Rules, 2016, as amended in 2019, as applicable. The BESS shall ensure that all Unit Battery modules from the plant after their ‘end of life’ (when they become defective/ non-operational/ non-repairable) are disposed in accordance with the “e-waste (Management and Handling) Rules, 2016” notified by the Government of India and as revised and amended from time to time and Battery Waste Management Rules, as and when notified by the Government of India	Provides protection to the public against improper handling and disposal of hazardous wastes. Responsible Authority: PCB Assam

Sl. No.	Name of Policy / Law / Regulation	Applicability to Outputs 3 and 4	Remarks
31	Batteries (Management and Handling) Rules, 2001	<p>Applicable as use and presence of batteries as back-up in the in the substations and BESS. Used batteries must be properly disposed to PCB Assam authorized and registered recyclers.</p> <p>The BESS shall ensure that all Unit Battery modules from the plant after their 'end of life' (when they become defective/ non-operational/ non-repairable) are disposed in accordance with the Battery Waste Management Rules 2001, and as and when notified by the Government of India. The Battery Waste Management Rules 2022" which introduces the concept of Extended Producer Responsibility (EPR) compels Indian manufacturers and importers of batteries to take on additional responsibility for efficiently managing batteries throughout their lifecycle and is to be complied with.</p>	<p>The rules apply "to every manufacturer, importer, re-conditioner, assembler, dealer, recycler, auctioneer, consumer, and bulk consumer involved in manufacture, processing, sale, purchase and use of batteries or components thereof". Half-yearly returns using the required forms are to be filed and submitted to PCB Assam</p> <p>Responsible Authorities: SSPCB</p> <p>For BESS -The industry, commerce and public enterprise department is the nodal agency in Assam that promotes collection and recycling of end-of-life batteries.</p>
32	E-Waste (Management) Rules, 2016 as amended in 2018 and 2022	<p>Applicable during construction and operation used e-waste (e.g., batteries) must be properly disposed to PCB Assam authorized and registered recyclers.</p> <p>The BESS shall ensure that all Unit Battery modules from the plant after their 'end of life' (when they become defective/ non-operational/ non-repairable) are disposed in accordance with the "e-waste (Management and Handling) Rules, 2016" notified by the Government of India and as revised and amended in 2018</p>	<p>Responsible Authorities: PCB Assam</p>
33	The Indian Electricity Act, 1910 and its amendments The Indian Telegraph Act, 1885	<p>Applicable as 11kV and 0.4kV overhead distribution lines will be laid. A Right of Way is required for laying new overhead distribution lines. The applicable ROW for 0.4kV, 11kV power lines are 1.2m, 7m respectively (Appendix 6)</p>	<p>Safety measures to be taken in laying of electrical lines and connections.</p> <p>Responsible Authorities: Central Electricity Authority (CEA) and AERC.</p>
34	Electricity Act, 2003 and its amendments	<p>Applicable as electric works will be carried out so the act must be complied with. Also, the provisions stipulated in section 67-68 of the Electricity Act,</p>	<p>Guiding act related to electricity in India. Sections 53, 67, 73, 161 and 177 deal with safety related to</p>

Sl. No.	Name of Policy / Law / Regulation	Applicability to Outputs 3 and 4	Remarks
		2003 read with section 10 and 16 of the Indian Telegraph Act, 1885 deals with compensation due for any damages due to the construction of any distribution lines.	electricity including power to make regulations. Responsible Authorities: CEA and AERC.
35	Central Electricity Authority (Measures Relating to Safety and Electricity Supply) Regulations, 2010 CEA (Measures Relating to Safety and Electricity Supply) Regulations, 2018 CEA (Measures relating to Safety and Electric Supply) Amendment Regulations 2015 CEA (Measures Relating to Safety and Electric Supply) Regulations, 2019	Applicable as the acts deals with distribution and transmission companies and mandates the provision for safety requirements including mandatory appointment of an Electrical Safety Officer and their qualifications.	Responsible Authorities: CEA and AERC.
36	CEA (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2010 and Central Electricity Regulatory Commission (CERC)	Applicable as these pertain to the safety requirements for construction, operation, and maintenance procedures of electrical lines. BESS interconnection with the grid and metering and distribution component installations shall abide by Central Electricity Regulatory Commission (CERC) Regulations/Procedure and RE connectivity procedure and the various CEA Regulations including the Grid Code, technical standards as issued by CEA in this regard, Grid Connectivity Regulations, Regulations on Communication System for transmission of electricity etc.	Responsible Authorities: CEA
37	CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022	Applicable as these pertain to the design of substations, BESS, etc. Includes requirement for soak pit and oil collecting pit beneath transformers.	Responsible Authorities: CEA

APDCL = Assam Power Distribution Company Limited, BESS = Battery Energy Storage System, CPCB = Central Pollution Control Board, CEA = Central Electricity Authority, CEPI = Comprehensive Environmental Pollution Index, CTE= Consent to Establish, CTO = Consent to Operate, CGWA = Central Ground Water Authority, CPA = Critically Polluted Areas., EIA = Environmental Impact Assessment, MoEF&CC = Ministry of Environment, Forest, and Climate Change, NEP = National Environment Policy, NGT = National Green Tribunal, RE = Renewable Energy, SEIAA = State Environmental Impact Assessment Authority, PCB Assam= Pollution Control Board, Assam, SPCB = State Pollution Control Board.

Source: ADB TA Consultant

18. Mandatory no objection certificates (NOC) for distribution lines (existing RoWs already having forest clearance) in Elephant Reserves and Reserved Forests (RF and DCRF),

intimation for works in ESZ, other permissions, NOCs and work permits to be obtained for the project by both the borrower (APDCL) or the JV and the EPC contractors are given in Table 2.2. If distribution lines pass along existing alignments in the Elephant Reserve/Reserved Forest areas then copies of the original requisite forest clearances (any retrospective for those existing lines without/violation and to be used under distribution component of the project must be applied early on as per Environment and Forests Department of Assam) need to be obtained by APDCL before detailed design approval and prior to construction, along with no objection certificate for the project works. If forest clearances were not legally required, e.g., forest land was earlier diverted (and clearance letters are available) then APDCL must intimate/secure a written no objection certificate (NOC) for the specific distribution lines from Environment and Forests Department of Assam.

Table 2.2 List of Environmental Consents and Work Permits Required

Sl. No.	Clearances / Permissions / NOC	Authority	Responsible Party	Status as of October 2023
1	Certificate of Registration of Principal Employer	Labor Commissioner, Ministry of Labor and Employment	APDCL	To be obtained prior to construction
2a	No objection for works in Elephant Reserve/ Reserved Forests with copy of original forest clearance.*	MOEF&CC and Environment and Forest Department of Assam.		To be obtained prior to construction
2b	Intimation and confirmation no further permission is needed for BESS as site is within Notified ESZ of WLS and those distribution lines in Nagaland Rangapahar ESZ.*	ESZ authority (including Rangapahar, Nagaland PCCF)		To be obtained prior to construction
3	Tree felling/trimming permissions	Environment and Forest Department of Assam		To be obtained prior to construction by PMU
4	NOC for installing or augmenting use of bore wells for construction or operational purpose, if applicable for BESS	CGWA		To be obtained prior to construction by PMU
5	NOC for change of land use for establishing temporary construction camps (if outside APDCL land area)	Revenue Department and District Administration and District Autonomous Council	EPC Contractor	To be obtained prior to construction by contractor through PMU
6	Consent to Establish (CTE) construction plant	State Pollution Control Board		To be obtained prior to construction
7	Consent to Operate (CTO) construction plant	State Pollution Control Board		To be obtained prior to construction
8	Labor License**	Chief Labor Commissioner, Assam		To be obtained prior to construction
9	Pollution Under Control Certificates for construction vehicles	District Transport Office		To be obtained prior to construction
10	Consent for works in IP areas	Department of Tribal Affairs, Directorate of Welfare of Plain Tribes and Backward Classes, Assam and districts through which lines will pass - Dima Hasao Autonomous District Council and East and West Karbi Anglong Autonomous District Council		To be obtained prior to construction

*APDCL will also reconfirm the status of forest land and ESZ before commencing work in case new reserved forest/ESZ boundary may be notified.

**Labor insurance is also required.

APDCL = Assam Power Distribution Company Limited, CGWA = Central Ground Water Authority, CTE = Consent to Establish, CTO = Consent to Operate, EPC = Engineering, Procurement and Construction, NOC = No Objection Certificate.

Source: ADB TA Consultant

B. State Environment Regulatory Framework and Standards

19. The environment safeguards framework in Assam consists of several acts, notifications, rules, and regulations to protect the environment detailed in Table 2.3. The key state authorities are discussed below:

- (i) **State Environmental Impact Assessment Authority (SEIAA).** An authority constituted by central government under sub-section (3) of section 3 of the Environment (Protection) Act, 1986 for every state and union territory. The composition of the SEIAA is published through separate gazette notifications and normally has a term of three years. It issues Prior environmental clearances to Category B projects. If the BESS installation required an EC due to its building size (in excess of 20,000 square meter), it would be prior applied with Assam SEIAA. However, given its size of 200 square meter, this is not required.
- (ii) **Pollution Control Board, Assam.** State Pollution Control Board, Assam is an autonomous statutory organization constituted on 2nd June 1975 under the provision of section 4 of the Water (Prevention & Control of Pollution) Act 1974 with a view to protecting the environment and preventing and controlling the pollution of water and air in the State of Assam. Responsible for pollution control activities at the state level for Assam, including planning and executing state level air and water quality initiatives, establishing standards for air and water quality based on national minimum standards, and enforcing and monitoring of all the activities within the state under air and water related legislation. SSPCB shall be issuing Consent to Establish (CTE) and Consent to Operate (CTO) for establishing and operating of any construction plant required such as batching plant, hot mix etc.
- (iii) **Environment and Forest Department of Assam.** The Mission of the Department of Environment and Forests, Assam is to protect and improve the environment, to safeguard the forests and wildlife of the State, to preserve and add new dimensions to the rich heritage of Assam's composite culture, to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures. It also encompasses opening up the forestry sector for income and employment generation while conserving the biodiversity of the state. The project may require permissions from the Environment and Forest Department for any felling of timber (except Mango, Jackfruit) and non-timber trees (except Bamboo) and transit of felled trees. No objection certificate from the Environment and Forest Department will be required for distribution lines passing through Reserved Forests, and they will have earlier been responsible to grant forest clearances for existing rights of way. The Environment and Forest Department and APDCL to ensure that no residential or labour camp shall be constructed over forest land.
- (iv) **Assam State Biodiversity Board.** In the exercise of powers conferred under sub-section (1) of Section 22 of the Biological Diversity Act, 2002 (Act 18 of 2003), the Government of Assam constituted the "Assam Biodiversity Board" on 29th September 2010 to promote biodiversity conservation in the State of Assam, sustainable use of its components and equitable sharing of benefits arising out of the use of biological resources of the state and traditional knowledge associated with them.
- (v) **Directorate of Archaeology.** The Directorate of Archaeology, under the Department of Cultural Affairs, Guwahati is responsible for maintenance of state protected monuments in Assam. Set up in 1961 as the Directorate of Archaeology and Museums the Directorate of Archaeology has been functioning under the Education (CTM) Department as an independent Directorate since 1983. The department is entrusted for the protection and preservation of ancient archaeological sites, monuments, remains of historical and archaeological importance, which are not less than one hundred years old and developing these into centers of tourists attraction in Assam; archaeological exploration of hitherto unknown sites, remains and their preliminary survey; archaeological excavation of the explored sites; documentation of antiquities found at archaeological sites as well as at excavated archaeological sites; conservation and restoration of protected archaeological sites and monuments;

publication of archaeological reports on exploration, excavation, conservation of archaeological sites; publication of annual reports, journals, brochures, leaflets, pamphlets on archaeology and antiquities; and protection, preservation and development of various Satras (consisting of a large prayer hall facing a simple shrine, surrounded by dormitories and bathing tanks for monk) of Assam.

(vi) **Autonomous Councils of Assam.** The Government of Assam have been taking various steps to accelerate development process for the welfare of Scheduled Tribe (ST) communities in the State through democratic decentralization of power and empowering the Scheduled Tribe (ST) communities to participate in the planning, monitoring and implementation of Tribal Sub Plan (TSP) schemes at the grass root level by constituting Territorial Councils, Autonomous Councils and Development Councils for different Scheduled Tribe (ST) communities in the State. The various Autonomous Councils constituted by the Government are under the following heads:

- Territorial Councils under Sixth Schedule of Constitution of India
- Statutory Autonomous Councils constituted under State Act

The Autonomous Councils are given varying degrees of autonomy within the State Legislature. In Assam there are 3 Autonomous Councils under the Sixth-Schedule of the Indian Constitution. The 3 Autonomous Councils are:

- Bodoland Territorial Council
- Dima Hasao Autonomous District Council
- Karbi Anglong Autonomous District Council (East and West Karbi Anglong)

(vii) **Assam Electricity Regulatory Commission (AERC).** The Commission is vested under Section 86 of the Electricity Act, 2003 with the responsibility of discharging the following functions: to determine the tariff for generation, supply, transmission and wheeling of electricity, wholesale, bulk or retail, as the case may be, within the State; regulate electricity purchase and procurement process of distribution licensees; facilitate intra-state transmission and wheeling of electricity; issue licences to persons seeking to act as transmission licensees, distribution licensees and electricity traders; and promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licence.

Table 2.3 Applicable State Environmental Requirements

Sl. No.	Name of Policy / Law / Regulation	Applicability to Project	Remarks
1	Assam Forest Policy, 2004	Applicable as some 11kV and 0.4kV lines are passing through Reserved Forest/Elephant Reserves in existing RoWs. Maintenance of environmental stability through preservation and, where necessary, restoration of ecological balance that has been adversely disturbed by serious depletion of forests in the State.	To conserve natural heritage of the state by preserving the natural forests and wetlands with vast variety of flora and fauna which represent the unique biodiversity and genetic resources of the State. Responsible Authorities: Environment and Forest Department of Assam and District Autonomous Councils.
2	Draft Assam Bamboo And Rattan Policy 2003	Applicable as 11kV and 0.4kV lines are passing through bamboo areas in some alignments. Regulation for the protection and conservation of biodiversity associated with bamboo forest and Rattan brakes and re-growth areas and their future development.	Protection and preservation of mountain ecology, protecting the mountain slopes by affording protection to bamboo forests and bamboo re-growth areas for sustained productivity and environmental security for the people.

Sl. No.	Name of Policy / Law / Regulation	Applicability to Project	Remarks
			Responsible Authorities: Environment and Forest Department of Assam and District Autonomous Councils.
3	Assam (Control of Felling & Removal of trees from Non-forest Land) Rules, 2002	The rule regulates felling permission and transit of timber derived from non-forest areas. The Rule mandates permission for felling of various species of trees from Department of Environment and Forest.	Responsible Authorities: Environment and Forest Department of Assam and District Autonomous Councils.
4	Assam Forest Regulation 1891 (7 Of 1891) Amended By The Assam Forest Regulation (Amendment) Act 2005 (Act No 2 Of 2008)	Applicable as some 11kV and 0.4kV lines are passing through natural habitat/vegetated areas in some alignments.	Responsible Authorities: Environment and Forest Department of Assam and District Autonomous Councils.
5	Assam Biodiversity Rules, 2010	These rules are established in the exercise of the powers conferred by Section 63 of the Biological Diversity Act, 2002 the Government of Assam. As per the act Indian entities or non-Section 3(2) (as prescribed under Biological Diversity Act, 2002) entities, prior intimation to the Assam Biodiversity Board is required for activities pertaining to commercial utilization, or bio-survey and bio-utilization for commercial utilization.	Responsible Authorities: Assam State Biodiversity Board
6	Assam Rhinoceros Preservation Act 1954	This Act aims at protection of the Indian Rhinoceros, Assam's state animal; and enables legal action against killing, injury and capture of the animal.	Responsible Authorities: Environment and Forest Department of Assam, and District Autonomous Councils
7	State Water Policy of Assam, 2007	Applicable as water is required during construction for the distribution and BESS components. The State Water Policy of Assam adopts integrated water resource management as a core strategy, based on the principles of water as a finite resource, need to use a participatory approach, the crucial role of men and women, ensuring clean water for human health and looking at water both as an economic and social good.	Responsible Authorities: Water Resource Department, Government of Assam
8	Assam And Meghalaya Autonomous districts (Constitution Of District Councils) Rules, 1951 (Parts I, li & lii) And District Autonomous Council By An Act Of Parliament By	Applicable as distribution lines in the autonomous council areas of Assam and passing through tribal settlements. All districts where distribution works are planned, East and West Karbi Anglong and Dima Hasao, are District Autonomous Councils. The Statutory Autonomous Councils are constituted for Social, Economic, Educational, Ethnic and Cultural advancement of the Scheduled Tribe (ST) communities living in Core Areas as well as in Satellite Areas	Responsible Authorities: Chief Executive Member of District Autonomous Council

Sl. No.	Name of Policy / Law / Regulation	Applicability to Project	Remarks
	Incorporating Into The Sixth Schedule In The Constitution (Amendment) Act, 1995 (42 Of 1995)	covering many districts of Assam. Permission from Autonomous Councils is required for project works.	
9	Assam Land and Revenue Regulation (Amendment) Act, 1947 as amended Assam Land (Requisition and Acquisition) Act. 1964	This act is aimed at protecting land-ownership rights of the indigenous tribal people of Assam. Applicable as lines, DTR and poles potentially in private land. An Act to amend and consolidate the law for requisition and speedy acquisition of premises and land for certain public purposes such as accommodation, transport, communication, irrigation, flood control and anti-erosion measures.	Responsible Authorities: Chief Executive Member of District Autonomous Council
10	The Assam Ancient Monument and Records Act, 1959 and The Assam Ancient Monument and Records Rules 1964	No components (sample surveyed distribution lines, and the BESS site) are situated within 500m of a state notified monument. May be applicable if there is an unanticipated impact (change in scope or design) during project implementation or final alignment mapping. Otherwise, the acts will only become applicable if there are any chance finds of physical cultural resources during excavation for construction.	Act for future preservation and maintenance of the sites/monuments by the Directorate. In event of any chance finds being made they must be notified / surrendered to the competent authority. Responsible Authorities: Deputy Commissioner, Directorate of Archeology, Guwahati

Source: ADB's TA Consultant

C. National Health and Safety (Labor) Regulatory Framework and Standards

20. The health and safety framework in India consists of several acts, notifications, rules, and regulations to protect the environment and wildlife as detailed in Table 2.4. The key national authorities are discussed below:

- i. **Ministry of Labor and Employment.** The ministry is responsible for protecting and safeguarding the interests of workers with due regard to creating a healthy work environment along with promotion of welfare and providing social security to the labor forces in both the organized and unorganized sectors. This is achieved through enactment and implementation of various labor laws (presently 44 statutes dealing with minimum wages, accidental and social security benefits, occupational safety and health, conditions of employment, disciplinary action, formation of trade unions, industrial relations, etc.) which regulate the terms and conditions of service and employment of workers.
- ii. **Central Electricity Authority.** The CEA is a statutory organization constituted under the Electricity Supply Act 1948, which has been superseded by the Electricity Act of 2003. The CEA is responsible for prescribing the technical standards related to construction of electrical plants, electric lines and connectivity to the grid, installation and operation of meters and safety and grid standards etc. The distribution components are required to adhere to the safety regulations and standards as prescribed by the CEA.

Table 2.4 Applicable National Health, and Safety Requirements

Sl. No.	Name of Policy / Law / Regulation	Applicability to Project	Remarks
1	National Policy on Safety, Health and Environment at Workplace, 2009	Applicable, seeks to strive for the objective of improving safety, health, and environment in the workplace during both the construction and operation	Responsible Authorities: Ministry of Labor and Employment
2	National Policy on HIV / AIDS and the World of Work	Applicable as influx of laborers for the construction works may lead to transmission of HIV/AIDS. Policy aims to prevent transmission amongst workers and protect the rights of the infected	Responsible Authorities: Ministry of Labor and Employment
3	Drinking Water Standard (IS 10500:2012)	Applicable as provides the standards of drinking water in India. The drinking water provided in line construction, substations, BESS, must adhere to the standards. The standard is given in Appendix 6.	Responsible Authorities: Bureau of Indian Standards, CPCB, PCB Assam
4	The Occupational Safety, Health and Working Conditions Code, 2020 (Gazette notification dated 29 th September 2020)	This is applicable as all project components will involve labour and workers. This Act consolidates and amends the laws regulating the occupational safety, health and working conditions of the persons employed in an establishment and for matters connected therewith or incidental thereto. The code applies in case of contract labour employed through a contractor in the offices of the Central Government or in the offices of the State Government, where the Central Government or, as the case may be, the State Government is the principal employer, as in the case of APDCL.	Responsible Authorities: Ministry of Labor and Justice, The ADC of the two districts, and District Magistrate as Inspector for the district
5	The Bonded Labour (Abolition) Act 1976	Applicable as it prevents use of bonded labor during construction phase	Responsible Authorities: District Magistrate as Inspector for the district or any officer delegated by him and the ADC committees
6	The Child Labour (Prohibition and Regulation) Act, 1986 and its amendment	Applicable and it prohibits the employment of children under the age of 14 by the contractors or APDCL.	Prohibits employment of children under the age of 14 in the building and construction industry. Responsible Authority: Labor Inspector and and the ADC committees
7	The Trade Union Act, 1926	Applicable as it allows the formation of Trade Unions for the purpose of regulating the relations between workers and APDCL.	Responsible Authorities: Registrar of Trade Unions and District Autonomous Councils.
8	The Code on Wages, 2019	Payment of minimum stipulated wages, avoiding inequality in payment of wages etc. to be ensured during the construction and operation phases	The code repealed and replaced Payment of Wages Act, 1936, the Minimum Wages Act, 1948, the Payment of Bonus Act, 1965, and the Equal Remuneration Act, 1976. The Code has consolidated all the provisions of these four labor laws that have been repealed regarding wage and bonus payments and makes it

Sl. No.	Name of Policy / Law / Regulation	Applicability to Project	Remarks
			mandatory for payment of minimum wages and timely payment of wages for all workers in India. Responsible Authority: Labor Commissioner
9	The Code on Social Security, 2020 (yet to be enforced)	Applicable during construction and operation, comply with code in relation to provident funds, gratuities, compensation, employee insurance etc. which are to be paid to the workers employed by the labor contractors, employees of contractors and APDCL.	The code repeals and consolidated the Workmen's Compensation Act, 1923, The Employees' Provident Funds and Miscellaneous Provisions Act, 1952, The Payment of Gratuity Act, 1972, The Employees' State Insurance Act, 1948 and five other acts. The act brings generation, transmission and distribution of power works under the ambit of the act. Workmen Compensation Insurance, regular Provident Fund (PF), gratuity and other insurances have to be obtained by the contractors for the project. Responsible Authorities: Labor Commissioner, PF Commissioner and and the ADC committees
10	Employers' Liability Act no. 24 of 1938	Deals with injuries to workers and the responsibility of the employer to maintain machinery and work site in good and safe conditions	Responsible Authorities: Ministry of Labor and Employment and and the ADC committees
11	The Explosives Act 1884 and its subsequent amendments. The Explosives Rules 1983	Applicable if explosives need to be used, they must also be followed if petroleum products are stored beyond the permissible capacities.	Sets out the regulations as regards to the usage and storage of explosives including explosive fuel (diesel or petrol) at the project site and precautionary measures to be taken. Responsible Authority: Chief Controller of Explosives
12	Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996	Emergency response planning must involve the responsible authorities in case during construction and operation a chemical accident that could impact the public occurs while handling any hazardous chemicals (flammable, toxic and explosive).	Protection of the public against chemical accident while handling any hazardous chemicals (flammable, toxic and explosive) Responsible Authorities: District and Local Crisis Group headed by the District Magistrate and Sub Divisional Magistrate
13	Public Liability and Insurance Act, 1991	The act is applicable to protect the public from any incidents during construction or in the operation phases of the project's components. Liability insurances are to be obtained by the EPC contractor and APDCL for construction and operation.	The act provides for protection to the public from accidents caused from hazardous materials resulting in continuous or intermittent or repeated exposure to death of,

Sl. No.	Name of Policy / Law / Regulation	Applicability to Project	Remarks
			or injury to, any person or damage to any property. Responsible Authorities: Labor Commissioner and District Magistrate and AERC.
14	<u>Contract Labour (Regulation & Abolition) Act, 1970</u>	Relates to the contracting of labour.	Responsible Authorities: Ministry of Labor and Employment

Source: ADB's TA Consultant

D. State Health and Safety (Labor) Regulatory Framework and Standards

21. Since labor is a subject in the concurrent list under the Constitution of India, the state governments are also competent to enact legislations. These labor statutes are enforced and monitored through the Labor Commissioners. The health and safety framework in Assam consists of several acts, notifications, rules, and regulations to protect the environment and wildlife as detailed in Table 2.5. The key state authorities are discussed below:

- i. **Labour Department, Government of Assam.** The Labour and Employment Department comprises two Departments, i.e., Labour Welfare Department and Skill Development & Entrepreneurship Department. Two autonomous bodies, namely the Assam Tea Employees Provident Fund Organization and the Assam Tea Employee's Welfare Board, are running under the administrative control of the Labour Welfare Department. The Labour Welfare Department looks after the health, safety, social security and welfare of labours by implementing labour laws through the Commissionerate/ Inspectorate of Labour/ESI Scheme and Assam Tea Employees Provident Fund Organization. The Labour Welfare Department is solely responsible for administration of all labour enactments (both Central and State) along with the rules related to the welfare of labours. Labour Welfare Department is responsible for discharging the judicial and semi-judicial functions pertaining to industrial disputes.

Table 2.5 Applicable State Health, and Safety Requirements

Sl. No.	Name of Policy / Law / Regulation	Applicability to Project	Remarks
1	The Assam Factories Rules, 1950	It is applicable to construction and operation as laborers will be hired for the various components	The Factories Act is a social legislation that has been enacted for occupational safety, health, and welfare of workers at the workplace. The State of Assam has formulated its rules as envisaged under the Act. Responsible Authorities: Labour Welfare Department, Government of Assam
2	The Assam Payment of Wages Rules, 1937; The Assam Payment of Wages (Procedure) Rules, 1981; The Assam Minimum Wages Rules, 1952; to be amended by the Draft of Code on Wages (Assam) Rules, 2021	It is applicable to construction and operation as laborers will be hired for the various components	An Act to regulate the employment and conditions of services of employed workers/labours Responsible Authorities: Labour Welfare Department, Government of Assam and ADC

Sl. No.	Name of Policy / Law / Regulation	Applicability to Project	Remarks
3	Notification issued vide GLR (RC) 100/2012/238, dated 18 October, 2016	It is applicable to construction and operation as laborers will be hired for the various components. Allows employment of women in factory on night shift between 7 PM To 6 AM with certain conditions in respect of the security and safety of women employees.	Provision permitting women workers in the night shift with adequate safety provision. Responsible Authorities: Labour Welfare Department, Government of Assam and ADC
4	Assam Government Circular No-LE.52/2015/11384 dated 18.10.2016	It is applicable to construction and operation as laborers will be hired for the various components	Provision to ease the mechanism for filling of complaints and grievances by the citizens to ensure speedy disposal, transparency, accountability in the Public Grievance Redressal under various Labour Laws. Responsible Authorities: Labour Welfare Department, Government of Assam and ADC
5	Assam Third Party Audit Scheme, vide Circular No-LE.52/2015 dated 01.11.2016	It is applicable to construction and operation as laborers will be hired for the various components	Regulation to promote the compliance of the labour laws, at the same time, intends to ease the regulatory business environment in the State, by bringing in more transparency and responsibility. Responsible Authorities: Labour Welfare Department, Government of Assam
6	Assam Social Security Rule – Draft, October 2021	It is applicable to construction and operation as laborers will be hired for the various components	Important provisions include gratuity payment, nominees and legal heirs, maternity benefit provisions, employee compensation provisions, and social security and cess (cess is a tax - generally one levied for promoting services like health and education) for building construction workers. Responsible Authorities: Labour Welfare Department, Government of Assam and the ADC
7	The Assam Public Health Act, 2010	Liability Insurances are to be obtained by the contractor and APDCL for construction and operation and works within settlement areas as many lines over houses and DTR and poles in public domain and some inside private lands.	Act to provide for protection and fulfillment of rights in relation to health and wellbeing, health equity and justice. Responsible Authorities: Health and Family Welfare Department, Government of Assam and ADC
8	Assam Rule 1971 for labour license	It is applicable to construction and operation as laborers will be hired for the various components	Responsible Authorities: Labour Welfare Department, Government of Assam and ADC

Source: ADB's TA Consultant

E. International Agreements Applicable to the Project

22. International agreements pertinent to the distribution component include multilateral environmental agreements (MEA) and conventions of the International Labor Organization (ILO) related to worker safety and welfare. India is a party and signatory to several international and regional environmental treaties, agreements, and conventions, to which the MoEF&CC is the national focal point. Table 2.6 provides the key international agreements to which India is a signatory with potential applicability to the distribution component. Of note, in relation to the occupational health and safety of labour, India is not a signatory to Occupational Health and Safety Convention of the ILO and several other ILO conventions related to the health and safety of workers.⁶

Table 2.6 List of Relevant International Agreements

Sl. No.	Name	Date of Ratification	Applicability	Remarks
1	Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat, 1971	1 February 1982	One Ramsar site is present in Assam. The Deepor Beel (also a WLS) is at a distance of 8.7km from the BESS site.	Deals with conservation and sustainable use of wetlands
2	Convention for the Protection of the World Cultural and Natural Heritage, 1972	14 December 1977	The protected areas of Assam include 5 National Parks and 17 Wildlife Sanctuaries as well as 3 proposed Wildlife Sanctuaries, 4 Tiger Reserves, 5 Elephant Reserves, 2 Biosphere Reserves and 2 Natural World Heritage Sites. No project components are situated within any UNESCO site or any Biosphere Reserves.	Addresses nature conservation and preservation of cultural properties
3	Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973	20 July 1976	Risk of illegal wildlife activities by workers outside of working hours.	Deals with protection of endangered species from illegal trade
4	Convention on the Conservation of Migratory Species of Wild Animals, 1979	1 November 1983	Elephant corridors are present inside Assam. Some are found within East Karbi Anglong District. Assam lies along the western part of the East Asian-Australasian flyway as well as in the Central Asian flyway and supports a Ramsar wetland, the Deepor Beel (also WLS and IBA) 8.7km from BESS site. Proposed lines in east Karbi Anaglong are inside the ESZ of the Nagaland based Rangapahar WLS. The risk of hunting or poaching of migratory species by the workers to be addressed.	Aims to conserve migratory species in their range
5	Convention For the Protection of	18 March 1991	Servicing and refilling of fire extinguishers and air conditioners	Lists the various ozone depleting

⁶ https://www.ilo.org/dyn/normlex/en/f?p=1000:11210:0::NO:11210:P11210_COUNTRY_ID:102691

Sl. No.	Name	Date of Ratification	Applicability	Remarks
	the Ozone Layer, 1985		during construction and operation, ensure that use of ozone depleting substances is prohibited	substances and steps for reducing their production
6	Montreal Protocol on Substances That Deplete the Ozone Layer, 1987	19 June 1992		
7	Rio de Janeiro Convention on Biological Diversity, 1992	18 February 1994	Some loss of natural flora due to tree felling, site clearance and RoW clearance is envisaged for distribution lines.	Deals with biodiversity conservation, sustainable usage of natural resources and habitat preservation.
8	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, 1998	24 May 2005	Transformers and other equipment procured must be PCB free. Usage of PCBs in transformers and other equipment procured under the distribution component will be prohibited as per the Regulation of Polychlorinated Biphenyls Order, 2016	Promotes the sharing of responsibilities related to import of hazardous chemicals including PCBs.
9	United Nations Framework Convention on Climate Change, 1992	1 November 1993	It is applicable as new equipment such as circuit breakers may contain sulfur hexafluoride (SF6) although solid dielectric (Hydrophobic Cycloaliphatic Epoxy (HCEP)) can be used in place of SF6 gas as an insulating medium.	Deals with reductions of greenhouse gases (GHG) to achieve 1.5°C target.
10	Kyoto Protocol to the United Nations Framework Convention on Climate Change, 1997	19 August 2002		
11	Paris Agreement under the United Nations Framework Convention on Climate Change, 2015	2 October 2016		
12	Stockholm Convention on Persistent Organic Pollutants, 2001	13 January 2006	Transformers and other equipment procured must be PCB free. Existing transformers and other oil containing equipment may be contaminated with PCBs which must be removed by 31 st December 2025 to comply with the Stockholm Convention	Lists PCBs as one of the pollutants. Implemented in India in part by the Regulation of PCBs Order, 2016.
13	International Labor Organization (ILO)	30 November 1954	Construction and operation will involve workers whose fundamental rights per the ILO need to be protected.	Labor laws of India are compliant to the ILO conventions that India is a signatory of.

Sl. No.	Name	Date of Ratification	Applicability	Remarks
	Fundamental Conventions: ⁷ Forced Labor, Equal Remuneration, Abolition of Forced Labor, Minimum Age, Worst Forms of Child Labor	25 September 1958 18 May 2000 13 June 2017		

GHG = Greenhouse Gas, IEE = Initial Environmental Examination, ILO = International Labor Organization PCB = Polychlorinated Biphenyl

Source: ADB's TA Consultant

F. Borrower's Environment and Social Policies, Procedures and Capacity

23. APDCL and NGEAL have no environment and social safeguard unit or full time environment, health and safety staff. APDCL's and NGEAL's capacity to implement the national environmental, health and safety policies and legislative requirements applicable to the project and ADB's SPS is limited, although APDCL have one environmental consultant deputed for the project (also involved with other funded projects). Environmental safeguard capacity development is needed (as provided in EMP of the IEE). Based on discussions with APDCL, their existing environment, health and safety staffing arrangement, staff qualifications and experience, a PMC is being hired with adequate staff and including Environmental Experts, Health & Safety Officers and Labour experts to ensure project's compliance with national requirements and ADB safeguards.

24. APDCL has a Corporate Social Responsibility (CSR) Policy⁸ with the following objectives:

- To create sensitivity within the Company and society toward social development and to consider CSR as one of the Company's responsibilities and to encourage cooperation with the wider stakeholder community.
- To promote high standard of authenticity, responsibility and accountability toward all stakeholders including employees, community, consumers, Government, etc.
- To promote socio-economic development through community development initiatives/programs.
- To bring about attitudinal change in APDCL employees and other stakeholders about the idea/perception of CSR. This Policy will create a frame work, procedure for assessment, implementation and monitoring of any activity under CSR.
- Among the scope of CSR activities, the key environmental and social policies include:
 - Protection of national heritage, art and culture, including restoration of buildings and sites of historical importance and works of art, setting up public libraries, promotion and development of traditional arts and handicrafts.
 - Promoting gender equality, empowering women, setting up homes and hostels for women and orphans, setting up old age homes, day care centres, and such other facilities for senior citizens, and measures for reducing inequalities faced by socially and economically backward groups; and
 - Ensuring environmental sustainability, ecological balance, protection of flora and fauna, animal welfare, agro forestry, conservation of natural resources and maintaining quality of soil, air and water.

⁷ https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11200:0::NO::P11200_COUNTRY_ID:102691

⁸ <https://www.apdcl.org/website/docs/documents/Approved%20CSR%20Policy%20-APDCL.pdf>

- The CSR policy also provides basic procedures for project identification, monitoring and documentation.

25. APDCL also has Safety Manual (2019)⁹ and a Disaster Management Plan (2015).¹⁰

G. Asian Development Bank's Safeguards Policies and International Good Practice

26. The ADB Safeguard Policy Statement, 2009 (SPS 2009)¹¹ broadly consists of three policy components: (i) Environment Safeguards, (ii) Involuntary Resettlement Safeguards, and (iii) Indigenous People Safeguards. The objectives of Environment Safeguards principle are to (i) avoid adverse impacts of projects on the environment and affected people, where possible; (ii) minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and (iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

27. Under SPS 2009 projects are categorized A, B, C according to the likely significance of impacts:

- (i) Category A: Projects with potential for significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA) is required.
- (ii) Category B: Project with some adverse impacts, but of lesser degree and / or significance than category A. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An IEE is required.
- (iii) Category C: Projects that are likely to have minimal or no adverse impacts. No EIA or IEE required, although environmental implications are still reviewed.

28. To achieve the desired results, safeguard requirements will be incorporated into the process which needs to be realized during the processing and implementation of the projects that ADB shall finance. Table 2.7 presents a comparison and gap analysis of ADB's SPS 2009 for a Category B environment project and Indian Requirements.

⁹ https://www.apdcl.org/website/docs/safety/Safety_Manual_2019_English.pdf

¹⁰ https://www.apdcl.org/website/docs/documents/disaster_management_plan.pdf

¹¹ <https://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf>

Table 2.7 ADB's SPS 2009 and Government of India environmental requirements gap analysis

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
Screening and Categorization	<ul style="list-style-type: none"> • EIA Notification of 2006 and its amendments list the types of projects to be screened and categorized and sets criteria to classify such new and expansion projects based on potential environmental impacts as either category A, B1 and / or B2. • The category of the project shall determine the level of environmental assessment. • EIA is mandatory for project activities that satisfy the defined threshold limits for category A • EIA is also mandatory for certain category B project activities that are within 10km of (i) Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time, (iii) Notified Eco-sensitive areas, (iv) inter-State boundaries and international boundaries • Category B projects will be screened and categorized by SEIAA as either B1 or B2 by Government of India, those categorized B1 require EIA before the granting of prior environment clearance whereas those categorized as B2 will not require EIA. • For building and construction projects, if more than 20,000 square meters in footprint area and more than 150,000 square meters of built-up (floor) area 	<ul style="list-style-type: none"> • As per ADB's Safeguard Policy Statement (2009) screening and categorization is required for all projects • Assigns categories based on potential impacts into either: <ol style="list-style-type: none"> i. Category A – EIA required (significant irreversible, diverse, or unprecedented adverse environmental impacts) ii. Category B – IEE required iii. Category C – no environmental assessment required but a review of environmental implications iv. Category FI – Environmental and Social Management System required 	<ul style="list-style-type: none"> • Power distribution projects are not listed under the schedule of the EIA Notification as environmental sensitive projects. Therefore, screening and categorization are not required by Government of India except for when building and construction components of a certain size are involved. • The new BESS building footprint is planned to be about 200 square meters, so screening and categorization is not required by Government of India since this size is exempt from needing to obtain prior environment clearance. • Under ADB's Safeguard Policy Statement (2009) the entire project including all the outputs is categorized as B, as the components are unlikely to have significant irreversible, diverse, or unprecedented adverse environmental impacts. This IEE has been prepared to address their potential impacts/risks and mitigation measures required.

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
	these are classified under Category B and Prior Environmental Clearance is required from SEIAA.		
Environmental Assessment	<ul style="list-style-type: none"> No assessment required for power distribution projects or small-scale building and construction 	<ul style="list-style-type: none"> Identify potential impacts on physical, biological, physical cultural resources and socioeconomic aspects in the context of project's area of influence (i.e., primary site and related facilities, associated facilities etc.) Assess potential transboundary and global impacts, including climate change. 	<ul style="list-style-type: none"> Major gap as per Indian regulations power distribution projects are not listed as environmental sensitive projects, building sizes are also below the threshold to require prior environment clearance, and hence no environmental assessment is required. However, to comply with ADB's Safeguard Policy Statement (2009) this IEE has been prepared.
Analysis of Alternatives	<ul style="list-style-type: none"> No analysis of alternatives required for power distribution projects or small-scale building and construction 	<ul style="list-style-type: none"> Category A (projects with significant impacts) are required to carry out alternative analysis. Alternatives to the project's location, design, and technology are to be examined and rationale for selecting the project location, design, and technology to be documented. Also "no project" alternative must be assessed. 	<ul style="list-style-type: none"> No gap, as components are unlikely to have significant irreversible, diverse, or unprecedented adverse environmental impacts but consideration has been given to alternatives as part of the environmental assessment.
Environmental Planning and Management	<ul style="list-style-type: none"> No environmental planning and management required for power distribution projects or small-scale building and construction 	<ul style="list-style-type: none"> Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts Key considerations include mitigation of potential adverse impacts to the level of "no significant harm to third parties", the polluter pays principle, the precautionary approach, and adaptive management. Prepare EMP addressing the potential impacts and risks identified by the environmental assessment which should include the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. 	<ul style="list-style-type: none"> Major gap, but this IEE including an EMP has been prepared to meet ADB's Safeguard Policy Statement (2009) requirements
Meaningful Consultation	<ul style="list-style-type: none"> No formal public consultations / public hearing is required for 	<ul style="list-style-type: none"> Meaningful consultation starts early and continues during implementation phase. It is 	<ul style="list-style-type: none"> Major gap, but meaningful consultations have been undertaken as part of the IEE

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
	power distribution projects or small-scale building and construction	undertaken in a conducive atmosphere and is inclusive of gender, vulnerable and indigenous groups such that the project incorporates all relevant views and concerns of affected persons and other stakeholders.	
Information Disclosure	<ul style="list-style-type: none"> Power distribution or small-scale building and construction projects do not require any information disclosure 	<ul style="list-style-type: none"> ADB will post in its website the following: <ol style="list-style-type: none"> Draft IEE prior to appraisal Final or updated IEE upon receipt Environmental monitoring report submitted by borrowers upon receipt Local disclosure is also required 	<ul style="list-style-type: none"> Major gap, but environment safeguard documents prepared under the project shall comply with the requirements of ADB's Safeguard Policy Statement (2009) and shall be disclosed on the ADB website and locally
Grievance Redress Mechanism (GRM)	<ul style="list-style-type: none"> GRM is not required 	<ul style="list-style-type: none"> Establish GRM to facilitate resolution of grievances or complaints received in the project 	<ul style="list-style-type: none"> Major gap exists, but GRM to be established as per the requirements of ADB's Safeguard Policy Statement (2009)
Monitoring and Reporting	<ul style="list-style-type: none"> No monitoring and reporting are required for power distribution projects or small-scale building and construction 	<ul style="list-style-type: none"> Borrowers are required to prepare and regularly submit periodic monitoring reports on the progress of EMP implementation to ADB for review and disclosure Prepare and implement corrective action plan if non-compliance is identified 	<ul style="list-style-type: none"> Major gap exists but monitoring measures in accordance with ADB's Safeguard Policy Statement (2009) are proposed in the IEE.
Biodiversity	<ul style="list-style-type: none"> Wildlife Protection Act, 1972 and amendments provides the procedures and guidelines for siting of projects within protected areas and their ESZ. Projects within protected areas or ESZ involve lengthy permission procedures. Projects obtaining permissions are mainly linear projects of national importance and are permitted with mitigation measures. Indian Forest Act, 1927 and the Forest (Conservation) Act, 1980 and its subsequent amendments set procedures for diversion of forest land for non-forest activities. The procedure is also time consuming especially for cases involving diversion >5 ha. Any 	<ul style="list-style-type: none"> ADB's Safeguard Policy Statement 2009 requires that the borrower assess the significance of project impacts and risks on biodiversity and natural resources as an integral part of the environmental assessment process. It also requires that the assessment focuses on the major threats to biodiversity including destruction of habitat and introduction of invasive alien species, and on the use of natural resources in an unsustainable manner. Borrowers are required to avoid, minimize, or mitigate potentially adverse impacts and risks and, as a last resort, propose compensatory measures, such as biodiversity offsets, to achieve no net loss or a net gain of biodiversity. ADB's Safeguard Policy Statement 2009 also lays down procedures for implementing projects in natural habitats, critical habitats, and Legally Protected Areas 	<ul style="list-style-type: none"> Biodiversity and critical habitat (in the ADB sense) can be found outside the Indian protected area system. Indian regulations have no provisions for protecting such biodiversity at project planning stage unless projects fall under the EIA Notification 2006. Gaps persist especially as prior EC is not required for power distribution or small-scale building and construction projects; there is no national mechanism to assess impacts on biodiversity and natural resources for this type of project outside of protected areas or forest areas. In ESZ, undergrounding of distribution lines is encouraged but, as distribution works do not require EC, there is no mechanism to consider site-specific biodiversity impacts. No components inside the protected areas will be part of the project scope.

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
	<p>diversion of forest land involves compensation of land and plants that shall be felled. For central government projects there are some relaxations related to compensation of land.</p> <ul style="list-style-type: none"> • Most, but not all, critical habitat or areas inhabited by endangered species (under schedules of the Wildlife Protection Act, 1972 and amendments) are protected under either the Wildlife Protection Act or the Forest Act 		<ul style="list-style-type: none"> • To comply with ADB's Safeguard Policy Statement (2009), an environmental assessment has been prepared considering biological impacts across project components.
Pollution	<ul style="list-style-type: none"> • The Environment (Protection) Rules, 1986 and various legislations address aspects such as air, noise, water pollution, hazardous substance management etc. • National Ambient Air Quality Standards have been specified as per MoEF&CC notification General Statutory Rules (GSR) 826I dated 16.11.2009 in compliance with the Air (Prevention and Control of Pollution) Act, 1981(Amended 1987) and Air (Prevention and Control of Pollution) Rules 1982 • Noise Standards have been specified as per the Noise Pollution (Control and Regulation) Rules, 2000 (Amended 2002). • Water quality standards have been specified as per MoEF&CC notification No. GSR 7421, Dt: 25.09.2000 and in compliance with the Water (Prevention and Control of 	<ul style="list-style-type: none"> • Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phaseouts. • Refers to World Bank Group / IFC's EHS Guidelines for international good practice standards and measures for pollution control and prevention as per Appendix 6. If national regulations differ, more stringent will usually be followed. If less stringent levels are appropriate in view of specific project circumstances, provide full and detailed justification. 	<ul style="list-style-type: none"> • Limiting value of some pollutants specified in the Indian regulatory standards are different than those specified in World Bank Group / IFC's EHS guidelines and hence those that are applicable to the project need to be established and the more stringent standards will apply. • The guideline values of the five WHO air pollutants referred to by the EHS guidelines in the absence of national standards are more stringent than the Indian standards. National Ambient Air Quality Standards (NAAQS) list 12 pollutants along with their permissible concentrations. The major pollutant that is listed in the Indian standard but not by the WHO to which the EHS guidelines refer is Carbon Monoxide (CO) although the WHO introduced one in their latest 2021 update of the guidelines. Also, the NAAQS are for two types of land uses – (a) industrial, residential, rural and others and (b) ecologically sensitive areas notified by Government of India whereas WHO make no distinction on land use. • Ambient noise limits for industrial receptors are lower as per the WHO

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
	<p>Pollution) Act 1972 (Amended 1988) and Water (Prevention and Control of Pollution) Rules 1974.</p> <ul style="list-style-type: none"> Standards applicable to the distribution component are provided in Appendix 6. 		<p>community noise guidelines to which the EHS guidelines refer than the Government of India standard, whilst at residential receptors they are similar, but differ for sensitive and commercial zones. The Government of India introduces an additional receptor type not considered by the EHS guidelines (WHO) namely silence zone (hospitals, educational institutions, courts, religious places and <i>'any other area which is declared as such by the competent authority'</i>)</p> <ul style="list-style-type: none"> National ambient surface water quality standards exist as well as drinking water standards (ISO 10500) The guideline values for treated sanitary wastewater discharges referred to by the EHS guidelines in the absence of national standards are the same or more stringent than the general effluent quality standards as set under the Environmental Protection Rules 1986. Sector specific Indian CPCB standards for effluent quality exist, although not for power distribution. Indian regulations have no provisions for ensuring pollution control is considered at project planning stage unless projects fall under the EIA Notification or will require a CTE/CTO from SPCB. However, to comply with ADB's Safeguard Policy Statement (2009) this IEE has been prepared considering impacts related to pollution risk and setting out the standards/guidelines that are to be met (Appendix 6). Where international good practice standards or guidelines are more stringent than national, it is the most stringent that applies unless otherwise justified in this IEE report.

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
Health and Safety	<ul style="list-style-type: none"> Occupational health and safety standards included in various Indian labour laws and codes Community health and safety of distribution projects is covered by CEA regulations including requirement to maintain vertical and horizontal safety clearances 	<ul style="list-style-type: none"> Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities. Refers to World Bank Group / IFC EHS Guidelines for the occupational health and safety guidelines to be followed 	<ul style="list-style-type: none"> No major gaps with respect to occupational health and safety, as both the World Bank Group / IFC EHS guidelines and Indian regulations require safe work areas, the use of safety equipment and personal protective equipment (PPE) Some gaps with respect to community health and safety as there are no standards for EMF which has been considered in the IEE.
Physical Cultural Resources	<ul style="list-style-type: none"> The procedures for obtaining permissions for siting of projects in the vicinity of a protected monument are laid in the various acts related to ancient monuments. National legislation prohibits projects that are within 100m of protected monuments. For projects within 300m, permissions are first to be obtained from the competent authorities. Chance finds as per Indian regulations are to be handed over to the authorities who shall inspect / assess the chance finds. Only rarely are protected physical cultural resources removed unless a project is of national importance and the resources are of minor importance and, in such cases, it is handled by the specialist from the Archaeological department. In most cases of conflicts, the project proponent is advised to relocate their project site. 	<ul style="list-style-type: none"> ADB's Safeguard Policy Statement (2009) states that the borrower is responsible for siting and designing the project to avoid significant damage to physical cultural resources. It requires that such resources that may have direct, indirect, cumulative, and induced impacts are identified and assessed by qualified and experienced experts using field-based surveys. If such resources are impacted, consultations with affected communities shall take place to identify the importance and to incorporate the views of the affected communities besides consultations with relevant national or local regulatory agencies. Appropriate mitigation measures ranging from avoidance to full site protection to selective mitigation, including salvage and documentation be provided in case of impacts. For projects that are located where physical cultural resources are expected to be found as per the environmental assessment, procedures for chance finds shall be included in the EMP and such finds shall not be disturbed until assessed by a competent specialist Movement of physical cultural resources shall be done only when no alternatives exist, overall benefits of the project substantially outweigh the anticipated cultural heritage loss and the removal is in accordance with relevant national and 	<ul style="list-style-type: none"> Some gaps persist for locally important physical cultural resources especially where prior environmental clearance is not required under the EIA notification and impacts are not required to be assessed. However, to comply with ADB's Safeguard Policy Statement (2009), this IEE has been prepared considering impacts on all physical cultural resources.

Project Stage	Indian Requirements	ADB's Safeguard Policy Statement (2009)	Gap Analysis
		international laws and uses the best available techniques	

ADB = Asian Development Bank, CEA = Central Electricity Authority, CPCB = Central Pollution Control Board, CTE = Consent to Establish, CTO = Consent to Operate, EHS = Environmental, Health and Safety, EIA = Environmental Impact Assessment, EMP = Environmental Management Plan, ESZ = Eco Sensitive Zone, GRM = Grievance Redress Mechanism, GSR = General Statutory Rules, IEE = Initial Environmental Examination, IFC = International Finance Corporation, MoEF&CC = Ministry of Environment, Forest, and Climate Change, NAAQS = National Ambient Air Quality Standards, PPE = Personal Protective Equipment, SEIAA = State Environmental Impact Assessment Authority, WHO = World Health Organization
Source: ADB's TA Consultant

29. The project will follow national as well as international good practice guidelines related to environment, health and safety including those set out in the:

- (i) IFC EHS General Guidelines, 30 April 2007
- (ii) IFC EHS Guidelines for Electric Power Transmission and Distribution, April 2007
- (iii) International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for Limiting Exposure to time-varying Electric, Magnetic, and Electromagnetic Fields (UP to 300 GHz)
- (iv) ILO, Safety and Health in Construction, 2022.

30. Section 4 on Construction and Decommissioning of the IFC EHS General Guidelines (30 April 2007) will be applicable for the distribution component. In addition, the IFC EHS Guidelines for Electric Power Transmission and Distribution (30 April 2007) shall also need to be considered while designing the substations, BESS and distribution line components and undertaking the environmental assessment. It requires consideration of terrestrial and aquatic habitat alteration, electric and magnetic fields, hazardous materials, occupational health and safety, and community health and safety. The project is required to comply with these guidelines regarding assessment of potential impacts and management measures, performance indicators and monitoring guidelines. APDCL and NGEAL shall follow the IFC EHS Guidelines for this project and shall also ensure that all appointed contractors and their subcontractors follow them.

31. The applicable international good practice standards and guidelines from the above-mentioned guidelines are set out in **Appendix 6**. Where international good practice standards or guidelines are more stringent than national, it is the most stringent that applies unless otherwise justified in this IEE report.

32. ADB's prohibited investment activities list (PIAL) will also apply. Thus, any use of CFCs, PCBs, and asbestos containing materials will be prohibited. In relation to child labor, considering capacity for supervision, no workers under 18 years of age will be permitted to work on the construction site or operational areas due to the hazardous nature of work involved.

III. DESCRIPTION OF THE PROJECT (OUTPUTS 3 AND 4)

A. Output 3 and 4 Project Components and Locations

33. The BESS and distribution components are based in the state of Assam. Assam is divided into 5 divisions, which are further sub-divided into 35 administrative districts (works shall be in 4 districts). While the distribution lines are planned in the East and West Karbi Anglong and Dima Hasao Districts (both in Central Assam Division), the BESS site is located in the Kamrup District (Lower Assam Division). The administrative map of Assam highlighting districts where works will take place is given in Figure 3.1. Assam shares an international border with Bhutan in the north and Bangladesh in the west, and internal borders with the states of Nagaland and Manipur to its east, Mizoram and Tripura to its south and Meghalaya and West Bengal to its west. Among the project districts, Kamrup shares border with Meghalaya, East Karbi Anglong with Nagaland, and Dima Hasao with Manipur state. The project components shall be implemented through EPC contracts awarded by APDCL.

Figure 3.1 Administrative Map of Assam showing (blue) districts where BESS (Kamrup) and Distribution Components (East and West Karbi Anglong and Dima Hasao) are planned



Source: <https://www.dreamstime.com/assam-map-political-administrative-districts-name-showing-international-state-boundary-district-vector-illustration-image218731964>

34. **Output 3: Renewable energy-powered battery storage system piloted.** This output will support the equity contribution of APDCL to set up a joint venture (NGEAL) with the Oil and Natural Gas Corporation (ONGC) Tripura Power Company to initially develop a pilot grid-connected battery storage installation (BESS) of at least 25 MW at the 400 kV Kukurmara Mirza grid transmission substation, under Mirza electrical circle in Kamrup district of Assam Electricity Grid Corporation Limited (AEGCL). The BESS will be housed on undeveloped land earlier owned

by AEGCL within its existing compound, but now under the ownership of the JV, adjacent to its visitor accommodation building, and accessed through its main security gate. No land acquisition will be involved. The BESS will be charged using electricity from the grid. It will improve APDCL's ability to meet peak demand and will provide frequency regulation to improve grid stability by storing excess energy during periods of low demand and releasing it during peak loads. BESS design parameters have been identified to achieve a storage capacity of 100 MWh for 4 hours with a depth of discharge (DoD) of 80% and a minimum battery efficiency of 95%. The overall battery capacity required is 25 MW¹². This can be achieved by using 8 units of 12.5 MWh battery containers. All Output 3 works regardless of scope will be required to follow the EMP for this output.

35. The available land area for BESS installation at the Kukurmara Mirza grid transmission substation site is approximately 6000 square meter. The battery containers will take up 50-60% of the total space, auxiliary services including power conditioning systems, transformers, and switch gear will account for 20-25% of total space, control room and other facilities will take up 10-15% of the total space, clearances for safety and access zones around the battery containers would take up 5-10% of the total space, and, the 132 kV grid connection structures will require around 5% of the total space. A bay extension will be required, details of the grid substation to be integrated with the BESS are provided under the existing facilities section. The 10 km location map is provided as Figure 3.2 while the 500m features are captured in Figure 3.3. Figure 3.4 shows the site boundary and site photos.

Figure 3.2 Location Map of BESS Site -10km



Source: ADB's TA Consultant

¹² Detailed Project Report (DPR) on implementing 25MW Battery Energy Storage System (BESS) at a transmission substation in Assam by APDCL- OTPC JV, February 2024

Figure 3.3 Map showing location BESS site and 500m radius



Source: ADB's TA Consultant

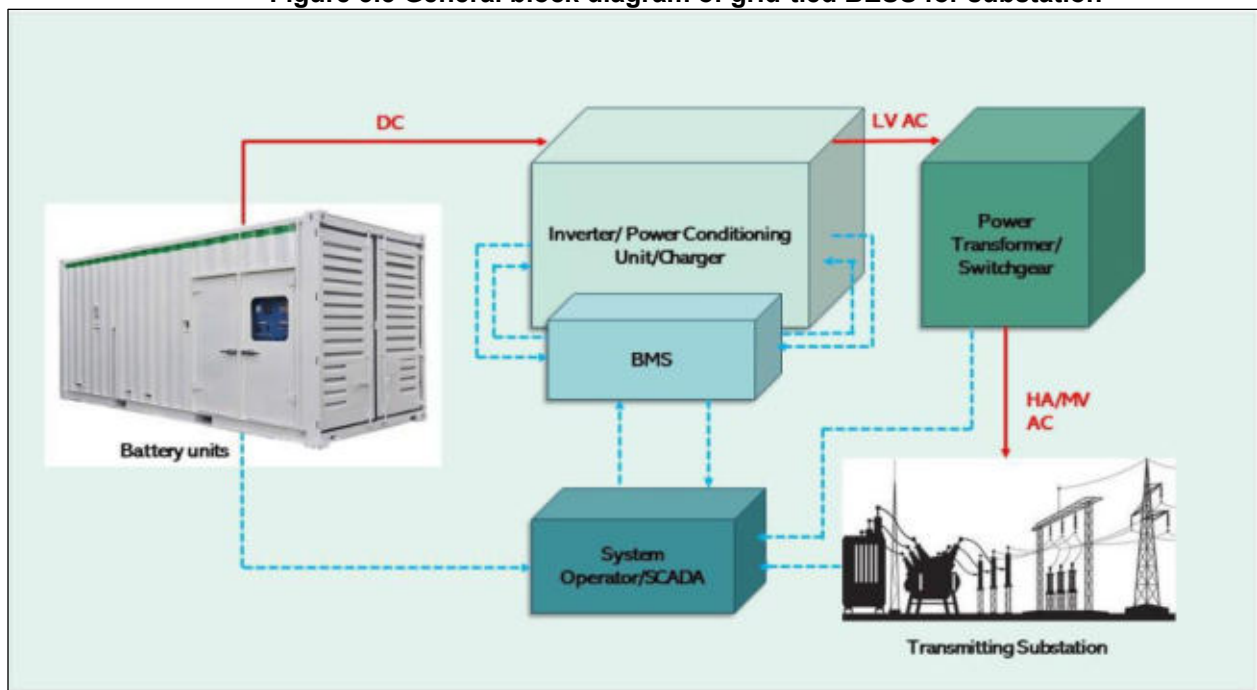
Figure 3.4 BESS Site Details



Source: ADB's TA Consultant

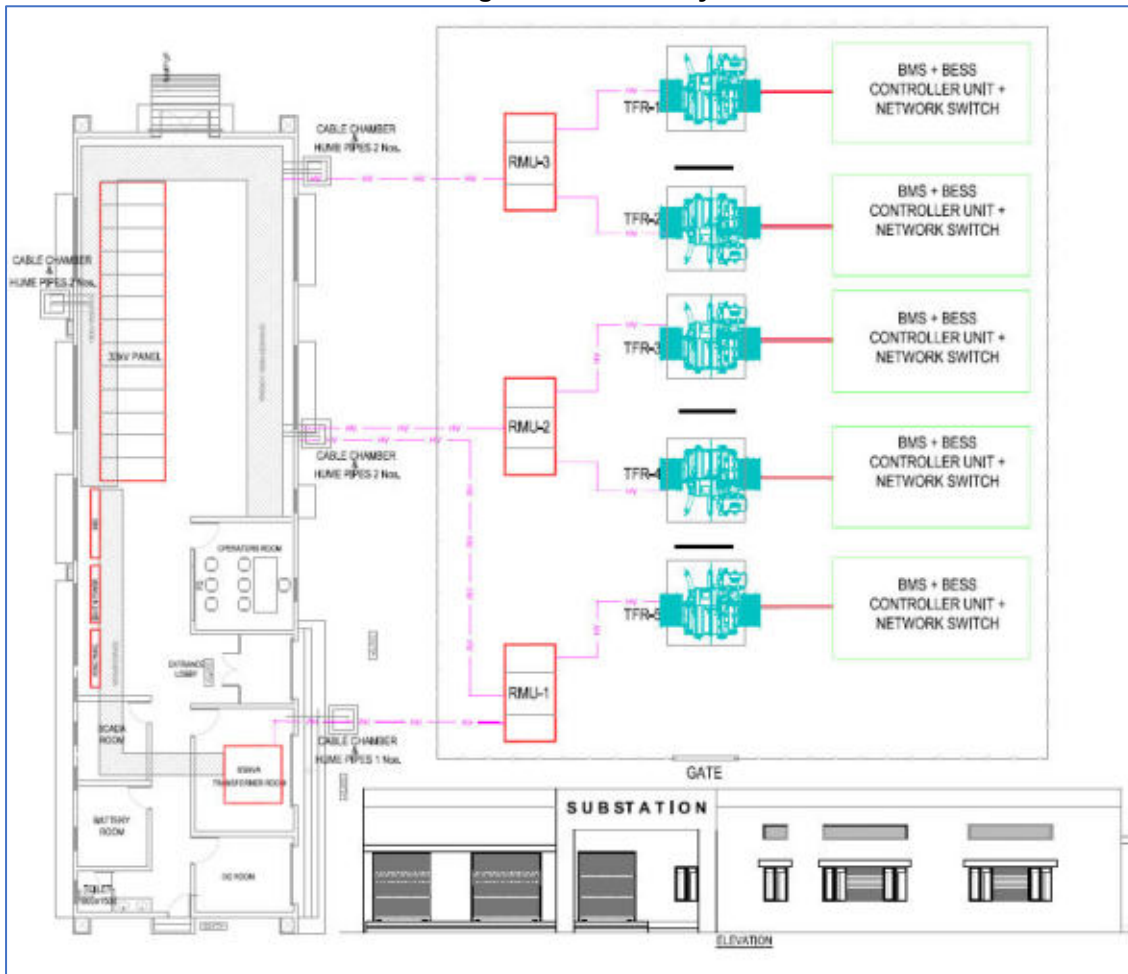
36. **BESS design and engineering:** As per the DPR (February 2024), considering the site conditions, for the BESS component, Lithium-Iron-Phosphate (LFP) batteries are found to be the most suitable choice in terms of environmental impact as they have improved environmental characteristics compared to some other lithium-ion battery chemistries. Even though LFP batteries require the extraction of lithium, iron, and phosphate, much like other lithium-ion batteries, the production process is more straightforward and environmentally friendly compared to other lithium-ion batteries. They require fewer hazardous materials and involve less complex manufacturing steps. As LFP batteries have high energy efficiency, the overall environmental impact during operation is reduced. A longer lifespan compared to other lithium-ion batteries means fewer batteries are needed over time, reducing the environmental impact associated with battery manufacturing and disposal. They are also relatively easy to recycle. Disposal of batteries at the end of life can cause an environmental hazard. Figure 3.5 shows the general technology of a BESS facility, whereas the APDCL BESS layout is shown in Figure 3.6. Equipment and infrastructure will include the following:

Figure 3.5 General block diagram of grid-tied BESS for substation



Source: APDCL

Figure 3.6 BESS Layout



Note: only 5 battery modules are shown in this diagram but 8 are required
Source: APDCL

- 8 LFP type Battery Modules (containerised system), housed in customized, climate-controlled enclosures with thermal management systems, modular design for scalability, fire retardant materials, and compatible with lithium-ion battery specifications
- Battery Management System (BMS),
- 40 nos. 2.5 MW capacity, bi-directional, grid-tied, with Indian grid synchronization Power Conversion System (PCS) with 40 nos. 2.5 MVA, 33kV/132kV, oil-cooled, outdoor type transformers,
- Energy Management System (EMS),
- Ancillary equipment: fire suppression system, security, and HVAC for thermal management,
- Control building with area of 200 square meters and height of 7.5 m,
- Cabling and interconnections, and
- Civil works:
 - Foundations - Reinforced concrete (M30 grade), including steel reinforcement as per design,

- Drainage - PVC or equivalent drainage pipes, catch basins, and gravel for filtration,
- Roads- Gravel or RCC as per requirement, width to accommodate heavy vehicles, and
- Fencing- Galvanized iron chain-link fencing with concrete posts.

37. The O&M needs for BESS are distributed over the 15-year lifespan of the battery, with recurring evaluations and replacements occurring annually, every five years, and again at the ten-year mark. Annual maintenance tasks include checking communications, cleaning, and regular inspections. In year 10, major replacements of inverter and powerpack components will be carried out to ensure a 20-year economic life.

38. Decommissioning Li-ion batteries is of utmost importance due to their hazardous materials. Damaged Li-ion batteries, if not fully discharged, pose a "stranded energy" risk and are still considered active batteries. To properly handle these batteries during decommissioning, it is essential to ensure the complete discharge of stored energy before classifying them as hazardous waste.

39. **Applicable design codes and standards:** The design a BESS for a substation should prioritize safety, performance, and grid compatibility. Adherence to relevant standards is crucial to achieving these objectives. Below are the main international standards to be followed in the BESS design, along with applicable national standards:

- IEC 62477-1: This International Electrotechnical Commission (IEC) standard addresses the general requirements for BESS safety and is a fundamental reference for safety considerations in BESS design.
- IEC 62619: This standard outlines the performance and testing requirements for BESS in stationary applications. It covers topics such as electrical safety, environmental considerations, and performance testing.
- IEC 60086-4: This standard provides guidelines for the safe use of lithium-ion batteries, which are commonly used in BESS. It covers topics such as electrical, mechanical, and environmental safety.
- IEC 62133: This standard specifies safety requirements for portable primary (non-rechargeable) and secondary (rechargeable) cells and batteries, which can be relevant for specific BESS applications.
- IEC 61427: This standard addresses the design and management of secondary batteries used in industrial applications, including energy storage systems.
- IEEE 1578 (Recommended Practice for Stationary Battery Electrolyte Spill Containment and Management) - Provides descriptions of products, methods, and procedures relating to stationary batteries, battery electrolyte spill mechanisms, electrolyte containment and control methodologies, and firefighting considerations. However, the batteries to be used for the BESS are dry cell type.
- ISO 13626-3: Part of the ISO 13626 series, this standard provides guidelines for the performance, safety, and environmental requirements of BESS in grid-connected applications.
- NFPA 855: The National Fire Protection Association (NFPA), USA standard outlines safety requirements for the installation of stationary energy storage systems.
- ANSI C18.3: This American National Standards Institute (ANSI) standard addresses the safety and performance requirements for lithium batteries used in stationary applications.

- Assam Electricity Grid Code (AEGC), Assam Electricity Regulator Commission, Government of Assam. The Grid Code governs the boundary between Assam Gridco and users and establishes guidelines for the operation of facilities for those who are connected to and will use the State Grid

40. **Output 4: Electricity distribution system in project areas enhanced.** The electricity distribution system in the surrounding areas of the proposed solar site in East and West Karbi Anglong district and in the rural parts of the neighbouring district of Dima Hasao will be strengthened. The project will finance renovation and upgradation of three existing substations, conversion of bare 11kV lines to covered conductor (CC), and conversion of bare 0.4 kV low tension (LT) lines to aerial bundled cable (ABC), installation of new distribution transformers and associated covered conductor 11 kV lines and ABC LT lines for capacity enhancement and voltage improvement, and grid extension to bring remaining off-grid electricity consumers if any in the surrounding area to the national grid. This output will also support training and awareness programs on safe and efficient use of electricity will be delivered to local communities (including at least 100 women and/or disadvantaged people). All components where civil works are required including for the substation renovation and modernization, bay extensions involving new power transformers, distribution line installation including new poles, new DTRs with associated lines in the public domain may result in potential adverse impacts and risks and are thus considered further within the IEE. All Output 4 works regardless of scope will be required to follow the EMP for this output.

41. **Scope of substation works:** The list of three substations for output 4 is given in Table 3.1, whereas the detailed existing substation environmental audit report is provided as Appendix 2. The status of the existing distribution network is given in Table 3.2 and the project distribution line scope is given in Table 3.3. The details of individual distribution lines and distribution transformers (DTRs) are given in Appendix 1.

42. All 3 existing 33/11 kV substations are on land owned by APDCL. The works will be carried out only within the land boundary of the existing substations, and no land acquisition will be involved. The substation locations are shown in Figure 3.7. All the substations are in rural areas of three administrative districts of Assam, namely Karbi Anglong East and West, Dima Hasao and Kamrup (BESS). The APDCL Electrical Circles (EC) covering these districts are nineteen. The EC are further divided into 45 electrical divisions (ED) and 158 sub-divisions (ESD). While all the three 33/11 kV substations are in Kanch EC, two of them (Baithalangso and Umpanai) are under Donkamokam ESD, whereas Gunjung is under Haflong ESD of APDCL.

43. The augmentation work at the 33/11 kV substations involves the installation of a new power transformer (PTR) at the existing 33/11 kV Gunjung substation in place of a damaged one; and installation of additional bus isolators, PTRs and 33kV incomers with associated works including switchgears in Baithalangso and Umpanai substations. Total of 3 PTR will be installed as part of the existing substation augmentation works. They will need to be installed on a transformer pad (4 meter x 4 meter) with transformer oil pit for CEA guidelines (refer Chapter 4, part B and part C of the CEA 2022 guidelines¹³). The renovation and modernization work also involves upgradation of protection equipment; provision of 11 kV switchgear panels in 2 substations including cabling works; and provision of auxiliary equipment and switchyard improvement works and design and installation of earth system to achieve safe voltage levels

¹³ [https://cea.nic.in/wp-content/uploads/regulations_cpt/2023/01/CEA Technical Standards for Construction of Electrical Plants Line s_Regulations_2022-3.pdf](https://cea.nic.in/wp-content/uploads/regulations_cpt/2023/01/CEA_Technical_Standards_for_Construction_of_Electrical_Plants_Line_s_Regulations_2022-3.pdf)

during earth faults in Baithalangso and Umpanai substations.

Table 3.1 Summary scope for substation R&M works

SI . N o.	Substation Name	Location (District)	EC	ED	Grid Coordinates	Scope of Work
1	Gunjung	Dima Hansao	Kanc h	Haflo ng	25°18'18.66" N, 93° 0'52.38"E	<ul style="list-style-type: none"> Replacement of one damaged 5 MVA PTR with a new 3-phase, 50 hertz 5 MVA oil filled PTR sited on new transformer pad
2	Baithala ngso	West Karbi Anglong	Kanc h	Howra ghat	25°58'2.54"N , 92°35'50.21" E	<ul style="list-style-type: none"> New 33kV incomer and associated equipment * Installation of 33kV bus isolator with structure and foundation Installation of new 3-phase, 50 hertz 2.5 MVA oil filled PTR with transformer pad
3	Umpana i	West Karbi Anglong	Kanc h	Howra ghat	25°56'25.87" N, 92°17'56.99" E	<ul style="list-style-type: none"> New 33kV incomer and associated equipment * 33kV bus isolator with structure and foundation Installation of new 3-phase, 50 hertz 2.5MVA oil filled PTR with transformer pad

*33 kV outdoor vacuum circuit breaker (VCB); relays and control panels for 33 kV feeder and PTR; 33 kV grade, oil insulated 10 MVA current transformers (CTs) -2 per substation; 33kV grade, single phase to earth connected 100 VA potential transformers (PTs) – 1 per substation; 33 kV 800 amps double-break isolator; 33 kV 10 KA lightning arrester; 9-unit 11 kV indoor VCB panel (6 no. of outgoing feeder panel, 2 no. incomer and 1 no. bus coupler); 11 kV XLPE 1 Core x 630 sq.mm (outdoor and indoor type) cables; 11 kV 630 amps double-break isolators; 33 kV composite polymeric disc insulator for stringing of 33 kV bus; 11 kV composite polymeric disc insulator for stringing of 11 kV bus; and control cables, clamps, galvanized iron pole for 11kV outgoing arrangement, etc.

Source: APDCL

Figure 3.7 Location of substations



Source: ADB's TA Consultant

44. **Scope for distribution line works:** Work comprises of installing and upgrading 546.75km of 11 kV and low-tension distribution lines. The 11kV and 0.4kV LT lines are all falling under the KANCH Electrical Circle (EC) under Nagaon Zone of Central Assam Region of APDCL. **Appendix 8** shows sample surveyed distribution lines mapped (for the IEE, site visits to sample 11kV and LT distribution lines were conducted with all routes being indicative at this stage). Approximately, 15km (15%) or 15 number (14%) of 11 kV lines out of a total 98.5 km, and 65km (18%) of 0.4 kV LT lines out of a total of 448.25 km of low-tension lines in the three districts. All CC 11kV lines in scope were mapped, whereas for LT lines, all those visited were mapped. The scope of works includes reconductoring 11kV distribution lines using covered conductors, new overhead 11kV covered conductor lines, and conversion of bare to ABC overhead lines. Figures 3.8 shows examples of the existing overhead lines (OHL) with covered conductor, and ABC in Assam.

Table 3.2 Status of the existing distribution network of Assam

Details	Length/quantity
No. of 33/11 kV Substations	347
Total Capacity of the Substations	3016.81 MVA
Total length of 33 kV Lines	5995.88 km
Total length of 11 kV Lines	54706.13 km
Total length of LT Lines (3-Phase)	45013.13 km
Total length of LT Lines (1-Phase)	98670.77 km
Total number of Distribution Transformers	64493
Total Capacity of Distribution Transformers	4484.31 MVA

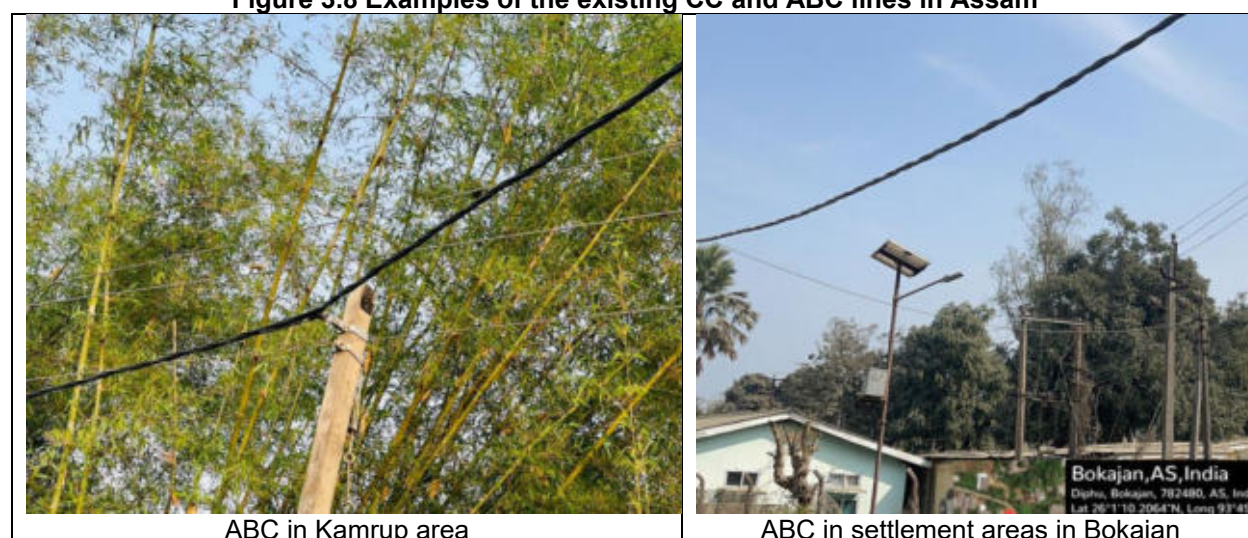
Source: <https://power.assam.gov.in>

Table 3.3 Summary of output 4 distribution works

SI No	Scope of Work	Unit	East and West Karbi Anglong District	Dima Hasao District	Total
B. Installation of New DTR and Lines					
B1	Installation of New 11/.415 kV, 100 kVA DTR	nos.	17	8	25
B2	Installation of New 11/.415 kV, 63 kVA DTR	nos.	19	12	31
B3	Installation of New 11/.415 kV, 25 kVA DTR	nos.	11	16	27
B4	Installation of New 11/.415 kV, 250 kVA DTR	nos.	5	0	5
	Total (New DTR Addition)	nos.	52	36	88
B5	11 kV covered conductor associated with New DTR	km	30.75	8.75	39.5
G1	Proposed Associated LT Line (3 Phase) – ABC	km	29.3	7.1	36.4
G2	Proposed Associated LT Line (1 Phase) - ABC	km	43	8.2	51.2
	Total (DTR associated LT Line)		72.3	15.3	87.6
D. R&M and Reconductoring of Existing 11 KV Line					
D1	Reconductoring of 11 KV feeder using GI Steel Tubular Pole SP-56 with Medium Voltage Covered Conductor	km	36.0	23.0	59.0
F Conversion of Existing LT line to Arial Bunched Cable					
F1	Conversion of Existing 3-Ph LT line with 3C x 120 sq. mm + 1C x 95 sq. mm Bare to ABC on SP-22 Poles	km	92.6	29.3	121.9
F2	Conversion of Existing 1-Ph LT line with 1C x 70 sq. mm + 1C x 70 sq. mm Bare to ABC on SP-22 Poles	km	162.6	76.25	238.85
	Total (LT Bare to ABC Conversion)	km	255.2	105.55	360.75
	Total 11kV CC	km	66.3	31.75	98.05
	Total LT ABC	km	327.6	120.85	448.45
	Total line (11kV and LT)	km	393.9	152.6	546.5

ABD = Aerial Bundled Cable, , DTR = Distribution Transformer
Source: APDCL

Figure 3.8 Examples of the existing CC and ABC lines in Assam



ABC in Kamrup area

ABC in settlement areas in Bokajan



11kV CC in Guwahati



11kV CC in East Karbi Anglong

Source: ADB's TA Consultant

45. **Scope for DTR work:** Distribution works also includes 93 new 11/.415 kV oil cooled and dry type distribution transformers (DTR) including ground mounted ones in the three districts. The DTR installations are all falling under the KANCH Electrical Circle (EC) under Nagaon Zone of Central Assam Region of APDCL. The scope of DTR installation is provided in Table 3.3. A DTR provides the final voltage transformation in the electric power distribution system, stepping down or up the voltage used in the distribution lines to the level used by the customer in their home, businesses, and commercial building. Figure 3.9 shows sample DTR sites and existing DTR in the project area.

Figure 3.9 New DTR location and examples of the existing DTR in Assam



Source: ADB's TA Consultant

B. Construction Activities

Design Principles and Construction Activities

46. All districts of the state of Assam lie in seismic zone V (very severe intensity zone), although earthquakes are rare, the last event happened in 1869. New equipment installed in the substations and BESS shall be installed on foundations having proper seismic design conforming to IS 1893 for seismic analysis, IS:1893-84 for the seismic zone and IS 2.2.4 for seismic acceleration. The new BESS control building will also need to meet seismic design requirements for buildings in seismic zone V, whilst it will need to be confirmed that the existing control rooms of substations have been adequately constructed in the past to meet these requirements. Poles of the overhead distribution lines can be toppled due to earthquakes, landslide as well as strong winds causing disturbances in the distribution network. Poles shall therefore conform to Indian Standard (IS) requirements and concrete foundations to the poles shall be having proper seismic design conforming to IS:1893 for seismic analysis, IS:1893-84 for seismic the zone and IS 2.2.4 for seismic acceleration. The new BESS facility site and substations are located away from river flooding zones. Summary features of the components involved with respect to construction are given in Table 3.4.

47. **BESS Works:** Figure 3.10 depicts representative BESS facility installation for reference. Tentative timelines and man-power requirement for the intervention is provided in Table 3.5. The construction will generally have the following stages:

- Selection of contractor (to be appointed by JV company)
- Site survey and planning - design to be seismic and climate resilient.
- Establishment of construction site, storage area, labor camp.
- Sourcing and transportation of material and equipment.
- Site clearance
- Excavation and levelling
- Foundation construction
- Cable trenches
- Drainage system installation
- Internal access construction
- BESS and control building installation
- Electrical works including earthing and connections
- Fencing, firefighting, first aid and securities installation
- Final inspection and site clean-up
- Testing and commissioning prior to operation

Figure 3.10 Representative images showing installation of BESS facility



Site preparation



Battery pad construction



Completed battery pads



Battery module installation



Example completed BESS facility

Source: <https://flexgen.com/birth-of-a-battery-storage-project-in-the-heartland/> <https://www.tennet.eu/battery-energy-storage-systems-bess>

48. **Substation R&M Works:** Tentative timelines and man-power requirement for the intervention is provided in Table 3.5. The following construction activities will be involved for works at the existing 3 substations to be upgraded, within the boundary of land owned by APDCL:

- Selection of contractor following International Competitive Bidding (ICB) tender process.
- Site survey and design - design to be seismic and climate resilient.
- Establishment of construction site, storage area, labor camp.
- Sourcing and transportation of material and equipment.
- Site clearance including repairing of old buildings and equipment (if required).
- Foundation/transformer pad construction
- Cable trenches
- Access construction for new PTR
- Installation of transformers, control panels etc.
- Electrical works including earthing and connections
- Switchyard gravelling of 0.15 m (thickness) by 40 mm size crushed stone
- Final inspection and site clean-up
- Testing and commissioning prior to operation

49. **Overhead distribution line works:** Once a contractor is selected following ICB tender process the works on 11 kV and LT overhead distribution lines shall involve detailed GPS survey of existing and proposed line routes, site-specific environmental assessment including ecological surveys of the routes, and design as per CEA guidelines and vertical and horizontal statutory clearances,¹⁴ establishment of the construction site, storage area and labor camp, and sourcing of materials and equipment. This will be followed by tree cutting or trimming and clearing of the Right of Way (RoW) wherever required, staged transportation and supply of poles, conductors, and other accessories to the work sites as per the logistics plan of the EPC contractor, foundation works for poles, erection of pole structures (single, double, triple or four) with stays and struts, unrolling of cables, cable stringing, earthing and installation of accessories on the distribution line and finally commissioning when the distribution line will be connected to existing/new transformers at the start and end point.

50. For the 11kV and LT lines, the construction for 1 km new length shall be approximately 18-21 days (approximately 5 days for digging and erection of poles, 2-3 days for the installation of accessories, 10-12 days for stringing and 1 day for commissioning). For the conversion of existing 11 kV lines to covered conductor, dismantling of existing steel poles/multi-pole lattice structures and old conductors shall require approximately 5 days besides another 18-21 days for erection to commissioning of 1 km line (total 23-26 days for 1 km). Replacement of conductors on existing poles will be quicker. To connect to the existing transformers APDCL will shut power for consumers during works for 6 hours (9am-3pm). Although it will vary depending on the plan of the EPC Contractor about 15 unskilled and 2 skilled laborers shall be required for 1 km of new overhead covered conductor line which will be installed in a transient manner. However, this may vary as per EPC Contractor's plans. Installation of 0.4 kV ABC is also quicker, needing only 4-5 days for stringing. Also, only 8 unskilled and two skilled laborers shall be required.

51. The general steps involved in undertaking the site survey and finalizing the routes are

¹⁴ Per Central Electricity Authority (CEA) electricity rules/guidelines and IFC EHS Guidelines on Transmission and Distribution e.g., installation above or adjacent to residential properties or other locations intended for highly frequent human occupancy (e.g., schools or offices) will be avoided.

listed below:¹⁵

- Survey of Right of Way (ROW) - during line survey various types of crossings i.e. road/highway crossing, railway, river/stream, telephone lines, other power lines are to be considered. If possible, highway and railway crossings should be avoided. Railway authority requires low and medium voltage lines to be crossed with underground cables.
- In finalising the route, the following technical parameters are considered:
 - Shortest route possible.
 - As close as possible to the road for easy maintenance and approach during the construction and maintenance.
 - Maintain the safety requirements as per regulations and GIIP - all lines included in output 4 to meet horizontal and vertical safety clearances from buildings, crossing other power lines etc.
 - Route should be in the direction of possible future load.
 - Angle points should be less.
- While locating poles on lines, the following general principles are considered:
 - Keep spans uniform in length as far as possible.
 - Locate to have horizontal grade.
 - By locating the poles on high places short poles can be used and will maintain proper ground clearance at the middle of the span. In some complex terrain areas of Dima Hasao, short poles are best located on ridges thereby increasing the spans without greatly increasing the pull on the conductor. This is possible because the sag can be made very large by maintaining the required ground clearance.
 - Poles are to avoid private properties
 - Poles should not be placed along the edges of cuts or embankment or along the banks of rivers or streams.
 - Cut-point/cut-outs¹⁶ for a section could be at a length of 1.6 km (except in special cases), where double-pole structures should be provided to take the tension of the conductors. It has been estimated that 10 poles are mostly required for one km length of 11kV line and 15 poles for LT line.

52. **Appendix 7** shows the general arrangements of existing lines which will likely be followed by the EPC contractors along with sample photographs of the existing overhead lines in Assam. There may be dense vegetation (degraded natural habitats or cultivated lands) adjacent to ROWs and so felling / lopping of branches may be required to provide sufficient ROW and access for maintenance. The EPC contractor shall ensure that alignment of lines complies with safety clearances. Temporary pedestrian and traffic diversions at road crossings shall be put in place as per an approved traffic management plan in consultation with APDCL (PIC). Scaffold and safety net below the distribution lines shall be used whenever works are in the settlement areas, across roads, or waterways, or as per the requirement of APDCL (PIC) to manage health and safety risks.

53. The exact number of poles required is to be defined by the EPC contractor based on the type of line (approximately 10 poles per km for 11 kV lines, about 15 poles per km for LT lines). There shall be minimal excavation and soil removal only for installing new poles. Digging of any foundation pits is done manually using auguring tools, concrete mixture for foundation is cast, and

¹⁵ <https://ncert.nic.in/vocational/pdf/kvdl104.pdf>

¹⁶ "Cut out" means any device for automatically interrupting the flow of electricity through the conductor when the current increases above a pre-determined value

poles are unloaded for erection which is done using chain and pulley blocks. Once the erection is done, the cross arms and pin insulators are mounted, and stringing of new wires is done manually with correct sag as per the CEA guidelines.

54. Similar exercise shall be taken where old bare 11 kV and LT conductor lines shall be replaced with covered conductors or ABC and for other 11 kV and low-tension lines that will make use of existing poles. The major difference shall be that all the existing poles (mostly tubular steel poles) shall be replaced for the 11 kV covered conductor lines and ABC with galvanized steel poles structures which can bear the higher weight while for other lines they shall only be replaced where required. Major rerouting of the distribution line may be required to avoid sensitive receptors (due to encroachment on vertical and horizontal statutory clearances of the existing lines) or site conditions. If the existing pole is removed, measures will be taken not to damage the pole during removal. They will be removed by pulling the complete structure from the ground; not cut off at the ground level. Pole structure will then be cleaned, and any material attached (including concrete) removed. Unused pits will then be backfilled and compacted completely with enough backfill piled above grade to prevent depressions being created by natural compaction. For new pole/multi-pole lattice structure locations this is done as for the new lines.

55. If no new poles are needed the reconductoring works shall only involve cutting or trimming of trees to ensure the ROW is maintained, dismantling of existing 1/2/3 phase bare conductors, cross arms, insulators, service tapings and other hardware followed by stringing, earthing, and installation of accessories including distribution boxes to provide customer connections which will be reinstated after the reconductoring is completed.

56. As part of the LT line works, there will be the additional installation of new 11/0.4 kV transformers. Some of these may replace old transformers in which case the DTR will be pulled out and sent to APDCL for repair or disposal. Civil works for the new DTR will include a foundation and earth mat if ground mounted following site levelling / preparation, or excavation of pole foundations if pole mounted. The DTR will then be erected including testing and commissioning. The foundation area required for ground mounted DTR installation is approximately 1.5m x 1.5m x 1m high, which will be bunded and fenced. A small kiosk will be provided to house the control panel/switchgear, about 2m x 0.61m x 0.35m. Pole mounted DTRs will usually be installed on existing single or double 11 kV line poles with transformers mounted on the pole itself (with switch gear and an enclosed control panel).

Table 3.4 Summary construction features of works involved

Key Features and Design		Components/Sub-components		
		BESS	Substations	Distribution Lines
Land ownership and footprint	Permanent works	<ul style="list-style-type: none"> Land for the BESS site is within AEGCL land. APDCL will use a part of this land to install the BESS facility. 	<ul style="list-style-type: none"> Existing substations are on APDCL land, no works are required to take place outside of the existing APDCL boundaries. 	<ul style="list-style-type: none"> Existing and new distribution line works including DTRs, and poles are mainly following existing alignments, within ROWs of existing roads or highways, and forest/vegetated tracts, private lands. Private land shall be avoided to the extent feasible, but if agriculture fields or other private land is unavoidable, then compensation for structural damage/trees/crops during installation shall be paid at the market value during construction per the prepared RIPP entitlement matrix.
	Temporary works e.g., construction camp, material storage site	<ul style="list-style-type: none"> Site is owned by AEGCL and vacant. It has sufficient space for works and temporary works, although proper space arrangement before work starts will be needed for temporary works area. 	<ul style="list-style-type: none"> Substations: APDCL land within the existing facilities – available space range from 30-50% and temporary works can be accommodated inside substation premises. 	<ul style="list-style-type: none"> Distribution lines: within the ROW of the distribution line, for day-to-day storage or nearest APDCL substation for longer term storage requirements.
Construction	Construction method	<ul style="list-style-type: none"> Per the construction method statement of EPC contractor. Manual construction of control building and foundations with on-site assembly and installation involving trucks, cranes, and forklifts to install the containerized BESS. Piling and blasting is not envisaged 	<ul style="list-style-type: none"> Per the construction method statement of EPC contractor. Manual construction with the involvement of powered mechanical equipment for substations works. Piling and blasting is not envisaged 	<ul style="list-style-type: none"> Per the construction method statement of EPC contractor. Manual construction with the involvement of powered mechanical equipment for OHL. Piling and blasting is not envisaged
Access	Access for construction	<ul style="list-style-type: none"> Access road to substation is highway and well maintained. Low to medium vehicle movement is recorded on the access road. 	<ul style="list-style-type: none"> Substations: existing road network is available but entry to the Gunjung substation is not paved, whereas access road to 	<ul style="list-style-type: none"> Distribution lines: existing road network available. New lines shall be aligned mainly along the existing roads or highways for easy access for maintenance.

Key Features and Design		Components/Sub-components		
		BESS	Substations	Distribution Lines
		<ul style="list-style-type: none"> Although unpaved road inside SS for access to BESS site it is not suitable to carry load of heavy vehicles. Road needs to be upgraded or alternate access to site for vehicle to be identified. New access in boundary wall may be opened to facilitate construction works. Planned parking inside the APEGL compound, access entry control is required along with traffic management 	<p>Baithalangsho is damaged and narrow</p> <ul style="list-style-type: none"> Access road for these two substations needs to be repaired 	<p>Many lines are crossing private land, dense settlements, houses/business without road access.</p> <ul style="list-style-type: none"> Many existing alignments do not comply with safety clearances/requirements with ROWs, including DTR and poles, inside private property/religious places and schools which will need them to be realigned with ROWs maintained/cleared
	Transportation of materials and equipment	<ul style="list-style-type: none"> By existing roads, highways as per the logistics plan of EPC contractor 	<ul style="list-style-type: none"> By existing roads, highways as per the logistics plan of EPC contractor 	<ul style="list-style-type: none"> By existing roads, highways as per the logistics plan of EPC contractor
Construction Plant	Batching Plants etc.	<ul style="list-style-type: none"> Unlikely to be required given small scale of construction works, although it will be for final determination of EPC contractor if they wish to utilize for the facility Construction plant is only to be set up at site after obtaining Consent to Establish (CTE) and Consent to Operate (CTO) from the Pollution Control Board, Assam 	<ul style="list-style-type: none"> Not required 	<ul style="list-style-type: none"> Not required
	Equipment	<ul style="list-style-type: none"> EPC Contractor would bring their own construction equipment and machineries including transport vehicles for workers and equipment, heavy materials handling facilities like large crane, forklift, etc. 	<ul style="list-style-type: none"> EPC Contractor would bring their own construction equipment and machineries including transport vehicles for workers and equipment, heavy materials handling facilities like mobile crane, forklift, etc. 	<ul style="list-style-type: none"> EPC Contractor would bring their own construction equipment and machineries including transport vehicles for workers and equipment, heavy materials handling facilities like mobile crane, forklift, etc.
Materials required	Cement, and steel	<ul style="list-style-type: none"> Direct from cement and steel plants (bulk quantity) with valid environmental 	<ul style="list-style-type: none"> Small quantities required and can be directly purchased from 	<ul style="list-style-type: none"> Direct from cement and steel plants (bulk quantity) with valid

Key Features and Design		Components/Sub-components		
		BESS	Substations	Distribution Lines
		<p>clearance, CTE and CTO or (if the quantity is less) wholesale distributors in the nearest settlement, source/brand shall be approved by JV</p> <ul style="list-style-type: none"> • Nearest cement plant is operating in Bokajan, Karbi Anglong East (320km from site) and can be transported through road to the construction site 	<p>cement and steel plants (bulk quantity) with valid environmental clearance, CTE and CTO or (if the quantity is less) wholesale distributors in the nearest settlement, source/brand shall be approved by APDCL (PIC)</p> <ul style="list-style-type: none"> • Nearest cement plants is operating in Bokajan, Karbi Anglong East (same as output 4 area) and can be transported through road to the construction sites 	<p>environmental clearance, CTE and CTO or (if the quantity is less) wholesale distributors in the nearest settlement, brand / supplier shall be approved by APDCL (PIC)</p> <ul style="list-style-type: none"> • Nearest cement plants is operating in Bokajan, Karbi Anglong East (same as output 4 area) and can be transported through road to the construction sites
	Sand	<ul style="list-style-type: none"> • Direct from local approved quarries with valid EC, CTE and CTO 	<ul style="list-style-type: none"> • Direct from local approved quarries with valid EC, CTE and CTO 	<ul style="list-style-type: none"> • Sand direct from local approved sources in Assam with valid EC, CTE and CTO
	Stone Aggregates	<ul style="list-style-type: none"> • Direct from suppliers with valid EC, CTE and CTO for crusher, stone aggregates in Assam 	<ul style="list-style-type: none"> • Direct from suppliers with valid EC, CTE and CTO either from approved quarries in Assam 	<ul style="list-style-type: none"> • Direct from suppliers with valid EC, CTE and CTO either from approved quarries in Assam
	Electrical, Mechanical and Instrumentation Parts	<ul style="list-style-type: none"> • Battery Modules and other equipment - direct from original equipment manufacturers (OEM) or authorized distributors as per the technical specifications and as approved by JV • Power Transformers to be installed will all be certified as PCB free 	<ul style="list-style-type: none"> • Direct from original equipment manufacturers (OEM) or authorized distributors as per the technical specifications and as approved by APDCL (PIC) • Power Transformers to be installed will all be certified as PCB free 	<ul style="list-style-type: none"> • Galvanized Steel Tubular Poles - from original manufacturers and as approved by APDCL (PIC) • Conductors - direct from original equipment manufacturers (OEM) or authorized distributors and as approved by APDCL (PIC) • Accessories - direct from original equipment manufacturers (OEM) or authorized distributors as approved by APDCL (PIC) • DTR to be installed will all be

Key Features and Design		Components/Sub-components		
		BESS	Substations	Distribution Lines
				certified as PCB free
Other Resources	Power	<ul style="list-style-type: none"> BESS construction will draw power from the existing Mirza substation and if required will use the existing DG set of the Mirza SS located within the premises during power cut events during construction. For operation – connection to grid, a dedicated diesel generator set will be required to be provided in case of the temporary power outage event during operation 	<ul style="list-style-type: none"> Connected to grid but a temporary diesel generator (DG) set will be required during construction/R&M of substation 	<ul style="list-style-type: none"> Not required
	Water	<ul style="list-style-type: none"> EPC contractor will determine if they source canned/bottled drinking water from an existing supplier (as the preferred option) or provide treated water for workers; all drinking water provided will be regularly tested and confirmed to meet Government of India drinking water standards, if the EPC contractor provides their own supply, permissions shall be obtained from authorities with the agreement of local communities. Other construction water to be obtained from existing local ground water sources depending on site conditions to be determined by the EPC contractor, permissions for which shall be obtained from authorities with agreement of local communities. Treatment system will be provided to ensure all drinking water meets Government of India drinking water standards 		
Labor	Workers camps	<ul style="list-style-type: none"> If required, construction labor camps within construction sites to be determined by EPC contractor (land is available inside premises) Per design approved by APDCL (PIC) and to contain all basic requirements (beds and beddings, mosquito nets, artificial lights, natural lights, windows and ventilation, fans, emergency exits, firefighting equipment, lockers, kitchen and dining halls, mobile charging points, toilets and washing facilities, potable drinking water, recreational space). Design of labor camps shall conform to IFC EHS guidelines, ILO's guidance on worker accommodation¹⁷ and regulations of Government of India 		
	Construction staffing	<ul style="list-style-type: none"> Most of the works required are manual labour intensive with the involvement of powered mechanical equipment The exact size of the workforce including the number of unskilled, semiskilled, and skilled shall be determined by the EPC contractor based on the project scheduling which shall be approved by the JV or APDCL (PIC) Local labor to be used to the extent possible but for working with electricity and at height only suitably qualified and experience labor will be used Both local and external laborer shall be utilized for which the EPC contractor shall obtain labor licenses and workmen 		

¹⁷ https://www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_ent/@multi/documents/publication/wcms_116344.pdf

Key Features and Design		Components/Sub-components		
		BESS	Substations	Distribution Lines
		compensation Insurances		
Wastes	Specific type of waste generated	<ul style="list-style-type: none"> Hazardous waste: battery module parts, used oil, empty metal or plastic fuel/oil/chemical containers, vehicle/equipment leaked oil/grease or solvent-soaked rags, used batteries etc. Non-hazardous waste includes all domestic and kitchen waste, packaging wastes including plastics, paper, cardboard, wood, etc. construction waste such as concrete, brick, rubble, iron scrap etc. E-waste: broken or used electrical equipment, wastes from installation of facility/yard lights, etc. JV will reuse or recycle using APCB authorized vendors as per the condition of the equipment; if fit for use, they will be stored for reuse by JV or they will be auctioned off as scrap material Decommissioning Li-ion batteries is of utmost importance due to their hazardous materials content. Damaged Li-ion batteries, if not fully discharged, pose a "stranded energy" risk and are still considered active batteries. To properly handle these batteries during decommissioning, it is essential to ensure the complete discharge of stored energy before classifying them as hazardous waste. 	<ul style="list-style-type: none"> Hazardous waste: used transformer oil, empty metal or plastic fuel/oil/chemical containers, transformer oil or solvent-soaked rags, used batteries etc. Removed electrical and mechanical equipment will be handed over to APDCL or transported to designated APDCL stores/ warehouse as per the direction of APDCL(PIC) Disposal of old transformers and other hazardous wastes shall be as per the Hazardous and Other Wastes (management and transboundary movement) Rules, 2016, Government of India. Other wastes will be recycled using APCB authorized vendors or suitably engineered and licensed waste management facilities for inert or solid waste Non-hazardous waste includes all domestic and kitchen waste, packaging wastes including plastics, paper, cardboard, wood, etc. construction waste such as concrete, brick, rubble, iron scrap etc. 	<ul style="list-style-type: none"> All the old bare conductor lines and any poles shall be handed over to APDCL or transported to designated APDCL store/warehouse as per the direction of APDCL (PIC) Disposal of any old DTR (if required) and other hazardous wastes shall be as per the Hazardous and Other Wastes (management and transboundary movement) Rules, 2016, Government of India.

ABC = Aerial Bundled Conductors, APDCL = Assam Power Distribution Company Limited, APCB = Assam Pollution Control Board, CTE = Consent to Establish, CTO = Consent to Operate, EPC = Engineering, Procurement and Construction, EHS = Environmental, Health and Safety, IFC = International Finance Corporation, OEM = Original Equipment Manufacturers, OHL = Overhead line, PMC = Project Management Consultant, ROW = Right of Way,
Source: ADB's TA Consultant

57. The designs will be in accordance with Government of India requirements and international good practice regarding technical and environmental, health and safety performance standards as set out in the IFC EHS Guidelines. Use of PCBs and all asbestos- containing materials will be prohibited. Any temporary offices/stores and labor camps will be set-up within the boundaries of the construction site at the existing substations. For distribution lines private land may be rented. Labor camps will not be needed if using local workers who reside in the surrounding area. Tentative timelines and man-power requirement for the substation and BESS interventions and a timeline for the completion of distribution line works are provided in Table 3.5.

Table 3.5 Estimated manpower and timeline

Activity	Substation		BESS		Distribution Lines
	Manpower	Timeline (months)	Manpower	Timeline (months)	Timeline (months)
Surveying and planning	4	2	4	1	3
Site preparation/ clearing Excavation/levelling	4-6	4	10	1	3
Transporting materials	6-8	2	15	1	4
Civil works/foundations	15-20	6	15	2	20
Electrical/mechanical installation	10	5	12	2	
Others-road, drainage, fencing	10	12	15	1	3
Clean-up/and restoration	4-6	2	3	1	3
TOTAL	-	33 (3 years)	-	9 (1 years)	36 (3 years)

Manpower = No. of workers; Timeline = in months

Source: ADB's TA Consultant and BESS DPR February 2024.

58. Tentative status of Contract Packages/Procurement is shown in Table 3.6.

Table 3.6 Summary of procurement status as of April 2024

Package/Lot	Scope	Bid Document	Contract Award	EMP Status	Remarks
P4 (one Lot)	Existing Substations	No	No	Draft EMP under preparation by ADB TA consultants as part of IEE to be included in bid documents by APDCL	Include final EMP in preparing bidding documents and contract
P4 (one Lot)	OHL Distribution Lines	No	No	Draft EMP under preparation by ADB TA consultants as part of IEE to be included in bid documents by APDCL	Include final EMP in preparing bidding documents and contract
N/A	BESS	No	No	Draft EMP prepared by ADB TA consultants as part of IEE to be included in bid documents by JV	Include final EMP in preparing bidding documents and contract

ADB = Asian Development Bank, APDCL = Assam Power Distribution Company Limited, BESS = Battery Energy Storage System, EMP = Environmental Management Plan, IEE = Initial Environmental Examination, TA = Technical Assistance.

Source: ADB's TA Consultant and APDCL

C. BESS Operation, Maintenance and Decommissioning

59. The EPC Contractor shall hand over the assets to the JV once the commissioning is done. However, they shall be required to rectify, repair, or replace any defect/s in the design, engineering, materials, or workmanship found and notified during the defect liability period. The JV will employ staff to be posted at the BESS to look after O&M, undertake inspections, and any maintenance works to maintain the BESS as per the Indian Electricity Rules and CEA guidelines. Regular O&M works shall be undertaken at the BESS by the staff posted to these sites. They shall be assisted for special maintenance works, as required, by contractors.

60. The life span of the BESS is 15 years. Following this the BESS will be repowered or decommissioned by the JV. 8 modules of defunct batteries will arise during O&M and decommissioning and will need to be disposed of as e-waste. Decommissioning Li-ion batteries is of utmost importance due to their hazardous materials. Damaged Li-ion batteries, if not fully discharged, are still considered active batteries. To properly handle these batteries during decommissioning, it is essential to ensure the complete discharge of stored energy before classifying them as hazardous waste. Charged battery disposal will be complying with safety standards and codes, ANSI Z535, IEEE 1578, NFPA 855, NFPA 70.

D. Distribution Operation and Maintenance

61. The EPC Contractor shall hand over the assets to APDCL once the commissioning is done. However, they shall be required to rectify, repair, or replace any defect/s in the design, engineering, materials, or workmanship found and notified during the defect liability period. APDCL has its own staff who are posted at the substations, subdivisions, divisions, and circles who look after the O&M of its assets, undertake inspections, and any maintenance works to maintain the substations as per the Indian Electricity Rules, Assam Electricity Regulatory Commission (AERC) and CEA guidelines. Regular O&M works shall be undertaken at the substation by the inhouse APDCL staff posted to these sites. They shall be assisted for special maintenance works, as required, by staff from the sub-division, division, circle, or region/headquarters. Similarly, O&M works for distribution lines shall be undertaken by the regular APDCL staff from the sub-divisions, division or circle as required. Inspections, regular and periodical maintenance are undertaken by APDCL linemen to maintain the distribution lines in accordance with the Indian Electricity Rules, AERC and CEA guidelines. Routine maintenance undertaken includes trimming of overgrown tree branches (if infringing on the conductors), changes of insulators and accessories (as per site conditions), reconductoring (if required as per site conditions), replacements of poles if damaged etc.

E. Existing Facilities

62. The output 3 and 4 components involve work within existing facilities i.e., 4 substations as well as existing DTRs. The existing 3 number of 33/11 kV substations under APDCL and 1 number of 400kV kV grid substation under AEGCL are connected to the existing interstate and national grid.

63. The existing substations at which works are proposed are classified as existing facilities as per ADB's Safeguard Policy Statement (2009). An environmental audit of the substations (existing facilities) has been undertaken. The audit report is provided in **Appendix 2**. The substation control buildings should normally be designed to be earthquake proof, although cracks/damaged/damp control rooms have been noted during the environmental audit and thus the risk of building failure and level of risk to substation workers during earthquake events are

heightened. The CAP (**Appendix 15**) that has been provided must be complied with by the APDCL and AEGCL (for BESS linked grid substation) prior to contractors being allowed access to site unless the JV or APDCL has specifically included the corrective action in the contract for the EPC contractor to address as part of their scope of works.

64. In replacing existing overhead bare conductors, EPC contractors will be required to ensure they comply with EMP requirements. Transformers retained in-situ (distribution and substations) should all have PCB warning signs and to be handled and stored following GIIP. Even if there is no risk of the transformers containing PCBs, APDCL must maintain its existing transformers in good condition. Further, where ground mounted transformers are retained, these should all be fenced/maintained by the APDCL to prevent access by the community for health and safety purposes and (especially those located close to a drain, waterbody, private land, etc.) retrofitted with 110% bunding to prevent oil leaking to soil, surface water, and groundwater and contaminating it.

F. Associated Facilities

65. The project does not include any associated facilities.

G. Alternatives Analysis

1. No Project Alternative

66. Alternative analysis included consideration of the no project alternative.

67. The no project alternative for the BESS component would have no direct negative environmental impacts since no construction works would be involved and no e-waste will be generated. However, socioeconomic benefits would not be realized. Without the BESS the opportunity for Assam to effectively integrate renewable energy with the grid, address peak demand deficits (presently combated using costly power) and peak tariffs will be lost. Electrical power distribution systems in general and the Indian electrical grid in particular are susceptible to fluctuations. In recent years, the increased addition of renewable energy sources, industrial development, and the promotion of electric vehicles has brought about significant changes in energy flow and peak demand patterns especially in the Assam region. It is anticipated that fluctuation and peak demand issues in the state can be tackled by providing a suitable energy storage system at the distribution and transmission level. Battery Energy Storage system (BESS) has emerged to be a potential solution for multiple energy management issues in power system applications.

68. The no project alternative for the distribution component would have no direct negative environmental impacts since no construction works would be involved. However, socioeconomic benefits would not be realized. The existing distribution network is aged, overloaded, and uses antiquated technologies making its operation and maintenance challenging particularly during heavy rain and storm that are common in many parts of the state. The lack of upstream distribution strengthening investment results in an unreliable electricity supply for consumers. Further, conversion of existing bare conductors to covered conductors and ABC lines shall also be helpful in reducing existing electrocution risks to both human beings and wild animals including avian fauna.

69. Overall, the with-project alternative was preferred by APDCL over the no project

alternative.

With Project Alternative

Alternative design, locations and routings

70. Since the existing substations to be taken up are already existing ones, no alternative analysis of the site locations have been done. For the BESS preselected land inside the 400kV Kukurmara Mirza grid transmission substation (to which the BESS is to be connected) site was planned to be used making use of available AEGCL land. Therefore, no alternate sites were evaluated.

71. Since the existing substations to be taken up are already existing ones, no alternative analysis of the site locations have been done.

72. Distribution lines were preliminarily selected by APDCL based on the requests of APDCL circle and division offices with lines requested for upgradation being either old line, damaged, those passing through dense vegetation/cultivations, private properties, and where frequent faults occur, and, where there is non-availability/shortage of power due to being remote areas. Based on prioritization of the lines, APDCL shortlisted several distribution lines.

73. **Existing Distribution lines.** The preliminary route selection for reconductoring of the existing 11kV lines shall be along the existing RoW therefore no alternative analysis of routings needs to be done although minor diversions of overhead lines may be required where there has been encroachment into the RoW and horizontal and vertical safety clearances are not met. For any minor diversions the criteria/principles for new lines will be followed. Screening confirmed no lines in the scope pass through the 300m of ASI and state protected monuments. Some existing 11kV lines pass through the ESZ of protected areas, Elephant Reserve, Reserved Forests, and KBAs/IBAs. Reconductoring only involves covered conductors; however, APDCL will only take them up on existing lines for which forest clearance has been obtained, if required, and/or a written no objection for works to distribution lines in the ESZ, Elephant Reserve and Reserved Forest lands from the Environment and Forest Department of Assam is given. If clearances/permissions are not forthcoming, they will be dropped.

74. Reconductoring with bare lines was dropped from the project scope in favour of covered conductor and ABC, as per APDCL and state government initiative to protect humans and wildlife.

75. Once the contractors are on board, during project implementation site-specific assessment checklist and consultation proformas will be completed by the contractors for the existing lines, then this IEE and EMP will need to be updated and cleared by ADB with any government clearances or permissions obtained before existing routings are approved by APDCL and works commence. Once the existing distribution lines have been mapped by the contractors, any found to be not meeting criterion (i) no components will be in or pass through Government of India (GoI) protected areas (PA), or the protected or regulated zones of Archaeological Survey of India (ASI) and State protected monuments, will be immediately dropped. For those in the, ESZ, RFs/Elephant Reserves or KBAs/IBAs site-specific biodiversity assessment and management planning will be undertaken, reconductoring of these existing lines will also be dropped if it will result in significant adverse impact.

76. Conversion of existing lines will only be permitted if school compounds and playgrounds are not crossed, or minor rerouting takes place to avoid them. Conversion of existing lines and

related facilities must minimize damage to existing trees (avoiding cutting of private trees) and properties whilst ensuring horizontal and vertical safety clearances are maintained in all cases.

77. **New DTR and associated Distribution Lines.** For new lines, the start and end DTR for 11 kV and LT lines and the names of the feeder to be linked and coordinates of all were provided by APDCL. The preliminary route selection for new lines shall be mostly along the existing power line and road RoWs. All new 11kV bare lines were dropped from the project scope in favour of covered conductor as per APDCL and state government initiative. All new DTR associated LT lines are ABC.

78. Since they have not been mapped yet, most LT lines cannot be screened but APDCL will ensure they are dropped if there are any in, or passing through, protected areas, or the protected or regulated zone of ASI and state protected monuments. None of the new 11kv Lines are passing through protected or regulated zone of ASI and state protected monuments. Some of the new 11kV and LT lines are planned through ESZ of protected areas, Elephant Reserves/Reserved Forests or KBAs. In such cases, APDCL is only installing covered conductors on existing RoWs where forest clearance has previously been obtained, if required, and/or a written no objection for works to distribution lines in the ESZ/Elephant Reserves/Reserved Forest lands from the Environment and Forest Department of Assam is given. If clearances or permissions are not forthcoming, they will be immediately dropped. Following site specific assessment, the distribution lines in, or passing through, ESZ, Elephant Reserve, Reserved Forests, KBA/IBA, or natural habitat will also be dropped if they will result in significant adverse impact.

79. Once the contractors are on board, during project implementation site-specific assessment checklist and consultation proformas will be completed by the contractors for the existing lines, then this IEE and EMP will need to be updated and cleared by ADB with any government clearances or permissions obtained before existing routings are approved by APDCL and works commence. The route surveys shall be conducted by the EPC contractors who will be responsible for determining the route alignment (including considering alternative routes) such that the project criteria and route alignment principles are followed. The criteria and principles that have been/will be adopted by APDCL for selection of route alignments for the new distribution lines are:

CRITERIA

- a. Lines and their related equipment in natural habitat will only be installed where significant conversion or degradation of natural habitat can be avoided.¹⁸
- b. Lines and their related equipment in critical habitat (all areas of the districts) will only be installed where site-specific biodiversity assessment demonstrates significant adverse impacts can be avoided.¹⁹
- c. No lines or related facilities in Wildlife Sanctuaries will be taken up under the distribution component.
- d. No lines or related facilities in Elephant Reserves or Reserved Forests which are requiring Wildlife Clearance or Forest Clearance will be taken up under the distribution

¹⁸ Subject to completion of the IEE, it is anticipated significant conversion or degradation of natural habitat can be avoided since all the routes will follow existing RoWs albeit with minor diversions.

¹⁹ Subject to completion of the IEE, it is anticipated significant adverse impacts can be avoided in most circumstances; exceptions relate to routes where critical habitat flora or the breeding or roosting sites of critical habitat fauna fall directly in or adjacent to RoWs as confirmed by design stage ecology surveys and to be reported through a site-specific assessment checklist. If exceptions are found during ecology surveys ADB should be consulted for advice and further site-specific assessment and mitigation measures will be required to demonstrate no significant adverse impacts before lines will become eligible.

component—existing RoWs will only be used if the Forest Clearance has already been granted and a No Objection Certificate is available.

- e. In Elephant Reserves and Reserved Forests or any other notified forests only covered conductor 11kV and ABC LT lines following existing RoWs without any diversions (unless they remain in existing road RoWs) and not requiring new access track construction will be taken up having first received a written no-objection from the Environment and Forest Department of Assam.²⁰
- f. In the eco-sensitive zones (ESZ) of Wildlife Sanctuaries of Assam or Nagaland only covered conductor 11kV and ABC LT lines will be taken up with intimation to and the confirmation of the Environment and Forest Department of Assam no further permission is required.²¹
- g. In Key Biodiversity Areas (KBAs) and Important Bird Areas (IBAs) only covered conductor 11kV and ABC LT lines following existing RoWs without any diversions (unless they remain in existing road RoWs) and not requiring new access track construction will be taken up.
- h. No lines or related facilities in the protected or regulated zone of Archaeological Survey of India and Directorate of Archaeology Assam protected monuments will be taken up under the distribution component.
- i. Lines and related facilities will only be installed where significant damage to local physical cultural resources can be avoided and physical cultural resources do not need to be removed from their current location.

PRINCIPLES

- a. New lines that trigger Category A (activities with significant adverse environmental impacts that are irreversible, diverse, or unprecedented) shall not be taken up under the distribution component.
- b. New lines resulting in the significant conversion or degradation of natural habitats as defined by ADB [Safeguard Policy Statement 2009] or which occur in areas with presence of ADB Critical Habitat-qualifying biodiversity and have been demonstrated through a site-specific assessment not to comply with ADB's Safeguard Policy Statement 2009 requirements, shall not be taken up under the distribution component.
- c. For all lines and related activities an ecological walkover to be conducted during the site specific assessment and prior to starting construction work to ensure adverse impacts to critical habitat species as well as nesting or roosting birds (and their eggs) or bats are avoided etc.
- d. Covered conductor and ABC lines and poles will adopt a "wildlife (including bird) sensitive design" such that, at the poles, all equipment will be adequately spaced, and live infrastructure insulated in 2m of any earthed infrastructure.
- e. Lines must conform to the standard 6 metre (20 feet) height from the ground set by the Indian Electricity Rules but in order to prevent elephant electrocution, the height above the ground at the lowest point of the lowest conductor or grounding wires (i.e., at maximum sag point) of powerlines passing through ESZ, Elephant Reserves, Reserved Forests, elephant corridors, natural habitat, or other areas outside of settlements with known presence or movement of Asian elephants, shall be: a minimum of 20 feet (6.6 metres) above ground on level terrain (slope <20 degrees) or a minimum of 30 feet (9.1 metres) above ground on steeper terrain (slope > 20 degrees).²²

²⁰ Consultation with wildlife and forest officials indicated that it would be forthcoming on request provided existing lines had earlier received Wildlife Clearance or Forest Clearance.

²¹ Consultation with wildlife officials indicated that this would be forthcoming on request.

²² <https://moef.gov.in/wp-content/uploads/2018/04/FIRSTDraft-guidelines-roads-and-powerlines.pdf>

- f. In Elephant Reserves, in recognized elephant corridors or other locations suggested for forest officials, installation of reinforced power supply poles with spikes to prevent rubbing of elephant in the post
- g. Lines will follow existing RoWs albeit with minor diversions to ensure safety clearances are met.
- h. Reconducted lines must meet all horizontal and vertical safety clearances with minor rerouting taking place if it is required.
- i. Lines will not be laid across school compounds, playgrounds, or other areas where children as vulnerable members of the community assemble without parental supervision; if adjacent guarding/net will be installed.²³
- j. Lines will not be laid across areas where community groups regularly assemble such as the grounds of temples or churches unless agreed with the representatives of user groups.
- k. Removal or reconducting of existing lines must minimize damage to existing trees and properties.
- l. Lines and related equipment must avoid or minimize damage to trees whilst ensuring horizontal and vertical safety clearances are maintained. If identified to be cut, felling will be after permission from the Environment and Forest Department of Assam has been secured.
- m. Lines and related equipment must avoid or minimize damage to property including structures (e.g., buildings) and roads, private gardens, crops, etc. whilst ensuring horizontal and vertical safety clearances are maintained. Any compensation payments for damages to private property must be undertaken by APDCL in accordance with the social safeguards entitlement matrix before the works commence.
- n. Lines and related equipment must create minimum disturbance to existing pedestrian and traffic routes in terms of blockages or diversions.
- o. Poles or any electrical equipment must not be installed in perennial or seasonal water bodies/riverbeds.

Alternative equipment design and construction installation

80. The principle that has (and will be) been adopted for the selection and design of new equipment is to comply with national requirements as well as considering international good practice per the IFC EHS Guidelines, particularly with respect to avoiding the use of PCB oils in purchase of transformers (already banned in India) and the use of all asbestos containing materials in new construction.

81. **Switchgear and Transformers.** Use of alternative insulation mediums like air, gas, and oil for switchgears and transformers are considered by APDCL. All substations under APDCL and those under project use vacuum circuit breakers. Gas insulated switchgears have several technical advantages over air and oil, notably their compact size and the insulating and fire extinguishing properties of gas. However, APDCL uses only vacuum type switchgears which is beneficial since there will be no SF6 usage. The switch gears in the new BESS facility is planned to be SF6 type.

82. Because transformers convert high voltage energy into more consumable power, they generate a lot of heat that the devices need to dissipate. and require cooling. A dry transformer is a static device with a cooling medium of natural air. Liquid transformers use mineral oil, as well as fans, to cool. The use of oil is a fast solution in reducing high-temperature hot spots in the

²³ Minor rerouting may be required to avoid crossing them based on site visit observations of the ADB TA consultant.

unit's coils, helping them last longer. Liquid transformers are ideal for medium voltage and high-voltage applications and can be quieter than dry types. A liquid transformer is typically more efficient than a dry type. A oil type transformer is smaller and needs less demand to make a conversion. Compared to a dry unit, a oil type transformer has many recycling and remanufacturing options available. It's easier to obtain coil and core reclamation. Overall, dry transformers produce less waste and are safer, while liquid options can be easier to recycle. For the project APDCL will install all oil types transformers.

83. **BESS battery module:** Comparing the environmental impact of different battery depends on several factors, including the entire lifecycle of the batteries, from production to use and disposal. Notable considerations are as follows:

- Lead-acid batteries contain lead, which is a toxic heavy metal, and the improper disposal of lead-acid batteries can lead to soil and water contamination.
- The widely used lithium-ion batteries, including those with various chemistries like NMC (Nickel Manganese Cobalt) or NCA (Nickel Cobalt Aluminium) require the extraction of lithium, cobalt, nickel, and other materials. Cobalt extraction has been associated with environmental and ethical concerns. But they generally have good energy efficiency, allowing them to store and release energy with minimal losses.
- Lithium Iron Phosphate (LFP) batteries are known for their improved performance and longer lifespan compared to some other lithium-ion batteries. They have a simpler and more environmentally friendly production process and are relatively easy to recycle. The project will be using the LFP type battery module.
- NiMH batteries contain nickel and other metals, and nickel mining can have environmental impacts. They are expected to be safer and have longer lifespans.
- Sodium-ion batteries are being researched as a potentially more environmentally friendly alternative to lithium-ion batteries. They use sodium, which is more abundant and less environmentally damaging to mine than lithium, but sodium-ion batteries are not commercially viable due to other performance reasons.
- The environmental impact of flow batteries depends on the type of materials used. Vanadium Redox Flow Batteries offer a highly favourable environmental footprint for large-scale energy storage solutions.

84. Considering the alternates, LFP batteries are found to be the most suitable choice in terms of environmental impact as they have improved environmental characteristics compared to some other lithium-ion battery chemistries, as discussed earlier, and will be used for the BESS facility.

85. **Distribution Poles.** There are many materials that can be used for distribution poles. This includes wood, cement concrete, reinforced cement concrete and steel poles including tubular and rail poles. Table 3.7 compares the various pole types. APDCL shall use galvanized iron tubular steel poles. Since, the use of steel poles increases the risk of electrocution to wildlife compared to the use of wood or cement poles mitigation measures like bird and wildlife friendly design will need to be adopted to counter this risk.

Table 3.7 Alternatives analysis of distribution poles

Type	Wood	Plain Cement Concrete (PCC)	Reinforced Cement Concrete (RCC)	Tubular Steel	Steel Rail
Material	Usually, seasoned Sal wood	Concrete	Reinforced concrete	Galvanized Steel	Steel

Type	Wood	Plain Cement Concrete (PCC)	Reinforced Cement Concrete (RCC)	Tubular Steel	Steel Rail
Suitability	Up to 11 kV	Up to 33 kV	Up to 33 kV	Up to 33 kV	Up to 33 kV
Life Span	18 to 25 years	The life span of the PCC pole is more than wooden poles	Longer life than wooden poles but less than steel poles	40 years and can be increased further by painting	40 years and can be increased further by painting
Strength	Not strong as compared to other poles	The tensile strength is higher than wooden poles	Have greater mechanical strength than PCC but less than steel poles	Steel pole has higher mechanical strength than wooden, RCC or PCC poles	The rail pole has high mechanical strength than wooden, RCC or PCC poles
Span	Shorter spans up to 50 m	80-100 m	80-200 m	60 – 80 m	60 – 80 m
Areas used	Not used in Assam (by APDCL) and rest of the country (by distribution entities)	Streets of cities	Both in cities and rural areas	Both in cities and rural areas	Overhead lines above the railway tracks
Height	10 m	7 - 8 m	6 – 17 m	7 – 16 m	11 – 13 m
Cost	Maintenance cost of the wooden pole is very high	Less than RCC	High cost of transport and installation	Installation and the cost of the pole are very high	Installation and the cost of the pole are very high
Advantage	<ul style="list-style-type: none"> • Suitable for lines of the moderate cross-sectional area • Natural insulating property • Such supports are cheap, easily available, provide insulating properties and, therefore, are widely used for distribution purposes in rural areas as an economic proposition 	<ul style="list-style-type: none"> • This type of pole can be used for a longer span • Cheaper than other poles • Require little maintenance. • Good insulating properties 	<ul style="list-style-type: none"> • The holes in the poles facilitate climbing of poles and at the same time reduce the weight of line supports • Require little maintenance • Good insulating properties 	<ul style="list-style-type: none"> • Easy to transport • Normally cast ex situ, thus ensuring good quality control • Higher load-bearing capacity than wood poles and RCC poles • Long life span 	<ul style="list-style-type: none"> • Easy to transport • Higher load-bearing capacity than wood poles and RCC poles • Long life span
Disadvantage	<ul style="list-style-type: none"> • Wooden poles generally tend to rot below the ground level, causing foundation failure • Double pole structures of are required to obtain a higher transverse strength and hence non economical 	<ul style="list-style-type: none"> • Weigh more than wood and steel poles • Easily breakable 	<ul style="list-style-type: none"> • High cost of transport owing to their heavy weight • Normally cast in situ, thus quality control can be an issue • Requires extra care in 	<ul style="list-style-type: none"> • Needs to be painted to avoid corrosion thus increasing cost and weight • Inadequate spacing in cross arms can be fatal 	<ul style="list-style-type: none"> • Very high cost • Mainly used in railway crossings • Needs to be painted to avoid corrosion thus increasing

Type	Wood	Plain Cement Concrete (PCC)	Reinforced Cement Concrete (RCC)	Tubular Steel	Steel Rail
	<ul style="list-style-type: none"> • This type of pole is suitable for a shorter span • Difficult to obtain naturally • Pressure on forests and is presently discontinued 		handling and erection	to birds who may get electrocuted while trying to perch	cost and weight

PCC = Plain Cement Concrete, RCC = Reinforced Cement Concrete
Source: ADB's TA Consultant.

H. Climate Risk Assessment and Adaptation Measures

86. The state of Assam is susceptible to climate and disaster risks (ADB CRA May 2024). To minimize the climate-related risks, this climate risk and adaptation assessment (CRA) has been carried out to design appropriate adaptation measures to enhance climate resilience of project outputs by an ADB's TA Consultant. The CRA purpose is to identify and assess risks based on the detail engineering specifications and site conditions of representative subprojects in Assam, together with climate change projections and determine their vulnerability to climate- based risk. Based on the characterization of projected climate change risks, the CRA seeks to inform design decision making and to adapt the project infrastructure and investment to improve the resilience of project outputs.

87. Increasingly variable weather and potentially stronger storms would affect the integrity of the BESS and distribution system and its equipment in various ways. Summary climatic trends are provided below:

- Averaged annual mean maximum temperature time series has shown significantly increasing trends in Assam and is (+0.01) °C /year during 1951–2010. At the same time, averaged annual mean minimum temperatures have also shown significantly increasing trends in Assam and is (+0.01) °C /year during the same period.
- State averaged annual rainfall trend, summer season rainfall trend, monsoon and post monsoon rainfall trend have been decreasing over Assam while increasing trends have been observed over Assam only in winter season.
- Flash floods are a regular occurrence in project districts. Nearly all the rivers are rain-fed and are prone to flood.
- As the climate continues to change, the significant hazards which are likely to impact the project areas in Assam are extreme heat, extreme rainfall events, wildfires and intense storms.
- The River Flood and Urban Flood hazard for project districts are classified as high. This means that potentially damaging and life-threatening floods are expected to occur at least once in the next 10 years.
- The extreme heat hazard is classified which means that prolonged exposure to extreme heat, resulting in heat stress, is expected to occur at least once in the next five years. Droughts will occur much less than once every 1000 year as the area received good rainfall.

88. **Battery and energy storage systems.** Operating temperature is one of the main factors

that significantly affect the life span as well as the performance of batteries. While high temperature increases the formation and modification of the surface film on batteries' electrodes making them degrade faster, low temperature slows down the electrochemical reactions within the batteries making them less efficient. Furthermore, extremely low, or high temperature can also create serious damage to LiBs. Therefore, for grid-scale battery energy storage systems (BESS), heating, venting and air conditioning (HVAC) systems are often required to maintain the battery enclosure's temperature within an operating range. Since the change in ambient temperature will impact HVAC's operation, it will also impact the overall performance of a BESS.

89. **Distribution upgradation.** Increasingly variable weather and potentially stronger storms would affect the integrity of distribution system and its equipment in various ways:

- (i) Strong winds (over 100 km/hour) can damage electric wires and other distribution components, mostly to the distribution systems through tree damage.
- (ii) Provided they remain below damage levels, stronger winds cool overhead lines by increasing heat convection. Lines can then carry a larger electric load while staying within temperature limits, which is usually 80°C at conductor surface.²⁴
- (iii) The networks, including transformer and switching stations, can be affected by heavy snow, ice, and moisture.²⁵ Line integrity can be reduced²⁶ due to line sag.
- (iv) Distribution lines with capacity constraints can suffer from load management issues, particularly during summers and winters when the demand for cooling and heating are at their peak, decreasing the amount of power that can be delivered through the network.²⁷
- (v) Distribution infrastructure can suffer from increased risks of flooding, landslides, and other natural hazards, with equipment mounted at ground level in substations especially susceptible.
- (vi) High temperature limits the power rating of overhead lines, underground cables, and transformers but does not cause immediate faults.²⁸ Network losses can increase by 1% if temperature increases 3°C in a network with initial losses of 8%.²⁹
- (vii) During extended periods of heat and drought, dust can build up on conductors. Lighting can also affect reliability.³⁰ :

²⁴ European Commission. 2011. [The Impact of Climate Change on Electricity Demand](#).

²⁵ B. Rothstein and G. Halbig. 2010. [Weather Sensitivity of Electricity Supply and Data Services of the German Met Office](#). In A. Troccoli (ed.). Management of Weather and Climate Risk in the Energy Industry. Dordrecht (The Netherlands): Springer Science.

²⁶ World Bank. 2008. [Europe and Central Asia Region—How Resilient is the Energy Sector to Climate Change](#). Washington, DC.

²⁷ World Bank. 2009. [Climate Vulnerability Assessments : An Assessment of Climate Change Vulnerability, Risk, and Adaptation in Albania's Energy Sector. Country Energy Sector Vulnerability Assessments Program](#). Washington, DC.

²⁸ United Kingdom Department of Energy and Climate Change. 2011. Wave and Tidal Energy: Part of the UK's Energy Mix.

²⁹ J. Neumann and J. Price. 2009. Adapting to Climate Change: The Public Policy Response: Public Infrastructure. Resources for the Future Climate Policy Program. June.

³⁰ [Electric Power Research Institute. 2008. Joint Technical Summit on Reliability Impacts of Extreme Weather and Climate Change. EPRI, Palo Alto, CA; NERC, Princeton, NJ; and PSERC, Tempe, AZ: 2008. 1016095.](#)

Table 3.8 Summary of risk and adaptation measures included in output 3 and 4 design

Project Components		Temperature	Wind Speed	Extreme events	Precipitation/ Heavy Rainfall Events	Increased Humidity
Distribution upgrade	Possible Risks	<ul style="list-style-type: none"> • Can reduce electricity carrying capacity of lines • Can increase losses within transformers. 	Strong winds can damage overhead distribution lines.	<ul style="list-style-type: none"> • High temperatures, storms, erosion, or flooding can damage control systems through loss of ICT service or reduced quality of service. 	<ul style="list-style-type: none"> • Heavy rains and flooding can undermine pole structures through erosion. • Flooding can damage distribution infrastructure in general. 	-
	Adaptation Measure	<ul style="list-style-type: none"> • Specify more effective cooling for transformers. 	<ul style="list-style-type: none"> • Require higher design standards for distribution poles for overhead and surface structures. 	<ul style="list-style-type: none"> • Increase the system's ability to return to normal operations rapidly if outages do occur. • Change routes of overhead lines along roads away from trees, rigorously prune trees, use covered and/or insulated conductors. • Allow increased rerouting during times of disruption. • Include lightning protection (earth wires, spark gaps) in the distribution network. • Design redundancy into ICT systems. • Develop and use "smart transformers" and "smart grids." 	<ul style="list-style-type: none"> • Design improved flood protection measures for equipment mounted at ground level. • Protect masts, antennae, switch boxes, aerials, overhead wires, and cables from precipitation (water ingress); wind;); unstable ground conditions (flooding, subsidence); and changes in humidity. 	-

Project Components		Temperature	Wind Speed	Extreme events	Precipitation/ Heavy Rainfall Events	Increased Humidity
BESS (25 MW)	Possible Risks	<ul style="list-style-type: none"> High temperature increases the formation and modification of the surface film on batteries' electrodes making them degrade faster 	-	<ul style="list-style-type: none"> Heavy rains and flooding can undermine BESS through erosion. 	-	<ul style="list-style-type: none"> Due to lithium's high reactivity to air and humidity, it can catch fire, creating a serious safety risk.
	Adaptation Measure	<ul style="list-style-type: none"> Use batteries that can withstand higher temperatures or are inherently self-healing 	-	<ul style="list-style-type: none"> Sustainable drainage system will be implemented. BESS will be installed 1 m from ground level. 	-	<ul style="list-style-type: none"> Customized, climate-controlled enclosures with thermal management systems, modular design for scalability, fire retardant materials, and compatible with lithium-ion battery specifications

Source: ADB's TA Consultant, adapted from CRA, 2024

IV. DESCRIPTION OF THE ENVIRONMENT

90. To establish the baseline setting of the project's Output 3 and Output 4, desk studies and site visits (reconnaissance surveys) together with primary baseline data collection (by accredited third party laboratory in April-May 2024) have been carried out for the project area of influence (PAI) of the battery energy storage system (BESS) and substation locations and sample alignments of 11 kV and low tension 0.4kV distribution lines. Studies and site visits have been confined to the PAI as defined in ADB's Safeguard Policy Statement (2009). The general corridor of potential impact was taken as a 500 m radius around the BESS and substations and 50m buffer (on either side) along the distribution line alignments, but direct impacts will be confined to the BESS and substations footprint area and right of way (ROW) of distribution line alignments (ROW for 11kV and low-tension distribution lines is 7m and 1.2m respectively). However, for internationally and nationally important biodiversity areas or physical cultural resources those within up to 10km were identified given their greater significance although they are unlikely to be directly impacted if falling outside the PAI.

91. The baseline setting was established for various environment components including biology, soils, water, air, noise, socio-economic aspects including occupational and community health and safety, and physical cultural resources. In this section, as the project activities are spread over 4 districts of Assam, the setting of the components as well as the general environmental setting of the concerned districts are presented. Primary baseline data were collected to supplement the secondary data including for air quality, noise, soil and water quality data by selected third party accredited laboratory (Hubert Enviro Care Systems Pvt. Ltd). Further details on the baseline settings of the 4 existing substations are included in the environmental audit in **Appendix 2**.

A. Site Specific Baseline

Battery Energy Storage System (BESS)

92. Table 4.1 presents a summary of the environmental baseline conditions at the proposed BESS site located within the existing 400kV Mirza Grid Substation. The PAI of the BESS occurs mostly within the substation area. The map of the nearest biodiversity areas to the site is shown as Figure 4.1, the IBAT map outputs in Figure 4.2 although not all protected areas of India are included in IBAT. Figure 4.3 shows the Ramsar site location and Figure 4.4 shows location maps and photographs of the site and surroundings.

Table 4.1 Environmental conditions (PAI 500m) of new Mirza grid substation linked 25 MW BESS

Location	Land ownership	Key Biological features in PAI	Key Physical features in PAI	Key Socio-economic Setting in PAI	Key physical cultural resource features in PAI
Kukurmar a, Mirza, Kamrup District Division: Mirza Circle: Mirza	APDCL site within AEGCL SS land	<ul style="list-style-type: none"> • Site is modified habitat. • SS covers about 65% of PAI • Kaziganga NP and UNESCO site is 180km and Manas NP UNESCO site is 90km • Deepor Beel WLS and Ramsar Site/IBA: 8.4km from site. The BESS site is inside the Deepor Beel WLS ESZ. • Garbhanga RF: 5.7km, (proposed WLS by the Assam State Government in 2022). • Rani RF: 4.5 km • Lachit Borphokon RF: 8.6km • Site available inside the SS is open space vegetated with tall grasses/herbs/shrubs -mostly <i>Cortaderia jubata</i>, <i>Saccharum spontaneum</i> • No IUCN threated CR/EN/VU floral species inside BESS site • Trees on site: No large trees on site. Few small saplings are present. • Outside the BESS site, within substation: <i>Psidium guajava</i>, <i>Ficus religiosa</i>, <i>Mangifera indica</i>, <i>Azadirachta indica</i>, <i>Molucca albizia</i>, <i>Typha latifolia</i> • Site clearance of vegetation is required. • No tree cutting is envisaged. 	<ul style="list-style-type: none"> • Site and PAI: flat topography • Average site elevation: 69m • No landfilling is needed • Climate: tropical monsoon rainforest climate; area prone to tropical cyclones • Geohazards: Seismic Zone: Zone V (High Risk) • Soil: alluvial • Surface water/rivers: one stream passing through the SS and 80m from BESS site. No other river inside the PAI. Cluster of small ponds at 465m from site. • Ground water: two bore wells are inside PAI, one adjacent to BESS site and other at 275m • Air quality: low levels of dust due to soil suspension/wind blown • Noise: quiet baseline, noise mostly due to low volume of traffic moving on road adjacent. Site noise: 60.2 dB(A) near site adjacent guest house, 54 dB(A) at site boundary. • Wastes on site: SS defunct equipment/wastes observed on site. Soil contamination in SS yard. Clogged drain. Empty SF6 cylinder in SS control room. 	<ul style="list-style-type: none"> • Site is inside grid substation land - industrial land use • Ongoing SS work is near to site but outside of the Mirza SS land • Rural habitation / no private residential/buildings inside PAI. • Nearest house: 110m (AEGCL staff quarter) • Poultry farm/hatchery is at 365m • Nearest settlement: Gosaihat Kochpara at 500m • No education/medical buildings inside PAI • Site is 0m to main Gosihat-Sathikarpa Road. • Nearest cropland: 120m 	<ul style="list-style-type: none"> • There are no local PCR, ASI or State protected monuments within PAI.

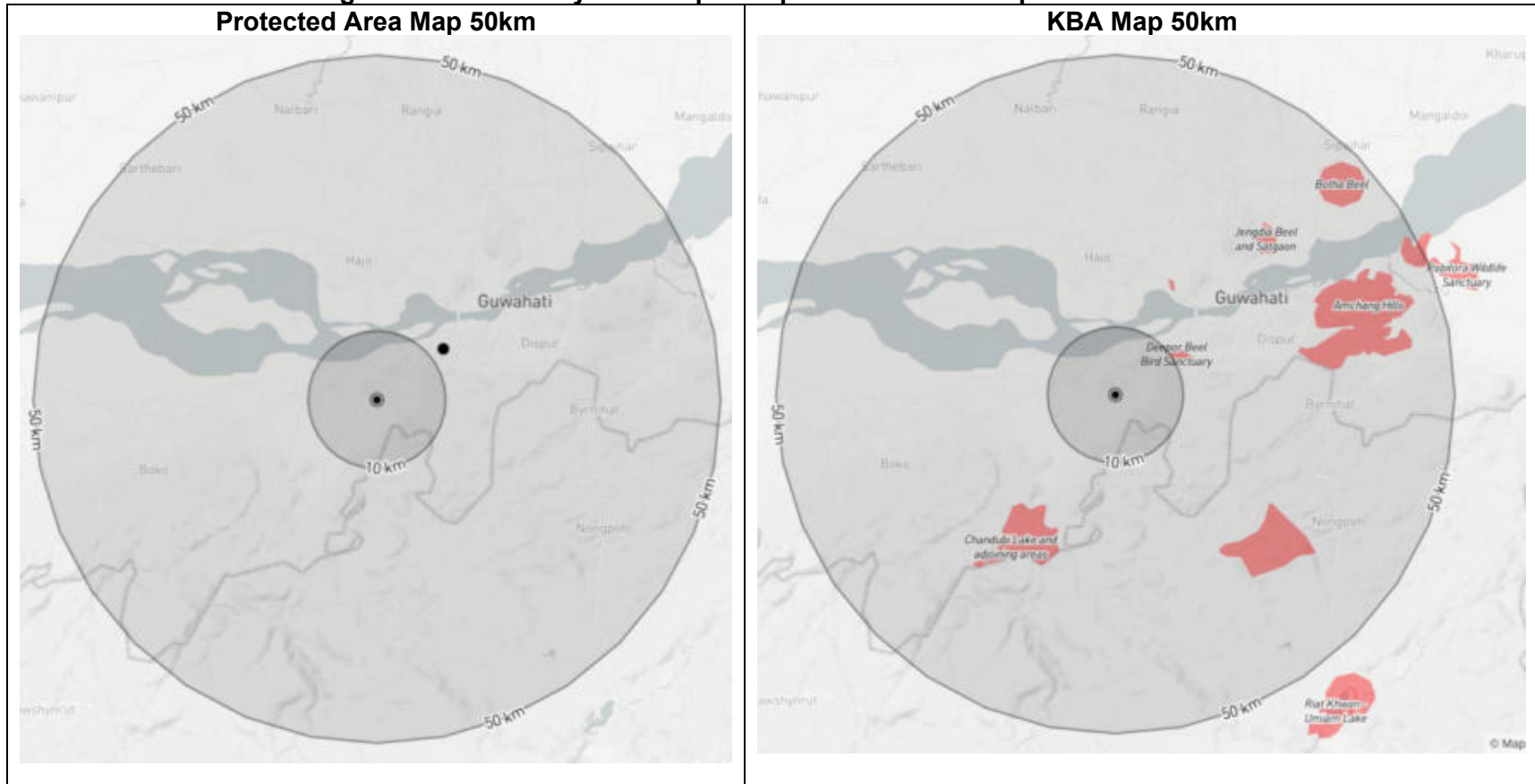
Source: ADB's TA Consultant

Figure 4.1 Distance of Project Site to Biodiversity Areas (up to 10 km)



Source: ADB's TA Consultant

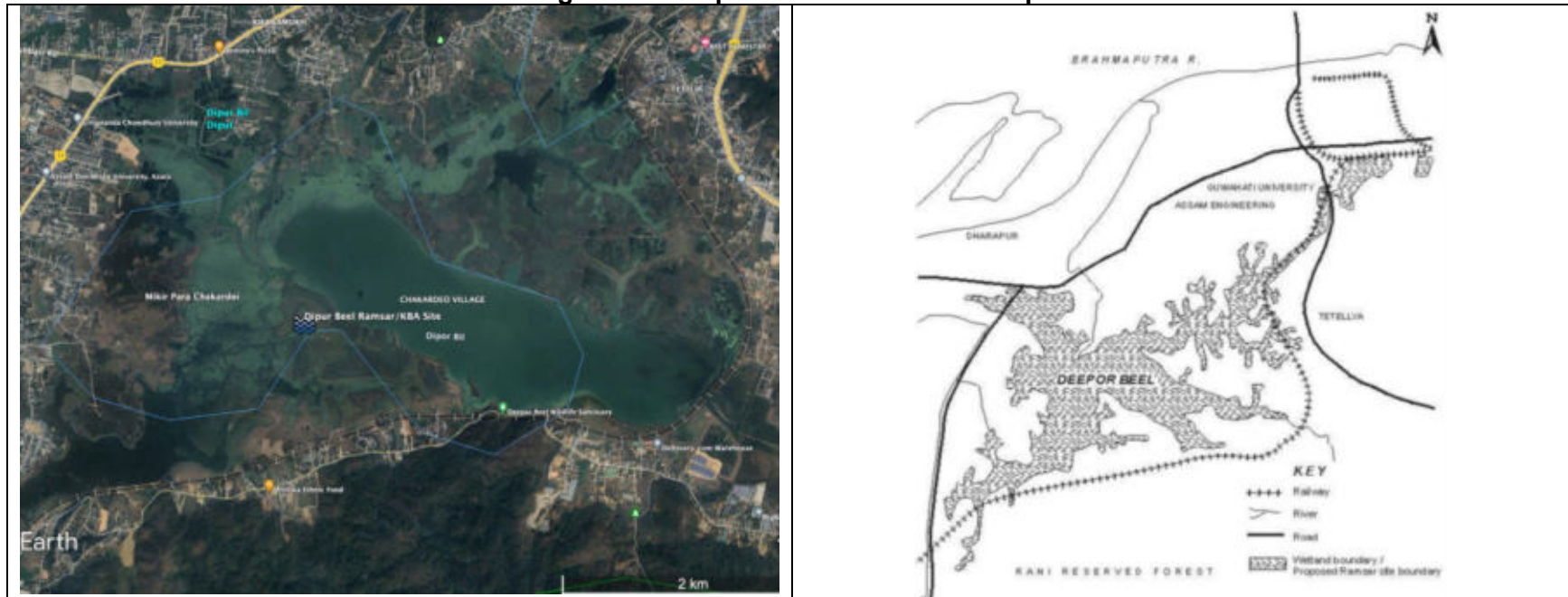
Figure 4.2 IBAT Analysis³¹ Output Map of 50km from Proposed BESS Site



Source: ADB's TA Consultant

³¹ IBAT PS6 & ESS6 Report. Generated under licence 5818-58548 from the Integrated Biodiversity Assessment Tool on 20 February 2024 (GMT). www.ibat-alliance.org

Figure 4.3 Deepor Beel Ramsar site map

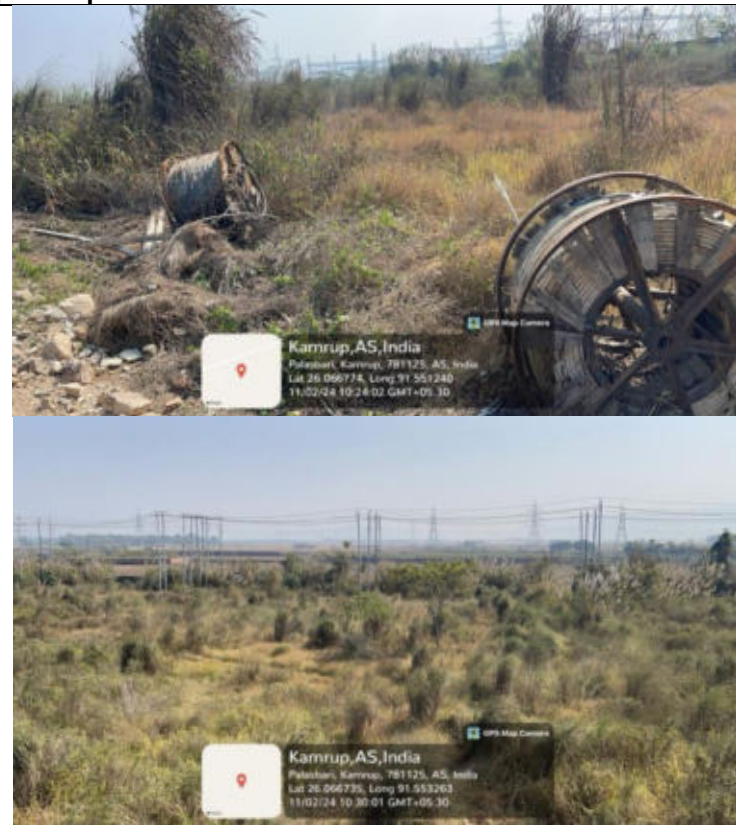


Source: ADB's TA Consultant and <https://rsis Ramsar.org/RI Sapp/files/41543220/pictures/IN1207map.pdf>

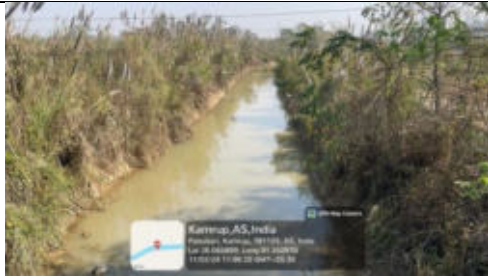
Figure 4.4 BESS site specific photos



Aerial map on 500m PAI



Site and waste dumped inside SS



Stream inside SS



Bore well adjacent to site



Site vegetation



Site landscape

Source: ADB's TA Consultant

Existing substations

93. Table 4.2 presents a summary of the environmental baseline conditions at the 3 existing substations included for R&M work. Figure 4.5 shows location maps and photographs of the substation sites and surroundings. Further details of the substations are included in the environmental audit in **Appendix 2**.

Table 4.2 Environmental conditions (PAI 500m) of existing 33/11kV substations

Name	Location	Land ownership	Key Biological features in PAI	Key Physical features in PAI	Key Socio-economic Setting in PAI	Key physical cultural resource features in PAI
Gunjung 33/11 kV substation	Dima Hasao District, EC: Kanch, ED: Haflong	APDCL	<ul style="list-style-type: none"> Site is modified habitat PAI is mix of 70% natural habitat, some vacant lands and sparse built-up area No UNESCO sites within 100km PA and ESZ: None in 10km KBA/IBA: None in 10km RF: None in 10km Ramsar site: None in 10km Trees and vegetation inside substation: <i>Tectona grandis</i>, <i>Ficus carica</i>, <i>Pithecellobium dulce</i>, <i>Moringa oleifera</i>, <i>Ficus benghalensis</i>, <i>Poaceae</i> sp. No IUCN threated CR/EN/VU floral species inside SS Outside the substation, within PAI notable floral species: <i>Psidium guajava</i>, <i>Ficus religiosa</i>, <i>Mangifera indica</i>, <i>Azadirachta indica</i>, <i>Artocarpus Chaplasa</i>, <i>Michelia Champaca</i>, <i>Mansonia depikae</i>, <i>Eugenia</i> 	<ul style="list-style-type: none"> Site and PAI topography: site is mostly flat with a gentle slope to the northern boundary, whereas rest of the PAI is mildly complex terrain Average site elevation: 588m Climate: tropical monsoon rainforest climate; thunderstorm is quite frequent during summer months. Mist and fog occur in the winter months. Multiple tree uprooting was observed along the access road of substation due to heavy rain and winds during audit. Geohazards: Seismic Zone: Zone V (High Risk) Soil: sandy loam Surface water/Rivers: stream at 100m. Ground water: a spring is present at 250m. No borewells, etc. with 50m of SS or rest of the PAI as reported by locals Air quality: low levels of dust due to soil suspension/wind blown 	<ul style="list-style-type: none"> Site - industrial landuse; rest of PAI: mostly natural habitat, vacant lands, roads, croplands, tea garden with labour quarter Rural and remote area, no private residential/buildings inside PAI. Nearest houses at 45m - tea estate labour quarters SS is located in Dima Hasao Autonomous/IP District area Nearest major settlement: Gunjung at 850m No education/medical buildings inside PAI Site is connected by a 80m damaged/unpaved access road with the main road/SH-40 Nearest cropland: 175m; slash and burn agriculture is practised in PAI including inside SS 	<ul style="list-style-type: none"> Local PCR: temple is at a distance of 60m No ASI or State protected monuments within PAI.

Name	Location	Land ownership	Key Biological features in PAI	Key Physical features in PAI	Key Socio-economic Setting in PAI	Key physical cultural resource features in PAI
			<p><i>species, Bambusa balcooa</i>, etc.</p> <ul style="list-style-type: none"> No tree cutting is envisaged. 	<ul style="list-style-type: none"> Noise: high baseline, no major sources nearby, although some repair works inside SS. Site noise: 59.9 dB(A). Wastes on site: SS defunct equipment/wastes observed on site. Rest of PAI: rare garbage dumps observed along roads 	<p>area. Nearest tea estate at 50m.</p>	
Baithalangso 33/11 kV substation	Karbi Anglong District, EC: Kanch. ED: Howraghat	APDCL	<ul style="list-style-type: none"> Site is modified habitat PAI is mix of about 35% natural habitat, and rest modified habitat – built-up/settlement area and croplands No UNESCO sites within 100km PA and ESZ: None in 10km KBA/IBA: None in 10km RF: Borbil RF at a distance of 2km Ramsar site: None in 10km Trees and vegetation inside substation: <i>Mangifera indica</i> and <i>Poaceae sp.</i> No IUCN threated CR/EN/VU floral species inside SS 	<ul style="list-style-type: none"> Site and PAI topography: site is flat, whereas rest of the PAI is mostly flat with some hillocks/complex terrain Average site elevation: 96m Climate: tropical monsoon rainforest climate; thunderstorm is quite frequent during summer months. Geohazards: Seismic Zone: Zone V (High Risk) Soil: sandy loam Surface water/Rivers: Borpani River is at distance of 480m; ponds at distances of 10m, 40m and 60m. Ground water: bore well is at distance of 15m from substation; multiple borewells within rest of 	<ul style="list-style-type: none"> Site - industrial landuse; rest of PAI: mostly modified/built-up – settlements, roads and croplands Town area; nearest houses at 10m SS is located in Karbi Anglong Autonomous/IP District area Nearest major settlement: SS and PAI within Baithalangso town Baithalangsho High School is at a distance of 205m; Baithalangsho High Secondary School is at 440m and Mount View School at 450m; Baithalangsho Civil Hospital at 296m 	<ul style="list-style-type: none"> Local PCR: Hindu Cemetery at 0m; Baithalangso Shiv Mandir/Temple at 480m No ASI or State protected monuments within PAI

Name	Location	Land ownership	Key Biological features in PAI	Key Physical features in PAI	Key Socio-economic Setting in PAI	Key physical cultural resource features in PAI
			<ul style="list-style-type: none"> Outside the substation, within PAI notable floral species: <i>Ficus religiosa</i>, <i>Mangifera indica</i>, <i>Azadirachta indica</i>, <i>Artocarpus Chaplasi</i>, <i>Mansonia depikae</i>, <i>Eugenia species</i>, <i>Bambusa balcooa</i>, etc. No tree cutting is envisaged. 	<p>the PAI as reported by locals/APDCL staffs</p> <ul style="list-style-type: none"> Air quality: moderate levels of dust due to soil suspension, unpaved access road and low volume traffic Noise: Low baseline, low volume traffic on access road. Site noise: 53.2 dB(A), whereas noise adjacent to cemetery was high at 62 dB(A), exceeding the 50 dB(A) limit Wastes on site: SS defunct equipment/wastes observed on site. Rest of PAI: garbage dumps observed along roads, near houses, vacant lands, etc. 	<ul style="list-style-type: none"> Site is connected by a damaged/unpaved 94m access road with the Baithanglasho main road Nearest cropland: 0m 	
Umpanai 33/11 kV substation	Karbi Anglong District, EC: Kanch. ED: Howraghat	APDCL	<ul style="list-style-type: none"> Site is modified habitat PAI is mix of about 45% natural habitat, and rest modified habitat – built-up/settlement area and croplands No UNESCO sites within 100km PA and ESZ: None in 10km KBA/IBA: None in 10km 	<ul style="list-style-type: none"> Site and PAI topography: site is flat, but slightly elevated from surrounding; whereas rest of the PAI is mostly flat Average site elevation: 563m Climate: tropical monsoon rainforest climate; thunderstorm/heavy rain and cyclone is frequent 	<ul style="list-style-type: none"> Site -industrial landuse; rest of PAI: mostly modified/built-up – settlements, roads and croplands Rural area; nearest house at 90m SS is located in Karbi Anglong Autonomous/IP District area 	<ul style="list-style-type: none"> Local PCR: Graveyard at 10m; Umpanai Presbyterian Church at 400m No ASI or State protected monuments within PAI

Name	Location	Land ownership	Key Biological features in PAI	Key Physical features in PAI	Key Socio-economic Setting in PAI	Key physical cultural resource features in PAI
			<ul style="list-style-type: none"> • RF: Graveyard RF at a distance of 10m • Ramsar site: None in 10km • Trees and vegetation inside substation: <i>Hanserong sp.</i>, <i>Soki sp.</i>, <i>Leucas sp.</i>, and <i>Poaceae sp.</i> • No IUCN threated CR/EN/VU floral species inside SS. • Outside the substation, within PAI notable floral species: <i>Tectona grandis</i>, <i>Gmelina arborea</i>, <i>Michelia champaca</i>, <i>Bombax ceiba</i>, <i>Sterculia villosa</i>, <i>Ficus religiosa</i>, <i>Mangifera indica</i>, <i>Azadirachta indica</i>, <i>Artocarpus Chaplasi</i>, <i>Mansonia depikae</i>, <i>Eugenia species</i>, <i>Bambusa balcooa</i>, etc. • No tree cutting is envisaged. 	<p>during summer/monsoon seasons.</p> <ul style="list-style-type: none"> • Geohazards: Seismic Zone: Zone V (High Risk) • Soil: sandy loam • Surface water/Rivers: Umlata Stream is at distance of 25m; ponds at distances of 300m and 310m. • Ground water: no bore wells within 50m radius of substation; multiple borewells within rest of the PAI as reported by APDCL staff • Air quality: low to moderate levels of dust due to main road with low volume traffic adjacent, substation entrance to main road (~10m) is unpaved • Noise: Moderate high baseline, although low volume traffic on access road. Site noise: 58 dB(A) and 58.2 dB(A) at the adjacent graveyard, exceeding the 50 dB(A) limit. • Wastes on site: SS defunct equipment/wastes observed on site. Rest of PAI: garbage dumps observed along roads, 	<ul style="list-style-type: none"> • Nearest major settlement: Umpanai village • Umpanai Nepali Basti LP School is at a distance of 90m; Umpanai Government LP School is at 273m and the Sangber Kro Memorial School Mount View School at 465m; Umpanai Public Health Centre at a distance of 285m. • Site is connected by a 10m access to the Nellei-Umpanai main road • Nearest cropland: 30m 	

Name	Location	Land ownership	Key Biological features in PAI	Key Physical features in PAI	Key Socio-economic Setting in PAI	Key physical cultural resource features in PAI
				near houses, vacant lands, etc.		

Source: ADB's TA Consultant

11 kV Distribution Line Settings

94. The 11kV distribution line baseline is discussed below based on sample surveys conducted. For the IEE, site visits (reconnaissance surveys) to sample 11kV and LT distribution lines were conducted. Approximately, 15km (15%) or 15 number (14%) of 11 kV lines (including sites for reconductoring of covered conductor lines and DTR associated new lines) out of a total 98.5 km, and 65km (18%) of 0.4 kV LT lines out of a total of 360.75 km of low-tension lines (including bare to ABC lines and DTR associated new lines).

- 98.5 km of 11 kV distribution line (including, 39.5km of DTR associated new covered conductor, plus conversion of existing 59km of bare lines to covered conductor) are planned in the districts of East and West Karbi Anglong (66.75km) and Dima Hasao (31.75km) in Assam state and shall pass through modified and natural habitats. The new lines are proposed to be mostly along the existing alignments of old lines (which will be dismantled) and will join the new DTRs. The existing ones are running along the ROW of existing roads and passing through private lands/over houses. Both east and west Karbi Anglong and Dima Hasao are part of the Autonomous/IP Council area, and the proposed lines will run across tribal/IP settlements/areas. Although no land acquisition is involved for the 11kV lines, some poles and DTR are located and to be located inside private lands.
- Though only indicative alignments of 11kV lines are available now, none of the 11kV lines proposed will be in or pass through – protected areas (only Wildlife Sanctuaries present in the districts), the protected or regulated zone of Archaeological Survey of India (ASI) and State protected monuments. None of the 11kV lines (refer Table 4.3) screened (location data provided by APDCL) against secondary maps/information available are passing through Wildlife Sanctuaries, and if after final route survey identified lines route through such sites, they will be dropped. There may be some 11kV lines that pass within/close to ESZ/Elephant Reserve/Reserved Forest areas. The Districts – East and West Karbi Anglong and Dima Hasao, where the 11kV lines are planned, are Critical Habitat (at a district level) – are supporting possible, likely or actual Critical Habitat for 25 globally-threatened species, at least 13 restricted-range species, 12 migratory species, four existing and one proposed Wildlife Sanctuary, Reserved Forests, six internationally-recognized sites (Key Biodiversity Areas), and two ecoregions holding unique assemblages of species associated with key evolutionary processes (*ADB Assam Solar Project: Critical and Natural Habitat Assessment Report, May 2024*). There will also be natural habitat and locally important cultural resources to which attention is required. Site-specific assessment will be conducted to confirm no high biodiversity values or physical cultural resources are present in the PAI. APDCL is only installing covered conductors and ABC in RFs and KBA/IBAs given their high biodiversity value.
- APDCL confirmed that no trees will be felled for the 11kV installation. Only trimming/looping will be undertaken. If after final route alignment, the laying of these lines may potentially require some felling of trees especially while installing the distribution poles, then APDCL will, first, as a principle, try to avoid felling (especially of private trees). Tree species observed in ROW during sample survey includes *Mangifera Indica*, *Zizyphus*, *Albizia sp.*, *Anthocephalus chinensis*, *Bauhinia purpurea*, *Lagerstroemia sp.*, *Artocarpus heterophyllus*, Bamboo, Banana, and others.
- The terrain across which the 39.5km of 11 kV on new DTR associated covered conductor, and 59km of existing lines to covered conductors shall pass is mostly on flat to moderately complex terrain across semi-urban and rural areas.
- Surveyed lines in semi-urban areas were moderate to severely dust polluted due to traffic movement. Lines in rural areas were mostly having low dust/air pollution issues, although

wind-blown dust was observed along unpaved road alignments. Noise was moderate to high for most lines as they are passing along roads and settlements. Noise was relatively low in rural areas.

- Garbage and wastes were recorded in most alignments and more severe for ROWs in town areas.
- No river/stream crossings were recorded.
- Land use in the PAI mostly includes settlements, some natural habitat, croplands, and, open fields/vaccant lands.
- Sample route alignments visited in Karbi Anglong were along roads except for many sections where they entered settlements or private land. In Dima Hasao most alignments visited were along the roads and some through natural habiat patches, although in settlement areas.
- Many of the lines, although along roads, are passing entrances to private properties; houses, shops and business. Multiple road crossings were recoded along existing and new alignments.
- Many of the existing lines cross the rooftops of houses, private courtyards, gardens, shops, temples, churches and in one case a school; there may have been encroachment of properties after the lines were originally installed by APDCL. Some of the 11kV lines visited were positioned at reduced height and even sometimes touching the LT lines and causing sparks and power failure as reported by locals. For these overhead lines safety clearances will need attention.
- Poles inside residential compounds were observed on many of the line visited. The final alignments will need to avoid impacting these properties
- Further baseline details of the sample 11kV distribution lines visited are provided in **Appendix 9a** along with maps of the indicative routes in **Appendix 10** and photographs of general arrangements in **Appendix 7**.

Low Tension Distribution Line Settings

95. The LT distribution line baseline is discussed below based on sample surveys conducted:

- The 448.45km of proposed overhead low tension (0.4 kV) distribution line including 87.6 km of DTR associated aerial bundled cable (ABC) conductor (36.4km of 3 Phase and 51.2km of 1 Phase line) and conversion of 360.75km of bare line to ABC, are spread across the three districts and pass through mostly modified habitats and settlements but also some natural habitat. These lines are passing along the existing semi-urban and rural roads, besides many lines passing through/entering private lands and settlements.
- Most lines visited (refer Table 4.3) pass over the rooftops of houses/shops/gardens in both semi-urban and rural areas; there may have been encroachment of properties after the lines were originally installed by APDCL. During the site visit one house was being built under the proposed LT line to be converted to ABC in Haflong, Dima Hasao.
- The low-tension lines start from existing 11/0.4kV distribution transformers (DTRs) (88 new to be installed under the project) and move in various directions across different land uses in the area to supply consumers. Most of these lines have not been mapped, but it has been confirmed by APDCL that none of the low-tension lines will pass through protected areas (only Wildlife Sanctuaries present in the districts), or in the protected or regulated zone (up to 300m from) of ASI protected monuments or state protected monuments. There may be some low-tension lines that pass along roads routed within/close to ESZ/Elephant Reserve/Reserved Forest areas. The Districts – East and West Karbi Anglong and Dima Hasao, where the 11kV lines are planned, are Critical

Habitat (at a district level) – are supporting possible, likely or actual Critical Habitat for 25 globally-threatened species, at least 13 restricted-range species, 12 migratory species, four existing and one proposed Wildlife Sanctuary, Reserved Forests, six internationally-recognized sites (Key Biodiversity Areas), and two ecoregions holding unique assemblages of species associated with key evolutionary processes (*ADB Assam Solar Project: Critical and Natural Habitat Assessment Report, May 2024*). There will also be natural habitat and locally important cultural resources to which attention is required. Site-specific assessment will be conducted to confirm no high biodiversity values or physical cultural resources are present in the PAI. APDCL is only installing covered conductors and ABC in RFs and KBA/IBAs given their high biodiversity value.

- The terrain across which the LT lines shall pass is mostly flat terrain across semi-urban and rural areas.
- Surveyed lines in semi-urban areas were moderate to severely dust polluted due to traffic movement. Lines in rural areas were mostly having low dust/air pollution issues, although wind-blown dust was observed along unpaved road alignments. Noise was moderate to high for most lines as they are passing along road and settlements. Noise was relatively low in rural areas.
- Garbage and wastes were recorded in most alignments and more severe for ROWs in town area.
- Some river/stream (including dry river beds) crossing were recorded. No poles will be in the riverbed.
- **Appendix 9b** details the setting of the sample low-tension lines visited. The low-tension lines should not require felling of trees, unless minor rerouting to meet safety clearances is needed, as poles that are damaged are proposed to be replaced in the existing pole location as well as new poles for DTR associated lines. However, lopping / trimming of branches may be involved.

Table 4.3 indicative distribution lines visited for IEE

Administrative District/ADC	Sub-Division*	Distribution line surveyed	Scope of work (APDCL)	Scope Sl. No.	km covered by survey
East and West Karbi Anglong	Diphu 1	Diphu-2 Feeder: Near Diphu Control room to Joysing Doloi	2km 11kV on covered conductor	D1, Sl. 1	2
	Bokajan	Bokajan Feeder: Bokajan to Bokajan	7km 11kV on covered conductor	D1, Sl. 8	7
	Bokajan	Sariahan Feeder: Sariahan to Sariahan	5km 11kV on covered conductor	D1, Sl. 9	5
	Diphu ESD-II	Longnit Feeder: Longkoi Bey	0.5km 11kV new DTR line on covered conductor	B4, Sl. 64	0.5
	Diphu ESD-II	Longnit Feeder: Thapadao	0.5km 11kV new DTR line on covered conductor	B4, Sl. 65	0.5
	Diphu ESD-II	Longnit Feeder: Borjan Church	0.5km 11kV new DTR line on covered conductor	B4, Sl. 66	0.5
	Diphu ESD-II	Longnit Feeder: Hidisajir	0.5km 11kV new DTR line on covered conductor	B4, Sl. 67	0.5
	Diphu ESD-II	Manj-Dillai Feeder: Hojainala	0.5km 11kV new DTR line on covered conductor	B4, Sl. 68	0.5
	Diphu ESD-II	Kheroni Feeder: Sedeng Terang	0.8km 11kV new DTR line on covered conductor	B4, Sl. 69	0.8
	Bokajan	Bokajan Feeder: Thana Road	0.8km 11kV new DTR line on covered conductor	B4, Sl. 71	0.8
	Diphu 1	Diphu-2 Feeder: Stadium	2km low tension (0.40kV) bare to ABC conductor	F1 and F2, Sl. 2	2
	Diphu 1	Diphu-2 Feeder: District Industrial centre	2.5km low tension (0.40kV) bare to ABC conductor	F1 and F2, Sl. 3	2.5
	Diphu 1	Diphu-1 Feeder: Teachers Colony	3km low tension (0.40kV) bare to ABC conductor	F1 and F2, Sl. 6	3
	Diphu 1	Diphu-1 Feeder: Rongkimi	3km low tension (0.40kV) bare to ABC conductor	F1 and F2, Sl. 7	3
	Diphu 1	Diphu-1 Feeder: Amalapatty	2km low tension (0.40kV) bare to ABC conductor	F1 and F2, Sl. 8	2
	Diphu 1	Diphu-1 Feeder: ITI Girls Hostel	3km low tension (0.40kV) bare to ABC conductor	F1 and F2, Sl. 10	3
	Bokajan ESD	Balipather 2 nd Feeder: Morakordoi guri	4km low tension (0.40kV) bare to ABC conductor	F1 and F2, Sl. 143	4
	Diphu ESD-II	Longnit Feeder: Longkoi Bey	1.5km low tension (0.40kV) new DTR line on ABC	G1 and G2, Sl. 64	1.5
	Diphu ESD-II	Longnit Feeder: Thapadao	1.5km low tension (0.40kV) new DTR line on ABC	G1 and G2, Sl. 65	1.5
	Diphu ESD-II	Longnit Feeder: Borjan Church	1.5km low tension (0.40kV) new DTR line on ABC	G1 and G2, Sl. 66	1.5
Diphu ESD-II	Longnit Feeder: Hidisajir	1.5km low tension (0.40kV) new DTR line on ABC	G1 and G2, Sl. 67	1.5	
Diphu ESD-II	Manj-Dillai Feeder: Hojainala	1.5km low tension (0.40kV) new DTR line on ABC	G1 and G2, Sl. 68	1.5	
Diphu ESD-II	Kheroni Feeder: Sedeng Terang	1.8km low tension (0.40kV) new DTR line on ABC	G1 and G2, Sl. 69	1.8	
Bokajan	Bokajan Feeder: Thana Road	1.6km low tension (0.40kV) new DTR line on ABC	G1 and G2, Sl. 71	1.6	
Dima Hasao	Haflong	Ditekchorra Feeder: Ditekchorra to Zoar	3km 11kV on covered conductor	D1, Sl. 7	3
	Haflong	Ditekchorra Feeder: Zoar to Michikur	2km 11kV on covered conductor	D1, S. 8	2
	Haflong	Reikho to Jatnga Lampu	2km 11kV on covered conductor	D1, Sl. 9	2
	Haflong	Kapurcherra Feeder: Jatnga Lampu to Kapurcherra Khasia	2km 11kV on covered conductor	D1, Sl. 10	2

Administ rative District/ ADC	Sub- Division*	Distribution line surveyed	Scope of work (APDCL)	Scope SI. No.	km covered by survey
	Haflong ESD	Lower Feeder: Lunxhok	2km low tension (0.40kV) bare to ABC conductor	F1 and F2, SI. 21	2
	Haflong ESD	Lower Feeder: Boildhura	2km low tension (0.40kV) bare to ABC conductor	F1 and F2, SI. 22	2

* All project lines are in the Kanch Electrical Circle

ADC: Autonomous District Council, ESD = Electrical Sub Division, ABC = Aerial Bundled Cable, DTR = Distribution Transformer

B. State Wide and Distribution Line District Baseline

1) Biological Setting

96. Assam, situated at the foothills of the eastern Himalayas, is the largest state in northeast India and lies in the middle reach of the Brahmaputra and Barak Rivers. The land has uneven topography with hills and plains. Since the Output 3 (BESS) site is fixed and within an existing grid substation area, as are the 3 substations under Output 4, their baseline is covered under the site-specific section in this chapter. For Output 4 distribution lines are planned across three districts of Assam – East and West Karbi Anglong and Dima Hasao, as the routes are not fixed the baseline for these districts in the context of Assam state is disused in this section.

a. Protected areas

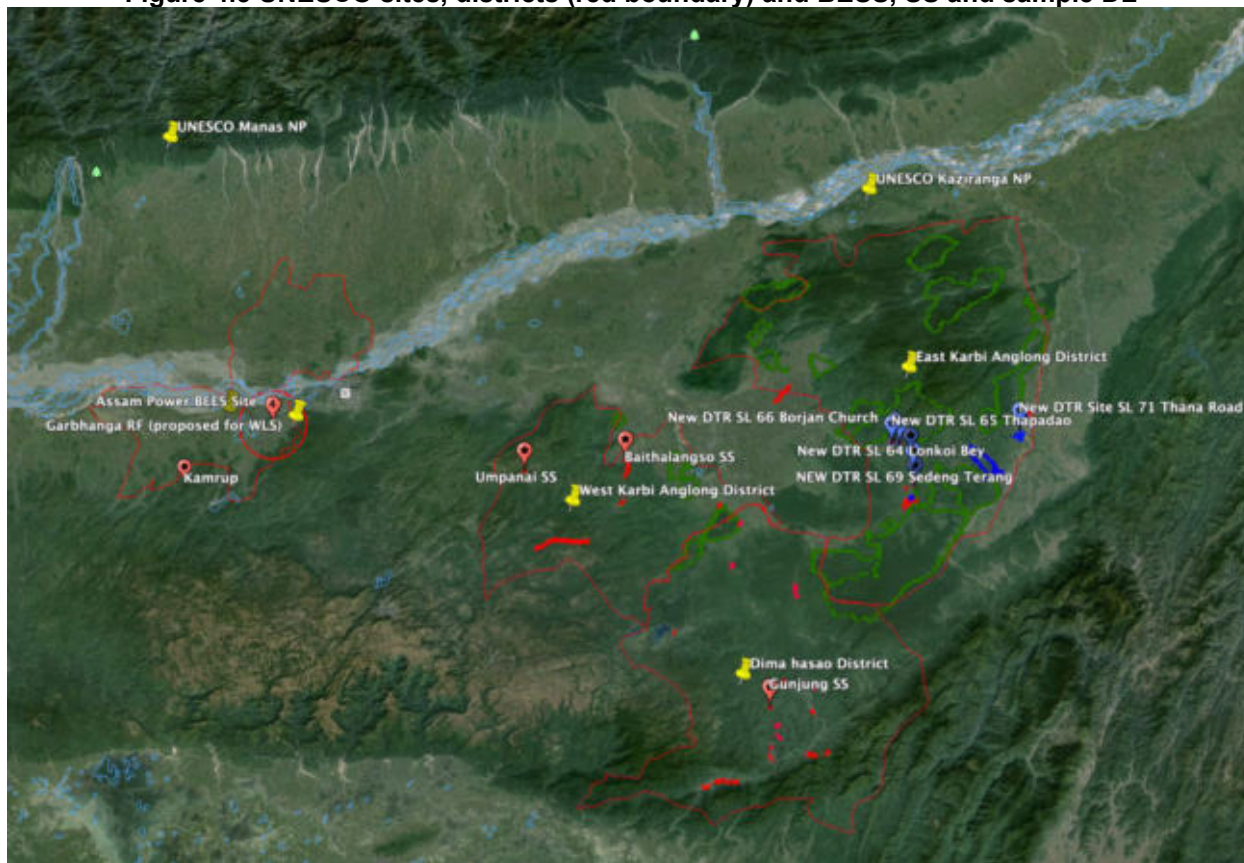
97. The protected areas (PA) of Assam occupy 3925 sq. km. and constitute about 5% of the state's geographical area.³² PAs include 5 National Parks and 17 Wildlife Sanctuaries as well as 3 proposed Wildlife Sanctuaries, 4 Tiger Reserves, 5 Elephant Reserves, 2 Biosphere Reserves and 2 World Natural Heritage Sites.

98. **UNESCO Natural World Heritage Sites:** Presently, Assam has two UNESCO Natural World Heritage Sites - Kaziranga National Park and Manas National Park. These sites receive the highest legal protection under the provisions of the Indian Wildlife (Protection) Act, 1972 and Indian Forest Act, 1927/Assam Forest Regulation 1891. The sites are managed by the Assam Environment and Forest Department, guided by legally approved Management Plans. Kaziranga National Park which hosts two thirds of the world's population of one-horned rhinoceros, as well as many mammals, including tigers, Indian elephants, leopards and bears, and many bird species, is also a tiger reserve declared in 2007 and recognized as an Important Bird Area (IBA) by BirdLife International.³³ It is covering an area of 42,996 hectare (ha). Manas National Park is also recognized as a Tiger Reserve (the UNESCO site forms the core of a larger national park), Biosphere Reserve, Elephant Reserve (core) and Important Bird Area. Manas is home to the Bengal tiger, pygmy hog, greater one horned rhinoceros and Indian elephant. It covers an area of 39,100 ha and spans the Manas River and is bounded to the north by the forests of Bhutan. All project locations - BESS, substations and distribution lines - are located at distance of at least 50km away from these two UNESCO sites. Figure 4.5 shows the UNESCO sites in relation to Output 3 and 4 interventions.

³² <https://asbb.assam.gov.in/information-services/protected-area-network>

³³ <https://datazone.birdlife.org/site/factsheet/kaziranga-national-park-iba-india>

Figure 4.5 UNESCO sites, districts (red boundary) and BESS, SS and sample DL





Source: ADB's TA Consultant


99. **Protected Areas and Eco-Sensitive Zones (ESZs).** Protected areas are a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values. There are several kinds of protected areas, which vary by level of protection depending on the enabling laws of each country or the regulations of the international organizations involved e.g., National Parks, Wildlife Sanctuaries, Conservation Reserves, Community Reserves and Marine protected Areas notified by MoEF&CC, Government of India, under the Environment Protection Act 1986.³⁴ Eco-sensitive zones are areas around protected areas. The basic aim is to regulate activities around protected areas so as to minimise negative impacts on the ecosystems of the protected areas. The ESZs of all the NPs and WLSs in East Karbi Anglong are not gazetted by the MoEF&CC and are listed in the Table 4.4. Only the Deepor Beel WLS has a notified ESZ. West Karbi Anglong and Dima Hasao do not have any protected areas.

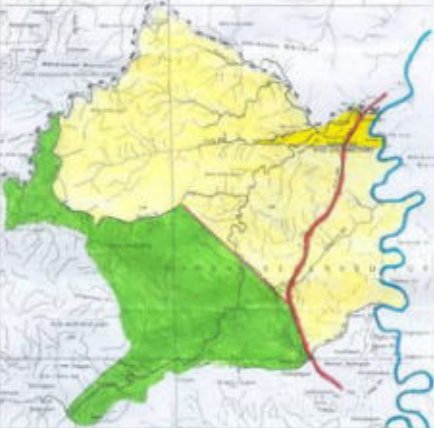
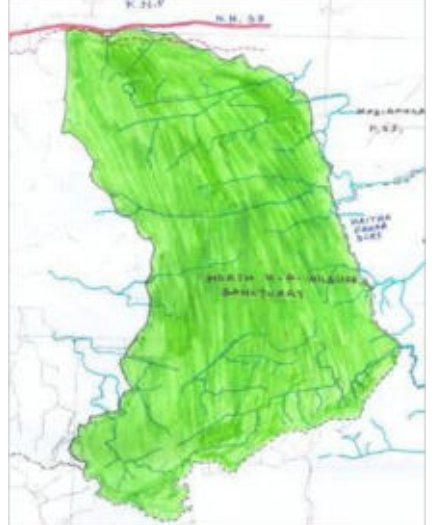
³⁴ <https://moef.gov.in/wp-content/uploads/2017/06/1%20Guidelines%20for%20Eco-Sensitive%20Zones%20around%20Protected%20Areas.pdf>

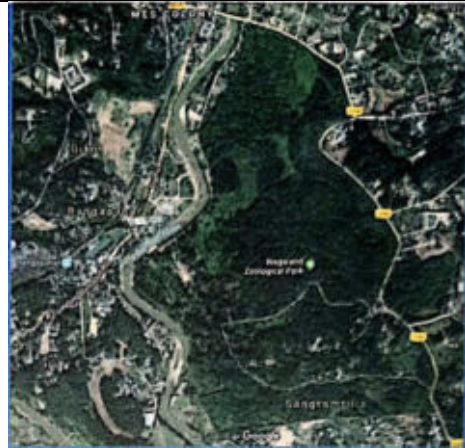
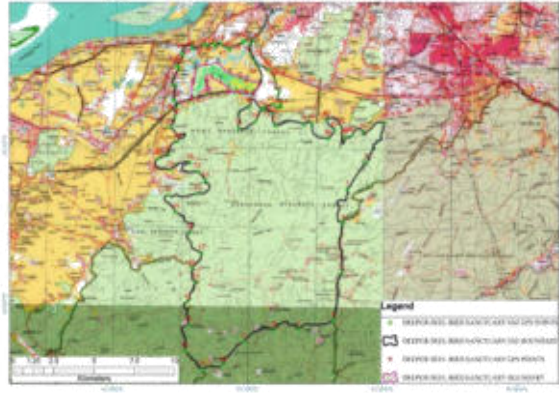
Table 4.4 Protected Area maps in distribution component districts

Name and Type	District	IUCN Category and Critical Habitat-qualifying site? ³⁵	Notification of ESZ	Limits of ESZ	Map of Wildlife Sanctuary (no ESZ boundary)
East Karbi Anglong Wildlife Sanctuary	East Karbi Anglong, Assam	IV? Yes	Not Notified	10km	
Garampani Wildlife Sanctuary	East Karbi Anglong, Assam	IV? Likely	Not Notified	10km	

³⁵ ADB Assam Solar Project: Critical and Natural Habitat Assessment, May 2024

Name and Type	District	IUCN Category and Critical Habitat-qualifying site? ³⁵	Notificati on of ESZ	Limits of ESZ	Map of Wildlife Sanctuary (no ESZ boundary)
Marat Longri Wildlife Sanctuary	East Karbi Anglong, Assam	IV? Yes	Not Notified	10km	

Name and Type	District	IUCN Category and Critical Habitat-qualifying site? ³⁵	Notificati on of ESZ	Limits of ESZ	Map of Wildlife Sanctuary (no ESZ boundary)
Nambor Wildlife Sanctuary	East Karbi Anglong, Assam	IV? Likely	Not Notified	10km	
North Karbi Anglong Wildlife Sanctuary (proposed)	East Karbi Anglong, Assam	IV? Yes	Not Notified	10km	

Name and Type	District	IUCN Category and Critical Habitat-qualifying site? ³⁵	Notification of ESZ	Limits of ESZ	Map of Wildlife Sanctuary (no ESZ boundary)
Rangapahar Wildlife Sanctuary and Zoological Park	Dimapur, Nagaland	IV? Unlikely	Not Notified	10km	
Deepar Beel Wildlife Sanctuary also Ramsar site	Kamrup, Assam	Likely	Draft notification no S.O.3494 (E), dated 25th August, 2021	Notifies the eco-sensitive zone shall be to an extent of 294 metres to 16.32 kilometres around the boundary of Deepar Beel Wildlife Sanctuary and the area of the ESZ is 148.9767 square kilometres. Since still a draft notification 10km ESZ will apply.	

Some IUCN management categories (suffixed by ‘?’) have been estimated, as they have not been officially declared on www.protectedplanet.org. Source: ADB’s TA Consultant, Maps source: <https://assam.gov.in/about-us/406> and Assam CNHA Report May 2024; Maps shows PA only and not ESZs.

100. According to the guidelines for declaration of ESZ around National Parks and Wildlife Sanctuaries, the following activities associated with the project are prohibited, regulated, and permitted:

- Felling of trees – Regulated (with permission from appropriate authority)
- Setting up of industries that causes pollution (water, air, soil, noise, etc.) – Prohibited
- Erection of electrical cables – Regulated (promote underground cabling)
- Widening of Roads – Regulated
- Use or production of any hazardous substances – Prohibited
- Discharge of effluents and solid waste in natural water bodies or terrestrial area – Prohibited

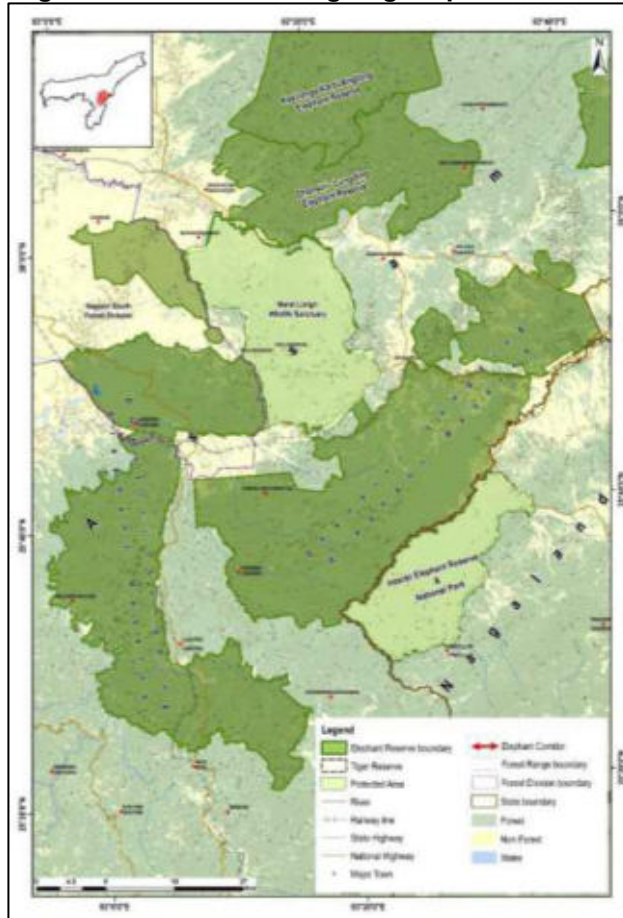
101. The next nearest protected area outside Assam to the Output 4 districts is in Nagaland, this is the Rangapara WLS (shares its boundary with the state border and Karbi Anglong district). No project substations are located within a 10km radius of the Rangapara WLS. Although distribution lines visited are about 4km from the WLS.

102. **Elephant Reserves in the DL districts.**³⁶ The state of Assam with around 5,700 elephants is a key conservation area for Asian elephants in India (MoEF&CC 2017).

- **Dhansiri - Lungding Elephant Reserve** was notified on 19/04/2003 vide No. FRW - 44/2002/70-A by the Assam Environment and Forests department in pursuance to the guidelines provided by the Project Elephant Division, MoEF&CC, Government of India. Part of this corridor comprising of RFs falls in the Karbi-Anglong districts, among others, where the 3 substations are located and distribution lines are planned. The reserve includes the Karbi Anglong East Forest Division and Karbi Anglong West Forest Division, among others. The RFs overlapping the corridor include Lumding RF, Inglongiri council RF, Kaki RF, Disama RF, Longnit council RF, Khunbamon RF, Jamuna RF, Tamulbai council RF, Dhansiri RF, Daldai RF, Barlangpher council RF and Langting – Mupa RF. The Dhansiri-Lungding Elephant Reserve has an area of 2,740 km² which is contiguous habitat with the northern boundary bordering Kaziranga-Karbi Anglong Elephant Reserve in Assam and eastern boundary bordering Intanki Elephant Reserve of Nagaland. Figure 4.6 shows the Dhansiri - Lungding Elephant Reserve.

³⁶ Wildlife Institute of India–Project Elephant Division, MoEF&CC (2023) Elephant Reserves of India: An Atlas (Version – 2/2023). Pp:99 (WII-TR NO/2023/19)

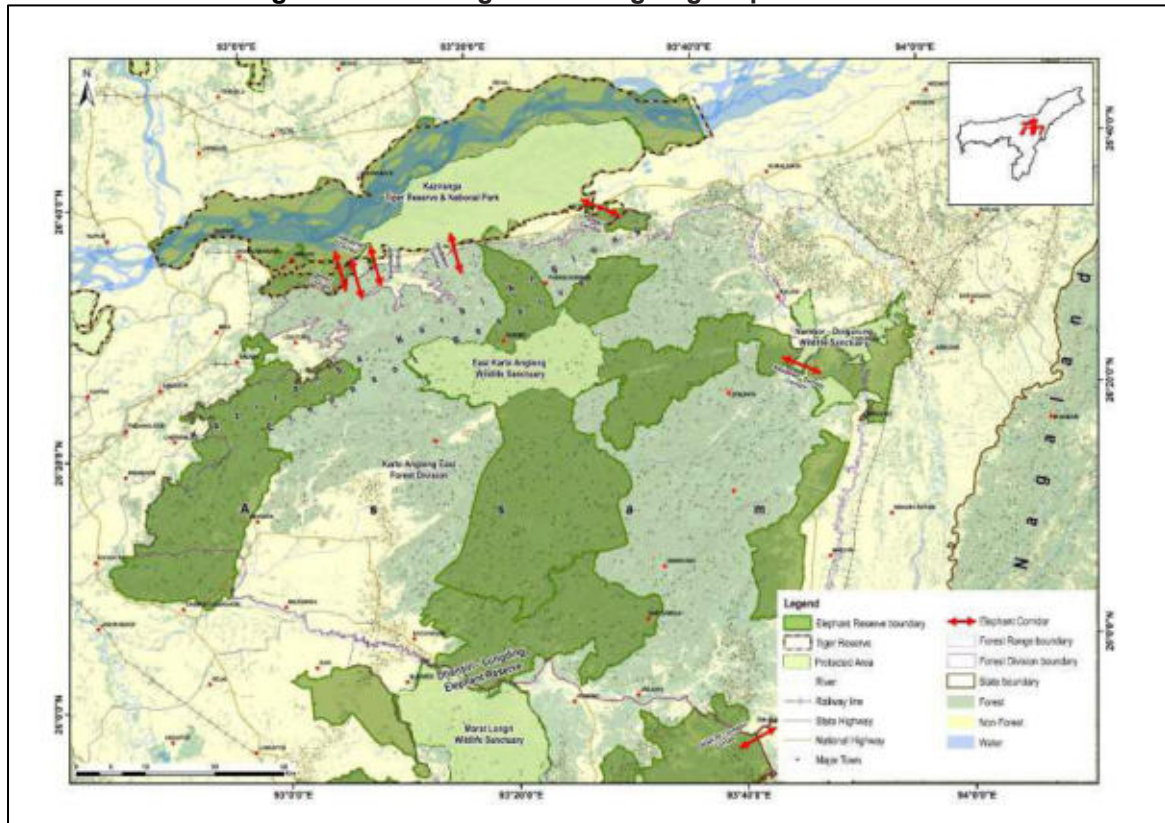
Figure 4.6 Dhansiri - Lungding Elephant Reserve



Source: Wildlife Institute of India–Project Elephant Division, MoEF&CC (2023) Elephant Reserves of India: An Atlas. (Version – 2/2023). Pp:99 (WII-TR NO/2023/19)

- Kaziranga-Karbi-Anglong Elephant Reserve** was notified on 17/04/2003 vide No. FRW - 44/2002/64-A by the Assam Environment and Forests department in pursuance to the guidelines provided by the Project Elephant Division, MoEF&CC, Government of India. It encompasses reserve forest and Protected Areas in Karbi Anglong East Forest Division, among others. The Kaziranga-Karbi-Anglong Elephant Reserve consists of an area of 3270 km² located in the central Assam region (Refer Figure 4.7). It is a contiguous habitat with the southern boundary of the reserve bordering with the Dhansiri-Lungding Elephant Reserve. RFs overlapping include the Panbari RF, Upper Doigurung RF, Nambor RF, Kaliyoni RF, Langlokso RF, Barjuri RF, Jungthung RF, Doboka RF, Suang RF, Diju valley RF, Bagser RF, Kukurakata, RF, Diju Valley North RD, Lower Daigurung RF and Haithapahar District council RF.

Figure 4.7 Kaziranga-Karbi-Anglong Elephant Reserve



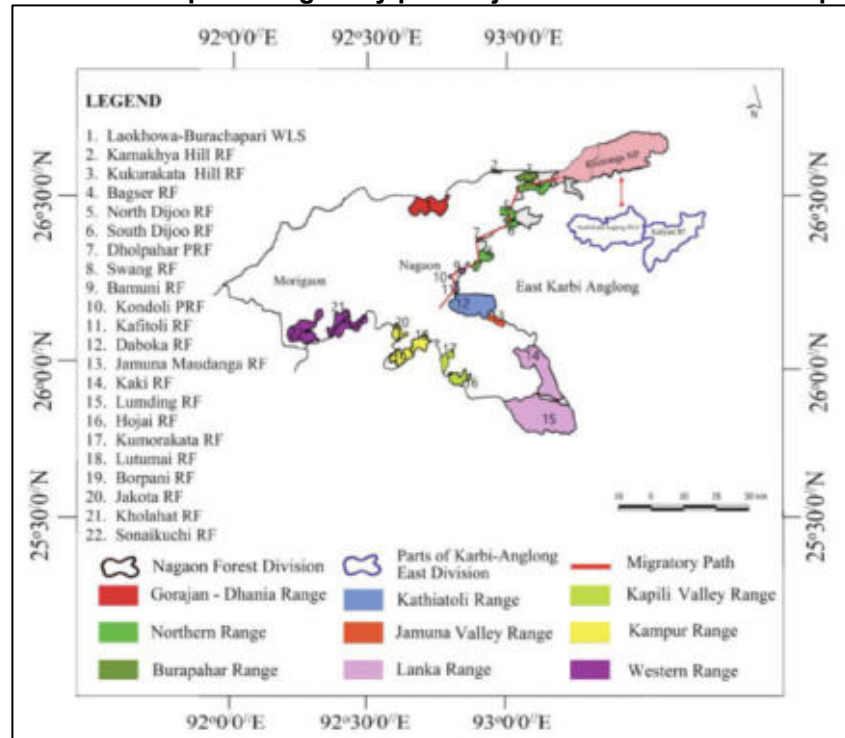
Source: Wildlife Institute of India–Project Elephant Division, MoEF&CC (2023) Elephant Reserves of India: An Atlas. (Version – 2/2023). Pp:99 (WII-TR NO/2023/19)

103. **Elephant Corridors:** Jyoti Bikash Baishya, et al. 2021³⁷ conducted studies on the migratory path of elephants in Nagaon Forest Division (FD) which is bounded in the south by the West Karbi Anglong and Dima hasao and in the east by the East Karbi Anglong and Golaghat districts. These areas are contiguous with the Kaziranga-Karbi Anglong Elephant Reserve. Census data indicate that the elephant population in the Nagaon FD is 79 in the year 2017. This represents elephants migrating through a corridor to different areas of Nagaon FD every year. During the paddy harvesting period (October to December), elephant herds are often present in the foothills of the Nagaon District, especially in the areas bordering the Kaziranga-Karbi Anglong Elephant Reserve. The corridor is adjacent to the distribution component area. Figure 4.8 shows the assumed migratory path of elephants in the Nagaon Forest Division. Kiranmay Sarma et al. 2020 conducted studies on human elephant conflict in Karbi Anglong district.³⁸ Figure 4.9 shows the Human-Elephant Conflict areas in the Karbi Anglong District. There are no other elephant corridors except this in the project districts.

³⁷ <https://www.asesg.org/PDFfiles/2021/53-39-Baishya.pdf>

³⁸ https://www.researchgate.net/publication/344520672_A_holistic_analysis_of_human-elephant_conflicts_in_Karbi_Anglong_district_of_Assam

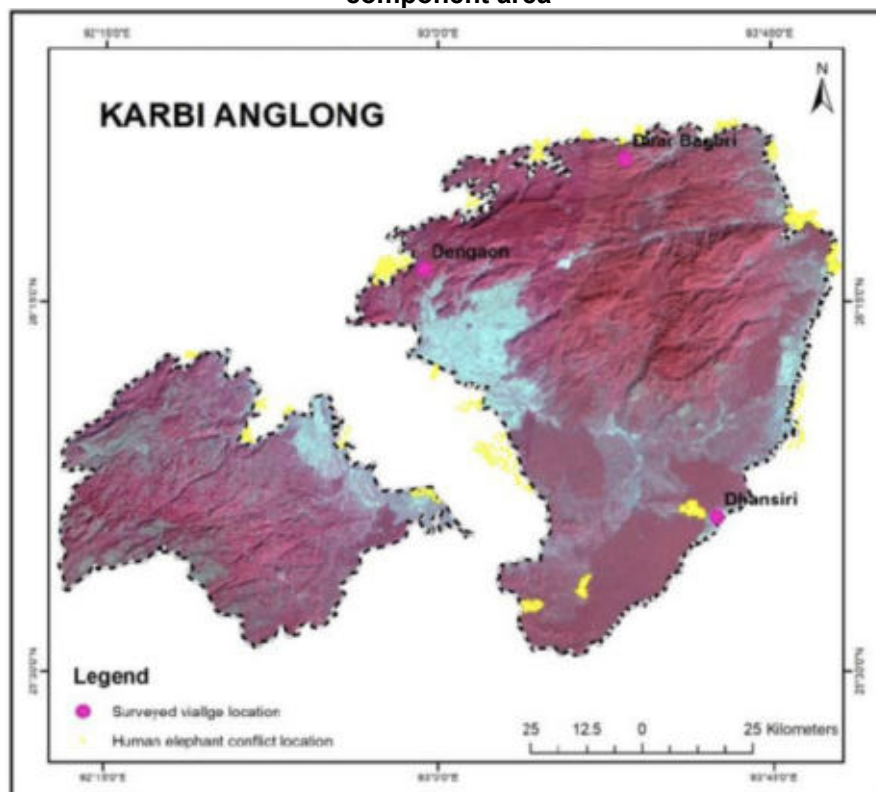
Figure 4.8 Potential elephant migratory path adjacent to distribution component area



Source:

https://www.researchgate.net/publication/351410042_Status_and_Distribution_of_Asian_Elephants_in_the_Nagaon_Forest_Division_Assam_India

Figure 4.9 Human-elephant conflict locations in East and West Karbi Anglong distribution component area



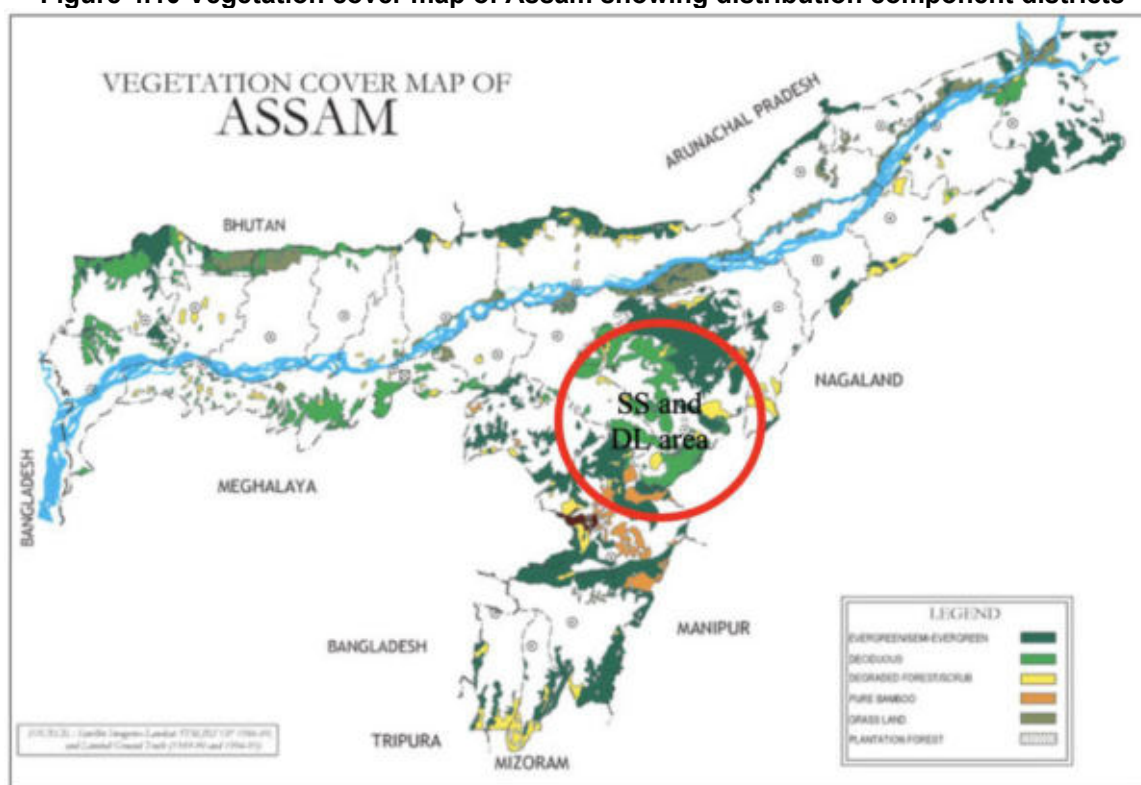
Source: https://www.researchgate.net/publication/344520672_A_holistic_analysis_of_human-elephant_conflicts_in_Karbi_Anglong_district_of_Assam

1. Forests

104. The only type of state protected forest in Assam is Reserve forests (RF): these are the most restricted forests and are constituted by the State Government on any forest land or wasteland which is the property of the Government. In reserved forests, local people are prohibited, unless specifically allowed by a Forest Officer, from settlement.

105. The recorded forest area in Assam is 26,832 km² which is 36.11% of total geographic area. Out of the 26,832 sq km, 17,864 km² is Reserved Forest and 8,968 km² is Unclassed Forest. As per the Champion and Seth Classification of Forest Types (1968)³⁹, the forests in Assam belong to seven forest type groups further divided into 25 different forest types. Each forest type represents a unique eco-system. In terms of forest canopy density classes, Assam has 2,794.86 km² under Very Dense Forest (VDF), 10,278.91 sq km under Moderately Dense Forest (MDF) and 15,252.74 sq km under Open Forest (OF). The vegetation cover map of Assam is provided as Figure 4.10.

Figure 4.10 Vegetation cover map of Assam showing distribution component districts



Source: https://asmervis.nic.in/Database/Maps_1007.aspx

106. **Forest in the Output 4 Districts:** these districts are predominantly open forest and moderate dense forest cover having small area with very dense forest. Quantitatively the total forest area in Dima Hasao (86.07%) and combined East and West Karbi Anglong (75.61%) have higher percent share of forest area than the overall state share (36.11%) of forest cover. Proportion of open forest is highest followed by moderately dense and very dense forest. Forest cover in different canopy classes of the Output 4 districts is given in Table 4.4 and Figure 4.11 and 4.12.

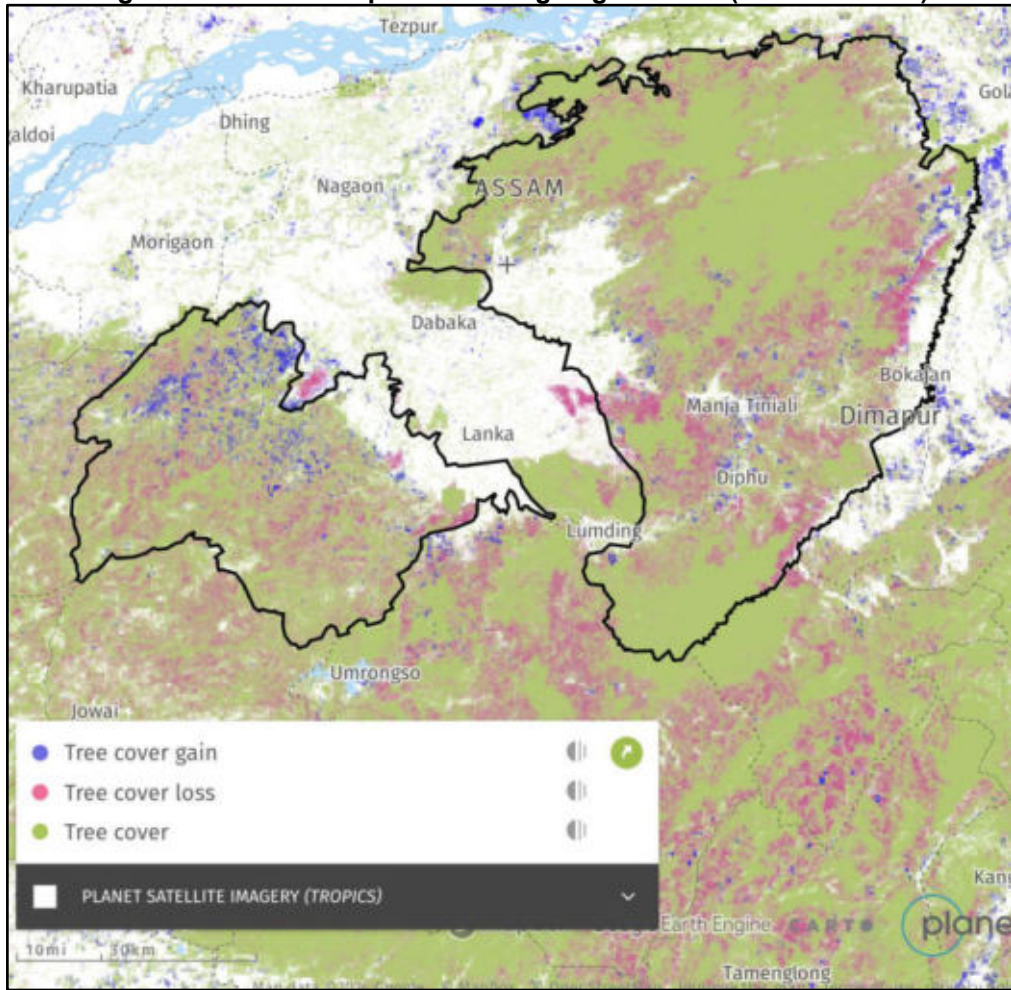
³⁹ Champion and Seth (1968) gave the detailed classification of forest types in India based on climate, physiognomy, species composition, phenology, topography, soil factors, altitude, aspect, and biotic factors.

Table 4.4 Forest cover in the Output 4 Districts

District	Geographic Area	Very Dense Forest	Moderately Dense Forest	Open Forest	Total Forest Area	% to total State area
East and West Karbi Anglong	10434	583.93	3766.62	3538.63	7889.18	75.61
Dima Hasao	4888	209	1519.73	2478.20	4206.93	86.07

Source: <https://fsi.nic.in/forest-report-2019>

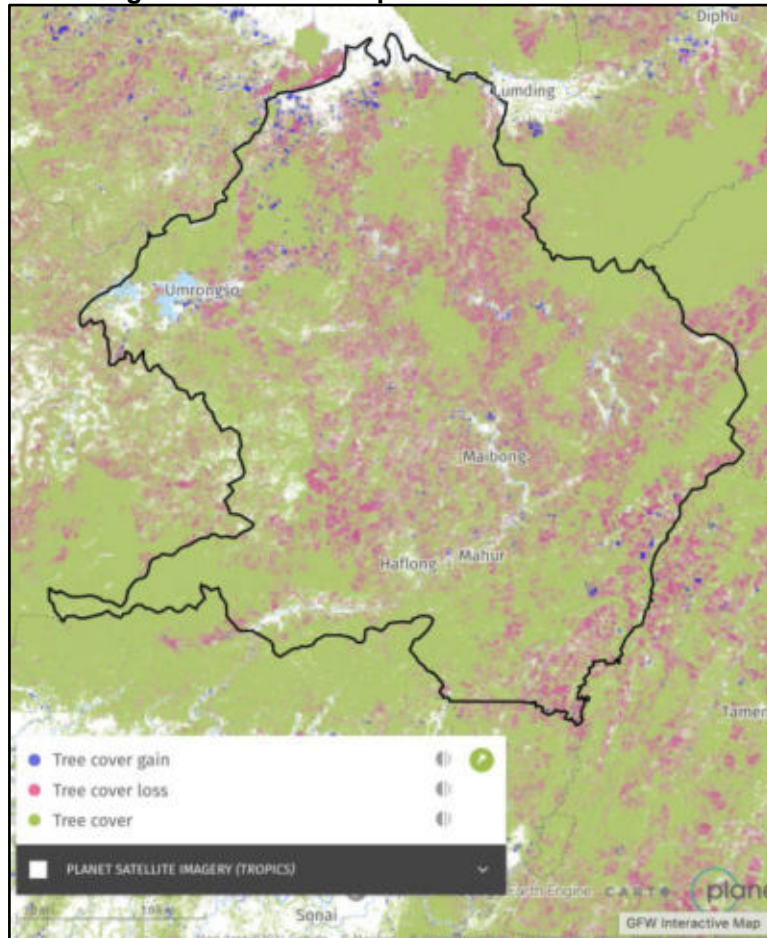
Figure 4.11 Forest Map of Karbi Anglong Districts (East and West)



Source:

<https://www.globalforestwatch.org/dashboards/country/IND/4/17/?category=undefined&map=eyJYW5Cb3VuZCI6dHJ1ZX0%3D>

Figure 4.12 Forest Map of Dima Hasao District



Source: <https://www.globalforestwatch.org/dashboards/country/IND/4/10/?category=undefined>

107. Within the planned distribution line area, a combination of natural and modified forests was observed. Natural forest in this context is described as naturally occurring vegetation, while modified refers to plantations carried out by the Assam Environment and Forest Department.

2. Wetlands

108. **Deepor Beel.** The site was declared as Ramsar site on 19/08/2002 and comprises an area of 4000 ha centred at 26°08'N 091°39'E. It is also recognised as a WLS and an IBA. A permanent freshwater lake in a former channel of the Brahmaputra river, of great biological importance and also essential as the only major storm water storage basin for the city of Guwahati. The beel is a staging site on migratory flyways and some of the largest concentrations of aquatic birds in Assam can be seen, especially in winter. Some globally threatened birds are supported, including Spotbilled Pelican (*Pelicanus philippensis*), Lesser and Greater Adjutant Stork (*Leptoptilos javanicus* and *dubius*), and Baer's Pochard (*Aythya baeri*). Details and maps are provided in the BESS site specific baseline section as this is the nearest intervention to this only wetland of Assam.

3. Internationally Recognized Areas

109. Eight KBAs, all of which are recognized for birds as IBAs, overlap East Karbi Anglong and Dima Hasao district (ADB Assam Solar Project: Critical and Natural Habitat Assessment, May 2024) (refer Table 4.5). Most of these sites were, however, identified in 2004-5 under previous IBA/KBA criteria. These sites were identified owing to their importance at the time to

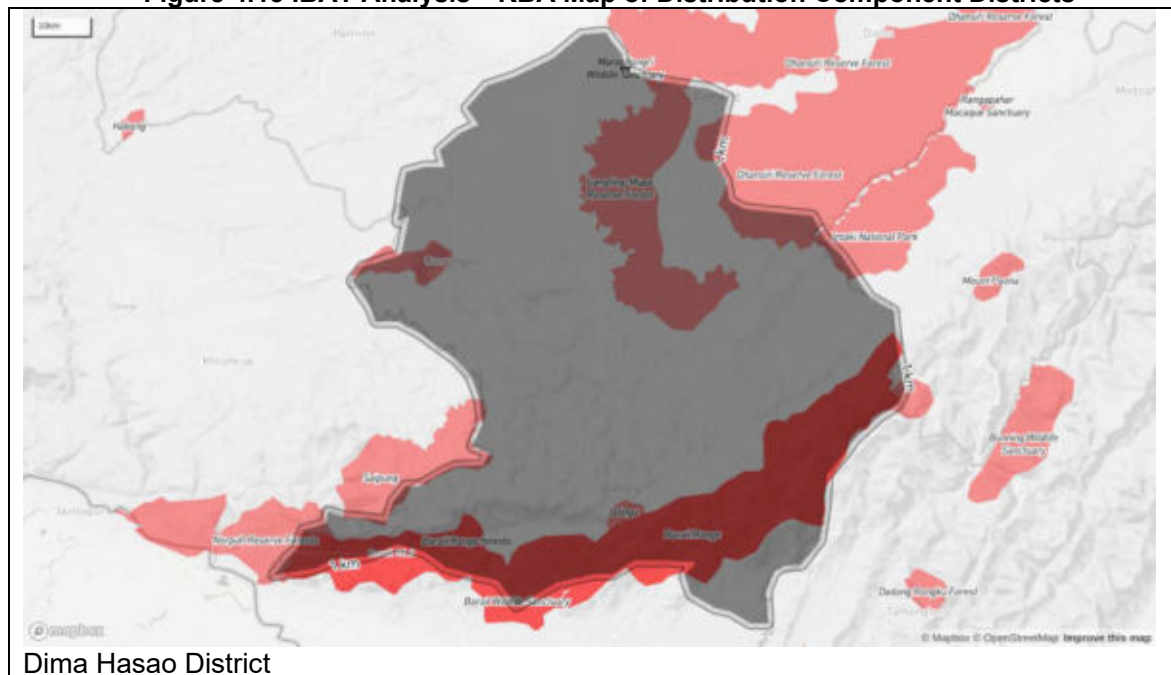
globally threatened or restricted-range species, or biome-restricted bird assemblages. KBA Maps are shown in Figure 4.13.

Table 4.5 Internationally-recognized areas overlapping, or falling within, the distribution component area of analysis

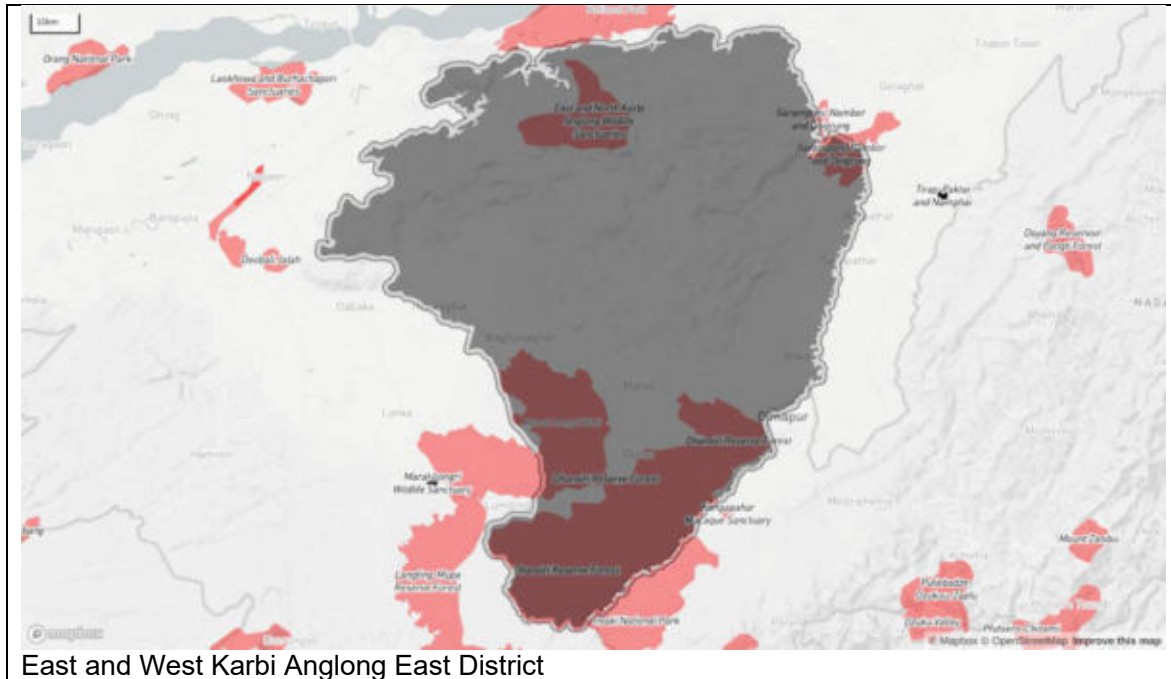
Name of Key Biodiversity Area	Type	Protected area (PA) or Reserved Forest (RF)?	Critical Habitat-qualifying site as a KBA (not PA/RF)?
Barail Range	IBA, KBA	Partly RF	Likely
Dhansiri Reserve Forest	IBA, KBA	RFs	Yes
East and North Karbi Anglong Wildlife Sanctuaries	IBA, KBA	PAs	Yes
Garampani, Nambor and Doigrung	IBA, KBA	PAs	Likely
Habang	IBA, KBA	No	Yes
Jatinga	IBA, KBA	No	No
Krungming Reserve Forest, Khorongma & Kopili-Umrangsu Reservoirs	IBA, KBA	Partially RF	Likely
Langting-Mupa Reserve Forest	IBA, KBA	RF	No
Lumding - Marat Longri	IBA, KBA	PA	Yes

Source: ADB Assam Solar Project: Critical and Natural Habitat Assessment, May 2024

Figure 4.13 IBAT Analysis⁴⁰ KBA Map of Distribution Component Districts



⁴⁰ IBAT PS6 & ESS6 Report. Generated under licence 5818-58548 from the Integrated Biodiversity Assessment Tool on 20 February 2024 (GMT). www.ibat-alliance.org



Source: ADB's TA Consultant

110. **Modified and Natural Habitat.** Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition. Land use within a 50m PAI of sample lines visited is dominated by modified habitat like semi-urban and rural settlements, agricultural land, uncultivated land, etc. For the sake of this assessment, areas of dense vegetation and waterbodies were considered as Natural Habitats (NH). In East Karbi Anglong, based on visual assessment during site visits, the NH in the PAI is about 10-15%, whereas in Dima Hasao District it is about 25-30%. Except for few distribution lines, the alignment/RoW is observed to be passing modified habitat (MH). As per discussion with APDCL, although lines are passing through trees and ROWs have trees, none will be felled for the installation of new lines and/or reconductoring of existing lines. All lines visited are passing through existing ROWs and no new ROWs are planned, as per APDCL. Looping and trimming are planned for some a ROWs during installation. No significant natural habitat loss is anticipated. No disturbance to any natural habitat river ecosystem is likely as none of the lines among those visited were crossing any water body nor where their ROW are near rivers.

111. **Critical Habitat Assessment (CHA).** The CHA was conducted by an ADB TA expert on critical habitat, and the detailed report (ADB Assam Solar Project: Critical and Natural Habitat Assessment, May 2024) is provided in **Appendix 3**. Summary findings are provided here.

- All six current or proposed protected areas overlapping Project AoAs are Wildlife Sanctuaries (Table 2 of Appendix 3). In India, this is usually a designation equating to IUCN Category IV protected areas (habitat or species management areas). As such, these six areas do not automatically qualify the AoA as Critical Habitat, following IFC (2019). However, five are likely to qualify the AoA Critical Habitat, since they are integral parts of KBAs which appear to contain concentrations of biodiversity sufficient to qualify as Critical Habitat (Table 2 of Appendix 3).
- East Karbi Anglong and the proposed North Karbi Anglong Wildlife Sanctuaries fall within the 'East and North Karbi Anglong Wildlife Sanctuaries Key Biodiversity Area', which qualifies as Critical Habitat.

- Garampani Wildlife Sanctuary and Nambor Wildlife Sanctuary are part of the 'Garampani, Nambor and Doigrung KBA', which likely qualifies as Critical Habitat.
- Marat Longri Wildlife Sanctuary falls within the 'Lumding - Marat Longri KBA', which qualifies as Critical Habitat.
- Rangapahar Wildlife Sanctuary is within neighbouring Nagaland, so outside of the DL area of analysis (AoA) but overlapped by the TL AoA and solar freshwater AoA (various maps provide conflicting information on its location, but it is located next to Nagaland Zoo⁴¹). This site was listed as a KBA on the basis of its inclusion in an Ecosystem Profile for the Eastern Himalayas (Key Biodiversity Areas Partnership 2024j), wherein it was listed as an important area for birds (CEPF 2005). The basis for this listing is unclear, the site does not appear to be listed as an IBA currently, and it is therefore unlikely that this small site qualifies as a KBA and hence Critical Habitat.

112. Candidate Critical Habitat-qualifying biodiversity identified via the Integrated Biodiversity Assessment Tool⁴² (IBAT: www.ibat-alliance.org) or other literature as actually or potentially present has been considered (**Appendix 3**). In each case, reasons are identified for each biodiversity feature likely meeting or not meeting Critical Habitat. Table 4.6 lists the CH-qualifying species in the distribution component area of analysis. The BESS component area of analysis does not support CH.

⁴¹ https://cza.nic.in/uploads/documents/reports/english/AR_nagalandzoo_2223.pdf

⁴² The World Database on Protected Areas (WDPA) is a joint project between UN Environment Programme and the International Union for Conservation of Nature (IUCN), managed by UN Environment World Conservation Monitoring Centre. Data for the WDPA is collected from international convention secretariats, governments, and collaborating NGOs. The WDPA uses the IUCN definition of a protected area as the main criteria for entries included in the database.

Table 4.6 ADB Critical Habitat-qualifying biodiversity in the Project AoAs⁴³

Biodiversity type	Species	ADB Critical Habitat criterion qualified ⁴⁴						Justification	Potential presence by District		
		1	2	3	4	5	6		Dima Hasao	Karbi Anglong	West Karbi Anglong
1. Mammal	Asian Elephant <i>Elephas maximus</i>	✓						The DL AoA holds a globally significant proportion of this Endangered species' population.	✓	✓	✓
2. Mammal	Bengal Slow Loris <i>Nycticebus bengalensis</i>	✓						Although information is limited, the DL AoA is likely to hold a globally significant proportion of this Endangered species' population.	✓	✓	✓
3. Mammal	Blond-bellied Langur <i>Trachypitecus pileatus pileatus</i>	✓						The DL AoA is highly likely to hold a globally significant proportion of this Endangered subspecies' population.	✓	✓	✓
4. Mammal	Western Hoolock Gibbon <i>Hoolock hoolock</i>	✓						The DL AoA is very likely to hold a globally significant proportion of this Endangered species' population.	✓	✓	✓
5. Mammal	Khasian Leaf-nosed Bat <i>Hipposideros khasiana</i>			?				The DL AoA potentially holds hold a globally significant proportion of this congregatory species' population.	✓		✓
6. Mammal	Rufous Horseshoe Bat <i>Rhinolophus rouxii</i>			?				The DL AoA potentially holds hold a globally significant proportion of this congregatory species' population.	✓	✓	✓
7. Mammal	Mount Popa Pipistrelle <i>Pipistrellus paterculus</i>			?				The DL AoA potentially holds hold a globally significant proportion of this congregatory species' population.	✓	✓	✓
8. Mammal	Chinese Pangolin <i>Manis pentadactyla</i>	?						Although information is sparse, the DL AoA might possibly hold a globally significant proportion of this Critically Endangered species' population.	✓	✓	✓
9. Mammal	Hog Deer <i>Axis porcinus</i>	?						The DL AoA may hold a globally significant proportion of this Endangered species' population.		✓	
10. Bird	Manipur Bush-quail <i>Perdica manipurensis</i>	?						Information is extremely limited, but the DL AoA might possibly hold a globally significant proportion of this Endangered species' population.	?	?	?
11. Bird	White-winged Duck <i>Asarcornis scutulata</i>	✓						The DL AoA holds a globally significant proportion of this Endangered species' population.	✓	✓	✓

⁴³ It is likely that more restricted-range species also qualify Project AoAs as Critical Habitat.

⁴⁴ ✓ = qualifies, or likely qualifies, the project AoA as supporting Critical Habitat; ? = may or possibly qualifies the project AoA as supporting Critical Habitat. Both based on available information. Critical Habitat criteria per ADB (2009): (1) Critically Endangered or Endangered species; (2) restricted-range or endemic species; (3) migratory or congregatory species; (4) unique assemblages of species that are associated with key evolutionary processes; (5) areas having biodiversity of significant social, economic, or cultural importance to local communities; and (6) including legally protected and internationally recognised areas which are supporting high biodiversity.

Biodiversity type	Species	ADB Critical Habitat criterion qualified ⁴⁴						Justification	Potential presence by District		
		1	2	3	4	5	6		Dima Hasao	Karbi Anglong	West Karbi Anglong
12. Bird	Violet Cuckoo <i>Chrysococcyx xanthorhynchus</i>			?				The DL AoA might possibly seasonally support a globally significant proportion of this migratory species' population.	✓	✓	✓
13. Bird	Square-tailed Drongo-cuckoo <i>Surniculus lugubris</i>			?				The DL AoA might possibly seasonally support a globally significant proportion of this migratory species' population.	✓	✓	✓
14. Bird	Bengal Florican <i>Houbaropsis bengalensis</i>	✓						The DL AoA is very likely to seasonally support a globally significant proportion of this Critically Endangered migratory species' population and this could also be the case for the TL AoA.	?	✓	?
15. Bird	Slender-billed Vulture <i>Gyps tenuirostris</i>	✓						The DL AoA is very likely to support a globally significant proportion of this Critically Endangered species' population.	✓	✓	✓
16. Bird	Amur Falcon <i>Falco amurensis</i>			✓				The DL AoA is very likely to support a globally significant proportion of this species' population during migration.	✓	✓	✓
17. Bird	Black-breasted Parrotbill <i>Paradoxornis flavirostris</i>	✓						The (theoretical) loss of all habitat within the DL AoA would result in the uplisting of this species from Vulnerable to Endangered.	✓	✓	✓
18. Bird	Swamp Grass-babbler <i>Laticilla cinerascens</i>	✓						The DL AoA likely supports a globally significant proportion of this Endangered species' population.	✓	✓	✓
19. Bird	Marsh Babbler <i>Pellorneum palustre</i>	?						The (theoretical) loss of all habitat within the DL AoA could potentially result in the uplisting of this species from Vulnerable to Endangered.	✓	✓	✓
20. Bird	Firethroat <i>Calliope pectardens</i>			✓				The DL AoA is likely to support a globally significant proportion of this species' population during migration.	✓	✓	✓
21. Reptile	Southeast Asian Box Turtle <i>Cuora amboinensis</i>	✓						The DL AoA potentially supports a globally significant proportion of this Endangered species' population.	✓	✓	✓
22. Reptile	Keeled Box Turtle <i>Cuora mouhotii</i>	✓						The DL AoA likely supports a globally significant proportion of this Endangered species' population.	✓	✓	✓
23. Reptile	Spotted Pond Turtle <i>Geoclemys hamiltonii</i>	?						The DL AoA potentially supports a globally significant proportion of this Endangered species' population.	✓	✓	✓
24. Reptile	Elongated Tortoise <i>Indotestudo elongata</i>	?						The DL AoA potentially supports a globally significant proportion of this Critically Endangered species' population.	✓	✓	✓

Biodiversity type	Species	ADB Critical Habitat criterion qualified ⁴⁴						Justification	Potential presence by District		
		1	2	3	4	5	6		Dima Hasao	Karbi Anglong	West Karbi Anglong
25. Reptile	Tricarinata Hill Turtle <i>Melanochelys tricarinata</i>	✓						The DL AoA likely supports a globally significant proportion of this Endangered species' population.	✓	✓	✓
26. Reptile	Black Softshell Turtle <i>Nilssonia nigricans</i>	✓						The DL AoA is very likely to support a globally significant proportion of this Critically Endangered species' population; the solar freshwater AoA may potentially support such a population.	✓	✓	✓
27. Reptile	Assam Roofed Turtle <i>Pangshura sylhetensis</i>	✓						The DL AoA is very likely to support a globally significant proportion of this Critically Endangered species' population; the solar freshwater AoA may potentially support such a population.	✓	✓	✓
28. Reptile	<i>Cyrtodactylus kazirangaensis</i>		✓					The DL AoA likely supports a globally significant proportion of this restricted-range species' population.		✓	
29. Fish	Kalabans (<i>Bangana dero</i>)			✓				The DL AoA is likely to support a globally significant proportion of this species' population during migration.	✓	?	?
30. Fish	<i>Batasio fasciolatus</i>			?				The DL AoA is likely to support a globally significant proportion of this species' population during migration.	?	?	?
31. Fish	<i>Danio assamila</i>		✓					The DL AoA holds a globally significant proportion of the range of this restricted-range species.	?	✓	?
32. Fish	<i>Esomus nimasowi</i>		✓					The DL AoA holds the entire known range of this restricted-range species.	✓		
33. Fish	Annandale Garra <i>Garra annandalei</i>			✓				The DL AoA is likely to support a globally significant proportion of this species' population during migration.	?	✓	?
34. Fish	<i>Garra clavirostris</i>		✓					The DL AoA holds the entire known range of this restricted-range species.	✓		
35. Fish	Deocata Pipefish <i>Microphis deocata</i>			✓				The DL AoA is likely to support a globally significant proportion of this species' population during migration.	✓	✓	✓
36. Fish	<i>Mystus carcio</i>			✓				Although information is limited, it seems likely that the DL AoA holds hold a globally significant proportion of this species' population during migration.		✓	
37. Fish	<i>Mystus dibrugarensis</i>			?				Although information is limited, it is possible that the DL AoA holds hold a globally significant proportion of this species' population during migration.		✓	

Biodiversity type	Species	ADB Critical Habitat criterion qualified ⁴⁴						Justification	Potential presence by District		
		1	2	3	4	5	6		Dima Hasao	Karbi Anglong	West Karbi Anglong
38. Fish	<i>Physoschistura elongata</i>	✓	✓					The DL AoA holds a globally significant proportion of the predicted range of this Vulnerable restricted-range species. The (theoretical) loss of all habitat within the DL AoA would likely result in the uplisting of this species to Endangered.	✓	✓	✓
39. Fish	<i>Psilorhynchus nahlongthai</i>		✓					The DL AoA holds the entire known range of this restricted-range species.	✓		
40. Fish	<i>Schistura multifasciata</i>			✓				The DL AoA is likely to support a globally significant proportion of this species' population during migration.	?	✓	?
41. Fish	<i>Schistura reticulofasciata</i>			?				The DL AoA is likely to support a globally significant proportion of this species' population during migration.	?	?	✓
42. Fish	<i>Schistura sikmaiensis</i>			✓				The DL AoA is likely to support a globally significant proportion of this species' population during migration.	?	?	✓
43. Fish	Gangetic Hairfin Anchovy (<i>Setipinna phasa</i>)			✓				The DL AoA is likely to support a globally significant proportion of this species' population during migration.	✓	✓	✓
44. Fish	<i>Sisor barakensis</i>	✓	✓					The DL AoA likely holds a globally significant proportion of this restricted-range species' population, and the (theoretical) loss of all habitat within the DL AoA would result in its uplisting from Vulnerable to Endangered.	✓		
45. Fish	Golden Mahseer <i>Tor putitora</i>	?		?				The DL AoA might possibly support a globally significant proportion of this Endangered migratory species' population.	?	?	?
46. Crab	<i>Potamiscus annandalii</i>		✓					The DL AoA likely holds a globally significant proportion of this restricted-range species' population.	?		
47. Crab	<i>Tiwaripotamon austenianum</i>		✓					The DL AoA likely holds a globally significant proportion of this restricted-range species' population.	?		
48. Prawn	<i>Macrobrachium altifrons</i>			?				The DL AoA might possibly support a globally significant proportion of this migratory species' population.	✓	✓	✓
49. Prawn	<i>Macrobrachium assamense</i>			✓				The DL AoA is likely to support a globally significant proportion of this migratory species' population.	✓	✓	✓

Biodiversity type	Species	ADB Critical Habitat criterion qualified ⁴⁴						Justification	Potential presence by District		
		1	2	3	4	5	6		Dima Hasao	Karbi Anglong	West Karbi Anglong
50. Prawn	<i>Macrobrachium cacharensense</i>			✓				The DL AoA is likely to support a globally significant proportion of this migratory species' population.	✓		
51. Prawn	<i>Macrobrachium manipurensense</i>			?				The DL AoA might possibly support a globally significant proportion of this migratory species' population.	✓		
52. Prawn	<i>Macrobrachium platyrostris</i>			✓				The DL AoA is likely to support a globally significant proportion of this migratory species' population.	?	?	?
53. Prawn	<i>Macrobrachium rogersi</i>			✓				The DL AoA is likely to support a globally significant proportion of this migratory species' population.	✓	?	✓
54. Insect	<i>Clinocentrus karbi</i>		✓					The DL AoA holds the entire known range of this restricted-range species.		✓	
55. Insect	<i>Dubito gomphus bidentatus</i>		?					The DL AoA might possibly hold a globally significant proportion of this restricted-range species' population.	?	?	✓
56. Insect	<i>Idionyx imbricata</i>		?					The DL AoA might hold a globally significant proportion of this restricted-range species' population.	?	?	✓
57. Insect	<i>Protosticta fraseri</i>		✓					The DL AoA is very likely to hold a globally significant proportion of this restricted-range species' population.		✓	
58. Insect	<i>Sympetrum haematoneura</i>			?				The DL AoA might possibly support a globally significant proportion of this migratory species' population.	?	?	✓
59. Plant	<i>Bulbophyllum karbianglongensis</i>		✓					The DL AoA holds the entire known range of this restricted-range species.	?	?	✓
60. Plant	<i>Carissa kopilii</i>		✓					The DL AoA holds half of the known range of this restricted-range species.	?	?	✓
61. Plant	<i>Cinnamomum carrierei</i>		✓					The DL AoA holds the entire known range of this restricted-range species.	?	✓	?
62. Plant	<i>Cryptocarya simonsii</i>	✓	✓					The DL AoA supports all of this Critically Endangered and restricted-range species' known population.	?	✓	?
63. Plant	<i>Justicia craibii</i>		✓					The DL AoA holds the entire known range of this restricted-range species.	✓	?	?

Biodiversity type	Species	ADB Critical Habitat criterion qualified ⁴⁴						Justification	Potential presence by District		
		1	2	3	4	5	6		Dima Hasao	Karbi Anglong	West Karbi Anglong
64. Plant	<i>Magnolia rabaniana</i>	✓						The DL AoA likely supports a globally significant proportion of this Critically Endangered species' population.	✓	?	?
65. Plant	<i>Pavetta puffii</i>		✓					The DL AoA holds the entire known range of this restricted-range species.	?	?	✓
66. Plant	<i>Piper jenkinsii</i>		✓					The DL AoA holds the entire known range of this restricted-range species.	✓	?	?
67. Plant	<i>Sloanea tomentosa</i>	✓						The DL AoA potentially supports a globally significant proportion of this Endangered species' population.	?	✓	?
68. Plant	<i>Syzygium cyanophyllum</i>		✓					The DL AoA holds the entire known range of this restricted-range species.	✓		✓
69. Plant	<i>Syzygium namborensense</i>		✓					The DL AoA holds the entire known range of this restricted-range species.	?	✓	?
70. Plant	<i>Syzygium nivae</i>		✓					The DL AoA holds the entire known range of this restricted-range species.	?		✓
71. Plant	<i>Wuodendron praecox</i>	✓						The DL AoA likely supports a globally significant proportion of this Endangered species' population.	?	✓	?
72. Site	East Karbi Anglong Wildlife Sanctuary						✓	Part of the 'East and North Karbi Anglong Wildlife Sanctuaries Key Biodiversity Area', which is within the DL AoA and qualifies as Critical Habitat (see below).		✓	
73. Site	Garampani Wildlife Sanctuary						✓	Part of the 'Garampani, Nambor and Doigrung Key Biodiversity Area', which is within the DL AoA and qualifies as Critical Habitat (see below).		✓	
74. Site	Marat Longri Wildlife Sanctuary						✓	Within the 'Lumding - Marat Longri Key Biodiversity Area', which is within the DL AoA and qualifies as Critical Habitat (see below).		✓	
75. Site	Nambor Wildlife Sanctuary						✓	Part of the 'Garampani, Nambor and Doigrung Key Biodiversity Area', which is within the DL AoA and qualifies as Critical Habitat (see below).		✓	
76. Site	North Karbi Anglong Wildlife Sanctuary (proposed)						✓	Part of the 'East and North Karbi Anglong Wildlife Sanctuaries Key Biodiversity Area', which is within the DL AoA and qualifies as Critical Habitat (see below).		✓	
77. Site	Barail Range Key Biodiversity Area						✓	Partially overlapped by the DL AoA and potentially holds globally significant populations of several Endangered tortoise/turtle species.	✓		

Biodiversity type	Species	ADB Critical Habitat criterion qualified ⁴⁴						Justification	Potential presence by District		
		1	2	3	4	5	6		Dima Hasao	Karbi Anglong	West Karbi Anglong
78. Site	Dhansiri Reserve Forest Key Biodiversity Area						✓	Within the DL AoA, partially overlapped by the TL AoA and solar freshwater AoA, and likely to hold globally significant populations of Endangered Asian Elephant.		✓	
79. Site	East and North Karbi Anglong Wildlife Sanctuaries Key Biodiversity Area						✓	Within the DL AoA and holds globally significant populations of Endangered Asian Elephant.		✓	
80. Site	Garampani, Nambor and Doigrung Key Biodiversity Area						✓	Within the DL AoA and appears to hold globally significant populations of Endangered White-winged Duck.		✓	
81. Site	Habang Key Biodiversity Area						✓	Within the DL AoA and holds globally significant populations of Amur Falcon during migration.		✓	
82. Site	Krungming Reserve Forest, Khorongma & Kopili-Umrangsu Reservoirs Key Biodiversity Area						✓	Within the DL AoA and likely to hold globally significant populations of Amur Falcon during migration.			✓
83. Site	Lumding - Marat Longri Key Biodiversity Area						✓	Within the DL AoA and likely to hold globally significant populations of Endangered Asian Elephant.		✓	
83-109. Sites	27 Reserved Forests (Table 4)						?	Sites in the DL AoA (including two in the terrestrial AoA) which might possibly hold significant populations of restricted-range species (notably plants), or actually/potentially hold significant populations of other Critical Habitat-qualifying plants and/or animals.	✓	✓	✓
110. Meghalaya subtropical forests	Ecoregion				✓			The DL AoA holds extensive areas of remaining forest on hills and so is likely, within this endemic-rich ecoregion, to hold significant assemblages of restricted-range species.	✓	✓	✓
111. Mizoram-Manipur-Kachin rain forests	Ecoregion				✓			The DL AoA holds extensive areas of remaining forest on hills and so is likely, within this endemic-rich ecoregion, to hold significant assemblages of restricted-range species.	✓		

AoA = Area of Analysis

Source: ADB Assam Solar Project: Critical and Natural Habitat Assessment, May 2024) in **Appendix 3**.

Key Biological Features

113. Key biological features in the PAI are summarized in Table 4.7.

Table 4.7 Summary of key biological features in the PAI by project component

Component	Subproject	Location	Key biological features in PAI
Substations, BESS	3 existing substation and, one 25 MW BESS facility	Substations in East Karbi Anglong East and Dima Hasao District; BESS in Kamrup District, Assam	<ul style="list-style-type: none"> Habitat type: modified habitat supported by sites of the existing substations and BESS site. All of the existing substations and the BESS are outside the UNESCO sites' core/buffer/transition zone. Protected areas within 10 km: BESS site is located at 8.4km from Deepor Beel WLS and inside ESZ. Intimation to PCCF, Environment and Forest of Assam, but no NOC required. All other three existing substations are located outside (none in 10km) of protected areas and ESZs. Key Biodiversity Areas (KBAs) and Important Bird Area (IBA) within 10km: Only BESS site is at 8.4km of Deepor Beel IBA/KBA. Forest land: all substations and BESS site are located outside Reserved Forests. RFs: Umpanai substation is at a distance of 10m from the Graveyard Reserved Forest. Baithalangsho substation is at a distance of 2km from Borbi RF. The BESS site is 4.5km from Rani RF. Wetlands: Deepor Beel Ramsar site is at 8.4km from BESS site. No other substations are within 10km of the Ramser site. Vegetation supported: mainly shrubs, herbs, and grasses with some trees. Trees to be lost: None Critical Habitat: substation components (East and West Karbi Anglong and Dima Hasao) occur within districts qualifying as Critical Habitat. Species for which the districts qualify as critical habitat are unlikely to be present at the substations and BESS site which are in already modified habitat. No species of high biodiversity value were observed during site visits and within the PAI of the sites. No high biodiversity values, in either natural or modified habitat, were observed. Ecological survey will reconfirm no plant or animal species of high biodiversity value are supported.
546.9 km of 11 kV, and low-tension distribution lines (including DTR associated lines)	<ul style="list-style-type: none"> Conversion of 11 kV Line to CC: 59 km Conversion of low tension (0.4 KV) to ABC: 360.75 km 	East Karbi Anglong, West Karbi Anglong and Dima Hasao District	<ul style="list-style-type: none"> Habitat type along distribution line routes: mix of natural forest habitat and modified habitat (roads/highways passing settlements, agricultural fields, etc.) – to be reconfirmed through ecological survey for final routes. Protected areas: sampled 11kV and LT lines were outside of protected areas. Some lines are in ESZs and will be CC and intimation to Environment and Forest Depart of Assam and Nagaland Forest Department (for Rangapahar

Component	Subproject	Location	Key biological features in PAI
	<ul style="list-style-type: none"> • New DTR associated low tension (0.4 KV) as ABC: 87.6 km • New 11kV as covered conductor: 39.5 km 		<p>WLS ESZ) will be done for any NOC. None in UNESCO site core/buffer/transition zones.</p> <ul style="list-style-type: none"> • Key Biodiversity Areas: Some of the 11kV and sampled LT lines are inside KBAs/IBAs, and will be ABC. • Elephant Reserve/Reserved Forests: 11 kV and low-tension lines are found mostly along roads and all in existing ROW, although some in Reserved Forests/Elephant Reserve – copy of all forest clearance/NOC for works on all existing RoW are to be available before work starts, and lines will be covered conductor/ABC. • Surface water: some of the sampled lines cross and also pass along the sides of rivers/streams/drains. • Vegetation supported: shrubs, herbs, grasses, and trees especially where the lines are passing through natural forest habitat. • Critical Habitat: the distribution component districts of East Karbi Anglong and Dima Hasao occur within areas qualifies as Critical Habitat. Some of the species for which the districts qualify as critical habitat may be present at sites where distribution lines are planned (Appendix 3: Table 4). This is the case, though to a lesser degree, even where no Natural Habitat remains. • No species of high biodiversity values were observed during site visits. No high biodiversity values, in either natural or modified habitat, were seen to be supported along the indicative distribution line routings. For all distribution line routings ecological survey will reconfirm no plant or animal species of high biodiversity value are supported. • A number of endangered species have been found electrocuted (secondary reports) in the state • Elephant electrocution in East Karbi Anglong potentially on/near existing project-related infrastructure.

Source: ADB's TA consultant

2) Physical Setting

1. Elevation, Topography and Drainage

114. The state can be divided into three principal geographical regions; Brahmaputra Valley region in the foothills of the Himalayas in northern part of the state, Barak Valley in the southern part and Mikir (Karbi Anglong) and Cachar hills that divide the two valleys region. Assam has mostly plain areas of low elevation with many rivers. There are hills of low elevation in Karbi Anglong, North Cachar Hills and Dima Hasao districts in the southern region. The peak height of hills in the state is about 1,850 metres above mean sea level in North Cachar Hills district. The topography of the Output 4 districts and elevation are provided in Figure 4.14 and Figure 4.15.

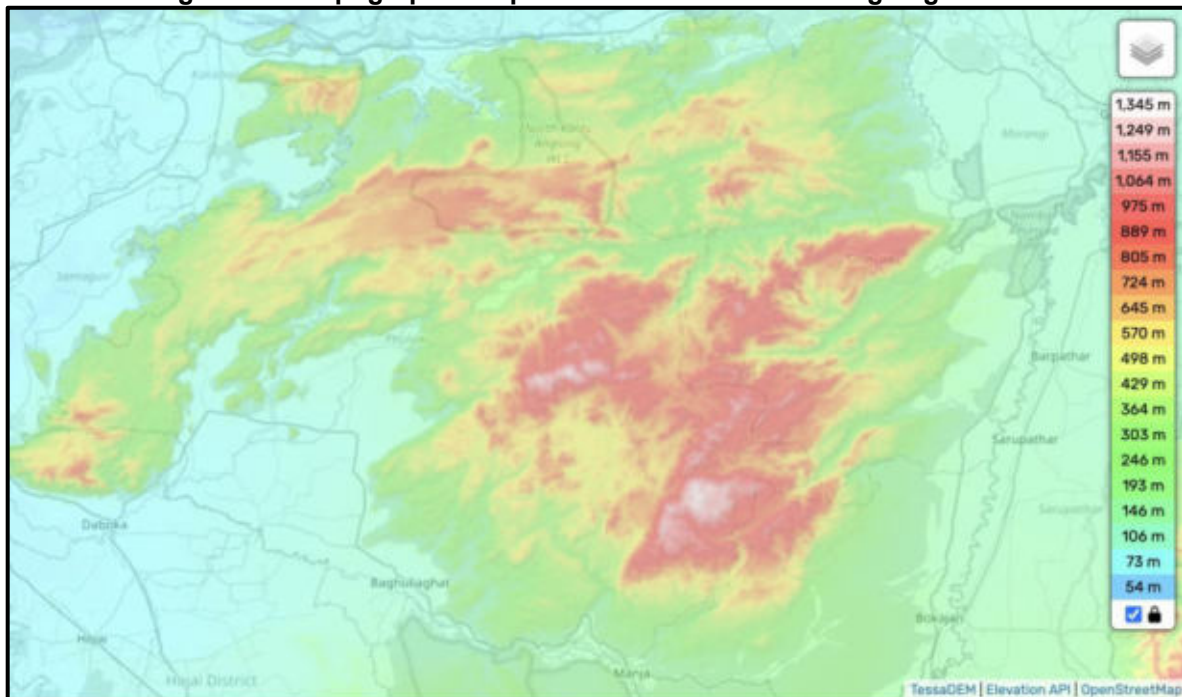
115. West Karbi Anglong district with geographical area of 4890 km² has dense tropical forest covered hills and plains. Among them, the highest is the Laru Peak which is at about

1,290 metres above the sea level. The district has an isolated hill in the core of the district, separating it from the Brahmaputra alluvial. Geomorphologically, the area can be divided into three parts viz. (1) Denudational Hills, (2) Pediment Zone and (3) Valley Hills Areas. The hills form a stable shield with rugged and rolling surface which represents a mature to sub-mature topography with rounded to sub-rounded crest and acquires dome shape at places.

116. The East Karbi Anglong District with geographical area of 5544 km² is situated in the central part of Assam, bounded by the state of Nagaland and Golaghat district in east, Hojai district in the west, Golaghat and Nagaon district in the north and Dima Hasao district and Nagaland in the south. The district with dense tropical forest covered hills and flat plains. Even though, the district is dotted with hills, a few of which can be categorized into Mountain. Among them, the highest is the Singhason Peak which is at about 1360 metres above the sea level.

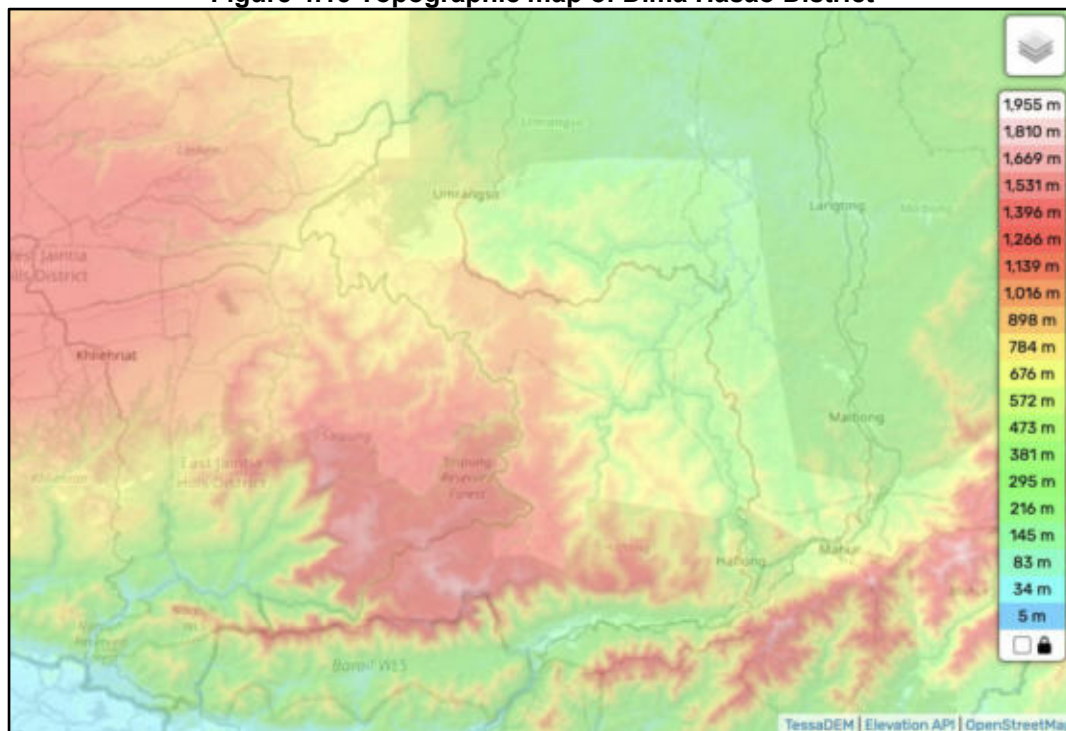
117. Dima Hasao is one of the three hill districts (others being the East and West Karbi Anglong) of Assam. The Borail Range is the defining feature of the terrain of this district owing to the altitude. Whilst most distribution lines pass through flat terrain, some of the lines pass through complex terrain in Dima Hasao. The elevation of the district headquarter Haflong is 966m.

Figure 4.14 Topographic map of East and West Karbi Anglong District



Source: <https://en-gb.topographic-map.com/map-lj834s/Karbi-Anglong/?center=26.27859%2C93.24573&zoom=10&lock=10%2C54%2C134>

Figure 4.15 Topographic map of Dima Hasao District



Source: <https://en-gb.topographic-map.com/map-kdjs57/Haflong/?center=25.34642%2C92.56647>

2. Geology, Soils and Geological Hazards

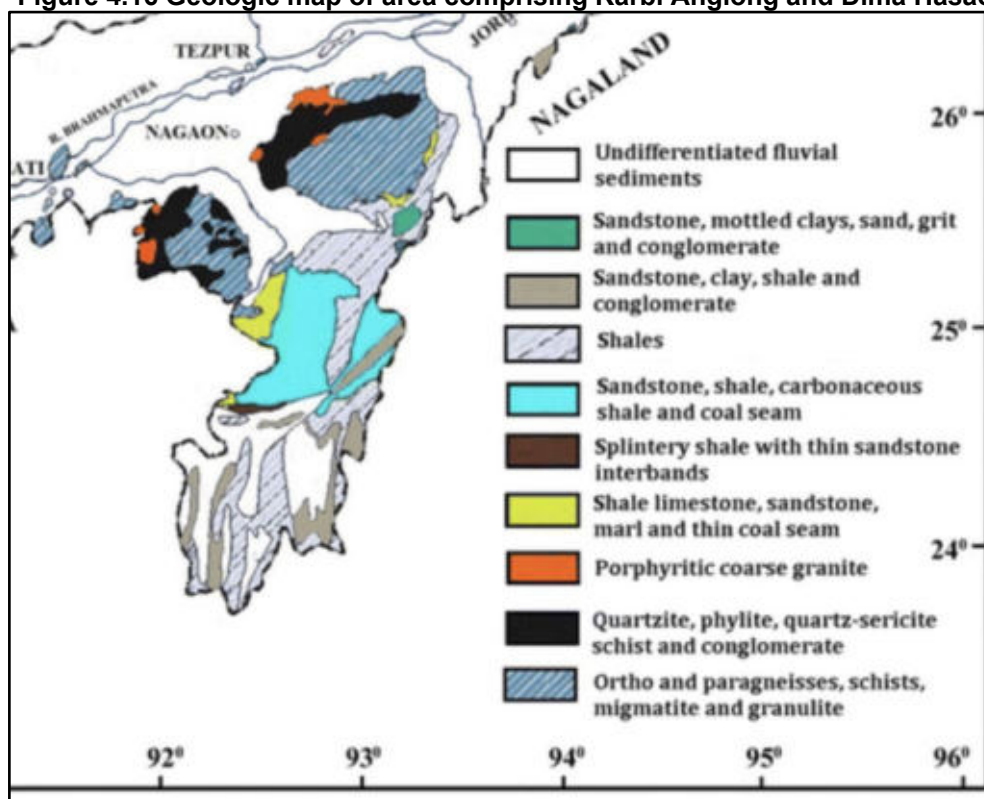
118. **Geology.** The State is occupied by rocks belonging to, (a) Proterozoic Gneissic Complex, (b) Shillong Group of Meso-Palaeo Proterozoic age, (c) Granite Plutons of Neo-Proterozoic-Lower Palaeozoic age, (d) Lower Gondwana sedimentary rocks of Permo-carboniferous age (e) Alkali Complexes of Samchampi, Borpung and volcanic rocks represented by Sylhet Trap of Cretaceous age, (f) Lower Tertiary (Paleocene-Eocene) shelf sediments of the Jaintia Group extending along the southern and eastern flanks of Mikir Hills and geosynclinal sediments of Disang Group in parts of the North Cachar Hills, and, (g) Upper Tertiary (Oligocene to Pliocene) shelf and geosynclinal sediments covering the southern flanks of Mikir Hills, the North Cachar Hills and the hills of the Cachar district in the Surma valley area. The geological map is provided as Figure 4.16.

119. Geologically, the East and West Kari Anglong district comprises (1) consolidated formations with the oldest Archaean gneissic rocks followed by Precambrian Shillong Series with rock types of phyllites, schists, quartzites etc. (2) Semi-consolidated rocks constituting the tertiary rocks starting from Eocene to Miocene age are available comprising the Jaintia, Barail, Surma and Tipam series with various grades of shales, siltstone and sandstones. (3) the unconsolidated alluvial sediments; the recent to sub-recent alluvial deposits comprise clay, silt, sand, and gravel admistures with sands⁴⁵.

120. The Dima Hasao district comprises of rock formations ranging in age from Achaean to Quaternary. The alluvial sediments constitute a very small area. The main geological domain is the tertiary rocks of Oligocene and Miocene periods.

⁴⁵ https://www.cgwb.gov.in/old_website/District_Profile/Assam/Karbi%20Anglong.pdf

Figure 4.16 Geologic map of area comprising Karbi Anglong and Dima Hasao



Source: https://www.researchgate.net/figure/Geological-base-map-of-Assam-modified-from-Geological-Survey-of-India-showing-the_fig1_313639253

121. **Soils.** The soils of Assam can broadly be divided into four main groups, viz. alluvial soils, piedmont soils, hill soils and lateritic soils.⁴⁶ The alluvial soils are extensively distributed over the Brahmaputra and Barak floodplains and are very fertile. The alluvial soils can further be divided into two main sub types young alluvial and old alluvial soils. The young alluvial soils are characterized by modern alluvium deposits. The baseline monitoring for soil quality analysis at selected locations are provided in Table 4.8.

122. Two types of soils are mainly observed in the East and West Karbi Anglong district. These are (1) brown to pale brown soil developed on the top of the hills, lateritic in places and (2) the alluvial soil, sandy loam or clayey developed on the low-lying terrain. The western part of Diphu sub-division in East Karbi Anglong district and North-eastern part of Hamren sub-division in West Karbi Anglong District, constitutes the flood plain areas of Jamuna and Kopili rivers. The thickness of sediments in these valleys is more than 250 m. The sediments constitute coarse to fine sands, clay and occasional gravel beds. Thus, the dominant soil types are alluvial soil, pale brown weathered soil.

123. The Dima Hasao district is covered by a variety of soil types which varies with different topographical conditions, composition of parent rock, palaeogeography and variation of climatic conditions (rainfall, temperature, degree of weathering etc). The soil is non-lateritic in flat alluvial area to lateritic in topographically high areas. It ranges from sandy to clayey loam in nature. The soil is acidic in reaction with pH ranging from 4.1 to 6.2 and very rich in organic carbon, medium to poor contents of phosphorus and high in potash content⁴⁷.

⁴⁶https://dirhorti.assam.gov.in/sites/default/files/swf_utility_folder/departments/horticulture_medhassu_in_oid_5/menu/document/District%20Irrigation%20Plan%2C%20Sonitpur_0.pdf

⁴⁷<https://www.gkvsociety.com/control/uploads/72993620a.pdf>

Table 4.8 Baseline soil quality

Site	pH (at 25°C)	Soil Texture	Sand	Silt	Clay	Total Organic Carbon	Heavy Metals (as Pb)	Maximum Dry Density	Optimum Moisture Content	Specific Gravity	Moisture Content	PAH/ VOC/ TPH/ PCB
	-	-	%	%	%	%	mg/kg	g/cc	%	-	%	mg/kg
New BESS	6.92	Clay	26.7	20.7	52.6	3.61	0.626	0.9	10.96	0.99	15.07	BLQ
Gunjung SS ^a	5.06	Loam	29.5	48.7	21.8	3.75	1.39	0.98	13.05	1.09	17.96	BLQ
Gunjung SS ^b	5.06	Loam	29.5	48.7	21.8	3.75	0.7941	0.97	13.05	1.09	17.96	BLQ
Baithalang so SS ^a	6.54	Loam	45.7	30.6	23.7	3.74	1.3054	0.87	9.73	0.98	13.42	BLQ
Baithalang so SS ^b	5.78	Clay	8.7	20.5	70.8	1.76	1.0378	0.63	10.59	0.72	14.81	BLQ
Umpanai SS ^a	6.02	Clay	28.3	30.9	40.8	4.12	1.2271	0.8	13.41	0.91	18.45	BLQ
Umpanai SS ^b	6.02	Clay	28.3	30.9	40.8	4.12	0.9519	0.79	13.41	0.91	18.45	BLQ

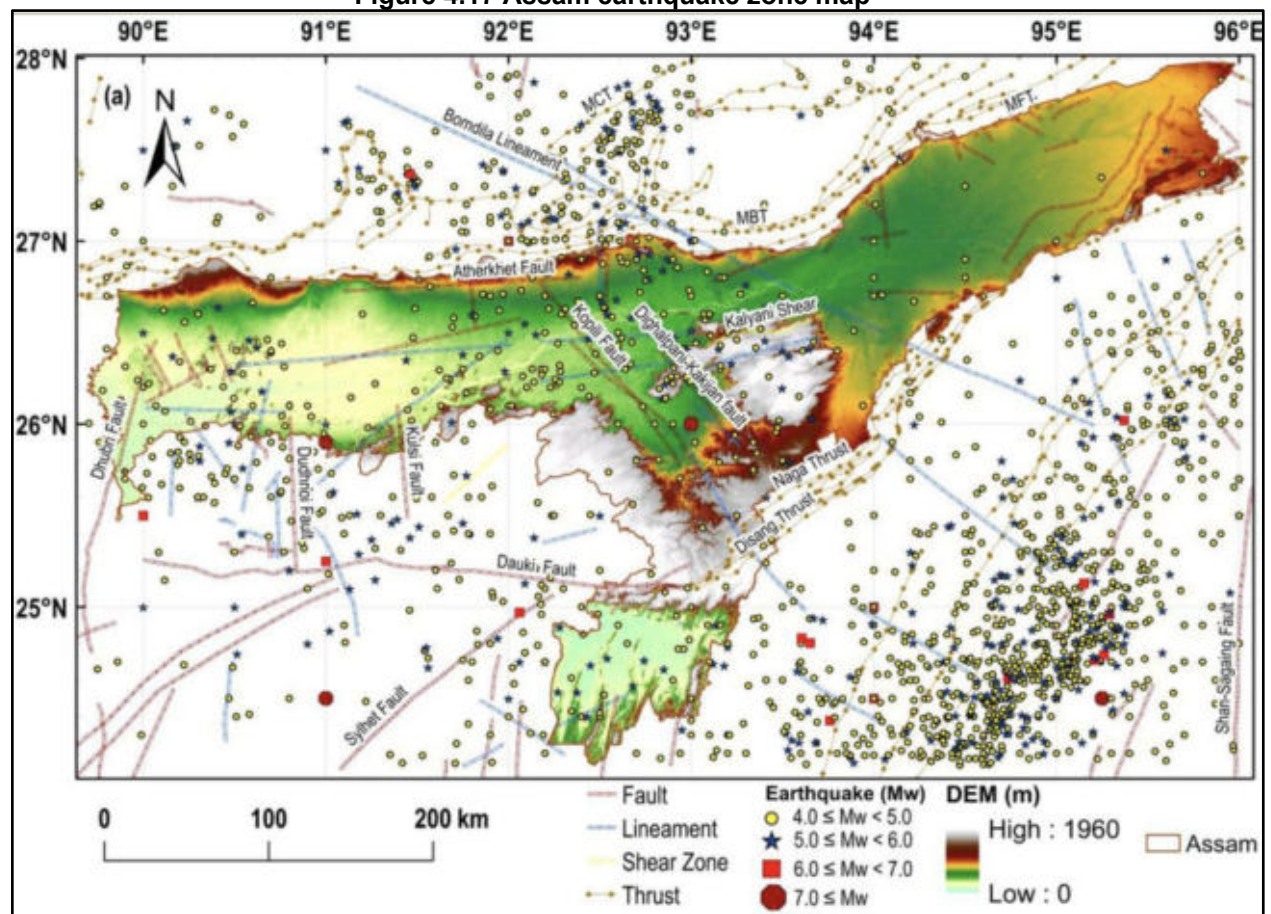
^a sampling at surface; ^b sampling at depth

BLQ = Below the Limit of Quantification; LOQ=Limit of Quantification is 0.1 milligrams per kilogram

Source: Hubert Enviro Care Systems Pvt. Ltd.

124. **Earthquake:** As per the seismic zone classification of India, the entire Assam state has been placed under seismic zone V. Therefore, the substation and distribution lines fall in highest potential for occurrence of severe earthquake (Very High Damage Risk Zone) or MSK IX or more. As per the BIS classification, all project districts, fall in in zone V (Very High Damage Risk Zone). Much of Assam lies in the Brahmaputra River Valley, except for a few southern districts (including East and West Karbi Anglong and Dima Hasao)⁴⁸. The northern and eastern parts of this valley are bounded by the Himalayan Frontal Thrust (HFF). In the eastern parts along with the HFF, there is the arc of the Lohit and Naga Thrusts. Among the large earthquakes in this region were the events in 1897 and 1950. All project districts can be regarded as highly susceptible area for high seismic activity. Figure 4.17 shows the earthquake zone map of the state.

Figure 4.17 Assam earthquake zone map



Source: https://ars.els-cdn.com/content/image/1-s2.0-S2590056022000366-gr1_lrq.jpg

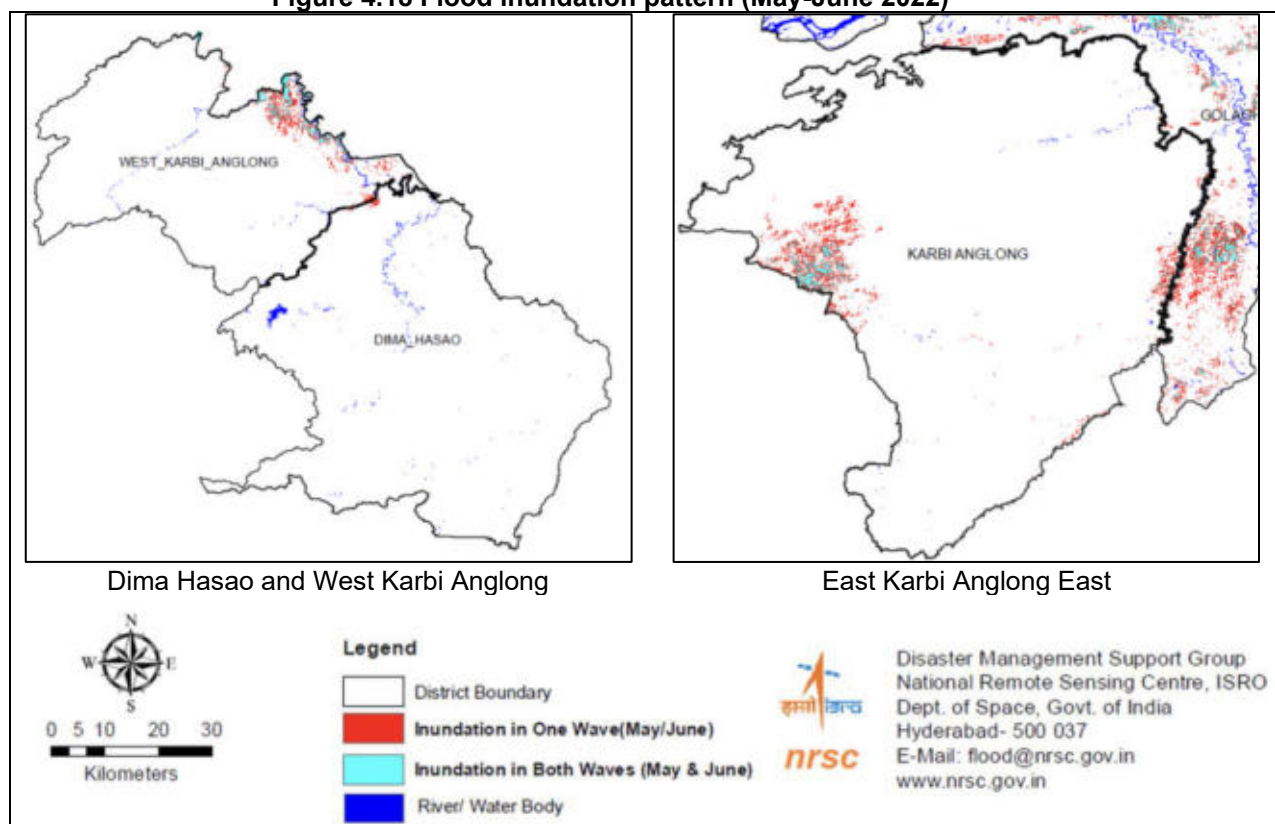
125. **Flood:** The state of Assam is largely vulnerable to floods. With its vast network of rivers, the state is prone to natural hazards like flood and erosion which has a negative impact on the overall development of the state.⁴⁹ The Brahmaputra and Barak Rivers with more than 50 tributaries feeding them, causes the flood devastation in the monsoon period each year. The flood prone area of the state as assessed by the Rastriya Barh Ayog (RBA) comprises 39.58 % of the total land area of Assam. Dima Hasao (lines and substation), and West Karbi Anglong (substation) are not affected, but East Karbi Anglong (distribution lines planned) is vulnerable to flood. Flash floods in the district of East Karbi Anglong are a regular feature and the main rivers are Amrenge, Borpani, Kolioni, Dhansiri, Dikharu, Nambor, Deopani, Jamuna,

⁴⁸https://aasc.assam.gov.in/sites/default/files/swf_utility_folder/departments/aasc_webcomindia_org_oid_4/portlet/level_2/SCENARIO%20OF%20SEISMIC%20HAZARD%20IN%20ASSAM.pdf

⁴⁹<https://waterresources.assam.gov.in/portlets/flood-erosion-problems#:~:text=Flood%20Problem,the%20monsoon%20period%20each%20year.>

Patradisha, Longnit, Doigrung which cause regular flash floods every year. Many areas of the district are affected with loss of properties and lives⁵⁰ during flooding. Flood inundation pattern for the distribution component districts are shown in Figure 4.18.

Figure 4.18 Flood inundation pattern (May-June 2022)



Source:

https://ndrf.nrsc.gov.in/documents/Disaster_Document/2022/AS/asflood50dsc17072022_1800hrs/asflood50dsc17072022_1800hrs_vap2.pdf

126. **Landslides.** The landslide susceptibility in all the project districts is classified as *medium* according to information published by UNDRR. This means that this area has rainfall patterns, terrain slope, geology, soil, land cover and (potentially) earthquakes that make localized landslides an infrequent hazard phenomenon. Climate change is likely to alter slope and bedrock stability through changes in precipitation and/or temperature. It is difficult to determine future locations and timing of large rock avalanches, as these depend on local geological conditions and other non-climatic factors. The two project districts of East and West Karbi Anglong are Medium Landslide Risk zones, whereas Dima Hasao district is classified as High Risk for Landslide Hazard (recent event in 2023).⁵¹

3. Water Resources and Quality

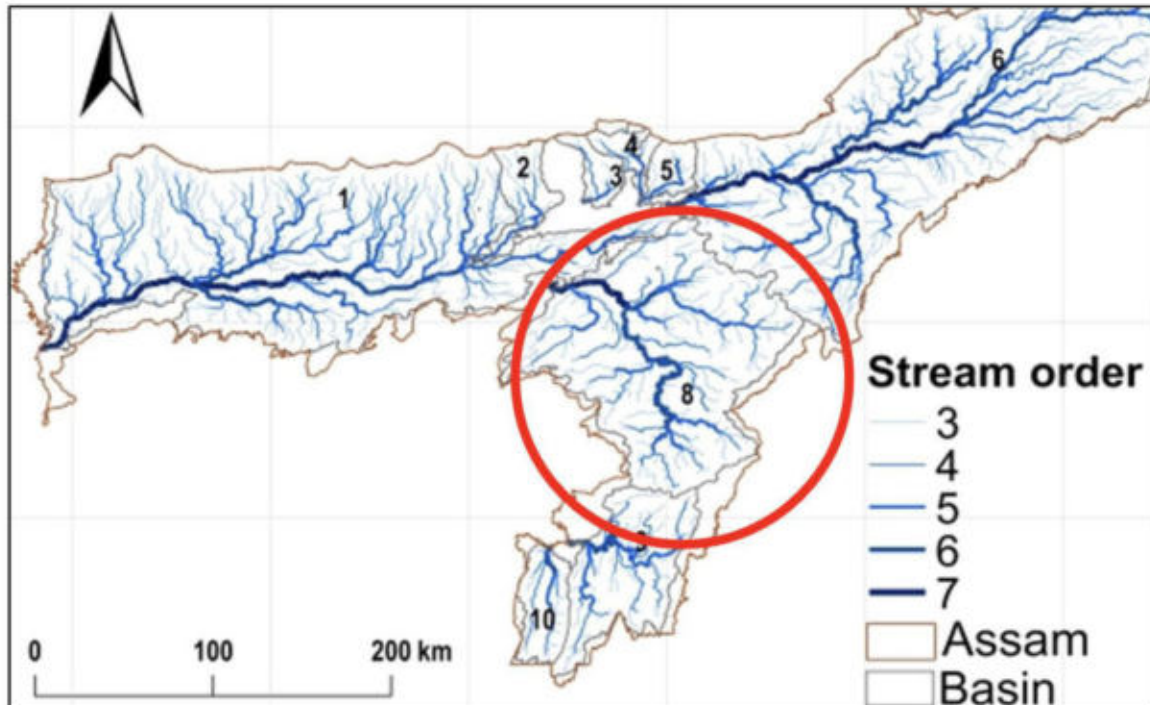
127. **Surface water.** The Brahmaputra flows down the plain of Assam east to west for 640 km up to the Bangladesh border. Through its course, the river receives numerous tributaries (about 73) coming out of the northern, north-eastern and the southern hill ranges. The river with its tributaries drains an area of 56,480 km² of the state accounting for 72% of its total geographical area (refer Figure 4.19). Most of the right bank tributaries of Brahmaputra are well rainfed and are perennial while the left bank tributaries are perennial in nature. Sinani is among the few rivers flowing through West Karbi Anglong district. Similarly, the drainage

⁵⁰ <https://www.asdma.gov.in/download/KEMEX.pdf>

⁵¹ <https://thinkhazard.org/en/report/1487-india-assam/LS>

network of East Karbi Anglong forms the upper catchment of Dhansiri river, Jamuna and Kopili rivers. The main rivers of the Dima Hasao district are Jatinga Diyung, Kopili, Jiri and Dhansiri Rivers with their tributaries. The River Jatinga is the only river that caters to the needs of the people of the Dima Hasao district.⁵²

Figure 4.19 Drainage network map showing distribution component area



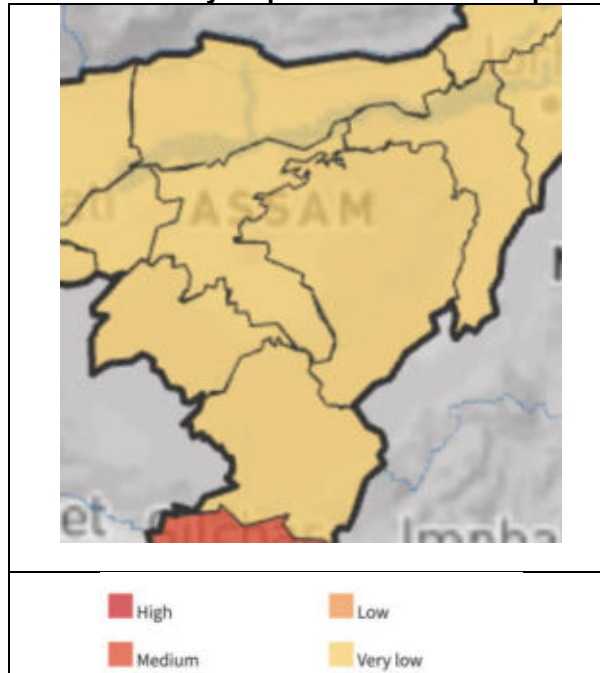
Source: https://ars.els-cdn.com/content/image/1-s2.0-S2590056022000366-gr5_lrg.jpg

128. **Water Availability.** Apart from the rainwater received, the state is endowed with number of perennial rivers and lakes, locally known as beels. In the last few decades, the rate of consumption of water in the agricultural sector, industrial sector and in the urban centers has increased significantly. Agriculture constitutes the largest share of water consumption amongst various uses followed by the domestic and industrial uses. The direct use of river water is limited in the state. Overall Assam is categorized as a medium water scarcity area, which means that there is up to 20% chance droughts will occur in the coming 10 years.⁵³ But the output 4 districts are however classified as low risk water scarcity areas as shown in Figure 4.20.

⁵² <https://ui.adsabs.harvard.edu/abs/2021EnvCh...500392C/abstract>

⁵³ <https://thinkhazard.org/en/report/1487-india-assam/DG>

Figure 4.20 Water scarcity map of distribution component districts



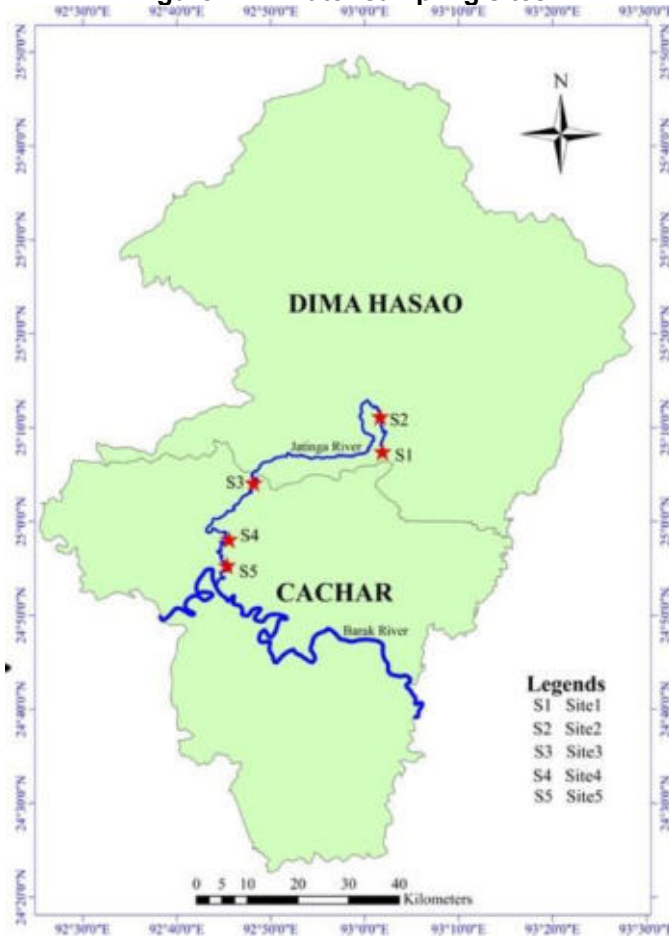
Source: <https://thinkhazard.org/en/report/1487-india-assam/DG>

129. **Water Quality.** Surface water is not used for drinking/domestic purposes in the distribution component areas as per feedback from locals and APDCL staff during site visits. Surface water is used for outdoor bathing and irrigation in some places. The River Jatinga originating from the Jatinga village, Dima Hasao district of Assam flows all the way through the western boundary of the Barail Wildlife Sanctuary and joins the River Barak, the second largest river of Assam. For a study conducted by Chakraborty et al⁵⁴, five sites (Figure 4.21) were selected from the upstream to the downstream of the river where site 1 and site 2 are in the upstream, in Dima Hasao district, site 3 is in midstream and site 4 and site 5 are in the downstream⁵⁵. The graph of water parameters analysed at the sites is shown in Figure 4.22 the analyses of 13 environmental variables found most of the variables well within the acceptable limit of drinking water quality standards prescribed by Bureau of Indian Standards/World Health Organization. Water Quality Status of the river considering nine parameters (potential of hydrogen, electrical conductivity, total dissolved solid, biological oxygen demand, dissolved oxygen, total alkalinity, total hardness, nitrate, phosphate) was evaluated using Water Quality Index by weighted arithmetic index method. WQS across the sites and seasons were either good or excellent and suitable for domestic, irrigation and industrial purposes.

⁵⁴ <https://www.sciencedirect.com/science/article/pii/S2667010021003668#fig0001>

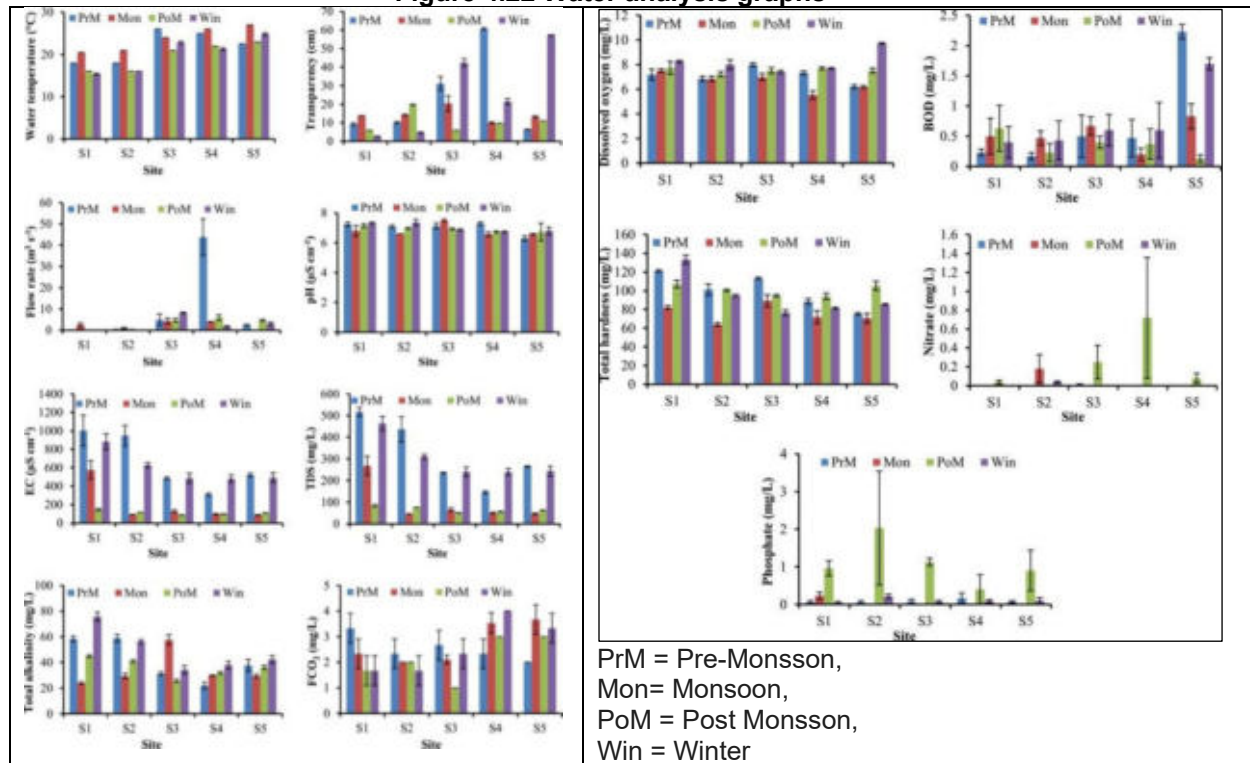
⁵⁵ <https://www.sciencedirect.com/science/article/pii/S2667010021003668#fig0001>

Figure 4.21 Water sampling sites



Source: <https://www.sciencedirect.com/science/article/pii/S2667010021003668#fig0001>

Figure 4.22 Water analysis graphs



Source: <https://www.sciencedirect.com/science/article/pii/S2667010021003668#fig0001>

130. In another study⁵⁶, the water quality index (WQI) of the Deepor Beel, a WLS and Ramsar site, was assessed. Sixteen parameters were analyzed, namely, pH, temperature, turbidity (T), electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total alkalinity (TA), total hardness (TH), calcium (Ca²⁺), magnesium (Mg²⁺), chloride (Cl⁻), sulphate (SO₄²⁻), phosphate (PO₄), and nitrate (NO₃⁻). Based on these 16 parameters, the WQI of 10 sampling locations in the wetland was estimated. The WQI ranged between 93.69 and 158.26, indicating all the sampling sites fall under poor category of water quality, except one sample which falls under good category water. Moreover, low DO, high range of COD and BOD along with the presence of NO₃⁻ and PO₄ indicates both organic and inorganic pollution from the surrounding area.

131. **Groundwater.** Hydrogeologically more than 75% of the state is underlain by unconsolidated formation comprising of clay, silt, sand, gravel, pebble and boulders. The entire Brahmaputra valley, covering more than 70% of the total geographical area of the state, contains a prolific aquifer system with the water table lying within 5 m of land surface. The Barak valley also has a good potential for the development of groundwater. The present stage of ground water development, even in the Brahmaputra valley, is in an initial stage. Groundwater is majorly used for irrigation purpose. Besides the irrigational use, groundwater forms the most common form source of domestic water use in the state. Based on the recommendation of the Ground Water Estimation Committee, Ministry of Irrigation, the recoverable recharge of ground water in Assam as worked out by the Central Ground Water Board, is about 2-million-hectare metre per year. With the present ground water resource available to be utilized, it is estimated that an additional area of about 14000 square kilometers of net area sown can be brought under irrigation. Drawing groundwater through dug wells, tube wells, shallow tube wells and deep tube wells for irrigation, domestic and industrial use is very common in the state. The status of ground water for the BESS and distribution component districts is shown in Table 4.8.

Table 4.8 Project district wise ground water status

District	Hydrogeology	Post Monsoon level	Pre Monsson-Level
East and West Karbi Anglong	Major Water bearing formations are sand and mixed formation. Shallow aquifer constitutes mixture of sand, clay with little gravel. Its thickness varies from 15 to 30 m. Ground water occurs under water table to semi-confined conditions	4.43 mbgl	4.24 mbgl
Dima Hasao	Major water bearing formations are thin sandy aquifers in valley portion and weathered and fractured/jointed Consolidated rocks in the hilly terrain form moderate to poor aquifers	3 to 10.0 mbgl	1.80 to 8.0 mbgl
Kamrup	The area consists of two broad hydrogeological units – 1) Pre-Cambrian consolidated rocks and 2) Quaternary alluvium consisting of unconsolidated sediments. Pre-Cambrian consolidated rocks are confined to hilly areas and inselbergs, where groundwater occurs in the shallow weathered zone and this can be developed through open wells. The joints and fractures developed due to tectonic activities form potential water bearing zones and are suitable for development through construction of bore wells.	4.46 mbgl	2.71 mbgl

mbgl = meters below ground level

Source: https://cgwb.gov.in/sites/default/files/MainLinks/Assam_State_Report_Resource_2020.pdf

⁵⁶ <https://link.springer.com/article/10.1007/s12517-023-11818-y>

132. Assam set up a Groundwater Cell in the year 1967 to explore and exploit the ground water resources. The chemical constituents in groundwater like TDS, bicarbonates, carbonate, chloride, calcium, magnesium, nitrate etc. are usually with permissible limit for domestic purposes except iron and fluoride. The water is slightly alkaline in nature, the pH value being up to 8.13. The iron content of ground water is found to vary from negligible to 5.0 ppm in shallow zone and 1 to 7.9 ppm in deeper zone. In most of the cases, it exceeds the permissible limit of 0.3 ppm in both shallow and deeper zones. The fluoride (F) content of some parts of the district is high and exceeds the permissible limits. The high concentration of fluoride is observed in deeper zones beyond 10 m on the pediment zones.⁵⁷

133. Baseline surface and ground water quality analysis (April-May 2024) was conducted at selected water bodies, for those in close proximity to project components and likely to be contaminated by works. The analyzed water quality parameters are compared with the designated best use water quality criteria recommended by CPCB or primary water quality criteria for outdoor bathing notified under Environment (Protection) Rules, 1986 or BIS Drinking Water Specifications i.e., IS:10500-2012 or water quality standards for coastal water depending on the use of water bodies. The results of the surface water analysis are given in Table 4.9, whereas for ground water, it is given in Table 4.10. The turbidity is high in all sampled water bodies, whereas the colour standards are not complaining for most sites.. The pH of the stream in Baithalangsho substation PAI is not as per the standard as more acidic. Similar for the pond near Umpanai substation. Contamination by coliforms is observed and so not suitable for drinking without undergoing adequate treatment. For ground water samples none of the samples collected is showing contamination.

⁵⁷ https://www.cgwb.gov.in/old_website/District_Profile/Assam/Karbi%20Anglong.pdf

Table 4.9 Surface water quality

Parameters	Units	Wildlife and Fish* standard*	IS: 10500:2012 Acceptable (Permissible) Limits	BESS		Existing 33/11kV Substation					
				Stream inside substation area-upstream	Stream inside substation area-downstream	Gunjung SS Stream near substation boundary	Gunjung SS Spring water at 200m	Baithalango SS Pond close to substation boundary	Baithalang so SS Karbi River at 490m	Umpanai SS Umlata Stream. 50m	Umpanai SS Pond at 400m
pH	-	6.5-8.5	6.5-8.5	6.52	6.58	6.54	6.81	6.81	6.12	6.51	6.23
Electrical Conductivity	µs/cm	-	-	63	61	136	128	131	169	22	18
Turbidity	NTU	-	1 (5)	95.6	81.5	48.3	41.6	49.3	35.4	2.9	2.5
Color	Hazen	-	5 (15)	5	5	5	5	5	<1	<1	2
COD	mg/l	-	-	NT	NT	NT	NT	NT	NT	NT	NT
DO	mg/l	>4	-	6.3	6.2	6.3	6.3	6.1	6.5	6.1	6.1
BOD (3 Days at 27 0C)	mg/l	-	-	NT	NT	NT	NT	NT	NT	NT	NT
Total Suspended Solid	mg/l	-	-	145	156	95	82	98	74	6	4
Total Dissolved Solids	mg/l	-	500 (2000)	35	34	76	72	73	94	12	10
Oil and Grease	mg/l	-	-	NT	NT	NT	NT	NT	NT	NT	NT
Total Phosphate	mg/l	-	-	0.042	0.035	0.12	0.092	0.038	0.14	NT	NT
Total Nitrogen	mg/l	-	-	11.01	10.56	3.65	5.56	7.03	8.37	NT	NT
Total Coliform	MPN/100	-	Shall not be detectable in any 100ml sample	58	43	54	35	70	84	70	74
Faecal Coliform	MPN/100	-	Shall not be detectable in any 100ml sample	<2	<2	<2	<2	<2	<2	<2	<2

* [https://cpcb.nic.in/wqm/Designated Best Use Water Quality Criteria.pdf](https://cpcb.nic.in/wqm/Designated%20Best%20Use%20Water%20Quality%20Criteria.pdf)

Highlighted data: exceedance of standards

NT: Not Traceable; NTU = Nephalo Turbidity Unit

Source: Hubert Enviro Care Systems Pvt. Ltd.

Table 4.10 Ground water quality

Parameters	Units	BESS			Existing 33/11kV Substation	Limit of IS: 10500-2012	
		Bore well adjacent to BESS site	Borewell near substation control room	Drinking water from substation control room	Baithalangso SS Bore well adjacent to substation	Desirable Limits (Max)	Permissible Limits in the absence of Alternate Source (Max.)
pH (at 25°C)	-	6.98	6.81	6.85	7.10	6.5 to 8.5	No relaxation
Color	Hazen	<1	<1	<1	<1	5	15
Turbidity	NTU	<1	<1	<1	<1	1	5
Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
Total Hardness as CaCO ₃	mg/l	84.0	78.0	11.0	19.0	200	600
Calcium as Ca	mg/l	22.44	20.04	2.0	4.41	75	200
Alkalinity as CaCO ₃	mg/l	110.0	106.0	16.0	22.0	200	600
Chloride as Cl	mg/l	4.89	3.95	14.85	2.47	250	1000
Magnesium as Mg	mg/l	6.80	6.80	1.45	1.94	30	100
Total Dissolved Solids	mg/l	135.0	117.0	55.0	41.0	500	2000
Total Coliform	MPN/100ml	Absent	Absent	Absent	Absent	Absent	NA
E. Coli	MPN/100ml	Absent	Absent	Absent	Absent	Absent	NA

NTU = Nephalo Turbidity Unit

Source: Hubert Enviro Care Systems Pvt. Ltd.

4. Ambient Air Quality

134. Growing air pollution has emerged as a serious concern in Guwahati, with vehicular emissions and dust contributing a major share of the deteriorating air quality. The Pollution Control Board Assam (PCBA) which has been monitoring the city's ambient air quality under the National Air Quality Monitoring Programme (NAMP) has recorded high levels of air pollution in all its monitoring stations. Data with the air quality monitoring station at Bamunimaidam reveals presence of respirable suspended particulate matter (RSPM) and suspended particulate matter (SPM) well above the prescribed limit since 2008. CPCB monitors the air quality index (AQI) (refer Table 4.10 for scale) in Assam, whose latest results are shown in Table 4.11. The location nearest to output 4 districts in Nagaon shows satisfactory AQI. Spot measurements using smartphone based application during site visits are provided in Table 4.12.

Table 4.10 Air Quality Index Scale

AQI	Remark	Possible Health Impacts
0-50	Good	Minimal impact
51-100	Satisfactory	Minor breathing discomfort to sensitive people
101-200	Moderate	Breathing discomfort to the people with lungs, asthma and heart diseases
201-300	Poor	Breathing discomfort to most people on prolonged exposure
301-400	Very Poor	Respiratory illness on prolonged exposure
401-500	Severe	Affects healthy people and seriously impacts those with existing diseases

Source https://airquality.cpcb.gov.in/AQI_India/

Table 4.11 Air Quality Index data of Assam

City	Station Name	Current 24 hr AQI value (as of 13.04.2024)
Guwahati	IITG, Guwahati - PCBA	Insufficient data available in last 24 hours.
	LGBI Airport, Guwahati - PCBA	300.00
	Pan Bazaar, Guwahati - PCBA	159.00
	Railway Colony, Guwahati - PCBA	158.00
Nagaon	Christianpatty, Nagaon - PCBA	95.00
Nalbari	Bata Chowk, Nalbari - PCBA	186.00
Silchar	Tarapur, Silchar - PCBA	37.00
Sivasagar	Girls College, Sivasagar - PCBA	64.00

Source https://airquality.cpcb.gov.in/AQI_India/

Table 4.12 Air Quality Index, spot reading data of sample sites visited

#	Site	Component	Date	AQI	Remark
1	Diphu	Distribution line	12.02.2024	210	Poor
2	Diphu Market	Distribution line	12.02.2024	217	Poor
3	Industrial Centre	Distribution line	12.02.2024	171	Moderate
4	Amlapptty	Distribution line	12.02.2024	77	Satisfactory
5	Ronkimi	Distribution line	12.02.2024	86	Satisfactory
6	Bokajan	Distribution line	14.02.2024	94	Satisfactory
7	Sairajan	Distribution line	14.02.2024	101	Moderate
8	Gunjung	Substation	15.02.2024	57	Satisfactory
9	Lungkhog	Distribution line	15.02.2024	51	Satisfactory
10	Hidisajir	Distribution line	18.02.2024	49	Good
11	Hojai Nadi	Distribution line	18.02.2024	44	Good
12	Longkoi Bey	Distribution line	20.02.2024	75	Satisfactory
13	Baithalangsho	Substation	19.02.2024	93	Satisfactory
14	Kukumara Mirza	Substation	17.02.2024	84	Satisfactory
15	Umpanai	Substation	20.02.2024	62	Satisfactory

AQI recoded from smartphone-based weather app -spot data

Source: ADB's TA Consultant

135. Ambient air quality is being monitored in Assam with the help of Manual and

Continuous Ambient Air Quality monitoring stations by CPCB. The monitoring of air pollutants is being carried out with the help of State Pollution Control Boards (SPCB), Pollution Control Committees (PCC) and other reputed institutes. CPCB co-ordinates with these agencies to ensure uniformity, consistency of air quality data and provides technical and financial assistance. The data generated through manual continuous monitoring for 2023 is presented in Table 4.13. The 24-hour average PM_{2.5} concentrations at Guwahati was at the prescribed Government of India standards of 60 µg/m³, while Nalbari and Silcher data exceed the IFC EHS guidelines. PM₁₀ mostly exceeded the prescribed standards. While SO₂ exceeded the IFS EHs standards in Guwahati, NO_x value were all below standards. These exceedences are in urban areas.

Table 4.13 Ambient Air Quality Status of Assam 2023

City / town / village	Annual Average in µg/m ³			
	SO ₂	NO ₂	PM ₁₀	PM _{2.5}
Bongaigaon	4	11	40	-
Daranga	6	13	54	-
Dibrugarh	6	11	39	-
Golaghat	6	12	50	-
Guwahati	26	11	114	60
Magherita	6	11	41	-
Nagaon	6	14	101	-
Nalbari	6	14	92	42
North Lakhimpur	6	14	57	-
Silcher	8	9	46	37
Sivasagar	6	12	47	-
Tezpur	6	14	97	-
Tinsukia	6	11	47	-
Government of India	80	80	100	60
IFC EHS (WHO AQG)	20	-	50	25
WHO AQG 2021	40	25	45	15

Average_Period:24 Hours, AQI = Air Quality Index

AQG= air quality guideline, EHS = Environmental, Health and Safety, IFC = International Finance Corporation, WHO = World Health Organization

Source: <https://cpcb.nic.in/manual-monitoring/>

136. Substations and sample distribution lines visited are characterized mainly by semi-urban and rural settlement/built-up and some vegetation cover/natural habitat and open/agriculture or uncultivated fallow land. There are few industrial activities in the areas visited and the major contribution to air pollution in semi-urban/settlement areas is due to vehicular emission, while in rural areas dust emission is mainly due to unpaved shoulders and unpaved/damaged roads. Few brick kilns were also recorded in East Karbi Anglong.

137. Baseline air quality monitoring was also conducted by third party laboratory for one season (April-May 2024). The 24-hourly baseline ambient air quality is provided in Table 4.14. The sampling and analysis of ambient air quality parameters are carried out as per the procedures detailed in relevant Parts of IS-5182 (Indian Standards for Ambient Air Quality Parameters) and CPCB guidelines. The following air pollution parameters were monitored and measured to establish baseline conditions of PAI:

- (i) Particulate Matter less than 2.5µm (PM_{2.5})
- (ii) Particulate Matter less than 10µm (PM₁₀)
- (iii) Sulphur dioxide (SO₂)
- (iv) Oxides of nitrogen (NO_x)
- (v) Carbon monoxide (CO)

138. The summary of ambient air quality results based on monitoring undertaken by third party laboratory at selected locations for identified project components likely to generate air

pollutants, like civil works in substations and the BESS facility, are presented in Table 4.14. The 24-hour average PM_{2.5} and PM₁₀ concentrations are well below the prescribed national and international standards. It may be noted that the latest WHO guidelines are very stringent and very few places can meet them. But here, away from the urban areas, the 24-hour average SO₂, NO_x and 8-hour average CO concentrations, recorded at all the sampling locations, are well below the prescribed limits. The air quality in the PAI is considered non degraded with respect to PM_{2.5}, PM₁₀, SO₂, NO_x and CO. The air quality test reports are provided in **Appendix 8**.

Table 4.14 Baseline 24-hour average air quality monitoring data (April-May 2024)

Location	Sampling date	PM _{2.5} (µg/m ³)	PM ₁₀ (µg/m ³)	SO ₂ (µg/m ³)	NO _x (µg/m ³)	CO (mg/m ³)
BESS -Site	11/05/2024	12.18	33.2	6.13	15.19	BLQ
BESS -Staff quarters	11/05/2024	12.75	32.9	7.22	14.77	BLQ
Gunjung SS	09/05/2024	12.79	20.6	8.79	13.96	BLQ
Baithalangso SS -Site	10/05/2024	12.25	22.4	9.20	15.73	BLQ
Baithalangso SS - Adjacent Cemetery	10/05/2024	13.07	25.4	6.92	13.32	BLQ
Umpanai SS -Site	10/05/2024	11.94	20.1	5.55	13.43	BLQ
Umpanai SS -Adjacent Graveyard	10/05/2024	14.51	26.4	6.41	16.40	BLQ
Government of India		60	100	80	80	4
IFC EHS (WHO AQG)		25	50	20	-	-
WHO AQG 2021		15	45	40	25	-

BLQ = Below the Limit of Quantification; LOQ=Limit of Quantification is 0.05 milligrams per cubic meter, AQG= Air Quality Guidelines, EHS = environmental, health and safety, IFC = International Finance Corporation, WHO = World Health Organization, Source: Hubert Enviro Care Systems Pvt. Ltd.

5. Ambient Noise and Vibration

139. The Assam Pollution Control Board, monitors noise level of major townships of the State, i.e., Silchar, Dibrugarh, Sivasagar, Tezpur, Golaghat, Nagaon and Bongaigaon besides the Metropolitan area of Guwahati city as a regular monitoring exercise since 2000. Of the noise level at six locations in the city, the average value of noise level was found out to be 73.4 dB(A) which is lower than the 75 dB(A) prescribed for an industrial zone but higher than 55 dB(A) prescribed for residential area⁵⁸.

140. There are no noise generating industries near the substations or along most of the distribution lines observed. For Bokhajn feeder lines very dusty conditions were observed due to ongoing road expansion, construction/ maintenance works; for these stretches noise levels were high. Traffic noise is the principal source of noise in the sample lines visited within semi-urban settlement areas like Diphu in East Karbi Anglong and Haflong in Dima Hasao. The distribution line PAI mostly includes semi-urban and rural open areas with intermittent settlement. Therefore, noise levels are relatively low. Spot measurements done for sites visited using a phone app are provided in Table 4.15.

141. Baseline noise monitoring was conducted for selected sites at substations and BESS site as per CPCB guidelines. The results of monitoring are provided in Table 4.16. As per the study it has been observed that the noise level at some of the sites exceeded the most stringent (Gol CPCB vs IFC EHS) criteria, both during day and night time by quite some

⁵⁸ <https://assamtribune.com/air-quality-noise-level-monitoring-by-pcba>

margin.

Table 4.15 Noise level at sites visited – Day Time

#	Site	Component	Date	Leq (A)	Dominant Landuse	Applicable Standard/ Guideline (Day)
1	Diphu	Distribution line	12.02.2024	83	Residential	55
2	Diphu Market	Distribution line	12.02.2024	89	Mixed (Residential +Commercial)	55
3	Industrial Centre	Distribution line	12.02.2024	71	Mixed (Residential +Commercial)	55
4	Amlapptty	Distribution line	12.02.2024	55	Residential	55
5	Ronkimi	Distribution line	12.02.2024	56	Residential	55
6	Bokajan	Distribution line	14.02.2024	62	Residential	55
7	Sairajan	Distribution line	14.02.2024	54	Residential	55
8	Gunjung	Substation	15.02.2024	48	Industrial	70
9	Lungkhog	Distribution line	15.02.2024	43	Sensitive	50
10	Hidisajir	Distribution line	18.02.2024	49	Residential	55
11	Hojai Nadi	Distribution line	18.02.2024	44	Residential	55
12	Longkoi Bey	Distribution line	20.02.2024	57	Residential	55
13	Baithalangsho	Substation	19.02.2024	45	Sensitive	50
14	Kukumara Mirza	BESS	17.02.2024	51	Industrial	70
15	Umpanai	Substation	20.02.2024	46	Sensitive	50

Sound recorded from smartphone-sound level measurement app -spot data

Source: ADB's TA Consultant

Table 4.16 Baseline 24-hour noise monitoring data (April-May 2024)

Sampling Date	Day	Location	Applicable Standard/ Guideline		Day Time dB(A)						Night Time dB(A)					
			Day	Night	L _{eq}	L ₉₀	L ₅₀	L ₁₀	L _{max}	L _{min}	L _{eq}	L ₉₀	L ₅₀	L ₁₀	L _{max}	L _{min}
11/05/24	Saturday	New BESS-Guest house adjacent	70	60	60.2	55.2	58.4	65.5	69.1	52.0	47.8	46.5	47.3	49.3	50.7	45.9
11/05/24	Saturday	New BESS-Staff quarters	55	45	57.2	52.7	55.1	62.0	65.2	49.8	49.4	48.1	49.0	50.9	51.5	47.9
11/05/24	Thursday	New BESS-Boundary	70	60	54.0	50.3	53.2	57.6	62.7	48.3	43.5	42.1	43.9	44.7	44.9	40.9
09/05/24	Friday	Gunjung SS	55	45	59.9	54.4	58.9	63.7	69.4	52.9	50.6	47.9	49.8	53.2	55.8	47.6
10/05/24	Friday	Baithalanso SS -Site	55	45	53.2	48.3	52.0	57.6	60.9	45.4	40.1	38.9	40.0	41.1	43.0	38.3
10/05/24	Friday	Baithalanso SS -Adjacent Cemetery	50	40	62.0	57.3	59.7	67.2	70.6	54.2	51.4	48.3	51.7	53.3	54.4	47.7
10/05/24	Friday	Umpanai SS -Site	55	45	58.0	53.3	56.5	62.5	65.8	52.2	46.9	44.4	47.2	48.1	49.0	43.4
10/05/24	Friday	Umpanai SS- Adjacent Graveyard	50	40	58.2	53.0	56.2	63.2	66.6	50.4	49.6	47.2	49.6	51.1	51.7	46.7

Noise criteria applicable: most stringent of Gol vs IFC EHS guidelines. Highlighted data: exceedance of criteria. Silent zone criteria of Gol apply where temples present in 100m.

Source: Hubert Enviro Care Systems Pvt. Ltd.

6. Waste management

142. **Municipal Solid Waste.** The urban local bodies in the state are yet to take necessary steps for proper management of MSW in the field of collection, segregation, storage, transportation, processing and disposal. In Assam, door to door collection of MSW has been taken up by Guwahati Municipal Corporation along with Silchar, Umrangshu, Maibang, Halflong, Badarpur, Karimganj and Sivasagarh town municipal bodies. In other parts, old practices are continued i.e. MSW collected from roadside bins provided at different locations in an interval of 2 – 3 days and taken into the dumping ground. For transportation of MSW generally tractor, truck, tipper, hand cart etc. are used. Practically no proper segregation of waste is practiced. In Paschim Boragaon area, Guwahati, a temporary storage facility has been set up by Guwahati Municipal Corporation. For processing of MSW there is no processing plant yet. One MSW processing unit is coming up in Dibrugarh district of Assam. Guwahati city has no sanitary landfill. All local bodies are utilizing low lying areas for disposal/dumping of MSW as they do not have any proper, scientific, well-developed landfill sites. Necessary landfill site for 100TPD MSW facility in Dibrugarh town has been selected. Guwahati Municipal Corporation has developed a waste processing and disposal facility (general segregation, recycling and dumping, not engineered sanitary facility). There are no other composting or incineration facilities available in Assam. For BESS the Guwahati waste management system can be utilised for recycling (not dumping) as only 30km from site. For the other project districts there are no disposal system. Nearest engineered solid waste management facility is in West Bengal.

143. **Hazardous Solid Waste.** There are 55 numbers of hazardous waste generating industries in 13 districts of Assam. Based on the annual returns submitted by the occupiers about 29,435 MTA of hazardous waste was generated during 2016-17. Among the 13 district of Assam, district Chirang generates maximum quantity of hazardous waste. The waste generators need to get themselves registered on the portal <https://geo.nic.in/nhwts/> within August 2023. This portal, namely “National Hazardous Waste Tracking System (NHWTS)” has been developed by Central Pollution Control Board to track generation, transportation, storage, recycling, utilization, and disposal of Hazardous Waste in the Country. APDCL needs to be registered as generator using the online system.

144. There is no Treatment Storage Disposal Facility (TSDF) (secure landfill) in Assam and the hazardous waste generated in the state is either being recycled/utilized(captive)/stored at the occupier’s premises or disposed through captive facilities in other states in common TSDF. Nearest engineered facility is in West Bengal. PCBA is coming out with a facility in Dibrugarh District and awarded the M/S Mumbai Waste Management Limited to design, finance, build and operate an integrated TSDF and CBWTF facility in May 2023 (not completed till July 2024).

Table 4.17 Output 3 and 4 District-wise Status on Hazardous Waste Generation and Management in Assam

District	No. of Hazardous Waste Generating Industry	Quantity of Hazardous Waste as per Authorization (MTA)	Quantity of Hazardous Waste as per Annual Return (MTA)	Quantity Disposed in Captive SLF (MT)	Quantity Disposed through Common SLF at TSDF (MT)	Quantity Disposed by Captive Incinerator (MT)	Quantity Disposed Through Common Incinerator or at TSDF (MT)	Quantity Co-processed in cement Kiln (MT)	Quantity utilized under Rule 9 (MT)	Quantity sent to recyclers of Schedule - IV Hazardous Wastes (MT)	Captive Utilization (MT)	Quantity of Hazardous Waste stored at occupier premises at the end of the year (MT)
Dima Hasao	2	0	3.75	0	0	0	0	0	0	0	0	11.5
East and West Karbi Anglong	1	0	0	0	0	0	0	0	0	17	0	0
Kamrup (BESS)	27	0	2212.262	728	0	0	0	0	1531.01	277.58	310.82	35.976

Source: https://cpcb.nic.in/uploads/hwmd/Annual_Inventory2016-17.pdf

Table 4.18 Number and Capacity of Authorized Recycling/Utilizing facilities in Assam

Type of Recycling Facilities	No of Facilities authorized for recycling / utilization / Co-processing of HW	Total Authorized Capacity (MTA)	Quantity Recycled/ Utilized/ Co-processed (MT) during the year
Lead bearing waste including battery waste	6	26100	9041.651
E-Waste	0	0	0
Paint and ink Sludge/residues	0	0	0
Used oil	6	27100	700.2
Waste Oil			
Total	12	53200	9741.851

Source: CPCB

Table 4.19 List of the Units Registered with PCB, Assam as Hazardous Waste Recyclers/ Reprocessors

Sl. No.	Name and Address of the Units	Waste (Qty.)
(i) Lead waste re-processors		
1.	M/s Royal Industries 15th Mile, Village-Burni, P.O.-Jorabat, Dist- Kamrup (Assam), Pin 793101.	Lead Acid Battery Plates and Lead Scrap - 900 MTA
2.	M/s. Nirmaan Industries D-7, DICC Campus, Numalijalah, P.S.- L. Amingaon, Guwahati, Dist – Kamrup (Assam).	Lead Acid Battery Plates and Lead Scrap - 1200 MTA
3.	M/s. S.R. Battery Works Murmura Gaon, Na-Pamua, Mariani Road, Cinnamora, Dist-Jorhat (Assam)	Lead Acid Battery Plates and Lead Scrap - 2400 MTA
4.	M/s. Anubhav Industries, Industrial Growth Centre, Chaygaon, Village- Chattabari, P.O.-Chaygaon, Dist- Kamrup (Assam).	Lead Acid Battery Plates and Lead Scrap - 9600 MTA
5.	M/s. Shree Sai Vamika Industries, Gauripur, Near Shiv Sai Steel, North Guwahati, Dist- Kamrup (Assam).	Lead Acid Battery Plates and Lead Scrap - 9600 MTA
(ii) Used oil & waste oil re-processors		
1	M/s. Modern Lube Industries, Barsha Para Industrial Area, Guwahati-34.	Used oil - 1000 KLA
2	M/s. Progressive Industries, Rani Industrial Area, Dist-KamrupGuwahati-34.	Waste oil- 1000 KLA Used Oil- 500 KLA
3	M/s Allied Industries, Digboi, Dist-Tinsukia (Assam).	Waste oil- 720 KLA
4	M/s. East End Petro Chemicals (P) Ltd., Dibrugarh (Assam).	Used oil - 600 KLA

Source:

https://pcb.assam.gov.in/sites/default/files/swf_utility_folder/departments/pcb_lip1_in_oid_8/portlet/level_1/files/LIST%20OF%20THE%20UNITS%20REGISTERED%20WITH%20STATE%20POLLUTION.pdf

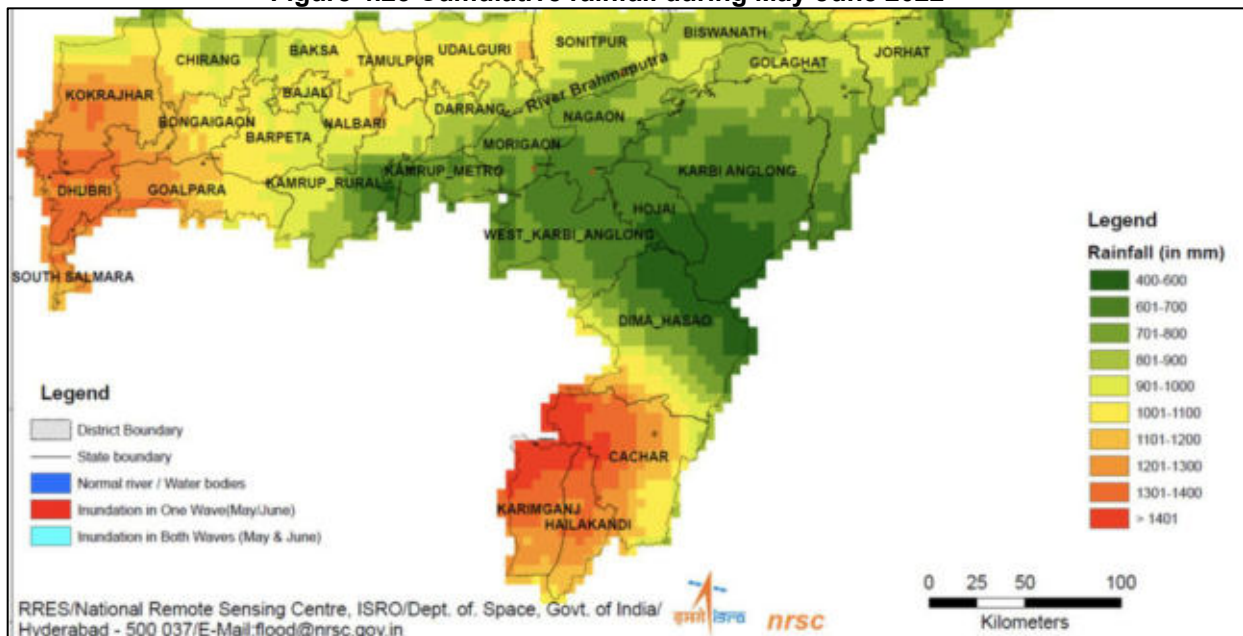
7. Climate Change

145. Assam has a subtropical climate and experiences four seasons during a year with summer, monsoon, autumn and winter. The summer season in Assam starts from the month of March and extends till the end of June and is characterized by extreme humidity and

frequent showers. The average temperature during this time of the year is between 35°C and 38°C. Monsoon season brings relief from the scorching heat of the summers. The average annual rainfall in the state is around 178 mm in the west and around 305 mm in the east. In the afternoons, thunderstorms known as Bordoicila are very common. The winter season in Assam is basically characterized by scanty rainfall and misty mornings and afternoons. It starts in November and continues till the month of February. The temperature at this time of the year is around 6°C to 8°C.

146. **Rainfall.** Rainfall is the sole source of natural recharge to the ground water regime. There are large variations in the quantity of rainfall within different parts of the state. The state gets highest rainfall (28.7%) of southwest monsoon rainfall in July followed by 28.6% in June. August and September receive 23.8% and 18.9% of southwest monsoon rainfall. Also, more than 66% of annual rainfall is received during the southwest monsoon season only. Among the output 4 districts, highest rainfall over the last 5 years from 2016 to 2020 is recorded as is 935.8 mm in 2018 in East Karbi Anglong district. The average annual rainfall in the project districts of Karbi Anglong and Dima Hasao is around 2609 mm rainfall every year. The cumulative rainfall pattern is shown in Figure 4.23.

Figure 4.23 Cumulative rainfall during May-June 2022



Source: https://ndrf.nrsc.gov.in/documents/Disaster_Document/2022/AS/asflood50dsc17072022_1800hrs/asflood50dsc17072022_1800hrs_vap2.pdf

147. **Drought.** Assam suffers periodic droughts due to variability in rainfall pattern over the years. Since 2010, Assam has witnessed drought like situation twice, affecting large number of districts. 14 districts of Assam witnessed drought like situation in 2014, and again in 2019, 20 districts experienced less rain and drought like situation.⁵⁹ The entire Dima Hasao and Kamrup district is vulnerable to drought.⁶⁰ West Karbi Analong is vulnerable to drought,

⁵⁹ https://asdma.assam.gov.in/sites/default/files/swf_utility_folder/departments/asdma_revenue_uneecopscloud_com_oid_70/menu/document/assam_state_disaster_management_plan_volume_1.pdf

⁶⁰ https://asdma.assam.gov.in/sites/default/files/swf_utility_folder/departments/asdma_revenue_uneecopscloud_com_oid_70/menu/document/dima_hasao_2024_25.pdf

although last events were in 2009.⁶¹

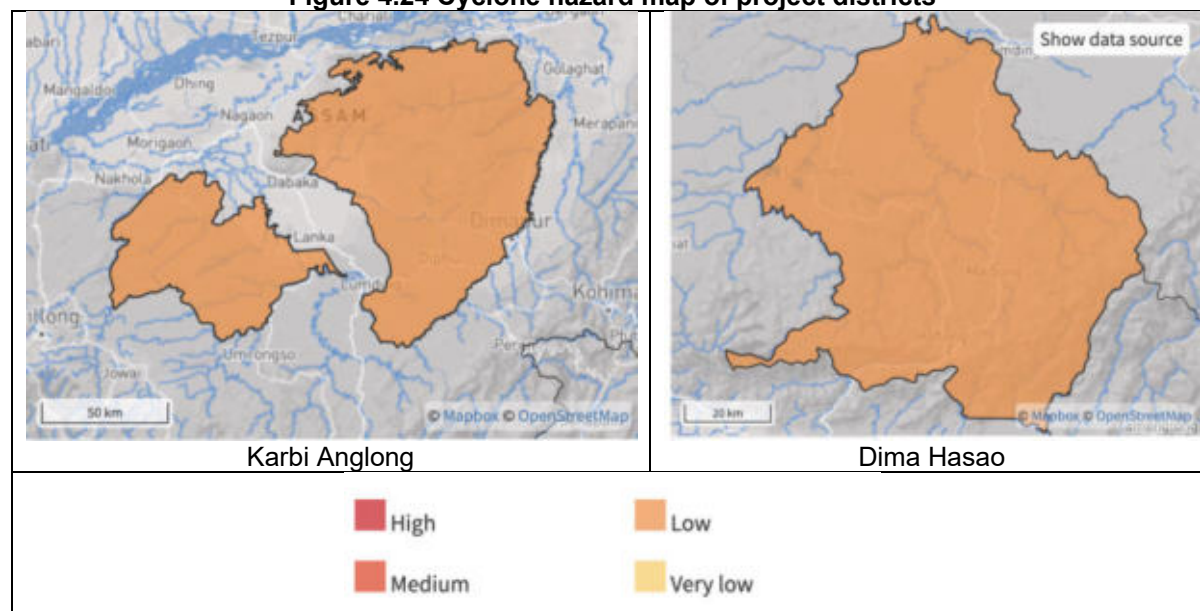
148. **Temperature.** In the plains of Assam, the maximum temperature does not exceed 35°C and in winter the minimum temperature is about 6°C. The state does not have much spatial variability in temperature throughout the year. The temperature of both West Karbi Anglong and East Karbi Anglong district varies from 6°C to 32°C and in Dima Hasao district varies from 6°C to 26°C.

149. **Forest Fire.** In Assam, about 0.03% and 10% is under very high and high vulnerability zones, whereas almost 12% and 56% of the area has very low and low fire potentials, and about 21% of the area has moderate fire vulnerability.⁶² All project districts have episodes of forest fire and classified as Moderate to High (Low to moderate for Kamrup) vulnerability risk.⁶³

150. **Wind Profile.** Along the west side of Assam is Bangladesh, which is prone to cyclone/winds. Every year, about 60 % of the area in Assam is affected by a cyclone episode in Bangladesh. Due to the location, districts within the project area that will be more prone to cyclone and winds are Dima Hasao and Kamrup. All project districts are classified as Moderate. damage risk zone A (39-44m/s).⁶⁴

151. **Cyclone.** In Assam cyclone hazard is overall classified as high. This means that there is more than a 20% chance of potentially damaging wind speeds in the state in the next 10 years⁶⁵. The distribution component districts although fall under Low Damage Risk Zone as shown in Figure 4.24.

Figure 4.24 Cyclone hazard map of project districts



Source: <https://thinkhazard.org/en/report/1487-india-assam/CY>

61

https://asdma.assam.gov.in/sites/default/files/swf_utility_folder/departments/asdma_revenue_uneecopscloud_com_oid_70/menu/document/west_karbi_anglong_2024_25.pdf

62 <https://nesac.gov.in/assets/resources/2020/12/Forest-Fire-Assessment-in-NER.pdf>

63 <https://nesac.gov.in/assets/resources/2020/12/Forest-Fire-Assessment-in-NER.pdf>

64 https://upload.wikimedia.org/wikipedia/commons/5/59/India_wind_zone_map_en.svg

65 <https://thinkhazard.org/en/report/1487-india-assam/CY>

Key Physical Features

152. Key physical features in the PAI are summarized in Table 4.20.

Table 4.20 Summary of key physical features in the PAI by project component

Component	Subproject	Location	Key environmental features in PAI
Substations, BESS	Total 3 existing substations and one 25 MW BESS facility	Substations in West Karbi Anglong and Dima Hasao District; BESS in Kamrup District, Assam	<ul style="list-style-type: none"> • Land use of substations and BESS site comprises buildings, electrical equipment, and open areas with grass, shrubs, and occasional trees; the available open space within substations varies from 30% to 69%. • All the existing substations and BESS are located in flat terrain • All 3 substations and the connecting BESS substation have evidence of oil leaks inside the compound/switch yard and soil contamination of various degrees especially in and around the transformers. • The soil quality monitoring shows no oil contamination at surface or sub-surface zone. • Standing water was observed in the BESS substation area only and not on the BESS site within it. A pond is located inside the BESS substation area-450m; ponds are 10m, 40m and 60m from Baithalangsho substation, and a pond is about 300m from Umpanai substation. Rivers and streams are located within 500m from all 3 substations and stream at 80 BESS site. • Bore wells is located within BESS substation and at 15m from Baithalangsho substation only. • Monitored baseline data shows ground water parameters are within range. • Monitored baseline data from shows ground water parameters, except, coliform, which indicates organic waste loading in the water bodies at all sites and turbidity and colour at one stream and pond as unsatisfactory. • Smartphone recorded data shows sites having satisfactory AQI, for all substation and BESS sites. Data shows PM_{2.5}, PM₁₀, SO₂, NO_x and CO concentrations, recorded at all locations, are lower than prescribed national and international standards. • Air quality in the PAI is considered non degraded with respect to PM_{2.5}, PM₁₀, SO₂, NO_x and CO. • Smartphone recorded spot ambient noise levels are all within assessment criteria for day time residential limit of

Component	Subproject	Location	Key environmental features in PAI
			<p>55 dB(A), at all substations and BESS site and overall noise level across PAI is low.</p> <ul style="list-style-type: none"> • Spot noise levels near gates, yards, transformer area and inside office using smartphone-based app were mostly in the 45 dB(A) to 51 dB(A) range. • Monitored ambient noise levels at sampling locations, are not within assessment criteria for day time residential limit of 55 dB(A), and night time limit of 45 dB(A) at most locations, showing high baseline noise level across PAI. • Transformer hum was not audible (monitored during environmental audit using mobile app) in any of the substations beyond 0.5m with levels ranging between 41 dB(A) to 43 dB(A). • No engineered waste disposal facility is present in Assam. Although some registered hazardous waste collectors/utilizers are available. • Old and defunct transformers are stored within existing substations. Used oils are also kept in barrels within the premises of APDCL's substations.
<p>546.9 km of 11 kV, and low-tension distribution lines (including DTR associated lines)</p>	<ul style="list-style-type: none"> • Conversion of 11 kV Line to CC: 59 km • Conversion of low tension (0.4 KV) to ABC: 360.75 km • New DTR associated low tension (0.4 KV) as ABC: 87.6 km • New 11kV as covered conductor: 39.5 km 	<p>East Karbi Anglong, West Karbi Anglong and Dima Hasao District</p>	<ul style="list-style-type: none"> • Kamrup has average elevation of 330m, 476m - Dima Hasao, 437 m - East Karbi Anglong and 428m-West Karbi Anglong district. • Topography is mostly flat in all PAI of the sample distribution line site visited, except for Dima Hasao area and some areas of West Karbi Anglong. • Surface water bodies: river/stream passing along few of the sample alignments; 11kV Diphu Feeder, 11kV Bokajan Feeder, LT District Industrial Centre Line and LT Teachers' Colony line. • No ponds are found within the ROWs although ponds are found within the PAI. • No ground water features like springs are found within the ROWs although ponds are found within the PAI. • On most route alignments, especially the rural areas, intermittent (soil suspension) conditions were observed due to bad road conditions, unpaved roads. In Bokhajan area dusty conditions were observed due to

Component	Subproject	Location	Key environmental features in PAI
			ongoing road expansion, including high noise levels at some locations. <ul style="list-style-type: none"> Observed distribution transformers were mostly not maintained with no/broken/damaged fences, most with no caution signages, severe grass undergrowth, some with oil leaks and contamination in all 3 districts.

Source: ADB's TA consultant

3) Socio-economic Setting

153. The socio-economic study adopted a desk-based methodology with review and analysis of published secondary data sources and primary data collection by social team. Secondary data was also collected from District Census statistics of 2011.

a. Administrative

154. Assam is located between 24°08' N-27°59' N latitude and 89°42' E-96°01' E longitude. Covering an area of 78,523 km² it is divided into 32 administrative geographical units called districts. The West Karbi Anglong district is a new district formed out of the existing Karbi Anglong District in 2016. The East Karbi Anglong is another district in which distribution components are planned. Both the East and West Karbi Anglong districts are under the common Karbi Anglong Autonomous Council, Diphu administered according to the Sixth Scheduled of the Indian Constitution. The other district where distribution components are planned is Dima Hasao District, which is surrounded by East and West Karbi Anglong district and Nagaland on the northeast, Manipur on the east, Hojai District to the north, West Karbi Anglong district on the northwest, Meghalaya on the west and Cachar district in the south. The district headquarters are located at Haflong. The district is a part of Dima Hasao Autonomous Council administered according to the Sixth Scheduled of the Indian Constitution. The Dima Hasao district occupies an area of 4,888 km². It is the second-largest district of Assam after East Karbi Anglong. The West Karbi Anglong district has an area of 4890 km², whereas the East Karbi Anglong District occupies 5544 km². Figure 4.25 shows the distribution component administrative divisions.

Figure 4.25 Map showing distribution component districts and surroundings



Source: <https://censusindia.gov.in/nada/index.php/catalog/1369>

Autonomous Councils. The Government of Assam have been taking various steps to accelerate the development process for the welfare of Scheduled Tribe (ST) communities in the State through democratic decentralization of power and empowering the Scheduled Tribe (ST) communities to participate in the planning, monitoring and implementation of Tribal Sub Plan (TSP) schemes at grass root level by constituting Territorial Councils, Autonomous Councils and Development Councils for different Scheduled Tribe (ST) communities in the State. The Autonomous Councils are given varying degrees of autonomy within the State Legislature.

- In Assam there are 3 Autonomous Councils under Sixth-Schedule of the Indian Constitution. The 3 Autonomous Councils are:
 - Bodoland Territorial Council – not part of distribution component
 - Dima Hasao Autonomous District Council – distribution lines and substations
 - Karbi Anglong Autonomous District Council (covering East and West Karbi Anglong districts) – distribution lines and substations
- Dimasa Hasao and Karbi Anglong Autonomous Districts have the autonomy to legislate and administer the subjects such as land, revenue, transport, public works, primary education, customary laws, fisheries, forests, planning and development, marketing and other subjects that are assigned under the Schedule VI of the Constitution of India. No State or Union law or regulation applies to an autonomous district council area unless the Governor of the State of Assam specifically adopts them as applicable to the ADC. A Deputy Commissioner, appointed by the Governor of the State, runs the civil administration and maintains law and order in each autonomous district.
- The Executive Committee of an ADC is elected by its 'citizens' or 'members'. Several ministries elected from among the legislative council members of the ADC are in charge of the ADC's development policies, finances, law and order, and land administration.

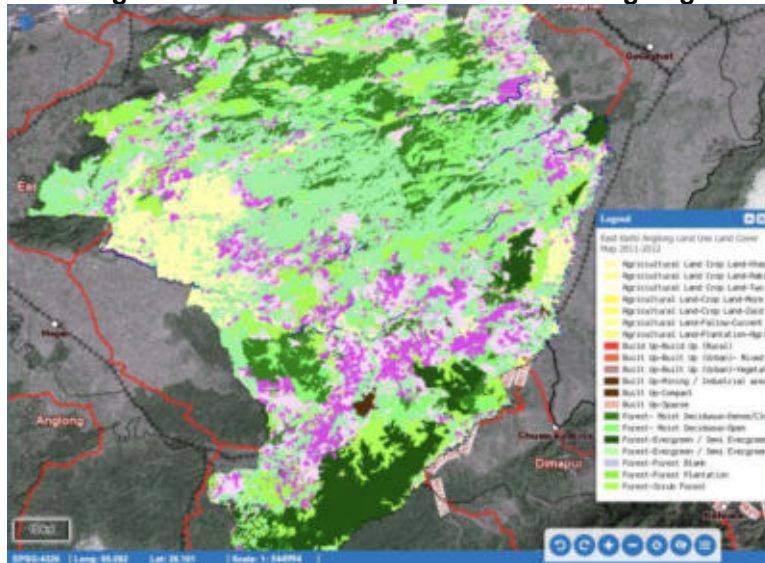
b. Land use

- The landscape is marked by numerous valleys, ridges, and steep slopes, making it predominantly suitable for agriculture and forestry.

- The total geographical area of the Dima Hasao district is 489596 ha out of which 8.4% is cultivable, 13.94% is forest and the rest is under wasteland.
- The combined East and West Karbi Anglong District landuse consists of 13.97% croplands, 42.38% of shifting cultivation land and about 43.64% of forest land.⁶⁶
- The major portion of the geographical area of Kamrup district is put to agricultural uses. Net area under different crops in the district is about 42% of the total geographical area.

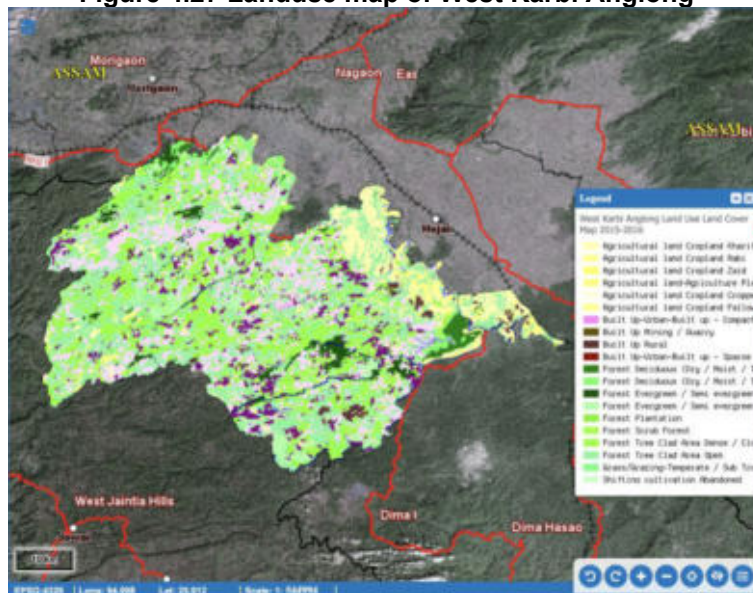
155. The LULC map of the East and West Karbi Anglong and Dima Hasao districts are provided as Figure 4.26 to Figure 4.28.

Figure 4.26 Landuse map of East Karbi Anglong



Source: <https://www.nesdr.gov.in/map.php>

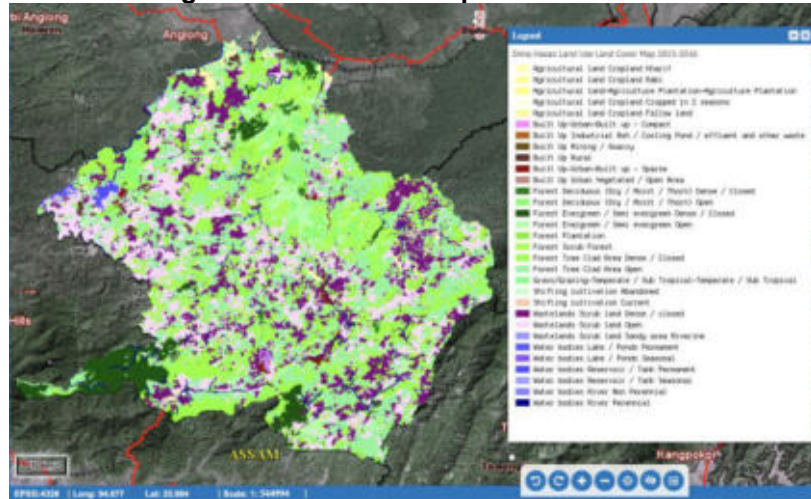
Figure 4.27 Landuse map of West Karbi Anglong



Source: <https://www.nesdr.gov.in/map.php>

⁶⁶ <https://kalpavriksh.org/wp-content/uploads/2019/05/Karbi-Anglong-Final-December-2002.pdf>

Figure 4.28 Landuse map of Dima Hasao



Source: <https://www.nesdr.gov.in/map.php>

c. Population characteristics

156. As per the Census 2011, the total population of Assam is 31,205,576. The population of Assam formed 2.58% of India's population in 2011. The total population of the state has increased in the last ten years (2011-2021) with a growth rate of 16.93%.⁶⁷ The total population of Assam was expected to reach 34.18 million by 2021 and 35.60 million by 2026. The distribution component districts are not listed as districts with higher population concentration in Assam.

157. According to the 2011 census, Karbi Anglong District (East+West) has a population of 965,280. This gives it a ranking of 451st in India (out of a total of 640). The district has a population density of 93 inhabitants per km². Its population growth rate over the decade 2001-2011 was 17.58%. Karbi Anglong District (East+West) has a sex ratio of 950 females per 1000 males, of which 95,103 (14.39%) live in urban areas. Scheduled Castes and Scheduled Tribes are 33,523 (5.07%) and 345,220 (52.23%) of the population respectively.

158. According to the 2011 census, Dima Hasao had a population of 214,102, giving it a ranking of 588th in India (out of a total of 640). The district had a population density of 44 inhabitants per square kilometre. Its population growth rate over the decade 2001-2011 was 13.53%. Dima Hasao had a sex ratio of 931 females for every 1000 males and a literacy rate of 78.99%. Dima Hasao is a tribal-majority district with tribals constituting about 71% of the total population. There are 13 tribal groups inhabiting the district along with a significant number of non-tribal groups like Bengali, Nepali and Assamese. The major tribal groups in descending order of population are Dimasa, Kuki, Zeme, Hmar and Karbis besides other smaller tribes like the Khelma, Hrangkhol, Biates, etc.

d. Vulnerable groups

159. **Minorities.** The major scheduled tribes living in the Dima Hasao district are Dimasas, Zeme, Nagas, Biate, Hmars, Kukis, Hrangkhawls, Vaipheis, Karbis, Khasi-pnars and Khelmas. 71% of the population belong to scheduled tribes. The Karbi Anglong District (East+West) is mainly dominated by the Karbi Tribe. The other scheduled tribes are Rengmas, Dimasas and Koch. Gorkhas, Kuki-Chin peoples such as Kukis, Hmars and Mizos, Garos, Tiwas, Khasis and Chakmas. Nearly 52.3% of the total population belong to scheduled tribes.

⁶⁷ <https://smartlib.umri.ac.id/assets/uploads/files/208ab-b0704010710.pdf>

160. There are no distinctive differences between the tribal peoples and other rural dwellers. All of them depend on leased land to earn their living either as cultivators or wage workers. As the majority populations in both autonomous districts the scheduled tribes share their co-identity of scheduled tribes with other tribes. They together with other rural dwellers share vulnerabilities in coping with rapid urbanization, finding employment, and getting higher education opportunities for their children.

161. Frequent floods and soil erosion in and around the Brahmaputra and nearby river valleys periodically push many households into severe poverty after destroying or damaging their property and crops. Cross- border conflicts in the border areas too adversely impact on the local economies of Karbi Anglong and Dima Hasao ADCs, causing instability and insecurity in the area.

162. **Children.** In Dima Hasao, there were total 32,414 children under age of 0-6 against 30,800 of 2001 census. Of total 32,414 male and female were 16,480 and 15,934 respectively. Child Sex Ratio as per census 2011 was 967 compared to 955 of census 2001. In 2011, Children under 0-6 formed 15.14% of Dima Hasao District compared to 16.38% of 2001. There was net change of -1.24 percent in this compared to previous census of India. In Karbi Anglong (East+West) district there were total 151,681 children under age of 0-6 against 150,238 of 2001 census. Of total 151,681 male and female were 77,428 and 74,253 respectively. Child Sex Ratio as per census 2011 was 959 compared to 973 of census 2001. In 2011, Children under 0-6 formed 15.86% of Karbi Anglong District compared to 18.47% of 2001. There was net change of -2.61 percent in this compared to previous census of India.⁶⁸

163. **Religion.** The dominant religious group in the distribution component districts is the Hindu community. Although they identify themselves as Hindus, some of them practice local rituals, and follow their own belief systems which may be different from that of the Hinduism. As per official census 2011 of Karbi Anglong (East+West) district, Hindu are majority. Hinduism constitutes 80.10% of Karbi Anglong population. Christian are minority forming significant 16.50% of total population. In Dima Hasao district, Hindu are majority. Hinduism constitutes 67.07% of Dima Hasao population. Christian forms 29.57% of total population.

164. **Poverty.** All three district have income inequality. Statistics available for 2022–23 for 31 States and Union Territories point out that less than 15% of Assam population are residing below poverty level (BPL). Assam has shown a significant decline with its poverty headcount ratio dropping from 36.97% in 2013–14 to 14.47% in 2022–23.⁶⁹ Many families are unable provide basic education to their children in spite of The Right of Children to Free and Compulsory Education (RTE) Act, 2009 in India. To promote and develop the minority communities, The Assam Minorities Development Board has taken some important schemes for socio-economic development including - Distribution of Hand Sprayer machine, Distribution of Sewing Machine, Distribution of Rickshaw, Distribution of Bi-cycle with utensil for selling fish, Distribution of 3-wheeler pick-up van, Distribution of 3-wheeler auto-rickshaw, Distribution of Thela, Distribution of Wheel- Chair, Distribution of Solar Home Light, Distribution of Water Purifier and Distribution of 5 HP Pump Set.

e. Living conditions, health and sanitation

165. **Structural Integrity.** Due to historical high seismicity of the region the local people developed a unique construction methodology using locally available materials to construct their dwellings that are highly earthquake resistant. Such houses are commonly known as Assam-type houses or Ikra. The name Ikra given to such housing typology is derived from the reed locally known as Ikra used extensively in walls and roof of such houses. This type of

⁶⁸ <https://www.census2011.co.in/census/district/157-karbi-anglong.html>

⁶⁹ <https://asombarta.com/niti-aayog-thumbs-up-to-assam-on-poverty-index/>

housing construction made of flammable materials is commonly found in both rural and urban areas.

166. **Electricity and Fuel.** As per National Family Health Survey study (NFHS 2023-2024), 26% of households in Assam have electricity. The proportion of households in the state with electricity is 77% in urban areas and 21 percent in rural areas. Several types of fuel are used for cooking in Assam, with wood as the most common type. In the state as a whole, 85% of households rely mainly on wood and 11% on liquid petroleum gas. There are large urban-rural differences. 50% of urban households in the state rely mainly on liquid petroleum gas, whereas 91% of rural households rely mainly on wood and 6% on liquid petroleum gas.⁷⁰

167. **Water and Sanitation.** Water sources and sanitation facilities may have an important influence on the health of household members, especially children. NFHS (2023-2024 survey) found that 11% of households in the state use piped drinking water. The proportion of households with piped drinking water is 48% in urban areas and 7% in rural areas of the state. Most households have fairly easy access to drinking water. 80% of households have a source of drinking water that is in the residence, yard, or plot or is accessible in 15 minutes or less, including the time to go to the source, get water, and come back. 41% of households in the state purify their drinking water (68% in urban areas and 38% in rural areas). The most common methods of water purification are filtration (mainly in urban areas) and boiling. Most of households in the distribution component districts get water from bore wells. Some households use water from springs in the area. Most river water is contaminated and is not suitable for human consumption. For washing and cleaning, most households use water from bore wells, while some use spring water. Others use river water for such purposes. Water for animal husbandry/cattle is taken from bore wells while others use river water or spring water.

Regarding sanitation facilities, only 15% of households in the state have a flush toilet (using either piped water or water from a bucket for flushing), 48% have a pit toilet or latrine, and 37% have no facility. The proportion of households that have a flush toilet is 58% in urban areas and 10% in rural areas of the state.

f. Health Status of Households.

Comparison of age-specific death rates indicates that state level death rates declined substantially in the youngest age group (under 5 years), increased substantially at ages 60 and over, and did not change much in the other age groups.⁷¹

- **Asthma.** The reported level of asthma (3,278 per 100,000 population) in Assam is higher than the level reported for India as a whole (2,468 per 100,000 population). The prevalence of asthma in Assam is considerably higher in rural areas (3,394 per 100,000 population) than in urban areas (1,931 per 100,000 population), and it is considerably higher among males (3,806 per 100,000) than among females (2,719 per 100,000). Age differences are also marked, with the prevalence increasing from 3,393 per 100,000 at age 14 to 9,453 per 100,000 at age 60 and over.⁷²
- **Respiratory infection.** 18% of children under age three in Assam suffered from acute respiratory infection (cough accompanied by short, rapid breathing) at some time during the two-week period before the survey by NFHS. The major cause being increase in traffic generated dust and other emissions.
- **Tuberculosis.** The overall prevalence of tuberculosis in Assam is 710 per 100,000 population, which is considerably higher than the national estimate of 544. The prevalence of tuberculosis is higher in rural areas (721 per 100,000) than in urban areas (583 per 100,000). Prevalence is higher for males (855 per 100,000) than for females (555 per 100,000).

⁷⁰ <https://rchiips.org/nfhs/assam.shtml#>

⁷¹ <https://rchiips.org/nfhs/data/as/aschap6.pdf>

⁷² <https://rchiips.org/nfhs/data/as/aschap6.pdf>

- Vector borne diseases. In Assam, 2,974 persons per 100,000 population were reported to have suffered from malaria during the three months preceding a survey, lower than the national rate of 3,697 per 100,000 population⁷³. According to two surveys, the rate of malaria in Assam increased slightly from 2,710 to 2,974 per 100,000 (2021 to 2023). Rural residents are more likely to suffer from malaria (3,066 per 100,000) than are urban residents (1,910 per 100,000). Assam officially reported approximately 205 cases of malaria in 2022. This was a decline compared to the previous year's reported cases. Overall, the number of malaria cases officially reported have dropped significantly over the last decade. In 2022, the number of dengue cases across the Assam was reported to be 191, up from about 33 dengue cases in 2020. The highest number of dengue cases were recorded in 2016 across the state with over six thousand cases. As per the data of the Ministry of Health and Family Welfare, from 2018 to 2022 a total of 730 people died of Japanese Encephalitis in India, out of which 442 were from Assam only.⁷⁴
- HIV/AIDS prevalence and awareness. Assam is categorized as a low HIV prevalence state with an estimated adult HIV prevalence of 0.08% (0.07–0.10) which is lower than the National Prevalence of 0.22%⁷⁵. It is estimated that Assam had 1160 new HIV infections in 2020 (NACO HIV Estimations Report, 2020). Assam is also a highly vulnerable state for HIV transmission as it is the gate-way of the north-eastern states; is surrounded by three high prevalence states of Manipur, Mizoram, Nagaland and Meghalaya; large number of young population from the state are migrating to other cities for employment; Assam has a large private health sector which caters to all the north-eastern states; large number of female migrants from other north-eastern states, West Bengal, and Nepal for employment and education and reported drug use. The distribution component will require employing a large workforce, including migrants from north-eastern or other Indian states. Knowledge of AIDS among women does not vary much by women's age, but there are substantial differentials by all the other background characteristics.⁷⁶ Three-quarters (76%) of urban women have heard about AIDS, compared with only 30% of rural women. Knowledge of AIDS is much greater among women from other backward classes (58%) than for women in the other caste/tribe groups. Knowledge also varies greatly by media exposure, ranging from 11% among those who are not regularly exposed to any media to 84% among those who regularly read newspapers or magazines.
- **Occupational and Community health and safety:** APDCL reported a total of forty people have died across the state of Assam⁷⁷ in 2022-23. As per APDCL, the major causes of these deaths are by electrocution include short-circuiting, poorly installed electricity poles and snapping of live wires during floods and storms and waterlogging. The National Crime Records Bureau (NCRB) records show a total of 91 cases of electrocution across the state, out of which 89 people died. This number was for 2021-22. APDCL has faced serious allegations from time to time regarding negligence due to inadequate safety measures and faulty wiring systems. However, a report mentioned that the lack of professionalism and slacking attitude of the on-ground employees of the department are the major cause of such accidents, which are otherwise avoidable. It also mentioned that in case of deaths, the department pays an

⁷³ <https://rchiips.org/nfhs/assam.shtml#>

⁷⁴ <https://www.indiatvnews.com/health/rise-in-japanese-encephalitis-cases-raise-concern-in-assam-2023-08-06-885187>

⁷⁵ <https://asacs.assam.gov.in/information-services/present-hiv-aids-scenario#:~:text=Assam%20is%20categorized%20as%20a,NACO%20HIV%20Estimations%20report%202020>

⁷⁶ ⁷⁶ <https://rchiips.org/nfhs/assam.shtml#>

⁷⁷ <https://www.sentinelassam.com/north-east-india-news/assam-news/assam-woman-arrested-for-killing-husband-in-jorhat-district>

amount of Rs. 4 lakhs as compensation to the next of kin. A minor died of electrocution in the Demow region of Assam in May 2024. A few years back, Robin Das, an employee of the department died on duty in the state. Assam Government set up an enquiry commission regarding this in 2017 under Justice (Retd.) HN Sarma (refer Table 4.13).

Table 4.21 Summary data on electrocution deaths (from 2017)

S.No.	Cause of death sited	Number
1	Coming in contact with snapped conductors	49
2	Coming in contact with live conductor due to sagging of conductors	7
3	Contact with unprotected/fault of transformers	3
4	Coming in contact with electrically charged object due to leakage of current	11
5	Own fault/negligence/ignorance	51
6	Faulty earthing	3
7	Fault of the APDCL staff	9
8	Coming in contact with live conductor during flood time	3
9	Coming in contact with live conductor while cutting tree branches	2
10	Fault of the contractor	3

Source:

https://www.apdcl.org/website/docs/documents/report/Report_Commission_Justice_HN_Sarma.pdf

g. Education, literacy and languages

168. Karbi Anglong Districts (East+West) are facing educational problems even though various measures have been taken by the government to increase the enrolment rate and reduce the dropout rate of the children. The major challenges are - poor communication facilities, power failure, insufficient educational institutions and poverty. Means of transport are inadequate and settlements are scattered in the area, especially in West Karbi Anglong because most parts are mostly covered by natural habitat/complex terrain. As a result, school going children in these areas find it difficult to travel to school because of unfavourable geographical localities. Average literacy rate in Karbi Anglong Districts (East+West) as per census 2011 is 87.37% of which males and females are 91.56% and 82.92% literates respectively. In actual number 87,104 people are literate in urban region of which males and females are 47,039 and 40,065 respectively. Literacy rate in rural areas of Karbi Anglong (East+West) district is 66.69% as per census data 2011. Gender wise, male and female literacy stood at 73.95 and 59.05% respectively. In total, 470,110 people were literate of which males and females were 267,214 and 202,896 respectively. In Dima Hasao average literacy rate is 77.54%. Male literacy rate in Dima Hasao district is 83.29%. Female literacy rate in Dima Hasao district is 71.33%. Total literates in Dima Hasao district are 140,873 people (Census 2011).

169. The languages in Assam are varied, ranging from Assamese to the Bodo language, which is one of its native indigenous tribes. Ahomiya/Assamese is widely spoken in the state and also in the distribution component districts. Karbi is another language spoken. Other languages spoken include Hindi and English.

h. Employment and livelihoods

170. Assam is predominantly rural, and the economy is primarily agrarian in nature with

almost 70% of the population directly dependent on agriculture as a source of income and another 15% of the population directly relying on allied activities for their living. Contribution of agriculture and allied activities towards state GSDP in 2019-20 was 15.64%. Agriculture is the main source of income for the people along with horticulture, livestock, plantation, sericulture, weaving, etc. Tribals are generally self-sufficient and mostly rely on wild vegetables found in hills both for domestic consumption and commercial purpose. There are some non-food crops like jute, mesta, cotton etc. grown in the kharif season.

171. Cultivation of land is the main occupation of both men and women. Income from the cultivation of land is supplemented by selling labour seasonally and by engaging in allied agricultural work such as raising pigs, chickens, and small businesses. Only a few men are engaged in trade and professional employment. The per capita income of Assam is the lowest in India. Assam is a rural state with a few urban cities and industrial centres. Assam's isolated location, far away from the main production centres of India, is one of the key reasons for its low level of economic progress. Its adverse climatic conditions also contribute to sluggish economic growth.

172. In 2019, Assam reported, 5,447,805 visitors with a subsequent increase in the tourists visiting Assam with each passing year. In 2017-18, Assam Tourism Development Corporation (ATDC) received earnings estimated at Rs 4.22 crore, much higher than that received in 2016-17, which was estimated at Rs 2.24 crore. Many locals are engaged in tourism-based livelihoods in the distribution component districts including vehicle supply, hotels, shops, handicrafts, restaurants, etc.

173. Assam is endowed with petroleum, natural gas, coal, limestone and many other minor mineral resources such as quartzite, kaolin, sillimanites, clay, feldspar, granite, etc. Assam accounts for about 26% of India's crude reserve and 12% of natural gas. Assam is the most industrialized state in northeast India and has maintained its leading position in the industrial sector in the country. The state is a pioneer in small scale industries and boasts of the largest number of special export promotion zones. It has a large base of skilled and industrial labour, making it an ideal destination for knowledge-based and manufacturing sectors. However, residents of Karbi Anglong (E+W) and Dima Hasao districts are not employed in these sectors in any major way.

i. Land ownership, assets, and economic development

174. As recoded during public consultation at the time of sample site visits, landowners are mostly on leasehold and there is no tenant employed. As jhum (slash and burn) cultivators, villagers (including migrants) move from one location to another with the permission of the Gaon bura and the villager, and the latter paid the former a fee for the use of land that belongs to the Autonomous District Council (ADC). All substations are within government land and distribution lines in existing ROWs, although many pass private and croplands. For DTRs, although a small footprint, many existing/planned inside private land. Permission will be required from ADC/Gaon Bura for installing DTR and poles in private lands.

175. In 2006, the Indian government named Karbi Anglong one of the country's 250 most backward districts (out of a total of 640). It is one of the eleven districts, including Dima Hasao, in Assam currently receiving funds from the Backward Regions Grant Fund Programme (BRGF). The Gross State Domestic Product (GSDP) of Assam for 2021-22 (at current prices) was an annual increase of 4% over the GSDP of 2019-20. In 2020-21, the GSDP of Assam was estimated to have grown by 6.4% over the previous year. GSDP of the state grew at around 11.77% from 2011-12 to 2017-18 whereas the Net State Domestic Product (NSDP) grew at a CAGR of around 11.75% from 2011-12 to 2017-18.

j. Infrastructure and accessibility

176. **Roads.** The total length of National Highways in Assam is 3,900.44 km. This includes 15 nos. of newly declared NHs for a length of 1,032.127 km. In addition, 847.00 km of road stretches have already been approved “in principle” as new NHs and another 1,253 km of state roads have been identified to be upgraded to NH. The East Karbi Anglong district is connected to other places by road through NH-36, NH-39 and NH-329. Bokajan and Diphu railway stations (both in East Karbi Anglong) are the main railway stations in the district. The NH 627 is connected with West Karbi Anglong. Although most main roads are in proper shape, many of the local roads visited during sample line surveys were bad/damaged or unpaved roads, which are narrow and encroached by local shops/vendors and private residences.

177. **Communication.** The East Karbi Anglong district is well connected by road. As majority of the area is complex topography and rural, transport communication and accessibility is not available in many parts of the West Karbi Anglong district. Karbi Anglong Autonomous Council Transport (KAACT) buses runs at regular interval from the West Karbi Anglong district headquarter to places like Guwahati, Diphu and Hojai. There is no railway station in the West Karbi Anglong district. The nearest railway station is at Hojai, 48 km away from Hamren. There is no Airport in any of the project districts.

178. Dima Hasao is connected by road to cities like Guwahati and Silchar. Dima Hasao has 3 railway stations around the area of Haflong. The roads of Dima Hasao are well-connected to main cities like Guwahati, Itanagar and Tezpur. There are several buses, both private and state run, which offer transportation services from the main cities of Assam to Dima Hasao.

179. For in-city transportation, shuttle cars, auto-rickshaws and other motor vehicles are available throughout districts.

180. **Education Infrastructure.** There are nearly 48,000 government lower and upper primary schools in Assam and around 5,000 private schools in the state. There are multiple schools, colleges, industrial training institutes in all project districts. University is available in Guwahati. Some distribution lines were observed to be passing school compounds, gates, playground.

181. **Access to Health Care and Health Infrastructure:** Health indicators in Assam are generally below the national average, reflecting the poorer socio-economic condition of the state relative to the rest of the country. As per NRHM, Assam has 4,621 sub centers, 1,014 PHCs, 151 CHCs, 14 sub divisional hospitals, and 24 district hospitals. Distribution component districts have a smaller number of PHCs and CHCs due to low population. Every district has one district hospital excluding Dibrugarh and Jorhat district. District hospitals in East Karbi Anglong and Dima Hasao are equipped with diagnostic facilities and treatment for Japanese Encephalitis, Malaria and Dengue. The details of health care services in distribution component districts are provided in Table 4.22 and Table 4.23.

Table 4.22 List of Health Institution in Output 3 and 4 districts

DISTRICT	No. of Sub Centres	No. of PHCs	No. of CHCs	No. of Sub District / Sub Divisional Hospitals	No. of District Hospitals
Kamrup (BESS)	280	71	11	1	1
Karbi Anglong (East & West)	145	46	5	1	1
Dima Hasao	65	11	2	0	1

PHC = Public Health Centre, CHC = Community Health Centre

Source: Source: <https://dhs.assam.gov.in/portlets/health-institutes>

Table 4.23 List of Community Health Centres in Output 3 and 4 districts

District	Health Block / Reporting Unit	Name of the Health Institution
Dima Hasao	Langting BPHC	Maibang CHC
	Gunjung BPHC	Umrangso CHC
Kamrup (BESS)	Uparhali / Mirza CHC	Mirza CHC
Karbi Anglong East	Howraghat BPHC	Howraghat CHC
	Howraghat BPHC	Bokulia CHC
	Howraghat BPHC	Dentaghat CHC
	Bokajan BPHC	Bokajan CHC
Karbi Anglong West	Donkamokam BOHC	Donkamokam CHC

BPHC = Bureau of Public Health centre

Source: <https://dhs.assam.gov.in/portlets/health-institutes>

k. Sensitive receptors

- BESS site – No sensitive receptors present (nearest settlement is beyond 300m, although staff quarters within 100m.)
- Substations – Baithalangsho is surrounded by rural settlement and cropland. Nearest house is 10m from boundary and a Hindu crematory adjacent which constitutes the sensitive receptors. Umpanai substation is located at 10m from a cemetery and 200m from nearest settlement. Gunjung substation has no settlement within 850m, although tea garden worker camps is about 66m from substation.
- No hospitals or educational facilities are present within 50m of any of the substations or BESS site
- One local temple is located at about 60m from Gunjung substation.
- Distribution lines – some schools are crossed; some temples are churches are also crossed, health facilities like PHC are close to some lines as seen in Diphu. One DTR and associate line is inside a church compound in Bokhajan 11kV and LT alignment.
- Multiple distribution lines are crossing residences, private lands, and croplands as the most sensitive receptors.

Key Socio-Economic Features

182. Key socio-economic features in the PAI are summarized in Table 4.23.

Table 4.23 Summary of key socio-economic features in the PAI by project component

Component	Subproject	Location	Key socio-economic features in PAI
Substations, BESS	Total 3 existing substation and, one 25 MW BESS facility	Substations in West Karbi Anglong and Dima Hasao District; BESS in Kamrup District, Assam	<ul style="list-style-type: none"> • 3 existing substations in two Autonomous/IP Council Areas – East and West Karbi Anglong (Karbi Anglong ADC) and Dima Hasao District (Dima Hasao ADC). • Out of a total geographical area of Karbi Anglong ADC, the forest cover occupies 73% area. Only about 4% percent of the geographical area is cultivable. Out of a total geographical area of Dima Hasao, the forest cover occupies 86% area. Only about 7% of the geographical area is cultivable. • Substation districts are the least densely populated districts of Assam.

Component	Subproject	Location	Key socio-economic features in PAI
			<ul style="list-style-type: none"> • For substations land adjacent includes habitation for Baithalangsho only, distance to nearest properties varies between 10m to 110m. • Sensitive receptors: BESS - no sensitive receptors present (nearest settlement is beyond 300m, although staff quarters within 100m). Substations – Baithalangsho - nearest house is 10m from boundary and a Hindu crematory adjacent to site. Umpanai is located 10m from a cemetery. No hospitals or educational facilities are present within 50m of any of the substations or BESS site, although present in the PAI. One local temple is located at about 60m from Gunjung substation. • The distribution component districts' population depends mostly on borewell water. River/Stream and Pond waters are not used, except for irrigation in some areas. Groundwater is used by local communities (drinking water), whereas surface water is mostly used for cleaning and washing. • Existing road network available for all sites and connected with main road, although most rural roads are damaged/broken.
546.9 km of 11 kV, and low-tension distribution lines (including DTR associated lines)	<ul style="list-style-type: none"> • Conversion of 11 kV Line to CC: 59 km • Conversion of low tension (0.4 KV) to ABC: 360.75 km • New DTR associated low tension (0.4 KV) as ABC: 87.6 km • New 11kV as covered conductor: 39.5 km 	East Karbi Anglong, West Karbi Anglong and Dima Hasao District	<ul style="list-style-type: none"> • Based on government records Assam is 85% electrified • All lines in three districts pass through Tribal/IP autonomous council areas • Land use in the PAI include settlements, forest, and cultivations. Lines will pass through settlement - both dense and isolated. • Settlement along ROWs include houses, business/shops, markets. • Sample route alignments visited were mostly along roads, but some sections of alignment pass along/crosses croplands and some in private land over residential houses/shops/businesses. • Along the roads in the semi urban areas are entrances to private properties, houses, shops, and businesses. • Many lines pass adjacent and over private properties, houses, courtyards. Individual properties were recorded within the RoW and safety clearances in most areas are not met. • Sensitive land use like schools and hospitals were recorded in both rural

Component	Subproject	Location	Key socio-economic features in PAI
			<p>and urban alignments and some inside the ROWs.</p> <ul style="list-style-type: none"> • Road crossings were present on many routes. • A number of incidents/deaths related to Operational Health & Safety (OHS) of APDCL (AERC/APDCL publication) staff and community health and safety regarding electrical supply issues have been noted in the past and reported in reports/newspapers • The state is highly susceptible to frequent flooding and erosion, brought about by heavy rains during the monsoon. • Some ponds were observed in the ROW. Human use of surface water is mostly limited to cleaning and washing whilst ground water is used for drinking where supply water is not provided across some of the PAI.

Source: ADB's TA Consultant

4) Physical Cultural Resources

183. The physical cultural resources (PCR) in the distribution component PAI and surroundings, which may be directly or indirectly impacted by the substation and distribution line works are discussed in this section. The BESS component within the existing substation does not affect any PCR.

a. World Heritage Sites

184. Presently, Assam has two UNESCO Natural World Heritage Sites – Kaziranga National Park (KNP) and Manas National Park (MNP). None of them are cultural heritage sites. None of these sites are within 50km of the BESS or the distribution component areas.

185. The ancient pyramids of Assam, known as Charaideo Moidam, are on track to potentially achieve UNESCO World Heritage Site status as a Cultural site. Government of Assam through Government of India has submitted proposal to UNESCO for its nomination, making it the sole historical site in India under consideration. Following the nomination, a UNESCO team conducted site inspections. These pyramids, serving as the final resting place for Ahom royal family members, possess profound historical significance. This proposed WHS is about 150km from any of the proposed interventions under the BESS or the distribution component areas.

b. National and other cultural heritage sites

186. **Archaeological Survey of India (ASI) national cultural heritage sites.** There are 55 monuments of national importance in Assam that have been recognised by Archaeological Survey of India (ASI). Table 4.24 lists the ASI monuments in the distribution component districts. There are no ASI sites in the East or West Karbi Anglong district. Figure 4.29 shows distribution line infrastructure and ASI sites.

Table 4.24 ASI protected PCR in distribution component districts

ASI Monument ID	Image	Name/ Description	Nearest Distribution Line/ Substation*	Distance (km) to nearest Line/ Substation	District	Coordinate location
N-AS-12		The Derebara Group of monoliths Dubungling	Gunjung SS and 11kV CC Hatikhali Thana to Diblong	9 and 11km	Dima Hasao (N. C. Hills)	25°21'36.0"N 92°57'00.0"E
N-AS-13		The Khartong Group of monoliths Kartongsip	Gunjung SS	21	Dima Hasao (N. C. Hills)	25°15'04.1"N 92°48'52.1"E
N-AS-14		The Kobak Group monoliths Khobak	Gunjung SS	19	Dima Hasao (N. C. Hills)	25°16'48.7"N 92°48'54.8"E
N-AS-15		Rock-cut temple, Maibong	Gunjung SS and 11kV CC Bashabari to Nablaidsa and 11kV CC Bashabari to Nablaidsa	11, 3.5 and 3.5	Dima Hasao (N. C. Hills)	25°19'06.7"N 93°07'47.7"E
N-AS-16		Two inscribed stones: on the treaty between the Dimasa King (Naranarayan) and the Ahom King Maibong	Gunjung SS	12	Dima Hasao (N. C. Hills)	25°17'27.42"N, 93° 8'47.85"E
N-AS-17		Bolosaon Group monoliths Nuchubunglo	Gunjung SS and LT ABC Haflong ESD Lunkhok to Lunkhok	14 and 11	Dima Hasao (N. C. Hills)	25°13'09.0"N 92°54'27.6"E

*Nearest components and distances subject to reconfirmation following route alignments and mapping of lines by the EPC contractor

ASI = Archaeological Survey of India

Source: ADB's TA Consultant

187. **Assam state protected and locally important cultural heritage sites.** 96 state protected monuments have been recognized by the Directorate of Archaeology in Assam. Table 4.24 lists the state protected monuments in the distribution component districts.

Table 4.24 State protected and locally important PCR in distribution component districts

State Monument ID	Name/Description	Nearest Distribution Line/Substation*	Distance (km) nearest Line/substation	District	Coordinate location
State protected PCR sites					
S-AS-44	Borgang Rock Inscription	DTR associated LT SL 66 Borjan Church	39.5	Karbi Anglong	26°11'10.72"N, 93° 2'32.32"E
S-AS-45	Ruins at Sarthe Rangpha	DTR associated LT SL 66 Borjan Church	38.0	Karbi Anglong	26° 6'16.89"N, 93° 0'44.94"E
S-AS-46	Burhagosain Than	DTR associated LT SL 66 Borjan Church	43.0	Karbi Anglong	26°13'42.75"N, 93° 2'39.41"E
S-AS-47	Rock-cut Durga at Tilapara	DTR associated LT SL 66 Borjan Church	37.0	Karbi Anglong	26°15'11.53"N, 93° 9'51.35"E
S-AS-48	Rock-cut Ganesa at Boga Doul	DTR associated LT SL 66 Borjan Church	33.0	Karbi Anglong	26°14'15.90"N, 93°10'51.46"E
S-AS-49	Metha-long-A	Baithalangsho SS	10.5	Karbi Anglong	25°52'35.24"N, 92°32'39.01"E
S-AS-50	Ruins at Sikari Rongpi Gaon	DTR associated LT SL 66 Borjan Church	39.0	Karbi Anglong	26°20'43.41"N, 93°24'37.98"E
S-AS-69	Tanks and Rampart	Gunjung SS	13.0	Dima Hasao	25°17'26.41"N, 93° 8'43.84"E
S-AS-70	Rampart Stone Inscription	Gunjung SS	12	Dima Hasao	25°17'28.35"N, 93° 8'41.02"E
Locally important PCR sites					
1	Bichikri Tank/Sacred Pond	Baithalangsho SS	8	West Karbi Anglong	25°57'51.54"N, 92°30'27.14"E
2	Historic cave at Langthor	LT Bare to ABC Lunkhok to Lunkhok	4.8	West Karbi Anglong	25°14'24.80"N, 93° 1'52.60"E
3	Archeological site Lungmaila	Gunjung SS	5.2	West Karbi Anglong	25°21'20.46"N, 93° 1'26.90"E
4	Deopani Durga Mandir	LT Bare to ABC Morakordoiguri	14.5	West Karbi Anglong	26°12'38.81"N, 93°49'41.94"E
5	Asalu Fort	LT Bare to ABC Lunkhok to Lunkhok	15.5	Dima Hasao	25°11'23.62"N, 93°10'32.27"E
6	Raj Pukhuri Naojan	BESS	7.4	Kamrup	26° 6'1.81"N, 91°28'58.48"E

*Nearest components and distances subject to reconfirmation following route alignments and mapping of lines by the EPC contractor

Source: ADB's TA Consultant

Figure 4.29 Map showing ASI, State and Local PCR in and around distribution components
 Distribution Line alignment areas (orange polygons), Substation (blue triangle), PCR (red stars)



Basemap: OpenStreetMap 2024
 Source: ADB's TA Consultant

c. Local culture and festivals

188. The major festivals celebrated in Assam are Bihu, Baishagu, Ali-Ai-Ligang, Baikho, Rongker, Rajini Gabra Harni Gabra, Bohaggiyo Bishu, Ambubashi Mela and Jonbill Mela and so on. The people of Assam also celebrate Holi, Durga Puja, Diwali, Swaraswati Puja, Lakshmi Puja, Kali Puja, Idd, Muharram, Me-Dam-Me-Phi, the birth and death anniversaries of Vaishnava Saints Srimanta Sankardev and Madhabdev. The tribals of Assam have their own colourful festivals like the Kherai Puja of the Bodos, the Baikhu and Pharkantis of the Rabhas, Ali-ai-ligang and Parag of the Mishing tribe, the Sagra-misawa wansawa and Iaghun of the Tiwas.⁷⁸ Classical Assamese music is divided into Borgeet and Ojapali which combines narrative singing with dancing. The music of Oja-pali has a raga system of clear traditional orientation. The traditional crafts like pottery and terracotta work, brass craft, jewellery making, musical instruments making, cane and bamboo craft, silk and cotton weaving, and woodcraft are a major source of employment for the people of Assam. Customs and traditions play a significant role in the society and the Assamese

⁷⁸ <https://culturalaffairs.assam.gov.in/frontimpotentdata/festivals-of-assam#:~:text=The%20major%20festivals%20celebrated%20in,Jonbill%20Mela%20and%20so%20on.>

strictly adhere to the customs laid down by their forefathers, pertaining to their communities. These customs are beliefs that originated in the past and have been followed ever since, generation after generation. The weddings, birth, death and festivals in Assam include many customs that are supposed to be followed by all.

d. Archeological value of the terrain

189. The East Karbi Anglong district is rich in pre-historic sites as evidenced from past and recent findings. Most of the findings are concentrated in the Diphu and Bokajan Sub-Divisions. A rich treasure of image of Ganesh, Kartik and Hara-Gaauri were found in the Devasthan of Howraght. Along with it, tombs with small gate panels images and engraved gate panels were found. A number of door lintels were scattered over the area. The locality shows evidence of ten temples and three Shiva lingas. This region is situated on the boundary dividing Nagaon and Karbi Anglong districts. About 15 km from Howraghat, in Jaljurigaon, remnants of a stone inscription or Sila Lipi, have been reported. According to available information, there is an inscribed copper plate or Tamor Pholi in the neighbouring Eradighalpani village.⁷⁹ Recently, a sword of unknown period has been found in the vicinity of Diphu town in East Karbi Anglong where many of the distribution lines are planned. It was found by some labourers while cutting earth. Specific location for the find is not available. Numerous broken pieces of potteries with designed, pointed knobs were found abundantly with the sword, thus indicating the flourishing of some kind of civilization in the past. The sword has been preserved in the District Museum, Diphu. Recently several elongated stones with faints incised lines had been found in Diphu town. Further exploration in the area has not been done. The elongated stones are worshipped by the public as Shiva Lingas in a temple. However, Directorate of Archaeology has yet to conduct any exploration of the district.

190. Directorate of Archaeology (DoA) has surveyed West Karbi Angalong and identified sites at Ronghan Lindole, the place of residence of the Karbi king with menhirs and megalithic cluster between two banyan trees (25°48'160"N, 92°33'072"E; megalith in Umchera (25°46'261"N, 92°31'371"E); megaliths at Nonjirong village NJG1 25°41'930"N, 92°28'746"E, NJG2 25° 41'791"N, 92°48'798"E), NJG3 (no coordinate), NJG4 (no coordinate); Tapat megalithic site (25°41'253"N, 92°28'460"E; Rongali (Tika) megalithic site (25°41'794"N, 92°28'802"E); Mokoidhrum megalithic site; and Mowsali megalith (25°14'417"N, 92°14'417"E), Muput megalith 25°40'994"N, 92°09'679"E). Due to unawareness of archaeological sites many are destroyed due to jhum or other activities. DoA also notes important archaeological remains at ruins of Mahamaya Pahar, rock inscriptions at Dakshin Bargana, rock cut at Ganesa at Bogadol, ruins at Lung Lok-so, Banlong Kongo (temple), Pub Purung Bhuddist Chowng, Koloni Suntong Monastery, Banlung Kongo (temple), and Dimasa Raja Royal Tank.⁸⁰

191. Dima Hasao district, in which multiple distribution lines is planned, is archaeologically rich and is known for its prehistoric archaeological remains. There are reports on finding celts belonging to Neolithic culture from several localities from the district (Mills and Hutton 1932). The potentiality of the district in prehistoric archaeological remains was justified when a systematic exploration and excavation was taken up in 1961 by a team from Guwahati university (Goswami and Sharma 1962). Besides having prehistoric remains, the district is also known for archaeological remains belonging to medieval period. A fresh survey carried out in 2020 reported four previously-unreported megalithic jar sites, increasing the number from seven to 11 known jar sites, with 10 geolocated. 797 stone jars, in various states of preservation, were found over an area of around 300 km² in Dima Hasao⁸¹. Sites surveyed by

⁷⁹ <https://karbi.wordpress.com/archaeological-evidence/>

⁸⁰ GoA, Directorate of Archaeology (2020) Exploration Report of West Karbi Angalong District, Assam.

⁸¹ <https://www.bbc.com/news/world-asia-india-60937348>

Directorate of Archaeology not included in the above tables include Lungmailai (25° 21'21.3"N, 93°01'26.7"E), Khobak Magalithic site (25° 17'08,0"N, 92°49'24.5"E), Megaliths of Tungje -- prehistoric cairn circle of Tungje 25° 15'41.9"N, 93°22'28.88"E), cist burial at Tungje village (25° 15'28.1"N, 93°22'8.9"E), historic cave at Langthor (25° 14'24.8"N, 93°01'52.6"E).⁸²

192. Based on the available information, there is potential for chance find in both East and West Karbi Anglong and Dima Hasao district.

Key Physical Cultural Resources Features

193. Key PCR features in the PAI are summarized in Table 4.25.

Table 4.25 Summary of key physical features in the PAI by project component

Component	Subproject	Location	Key PCR features in PAI
Substations, BESS	Total 3 existing substations and, one 25 MW BESS facility	Substations in West Karbi Anglong and Dima Hasao District; BESS in Kamrup District, Assam	<ul style="list-style-type: none"> • No ASI monuments are located within 9km of any substation. The Derebara Group of monoliths Dubungling is 9km to the Gunjung substation. The BESS site is at a distance of 7.9km from the state protected Raja Pukhuri Noajan site. • No State protected monuments are located within 10km of any substation, or BESS site. • Locally important cultural and religious places within 500m: nearest cultural site, a Hindu crematory area located adjacent to Baithalangsho substation, whereas graveyard is located 10m from the Umpanai substation. • Nearest Paleontological stone age sites are recorded at 5.2 km at Lungmaila from the Gunjung substation. • Assam has a high potential for undiscovered archeology as per reported data. • Potential for chance finds exists where there is undisturbed land

⁸² GoA, Directorate of Archaeology (2023) Report on Archaeological Exploration and Excavation at Dima Hasao District of Assam.

Component	Subproject	Location	Key PCR features in PAI
546.9 km of 11 kV, and low-tension distribution lines (including DTR associated lines)	<ul style="list-style-type: none"> • Conversion of 11 kV Line to CC: 59 km • Conversion of low tension (0.4 KV) to ABC: 360.75 km • New DTR associated low tension (0.4 KV) as ABC: 87.6 km • New 11kV as covered conductor: 39.5 km 	East Karbi Anglong, West Karbi Anglong and Dima Hasao District	<ul style="list-style-type: none"> • No ASI protected monuments are within 20km of any 11kV or LT distribution lines sampled. • No State protected monuments are within 30km of any 11kV, or LT distribution lines sampled. • Locally important cultural and religious places like temples and churches are located throughout 3 districts and some are within/adjacent to the ROWs, e.g. one DTR and associate line is inside a church compound in Bokhajan 11kV and LT alignment • Potential for chance finds exists where there is undisturbed land; Paleontological stone age sites are recorded in the state

Source: ADB's TA Consultant

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Introduction

194. This section identifies and assesses the potential and perceived environmental impacts and risks that can be expected from the BESS and distribution components of the project. It summarizes the potential impacts and risks identified (Table 5.4), mitigation measures to address those impacts, which are incorporated into the project level Environmental Management Plan (EMP), and the residual impacts which will remain post mitigation.

195. Potential impacts that will occur are site-specific, and few if any of them are irreversible. Environmental impacts and risks on the physical, biological and socioeconomic (including occupational and community health and safety, vulnerable groups, gender inclusion, impacts on livelihood) and physical cultural resources (PCR) in the project's area of influence (PAI) were considered in terms of nature of impact (i.e., direct, or indirect), spatial nature (i.e., within the site/ROW or further), temporal nature (i.e., long/medium/short term), severity, likelihood as well as frequency and cumulative/induced nature of their occurrence. The interventions will have a diverse range of impacts and risks on the environment from both the location of the components and the scope of the proposed works across two distinct phases (i) pre-construction and construction, including survey, detailed design, preparatory works, site or ROW clearance, construction, and installation, and (ii) operation, including maintenance (O&M) as well as decommissioning of the BESS component as described in Chapter III. The preconstruction phase will influence the impacts of the subsequent phases, but it is evaluated along with construction, as it will have minimal impact being mostly desk based with some survey and site investigation. Mitigation for construction and operation will, however, need to be considered upfront during the pre-construction phase. For the purposes of this IEE, the following mitigation hierarchy is adopted, the priority being to first avoid or reduce the source of impacts and then to address the impacts that do occur via mitigation to reduce the significance of the impact, and then as a last resort using compensatory or offset measures.

196. The potential impacts and risks from the BESS and distribution component works were assessed based on available project information, but as detailed design will be undertaken by the EPC Contractor and distribution line routings are only indicative, the IEE report including EMP will need to be revisited and updated after route surveys/detailed design of distribution lines by the EPC contractors is complete. The updated assessment will need to be reviewed and cleared by ADB before commencement of the related works. Preparations for construction include establishing the EPC contractor's environment, health and safety management arrangements (including preparing a contractor's environmental management plan (CEMP)) to ensure mitigation of construction related impacts by the contractor in accordance with the EMP.

B. Methodology

197. The initial step was to identify the potential impacts and risk based on the component activities that may occur across different phases and their nature (i.e., positive, negative, direct, or indirect, cumulative, or induced). The activity – impact/risk interaction matrix is presented in Table 5.1.

198. Following the impact/risk identification, scoping of impact significance (for impacts primarily based on magnitude and for risks based on consequence versus the sensitivity of receptors including workers, local communities, and the surrounding environment) informed

by professional judgement following review of project documents, site visits, meaningful consultations, reference to international good practice guidance and primary and secondary baseline data analysis was conducted as presented in Table 5.4. Significance also considers the likelihood, frequency or duration of the impact and parameters such as: (i) spatial extent (i.e., site specific, localized, or widespread); (ii) temporal nature and reversibility (i.e., temporary during construction, permanent, short term, or long term); (iii) opportunities for mitigation and (vi) legal standards and established international good practice guidelines – i.e., the eventual significance may not directly correspond to a function of magnitude and sensitivity in all cases.

199. For the assessment, impacts and risks have been categorized as being of Maximum, High, Medium, Low or Minimal significance based on Figure 5.1 and Tables 5.2 to 5.3. Significance is determined pre-mitigation but including the standard design features that would be incorporated by APDCL in accordance with national environment, health and safety requirements.

200. Following scoping the impacts of Maximum or High significance were subject to detailed assessment and/or quantification. Impacts of Medium significance also required a thorough understanding to define suitable mitigation measures. Assessment methods used include quantitative, semi-quantitative and qualitative techniques. The assessment of environmental impacts during pre-construction/construction and operation and maintenance (decommissioning) are discussed along with a summary of their recommended mitigation. For the full details of mitigation measures the EMP is to be referred. Mitigation is required for all potential impacts to ensure residual significance is reduced to the extent possible. While sensitivity factors cannot be influenced, mitigation measures can be put in place to decrease the magnitude, likelihood or consequences of impacts and risks to decrease the overall significance. Considering the mitigation measures proposed the environmental impacts and risks have then been re-categorized to reflect their expected post-mitigation levels and estimate residual impacts.

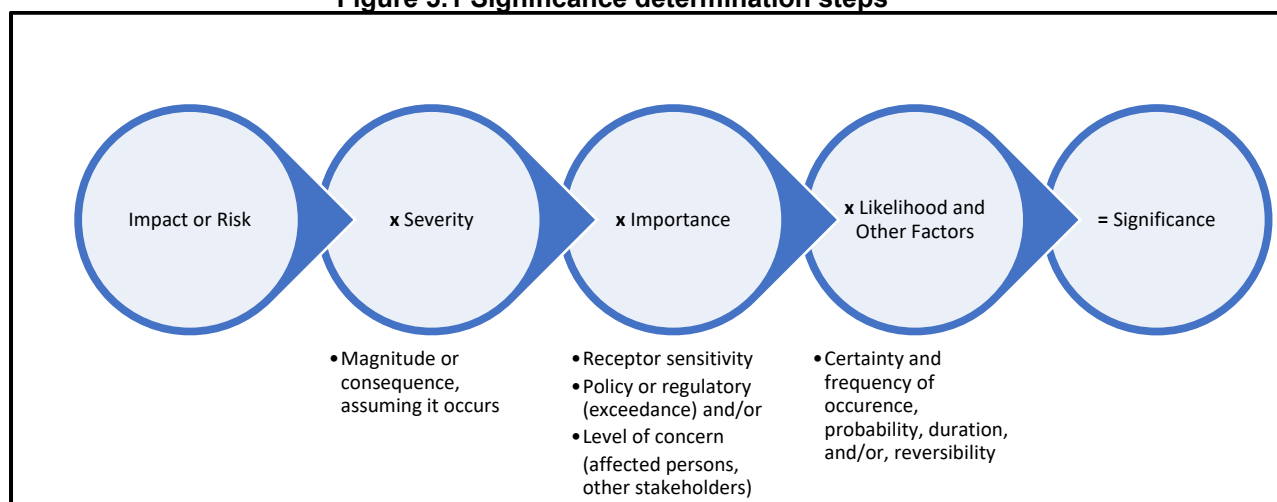
Table 5.1 Output 3 and 4 Activity Impact/Risk Identification Matrix

Component Activities	Environmental Impacts and Risks												
	Biological		Physical							Socio-economic			Physical Cultural Resources
	Vegetation/trees	Wildlife	Topography/Terrain/Drainage	Ambient air quality	Noise and vibration	Soil	Water Resources	Natural resources and waste generation	Climate change	Occupational Health & Safety including discrimination and SEAH in workforce	Community Health and Safety/Labour influx and conflicts	Land and Livelihoods including traffic congestion/ utilities	Physical Cultural Resources
Pre-Construction and Construction													
Detailed design survey work		√								√	√	√	
Labour Influx and establishment accommodations/facilities	√	√	√	√	√	√	√	√		√	√	√	√
Mobilization/transport of construction material and equipment, etc.		√		√	√		√	√		√	√	√	
Storage of materials etc.	√	√	√	√		√	√			√	√	√	√
Substation works including site preparation, excavation, foundation, and construction and installation works	√	√	√	√	√	√	√	√		√	√		√
BESS facility including site preparation, excavation, foundation, and construction and installation works	√	√	√	√	√	√	√	√	√	√	√		√
Selective clearing of vegetation/trees in distribution line ROW	√	√						√		√	√	√	√
Foundations for and erection of poles (OHL)	√	√	√	√	√	√	√	√		√	√	√	√
Stringing/reconductoring activities		√			√			√		√	√	√	
New DTRs installation on poles or ground mounted requiring foundations	√	√	√	√	√	√	√	√		√	√	√	√
Site restoration	√ (+)		√					√					
Operation and Maintenance (Decommissioning)													
Power line presence including transformers		√				√	√			√	√		
Power line maintenance	√	√			√	√	√	√		√	√	√	√
Substation presence/O&M		√			√	√	√	√		√	√		
BESS presence/O&M		√			√	√	√	√	√	√			
Disposal of any defunct equipment/ conductors/ poles/ transformers during O&M						√	√	√		√	√		
Decommissioning of BESS at end of life including the battery disposal	√ (+)	√	√	√	√	√	√	√	√	√	√		

Parameters that are likely to be influenced by output 3 and 4 component activities are marked (√) and (+) – positive impact

Source: ADB's TA Consultant

Figure 5.1 Significance determination steps



Source: ADB's TA Consultant

Table 5.2 Significance Factors

Category	Maximum	High	Medium	Low	Minimal
Factors to determine Severity and Importance:					
Magnitude Change	Very Large	Large	Medium	Small	Very Small (negligible)
Consequence	Critical (catastrophic)	Major	Moderate	Minor	Minimal (negligible)
Receptor Sensitivity	International	National/State	District	Local / Community	Individual
Receptor Resilience and Adaptability	No capacity to absorb proposed changes	Minimal capacity to absorb changes	Some capacity to absorb changes	Good capacity to absorb changes	Very good capacity to absorb changes
Receptor Vulnerability	Far above average vulnerability	Above average vulnerability	Average vulnerability	Below average vulnerability	Far below average vulnerability
Policy or Regulatory (exceedance)	Large	Medium	Small	None	Not Regulated
Level of Concern	Global / National	Regional/State	District	Community	Individual
Factors to determine Likelihood:					
Likelihood	Continuous	Frequent	Occasional	Infrequent	Rare
Probability	Certain	Likely	Possible	Unlikely	Improbable
Duration (temporal extent)	Very long term, > 3 years	Long term, > 1 year	Medium term, < 1 year	Short term, < 1 month	Very short term, < 1 week
Other Factors to determine significance:					
Spatial extent	Far beyond project site boundaries (>500m)	Beyond project site boundaries (<500m)	Immediately adjacent to project site (<50m)	In project site	Confined location in project site
Reversibility	Irreversible	Reversible with effort in long term	Reversible with ease in long term	Reversible with effort in short term	Reversible with ease in short term
Opportunities for mitigation	No or minimal opportunities for mitigation	Few opportunities for mitigation	Some opportunities for mitigation	Several opportunities for mitigation	Numerous opportunities for full mitigation

Category	Maximum	High	Medium	Low	Minimal
Legal standards	Breaches national standards and international good practice guidelines	Complies with international good practice guidelines but breaches more stringent national standards	Complies with national standards but breaches more stringent international good practice guidelines	Meets national standards and international good practice guidelines	Not applicable

Source: ADB's TA Consultant

Table 5.3: Impact and Risk Significance Determination Matrices

Impact Severity	Maximum	High	Medium	Low	Minimal
Receptor Importance					
Maximum	Maximum	Maximum	High	Medium	Medium
High	Maximum	High	Medium	Medium	Low
Medium	High	High	Medium	Low	Low
Low	High	Medium	Low	Low	Minimal
Minimal	Medium	Medium	Low	Minimal	Minimal

Risk Consequence	Maximum	High	Medium	Low	Minimal
Receptor Importance					
Maximum	Maximum	Maximum	High	Medium	Medium
High	Maximum	High	Medium	Medium	Low
Medium	High	High	Medium	Low	Low
Low	High	Medium	Low	Low	Minimal
Minimal	Medium	Medium	Low	Minimal	Minimal

Source: ADB's TA Consultant

C. Environmental Impacts and Mitigation Measures

201. Scoping of impacts to determine impact significance across different phases is presented in Table 5.4. Potentially significant impacts pre-mitigation given further consideration relate to disturbance to trees, vegetation and wildlife during construction, occupational and community health and safety plus hazardous (e-waste) disposal of BESS batteries during its decommissioning. Impacts scoped out as being of low-minimal significance in Table 5.4 are not assessed in further detail within this IEE, although brief description is provided. For potential environmental impacts related to operation and maintenance (O&M) activities including decommissioning of the BESS that are similar but of same or lesser magnitude than those during construction, further assessment was not conducted.

202. Prior to construction, activities undertaken during the detailed design and pre-construction phase will influence the subsequent impacts of the project. Mitigation for construction, including site establishment, mobilization and clearance for construction work, and operational impacts will need to be considered upfront during the detailed design and preconstruction stages. Preparations for construction, including establishing the contractor's environment, health and safety management arrangements to mitigate construction related impacts will occur during pre-construction. This will include the development of a construction environmental management plan (CEMP) and a health and safety risk assessment and plan to provide details on how the contractor plans to implement the EMP and relevant parts of the IFC EHS Guidelines on Construction and Demolition. The CEMP will identify the temporary construction facilities required for the

construction package be that for the substations, BESS or distribution lines e.g., laydown area, stores, temporary workers facilities etc. There will also be surveying of the route alignments and procurement of equipment and materials to transport to the site ready for their installation. No works including site establishment and vegetation clearance will commence on site until APDCL has approved the detailed designs (after having received ADB clearance of their IEE update in respect of final alignments) and CEMP because if not properly planned in the pre-construction stage, the construction phase will have potential significant impacts on the natural and human environment.

Table 5.4 Impact and Risk Scoping Matrix for BESS and Distribution Components

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
BIOLOGICAL ENVIRONMENT							
Vegetation / trees	<p>Presence of workers; storage of material/equipment; clearance of vegetation in grounds of BESS and substation sites for construction; any clearance of vegetation and lopping of tree required along distribution lines to install pole foundations/conductors/DTRs or to maintain safety clearances; trimming of trees during O&M of distribution lines. Whilst, as per APDCL, no tree felling is envisaged, the number of trees to be cut cannot be determined until the route alignments and DTR locations are confirmed by the EPC contractor. Wildlife Sanctuaries will be avoided but some lines in ESZ/Elephant Reserves/Reserved</p>	<p>Construction and to a lesser extent during distribution line O&M and BESS decommissioning</p>	<p>Low to Medium Locally important receptor, mostly modified habitat including BESS and substation sites, but some natural habitat in DL footprint. Natural habitat above average vulnerability as minimal capacity to absorb changes, district concern.</p> <p>High to Maximum Some distribution lines in ESZ/Elephant Reserves/Reserved Forests/KBA/IBA</p> <p>Some critical habitat qualifying plant species including two CR trees and two EN trees are potentially present along distribution lines, critically endangered, endangered and restricted range species triggering critical habitat having</p>	<p>Low to Medium Low to medium magnitude for new DTR associated lines as vegetation clearance is required in the RoW of 1.2m (LT) and 7m (11kV) lines and in footprint of poles and DTRs; new DTR associated distribution lines will mostly be following existing line alignments where vegetation will have been previously cleared, and most sampled alignments were along modified habitats. Low magnitude for</p>	<p>High to Low Adverse (Medium Adverse for 11kV and low-tension lines in natural habitat, High to Medium Adverse for 11kV and low-tension lines in ESZ/Elephant Reserves/Reserved Forests/KBA/IBA)</p>	<p>Yes, including routing to avoid critical habitat qualifying plant species during detailed survey and compensatory plantation for other tree loss as per GoA. In ESZ/Elephant Reserves/Reserved Forests/KBA/IBA only existing ROWs will be followed where vegetation will have previously been cleared.</p>	<p>Medium to Low Adverse (Medium Adverse for 11kV and low-tension lines in natural habitat, ESZ/Elephant Reserves/Reserved Forests/KBA/IBA)</p>

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	Forests/KBA/IBA. Many threatened and endemic species occur in Assam and need detailed survey during distribution line route surveys. Site restoration to have positive impacts.		far above average vulnerability	reconductoring existing lines on same alignment and works in the grounds of existing substations and BESS site. If critical habitat-qualifying species occur along planned ROW, there is potential for irreversible impact on individuals if trees were cut or plants uprooted, but significant impacts are unlikely at the population level.			
	Unintended disturbance to vegetation and trees outside distribution line ROWs and DTR footprints due to construction works, potential for accidental forest fire or illegal	Construction and to a lesser extent during distribution line O&M and BESS decommissioning	Low to Medium Locally important receptor, even if modified habitat in project footprint, there may be some natural habitat beyond the distribution line ROWs in which case there is	Low to Medium Minor to medium consequence if unintended disturbance occurred. Unlikely	High to Low Adverse (Medium Adverse for 11kV and low-tension lines in natural	Yes, full time ecological supervision can ensure disturbance is minimized. In ESZ/Elephant Reserves/Reserved	Medium to Low Adverse (Medium Adverse for 11kV and low-tension lines in natural habitat,

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	cutting of trees or collection of non-timber forest products by workers. Wildlife Sanctuaries will be avoided but some lines in ESZ/Elephant Reserves/Reserved Forests/KBA/IBA. Some threatened and restricted-range-restricted species occur in distribution component districts and need detailed survey during distribution line route surveys. Where existing bare LT and 11kV conductors will be replaced by ABC and CC, this will reduce the risk of accidental forest fire and so have a positive impact.		<p>above average vulnerability as minimal capacity to absorb changes, district importance</p> <p>High to Maximum Some distribution lines in ESZ/Elephant Reserves/Reserved Forests/KBA/IBA</p> <p>Some critical habitat qualifying plant species including two CR trees and two EN trees are potentially present along distribution lines, critically endangered, endangered and restricted range species triggering critical habitat having far above average vulnerability</p>	<p>impacts will occur beyond project footprints and ROWs and most sampled alignments were along modified habitats. But disturbance may occur for some lines and DTRs since not within fenced sites.</p> <p>If critical habitat-qualifying species occur, there is potential for irreversible impact on individuals if trees were cut or plants uprooted, but significant impacts are unlikely at the population level.</p>	habitat, High to Medium Adverse for 11kV and low-tension lines in ESZ/Elephant Reserves/Reserved Forests/KBA/IBA)	Forests/KBA/IBA only existing ROWs will be followed so as not to open up natural habitats to human activities.	ESZ/Elephant Reserves/Reserved Forests/KBA/IBA)
Wildlife	Disturbance of wildlife from works and from	Construction and, to a	Low to Maximum	Low to Medium	High to Low Adverse	Yes. In ESZ/Elephant	Medium to Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	<p>labor influx in area; noise; light; dust; etc.; clearance of vegetation and lopping/trimming of trees can affect nesting birds, including trimming of vegetation during O&M. A number of threatened and restricted-range-restricted species occur in Assam, and confirmation of presence/absence needs detailed survey during distribution line route surveys. Project avoiding undertaking works in wildlife sanctuaries where greatest potential for disturbance to wildlife exists.</p>	<p>lesser extent, during distribution line O&M and BESS decommissioning</p>	<p>Some internationally important mammals/birds/reptiles/one amphibian/fish/invertebrates of global concern are potentially present, critically endangered (birds and reptile), endangered and endemic species triggering critical habitat having far above average vulnerability.</p>	<p>Habitat loss for wildlife is confined to the project footprint. New DTR associated distribution lines will mostly be following existing line alignments minimizing habitat loss and fragmentation. Magnitude of impact beyond project footprints and ROWs will be small in most cases but medium where noisy activities will be undertaken, disturbance may occur for some lines/DTRs especially in those passing through natural habitat, ESZ/Elephant Reserves/Reser</p>	<p>(especially for 11kV and low-tension lines in natural habitat, ESZ/Elephant Reserves/Reserved Forests/KBA/IBA)</p>	<p>Reserves/Reserved Forests/KBA/IBA only existing ROWs will be followed. Full time ecological supervision can ensure disturbance is minimized.</p>	<p>(especially for 11kV and low-tension lines in natural habitat, ESZ/Elephant Reserves/Reserved Forests/KBA/IBA)</p>

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				ved Forests/KBA/IB A. If critical habitat-qualifying species occur, there is potential for irreversible impact on individuals, but significant impacts are unlikely at the population level.			
	Potential wildlife mortality during construction/O&M, e.g., increased risk of road accidents, or illegal hunting and poaching by workers.	Construction and, to a lesser extent, during distribution line O&M	Low to Maximum Some internationally important mammals/birds/reptiles/one amphibians/fish/invertebrates of global concern are potentially present, critically endangered (bird and reptile), endangered, endemic, migratory/congregatory species triggering critical habitat having far above average vulnerability	Low to Moderate Minor to medium consequence if unintended disturbance occurred. Unlikely impacts will occur beyond project footprints and ROWs, but disturbance may occur for some lines and DTRs since not within fenced	High to Low Adverse	Yes. Full time ecological supervision can ensure disturbance is minimized.	Medium to Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				sites. In most cases the consequences will be minor. If critical habitat-qualifying species occur, there is potential for irreversible impact on individuals, but significant impacts are unlikely at the population level.			
	Electrocution and collision risks to wildlife, especially birds, due to overhead conductors (collision) and live electrical infrastructure (electrocution for elephant, climbing wildlife, birds) associated with distribution lines. Only covered conductors and ABC will be used for the project. Where existing bare conductors will be	Operation of overhead distribution lines	Low to Maximum While many potentially impacted species are widespread and common, there are some internationally important receptors of global concern potentially present, critically endangered, endangered, endemic, migratory/congregatory species triggering critical habitat having far above average vulnerability	Low New DTR associated distribution lines will mostly be following existing line alignments so not introducing additional collision risk. Electrocution by climbing wildlife and birds on intact conductors will be avoided due	Medium to Low Adverse (especially for 11kV and low-tension lines in natural habitat, ESZ/Elephant Reserves/Reserved Forests/KBA/IBA)	Yes, distribution lines installed at appropriate height above ground for elephant and safety features maintained to avoid electrocution risk.	Medium to Low Adverse (especially for 11kV and low-tension lines in natural habitat, ESZ/Elephant Reserves/Reserved Forests/KBA/IBA)

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	replaced by covered conductor and ABC, this will reduce the risk of electrocution and so have a positive impact.			to use of CC and ABC. Sagging conductors may be snapped by elephants colliding and exposing the live wire but consequences should be minor since electrocution will only occur if the line is not tripped. If critical habitat-qualifying species occur, there is potential for irreversible impact on individuals, but significant impacts are unlikely at the population level.			
PHYSICAL ENVIRONMENT							
Elevation, topography and drainage	Potential change in topography and terrain during earthworks and installation of foundations for new	Construction and BESS decommissioning	Low to Medium Mostly flat terrain, although some areas have complex terrain. Good capacity to	Minimal Changes in topography and terrain will mostly be of	Low to Minimal Adverse	No	Low to Minimal Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	OHL poles, DTRs, BESS and substation works		absorb changes, but above average vulnerability in complex terrain areas.	very small magnitude as BESS and substations are already having a level construction platform. Pole and DTR footprints are very small.			
	Potential change in drainage patterns and surface water runoff due to construction for BESS (stream at 80m) and to a lesser extent OHL poles, DTRs, and substation works. No alteration to natural drainage flow pattern by earthworks envisaged, although for the BESS introduction of large area of impermeable surfaces will alter the existing greenfield runoff.	Construction and BESS decommissioning	Low Locally important receptor, some capacity to absorb changes	Low to Minimal No substations or BESS support surface water drainage routes to be impacted. Pole and DTR footprints are very small. BESS will result in the most increase in impermeable surface and therefore runoff, but impact will be confined to existing substation compound and no risk of waterlogging or	Low to Minimal Adverse	Yes	Low to Minimal Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				flood risk on adjacent land is envisaged.			
Soil	Excavation and compaction (change in structure) of topsoil and subsoil from installation of foundations for OHL poles, DTR, BESS, substation equipment, as well as soil erosion due to clearance of vegetation and surface water runoff across bare ground, especially during the monsoon season.	Construction and BESS decommissioning	Low to Medium Soils in existing substations below average vulnerability with soils in BESS which is already modified habitat in existing substation compound having some capacity to absorb change. Medium sensitivity in croplands, natural habitat, and areas with complex terrain, community concern	Medium to Low Medium for BESS as soil disturbance to previously undeveloped land within exiting substation compound due to site preparation is envisaged. Small magnitude for substations as soils already disturbed whilst for OHL poles and DTRs which will require some ground work preparations for foundations footprints are small.	Medium to Low Adverse	Yes	Medium to Low Adverse
	Storage of fuel, oil, chemicals during construction, operation, and	Construction and to a lesser extent during		Low to Minimal Minor consequence	Low to Minimal Adverse	Yes	Low to Minimal Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	maintenance works; potential for spills and leaks including transformer oils to result in soil contamination	distribution line O&M and BESS decommissioning Operation of BESS, substations, and DTRs		due to volumes involved and unlikely to impact soils beyond immediate use or storage location, reversible with effort in long term, several opportunities for mitigation			
Water resources	Alteration of surface water resources	Construction and BESS decommissioning	Low Some capacity to absorb changes, no major rivers/streams, surface water resources not used for drinking water, community concern	Minimal Ponds are adjacent to Baithalangsho substation but outside the site. No other substations support surface water to be impacted. Surface water stream is passing 80m from the BESS site. Some DTRs may be in proximity to surface water once mapped. Some distribution lines	Minimal Adverse	No	Minimal Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				are crossing over rivers/streams, including over river bridges. No large waterbodies/wetlands will be crossed where poles would be needed in waterlogged area.			
	Use of water resources including potable water supply for construction and workers; at BESS operational water will be sourced from ground water sources and supplied waters	Construction, operation and BESS decommissioning	Low BESS and distribution components not in water stressed zone, some capacity to absorb changes, community concern	Low Small magnitude as construction works require only a small crew at each site, greatest magnitude for BESS. During operation there will be only a few staff present utilizing the water	Low Adverse	Yes	Low Adverse
	Sediment laden surface water runoff from installation of foundations for OHL poles, DTRs, BESS and substation works causing surface water	Construction and BESS decommissioning	Low Some capacity to absorb changes, no major rivers/streams, surface water resources not used for	Medium to Low There are water bodies in the 500m PAI of the BESS (adjacent stream at 80m)	Low Adverse	Yes	Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	pollution and affecting aquatic ecology		drinking water, community concern Per secondary data analysis surface water quality generally does not meet national standards	and adjacent pond to Baihalangsho substations, but none inside. Distribution lines and DTRs may also have surface water adjacent. Small magnitude of change, any new exceedance of national water quality standards as a result of project works would be very short term, some opportunities for mitigation, reversible with ease in short term			
	Storage of fuel, oil, chemicals during construction, operation, and maintenance works; potential for spills and leaks including transformer oils from	Construction and to a lesser extent during O&M of distribution lines and BESS	Low to Medium Some capacity to absorb changes, no major rivers/streams, surface water resources not used for drinking water,	Medium to Low Moderate consequence due to volumes involved, impact may affect water resources	Medium to Low Adverse	Yes	Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	BESS, substations and DTRs to result in water pollution	decommissioning Operation of BESS, substations and DTRs	groundwater used for drinking water average vulnerability, community concern Per secondary data analysis surface and groundwater quality generally does not meet national standards, only groundwater in some areas is used for drinking	beyond site boundaries, including groundwater, reversible with effort in long term, several opportunities for mitigation.			
	Open defecation or disposal of untreated sanitary effluent from workers sanitation (and any septic tank) to surface or ground water causing water pollution. Gunjung substation has no working sanitary facilities. Other two existing substations already have sanitary facilities so additional wastewater source in respect of operation only arises from the BESS facility and Gunjung substation.	Construction and to a lesser extent during O&M of distribution lines and BESS decommissioning Operation of BESS facility, this will be connected to new sanitary system inside the substation.	Low to Medium Some capacity to absorb changes, no major rivers/streams, surface water resources not used for drinking water, groundwater used for drinking water average vulnerability, community concern Per secondary data analysis surface and groundwater quality generally does not meet national standards, only groundwater in some areas is used for drinking	Moderate to Low Small magnitude as construction works require only a small crew at each project site and during operation there will be only a few staff (6 for BESS) present utilizing sanitary facilities and resulting in wastewater	Medium to Low Adverse	Yes	Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
Ambient air quality	<p>Generation of dust during foundations for OHL poles, DTRs, BESS, and substations; air pollution emissions from construction plant and vehicles travelling to/from project sites. BESS and to a lesser extent substations will involve the most earthworks and have greatest dust impact. Additional emissions from traffic congestion where distribution line ROWs are along roads and settlements and where roads are narrowed/blocked.</p>	Construction and BESS decommissioning	<p>Medium to High Locally sensitive receptors, some capacity to absorb change although vulnerability of school children and other groups along distribution lines may be above average. No sensitive receiver in BESS PAI or at Gunjung and Umpanai SS, but Baithalangsho SS in rural settlement area. Per primary baseline data existing baseline air quality parameter concentrations meet the prescribed national/international standards/guidelines. In more urban area or where road works are taking place the airshed may be degraded in this respect, individual/community concern.</p>	<p>Medium to Low Small magnitude of change in relation to OHL poles, and DTR installation works which are short term and transient. Medium magnitude for BESS and earthworks at substations. Cumulative from ongoing road building/renovation works for lines near highway in East Karbi Anglong-Bokhajan/Diphu. Any exceedance of national air quality standards would be very short term, impact restricted to within and</p>	Medium to Low Adverse	Yes	Medium to Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				immediately adjacent project footprint, some opportunities for mitigation, reversible with ease in short term			
Noise and vibration	Presence of construction workers generating noise, noise from operation of mechanical equipment and plant, material mobilization, and construction vehicles travelling to/from project sites etc. BESS and to a lesser extent substations will involve the most earthworks and have greatest noise impact. There will be increased noise from sites in semi-urban areas from the traffic congestion that results where roads are narrowed/blocked.	Construction and BESS decommissioning	Medium to High Locally sensitive receptors, some capacity to absorb change although vulnerability of school children and other groups may be above average, community concern. No sensitive receiver in BESS PAI or at Gunjung and Umpanai SS, but Baithalangsho SS in rural settlement area. Per site primary baseline data, noise baseline is exceeding national/prescribed standards/guidelines.	Medium Small magnitude of change in relation to OHL poles, and DTR installation works which are short term and transient. Medium magnitude of change in relation to BESS and substation works. Any exceedance of noise standards would be very short term, impact restricted to within and immediately adjacent project footprint with greatest impact	Medium Adverse	Yes	Medium to Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				at Baithalangsho SS where properties adjacent, some opportunities for mitigation, reversible with ease in short term			
	<p>Changes in ambient noise levels— distribution line may produce a small amount of sound energy because of corona and transformer hum from BESS, substations and DTRs.</p> <p>Low level noise from corona becomes most noticeable at higher voltages (345 kV and higher) and in wet/humid conditions compared to project voltages of 11 kV and 0.4kV. Under fair weather conditions corona is rarely noticed.</p>	Operation of distribution lines, substations, and DTRs.		<p>Minimal Very small magnitude of change; existing substation transformer hum recorded to be low and present only within 1-2 m of switch yards</p>	Low Adverse	Yes	Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	No other vibration generation sources and present for the BESS and distribution component						
Natural resources and waste generation	Use of raw materials from existing licensed sources: sand, fuel, oil, chemicals etc.	Construction and to a lesser extent during O&M	Low No policy or regulatory concerns as existing licensed sources will be used	Low Low magnitude in relation to construction materials: several opportunities for mitigation, impact may be beyond site boundaries	Low Adverse	Yes	Low Adverse
	Disposal of inert soil inappropriately on land or in nearby water bodies, including stream in 80m of BESS	Construction and to a lesser extent during O&M and BESS decommissioning	Medium District level concern since may be dumped outside the local community	Low Low magnitude for BESS, substation, distribution lines and DTR; only volumes required for foundations as not cut and fill. Several opportunities for mitigation, impact may be beyond site boundaries	Low Adverse	Yes	Low Adverse
	Disposal of solid wastes inappropriately	Construction and to a	High National/state level	Medium	Medium Adverse	Yes	Medium Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	on land or in nearby water bodies	lesser extent during O&M	concern, two landfill sites/multiple dump sites but no engineered solid waste management facility in Assam	Low magnitude in terms of volumes generated, some opportunities for mitigation, impact may be far beyond site boundaries if not disposed adequately			
	Disposal of hazardous wastes, including mineral oils from transformers and e-waste BESS batteries inappropriately on land or in nearby water bodies	Construction and to a lesser extent during O&M	High National/state level concern as no hazardous waste management facilities in Assam, although state has multiple authorized recyclers/utilizers and reproprocessors	Medium to Low Low magnitude in terms of volumes generated during construction, one existing DTR to be replaced and therefore requiring disposal, defunct BESS batteries will need to be disposed of, some opportunities for mitigation, impact may be	Medium Adverse	Yes	Medium to Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				far beyond site boundaries			
	Disposal of solid and hazardous waste especially e-waste BESS batteries inappropriately on land or in nearby water bodies	BESS decommissioning		High High magnitude in terms of volumes generated and therefore requiring disposal, some opportunities for mitigation, impact may be far beyond site boundaries	High Adverse	Yes	Medium Adverse
Climate Change	No SF6 (a potent GHG) gas-insulated switch gear will be installed at any substations; SF6 in switch gears in new BESS facility	Operation and to a lesser extent during construction (installation and decommissioning for BESS)	Maximum Global/National level concern	Minimal Minimal magnitude at a global scale, leakage is unlikely and rare occurrence unless not managed, some opportunities for mitigation	Medium Adverse	Yes	Medium Adverse
SOCIOECONOMIC ENVIRONMENT							
Occupational (workers) H&S including discrimination and	Unsanitary and unhealthy working conditions including at overnight accommodation provided by employer, leading to	Construction and to a lesser extent during O&M of all components and BESS	Medium to High Individual receptors/concern, average vulnerability, although any under 18s and foreign	High to Medium Major consequence for individual if fatality occurs, but	High to Medium Adverse, pay attention to vulnerable groups who	Yes	Medium Adverse, less likely worst case will occur

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
SEAH in workforce	H&S incidents e.g., slips, trips, falls from height, interactions with equipment and machineries, electrocution, working along or within running road, and human health impacts from dust, noise, handling mineral oils, PCBs or asbestos in existing substations, ponding of water for mosquitos, spread of communicable diseases including malaria and dengue, HIV/AIDS etc.	decommissioning	migrant workers may be above average	only a small number of workers involved during construction and fewer during O&M, rare occurrence, in most cases moderate to low consequences will occur, and several opportunities for mitigation	may be at greater risk		
Community H&S/Labour Influx and Conflicts	Risks to community due to construction activities including construction traffic, storage of materials along roadside and private lands, inappropriate disposal of wastes, presence of open	Construction and to a lesser extent during O&M of all components in public domain and BESS decommissioning	Medium to High Community concern, average vulnerability although IPs and children of above average vulnerability, especially where schools are located adjacent	Medium Major consequence for individual if fatality occurs, but impacts at individual not community level,	Medium Adverse but pay attention to presence of schools/vulnerable groups who may be at greater risk	Yes	Medium Adverse, less likely worst case will occur

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	pits, inadequate warning signs dust, noise, live electricity etc.		to distribution lines (in one case passing through school compound) or DTRs	rare occurrence, and several opportunities for mitigation			
	Increased risk of traffic accidents involving pedestrians and vehicles due to OHL works along road			Medium Major consequence for individual if fatality occurs, but impacts at individual not community level, rare occurrence, and several opportunities for mitigation	Medium Adverse but pay attention to presence of schools/vulnerable groups who may be at greater risk	Yes	Medium Adverse, less likely worst case will occur
	Spread of communicable diseases including HIV/AIDS, and other STDs from presence of migrant workers especially in rural area with risks increased due to transitory nature of the distribution line works.			Medium Major consequence for individual if fatality occurs, but only a small number of workers involved during construction and fewer during O&M, in most cases moderate to low	Medium Adverse	Yes	Medium Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				consequences will occur, impacts at individual not community level, rare occurrence, and several opportunities for mitigation			
	Community interactions and conflict with project workers including sexual exploitation, abuse, and harassment from presence of migrant workers and noise and other disturbance due to works at substations adjacent to crematory and graveyard during funerals			Medium Only a small number of workers are involved, disruption to communities greatest in semi-urban areas and at substations adjacent to crematory/graveyard but noise and the presence of workers would be very short term, some opportunities for mitigation, reversible with ease	Medium Adverse	Yes	Medium Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				in short term			
	Risks to community due to electrocution by coming in contact with live wires, especially during monsoon/flooding, fire risk, EMF exposure, sagging lines, tree branch removal inside private property, coming in contact with DTR/poles, cable break incidents etc. Most concern where property close to or encroaching in existing ROW (40 deaths due to bare conductor electrocution reported in 2022-2023 in Assam) of existing distribution lines along roads/highways of narrow width etc.	Operation		High to Medium Major consequence for individual if fatality occurs, but impacts at individual not community level, rare occurrence, and several opportunities for mitigation	High to Medium Adverse but pay attention to presence of schools/vulnerable groups who may be at greater risk	Yes	Medium Adverse, less likely worst case will occur
Land and livelihoods including traffic congestion	No land acquisition envisaged for OHL, substations and BESS; private land for DTR footprints (if required) will be acquired by project. Direct or indirect damage to community and private	Construction and to a lesser extent O&M of distribution lines	Low to Medium Locally sensitive receptors, most of average vulnerability but IPs and some small businesses and informal vendors may be of above average vulnerability,	Minimal Land acquired through willing seller willing buyer for DTR installations if required. Possible unplanned	Lot to Minimal Adverse	Yes, including compensation for land acquisition and damages in accordance with RIPP, Government Of	Low to Minimal Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	property and road surfaces especially from OHL crossings through private land including agricultural fields (crops)– see RIPP for further assessment of land acquisition and temporary damages		community level concern	damage to private property: croplands in rural areas, buildings in semi-urban locations including from vibration, and where property close to or encroaching in ROW of existing distribution lines along roads/highways of narrow width etc. Since distribution works in autonomous council areas no disproportionate impact on IPs. Impacts at individual not community level. Several opportunities for mitigation.		Assam guidelines and contractor to repair any damage caused	

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	Temporary disturbance and loss of access to business properties resulting in OHL works affecting livelihoods of business along ROWs in built-up/market area of towns			Low Minor consequence at individual level although greater impact in semi-urban and built-up areas. Since distribution works in autonomous council areas no disproportionate impact on IPs. Disruption would be very short term, some opportunities for mitigation, reversible with ease in short term	Low Adverse	Yes, including compensation for any livelihood loss in accordance with RIPP, Government Of Assam guidelines	Low Adverse
	Loss of land / restricted usage under distribution line poles, and conductors (limitations on structures within safety clearance of ROW; etc.) Due to space shortage, many properties alongside of	Operation	Low to Medium Locally sensitive receptors, most of average vulnerability but some IPs and small businesses and informal vendors or households with children and elderly may be of above	Low Minor consequence for individual where property close to or encroaching in ROW of existing	Low Adverse	Yes	Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	the existing ROWs and front porches/entries to shops, etc encroach on the RoW -- see RIPP for further assessment		average vulnerability, individual level concern	distribution lines along roads/highways of narrow width etc. Since distribution works in autonomous council areas no disproportionate impact on IPs. Impacts at individual not community level. Several opportunities for			
	Damage to other public utilities e.g., gas pipes, power lines, telephone lines, water pipelines or sewers	Construction and to a lesser extent O&M of distribution lines	Low Locally sensitive receptors, community level concern	Medium Moderate consequences if damage/breakage to utility occurs because of construction especially in urban area where many people are served,	Low Adverse	Yes	Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				supply to local community hampered until supply restored, rare occurrence, several opportunities for mitigation			
	Temporary loss of power during works affecting existing distribution lines, impact on residences, business, and livelihoods			Low Minor consequence although greater impact in semi-urban area, disruption would be very short term, some opportunities for mitigation, reversible with ease in short term	Low Adverse	Yes	Low Adverse
	Stress on use of community resources and services e.g., water supplies, hospitals	Construction, operation and BESS decommissioning	Medium District level concern	Low Small magnitude as construction works require only a small crew at each project site and during operation there will be only a	Low Adverse	Yes	Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				few staff present utilizing the water resources			
	Traffic congestion including cumulative impacts if existing road works / other activities taking place in parallel with distribution line works adjacent to roads	Construction and to a lesser extent O&M of distribution lines and BESS decommissioning	Medium District level concern	Low Low magnitude as most roads are having low to moderate traffic movement, most lines in rural/semi urban areas with low to moderate traffic flow, congestions along some lines in semi-urban/market areas. Disruption would be very short term, some opportunities for mitigation, reversible with ease in short term	Low Adverse	Yes	Low Adverse
	Employment and micro level economic development opportunities from	Construction and to a lesser extent O&M and	Medium District level concern	Beneficial Very small magnitude of change in	Beneficial	Yes	Beneficial

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
	provision of accommodation for workers etc.	BESS decommissioning		relation to construction as only small number of workers involved			
	Energy supply and security	Operation	Medium to High District/State level concern	Beneficial	Beneficial	n/a	Beneficial
PHYSICAL CULTURAL RESOURCES							
Physical and Cultural resources	Potential risk of damage to physical cultural resources including IP resources (e.g. trees) due to distribution line construction. ASI and State protected monuments have been/will be avoided by distribution components.	Construction and to a lesser extent O&M of distribution lines	Low to Medium Local/community and district importance physical cultural resource receptors, community concern	Medium Possible damage being caused to physical cultural resources immediately adjacent to project footprint, greatest likelihood in semi-urban area from lines and DTRs since not within fenced sites. New and reconducted distribution lines will be following existing distribution line/ROW. No physical cultural	Medium to Low Adverse	Yes, consultation to identify PCR once distribution lines mapped and full time supervision can ensure disturbance is minimized	Medium to Low Adverse

Receptor (IEC)	Rationale for Potential Environment Impacts/Risks	Phases of Project	Importance	Severity (Likelihood and Other Factors)	Significance Prior to Mitigation	Mitigation Incorporated into EMP	Significance Post Mitigation
				resources observed in the footprint of BESS site; substations.			
Chance Finds	Potential risk of damage to undiscovered physical cultural resources e.g., archaeological remains due to construction, especially during new pole/DTR installation on previously undeveloped lands	Construction	Medium Secondary data analysis shows many archeological sites/ruins discovered in recent past. Sensitivity unknown, but likely if any encountered will be at most local/community or district receptor	Low If encountered risk of minor damage before work halted, some opportunities for mitigation but any damage would be irreversible, confined to project footprint, rare occurrence and unlikely to occur at project site	Low Adverse	Yes	Low Adverse

Note: impacts subject to reconfirmation following route surveys and siting of DTRs — once the lines and related facilities have been mapped site-specific assessment and management planning will be required.

APDCL = Assam Power Distribution Company Limited, EMP = environmental management plan, EPC = engineering, procurement and construction, EMF = electromagnetic field, GHG = greenhouse gases, IEE = initial environmental examination, OHL = overhead line, PAI = project area of influence, ROW = right of way, RIPP = resettlement and indigenous peoples plan, SEAH = sexual exploitation, abuse and harassment, WHO = World Health Organization

Source: ADB's TA Consultant

D. Potential Biological Impacts and Mitigation Measures

a. Impacts and Risks

- Based on biological baseline screening (Chapter IV) and the CNHA (**Annexure 3**) the three districts of East and West Karbi Anglong and Dima Hasao, where the substation renovation and distribution lines are planned, can be considered to support Critical Habitat, for four existing and one proposed Wildlife Sanctuary, Reserved Forests, six internationally-recognized sites (KBA), and two ecoregions holding unique assemblages of species associated with key evolutionary processes⁸³. They also support possible, likely or actual support Critical Habitat for 25 globally threatened species, at least 13 restricted-range species, and 12 migratory species (CNHA, 2024).
- This does not mean that Outputs 3 and 4 will necessarily impact any Critical Habitat qualifying biodiversity.
- BESS and distribution component impacts on vegetation and habitats are most likely in relation to the project footprint (including Rights of Way of distribution lines) leading to direct habitat loss and degradation, especially the loss of natural forest habitat. Construction works, especially site establishment, vegetation clearance and earthworks, will have impacts on terrestrial vegetation and habitats. Some indirect impacts related to disturbance may also occur.
- None of the substations nor the BESS site support natural habitat. They are all located within existing AEGCL/APDCL land holdings with the substation habitats having already been highly modified. Site walkovers identified common flora/tree species in and around ROW. No additional ecological studies of these sites are required to determine that impacts on critical habitat features are avoided. The BESS site and Umpanai substation have no trees, while Gunjung and Baithalangsho substations have a few trees, but they will not be felled and are not anticipated to be impacted during construction and/or operation. The ground vegetation of grasses/herbs/shrubs will need to be cleared in switchyard area of Baithalangsho (about 350m²) and Umpanai (about 150m²) substations and the BESS site (about 3200m²) (consisting of common species of grass/shrubs and 2/3 sapling of *Psidium guajava* and *Mangifera indica*). In conclusion, significant habitat loss will not result.
- The BESS site is located inside an existing grid substation, although overlapping the ESZ (given it is on modified habitat within an existing substation compound this is more of a regulatory rather than ecological concern) of the Deepor Beel WLS. The Environment and Forest Department of Assam has been consulted and the BESS is not a prohibited industry per the ESZ notification. The BESS will only be taken up once intimation is sent to the PCCF Wildlife (Assam).
- New and reconductoring using covered conductor or ABC of 11kV and LT lines will mostly be on existing RoW alignments where vegetation should have already been cleared such that pole installation and stringing will have limited direct impact, and significant habitat loss will not result. However, the final route alignments and the location of DTRs will be determined by contractors, following the criteria/principles, set out in Chapter III.
- Screening of all 11kV (indicative routes) and LT lines (in general locations) has confirmed all those included in the final project scope are located outside of wildlife sanctuaries. However, some distribution lines will enter ESZ, Elephant Reserves, Reserved Forests, KBA/IBA or pass through natural forest habitat (defined per SPS 2009 as the biological communities supported are largely native and primary ecological

⁸³ Assam Solar Project: Critical and Natural Habitat Assessment, May 2024





functions (such as timber, soil and water conservation) are still being provided] or the globally outstanding ecoregions hence only covered conductor and ABC will be used.

- As per discussion with APDCL, no trees will need to be cut, although lopping/trimming will be required to achieve the standard safety clearances for distribution lines. Any tree felling will be avoided through minor realignment. Realignment is preferred by APDCL.
- The contractors will undertake an inventory of trees to be lopped/trimmed, prior to APDCL allowing any vegetation clearance. Environment and Forest Department of Assam. approvals required for the tree cutting will be sought pre-construction.
- There is a risk that critical habitat qualifying threatened and restricted-range flora species may occur along the distribution lines and in the DTR footprints and thus be disturbed. Those in the ESZ, Elephant Reserves, Reserved Forests, KBA/IBA, natural habitat and in the globally outstanding ecoregions need particular attention. Site-specific assessment will need to include detailed route surveys conducted by a team that includes a skilled botanist before any works take place. This will need to be followed by re-routing/micrositing of all infrastructure to avoid any critical habitat flora species found during these surveys, prior to any tree lopping/trimming or earthworks, to avoid impacts on them.
- Some indirect impacts related to disturbance may also occur for the BESS, substation, distribution line and DTR construction, and to a lesser extent during O&M works. In addition to clearance of vegetation and lopping/trimming of trees in the project footprint, potential impacts on biodiversity relate to disturbance of adjacent vegetation, disturbance of wildlife due to the presence of people and construction equipment (and associated sound, noise, light, etc.), and mortality (through road vehicle accidents, or if workers are involved in illegal cutting of trees, unauthorized collection of non-timber forest products, hunting or poaching of fauna). The greatest risk for disturbance is in ESZ, Elephant Reserves, Reserved Forests, KBA/IBA, and natural forest habitat areas. Even if outside these areas it is still possible that workers could stray into these areas due to proximity to the OHL.
- Once installed, most infrastructure will have minimal impact. The main operational biodiversity risk is from overhead power lines resulting in collision of birds/bats and electrocution risk for elephant, birds, bats, monkeys or other climbing wildlife from live infrastructure. This includes 27 globally-threatened species, at least 23 restricted-range species, 25 migratory species, four existing and one proposed Wildlife Sanctuary, 34 Reserved Forests⁸⁴, seven internationally-recognized sites (Key Biodiversity Areas), and two ecoregions holding unique assemblages of species associated with key evolutionary processes for which the distribution component districts qualify as critical habitat.
- The existing design of bare conductor distribution lines and poles in Assam presents a high risk of electrocution for medium and large-sized birds and bats, as well as climbing wildlife, including apes and monkeys, and in the case of low hanging lines elephants. As well as the bare conductors, distribution lines also include pole-mounted equipment such as surge arresters, fuses, switches, transformers, reclosers, regulators, and capacitors. If unprotected, this equipment and associated bare jumper wires also pose an electrocution risk. Representative electrocution cases shown in Figure 5.2.

⁸⁴ In Assam, a range of activities are prohibited in Reserved Forests, under national and State legislation. Those activities generally include grazing, tree-felling, farming, and quarrying, among others. Although such protection and prohibitions align well with IUCN Category IV protected areas (Dudley 2008), which aim to protect particular species or habitats (in Assam, the forest habitats), Reserved Forests are not considered legally protected areas by the Government of India. Therefore, while Reserved Forests align with protected area categorization by IUCN, and are thus treated as such within ADB safeguards, they are treated separately in this document.

- Although no bird carcasses were recorded during site visits, and none confirmed by locals or DFO, surveys of similar power lines in western Rajasthan, India, found approximately one avian carcass per four poles (Harness et al, 2013). Scavenging prevents the accurate identification of poles that have caused an electrocution, but it is reasonable to assume that the proportion of poles that are causing an electrocution is far greater.

Figure 5.2. Electrocution cases in Assam

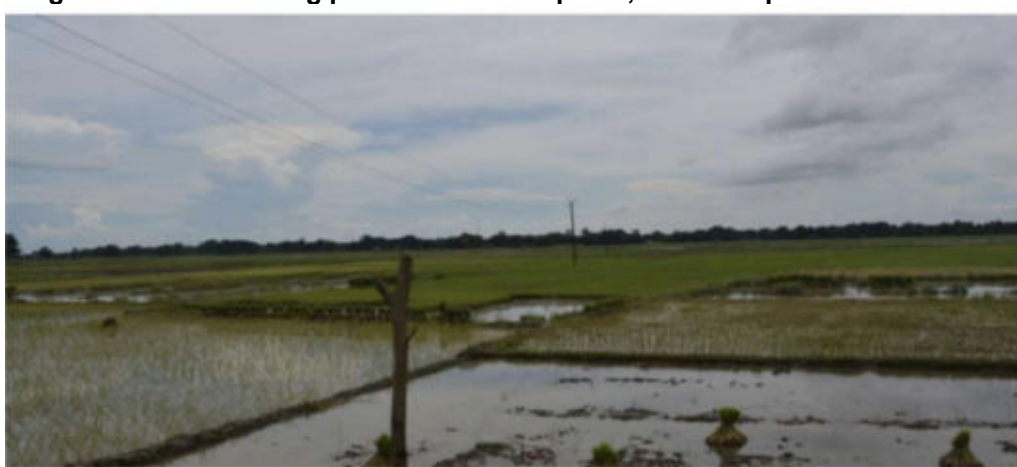
	
<p>Sub-adult male Hoolock Gibbon (<i>Hoolock hoolock</i>) electrocuted at Kachijan village in Doomdooma Reserved Forest in upper Assam Tinsukia. Source: https://hubnetwork.in/assam-hoolock-gibbon-found-dead-due-to-suspected-electrocution-in-tinsukia/</p>	<p>Phayre's leaf monkey (<i>Trachypithecus phayrei</i>) electrocuted near Assam University, Barak Valley Source: https://barakvalleyupdates.com/engendered-monkey-dies-of-electrocution-near-assam-university/</p>
	
<p>Fully grown male Golden langur (<i>Trachypithecus geei</i>) electrocuted in Shibbari, Bongaigaon district Source: https://india.mongabay.com/2020/07/golden-langurs-cling-to-splintered-forests-and-fringe-villages-in-assam/</p>	<p>Two wild adult Asian Elephants (<i>Elephas maximus</i>), a male and a female, electrocuted at Pukdhekhora under Dokmoka range of east forest division in Karbi Anglong district Source: https://thehillstimes.in/assam/wild-elephants-electrocuted-in-karbi-anglong#google_vignette</p>

- According to data available with the Environment and Forest Department of Assam and NGOs (Assam Elephant Foundation) out of the 212 (up to October 2023) Asian elephant (*Elephas maximus*) deaths reported since 2017, 52 died due to electrocution. This is compared to at least 26 elephants dying in train hits, and another 18 dying after being allegedly poisoned by villagers. Although the official reason of death of the remaining 107 elephants remains unknown, NGOs suspect electrocution and poisoning.
- The issue is more profound in Nagaon, Sonitpur and nearby areas mainly due to destruction of forests in Karbi Anglong Hills, where distribution lines are planned. Accidental electrocution reported in these areas of Assam takes place due to

sagging/low hanging power lines (Figure 5.3), broken or damaged poles, unsecured transformers, power line in some areas.⁸⁵

- Electrocutation of wildlife is not only a conservation concern; it also negatively impacts on distribution system reliability because many electrocutions trigger system protection. In certain habitats, wildlife electrocutions are a significant cause of wildfire ignitions.
- Risks will be minimized by only installing covered conductors and ABC with wildlife sensitive design features incorporated (e.g., adequate spacing and insulation, including all accessories) as part of the project to minimize electrocution risk. The replacement of existing uncovered conductors with covered conductors and ABC will also have a beneficial impact by significantly reducing the existing collision and electrocution risk to wildlife.

Figure 5.3 Low hanging power lines in cropland, site of elephant electrocution



Source: https://www.researchgate.net/publication/358138772_Electrocution_of_elephants_in_Assam

203. The overall impact significance of the project pre-mitigation is assessed as **High to Low Adverse** for distribution lines and DTRs depending on final routes; and **Low Adverse** for the BESS and substations. Most distribution lines will have Low Adverse impacts but for powerlines in natural habitat impacts may be **Medium Adverse** with potential for **High Adverse** impacts for 11kV and low-tension lines in ESZ, Elephant Reserves, Reserved Forest, KBA/IBA if existing ROWs were not followed resulting in new vegetation clearance and/or critical habitat qualifying plant species not avoided. If High Adverse impacts were to result these would be **Significant**.

Mitigation

- The detailed route alignments of the various 11kV and LT distribution lines and the location of related equipment will be determined by the contractors, following the criteria/principles set out in Chapter III.
- Since the distribution routes assessed are only indicative and will not be finalized until the contractors are on board, during project implementation site-specific assessment checklist and consultation proformas will be completed by the contractors and verified by the PMC environment safeguards team. It will be for the contractor to decide the final distribution line routes and, since they cannot be avoided in all cases, they need to be aware of routes in close proximity to ESZ, Elephant Reserves, Reserved Forests, KBA/IBA and understand the ecological constraints of the project associated with working in critical habitat, natural forest habitat and the globally outstanding ecoregions.

⁸⁵ https://www.researchgate.net/publication/358138772_Electrocution_of_elephants_in_Assam

- No distribution lines will enter Government of India wildlife sanctuaries, although some may be in close proximity to them. This will be reconfirmed during route surveys by the contractor who will ensure that their final 11kV alignments maintain this position, and that the LT lines also meet the requirement. Distribution lines in their ESZ will only be taken up with intimation to and the confirmation of the Environment and Forest Department of Assam no further permission is required.
- Distribution lines and DTRs in Elephant Reserves and Reserved Forests will only be taken up if wildlife or forest clearance is not required, and once a no objection has been granted by Environment and Forest Department of Assam.
- In the Elephant Reserves, Reserved Forests, and, KBA/IBA distribution lines and DTRs will only be laid in existing RoWs without minor diversions (unless they remain within existing road RoWs) and they are not requiring new access track construction. Only existing roads can be used with manual transport of materials and equipment to pole locations if needed.
- The key mitigation measure will be pre-construction ecological checks along all distribution line routes and of DTR footprints for natural habitat and Critical Habitat-qualifying species by an ecological team including a skilled taxonomist/botanist familiar with the biodiversity of Assam, followed by re-routing/micro-siting of all infrastructure to avoid any such species found during these surveys, prior to vegetation clearance or pole/DTR installation. The results of the ecological walkover survey shall inform the completion of the site-specific assessment checklist to inform any additional assessment and the updated IEE.
- For all distribution lines the District Forest Officers of East and West Karbi Anglong and Dima Hasao will be consulted by the ecologists on potential species occurrence during site specific assessments and actively engaged by APDCL and contractors throughout project implementation.
- Conduct an inventory of trees to be cut/lopped/trimmed prior to the start of vegetation clearance at all sites; avoiding cutting of trees to the extent possible and obtaining permission for lopping/trimming.
- If trees were to be cut, they would be compensated at 1:10 per Gol/GoA requirements based on the number of public trees counted by the contractor to be cut. Rather than undertaking the compensatory reforestation themselves this will be done by Environment and Forest Department of Assam In degraded forest land, and other areas as available. However, APDCL will obtain the locations and regularly monitor the progress of any compensatory reforestation process that it has funded, to ensure that adequate planting takes place such that there is no net loss of the private and public trees overall. Overall, for no net loss of biodiversity the tree types and locations selected need to be matched with the tree/habitat loss they are mitigating for, and that a natural-like habitat not plantation is the result. APDCL will need to work with the Environment and Forest Department of Assam to ensure the compensatory reforestation program is structured in such a way to achieve this outcome.
- Inventory of invasive plant species by an experienced ecologist and in consultation with Forest Officers, and then removal during site clearance (to also be followed by APDCL in O&M during routine vegetation maintenance).
- Ecologists will be employed by the contractors and works at all distribution line and DTR sites requiring tree lopping/trimming or supporting natural forest habitat or in the globally outstanding ecoregions, in the ESZ, or in or within 500m of Elephant Reserves, Reserved Forests, or KBA/IBA will be carried out under full time ecological supervision to minimize disturbance.
- Ecologists will conduct induction and regular awareness training for workers regarding avoiding disturbance to wildlife.
- Demarcation of the working area by the contractor and avoidance of encroachment outside the agreed corridor of impact.

- Outside of existing substations no temporary project facilities including temporary construction camps for workers, maintenance yards, and storage areas for material and equipment shall be established in areas of natural forest habitat, in the ESZ, or in or within 500m of Elephant Reserves, Reserved Forests, or KBA/IBA.
 - No construction works to be undertaken from one hour before dusk to one hour after dawn in areas where there is no existing human disturbances e.g. rural areas away from the RoW of existing roads, in areas of natural forest habitat, in the ESZ, or in or within 500m of Elephant Reserves, Reserved Forests, or KBA/IBA
 - PMU Environment Specialist will be delegated authority under the contract to be able to halt construction works if any wildlife that needs to be rescued is observed.
 - A wildlife identification and rescue protocol will be adopted by the contractor in consultation with DFO/forest officials.
 - Prompt revegetation of disturbed areas on the completion of works with plant species native to the districts.
 - Covered conductor and ABC lines and poles will adopt a “wildlife sensitive design” such that, at the poles, all equipment will be adequately spaced, and live infrastructure insulated in 2m of any earthed infrastructure.
 - Analysis of existing covered conductors and ABC in Assam on which the technical specification will be based has been undertaken (Appendix 14) and with good quality installation will be wildlife sensitive.
- p. Conductors will be mounted at a height of 6m (20 feet) as the standard height from the ground set by the Indian Electricity Rules, but in order to prevent elephant electrocution, the height above the ground at the lowest point of the lowest conductor or grounding wires (i.e., at maximum sag point) of powerlines passing through ESZ, Elephant Reserves, Reserved Forests, elephant corridors, natural habitat, or other areas outside of settlements with known presence or movement of Asian elephants, shall be: a minimum of 20 feet (6.6 metres) above ground on level terrain (slope <20 degrees) or a minimum of 30 feet (9.1 metres) above ground on steeper terrain (slope > 20 degrees).⁸⁶
- DTRs on the distribution lines will also have all live infrastructure insulated in 2m of any earthed infrastructure and all ground mounted transformers will be robustly fenced and secured.
 - In Elephant Reserves, in recognized elephant corridors or other locations suggested for forest officials, installation of reinforced power supply poles with spikes to prevent rubbing of elephant in the post (also as per MOEF&CC notification (project Elephant Division) F.no.12-1/2019-PE-Part I dated 16th September 2022.⁸⁷
 - For operations, APDCL to maintain specified height of the distribution lines, rectification of sagging, and regular monitoring and maintenance of their condition during operation to ensure no broken or damaged pole/lines and all DTRs remain robustly fenced and secured.

Residual Impacts

204. Mitigation measures will be adopted by APDCL and their EPC contractor to ensure no net loss of biodiversity (NNL) is achieved. With mitigation, the residual impact is considered **Medium to Low Adverse** and **Not Significant**. Medium Adverse impacts will remain for powerlines in areas of high biodiversity value, but the mitigation and the achievement of NNL will reduce the magnitude of impact. The replacement of existing uncovered conductors with covered conductors and ABC will also have a beneficial impact by significantly reducing

⁸⁶ <https://moef.gov.in/wp-content/uploads/2018/04/FIRSTDraft-guidelines-roads-and-powerlines.pdf>

⁸⁷

https://wildlife.punjab.gov.in/act_rulepdf/1669970010.Advisory%20on%20implementation%20of%20measures%20to%20mitigate%20the%20impact%20of%20power%20transmission%20lines.pdf

the existing collision and electrocution risk to wildlife.

E. Potential Physical Impacts and Mitigation Measures

205. The construction works especially site establishment, vegetation clearance and earthworks required for the BESS and distribution components, could have impacts on the physical environment. The most significant impact (**High Adverse**) relates to the disposal of BESS batteries upon decommissioning whilst less significant impacts (**Medium Adverse**) relate to changes in soil structure from construction, storage of fuel/oil/chemicals and sanitation affecting the quality of soil and water resources, ambient air quality due to construction works, noise and vibration due to construction works, solid and hazardous waste generation and disposal, and climate change, which are discussed in the following sections. Other physical impacts of the BESS and distribution components pre-mitigation are assessed as **Low to Minimal Adverse** and Not Significant. However, mitigation measures will still be adopted APDCL and their contractor.

206. The EPC contractors will ensure during BESS and substation detailed design, and distribution line route survey, including DTR siting and design, that the final layouts and alignments have not greater impact than predicted by the IEE by having cognizance of international good industry practice per the IFC EHS General Guidelines and Power Transmission and Distribution Sector Guidelines and the presence of adjacent ecological and human receptors. The construction environmental management plan (CEMP) to be prepared by the EPC contractors before construction commences will incorporate mitigation measures required to control impacts on the physical environment during construction elaborating on those included in this section.

a. Elevation, Topography, Drainage and Soils

Impacts

- BESS site and substations are in flat lands and will not require any levelling or cut and fill to be undertaken.
- Earthworks will cause changes in soil structure. Excavation and compaction of the topsoil and subsoil shall occur, and especially at the BESS site the risk of soil erosion is heightened due to clearance of vegetation and surface water runoff across bare ground and potentially into the stream at 80m from the site, especially during the monsoon season.
- Other distribution components will involve very small changes in topography/terrain with 80% of the distribution scope in flat terrain.
- Only small areas of a few meters square will need to be excavated for the distribution line pole (augured) and DTR foundations. Most distribution line alignments are along roads/settlements with already disturbed soil condition although some pass more fertile agricultural land and natural forest habitat.
- Storage of hazardous materials like fuels, oils, chemicals and wastes generated, including requirement for mineral oil for transformers, if not adequate may contaminate the soil. As soil is mostly alluvial in PAI, risk of percolation to lower depths will be present.

207. Overall pre-mitigation the impact on topography/terrain, drainage and soil structure is **Medium to Minimal Adverse** requiring some mitigation (for BESS) but **Not Significant**, the impact is permanent and will remain post-construction except the risk of soil erosion following prompt revegetation of disturbed areas on the completion of works with plant species native to Assam.

Mitigation

208. The CEMP to include:

- In all cases seismic design requirements will be followed. All new infrastructure, including distribution poles and DTRs, to be located away from the banks of rivers/streams and outside of their flood/inundation zones.
- For some distribution lines in complex terrain (Dima Hasao district) slope stability measures will need to be identified during detailed design to minimize the risk of pole uprooting and OHL fall, especially for those poles which will have a slope or embankment on one or both sides.
- The detailed design for the BESS and substations will include provision of effective drainage design to prevent possible flooding or waterlogging whilst attenuating storm water runoff leaving the site to greenfield runoff rates such that there will be minimal changes to the natural flow rates and paths of storm water runoff across adjacent land. Drainage will be designed to route storm water runoff from the sites to existing watercourses or to infiltrate to ground to avoid flooding of nearby areas. The detailed design will incorporate the climate change adaptation measures suggested by the ADB 2024: Climate Risk Assessment (Assam Solar CRA V4, May 2024).
- Minimizing removal of existing vegetation and topsoil, and, promptly revegetating with native species or surfacing any areas where excavation and other earthworks are done
- Excavation and other earthworks will be conducted during the dry season to minimize soil erosion and sedimentation of watercourses although this has potential to exacerbate dust impact.
- Topsoil disturbed will be separately stored and used to restore the surface of the excavated area.
- Infertile and rocky material will where possible be reused as fill material, if it needs to be taken off site it will be disposed by licensed waste management operator at designated disposal area suitable for inert waste. It must be ensured that this inert waste is not contaminated with solid and hazardous waste (including oil spills) by maintaining good housekeeping for the waste segregation/storage/transport/disposal.

b. Water Resources

- Additional water requirement including potable water during construction phase is envisaged, and for the BESS it will also be needed during operation. Distribution line installation will need low quantity of water, substation works and BESS work will need the most water. Water is planned to be sourced from nearby bore wells for distribution lines and substations. For BESS construction existing bore wells inside the grid substation will be utilized, whereas for operations APDCL is planning a new bore well inside the facility. This may impact on surface water allocation although the number of workers at each site will be limited.
- During construction and once operational there will be fuel, oil and chemicals stored at the substations and BESS facility that may be spilt or leak, and from transformers mineral oil may leak. These have the potential to contaminate surface waters and ground water. 11X new transformers and ninety-three new DTRs are being installed under the project. Oils from these transformers may leak or spill during installation. Replacement of one transformer at Gunjung substation and removal of two old and defunct/leaking PTR in Baithalangsho substation also poses a risk of oil leaks during removal.
- Spills and leaks may result in pollutants being picked up by surface water runoff either directly (BESS site at 80m to stream and adjacent to bore well) or indirectly through

the BESS and substation drainage system and entering surface waterbodies or result in infiltration of pollutants to soils and groundwater.

- Additional sanitary wastewater will be generated during construction, including from construction camps, and operation of the BESS. Sanitary wastewater, if not properly treated and disposed, will pollute adjacent surface waterbodies and may contaminate groundwater. However, the amount of sanitary wastewater generated would be limited as construction works and operation will involve only a few workers. In two of the substations existing sewerage systems need maintenance, whereas the one in Baithalangsho is damaged and need repairing, except for the BESS connected gid substation.
- There may also be wastewater from washing of construction equipment and vehicles.

209. The use of water resources and the risk of water pollution during construction or operation is assessed as **Medium to Minimal Adverse** requiring mitigation but **Not Significant**.

Mitigation

- Permissions for any additional or new surface water abstractions or borewell installation shall be obtained including NOC from CGWB together with agreement of local communities before drilling and/or abstraction.
- For the BESS facility a new sewerage system using septic tank and soakaway will be constructed. For substations they will connect to the existing system or if defunct/not available (Gunjung and Baithalangsho) include for provision of adequate on-site sanitation facilities including septic tanks and soak-away pits. Septic tanks with soak aways are to be installed within the APDCL grounds but located at least 50m from any bore well used for drinking water (at 10m for Baithalangsho) and 25m from any pond (at 10m for Baithalangsho).
- Use of pit latrines will be prohibited during both the construction and operation phases.
- To reduce the risk of leaks of spills causing soil or water pollution, and for emergency response, clean-up, and contaminated soil remediation the General EHS Guidelines will be followed including the following measures:
 - All transformers at the BESS and substations and stand-alone, oil cooled ground mounted DTRs will be sited more than 50m from surface water, unless a source-pathway-receptor model shows there will be no adverse impact on aquatic ecology or human health.
 - All transformers will be banded to 110% capacity if oil cooled transformer used but preference will be given to the dry type; this will follow the requirements for soak pit/oil collecting pit beneath transformers in CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022.
 - BESS and substation surface water drainage system to be directed through an oil and grease separator before discharge outside the site.
 - BESS and substation operators will need to be trained in good housekeeping practices including how to clean up oil/fuel spills and dispose of contaminated sorbent material which would be treated as hazardous waste.
- The CEMP to include:
 - Provision of adequate on-site sanitation facilities including septic tanks and soak- away pits 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 treatment and disposal.
 - For the transient works in semi-urban areas access to alternative sanitary facilities (e.g., existing public toilets) that do not allow the untreated disposal of sewage to adjacent water bodies may be provided.

- Sanitation facilities will include an adequate number of toilets (one per six workers) and sinks for the workers
- Same requirement applies to any construction camps; the use of locally hired workers may eliminate the need for the establishment of temporary construction camps by contractors.
- Provision of designated hard standing areas for equipment servicing, refueling and wash down at least 50m from watercourses and wells, with drainage directed through oil and grease interceptors before being discharged into a settling pond prior to discharge offsite.
- Storage of oil, fuels and chemicals and mounting of equipment containing oil and diesel on drip trays to catch leaks.
- Oil spill clean-up materials (sorberent pads, loose sorberent material, etc.) should be stationed at site and stationed in/outside any oil/fuel/chemical storage area in clearly labelled containers.
- Excavated soil will be covered with canvas or tarpaulin when spoil heaps are not active and stored on flat land at least 10m from watercourses.
- No wastewater will be discharged direct to surface waterbodies or groundwater without adequate treatment.
- Use of pit latrines will be prohibited as will open defecation and urination and uncivil use of roads or private premises by construction workers

c. Ambient air quality

- The BESS facility and works at the existing substations will involve the most earthworks and also involve construction in a single location over a period of at least 12 months.
- The construction of the BESS facility will involve the most earthworks in the form of foundations for battery module pads, control building foundation works etc. and have greatest dust impact. The generated dust will remain within the grid substation area. This site is distant from individual residences (closest around 450m) and surrounded by an existing compound wall, although the guest house building is adjacent so impacts on AEGCL staff need to be managed.
- Earthworks at the substations will mostly be grading of the existing ground for gravelling of the switch yards, some foundation work for new bays and cable trenches. This will generate dust, although the dispersion is anticipated to remain within the substation area, although in windy situation it may impact on the adjacent houses at 10m, crematory and graveyard.
- The distribution poles and DTRs will involve only limited earthworks for the installation of foundations mostly in rural areas and any dust generated is unlikely to cause a nuisance outside of the settlements as works are transient, but in settlements especially near residential areas poorly managed construction may result in dust nuisance to adjacent receptors.
- Transport of loose construction materials in uncovered trucks or on unsurfaced roads may also increase the levels of dust. Road conditions are mostly good in Assam, although some roads in rural areas are not paved or with broken shoulders and access to the Gunjung and Baithalangsho substations is unpaved/broken and will generate dust, especially for Baithalangsho, where the access road is used by locals and houses adjacent.
- The temporary use of diesel-powered equipment including diesel generator (DG) sets and movement of construction vehicles may increase vehicular emissions (NO_x, SO₂ and PM)
- Some distribution line works in semi-urban market/dense settlement areas are likely to cause road traffic congestion and thus further increase the levels of dust as well as increasing vehicle emissions.

- Congestion in certain stretches (e.g. 11kV Boarder Feeder and Church Feeder, where works for road widening are ongoing (if still during project implementation) will have a cumulative adverse impact.

210. Overall pre-mitigation the impact of dust is **Medium to Low Adverse** requiring mitigation but **Not Significant**. Ambient air quality impacts will be temporary during construction (up to 12-24 months within BESS and in substation areas) and for the distribution lines transient in nature for only a short period of time; following construction any ambient air quality impacts will be reversible, and the baseline will quickly return to the pre-construction conditions.

Mitigation

211. The CEMP will include the following measures:

- APDCL access roads to existing Gunjung and Baithalangsho substations to be surfaced/repared before any works at the sites commence.
- Minimizing removal of existing vegetation and topsoil, and, promptly revegetating with native species or surfacing any areas where excavation and other earthworks are done.
- Central covered warehouse for storage of construction materials will be provided while construction vehicles transporting stone, sand, and other dust generating materials will be covered with a canvas or tarpaulin.
- Good housekeeping will be required with stockpiles of soil and other dust generating materials kept to a minimum and covered with a canvas or tarpaulin.
- Water to be sprayed using specialized water tankers to suppress dust during works in the vicinity of communities, crematory and graveyard (especially Baithalangsho substation). The water should be sprayed at least twice a day at sites with civil works, and on unpaved access roads and unsurfaced areas adjacent to the distribution lines.
- Soil scattered from pole/DTR installation on pavements and roads shall be immediately swept up to avoid windblown dust.
- For BESS works undertake weekly dust soiling checks of surfaces of adjacent properties (adjacent guest house) during earthworks and help with cleaning of external surfaces of property if dust is evident.
- Vehicles and construction equipment shall be regularly serviced and well maintained
- Vehicles and construction equipment shall comply with statutory emission standards
- Providing workers with N95 dust masks to be worn when dust generating activities take place
- Open burning of construction related waste will be strictly prohibited
- If there is an increase in existing background air pollution or complaints are received contractor will be required to implement additional dust mitigation e.g., barricading/isolating sources of dust, use of wheel wash etc.

d. Ambient noise and vibration

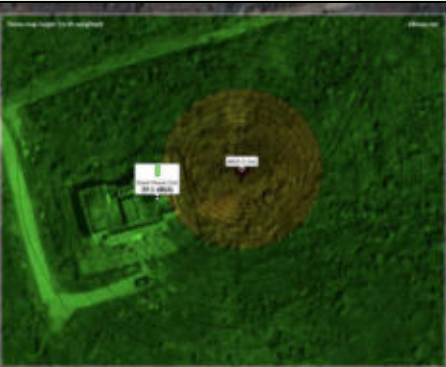
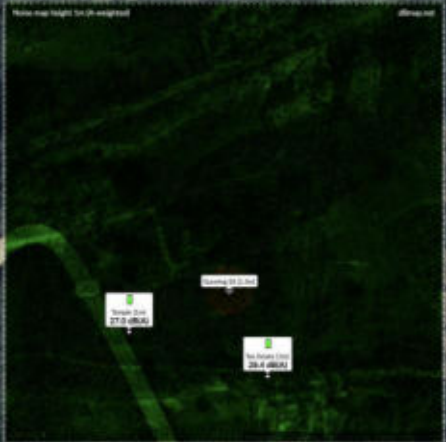
- The BESS facility and works at existing substations will involve the most earthworks and also involve construction in a single location over a period of at least 12 months.
- The use of construction equipment for earthworks and building works and the use of construction vehicles may increase the noise levels in and near the sites. No blasting or piling activities are currently planned.
- The equipment and machinery used for construction activity will produce cumulative noise at the properties depending on the source type, sound power, number, weather condition, distance, and duration of working period.
- No sensitive receivers are in 400m of the BESS site and 60m of the Gunjung substation. Baithalangsho substation is located close (10m) to residential and adjacent

to crematory (sensitive) receptors while Umpanai substation is located at about 10m from a graveyard/cemetery.

- Noise attenuates over distance but at these short distances the construction noise will be experienced at the adjacent receptors for Baithalangsho substation and will need to be managed.

212. To assess the impacts, noise modelling was conducted for the BESS and substations, based on proximity to sensitive receivers and adjacent receptors. The model used a 'worst-case scenario' as it does not consider factors like topography, ground absorption, large obstructions in the propagation path, e.g., barriers etc., refraction of noise, wind speed or direction effects and changing frequencies. Without any facility boundary or other barrier/obstructions, the noise level will propagate and attenuate significantly with distance. For modelling purpose, the cumulative source sound power (Lw) level from activities during construction was taken as 80 dB, but the impact will be greater if the contractor uses construction methods resulting in a greater sound power level than this, although piling and blasting are not currently anticipated. It assumes that all works will be in the day time for these sites; and relevant standards/guidelines are applied. Noise assessment details are provided in Table 5.5.

Table 5.5 Noise assessment

Site	Receptor	Baseline dB(A)	LAeq, T Calculated dB(A)	LAeq, T Cumulative dB(A)	Assessment Criterion, dB(A)	Exceedance, dB(A)	Impact	Noise Map
BESS	Guest House (Residential) 5m	57.2	39	57.2	55 But <3dBA as already exceeded	0	Minimal	
Gunjung substation	Tea estate labour quarters (Residential) 66m	59.9	28	59.9	55 But <3dBA as already exceeded	0	Minimal	
	Local Temple (Sensitive) 60m		27		50 But <3dBA as already exceeded			
Baithalangsho substation	Hindu Crematory (Sensitive) 0m	62	36	62	50 But <3dBA as already exceeded	0	Minimal	
	House 1 (Residential) 10m		34		50			

Site	Receptor	Baseline dB(A)	LAeq, T Calculated dB(A)	LAeq, T Cumulative dB(A)	Assessment Criterion, dB(A)	Exceedance, dB(A)	Impact	Noise Map
					But <3dBA as already exceeded			
	House 2 (Residential) 35m	62	31	62	50 But <3dBA as already exceeded	12	Minimal	
Umpanai substation	Graveyard (Sensitive) 10m	58.2	33	58.2	50.0 But <3dBA as already exceeded	0	Minimal	

Baseline noise source: Hubert Enviro Care Systems Pvt. Ltd.

Assessment criteria Gol vs IFC EHS most stringent for industrial, residential, commercial or silent zone.

Source: ADB's TA Consultant

- The distribution poles will involve limited earthworks for the installation of pole foundations and no drilling; in rural areas any noise generated is unlikely to cause a nuisance outside of the settlements as works are transient but in settlements especially near residential areas poorly managed construction may result in short-term noise nuisance to adjacent receptors. Noise will mostly affect the sensitive receivers located within about 50m if they are not informed in advance of the works and the scheduling of installation is not properly organized.
- Road traffic congestion associated with pole installation and DTRs may further increase the levels of noise from vehicle engines and the honking of horns in congested settlement areas/market areas.
- For the BESS and substations there is also operational noise of transformers to be considered particularly for Baithalangsho substation, given the proximity to residential/sensitive receptors. The humming noise emitted from electric power transformers can constitute a serious environmental annoyance to nearby communities. Because of its tonal component it causes greater annoyance than other noise at the same level. However, at the existing substations transformer hum was recorded to be low and present only within 1m of switch yards so it will only be an issue if transformers are within very close proximity to the adjacent receptors and not well maintained. Internationally recognized EHS guidelines will need to be applied during detailed design of the substation layout, ensuring that noise levels generated from the substations do not exceed statutory limits for residential and silent areas at the site boundary as applicable to the substation site (Table 5.8).

213. Overall pre-mitigation, the impact of noise is **Medium Adverse** requiring mitigation but **Not Significant**. Construction noise impacts will be temporary and for the distribution lines transient in nature for only a short period of time; following construction any noise impacts will be reversible and except for at the substations the baseline will quickly return to the pre-construction conditions.

Mitigation:

- Construction works at the BESS and substations will be acceptable if internationally recognized EHS guidelines are applied during detailed design of the BESS and substation layout. This includes ensuring that noise levels generated do not exceed statutory limits at the site boundary and nearest receptor within/outside the site as applicable to the site (Table 5.6).
- Maximum allowable noise levels for residential areas are 55 dB(A) during daytime (0600–2200hrs) and 45 dB(A) during nighttime (2200–0600hrs) and in silent zones is 50 dB(A) during daytime (0600–2200hrs) and 40 dB(A) during nighttime (2200–0600hrs) and these are not to be exceeded. The layout of the BESS and substations can be designed to keep noisy construction works at the furthest from the adjacent receptors to minimize noise generated from construction activities and their operation. If after detailed design the noise levels at the site boundary will exceed the required noise levels for either daytime (construction) or night-time (operation) (which is not currently anticipated) then an acoustically designed noise barrier will need to be installed around the perimeter to bring the noise level down to the required noise level. This can be temporary for construction noise, but as operational noise is permanent the acoustic noise barrier will need to be a permanent installation as part of the detailed design. Monitoring as per Environmental Monitoring Plan (EMoP) to be conducted.

Table 5.6 Noise Standards and Guidelines in dB(A)

Receptor	GoI Standard LAeq, 24 hr		IFC EHS LAeq, 1 hr		Prescribed Standard to be followed. LAeq, 1 hr	
	Day	Night	Day	Night	Day	Night
Industrial	75	65	70	70	70	65
Commercial	65	55	70	70	65	55
Residential	55	45	55	45	55	45
Silence (at 100m buffer)						
Educational	50	40	-	-	50	40
Health/Medical	50	40	-	-	50	40
Court	50	40	-	-	50	40
Religious Places	50	40	-	-	50	40
Authority Declared	50	40	-	-	50	40

For the operational standard, design to nighttime noise level as substations/BESS operate 24/7

Source: ADB's TA Consultant

- CEMP to include:
 - If works that exceed these noise levels or result in an increase of >3dB(A) compared to the baseline situation cannot be timed to avoid disturbing sensitive receptors temporary noise barriers will be placed around construction equipment. Temporary noise barriers are available that can theoretically reduce noise levels by up to 30dB(A) which would be sufficient to mitigate the noise impact in the sensitive receptors.
 - No noisy works at night, on the weekends, public holidays, religious festivals, and for works in proximity to schools, during exam periods – any noisy works within these periods to only be undertaken with the agreement of local community and residents within 50m.
 - Use of low noise generating equipment e.g., less than 55dBA sound pressure level at 1m
 - Drivers will be required to observe low speed wherever necessary and no blowing of horns.
 - Vehicles and construction equipment shall be regularly serviced and well maintained.
 - Vehicles and construction equipment shall comply with statutory emission standards.
 - Traffic management controls will be implemented to reduce noise from traffic congestion.
 - Construction workers exposure to noise should not exceed the levels set out in the General EHS Guidelines on Occupational Health and Safety otherwise the hearing protection is to be provided.
 - If there is an increase in existing background noise levels >3dBA or complaints are received contractor will be required to implement additional noise mitigation at the construction site.

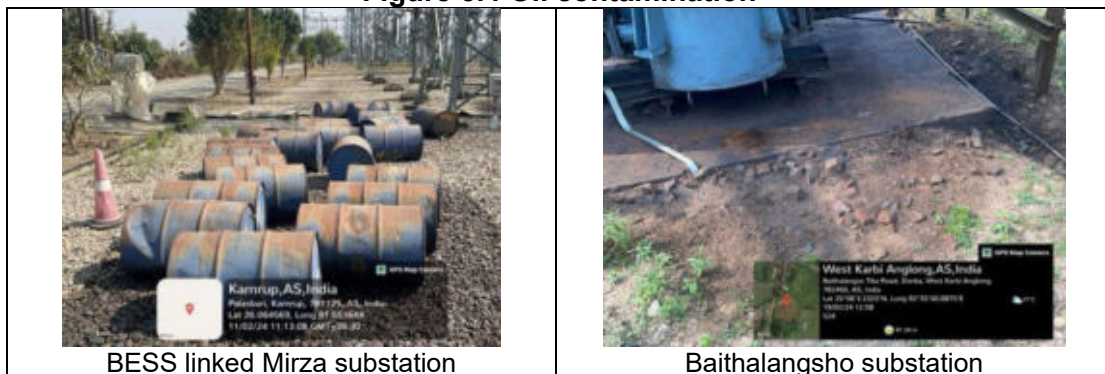
e. Waste generation

- The works at the existing substations and the construction of the BESS facility will involve the most earthworks and generation of wastes. The installation of poles and DTRs will also involve some waste generation, especially as existing RoWs will be used which will require the removal of poles and conductors in some distribution line alignments. Unwanted/damaged cables and poles are usually stored outside of APDCL substation boundaries on vacant private lands and road side until reused/auctioned by APDCL.

- Some hazardous waste may be generated during both construction and operation such as waste oil, oily cloths, and lubricants. Although soil is usually inert, existing substations were observed to have contaminated soil (Figure 5.4) in some cases and so some excavated soil (especially Baithalangsho substation with major contamination) may need to be treated as hazardous waste. If it were inappropriately dumped it could lead to soil and water pollution and be a community health hazard.
- On the existing distribution line, the existing ground mounted transformers are mostly not maintained with some (usually low) levels of leakage and oil contamination observed, so same risk will exist for new DTRs installed under the distribution component.
- For existing distribution transformers there is a concern that those at the existing substations and on the distribution lines may contain PCBs although no UNIDO listed transformers were recorded in any of the substations audited. Some of the distribution transformers will be removed when the new transformers are installed and taken to the APDCL repair workshop. Here they will either be repaired or sent for disposal if beyond repair. PCBs were not manufactured in India although transformers containing PCBs were made by a couple of companies up until 2004-2006 and their import was only banned in 2016. All old transformers must be considered at risk of containing PCBs (refer Table 5.7). However, the risk is significantly lower for transformers manufactured post-2003 since by that time Indian regulations on the reprocessing and recycling of used oil limiting PCB content had been introduced reducing the likelihood of any cross-contamination.⁸⁸
- The most significant impact relates to the use of batteries at the BESS which become defunct during installation, O&M or otherwise require disposal upon decommissioning and end of life. There are 8 battery modules proposed, each containing 2 MWh per module, matched voltage for power conversion system - total 50 nos. which would be considered hazardous waste.
- Damaged Li-ion batteries, if not fully discharged, pose a "stranded energy" risk and are still considered active batteries.

214. The risk from waste generation is assessed as **Medium Adverse** requiring mitigation but **Not Significant**, except in the case of the decommissioning BESS battery waste which is **High Adverse** and **Significant**.

Figure 5.4 Oil contamination



⁸⁸ Hazardous Wastes (Management and Handling) Amendment Rules, 2003 (below detection limit); Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 (<2ppm).



Source: ADB's TA Consultant

Table 5.7 Risk of Existing Transformers Containing Polychlorinated Biphenyls

Risk of containing PCBs	Date of manufacture	Short-term corrective action pre-construction	Long-term corrective action by 2025
High Risk	No date, tampered rating plate, or dating pre-1994 (ceased global manufacture)	Obtain rating plate details, include in inventory – in absence of any documentary evidence PCB free, test transformers	For all transformers ensure well maintained and do not leak. Comply with the Regulation of Use, Handling and Disposal of Polychlorinated Biphenyls prohibition on PCB containing equipment by deadline of 31.12.2025.
High-Medium Risk	Pre-2004 (reuse of waste oils 20.5.03)		
Medium-Low	Post-2003 (reuse of waste oils 20.5.03)	Obtain rating plate details and include in inventory – in absence documentary evidence PCB free, transformers that (i) are of brand listed by UNIDO in Table 5 of their 2014 Guidelines for PCB Waste Identification, Tracking and Recording ⁸⁹ (ii) are poorly maintained and leaking and the project connects to. (iii) are at risk of being disturbed (moved) as a result of project works resulting in oil leakage; or (iv) are poorly maintained and leaking in high-risk locations e.g. adjacent to community water source.	
Low Risk	Post-2016 (national bans import 6.4.16)		

Source: ADB's TA Consultant

Mitigation

- New transformers (in BESS, substations, and as standalone DTRs) will need to be certified PCB free.
- There is no hazardous waste management facility to manage end of life/damaged LFP batteries from BESS in Assam. Decommissioning batteries is of utmost importance due to their hazardous materials. APDCL has planned to have clause with vendors to take them back when defunct/damaged/end of life. To properly handle these batteries during decommissioning, it is essential to ensure the complete discharge of stored

⁸⁹ 2014, UNIDO, GUIDELINES FOR PCBs WASTE IDENTIFICATION, TRACKING AND RECORD KEEPING: [guidelines for PCBs, PCB-containing equipment and waste identification, tracking, and record keeping \(unido.org\)](https://www.unido.org/publications/guidelines-for-pcb-containing-equipment-and-waste-identification-tracking-and-record-keeping)

energy before classifying them as hazardous waste. Decommissioning needs to comply with safety standards and codes - ANSI Z535, IEEE 1578, NFPA 855, NFPA 70. There are no Li-ion battery recyclers in Assam, although the Industry, commerce and public enterprise department is the nodal agency in Assam that promotes collection and recycling of end-of-life batteries. The top Li-ion battery recyclers in India include Attero Recycling, Ziptrax Cleantech, Lohum Cleantech, ACE Green Recycling, and BatX Energies, with plants based near Delhi (~1850km) and Mumbai (~2570km).

- Government of India regulations permit the use of existing PCB containing equipment up until 2025 provided it is within its certified lifetime and properly maintained without possibility of leakage or release of PCBs into the environment with disposal of waste PCBs or contaminated equipment by 2028 in accordance with the Stockholm Convention.⁹⁰ Under Government of India regulations APDCL should have an inventory of PCB containing transformers based on manufacturer information or testing of oil. The most suitable way to determine if PCB is present is for a suitably qualified institute to sample and analyze the oil following United Nations Environment Protection Agency (UNEP) Guidelines for the identification of PCB and materials containing PCB and a health and safety risk assessment and plan referring to the measures in PCB transformers and capacitors: From Management to Reclassification and Disposal as well as the latest UNEP (2023) Guidance for development of PCB inventories and analysis of PCB, Secretariat of the Basel, Rotterdam and Stockholm conventions. It is not recommended to take an oil sample for hermetically sealed oil distribution transformers since the transformer itself is fully closed to the environmental condition, but conservator type transformers can be tested in the field. The hermetically sealed transformers can be tested once at the repair workshop by APDCL. In the absence of Transformer Oil Test data, the date of manufacturing can be used to compare with the PCB risk matrix to ascertain risk.
- Given the 2025 deadline for removal which coincides with the date of the project APDCL will have the responsibility to replace any existing transformers which contain PCBs, as per international good practice and in compliance with the ban by the Government of India on 6 April 2016. Once transformers have been found to contain PCBs they must be labelled as such, any PCB storage areas should also be marked to allow expeditious identification and response to a PCB accident. Similarly, transformers found to be PCB free should be marked as such for future reference of compliance with Government of India regulations and the log of test results to support this kept by APDCL.
- No asbestos containing materials must be used during the construction for roofing, etc.
- The CEMP to include:
 - Provision of construction waste and domestic solid waste collection and disposal system.
 - Solid and hazardous waste (including damaged/defunct BESS battery) generated during construction will be limited in volume but should be temporarily stored on site in segregated, labeled, sealed, and covered garbage bins.
 - Solid and hazardous waste will need to be handed over to authorized third-party vendors (in Assam (licensed reproprocessors/utilizers) or Registered battery recyclers of LFP batteries in India (Delhi/Noise/Mumbai) or West Bengal (nearest engineered facility for hazardous waste) for environmentally safe and sound disposal through approved reuses or recycling or disposal to licensed engineered waste management facilities – available facilities detailed in the baseline Chapter IV. Based on the type of waste handled the third-party

⁹⁰ 2016, MOEF&CC: [S.O. 1327\(E\) \[06-04-2016\] : Notification on Regulation of Polychlorinated Biphenyls\(PCBs\) Order, 2016](#) | [The Official Website of Ministry of Environment, Forest and Climate Change, Government of India \(moef.gov.in\)](#)

vendors will need to be approved by PCB Assam for the transport, storage, and disposal of either solid or hazardous waste including transformer oil and PCBs.

- Records of materials used, generated waste, and transfer records will be kept by the contractor.
- Any vegetation material that is not handed over to a landowner will be immediately disposed using appropriately licensed waste management operator.
- Existing BESS linked substation, other substation sites and DTRs with soil contamination/exposed to oil leakage to be assessed for potential contamination and appropriate removal and/or remediation measures for any oil or PCB contamination of soils implemented, as addressed in the section on contaminated land contained in the General EHS Guidelines.
- APDCL and contractors involved with disposal of oil waste and any old transformers will be required to follow the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 for transport, storage, and disposal of potentially PCB oil containing transformers.
- Disposal must involve facilities capable of safely transporting (closed trucks) and disposing of hazardous waste containing PCBs. In stores or other designated storage areas, the transformers will need to be stored on a bunded concrete pad or drip tray enough to contain 110% of the liquid contents should they spill or leak. The storage area should also ideally have a roof to prevent precipitation from collecting in the storage area.

f. Climate Change and Risk

215. Given low to medium voltage components and because substations are air and not gas insulated, only small volumes of SF₆ may be used in the in RMU/switchgears in the BESS. SF₆ is a potent Green House Gas. It has a global warming potential 23,900 times greater than CO₂. Due to its high global warming potential, SF₆ contributes to climate change if it is released into the atmosphere during installation, operation, maintenance or during end-of-life disposal. The amount of SF₆ contained in switchgear equipment varies greatly according to type and manufacturer. Major leak of SF₆ from project-installed equipment is the worst-case scenario but could easily occur during operation if equipment is not well maintained, or at end of life if the equipment is not appropriately disposed.

216. Although leakage of SF₆ is rare and unlikely, and the worst-case SF₆ release from the project will be negligible in percentage terms compared to the 36 billion annuals global CO₂e emissions, as climate change is a global issue the impact is assessed as **Medium Adverse** requiring mitigation but **Not Significant**. Climate vulnerability risk assessment is provided in Chapter III, with major risks being extreme rainfall events, high winds, earthquakes and forest fires.

Mitigation

- Use of solid insulation in preference to SF₆ insulated equipment for circuit breakers in bay extensions at substations and BESS (circuit breakers/RMU). If no alternative the use of SF₆ must be minimized as part of design requirements. Design will comply with international norms and standards for handling, storage, and management of SF₆.
- Any equipment containing SF₆ will be enclosed hermetically to ensure leakage will be minimal during operation -- "sealed for life" units, tested and guaranteed by the supplier at less than 0.1% leakage rate.
- Provide SF₆ leakage detector at BESS.
- SF₆ in fire extinguishers provided at substations and BESS to also be avoided.
- During O&M APDCL will need to monitor leakage rates if such event take place and provide training to O&M staff on SF₆ management.

- APDCL will need to ensure end-of-life circuit breakers are appropriately disposed by a certified industrial waste management company who will need to remove SF6 and treat the equipment prior to disposal in accordance with International Electrotechnical Commission (IEC) standard 61634 to ensure SF6 is not released to atmosphere - recovered SF6 to be reused, recycled, or destroyed in a high-temperature incinerator.

F. Potential Socio-economic Impacts and Mitigation Measures

a. Land use, Livelihoods and Access Restrictions

- The substations and BESS sites are in AEGCL/APDCL land and already industrial in nature whilst the planned distribution lines are mostly in existing ROWs, so no land use changes are anticipated. For the new DTRs, poles and lines, some private areas may be used as per APDCL. Refer Figure 5.4 showing existing distribution lines crossing private properties in PAI. Some lines/poles will pass in croplands, existing ROWs, although no land use changes will occur, but some damage to crops will take place, if standing crops are present. The land acquisition and compensation for temporary damages in such cases will be conducted in accordance with the Resettlement and Indigenous Peoples Plan.
- Impacts will be due to construction of the distribution lines include damage to private and public properties as many of the existing ROWs are passing through private lands/houses market areas/shops; interference with other utilities like existing OHL power lines (many already touch each other during monsoon/windy conditions); traffic congestion and blockage of access ways to residences and business will occur during construction; and temporary power outages during installations.
- Most roads in rural area and market/settlement areas are relatively narrow, and some in bad condition, and movement of large trucks along these roads carrying the electric cables/transformers/panels/poles and other materials might cause temporary blockage and nuisance to the locals. The BESS site is located close to a wide main road and connecting roads are highway, hence there is room for transporting battery modules and other equipment, although movement of cranes for installing of battery modules may cause traffic congestion and damage roads.
- Some sections of distribution lines will traverse narrow single/two-lane densely populated settlement areas (especially in Diphu and Haflong towns) which can cause interference to the normal flow of traffic. As there may be limited space for the temporary storage of the materials, the contractor may park vehicles/trucks carrying these materials on the road/side further causing traffic congestion and hazards to pedestrian and vehicle commuters.
- The substations and BESS facility are accessible from existing village roads, urban main roads and/or state highway paved roads at distance varying in the range of 5m-50m. All sites have access roads connecting with the main road. Some of the access roads are unpaved and/or in need of repair. Poor condition and unpaved access roads need to be surfaced to connect these substations (Baithalangsho and Gunjung) with existing paved roads.
- Construction traffic to and from the sites will be minor and periodic in nature although large vehicles will be required for equipment transport. However, care needs to be taken to avoid damage and disturbance to properties along the access route with consultation before works start to inform on the extent of work and schedules.
- Potential negative impacts include inconvenience during O&M works for the local community when there may be power outages for maintenance, which may affect business and residences although this impact would be short term and already being done for the existing system.

217. Overall, the construction of the BESS and distribution components will have **Low to**

Minimal Adverse impacts that are **Not Significant** to land use and livelihoods of the local community although these impacts will need to be well managed to avoid conflict situation with the local community especially as all distribution lines in Autonomous/IP Council areas. The impact of the BESS and distribution component on the socio-economic environment will be beneficial as improved access to uninterrupted electricity supply will help stimulate economic growth, particularly in rural areas of the state. During operation, benefits to local people can be maximized if APDCL recruits local persons for the few semi-skilled and unskilled positions at the BESS facility.

Figure 5.5 Lines and private land use



Source: ADB's TA consultant

Mitigation

- The EPC contractors will ensure during route surveys that the final alignments have not greater impact than predicted by the IEE.
- Per national regulations it is mandatory for APDCL to seek requisite clearances prior to construction from agencies like, departments of roads, telecommunication, and wherever necessary, from railway authorities that could be affected by the construction of power distribution infrastructure.
- The CEMP to be prepared by the EPC contractors before construction commences will incorporate mitigation measures required to manage land and livelihood related impacts (as per RIPP) during construction elaborating on those included in this IEE

and the EMP. It will include a construction traffic management sub-plan (especially for lines in the congested/market and ongoing highway widening ROWs), as to minimize adverse impacts of the project on traffic, the contractor will be required to properly plan and execute a traffic management plan in accordance with national regulations and the IFC General EHS Guidelines that is supported by good site supervision.

- The CEMP will be including the following measures:
 - Ongoing consultation is to be taken up along with disclosure of BESS and distribution component impacts and activities.
 - GRM to be operational, and all stakeholders to be aware of it, including how to register grievances.
 - Community awareness raising regarding the BESS and distribution component with concerned local government authorities and media dissemination for all communities living and working nearby so they know what to expect.
 - Conflict situations to be avoided by early consultation before the start of work and keeping open communication channels throughout.
 - In case there is a need for temporary storage, locations to be agreed and any impacts on private land and assets to be compensated in line with national requirements. Cut vegetation, excavated soil, replaced conductors and poles will need to be stored away from the running road, croplands and habitation.
 - Contractors will be required to ensure that safe access ways to public and private amenities are maintained throughout the construction period.
 - Traffic management will need to be done in consultation with the affected communities to ensure they are aware of likely disruption.
 - Post warning signs and manage traffic movements to protect the travelling public and its workers as necessary and ensure drivers obey road rules and travel at a safe speed given the nature of local roads in some areas and size of vehicles involved. Road safety and warning signs must be posted at 500m, 100m, and immediately in advance of the distribution line works at least two weeks prior to the works commencing to inform the public of turning vehicles and the temporary blockage of one lane of the road during pole installation works.
 - For congested and narrow roads flagmen should be utilized to warn road users of the situation.
 - If stringing conductors presents a possible risk to traffic on roads, and community for lines over residents, scaffolds will be constructed to protect locals, pedestrians and vehicles (and the conductor itself) from potential injury/damage during conductor stringing.
 - During construction, benefits to local people can be maximized if the contractor recruit's construction workers locally. However, precedence must be given to ensuring that all workers are appropriately skilled given the hazardous nature of distribution works and so local workers will be limited to few unskilled positions.
 - Wherever possible, the contractor should not discriminate and should proactively encourage the employment of suitably skilled women on the project.

b. Occupational health and safety

- The renovation of existing substations, the construction of the new BESS facility and installation of 11kV and LT lines including works for the DTRs present occupational health and safety risks (also refer Figure 5.6) including from unsanitary and unhealthy working conditions including at overnight accommodation provided by employer, leading to H&S incidents/accidents e.g., slips, trips, falls from height, interactions with equipment and machineries, electrocution, working along or within running roads, working in complex terrain in some areas of west Karbi Anglong, heavy monsoon, flooding and human health impacts from dust, noise, handling mineral oils, PCBs or

asbestos in existing substations or in existing DTRs, ponding of water for mosquitos, spread of communicable diseases, HIV/AIDS etc. If not managed injuries are likely to occur.

- Due to construction works for distribution lines being undertaken along roads, some of which are busy, they may give rise to slow moving traffic and congestion increasing the risk of a traffic incident involving workers. Some stream/river (dry and perennial), river bridge crossings, although in flat terrain, also pose a risk related to working over or near water.
- Other health and safety risks to construction workers include exposure to vector borne diseases such as malaria, dengue, exposure to communicable diseases, such as COVID-19, exposure to hazardous chemicals including PCB exposure risk, unsanitary conditions at the work sites and in overnight accommodation provided by their employer, toppling of poles and falls from height, working in complex terrain and slopes, electrocutions, dust, and noise exposure etc.
- The existing health services in the parts (West Karbi Anglong and parts of Dima Hasao) of Assam that are rural/remote may not be able to accommodate additional patients from the construction workforce during emergencies.

Figure 5.6 Occupational H&S Risks



- The main occupational health and safety issues inherent to the operation of the BESS, substations and distribution lines include hazards due to exposure of workers to live power lines, working at heights, and potential exposure to electric and magnetic fields. Government of India has no limits of exposure to electric and magnetic fields. However, international exposure limits will be applied to the project (**Appendix 6**).

- In terms of operation, every year many electricity workers are killed or disabled in India due to electrical accidents due to accidental contact with live wire/equipment, violation/neglect of safety measures, defective equipment, lack of supervision etc. The quality of existing installations (Figure 5.7) is cause of concern in terms of poor installation increasing exposure to OHS risks.

218. Overall, pre-mitigation the BESS and distribution components pose a **High to Medium Adverse** risk which is Significant to the health and safety of workers. The probability of an incident resulting in fatality will be higher if appropriate health and safety measures are not enforced.

Figure 5.7 Quality of distribution installation infrastructure and H&S



Source: ADB's TA consultant

Mitigation

- The EPC contractors will ensure during existing substation and the new BESS detailed design and route surveys for distribution lines that the final layouts and alignments have not greater risk to occupational health and safety than predicted by the IEE by having cognizance of international good industry practice per the IFC EHS General Guidelines and Power Transmission and Distribution Sector Guidelines, CEA requirements and Assam Electricity Regulatory Commissions (AERC) requirements, recommendations and notifications.
- As per AREC File No. AERC. 639/2017⁹¹, Petition No. 15/2017, dated 18.09.2017, the technical persons of ADPCL like supervisors, lineman, etc. are to possess the requisite

⁹¹ <https://aerc.gov.in/orders/1671183166.pdf>

technical qualification and undergo different safety trainings from time to time. The training institute of APDCL imparts training to its engineers, technicians from time to time.

- There will be hired staff for operation of the NGEAL JV arrangement, based at the new BESS during upon operation and therefore the detailed design must ensure adequate sanitation and welfare facilities are incorporated into the buildings at the site. Sanitation and welfare facilities should meet the requirements of the IFC EHS General Guidelines,⁹² EBRD,⁹³ and ILO⁹⁴.
- CLS to be followed especially Fundamental Conventions:⁹⁵, Forced Labor, Equal Remuneration, Abolition of Forced Labor, Minimum Age and Worst Forms of Child Labor
- The assessment of the transformer manufacturing date against the UNIDO guidance was conducted for the 3 substations and BESS grid connected substation and none are at high risk of containing PCBs; but since PCBs are toxic and bio accumulative unless transformers have been certified PCB free all workers working with existing transformers must avoid all exposure to skin and eyes and avoid any potential for accidental ingestion by wearing suitable chemical and/or oil resistant gloves, goggles, and protective clothing during sampling processes and under normal working conditions. If PCBs meets the skin, immediately rinse the affected area with large amounts of running water. This may be done in a sink if the hands are the only portion of the body contacted or under a safety shower if the exposure area is more extensive. If large parts of the skin came in contact with PCBs, remove contaminated clothing while under the shower for a minimum of 15 minutes. Eyewash stations are required. Once equipment has been found to contain PCBs it must be labeled as such, any PCB storage areas should also be marked to allow expeditious identification and response to a PCB accident. Similarly, equipment found to be PCB free should be marked as such for future reference and log of test results to support this kept by APDCL. Specific procedures for the management of PCB containing oils must be followed by APDCL and contractors, based on good international industry practice, as elaborated in internationally accepted guidance documents produced by the Conference of the Parties to the Stockholm Convention on Persistent Organic Pollutants.
- There are no records of any asbestos survey conducted by APDCL/AEGCL, but no asbestos materials were observed during audits in the substations. However, as some of the substation (especially Baithalangsho) structures are old and because of the health risks associated with exposure to asbestos dust, which is carcinogenic, the potential presence of asbestos needs to be surveyed by the contractor as part of their occupational health and safety risk assessment using competent third party before any works disturbing existing substations and BESS connected grid substation. If any asbestos is encountered at any of the existing substations and is at risk of being disturbed by construction work and exposing workers to asbestos dust it must be safely removed and treated as hazardous waste. There are no national acts or regulations banning the use of asbestos in construction but use of any asbestos containing materials by the contractor will be prohibited.
- The CEMP will include an occupational health and safety risk assessment and management plan including an emergency response plan to be developed in accordance with national regulations, the project EMP and IFC EHS Guidelines and ILO guidance and approved by APDCL of NGEAL prior to works. The risk assessment should be undertaken through a facilitated risk assessment workshop involving contractor, APDCL, NGEAL for the BESS, and PMC. The occupational health and

⁹² <https://www.ifc.org/wps/wcm/connect/1d19c1ab-3ef8-42d4-bd6b-cb79648af3fe/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES&CVID=nPtgxyx>

⁹³ https://www.ebrd.com/downloads/about/sustainability/Workers_accomodation.pdf

⁹⁴ <https://www.ilo.org/publications/workers-housing>

⁹⁵ https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11200:0::NO::P11200_COUNTRY_ID:102691

safety plan should follow the health and safety hierarchy including measures set out in the IFC EHS General Guidelines on Occupational Health and Safety and those on Electric Power Transmission and Distribution. The emergency response plan will be including emergency response and preparedness procedures, communication systems and protocols to report any emergency, including interaction with commune and provincial emergency and health authorities. Communication channels and protocols with local and regional emergency and health authorities will need to be established in case of an incident. CEMP H&S sub-plans will include the following measures:

- Provision of personal protective equipment (PPE) such as hard hats and safety gloves/boots for every worker (with use mandatory and subject to no work conditions if not compliant) as a last resort where risks cannot be avoided.
 - Provide readily available first-aid for workers as well as an ambulance for more serious cases.
 - Orientation regarding not to leave project footprint and potential risks of working close to state borders (Diphu-Nagaland border). The PAI is not disputed but Assam filed Original Suit No. 2/1988 before the Honorable Supreme Court for identification of the state boundary and resolving of border disputes with Nagaland. The matter is now in the trial stage before the Honorable Supreme Court of India.
 - Hire local workers and staff as far as possible especially as all distribution component works in Autonomous/IP Council areas.
 - Consider the use of security personnel, capacity development, trainings and awareness raisings, feedback to ensure workers comply with the code of conduct especially adjacent to the Nagaland state border and in other areas with a higher conflict risk.
 - All workers will receive health and safety induction and those working with live electricity and at heights will attend specialist health and safety trainings and be certified to do so following medical check. Untrained workers will not be permitted to work with live electricity or at height.
 - Live lines will be deactivated and properly grounded before work is performed on, or in proximity, to the lines and this will be checked and certified in writing by the contractor's Health and Safety Officer in advance.
 - While working at heights personal safety measures such as harnesses, tool bags, ropes etc. will need to be provided.
 - Sufficient toilets (one per six workers) and hand washing facilities, clean eating area, and shaded rest area to accommodate the number of workers on site must be accessible at all construction sites.
 - Drinking water that meets Government of India drinking water standards must be provided, if an authorized supplier of canned water is not used the source must be regularly tested to confirm it meets these standards.
 - If a construction camp is provided it must be similarly adequately equipped with sufficient toilets, hand washing facilities, showers or baths, food preparation and clean eating area, etc.
- PMU H&S Specialist/EHSS will be delegated authority under the contract to be able to halt construction works if occupational health and safety risk that poses a risk to life is present.
 - Given the operational occupational health and safety risks once facilities are handed over to APDCL they will need to adopt the following measures:

- APDCL to be guided by the “Environmental, Health, and Safety Guidelines – Electric Power Transmission and Distribution” (IFC 2007) when working with distribution components.
- Risk assessment and occupational health and safety plan for the maintenance of substations, BESS, and distribution lines will be developed and adhered to during their operation. Emergency situations considered will include fire and electrocution of workers.⁹⁶
- Training program for all workers on substation and BESS sites and responsible for maintenance of distribution lines including DTRs to be provided.
- O&M to be performed only by adequately and regularly trained and experienced staff of NGEAL/APDCL’s at BESS and various Division and Sub-division Offices under supervision of a Health and Safety Officer.
- Workers to observe guidelines to minimum approach distances for tools, vehicles, pruning, and other activities when working around power lines.
- Restricting working at height only by workers who are trained and certified to do so.
- Testing of structural integrity prior to proceeding with the work and the use of fall protection measures such as harnesses, tool bags, ropes etc.
- Restricting access to electrical equipment only by workers who are trained and certified to work on electrical equipment.
- Proper grounding and deactivation of live power lines during maintenance work or when working near the lines.
- Provision of PPE for workers, safety guidelines, personal safety devices such as harnesses, tool bags, ropes etc., and other precautions.
- For O&M staff occupational health and safety measures include ensuring they are not exposed to excess EMF in line with international guideline levels (**Appendix 6**).
- Sanitation and welfare facilities as per construction will also be required for maintenance workers.

c. Community health and safety

- All substation and BESS site are already within APDCL/AEGCL compounds and fenced, although the Baithalngsho substation boundary needs reconstruction/repair before construction starts. Thus, they will therefore not be accessible to the public.
- The operation of the distribution lines which are mostly near community areas/settlements may expose the locals to electrocution hazards because of direct contact with live conductors or flashover from the conductor to a pole, particularly if the person, tree, or structure is near a live line where the safe horizontal or vertical clearances are compromised.
- Indian Electricity Rules and Regulations provide for safety clearances to the ground, roads and habitations to ensure safety of human beings and livestock moving, living, or working in the vicinity of distribution networks which in some instances are not currently met.
- Minor rerouting where safety clearances are not currently met and the use of covered conductor and ABC where existing lines are reconducted reduces health and safety risks and is beneficial to the population.
- Presence of overhead distribution lines (conversion of 11kV bare to covered conversion, ABC LT lines and DTR associated covered/ABC 11kV and LT lines) in settlement areas, will reduce exposure of the local communities to fire risks, EMF, and potential electrocution during storms if wires snap and poles fall on houses and roads

⁹⁶ Including an emergency response plan with emergency response and preparedness procedures, communication systems and protocols to report any emergency, including interaction with commune and provincial emergency and health authorities.

etc. Houses made of flammable material roofs and walls like wood, in rural areas of distribution component districts, are at particular risk from fire hazards from cable snapping and exposure of live wire due to break and such fires may easily result in fatalities.

- In terms of operation, every year many members of the public are killed or disabled in India due to electrical accidents due to snapping of conductors, accidental contact with live wire/equipment, violation/neglect of safety measures, defective equipment, inadequate maintenance, and unauthorized works. About 40 locals have died due to electrocution in the state of Assam in Financial Year 2022-2023, as per APDCL records. The major causes that led to electrocution deaths were short circuits, snapping of live wires during floods and waterlogging, and poorly installed electricity poles⁹⁷.
- As with OHS the quality of existing installations in the public domain is cause of concern in terms of poor installation and non-maintenance/regular checks, increasing exposure to risks. Very few APDCL ground mounted transformers, as observed during site visits, are fenced but not maintained/damaged.
- To protect against EMF the International Commission for Non- Ionizing Radiation Protection (ICNIRP) for the public (up to 24 hours a day) will be adopted (**Appendix 6**). EMF levels associated with distribution lines are significantly lower than those associated with overhead transmission lines. EMF levels associated with distribution lines are significantly lower than those associated with overhead transmission lines. The EMF from distribution networks can vary widely depending upon the number of phases. A US study states typical 11kV overhead distribution line with 300amps current can result in magnetic field of 22mG immediately below the line dropping to 15mG at 7.5m from the line and 8mG at 14m distance. In the UK for an 11kV line under the line itself the maximum magnetic field is 7uT and the electric field is 700V/m, but typically 0.2-0.5uT and 200V/m. This is well below the applicable guideline levels in Appendix 6. Therefore, the health impact of the electric field is negligible. The impact of EMF is dependent on the duration of exposure but provided the ICNIRP guideline levels are complied with for community exposure to the distribution components no significant adverse impacts are envisaged.
- Potential nuisance to nearby properties during construction includes dust, noise and vibration, from earthworks and the operation of construction equipment, and the passage of heavy vehicles transporting materials to the sites.
- Some of the distribution lines will pass through agricultural and other private land, but in many cases the distribution lines will follow routes along existing road RoWs as well as over private land/houses/shops, such that activities will mostly be performed in the road corridor, but some in private lands.
- The use of roadside and adjacent spaces during construction works will cause traffic congestion and increase the risk of a traffic incident in some of the busy market areas. Sample photographs of ROW housing/commercial activities in the route alignments are shown in Figure 5.8. Since works are in the public domain, impacts on the community during construction works may include health and safety incidents due to the presence of open pole/DTR foundation pit, road blockages and congestion, exposure to pollution and wastes, conflicts with workers and staff of APDCL due to sexual exploitation, or harassment of locals by workers, spread of communicable diseases like STDs, and cultural conflicts in project areas.
- There could be occasional cases (as seen during site visits) where dilapidated/hanging/twisted distribution poles need to be replaced, poles are currently located on private property, or lines do not comply with safety clearances. In the semi-urban areas/settlement they will be in very close proximity to nearby residences, businesses, etc. Many houses and shop/business porches have been built under the

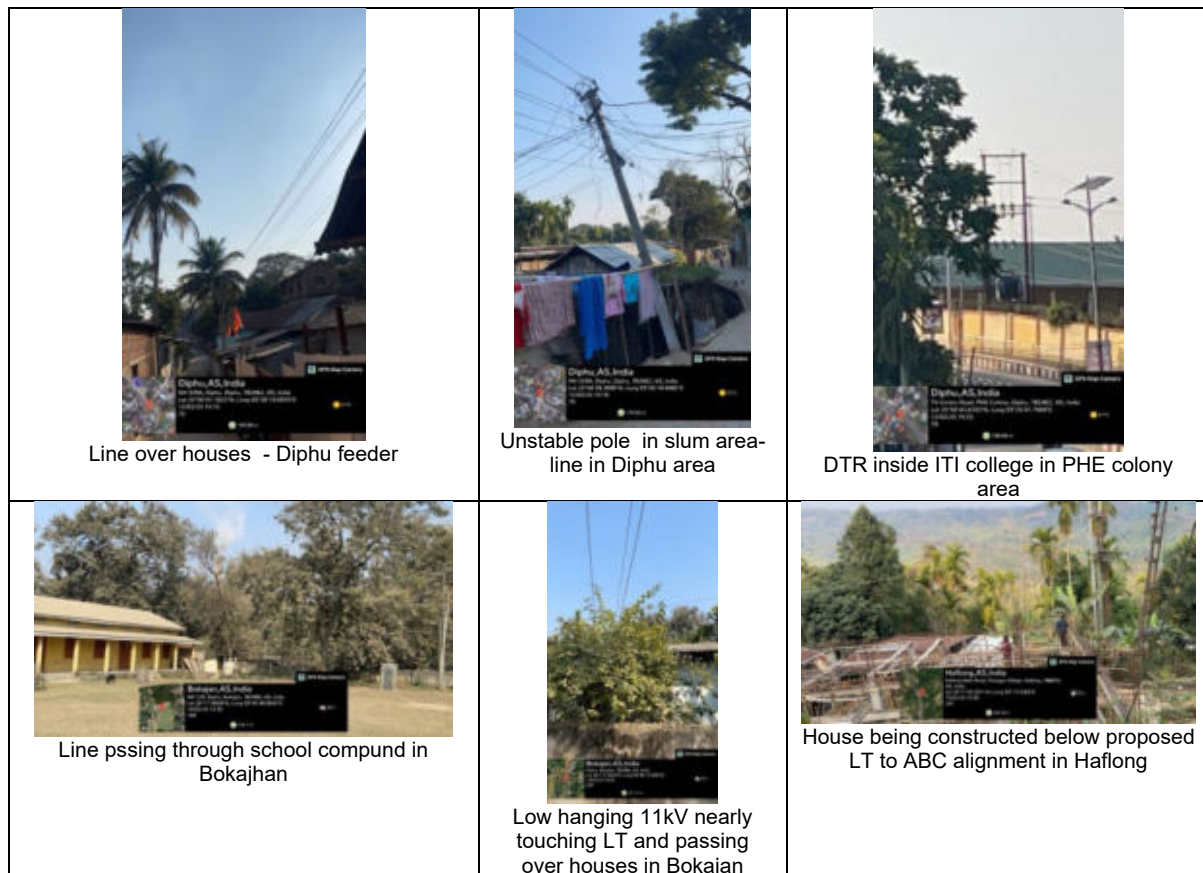
⁹⁷ <https://timesofindia.indiatimes.com/city/guwahati/40-died-of-electrocution-in-assam-this-financial-year-apdcl-data/articleshow/95132649.cms>

power lines and still ongoing as observed during site visit, thus increasing vulnerability, and violating the safety clearances. Poles and lines will be removed and stored temporarily on site/along the roads (existing case). Although existing RoW will be used to undertake such activities, working in private properties will increase potential risk for incidents or conflicts between the public and workers. Already multiple applications have been made to APDCL for removal of poles/lines from private property which needs to be taken into account.

- The risks from the distribution line works are short term given the transient nature of distribution line works concentrated on each short section and activities being for a relatively short time. However, they will be greater if communities are not informed in advance about the works and appropriate health and safety measures (e.g., dust and noise management, community awareness, hazard warning boards for on-going construction activities, temporary works boundary fences, and traffic management controls) are not enforced at the construction sites.

Figure 5.8 Community H&S Risks Associated with Distribution Line ROW and Operation of Distribution Network





Source: ADB's TA consultant

- Overall, pre-mitigation, the distribution components poses a **High to Medium Adverse** risk which may be significant to the health and safety of local communities especially vulnerable groups (children) in some sites if safety clearances are not maintained, but overall would be not significant. The probability of an incident resulting in fatality will be higher if appropriate health and safety measures are not enforced by the EPC contractor and APDCL.

Mitigation

- The EPC contractors will ensure during existing substation, new BESS detailed design and route surveys for distribution lines that the final layouts and alignments have not greater risk to community health and safety than predicted by the IEE by having cognizance of international good industry practice per the IFC EHS General Guidelines and Power Transmission and Distribution Sector Guidelines. Community health and safety measures e.g., fencing and signage will be incorporated into the detailed design:
 - Lightning arresters to be provided along the lines.
 - There should also be provision for ensuring security of the cable to avoid damage.
 - Each pole should also have installed a sign warning about the safety hazard from the power lines, for ground mounted transformers these should be fenced off with a locked gate.
- In all cases including conversion of distribution lines where safety clearances are currently encroached upon the minimum electrical clearance, as required by the Indian Electricity Rules and Regulations⁹⁸ are to be maintained with respect to the ground, roads and habitations, to ensure safety of human beings and livestock in the vicinity of the distribution lines.

⁹⁸ DGMS, 1956: [Microsoft Word - New Microsoft Word Document.doc \(dgms.net\)](#)

- If safety distances are found not to be complied with during reconductoring the distribution line will have a realignment to facilitate compliance.
- In addition to these safety clearances, given greater vulnerability of children to health and safety risk, the crossing of school compounds and playgrounds will be avoided by routing new distribution lines outside them and any other similar community facilities during survey work. For any lines within 5m of such facilities the arrangement plan will be included in the site-specific assessment checklist, to inform the updated IEE, following detailed route surveys being completed during detailed design. Existing distribution lines being reconductored which cross school compounds, playgrounds and other similar community facilities will also be realigned to ensure that the same requirements as for new lines are met. The arrangements plan for any such realignments will be included in the site-specific assessment checklist, to inform the updated IEE following detailed route surveys being completed by the contractor.
- Once operational, APDCL staff need to conduct regular inspections (at least monthly) on the distribution lines to ensure that the clearances are maintained. The inspection protocol should include possible conductor snapping and de-energizing of the line within three cycles to avoid the potential for electrocution from a breakage.
- The community needs to be educated by the contractor and APDCL with respect to the importance of maintaining the horizontal clearance from buildings in order that they do not erect new buildings within this zone as has reportedly occurred in all the instances where safety clearances are breached.
- The CEMP will include a community health and safety risk assessment and management plan including an emergency response plan to be developed in accordance with national regulations, the project EMP and IFC EHS Guidelines and approved by APDCL or NGEAL prior to works. The risk assessment should be undertaken through a facilitated risk assessment workshop involving contractor, APDCL, NGEAL for the BESS, and PMC. The community health and safety plan should follow the health and safety hierarchy including measures set out in the IFC EHS General Guidelines on Community Health and Safety and those on Electric Power Transmission and Distribution. The emergency response plan will be including emergency response and preparedness procedures, communication systems and protocols to report any emergency, including interaction with commune and provincial emergency and health authorities. Communication channels and protocols with local and regional emergency and health authorities will need to be established in case of an incident. CEMP H&S sub-plans will include the following measures:
 - Measures for the physical environment will be adopted to reduce disturbance; notably construction works will be restricted to daytime unless in agreement with the local community adjacent, so the noise limit is 55dB(A) in residential areas and 50dB(A) in silent areas.
 - If works are not completed within the day the contractor must not leave any hazardous conditions (e.g., unsigned, unfenced, and unlit open pits without means of escape and emergency contacts in case an accident occurs) overnight unless absolutely no access by public can be ensured.
 - Construction workers including subcontractors will be given awareness raising in HIV/AIDS, other communicable diseases, and sexual, exploitation, abuse, and harassment with strict penalties (e.g., immediate removal from site) for any. Contractors staff will also be given awareness raising in HIV/AIDS and sexual, exploitation, abuse, and harassment.
 - Contractor and APDCL (its training institute staff can be used for local awareness meetings) with the support of CSOs/External experts and Institutions/NGOs as part of its regular health and safety practices to organize health and safety campaigns prior to construction regarding construction risks and from coming into contact with live electrical equipment prior to energizing

- the distribution lines as well as in relation to smart meters about how to avoid electrical incidents.
- Awareness programs will use distribution of social media, posters, leaflets, and safety booklets to all households in Assamese/Hindi/Karbi and other local languages within 500m substations and new BESS facility, and 50m of OHL distribution line ROWs and DTR sites as well as face-to-face orientation at the village/community level. These posters and safety booklets will be available within substations, BESS and local electrical offices of APDCL.
 - PMU H&S Specialist/EHSS will be delegated authority under the contract to be able to halt construction works if community health and safety risk that poses a risk to life is present.
 - Given the operational community health and safety risks once facilities are handed over to APDCL they will need to adopt the following measures:
 - Risk assessment and community health and safety plan for the maintenance of BESS, substations and distribution lines will be developed and adhered to during their operation. Emergency situations considered will include fire and electrocution of members of the public.
 - APDCL with the support of CSOs/External experts and Institutions/NGOs as part of its regular health and safety practices to continue to organize health and safety campaigns for the community to be educated with respect to the hazards associated with meeting electrical equipment.
 - In case of fire events, explosion, and other related situations, given the APDCL may not be available immediately in rural/remote locations or in case roads are damaged due to flooding, etc., the community should be educated with respect to emergency response with 24/7 emergency contact numbers for APDCL included on signs; APDCL will need to ensure this is manned 24/7 to ensure that it is effective reporting route.
 - All fenced ground mounted DTRs will be kept locked with warning signs and emergency procedures as they are being installed on the public street or close to them.
 - Regular inspections of the line and the facilities would help identify missing or damaged/corroded parts that need immediate replacement.

G. Potential Physical Cultural Impacts and Mitigation Measures

219. The potential impacts on physical cultural resources include potential damage to existing structures and potential for undiscovered underground resources during earthworks for pole/DTR. Presence of religious and cultural places is anticipated along distribution line routes (refer Figure 5.9), which need to be inventoried with details after route alignments are surveyed and finalized. Based on baseline analysis (Chapter IV) the distribution component districts have some hilly terrain/natural habitats and there have been recent finds, it is although unlikely that chance find will occur as most pole/DTR in existing ROW and modified habitat, although a chance find procedure will still be adopted.

a. World Heritage Sites and National/State Monuments

220. There are no international, national or state important archaeological, historical, religious areas in and around the substation and BESS sites or along the indicative OHL alignments/PAI. For those routes not mapped yet, this is to be confirmed during the survey of the alignment. No distribution lines are/will be within 300m of national/state protected monuments.

b. Impacts on other physical cultural resources

221. Local PCRs such as temples and churches and archaeological sites such as monoliths are found in the wider project area as discussed in Chapter IV under baseline and some lines are passing over them. There may also be IP physical cultural resources present. Although no potential damage is anticipated to such structures or sites, movement of construction vehicles, dust and noise is anticipated disturbing users. The distribution lines could have visual impact/create visual clutter in the vicinity of physical cultural resources. However, there are existing power lines and telecommunication lines in towns/villages and along the road RoW in most locations so the new and converted lines will not be a new component in the landscape.

c. Chance finds

222. It is also possible that chance finds could occur during excavation works for all components.

Figure 5.9 Local PCR in visited ROWs



Source: ADB's TA consultant

223. Overall, pre-mitigation the BESS distribution components poses **Medium to Low Adverse** risk which is **Not Significant** to impacts on physical cultural resources.

Mitigation

- EPC contractors will ensure during route surveys that the final alignments do not have any impact greater than predicted in the IEE, including ensuring that none of distribution lines pass through ASI sites or their regulated zone of 300m. The detailed route surveys of the 11kV / low tension distribution lines will need to confirm this in the case with the completion of the site-specific assessment checklist to inform the updated IEE before any works commence.
- EPC Contractor for all components will be required to conduct an inventory of physical cultural resources in and adjacent to the RoW and within 500m of substations and BESS prior to the start of any works. This will be collated in consultation with local communities including indigenous peoples. Directorate of Archaeology will also be consulted. Where any PCR is identified within the RoW they will be demarcated and where any are found to be directly impacted, due to their presence within the RoW micro-alignment changes will be made to avoid impacts to the sites. Visual impacts/amount of visual clutter will be managed through sensitive route alignment of overhead cables and DTR.
- Demarcation of the working area by the contractor and avoidance of encroachment
- outside the agreed corridor of impact. All local PCR adjacent to worksites will be identified and temporary barriers placed around them to ensure no damage by equipment and machinery.
- No temporary or permanent project facilities shall be established within the ASI and state protected monuments or their regulated zone.
- PMU Environment Safeguards Officer will be delegated authority under the contract to be able to halt construction works if any damage to known physical cultural resources is caused or chance finds are encountered.
- A Chance Find Procedure will be developed for implementation for all distribution components in the event physical cultural resources are found. The procedure will include at least the following:
 - If suspected physical cultural resources are encountered, all works at the find site should be immediately halted and local administration (Autonomous Council, Block Development Officer/Sub Divisional Officer) to be informed.
 - The find should be assessed by a competent local official managing cultural issues (Directorate of Archaeological Assam), and procedures to avoid, minimize or mitigate impacts to such physical cultural objects should be agreed in writing with them.
 - Work should not begin until the procedures to avoid, minimize or mitigate impacts to the physical cultural resources have been agreed and implemented in full.
 - If avoidance is not feasible, and no alternatives to removal exist, and the project benefits outweigh the anticipated cultural heritage loss from removal which is unlikely unless in case of resource of local value, following clearance of ADB the physical cultural resources should be removed and preserved using the best available technique in accordance with relevant provisions of national heritage protection laws and decrees.
 - Records should be maintained of all finds, including chain of custody instructions for movable finds.
 - All construction workers to be made aware of the chance-find procedure and types of finds to be reported.

H. Post-Mitigation (Residual) Impacts

224. Overall post mitigation impact significance is provided (refer the last column of the matrix) in the Table 5.4, there are no significant residual impacts.

I. Cumulative and Induced Impacts

225. Cumulative impacts are defined as the combination of multiple impacts from ongoing projects/works, the proposed intervention, 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.

226. The new BESS and substation works will take place on APDCL land but distribution line activities, including construction, will mostly take place along existing power line and road ROWs and in East and West Karbi Anglong and Dima Hasao district. A detailed assessment of other ongoing or planned activities is not possible at this stage. However, during the distribution line site visits, it was observed that along one stretch of planned line, highways widening is ongoing. This is contributing to clearance of vegetation including trees, air pollution, especially dust, noise, soil erosion, and waste generation, with the storage of wastes, spoil from earthworks and construction materials along the highway ROW, thus decreasing the effective width of the road for use by pedestrians and traffic. It was also observed that no environmental management is being implemented on site for these works.

227. Cumulative impacts are anticipated in such ROWs where roads and other activities are ongoing and/or planned in the future in parallel with the planned distribution line work implementation. Impacts would mainly relate to construction works increasing the significance of those impacts predicted from the distribution lines alone: vegetation clearance, dust generation, noise emission, soil erosion, sediment flow along steep roads, and occupational and community health risks from reducing the effective width of the road and affecting people's access and traffic flows. Possible conflicts among workers along with workers on the other works may also take place.

228. To manage these impacts the EPC contractor will be required to coordinate with road authority and other utility sectors having planned works. O&M impacts may occur when other works/activities do not pay respect to the presence of the distribution line and damage it, which could expose their workers to electrocution risk as well as increasing risks to others from the damaged distribution line. APDCL can provide awareness raising to road and other utility sectors (contractors) regarding safe working practices around its distribution lines and undertake regular inspections and maintenance to identify any damage that has been caused. Output 4 will add to the quantum of distribution lines in Assam. However, for the most part although classed as new lines the distribution line works will be replacing or reconstructing existing distribution lines. Since bare conductors which pose greatest risk to biodiversity will be avoided significant cumulative biodiversity impacts are not anticipated. Cumulative community health and safety impacts are considered positive; the installation of covered conductors/ABC will reduce O&M risks.

229. Induced impacts are the adverse and/or beneficial impacts on areas and communities from unintended but predictable developments caused by a project which may even occur later or at a different location. There may be some induced socioeconomic development because of implementation of the project. During construction roadside eateries/grocery stores may be able to provide services for construction workers. However, as all of the substations (including one where BESS is planned) already exist, and distribution lines works are in existing ROWs/sites and are transient in nature, any such impacts are anticipated to be negligible (minimal). Since new lines will mostly follow existing ROW there will be minimal induced impact from opening sensitive habitat areas to human access. Improved quality of electricity supply during operation may contribute to improved socioeconomic development in Assam, however, given the distribution network already exists any such impacts are considered at most minor. Any such induced development due to improved supplies will need to be in accordance with the national laws and regulations of India. It should also be noted that any such future development is entirely independent of the Output 3 and 4 components.

VI. CONSULTATIONS, PARTICIPATION, AND INFORMATION DISCLOSURE

A. Introduction

230. The purpose of the stakeholder consultation and public participation process is to ensure that interested stakeholders, affected communities as well as the public are informed about APDCL's plans and to solicit their views and opinions. According to ADB's Safeguard Policy Statement (2009): *"The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation. Meaningful consultation is a process that:*

- (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.
- (vi) Consultation will be carried out in a manner commensurate with the impacts on affected communities.
- (vii) The consultation process and its results are to be documented and reflected in the environmental assessment report."

231. This chapter summarizes the outcome of public consultations conducted as part of the environmental assessment for the BESS and distribution components of Assam Solar Project.

B. Public Consultations

232. Consultations were held to inform the IEE report with local communities at 15 locations in February 2024 and April 2024. Consultations were held during the substation audits and in the ROW of distribution lines for sample distribution lines with residents within 50m of the sites wherever available (Umpanai has no residence within 50m). During site visits AEGCL staff (nearest neighbor) and the Gram Panchayat Head were interviewed in the BESS site. In total 8 villages/towns (15 locations) were consulted, including general revenue villages along the distribution lines, existing substations, and BESS site. All substation and distribution lines are in Tribal/IP Autonomous Council Districts.

233. The total number of members of the public consulted for the IEE was 66 participants of which 39 were male and 27 were female. Locations and number of participants are described in Table 6.1, consultation details in Table 6.2 and details on consultation records are provided in **Appendix 10** During each consultation, the project details were conveyed, project awareness was requested, project stages, process and environment, health, safety impacts and risks discussed along with how they will be mitigated. During the meetings stakeholder consultations and GRM process/complaint registration//redressal were also disclosed.

Table 6.1 Locations and Participants

#	Name of Village /Town	Male Participants	Female Participants	Total Participants
1	Diphu	3	2	5
2	Diphu Market	5	0	5
3	Industrial Centre	0	5	5
4	Amlapptty	2	0	2
5	Ronkimi	2	2	4
6	Bokajan	1	3	4
7	Sairajan	3	0	3
8	Gunjung substation	11	6	17
9	Lungkhog	2	3	5
10	Hidisajir	4	1	5
11	Hojai Nadi	1	1	2
12	Longkoi Bey	2	2	4
13	Baithalangsho substation	3	1	4
14	Kukumara Mirza BESS	0	1	1
Total		39	27	66

Source: ADB's TA Consultant

Table 6.2 Sample Distribution Line, Substation, BESS site Public Consultation Summary

Location	Date	Number of participants			Issues Raised/ Concerns	IEE follow-up/Project Response
		M	F	T		
Distribution Line						
Distribution Line Route: (11kV Diphu feeder Jaisingh Daloi) - bare to CC alignment along road - passes busy market/ settlement area/town. House and shop inside ROW	12.02.2024	3	2	5	<ul style="list-style-type: none"> Major power cuts - one or two times daily and more during monsoon seasons for longer period Sewerage system, drain is needed Road repair is required near the house Bore well water is consumed - maybe not good, taste wise Package drinking water is used – costing is high No accidents/incidents observed 	<ul style="list-style-type: none"> Distribution line works helps reduce power outages Consultation and disclosure before work starts Water quality testing for all substations Specific measures to help manage community safety risks and comply to horizontal and vertical safety clearances, have been included in the EMP
Distribution Line Route: ((11kV Diphu feeder Jaisingh Daloi) - bare to CC alignment along road -	12.02.2024	5	0	5	<ul style="list-style-type: none"> Major power cuts - one or two times daily -impacts business, especially 	<ul style="list-style-type: none"> Distribution line works helps reduce power outages

Location	Date	Number of participants			Issues Raised/ Concerns	IEE follow-up/Project Response
		M	F	T		
passes busy market/ settlement area/town -shop inside ROW					<ul style="list-style-type: none"> items needing refrigeration/ perishable products No accidents/incidents observed No objection to work, but advise to do in parts Prior information is required 	<ul style="list-style-type: none"> Consultation and disclosure construction schedule, etc., before work starts If requested printed copy of the full IEE will be provided and if required translated free of charge
Distribution Line Route: (LT Industrial Center Feeder) - bare to ABC alignment along road - passes busy market/ settlement area -temporary shop inside ROW and beside DTR	12.02.2024	0	5	5	<ul style="list-style-type: none"> One fire incident recorded in the DTR last year Water crisis is prevalent in the area Road is damaged and needs repair – no permanent road is present where they reside Shops has not electricity and cannot do business in the evening 	<ul style="list-style-type: none"> Project implementation will improve the electricity related issues, road issues are out of scope Specific measures to help manage community safety risks and comply to horizontal and vertical safety clearances, have been included in the EMP
Distribution Line Route: (LT Amlapty DTR to ESSAR petrol pump) - bare to ABC alignment along road -passes settlement area. Shop in ROW	12.02.2024	2	0	2	<ul style="list-style-type: none"> Power line height is very low – increase the power line to proper height Large vehicle/truck movement snaps line Roads are dusty in the area – coughing is an issue Steet lights are needed 	<ul style="list-style-type: none"> Project implementation will improve the electricity related issues Specific measures to help manage community safety risks and compliance to horizontal and vertical safety clearances, have been included in the EMP
Distribution Line Route: (LT Ronkimi DTR to Ronkimi) - bare to ABC alignment along road - passes settlement area Houses in ROW	12.02.2024	2	2	4	<ul style="list-style-type: none"> Lines are very low hanging and pass over houses Requested power department for removal but not responded Daily power cuts – effects children's studies when in home 	<ul style="list-style-type: none"> Project implementation will improve the electricity related issues Consultation and disclosure construction schedule, etc., before work starts If requested printed copy of the full IEE will be provided and if required translated free of charge Specific measures to help manage community safety risks and comply to horizontal and vertical safety clearances, have been included in the EMP APDCL requested to check on applications
Distribution Line Route: (11kV Bokajan Feeder CC) -- alignment along road -passes settlement area. Houses in ROW	14.02.2024	1	3	4	<ul style="list-style-type: none"> 11kV line passes over main gate and courtyard Applied to APDCL for line relocation outside property since 2022, but there has been no response 	<ul style="list-style-type: none"> Project implementation will improve the electricity related issues Specific measures to help manage community safety risks and comply to

Location	Date	Number of participants			Issues Raised/ Concerns	IEE follow-up/Project Response
		M	F	T		
					<ul style="list-style-type: none"> • Fire/flashings in the lines as two lines sometimes touch each other and cause sparks • Lines are very low hanging about 12 ft from ground observed 	<ul style="list-style-type: none"> • horizontal and vertical safety clearances, have been included in the EMP • Consultation and disclosure construction schedule, etc., before work starts • If requested printed copy of the full IEE will be provided and if required translated free of charge • APDCL requested to check on applications
Distribution Line Route: (11kV Sairajan Feeder) – CC along road, cropland-passes rural settlement area houses/ cropland in ROW	14.02.2024	3	0	3	<ul style="list-style-type: none"> • Low hanging lines • No accidents recorded • Daily power cut is major issue • Wastes dumped near road-not disposed by local authority – flies and mosquitoes is major issue due to this • Drains are clogged with waste • Many poles are damaged and supported by wooden/bamboo poles-but can topple on shops 	<ul style="list-style-type: none"> • Project implementation will improve the electricity related issues • Specific measures to help manage community safety risks and comply to horizontal and vertical safety clearances, have been included in the EMP • APDCL requested to check on applications • Distribution line works helps reduce power outages • Removal of waste from the site per the requirements of the IEE/EMP
Distribution Line Route: (LT Lungkhog DTR to Lungkhog Part II) – bare – ABC some along road, mostly passes over houses/private area in ROW	15.02.2024	2	3	5	<ul style="list-style-type: none"> • Snake and squirrel electrocution observed in power lines • Applied to APDCL for line relocation outside property but there has been no action taken • Frequent and daily power cut is major issues - affects business 	<ul style="list-style-type: none"> • Project implementation will improve the electricity related issues • Specific measures to help manage community safety risks and comply to horizontal and vertical safety clearances, have been included in the EMP • Consultation and disclosure construction schedule, etc., before work starts • If requested printed copy of the full IEE will be provided and if required translated free of charge • APDCL requested to check on applications
DTR and associated Line						
Replacement of DTR – 25MVA (defective) to 63MVA and ABC LT & 1CC 1kV line from Hidisajir to Hidisajir Mostly rural road, private land/houses and open field;	18.02.2024	4	1	5	<ul style="list-style-type: none"> • Power failure due to vegetation and branches over line • No incident observed • Advise - lines can be moved on road • Inform before work when working on pole inside compound 	<ul style="list-style-type: none"> • Project implementation will improve the electricity related issues • Specific measures to help manage community safety risks and comply to horizontal and vertical safety clearances, have been included in the EMP

Location	Date	Number of participants			Issues Raised/ Concerns	IEE follow-up/Project Response
		M	F	T		
houses partly in ROW and DTR adjacent to house					<ul style="list-style-type: none"> No wildlife observed except crows, sparrows Water crisis is present in the area Roads need repair 	<ul style="list-style-type: none"> Consultation and disclosure before work starts
Hojai Nadi DTR (25MVA to 100 MVA), new poles required, associated ABC LT & CC 11kV line. Lines inside property and road; pole to stay inside property but moved close to boundary	18.02.2024	1	1	2	<ul style="list-style-type: none"> Water crisis in the area Dusty roads Applied to APDCL for line relocation and pole outside property but there has been no action taken 	<ul style="list-style-type: none"> EMP implementation Specific measures to help manage community safety risks and comply to horizontal and vertical safety clearances, have been included in the EMP APDCL requested to check on applications
Longkoi Bey DTR (16MVA to 25MVA)- associated ABC LT & 11kV CC line -lines passes mostly road and private property	20.02.2024	2	2	4	<ul style="list-style-type: none"> No incident observed Advise - lines can be moved on road 	<ul style="list-style-type: none"> Specific measures to help manage community safety risks and comply to horizontal and vertical safety clearances, have been included in the EMP
Substations						
Gunjung Residents (tea garden labour camp) - 66m from substation	15.02.2024	11	6	17	<ul style="list-style-type: none"> All migrant labors - living with family Income is low Water crisis/scarcity in area No accidents/ incidents recorded for substation or nearby lines Sanitation system is very poor and inhouse toilets not available; use open areas as toilet Camp is poor shape, need repair and cramped. Need better accommodations Medical facilities are far away Forest/vegetation used as cooking fuel Roads need repair and maintenance Wildlife observed- peacock, monkeys, snake, wild cats 	<ul style="list-style-type: none"> Recommendation to ensure sanitation system designs at this site included in the IEE, CAP provided as part of EMP
Baithalangsho Residents 10-35m from substation	19.02.2024	3	0	3	<ul style="list-style-type: none"> No issues with substation – although very old Water logging on road but substation is not observed to be flooded The road needs to be repaired and paved 	<ul style="list-style-type: none"> Distribution line works helps reduce power outages Consultations and disclosure before work starts. EMP implementation

Location	Date	Number of participants			Issues Raised/ Concerns	IEE follow-up/Project Response
		M	F	T		
					<ul style="list-style-type: none"> Power failure is cause of concern 	
Umpanai	No houses in 50m, nearest vacant house at 90m, no consultations conducted.					
Mirza Substation (BESS) No private house/buildings in 100m. House at 110m from BESS site; staff quarter within grid substation area	17.02.2024	0	1	1	<ul style="list-style-type: none"> No fires fighting system available at nearby substation Snake-cobra found in the area Power related complaints can be registered by text No accidents observed or heard since last 10 years R&M of staff quarters needed Playground need for local staff/children Water quality is not good- potentially high in iron 	<ul style="list-style-type: none"> EMP implementation Water quality testing included in EMoP
Total		39	27	66		

Source: ADB's TA Consultant

234. The major issues identified during consultation was the presence of poles and power lines in private properties. No other major issues were raised. The analysis of the consultations brought out that whilst impacts on the consumers of electricity distribution services as well as the safety of those along/adjacent to route alignments (including many houses/court yards over which OHL currently pass or poles present) will be positive, there are also likely to be negative impacts on other affected parties including houses close to Baithalangsho substation and the RoWs over which OHL may pass, impacts on private lands and crop lands along which route alignments will pass during construction and post construction stage with land use restrictions, temporary impacts and inconvenience to communities residing along the distribution line alignments during construction, temporary economic impacts on businesses along the alignments (busy market areas – Diphu, Haflong towns, others), and temporary inconvenience for traffic where distribution line alignments are along narrow/busy and densely built-up/market areas.

235. These consultations are considered sufficient to inform the IEE which is based on trends in issues emerging from the consultees. However, the alignment of distribution lines consulted on was only indicative so the detailed impacts of the distribution lines on the local community were uncertain. Further consultations will be conducted for all components before construction and continue throughout the project implementation.

C. Other Stakeholder Consultations

236. Karbi Anglong Autonomous Council (East, West Karbi Anglong and Dima Hasao District) committee stakeholders, Kamrup GP, PCCF-Wildlife, PCCF-Forest (Both Assam and Nagaland), Director of Directorate of Archeology and District Forest Officer were also consulted (Tables 6.3).

Table 6.3 Summary Stakeholder Consultation for BESS and Distribution Component

Consultation Location and Date	Name	Discussion/Issues Raised	Project Response
Karbi Anglong Autonomous Council Head Office, Diphu 15.12.2023	The Karbi Anglong Autonomous Council -Chief Executive Member, Chairman, Ministers, Chairman PWD Board, and other members	<ul style="list-style-type: none"> • Council provide representation to the minorities who constitute a considerable proportion of the total population of the sub-division. • Supports the project 	<ul style="list-style-type: none"> • Community awareness in project village to be conducted • APDCL assured they would be obtaining necessary permission from Autonomous Council and Village heads (Gaon Bura) for works and also grievances/ compensation and do continue consultations/awareness raising during implementation. • APDCL will also take permission for obtaining any new land/DTR site and line works within these areas

Consultation Location and Date	Name	Discussion/Issues Raised	Project Response
			<ul style="list-style-type: none"> APDCL will share a copy of the IEE with Autonomous Council
<p>Dima Hasao Autonomous Council Head, Haflong</p> <p>12.06.2024</p>	<p>The Dima Hasao Autonomous Council -Chief Executive Member</p>	<ul style="list-style-type: none"> Full support to the project Will liaise with all offices under ADC in districts and state for any issues or smooth implementation of the projects Labour and community related issues due to project can be handled by ADC Provide detailed schedule of works and areas where the works are taking place before hand 	<ul style="list-style-type: none"> APDCL assured they would be informing work details and obtaining necessary permission from Autonomous Council and Village Heads APDCL will also take proper permission for land related issues for lines/DTR APDCL will submit copy of IEE to the ADC
<p>BESS site, Mirza, Kamrup</p> <p>23.05.2024</p>	<p>Gram Panchayat Head, Kamrup Rural GP</p>	<ul style="list-style-type: none"> Aware of the BESS project and its benefits Accepts that environmental issues during construction need to be managed No issue with water scarcity in the area No issues of traffic congestion due to transport of material/equipment for BESS 	<ul style="list-style-type: none"> APDCL will share a copy of the IEE if requested in local language with GP EMP implementation
<p>Karbi Anglong Autonomous Council Head Office, Diphu</p> <p>15.12.2023</p>	<p>Mr Vikram Gupta, Principal Chief Conservator of Forests, Wildlife and Chief Wildlife Warden, ADC</p> <p>Vikram Singh Rongli, DFO Karbi Anglong, Environment and Forest Department of Assam</p>	<ul style="list-style-type: none"> Lahorijan proposed reserved forest (PRF) in Karbi Anglong project area Elephant corridor is about 2 to 3 km from Solar Site, but in East Karbi Anglong project area (also distribution line area) Elephants seen during paddy harvesting time No tiger reported from area Bengal Slow Loris, Chinese Pangolin, Western Hillock Gibbon, Blond Bellied Langur. The Assam Frog (<i>Polypedates assamensis</i>), endemic to Assam is not available in Karbi Anglong No impact is anticipated on wildlife and forest during project implementation No objections from Forest Office regarding installation of power lines in the area No reports of electrocution/collision of wildlife reported from the area No human/wildlife conflicts reported in the area Forest maps are not digitized, only dated paper maps are available 	<ul style="list-style-type: none"> Data received from Environment and Forest department used to inform the IEE Distribution components identified as passing through protected areas will be dropped from the scope. Any lines/infrastructure requiring new ROW in ESZ/Reserved Forests/Elephant Corridor will be dropped Some existing 11kV and low-tension lines/RoW are inside ESZ, Elephant Reserve, Reserved Forest land for which covered conductor/ABC are planned and subject to Forest Clearance/NOC/intimation from

Consultation Location and Date	Name	Discussion/Issues Raised	Project Response
		from DFO and can be shared with project team	Environment and Forest Department or dropped <ul style="list-style-type: none"> • CNHA report prepared to screen critical and natural habitats in distribution component area and inform IEE/EMP.
Hotel Hempi, Diphu 14.02.2024	Vikram Singh Rongli, DFO Karbi Anglong, Environment and Forest Department of Assam	<ul style="list-style-type: none"> • No records of any IUCN CR, EN, VU species in the area • No reports of electrocution/collision of wildlife accidents, etc., reported from the area • No human/wildlife conflicts reported in the area • Forest maps are not digitized, only dated paper maps are available from DFO and can be shared with project team 	<ul style="list-style-type: none"> • Ongoing consultation and liaison with Forest Officials during project implementation • Although no incidents and/or sittings, implement EMP including wildlife measures
Environment and Forest Department, Aranya Bhawan, Panjabari, Guwahati 23.04.2024	RP Singh, PCCF and Head of Forest, (Forest), Assam) and Sameer Baidya, Deputy CCF (Forest, Assam)	<ul style="list-style-type: none"> • GIS maps of forest areas are available through proper channel by application to Forest department by APDCL. • Wildlife details can be provided by PCCF Wildlife Office • For all lines/other components, new and augmentations in WLS and ESZ permission is required. • For all project activities intimation to Forest and Environment Department of Assam is required 	<ul style="list-style-type: none"> • All 11kV and LT lines are CC or ABC. • All bare lines are dropped and/or CC/ABC. • To implement the Criteria and Principles provided in the IEE • Printed copy of the full IEE will be provided and if required translated free of charge
Environment and Forest Department, Aranya Bhawan, Panjabari, Guwahati 24.04.2024	Sandeep Kumar, PCCF and Chief Wildlife Warden, Assam (Wildlife, Assam) and DD Gogoi CCF (Wildlife, Assam)	<ul style="list-style-type: none"> • East Karbi Anglong houses the Marat Longri WLS • In the 3 project districts - 4 WLS and 2 Elephant Reserves are present • Lines in ESZ to be CC and final lines/routes to be provided to Department; NOC is required • For lines in ESZ- inform Department • Rangapar WLS in Nagaland- intimation to be provided through official channel • East Karbi Anglong houses the Dhansri-Lunding Elephant Reserve • Even if EC is not required, if in WLS WL clearance is required • For BESS – Deepor Beel ESZ is overlapped, no concerns; no committee is formed yet • DL component- If in PA then to be dropped 	<ul style="list-style-type: none"> • WLS and RF maps/forest data as received from Environment and Forest Department of Assam are used for assessment and informing the IEE • All 11kV and LT lines are CC or ABC. • All bare lines are dropped and/or CC/ABC. • To implement the Criteria and Principles provided in the IEE • No works will be taken up in WLS. No SS in ESZ/Elephant Reserve/RFs. Line

Consultation Location and Date	Name	Discussion/Issues Raised	Project Response
		<ul style="list-style-type: none"> • If line in RF and Elephant Reserves RF – for existing RoW – Forest Clearance to be obtained/existing - other wise to be taken • If diversion/alignment changes/new alignment then forest clearance is required • Elephant Corridors/Reserves can be Revenue Land – then intimation and comments/NOC of WL Warden is required through online process; process is fast tracked • For existing lines in RFs – to get FC for the existing lines if not already taken • Powerline Design – all lines and associated infrastructures in Forest area/RFs to be covered; there should be no bare conductors; State CM has instructed to insulate all lines inside and outside forest/WLS areas • Species in all 3 districts – Bengal Florican – No sighting; Elephants- Yes present; Bos Gauras- Yes in East and West Karbi Anglong; Hillock Gibbon – in Marat Longri WLS; Capped Langur -Yes present; Chinese Pangolin-Yes present; Assam Roofed Turtle- Not present; Leopard and Small Cats - yes present; Bengal Slow Loris- Not present; The Karbi Anglong Forest is important for dispersal of Tigers. 	<p>will be in ESZ/Elephant Reserve/RFs KBA/IBA with necessary NOC/permission and lines all CC and ABC as planned.</p> <ul style="list-style-type: none"> • Printed copy of the full IEE will be provided and if required translated free of charge
<p>Department of Environment, Forest and Climate Change of Nagaland, Kohima (VC mode)</p> <p>10.06.2024</p>	<p>Dharmendra Prakash, PCCF and Head of Forest, Nagaland</p> <p>Ved Pal Singh Additional PCCF (Territorial) and Chief Wildlife Warden, Nagaland</p>	<ul style="list-style-type: none"> • No issues or objections will be there if projects in ESZ of the Rangapara WLS • But larger issues is the Disputed Area Belt (DAB). Assam and Nagaland share a 512-km long border. The disputed area belt (DAB), which includes reserve forests, lies in Assam's Golaghat and Jorhat districts (not part of distribution component) and Nagaland's Wokha and Mokokchung districts. For years, the Central Reserve Police Force has remained deployed to the DAB as a neutral force. • The Supreme Court earlier constituted some commissions, including one that was set up in 1971 and headed by the then Law Commission chairman KVK Sundaram, to resolve the dispute 	<ul style="list-style-type: none"> • APDCL to obtain Disputed Area Belt (DAB) map of the area from District Commiserate Office, Guwahati • As per APDCL and checking the Diphu or other area which will install distribution lines is not inside the DAB. • Inform (already official email sent in May 2024) project details in the ESZ area

Consultation Location and Date	Name	Discussion/Issues Raised	Project Response
		<p>but the efforts yielded no positive results. Each state claim ownership of the DAB.</p> <ul style="list-style-type: none"> If project components fall inside the DAB then Nagaland will object as case is sub-judice in Supreme Court of India. 	
Directorate of Archaeology, Assam, Ambari, Guwahati 24.04.2024	Dr. Deepi Rekha Kouli, Director, Directorate of Archaeology, Assam	<ul style="list-style-type: none"> For State protected monuments- same as ASI regulations-100m restricted and 200m regulated zone from structure boundary If lines/poles in regulated zone, APDCL to apply for permission In buffer zone no large/major construction allowed If chance find – intimation to Chief Executive Member of concerned Autonomous Council is to be done and Directorate of Archaeology, Assam. The Directorate of Archaeology, Assam also takes care of unprotected sites (unregulated monuments) Chance find – potential to find present Stone Jar chance find potential in Dima Hasao district is present If discovered preserve the find, provide fencing from APDCL fund and intimate authority 	<ul style="list-style-type: none"> Provide existing ASI and State protected PCR details and distances to Directorate Provide copy of IEE to Directorate Develop change find procedure as part CEMP Implement IEE/EMP

Source: ADB's TA Consultant

D. IEE Disclosure

237. Apart from meeting the requirements under ADB's Safeguard Policy Statement 2009, meaningful consultation is important for information disclosure under the Government of India, Right to Information Act of 2005.

238. During the due diligence conducted for the project, information related to location of the BESS, substations, and distribution alignments; land requirements for DTR and OHL ROW and procedures; potential environmental, health and safety impacts of the project, positive and negative, direct and indirect; and grievance redress procedures were shared with affected persons during consultations.

239. APDCL will continue its communications with affected persons and other stakeholders and disclose information such as dates of EPC contractor's surveys and census of affected households, project related impacts and measures included in the environmental management plan, specific entitlements of the affected persons, grievance redress procedures and dates of the commencement of civil works. The EPC contractor will also undertake further consultations to inform the detailed design and subsequently disseminate information ahead of the start of civil works.

240. Brochures and posters on the main findings of the IEE and where the full version can

be accessed, as well as a translation of the executive summary of the IEE, will be printed in Assamese/Karbi and they will be made available/displayed for public scrutiny at places easily accessible to affected persons and other interested parties – including but not limited to the APDCL’s substation, divisional offices and on the construction site and if requested access to a printed copy of the full IEE will be provided and if required translated free of charge. The draft IEE will be disclosed on ADB’s website, as well as on APDCL’s website upon project approval. Once the draft IEE is finalized with updated information, or upon any subsequent updates during project implementation if any, the same procedure of disclosure will be followed.

241. Six-monthly environmental monitoring reports (EMR) during since loan effectiveness (say, for the reporting periods from January to June and July to December within 15 days i.e on or before 15 July, and 15 January every year) and annual EMR during the operation stages will be submitted by APDCL to ADB for review and clearance till issuance of project completion report by ADB under the Project. After ADB’s clearance of the EMRs, it shall be disclosed on ADB’s and APDCL’s websites.

E. Ongoing Consultations and Disclosure

242. During project implementation, additional meaningful environmental consultations will be completed for the BESS, existing substations, new (DTR conncted) and existing distribution lines including placement of new DTRs, prior to the commencement of any construction works. For future consultations during the implementation, the following processes are envisaged:

- (i) Identification of key stakeholders will be done by the contractors which will be finalized in due consultation with officials of APDCL.
- (ii) The contractors concerned with guidance from the PMC will identify appropriate methods for consultation at each location and dissemination platforms for broader reach.
- (iii) The contractors with guidance from PMC will develop appropriate communication materials in local language especially where affected people include scheduled tribes/indigenous peoples.
- (iv) For disclosure purposes, the communication materials will include the positive and negative impacts, mitigation measures, grievance redress mechanism, construction schedule etc.
- (v) The contractor will give advance notice about the consultations or other engagement and will disseminate properly for wider participation of beneficiaries or affected people especially women and the scheduled tribes/indigenous peoples.
- (vi) Consultation process will be utilized to address the concerns and project implementation issues raised by the affected people during the consultation.
- (vii) There will be budgetary provision to implement the future consultation and dissemination strategy.

243. For the consultations, the dates, attendees, male/female split, details of any participants vulnerabilities, topics covered, and, views and opinions raised should be recorded along with details of how the subproject has responded to them. Consultation meetings are to be attended by at least 10% of the village population and have at least 30% representation of women excluding APDCL and consultant/contractor representatives, if it is not possible at the public consultation a separate gender focus group must be held to ensure their concerns are heard. There must also be adequate representation of other vulnerable groups.

VII. GRIEVANCE REDRESS MECHANISM

244. A grievance is an issue, concern, problem, or claim (perceived or actual) that an individual or community group wants to see resolved by the project. A Grievance Redress Mechanism (GRM) is a locally based, project-specific extra-legal way to deal with and resolve project-related grievances/complaints faster than legal mechanisms and thus enhance project performance standards in terms of environmental and social safeguards. APDCL will take relevant concerns of affected persons and other stakeholders seriously and ensure that they are actively able to raise and discuss their concerns throughout the project cycle by setting up GRMs. A separate GRM will be set up for the distribution component to be dealt with by APDCL and the BESS component to be dealt with by the New and Green Energy of Assam Limited (JV between OTPC and APDCL).

245. The GRMs will aim to provide affected persons and other stakeholders with a clear and simple way of filing a suggestion or complaint on the environmental, health and safety performance of the project. The GRMs will also cover social safeguards. According to ADB's SPS 2009, a GRM must address complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to the affected persons at no costs and without retribution. Given these requirements, handling of grievances on the implementation of the BESS and distribution component will be as discussed in this chapter.

246. The APDCL and the JV will establish project component-specific Grievance Redress Mechanisms (GRM) to receive and manage any grievances (complaints) that may arise from the BESS and distribution project works and facilitate prompt resolution of affected persons' issues, concerns, problems, or claims. Affected persons may include members of the local community or construction workers. The GRMs will address environmental and social safeguard and other related eligible grievances/complaints raised by affected persons, in a timely and culturally appropriate manner.

247. The GRMs will ensure that:

- (i) physically or economically displaced people receive appropriate compensation in accordance with the RIPP;
- (ii) the basic rights and interests of every person affected by the environmental and social performance of the JV and APDCL and their contractors on the project are protected; and
- (iii) issues, concerns, problems, or claims arising from any poor environmental (or social) performance of JV and APDCL and their contractors during the conduct of pre-construction, construction, operation and maintenance activities are promptly and effectively addressed.

248. Recourse to the GRMs does not impede access to the country's judicial or administrative remedies. Affected peoples can approach the court of law at any time and independently of the project's grievance redress process. Affected peoples may (subject to eligibility criteria) also access ADB's Accountability Mechanism⁹⁹ whereby people adversely affected by ADB-financed projects can express their grievances, seek solutions, and report alleged violations of ADB's operational policies and procedures, including ADB's safeguard Policy Statement 2009.

249. The GRMs will be set up by JV for the BESS and APDCL for distribution component,

⁹⁹ There are two parts to ADB's Accountability Mechanism, problem solving led by ADB's special project facilitator can assist the complainant in finding solutions to their problems, while compliance review, led by a three-member panel, can investigate alleged violations of ADB's operational policies and procedures, including safeguard policies, and recommend corrective actions to ensure project compliance.

upon loan effectiveness and be fully operationalized prior to the commencement of any civil works, including enabling works. JV/APDCL, PMC and the contractor will appoint GRM focals. The NGEAL/APDCL focals may be a different person during the construction and operation. All staff of NGEAL/APDCL PMU, PIU, PMC, and the Contractors, as well as local and associated government and other entities directly involved in the GRM process will receive a training prior to 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. Upon completion of works similar training will be provided to the JV and APDCL O&M staff.

250. Communities within the project's area of influence (including within 500m of BESS/substations and in 50m of RoWs) will be made aware of this GRMs 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 BESS/substation/distribution line sites, in Assamese/Karbi/Hindi; and (iii) notices on the social media/cable and/or local newspaper, as well as notice boards on project-sites, at BESS Mirza substation, APDCL's local offices, in local government offices, and on APDCL and JV website etc. with details of the GRM together with details of the project and where the IEE can be obtained to capture a wider audience. Pre-construction and once operational, the JV and APDCL will be responsible to post clearly visible signboards at the project sites with contact details including the name and phone number of their GRM focal person, together with suggestion boxes that will be regularly checked for any grievances received. During construction, the contractor will be responsible for posting these signboards, including contact details with the names and phone numbers of both the JV and APDCL and contractor's GRM focal persons as well as the suggestion box to be regularly checked at the construction site. Any concerned person or group of people can file a complaint through the project's GRM, at any time and at no cost. The time frame for receiving a response will be made known to the grievant. Investigations and deliberations on the grievances will be communicated to the grievant and outcomes publicly disclosed.

251. **APDCL existing GRM system.** APDCL has an established Consumer Grievances Redressal Forum (CGRF) where a consumer may approach with grievances related to their power supply in the APDCL supply area. Since it relates to power supply issues it needs to be augmented by the project level GRM, but consumers may also approach it in the first instance for referral to the correct avenue to raise a project level grievance. The CGRF at different levels consists of Level-1, Level-2, District Level CGRF and State Level/Company CGRF. Level-1 is Sub-Divisional level where a consumer may approach any issues which is looked after by the Sub-Divisional Engineer. Level-2 is Divisional level where Assistant General Manager is taking action of the issues of consumers. District Level CGRF is the Circle level forum which is supervised by the Chief Executive Officer of each Circle. State Level/Company CGRF is supervised by the Chief General Manager (CR, Marketing and Safety), APDCL who is the Chairperson of this level. There are 5 members including Chairperson in each District level CGRF where the Chief Executive Officer is the Chairperson on that level and also in State Level CGRF as the consumer dispute resolution authority where one Member nominated by the Assam Electricity Regulatory Commission (AREC) as an Independent Member. The Chief General Manager (CR, Marketing and Safety), APDCL is present Chairperson of State Level CGRF. Address and Contact details of State Level CGRF is:

Office of the Chairperson
State Level Consumer Grievances Redressal Forum
APDCL, Old AERC Building, 1st Floor
ASEB Campus, Sixmile, Guwahati-781022
Phone No. +913613154404

252. NGEAL and ADPCL, PMC and contractor's focals will actively engage with the affected local communities and construction workers throughout pre-construction, construction and 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 APDCL's and JV's website with dedicated link/message box, by phone/WhatsApp at numbers 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 at the BESS site and APDCL's closest office. All staff and workers of NGEAL/APDCL/PMU/PIU/PMC and Contractors and subcontractors (if any), will also be made aware of the existence of the GRM and must know who to direct any complainant to, if approached regarding a grievance. Local government representatives/GP/Autonomous Councils/ward members will also be briefed by JV/APDCL on the GRM and so be able to take up complaints and pass them onto APDCL or the contractor to be addressed. NGEAL/APDCL management will have overall responsibility for timely grievance redressal on safeguard issues with the support of their GRM focal for ensuring disclosure, registration of grievances, and communication with the grievant.

253. A grievance log must be kept at all times on-site by the contractor's focal and collated at PMU level by NGEAL/APDCL's focal. Any grievance/complaint received, whether minor or major, whoever it was first addressed to, must be reported and documented when it is received, including: name of the person making the complaint; date and time the complaint was received; location and relation of the complaint to the project; nature of the complaint; dates of subsequent communications; details of all meetings held, including participants, date, issues discussed and decisions taken; details of all actions taken towards resolution of the grievance; log of all formal communication sent to the complainant informing of the evolution of the process etc. All entries to the grievance register, no matter how minor or whether resolved at an initial informal level on site or at any of the formal levels of the GRM, along with updates on ongoing or completed actions taken to address the grievance will be included in monthly reports by the contractor to NGEAL/APDCL and detailed in the quarterly project reports and environmental monitoring reports to be submitted by NGEAL/APDCL to ADB. NGEAL/APDCL will also notify ADB immediately of any grievances that enter the third stage (GRC) of the GRMs or are related to immediate risk to human life, or impending damage to structures, flora or fauna, or physical cultural resources.

254. In grievance redress it is important for grievance handlers to be clear on the issues involved and why the grievant is dissatisfied. The first step is an honest appraisal of whether the grievance received is proactive or reactive to a situation, how it is relevant to the proposed project, and if it falls under the national and ADB policy and legal framework as described in Chapter II. This will enable ineligible grievances to be identified. For those that are eligible the facts must then be established in full through soliciting information and observations in the field, in communication with the grievant and others to clearly define the problem to be resolved. The grievance handlers need to be able to clearly appraise the grievant of their grievance's relevance to the project, and the applicable national and ADB policy and legal framework, so that both sides have common understanding of the context. Once the problem is clear, options for resolution can then be analyzed, and a time bound grievance resolution action plan agreed with the grievant for implementation by JV/APDCL or their contractor. Once a resolution has been proposed to the complainant, the grievant will be asked to sign a form acknowledging receipt of that proposal and providing their approval or refusal, 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. Implementation of the actions must then be monitored by the NGEAL/APDCL GRM focal with regular follow-ups. Whilst resolution may be quickly reached, the grievance can only be fully closed out once all actions have been completed and the grievant has confirmed their satisfaction. Implementation of the actions must therefore be undertaken by NGEAL/APDCL as promptly as is possible and ideally within 15 working days of being agreed, though this will depend on the nature of grievances involved. PMC will also monitor the operationalization of the GRM and the effectiveness of the grievance resolution process along with NGEAL/APDCL PMU and both will recommend improvements

to increase the efficiency, timeliness and fairness of the process.

The GRMs will follow a three-tier formal structure with a first informal level. Figure 7.1 and 7.2 summarizes the process.

a. Site-level grievance handling protocol – Informal Contractor/Electrical Subdivision Level

- The contractors will define a site-level grievance handling protocol, as initial informal input to the GRM.
- For any urgent matter, in particular emergency and health and safety issues, the contractor's site-level focal will take note of the grievance/complaint and get immediately in contact with their site supervisor for immediate action. Short-term issues (e.g. dust, noise, leaks, inappropriate behaviour, conflict, health and safety etc.) may be corrected by the construction workers immediately under the direction of the focal and site supervisor. If it cannot be readily resolved by the contractor, then the on-site APDCL Electrical Subdivision or JV field staff will provide the most easily accessible first informal level of contact to address it.
- For the BESS, in case of immediate risk to human life (including transport route), or impending damage to structures, the JV Site Engineer/EHSS shall get in immediate contact with their Environment or H&S Specialist who shall have the power to halt works until corrective action is taken.
- The BESS JV O&M staff will take over this level once operational.
- If construction workers wish to file a complaint and are not comfortable logging it informally with the contractor, then they can also raise it informally with the JV Site Engineer/EHSS.
- For distribution component, in case of immediate risk to human life, or impending damage to structures, flora or fauna, or physical cultural resources, the APDCL Electrical Subdivision Site Engineer/EHSS shall get in immediate contact with the APDCL PMU Environment or H&S Specialist who shall have the power to halt works until corrective action is taken.
- The electrical subdivision O&M staff will take over this level once operational.
- If construction workers wish to file a complaint and are not comfortable logging it informally with the contractor, then they can also raise it informally with the on-site APDCL Electrical Subdivision Site Engineer/EHSS.
- Whatever the source and the form in which the grievance/complaint is received and its nature, and however minor, it should be accepted by the focal and registered in the grievance register and reported to the JV or ADPCL GRM Focal.¹⁰⁰ A template for recording grievances is provided in **Appendix 11**.
- A log of all active complaints, even if resolved at this informal level of GRM, must be communicated to APDCL and JV GRM Focal fortnightly by the contractor's on-site focal.
- Grievances to be redressed within three working days of the grievance first being raised.

b. First level of GRM – Formal Electrical Division Level

- The first level for distribution component is headed by the APDCL Electrical Division Staff. While for the BESS JV will be Project Engineer.
- If no resolution or understanding on the grievance is informally reached after three working days, or the grievant chooses, they can direct their grievance directly to the formal GRM process, or if an informal grievance is deemed more than minor, the grievance will be formally registered by the on-site APDCL Electrical Subdivision or JV field staff and taken up by either the APDCL Electrical Division Project Engineer (PIU) or the JV Project

¹⁰⁰ If the complaint is not eligible, the complainant should be informed of the reasons in writing and directed onto other appropriate mechanisms if applicable.

Engineer in the first formal level of the GRM, to be resolved within seven working days of it being filed.

- All grievances/complaints will be sorted by the APDCL/JV Project Engineer supported by the GRM Focals for their eligibility, level of urgency and by nature (suggestions or comments, grievances/complaints related to adverse impacts of the project on an individual or group, violations of law, etc.). The GRM Focal will send a formal reply to the complainant within 3 working days of the receipt of the grievance/complaint, to acknowledge receipt, provide the complaint's registration number, and set up a meeting in presence of the contractor's project manager. Through the first formal reply,¹⁰¹ the complainant will be informed of the process and of his/her possibility to subsequently escalate the complaint in case no resolution were found at this stage; contacts to the second level GRM will be included.
- During the meeting other participants may be called upon (both for the BESS and distribution components), including but not limited to the contractor's environment manager, labour, social and community liaison officer, health and safety manager and the PMC resident EHS supervisors, environmental specialist, labor officer, H&S expert, etc. The affected person(s) may come in presence of two representatives of their choice (selected to be gender inclusive), including a representative of their IP group if applicable.
- This first meeting shall take place no later than one week after receipt of the grievance/complaint.¹⁰² During the meeting, the complainant and APDCL/JV Project Engineer will agree on the course of action to be taken and timeline to resolution. Details of the meeting will be documented; minutes of meeting will be signed by both complainant and the contractor's site-level focal and annexed to the grievance's file. If both parties do not agree on a resolution, the complaint may be escalated to the second level of GRM. If both parties agree, the contractor (and subcontractors, as applicable) will take remedial action, keeping the complainant informed at each stage or every fortnight, whichever the shortest. Such actions should be taken in the briefest delay, within a maximum timeframe of 30 days. However, all simple complaints, will be resolved within 7 days of the meeting being held. Following resolution, if the complainant is not happy with the resolution or if no action has been taken within the agreed timeframe, they can escalate the grievance to the second level of GRM.

c. Second level of GRM – Formal PMU Level

- The second level of the GRM is headed by the PMU, supported by Electrical Divisional Staff for the distribution component and Project Engineer for BESS.
- If no resolution or understanding on the grievance is reached at the first level after 7 working days, or earlier if the Electrical Division PIU (Project Engineer for BESS) feel they are unable to resolve it themselves, the grievance will be formally filed with the second stage and taken up by the APDCL PMU/JV Project Director for it to be resolved within 15 working days of being filed.
- All complaints will be sorted by the APDCL PMU/JV Project Director with the support of the GRM Focal for eligibility and level of urgency and by nature (suggestions or comments, grievances/complaints related to adverse impacts of the project on an individual or group, violations of law, etc.).
- Just as for the first level, all grievances will be properly recorded, and the concerned person or group will be informed formally of receipt; timeline; and resolution. The GRM Focal will send within 3 days of receipt a letter to the complainant acknowledging receipt; within 15 days a meeting should be held and resolution action plan and timeline agreed upon with the complainant.

¹⁰¹ Same template of this first communication is recommended to be followed project wide.

¹⁰² This timeline may only be extended if the affected person/group requests for a later date for the meeting based on availability. If the complainant has difficulty to travel to meeting location upon short notice, the location of the meeting may be flexible.

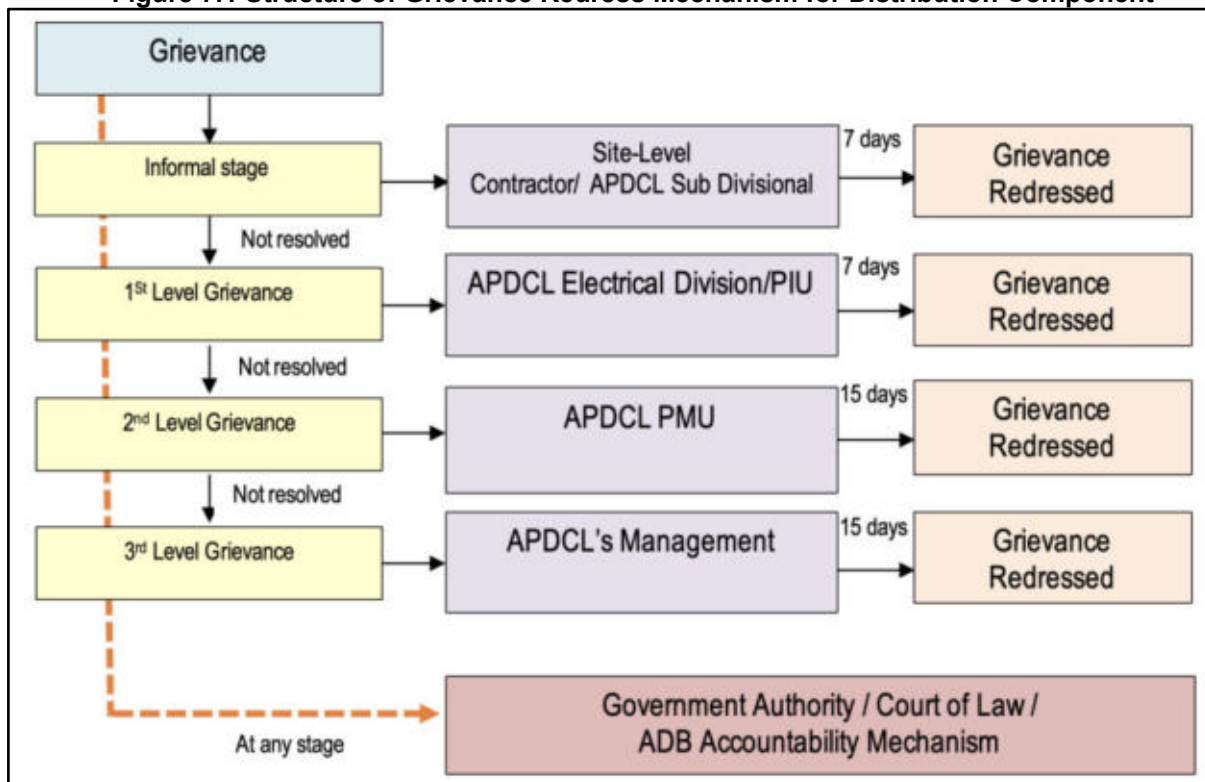
- The meeting should include the PMU/JV's Project Director, the PMU/JV's GRM focal, the complainant who may be accompanied by or represented by two representative including one female and Autonomous Council/IP representative (for distribution component) if applicable, PMU/JV's Environment Specialist, H&S Specialist and/or Social Specialist, PMC Resident EHS Officers and experts if required, as well as other members if applicable, including contractor's representative, Autonomous Council representative, community organization representative etc.
- As in the first level, the second level may have two outcomes: if the parties found a resolution and the complainant signed their approval of the resolution, such actions should be taken in the briefest delay, within a maximum timeframe of 30 days. However, all simple complaints, will be resolved within 7 days of the meeting being held.
- If no resolution has been reached, the grievance is forwarded to the third level of the GRM.

d. Third level of GRM – Formal Management level

- The same process of logging the grievance complaint, communicating with the complainant and reporting will be followed.
- The third level of GRM is handled by APDCL's Management and BESS JV Management. The APDCL/JV Managing Director supported by the APDCL/JV GRM Focal form a grievance redress committee and chair the meeting made up of APDCL/JV's Project Director, PMU/JV's Environment Specialist, H&S Specialist and/or Social Specialist, PMC Resident EHS Officers and experts if required, two representatives of the complainant including female and indigenous peoples representative if applicable, as well as, as applicable, a representative of the contractor, and the appropriate government representatives for resolving environment and social issues (such as but not limited to land revenue, forest office, Directorate of Archaeology/ASI office, municipality representatives), etc.
- The GRC will be convened and will meet at short intervals subject to the number of grievances to resolve.
- The grievance redress committee will agree on the resolution approach and action plan, inform concerned parties about actions to be taken and their timeline, and will monitor progress through regular follow-ups. Resolution will be as prompt as possible; receipt of complaint will be acknowledged to the complainant within 3 days, the resolution approach agreed upon within 15 days and actions taken within 30 days. However, all simple complaints will be resolved within 7 days of the meeting being held.
- Approval of the resolution by the complainant will be sought in writing. If the complainant is still dissatisfied after this stage, they may avail of the court of law or ADB's Accountability Mechanism.

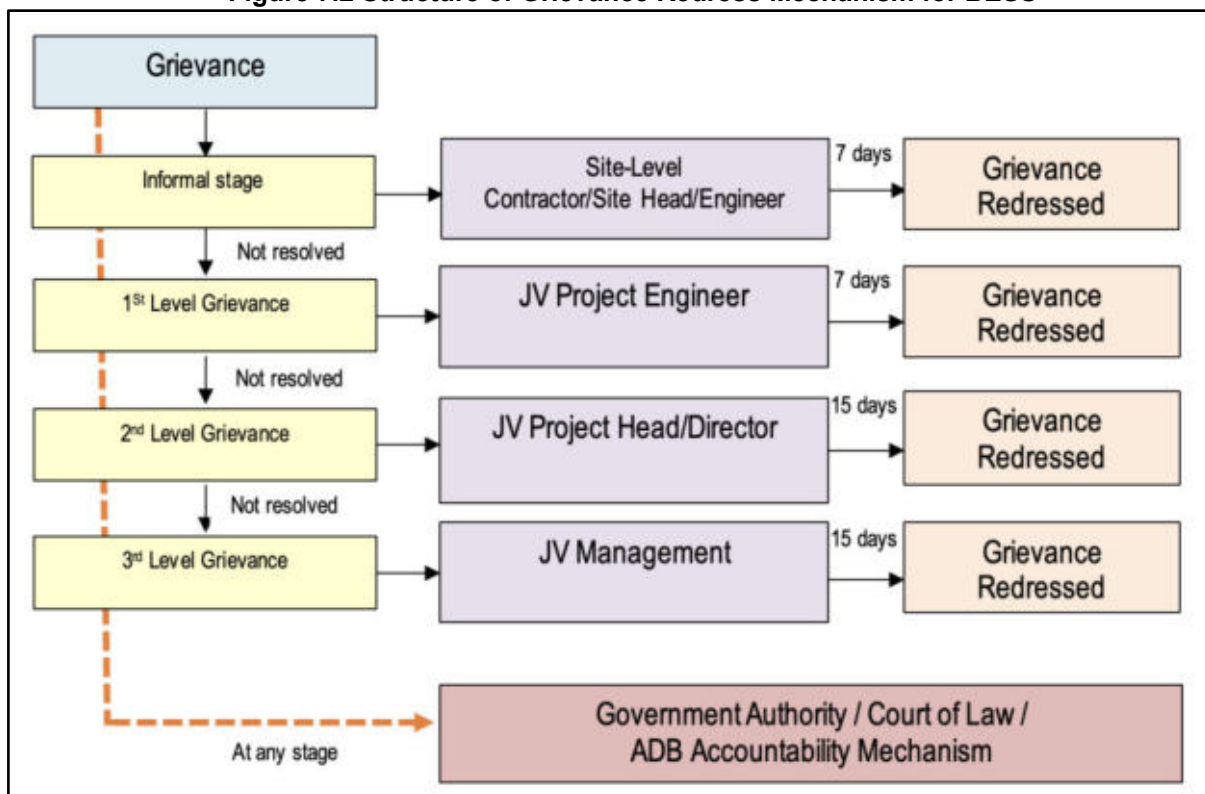
255. **Budget.** APDCL and the contractor will need to provide staff for and allocate budget for the GRM that will sufficiently cover the costs of its operations including initial awareness raising, capacity development trainings, support services, field inspections, meetings, documentation, and supplies etc.

Figure 7.1 Structure of Grievance Redress Mechanism for Distribution Component



Source: ADB's TA Consultant

Figure 7.2 Structure of Grievance Redress Mechanism for BESS



JV (OTPC and APDCL): National Green Energy Assam Limited; Source: ADB's TA Consultant

256. **Unresolved Grievances.** If the established GRM is not able to resolve the issue, then it must pass to the courts of law or alternatively an affected person can use the ADB

Accountability Mechanism through directly contacting (in writing) the Complaint Receiving Officer (CRO) at ADB headquarters or ADB India Resident Mission. A complaint can be submitted in any of the official languages of ADB's developing member countries. The ADB Accountability Mechanism information will be included in the project-relevant information to be distributed to the affected communities, as part of disclosing the GRM. Despite the GRM, a grievant shall have access to the country's legal system at any stage and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the outcome of the GRM resolution.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Introduction

257. ADB's Safeguard Policy Statement (SPS) 2009 requires that an Environmental Management Plan (EMP) be prepared to ensure construction and operation of the BESS and distribution components of the project will be undertaken in accordance with its safeguard requirements. It is an overarching document that will guide environmental management implementation, supervision, and monitoring by APDCL of Government of Assam, the JV and their contractor's activities on the BESS and distribution components under the project. The EMP aims to (i) ensure project implementation by APDCL and the JV will comply with ADB's Safeguard Policy Statement 2009 requirements and international good practice as set out in the IFC Environment, Health and Safety (EHS) general and sector guidelines, (ii) ensure project implementation will comply with applicable environmental, health and safety requirements of the Government of India (including international agreements it is a signatory too) and Government of Assam, and (iii) ensure local biological and human receptor sensitivities are taken into account.

258. The EMP summarizes the anticipated adverse environmental impacts and risks of the BESS and distribution project component, measures required to avoid, reduce, mitigate, and compensate/offset for the impacts and risks identified, and monitoring requirements with respect to the following stages: (i) pre-construction, and construction, and (iii) operation and maintenance including decommissioning of the BESS. It also includes an environmental assessment checklist and consultation proforma for distribution lines/DTRs to inform any IEE update prior to construction. Prior to the approval of sites/routes/designs APDCL will consult ADB regarding the need to update the IEE. The IEE report will be updated to cover environmental impacts and mitigation measures after the finalization of distribution line route alignments including the sites for the related DTRs by EPC contractors. The updated IEE report (addendums) can be prepared in phased manner (based on finalized detailed design/route alignments for the distribution lines) as per suggested format given in **Appendix 16** of the IEE. The updated IEE including the EMP shall be submitted by the APDCL to ADB for review and clearance before commencement of work. There is no need to update the IEE for the BESS and substations unless the scope of works changes. As part of the EMP, in addition to general mitigation and monitoring plans applicable to all components detailed mitigation and monitoring plans are developed for the substation works, BESS installation, distribution lines, and related DTRs to be implemented by APDCL, JV and their contractors during the project implementation. To ensure the mitigation and monitoring plans are implemented by the project management unit (PMU) or JV and contractor, APDCL and the JV will undertake a program of environmental supervision, audit and monitoring supported by PMC during the project implementation.

259. The definitive version of the EMP cleared by ADB will be the version disclosed on its website. The EMP is dynamic and can be updated as appropriate during the project implementation. However, any update to the EMP will first need to be cleared by ADB. In addition, any unanticipated impacts, or requirements for corrective action due to non-compliance identified during project implementation will be reported by APDCL (JV) to ADB, appropriate action will be agreed and taken by APDCL, the JV and their contractors to address them and bring the project implementation back on track.

260. The EMP contains a number of components crucial to effective environmental management within the project, these include:

- (i) Corrective Action Plan (CAP) for existing facilities (substations) to be implemented by APDCL (under JV working together with AEGCL for BESS

- linked substation) pre-construction unless APDCL or JV has delegated them to the contractor as part of their contractual obligations (**Appendix 12, Table A1**);
- (ii) Mitigation plan including performance standards to be implemented during detailed design and pre-construction, construction, and operation and maintenance and decommissioning (BESS) phases (**Appendix 12, Table A2** provides the general mitigation plan which is applicable to all components, and component specific plans for the substation works, BESS, distribution lines, and DTR components;
 - (iii) Environmental, health and safety codes of practice (ECOP) elaborating on the mitigation measures to be implemented during the construction, and operation and maintenance phases (**Appendix 13**);
 - (iv) Environmental assessment checklist, consultation proforma to confirm siting/routing and design meets the environmental principles and to inform the IEE update prior to construction (**Appendix 14**);
 - (v) Environmental monitoring plan (EMoP) including performance standards for quantitative monitoring to be undertaken during pre-construction, construction, and operation and maintenance and decommissioning (BESS) phases (**Appendix 15**) provides the general monitoring plan which applicable to all the components, and component specific plans for the substation works, BESS, distribution lines, and DTR components);
 - (vi) Implementation arrangements, including organizational roles and responsibilities for mitigation, supervision, monitoring and reporting, training requirements for APDCL, JV and their contractors on various aspects of EMP implementation, and preliminary cost estimates/budget covering the various aspects of EMP implementation.
 - (vii) Grievance redress mechanism (GRM) – this will be part of the IEE report and sets out the GRM with roles and responsibilities for APDCL (and JV for BESS) and their contractors, both APDCL and JV and their contractors will have GRM focal points.

261. For operational management, ADPCL will develop and implement standard operating procedures (SOP) addressing the environment, health and safety impacts and risks of its substations, distribution lines, and DTR operation and maintenance works including recording of any occupational and community health and safety incidents. The JV will prepare similar for the BESS as part of its ESMS to be developed as part of the equity contribution. Decommissioning management plan for the BESS component will also be developed and implemented nearer the time.

B. Impacts, Mitigation and Monitoring

1. Summary of main impacts

262. Potential environmental impacts were identified in relation to the design, location, construction, operation and maintenance (decommissioning) of the BESS and distribution infrastructure and mitigation measures have been developed in respect of all impacts identified, and potentially significant ones provided below:

- The distribution component area (East and West Karbi Anglong and Dima Hasao) qualifies as critical habitat. Direct habitat loss and degradation, especially the loss of natural forest habitat, is the main concern with respect to potential impacts. Critical habitat-qualifying flora and fauna species may occur along the distribution lines. However, no tree cutting is envisaged by APDCL for either the BESS or distribution component, only lopping/trimming will be required.
- The BESS component involves batteries which will need to be disposed of as hazardous waste at end of life.

- Occupational health and safety risks are potentially significantly due to working at height and with electricity etc.
- Many existing distribution lines were observed to be passing over houses and shops with poles/DTRs located in private compounds whilst some were seen to cross/run near school compounds.¹⁰³ Houses were observed to be being constructed below power lines in at least two sites. It is a potentially significant community health and safety risk as many poles/DTRs were also observed to be broken/hanging and non-compliant to safety clearances with lines sagging/low hanging in dense settlement areas. This may expose the locals to electrocution hazards because of direct contact with live conductors or flashover from the conductor to a pole, particularly if the person, tree, or structure is near a live line where the safe horizontal or vertical clearances are compromised.
- Other impacts are traffic congestion, noise, and dust in semi-urban/dense settlement and market areas, and at sites with occupied properties adjacent. Pollution, health and safety risks to workers and the community will remain during operation and maintenance works. The environmental audit for existing substations (including one associated with the BESS site) did not identify any transformers containing PCB oil, based on assessment against United Nations Industrial Development Organization (UNIDO) guidance. However, transformer oil of any transformers being worked on or removed as part of the project will be tested for PCBs. New transformers will need to be installed on securely fenced, banded plinths of 110% capacity for ground-mounted transformers in accordance with international good practice and the Government of India's regulations.
- Local physical cultural resources were identified along the sample distribution lines, and at least four lines were observed that were inside temple/churches which may be disturbed during works if not realigned.

263. The criteria and principles that have been/will be adopted by APDCL for selection of route alignments for the new DTR associated distribution lines and DTRs are:

CRITERIA

- a. Lines and their related equipment in natural habitat will only be installed where significant conversion or degradation of natural habitat can be avoided.¹⁰⁴
- b. Lines and their related equipment in critical habitat (all areas of the districts) will only be installed where site-specific biodiversity assessment demonstrates significant adverse impacts can be avoided.¹⁰⁵
- c. No lines or related facilities in Wildlife Sanctuaries will be taken up under the distribution component.
- d. No lines or related facilities in Elephant Reserves or Reserved Forests which are requiring Wildlife Clearance or Forest Clearance will be taken up under the distribution component—existing RoWs will only be used if the Forest Clearance has already been granted and a No Objection Certificate is available.
- e. In Elephant Reserves and Reserved Forests or any other notified forests only covered conductor 11kV and ABC LT lines following existing RoWs without any diversions (unless they remain in existing road RoWs) and not requiring new access track

¹⁰³ To uphold safety clearances and minimize community health and safety risks during operation minor rerouting may be required with great care taken in dismantling the existing conductors.

¹⁰⁴ Subject to completion of the IEE, it is anticipated significant conversion or degradation of natural habitat can be avoided since all the routes will follow existing RoWs albeit with minor diversions.

¹⁰⁵ Subject to completion of the IEE, it is anticipated significant adverse impacts can be avoided in most circumstances; exceptions relate to routes where critical habitat flora or the breeding or roosting sites of critical habitat fauna fall directly in or adjacent to RoWs as confirmed by design stage ecology surveys and to be reported through a site-specific assessment checklist. If exceptions are found during ecology surveys ADB should be consulted for advice and further site-specific assessment and mitigation measures will be required to demonstrate no significant adverse impacts before lines will become eligible.

construction will be taken up having first received a written no-objection from the Environment and Forest Department of Assam.¹⁰⁶

- f. In the eco-sensitive zones (ESZ) of Wildlife Sanctuaries of Assam or Nagaland only covered conductor 11kV and ABC LT lines will be taken up with intimation to and the confirmation of the Environment and Forest Department of Assam no further permission is required.¹⁰⁷
- g. In Key Biodiversity Areas (KBAs) and Important Bird Areas (IBAs) only covered conductor 11kV and ABC LT lines following existing RoWs without any diversions (unless they remain in existing road RoWs) and not requiring new access track construction will be taken up.
- h. No lines or related facilities in the protected or regulated zone of Archaeological Survey of India and Directorate of Archaeology Assam protected monuments will be taken up under the distribution component.
- i. Lines and related facilities will only be installed where significant damage to local physical cultural resources can be avoided and physical cultural resources do not need to be removed from their current location.

PRINCIPLES

- q. New lines that trigger Category A (activities with significant adverse environmental impacts that are irreversible, diverse, or unprecedented) shall not be taken up under the distribution component.
- r. New lines resulting in the significant conversion or degradation of natural habitats as defined by ADB [Safeguard Policy Statement 2009] or which occur in areas with presence of ADB Critical Habitat-qualifying biodiversity and have been demonstrated through a site-specific assessment not to comply with ADB's Safeguard Policy Statement 2009 requirements, shall not be taken up under the distribution component.
- s. For all lines and related activities an ecological walkover to be conducted during the site specific assessment and prior to starting construction work to ensure adverse impacts to critical habitat species as well as nesting or roosting birds (and their eggs) or bats are avoided etc.
- t. Covered conductor and ABC lines and poles will adopt a "wildlife (including bird) sensitive design" such that, at the poles, all equipment will be adequately spaced, and live infrastructure insulated in 2m of any earthed infrastructure.
- u. Lines must conform to the standard 6 metre (20 feet) height from the ground set by the Indian Electricity Rules but in order to prevent elephant electrocution, the height above the ground at the lowest point of the lowest conductor or grounding wires (i.e., at maximum sag point) of powerlines passing through ESZ, Elephant Reserves, Reserved Forests, elephant corridors, natural habitat, or other areas outside of settlements with known presence or movement of Asian elephants, shall be: a minimum of 20 feet (6.6 metres) above ground on level terrain (slope <20 degrees) or a minimum of 30 feet (9.1 metres) above ground on steeper terrain (slope > 20 degrees).¹⁰⁸
- v. In Elephant Reserves, in recognized elephant corridors or other locations suggested for forest officials, installation of reinforced power supply poles with spikes to prevent rubbing of elephant in the post
- w. Lines will follow existing RoWs albeit with minor diversions to ensure safety clearances are met.
- x. Reconducted lines must meet all horizontal and vertical safety clearances with minor rerouting taking place if it is required.

¹⁰⁶ Consultation with wildlife and forest officials indicated that it would be forthcoming on request provided existing lines had earlier received Wildlife Clearance or Forest Clearance.

¹⁰⁷ Consultation with wildlife officials indicated that this would be forthcoming on request.

¹⁰⁸ <https://moef.gov.in/wp-content/uploads/2018/04/FIRSTDraft-guidelines-roads-and-powerlines.pdf>

- y. Lines will not be laid across school compounds, playgrounds, or other areas where children as vulnerable members of the community assemble without parental supervision; if adjacent guarding/net will be installed.¹⁰⁹
- z. Lines will not be laid across areas where community groups regularly assemble such as the grounds of temples or churches unless agreed with the representatives of user groups.
- aa. Removal or reconductoring of existing lines must minimize damage to existing trees and properties.
- bb. Lines and related equipment must avoid or minimize damage to trees whilst ensuring horizontal and vertical safety clearances are maintained. If identified to be cut, felling will be after permission from the Environment and Forest Department of Assam has been secured.
- cc. Lines and related equipment must avoid or minimize damage to property including structures (e.g., buildings) and roads, private gardens, crops, etc. whilst ensuring horizontal and vertical safety clearances are maintained. Any compensation payments for damages to private property must be undertaken by APDCL in accordance with the social safeguards entitlement matrix before the works commence.
- dd. Lines and related equipment must create minimum disturbance to existing pedestrian and traffic routes in terms of blockages or diversions.
- ee. Poles or any electrical equipment must not be installed in perennial or seasonal water bodies/riverbeds.

2. Corrective Action Plan for Existing Substations

264. Since the substation works and BESS facility involve existing facilities, these have been subject to environmental audit as summarised in the IEE. All substations were audited. Based on the findings it is necessary for corrective action to be undertaken by APDCL or by NGEAL working with AEGCL in respect of the BESS bay extension. **Appendix 12, Table A1** of the IEE contains the corrective action plan (CAP); unless otherwise indicated, all actions are to be completed by APDCL or JV prior to their contractors being given access to project sites involving existing facilities. APDCL or JV may delegate some actions to their contractors, as part of their contractual obligations. In this case the actions are to be delivered by the contractor at the same time as undertaking the project works. The corrective action plan also applies to 400kV Mirza Grid substation of AEGCL, planned to be linked with the new BESS facility with a bay extension.

3. Environmental Mitigation Plan

265. All contractors will comply with all applicable national and state environmental, health and safety (labor) laws and regulations, any environment, health and safety policy or procedures of APDCL or NGEAL, ADB's Safeguard Policy Statement (2009) environmental safeguard requirements along with the International Finance Corporation's Environmental Health and Safety General Guidelines and the guidelines on Electric Power Transmission and Distribution, and the International Labor Organization's Safety and Health in Construction guidelines allocating the staff and budget required to ensure that such requirements are met.

266. **Table A2 to Table A4 in Appendix 12** set out the mitigation plans for the distribution lines (Table A4), substations/BESS/DTR (Table A3) components as well as a general plan (Table A2) which is applicable to all components even those with minimal impacts. The mitigation plans identify feasible and cost-effective mitigation and compensation (offset) measures to be taken to reduce potentially significant, adverse environmental impacts and

¹⁰⁹ Minor rerouting may be required to avoid crossing them based on site visit observations of the ADB TA consultant.

risks to acceptable levels and generally ensure international good practice, and national environmental, health and safety requirements are followed. Here, mitigation and compensation (offset) measures are proposed for each potential impact and risk identified by the IEE, including details of the responsible parties for implementation, the budget source for supporting key activities, and the associated performance standards to be achieved. The mitigation measures in the EMP are to be implemented at all construction sites as well as at any workers camps or accommodation provided by EPC contractors or their subcontractors, on or off site. Some measures that must be commenced during the detailed design and pre-construction phase will need to continue to be implemented by the contractor during the construction phase. Operational (decommissioning) phase mitigation measures are primarily for APDCL and NGEAL. However, all maintenance works during this phase including by the contractors during their defect liability period and operation/maintenance obligations will be undertaken following the construction measures.

4. EHS Codes of Practice (ECOP) and Construction EMP (CEMP)

267. The EHS Codes of Practice (**Appendix 13**) further elaborate on the pollution prevention, health, and safety measures to be adopted and are to be implemented as an integral part of the mitigation plans.

268. The CEMP is the document that the EPC Contractor will prepare outlining how they intend to implement the project-level EMP and ensure that all the mitigation and monitoring is completed according to the implementation arrangements specified in the EMP and the IEE as a whole. The CEMP will describe the precise location of the required mitigation / monitoring, the persons at the contractor responsible for the mitigation / monitoring, the schedule and reporting methodology etc. The CEMP will be approved by APDCL or NGEAL before work starts. The CEMP will include the following key sub-plans – Pollution Prevention Plan and Emergency Response Plan, Biodiversity Management Plan for Distribution Line and DTR works, Occupational Health and Safety Plan & Emergency Response Plan, Labour Management Plan, Construction Camp/Labor Accommodation Management Plan, Community Health and Safety Plan and Emergency Response Plan, Chance Find Procedure for Distribution Line and DTR works, Waste Management Plan including e-waste management plan for BESS, Traffic Management Plan, and Training Plan.

5. Environmental Monitoring Plan (EoMP)

269. The EMoP (**Appendix 13**) sets out the minimum provisions for quantitative environmental monitoring and performance standards to be achieved. Monitoring activities including sampling and analysis for air quality, noise, surface water and groundwater quality, and soil are to be carried out by NABL¹¹⁰ and/or MOEF&CC accredited suitably qualified and experienced third-party monitoring organisation. Quantitative monitoring activities may be modified during project implementation, depending on the contractors' performance and analytical results obtained. If performance is worse than expected, corrective action will be identified, and environmental monitoring activities adjusted accordingly by APDCL/NGEAL to help resolve any unsatisfactory performance.

270. In addition to quantitative monitoring there will also be supervision and monitoring of EMP implementation, the performance standard being all EMP measures are implemented in full at the appropriate time. Following loan effectiveness, environmental monitoring reports (EMRs) (**Appendix 16**) will be submitted to ADB on a semi-annual basis by APDCL (including inputs on the BESS provided by NGEAL) up to the completion of construction reverting to an

¹¹⁰ National Accreditation Board for Testing and Calibration Laboratories (NABL) is an accreditation body in India, with its accreditation system established in accordance with ISO/ IEC 17011. "Conformity Assessment – Requirements for Accreditation bodies accrediting conformity assessment bodies." For testing laboratories

annual basis during operation up to the ADB project completion report with safeguards inputs provided to quarterly progress reports. Following loan effectiveness, semi-annual EMRs will be due for submission to ADB within 15 days of the month following period end, e.g., before mid-July and mid-January each year. EMRs will be submitted until the ADB Project Completion Report is issued, or later if required therein. The EMRs will describe project implementation progress, any scope or design changes, compliance against safeguard requirements that are covenanted in the legal agreements, progress with environment mitigation and offset implementation, quantitative monitoring results in accordance with the EMoP, and grievances received.

271. If any performance standards are breached or any of the safeguard requirements that are covenanted in the loan agreements are found not to be satisfactorily complied with by APDCL, NGEAL and their contractors, an appropriate, time bound, budgeted, corrective action plan (CAP) will be developed and implemented as agreed upon with ADB to rectify unsatisfactory performance or safeguard noncompliance. EMRs, CAP if prepared by APDCL/NGEAL separately to their EMR submission, and updated IEE, if any, submitted by APDCL during project implementation will first be reviewed by ADB to ensure quality and acceptability and then, once cleared by ADB for disclosure, are to be disclosed locally (in the same places as the IEE report was originally disclosed) by APDCL/NGEAL and on the ADB website upon receipt.

C. Institutional Arrangements and Implementation Responsibilities

272. The main parties that will be involved in environmental management and monitoring activities for this project are as follows:

273. **The Government of Assam, Power Ministry (Electricity Distribution)** is the executing agency (EA) and main project coordinating body on behalf of government.

274. **APDCL Management.** APDCL Management is the implementing agency (IA) for the project, having responsibility for environmental, health and safety management and compliance with Government of India and Government of Assam regulatory requirements, ADB's Safeguard Policy Statement 2009, and ADB project's loan covenants and EMP requirements during all phases of project implementation ultimately lies with APDCL's management. It also has the responsibility for leading on delivery of the distribution component.

275. **New and Green Energy of Assam Ltd Management (NGEAL).** The JV Management will receive an equity contribution to deliver the BESS component, and in doing so will take responsibility for environmental, health and safety management. Compliance with Government of India and Government of Assam regulatory requirements, ADB's Safeguard Policy Statement 2009, and ADB project's loan covenants and EMP requirements during all phases of BESS implementation lies with NGEAL's management. NGEAL will be developing an ESMS under the project.

276. **APDCL Project Management Unit and NGEAL Project Management.** Responsible for the overall day-to-day management of the technical, environmental, and social aspects of the distribution and BESS components and thus compliance with Government of India and Government of Assam regulatory requirements, ADB's Safeguard Policy Statement 2009 and the project's loan covenants and EMP requirements during the detailed design, preconstruction and construction phases, reporting to APDCL or NGEAL management. The APDCL Project Management Unit (PMU) for the distribution component and NGEAL project management team for the BESS will be overall responsible for EMP implementation, coordination, supervision and monitoring activities. For this, the APDCL PMU and JV will include their own environment, health and safety safeguard staff – one environment officer,

and, one health and safety officer, there will also be a social safeguard specialist for the distribution component and one EHS supervisor for the BESS. Upon completion of construction, since EMP implementation is ongoing during O&M, the APDCL and JV EHS staff will need to continue in their roles sitting within their respective organization structure to provide corporate EHS support. APDCL and NGEAL may decide to source the EHS safeguard staff either through direct hiring (either on a contractual or permanent employment basis) or through deputation. Since NGEAL JV have no existing staff and there may be a shortage of suitably qualified and experienced EHS professionals presently employed in APDCL given their focus on electrical engineering a direct hiring is the advised approach.

277. The PMU and JV EHS staff will be responsible for ensuring correct implementation of the Environmental Management Plan (EMP) and compliance with ADB's safeguards requirements and environmental (including ecology), health and safety (labor) national regulations. They will be tasked to supervise/support and if required obtain permissions, prepare the training plan, stakeholder engagement plan, consultation materials, operationalize the GRM, update the IEE, approve the EPC Contractors designs and CEMPs, prepare EMRs, and so on, in addition to undertaking day-to-day on-site supervision and monitoring activities of their respective contract packages. PMU/JV will delegate relevant detailed design, preconstruction, and construction measures from the EMP to their contractors through the contract.

278. If any change in design including sites/routes or other unanticipated environmental impacts become apparent during project implementation, PMU/JV will be required to immediately inform ADB and (i) assess the significance of such unanticipated impacts; (ii) evaluate the options available to address them; and (iii) update the IEE and EMP taking corrective action where necessary.

279. **APDCL Project Implementation Unit and NGEAL.** For the distribution component, the PMU staff will be supported by the Project Implementation Units (PIUs) of APDCL (Electrical Division). The BESS project management team of NGEAL will also be supported by a site team. These will be responsible for EMP implementation at site level during detailed design, preconstruction and construction. They will undertake day to day on-site management, supervision and monitoring of the contractor with respect to the technical, environmental, and social aspects of implementation and thus compliance with all requirements. There will need to be a designated EHS supervisor at district level in each PIU and the EHS supervisor will be resident at the BESS site responsible for day-to-day supervision of environment, health and safety related aspects on the ground, acting as GRM focal during implementation of the project components and reporting to the PMU or JV EHS staff. There will also need to be adequate numbers of field officers (PIU) who are dedicated to EHS supervision and implementation during execution of the project.¹¹¹ EHS field officers will be responsible for supervising and monitoring the contractor's implementation, with technical field officers responsible for implementing the EMP with respect to APDCL responsibilities. The Electrical Divisions and NGEAL project management team will also need to nominate the electrical safety officers as per the regulatory requirements with respect to overseeing the design, installation, and O&M of electrical equipment.

280. The APDCL staff nominated for EHS support at PIU level will form the basis of EHS units which will be established at Electrical Division level, and which will continue into operation of the project. APDCL and NGEAL O&M staff with the support of the PMU/JV EHS staff will become fully responsible overall day to day management of the technical,

¹¹¹ The number of EHS site supervisors required in an Electrical Division will depend on the number of components being undertaken under their jurisdiction, there should be at least one EHS site supervisor nominated for works on each substation with separate EHS site supervisors overseeing the distribution line works.

environmental, and social aspects and thus EMP implementation during operation and maintenance.

281. **Contractors and their subcontractors, if any.** The APDCL PMU and NGEAL will delegate responsibility for implementing all relevant measures during detailed design, pre-construction, construction, and for the BESS the first six months of operation to their contractors. The contractor will be required to comply with the ADB-cleared IEE report during the detailed design, preconstruction, and construction phases, and for any operational period, closely supervised and monitored by the APDCL PMU and NGEAL. The contractor will be responsible for (a) providing the relevant details/environment data after detailed design/route or DTR site finalization of distribution lines to the PMC for updating the IEE reports (in the form of an addendum, in phased manner) for distribution lines; and (b) reporting environmental safeguards progress and performance at least monthly to PMC/APDCL PMU/NGEAL including record data required by the EMoP and providing necessary inputs to the quarterly progress reports and semi-annual EMRs for the duration of their contract. The requirement to undertake relevant mitigation and monitoring actions as set out in this EMP applies to the construction site as well as any temporary workers camps or overnight accommodation provided by them. The main EPC contractor has responsibility for EMP implementation. However, the contractor is required to ensure that the EMP requirements are cascaded down to all sub-contractors (if engaged under the Project) undertaking works, regardless they are formally or informally employed, and to be responsible for supervising and monitoring their sub-contractors in turn. The cost for implementing mitigation and monitoring measures as outlined in this EMP will be included in the EPC contract, unless specifically assigned to APDCL/NGEAL to implement.

282. It must be ensured through the bidding document that the following staff are on the contractor's team;

- At least one dedicated environment manager with an environmental management bachelor's degree or similar qualification and 15 years' experience to be based full-time on-site for the duration of works under the contract package, to manage the environment safeguards team and support the contractor's EMP implementation on a day-to-day basis reporting to their management, including environmental assessment forms and consultation proformas during detailed design and supervising—and monitoring works -- preparation of weekly environment checklists to agreed formats and the environmental section of the monthly progress reports;
- For distribution line packages at least one dedicated ecologist/botanist with an ecology bachelor's degree or similar qualification and 10 years' experience including familiarity with Assamese flora and fauna to be based full-time on-site for the duration of works under the contract package, to support with environmental assessment forms during detailed design and the contractor's EMP implementation on a day-to-day basis reporting to the environment manager;
- For BESS and substations, a part-time ecologist/botanist with an ecology bachelor's degree or similar qualification and 10 years' experience including familiarity with Assamese flora and fauna to be available on call for the duration of works under the contract package, to support the contractor's EMP implementation on a day-to-day basis reporting to the environment manager;
- An environment specialist with an environmental management bachelor's degree or similar qualification and 15 years' experience in pollution control including PCB and SF6 management to be available on call for the duration of works under the contract package, to support the contractor's EMP implementation on a day-to-day basis reporting to the environment manager;
- One dedicated health and safety manager with NEBOSH/IOSH certification or similar qualification with 10 years' experience to be based full-time on-site for the duration of

works under the contract package, to implement, supervise and monitor the health and safety (labor) aspects of the EMP on a day-to-day basis reporting to the environment manager-- preparation of weekly H&S (labor) checklists to agreed formats and the H&S (labor) section of the monthly progress reports;

- At least one dedicated labor officer with 5 years' relevant experience to be based full-time on-site for the duration of works under the contract package, to implement, supervise and monitor the labor aspects of the EMP on a day-to-day basis reporting to the health and safety manager; and
- At least one dedicated social and community liaison officer with 10 years' relevant experience for the distribution component to be based full-time on-site for the duration of works under the contract package, to act as the GRM focal and implement, supervise and monitor the social and community relations aspects of the EMP on a day-to-day basis reporting to the environment manager.

283. Further, each active construction site is to have adequate environment, health and safety supervision, particularly to ensure the health and safety of all workers and local communities. Environment, health and safety supervisors are to be suitably qualified and experienced senior engineers having NEBOSH/IOSH certification or similar qualification who are based on-site full-time and nominated to the role of EHS supervisor with responsibility for ensuring EMP implementation by the contractor, subcontractors and third parties, acting on the advice of, and reporting to the environment safeguards team. Each nominated EHS Supervisor will be supported by full-time onsite Health and Safety steward(s) with at least one steward to each 50 persons – a steward will not supervise more than one site/distribution line or more than 50 workers at a time.

284. All subcontractors will be required to appoint an OHS representative, who will be available on each work site.

285. Other safeguard experts such as field ecologists including botanists/taxonomists with expertise in Assam or archaeologists will also need to be employed on a part-time/intermittent basis by the contractor to meet the EMP requirements, particularly for completing the site specific assessment checklists to ensure sensitive receptors are adequately identified, and depending on the subsequent site-specific assessment and management requirements of each component.

286. The contractor's environment safeguards team will act as their GRM focals for each contract package to keep affected persons informed of works and be available to receive and deal with any grievances at the project site level. They will also be responsible for reporting EHS progress and performance at least monthly to APDCL and providing necessary inputs to the quarterly progress reports and the semi-annual EMRs.

287. Construction contractors will have a corporate EHS policy and environmental management certifications such as ISO 14001 (or equivalent) and EHS certification such as ISO 45001 or equivalent.

288. **Project Management Consultants (PMC).** Capacity building and training will be required especially for the APDCL PMU, PIUs, NGEAL and contractors. The training and capacity building will not only be project specific but will also target the development of long term EHS capacity at the APDCL and NGEAL at corporate and Electrical Division/BESS level. For this the APDCL PMU and PIUs and NGEAL will be assisted by environmental, health and safety specialists of the Project Management Consultant (PMC) in supervising the implementation of the EMP/CEMP who will provide environment, ecology/wildlife, social, labor, health and safety and gender expertise. Given ecological sensitivities an ecologist/botanist specialized in Assamese flora and fauna needs to be included whilst the distribution component will benefit from an expert in pollution control, oil and PCB

management. Residential environment, health and safety (EHS) supervisors will be employed on full time basis for day to day supervision of the BESS and distribution components in conjunction with the APDCL PMU, PIU and NGEAL EHS staff. The EHS supervisors will be based at the sites.

289. APDCL to also hire as part of the PMC an ESMS consultant in relation to the equity contribution. The ESMS consultant will prepare an Environmental and Social Management System to allow NGEAL to address environment, health and safety, labor and social safeguard impacts and risks associated with its operations, including policies and procedures for implementing all its future BESS developments and SOP for O&M of the BESS including under the project.

290. The PMC will help APDCL and NGEAL JV to develop standard operating procedures (SOP) addressing the environment, health and safety impacts and risks of its operational substations and the BESS, maintenance of these facilities and the distribution lines, including recording of any occupational and community health and safety incidents since they will be responsible for this phase of the project.

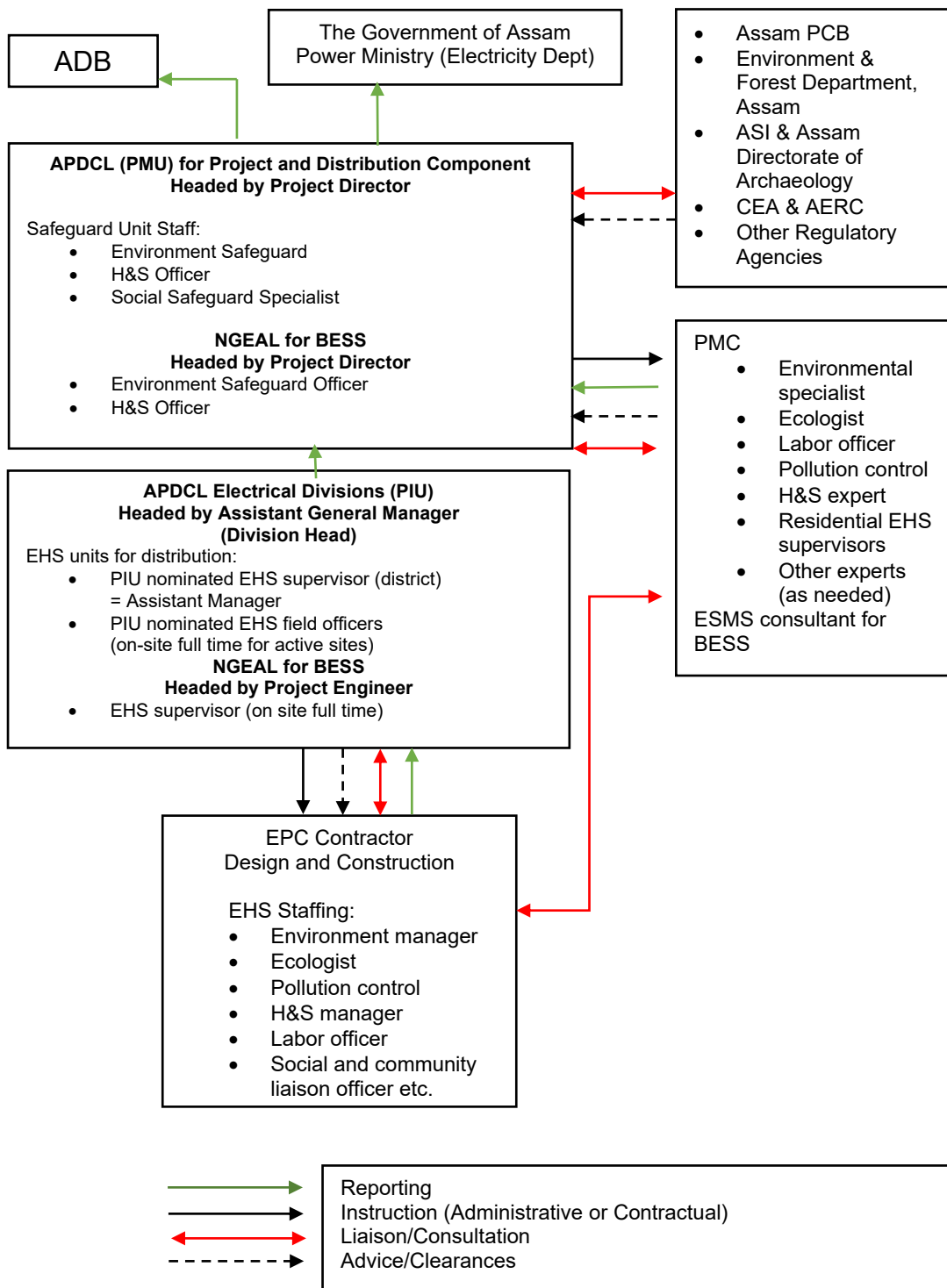
291. **Construction and O&M workers employed formally or informally by ADPCL, NGEAL, contractors and their subcontractors**—these workers will need to abide, in their behaviour and work, to directives issued by their employer with regards to environmental, health and safety management.

292. **The Assam Electricity Grid Corporation Limited (AEGCL)**, is a Public Sector Company registered under 'Company Act, 1956'. It is notified as the State Transmission Utility (STU). Its core business is to efficiently transport electrical power from electrical power bulk heads to the distribution company networks in the state of Assam. The new BESS facility to be linked with the 400kV Mizra Grid substation in Kamrup District, will be housed within this AEGCL land. The corrective action plan will apply to this AEGCL substation where a bay extension will be undertaken.

293. **Line agencies with regulatory responsibilities**— Other government agencies (refer Figure 7.1) are responsible for issuing and enforcing environment, forest and wildlife clearances, other permits, and licenses that may be required for the the BESS and distribution component of project and must be sought by APDCL, NGEAL or their contractor.

294. The proposed institutional arrangement relevant for EMP implementation is shown in Figure 8.1. The reporting, instructions, liaison/consultation, and advice/inspection channels are also shown.

Figure 8.1 Environment Safeguards Implementation Arrangement



Source: ADB's TA Consultant

295. **Roles and responsibilities of the Borrower.** Detailed roles and responsibilities are as follows:

1. **APDCL PMU and NGEAL/EHS Safeguard Staff**

- Ensuring adherence to all applicable national and state environment, health, safety, and labor laws and regulations in force at the time.
- Ensuring adherence to ADB's Safeguard Policy Statement (2009) and the related IFC Environment, Health, and Safety (EHS) general and power transmission and distribution guidelines (2007) and the International Labor Organization's Safety and Health in Construction guidelines.
- Ensuring adequate management support, budget, staff, and other resources are allocated to satisfactorily implement, supervise, and monitor implementation of the EMP during all phases.
- Appointing suitably qualified and experienced staff to support EMP implementation during construction and operation, as per the EMP capacity building requirements.
- Preparing a detailed training plan, providing training venues, and providing with support of PMC a suite of training activities for APDCL/NGEAL staff and contractors in relation awareness raising on EMP implementation.
- Ensuring that all PMU/PIU/O&M/NGEAL/ staff support and attend all capacity development and training activities provided for them.
- Adopting a zero-tolerance approach to OHS and enforcing all APDCL/NGEAL staff to comply with OHS requirements of the EMP including wearing of appropriate PPE on site to set a good example to the contractor and their workers.
- Implementing the EMP throughout all phases or, if responsibilities are delegated, supervising, and monitoring implementation by the contractor.
- Incorporating the EMP into the bidding and contract documents before issuing tenders and contract awards.
- Reviewing bids to ensure they are fully in accordance with the EMP requirements prior to contract award.
- Implementing the corrective action plan at the existing substations prior to access being given to the contractor or delegating actions to the contractor through the contract.
- Ensuring that all necessary Forest Clearances and NOC are secured before approving the works to start in the ESZ/Elephant Reserve/Reserved Forests.
- If required, ensuring all tree cutting permits and necessary compensation is paid to the forest department for cutting of trees before the commencement of related work. To agree an MOU for monitoring of any required compensatory plantation as per the EMoP requirements.
- Ensuring the contractor secures all necessary CTE, CTO (for construction plant, and ancillary facilities like DG for BESS component), insurances, labor and other permissions before the commencement of related work, maintain records with copies of all the clearances, permits, licenses, and insurances obtained.
- Ensuring the contractor provides adequate training to their subcontractors and all workers including daily EHS toolbox talks and emergency response drills; suggesting topics for the training based on site observations.
- Ensuring all distribution lines and DTRs comply with the criteria/principles set out in the IEE.
- Ensuring the completion of environmental assessment forms and consultation proformas for each site/distribution line and undertaking site specific assessment and management planning and updating the IEE/EMP as required in consultation with ADB prior to approval of the contract package, contractor's sites/route alignments with respect to any changes from the impacts/risks of sample, indicative sites/distribution line routes assessed in the IEE. Obtaining ADB's clearance for the IEE/EMP update prior to the commencement of work, including site establishment and vegetation

clearance. Once cleared, ADB will disclose the updated IEE on its website whilst APDCL will locally disclose it.

- Following site specific assessment reviewing and approving the contractor's detailed designs, as well as CEMP and EMP sub-plans to ensure they incorporate and are in accordance with the EMP requirements including additional site-specific requirements.
- Preparing a community liaison plan to elaborate on ongoing consultation and information disclosure in relation to EMP implementation considering gender, vulnerable groups, and indigenous peoples; preparing consultation materials for distribution to affected communities.
- Locally disclosing the IEE and other environmental safeguards documents, including publication on APDCL's website. Help with translation of the IEE into local languages or an explanation of its content will be extended free of charge to affected persons on request.
- Undertaking and documenting all ongoing consultation, details of consultations such as minutes of the meetings, photographs to be documented in the EMRs submitted to ADB.
- Establishing and operationalizing the GRM for affected persons (construction workers and local community members) in line with GRM Chapter in IEE report, including appointing GRM Focals and establishing a GRC, disseminating contacts, recording, and promptly resolving grievances received. All ongoing grievance-related information will be documented in the EMRs submitted to ADB.
- Once operational, any contractors hired for maintenance works will be supervised and monitored by O&M staff with roles and responsibilities the same as those of the contractor for construction.
- Developing and implementing SOP building on the EMP and reflecting operation and maintenance-related measures to be followed by APDCL/NGEAL O&M team addressing the environment, health and safety impacts and risks of the BESS and substations, distribution lines, and DTR operation and maintenance works including recording of any occupational and community health and safety incidents.
- Checking, supported by PIU/PMC that environmental monitoring as set out in the EMoP during all phases, documenting quantitative and qualitative monitoring results, for quantitative monitoring hire accredited, and quality assured, third-party laboratories is being implemented.
- Undertaking with the support of PIU/PMC monthly EHS meetings including site walkover inspection to determine the status of EMP implementation by the contractor during construction as well as random "spot check" site visits to audit their EMP implementation. Minutes of meetings and findings of site walkover inspections will be attached to the EMRs to be submitted to ADB.
- Identifying areas for improvement, unsafe acts, and any non-compliances with the EMP by the contractor and/or PMU/PIU staff and instructing corrective actions to be taken by them to bring implementation back on track.
- Thoroughly investigating all unanticipated impacts, near-misses, accidents, and chance finds; preparing a detailed incident report where applicable, identifying and instructing on corrective actions particularly to avoid any repetition of near-misses and accidents.
- Monitoring and reporting on EMP implementation including reporting on EMP implementation in quarterly progress reports and preparing semi-annual EMRs for submission to ADB up until the completion of construction, reverting to annual up until the ADB project completion report, or for longer period if it is required by the ADB PCR.
- Reporting any unanticipated impacts, accidents, and chance finds to ADB within 48 hours of them occurring along with a corrective action plan.
- Reporting to ADB any grievances submitted to the third formal stage of the GRM upon receipt.

- Further updating the IEE/EMP as necessary and locally disclosing any updates if any unanticipated impacts (including project scope or design changes) occur during implementation; any such updates must be submitted to ADB for clearance and disclosure on the ADB website before any related works commence or are cleared by APDCL PMU or NGEAL to continue.

2. **APDCL PIU/NGEAL**

(additional to PMU responsibilities (listed above) that cascade down to site level)

- Ensuring that prior to acceptance of the construction works from the contractor all pre-construction and construction EMP measures have been fully closed out, and the works as constructed will enable APDCL/NGEAL to fully comply with all the operational EMP measures.
- Following the formal systems and templates developed for supervision and monitoring, undertake day-to-day supervision to ensure that contractors adhere to all the provisions in the EMP as well as their CEMPs and sub-plans as approved by APDCL or NGEAL.
- Keep daily records and photo logs of site observations to inform preparation of the semiannual EMRs.
- O&M workers employed formally or informally by APDCL/NGEAL will need to abide, in their behaviour and work, to directives issued by their employer with regards to environmental, health and safety management.

296. **Roles and responsibilities of the Contractor**

- Implementing all measures and responsibilities allocated to the contractor under the EMP for the full duration of the contractor's involvement.
- Ensuring adherence to all applicable national and state environment, health, safety, and labor laws and regulations in force at the time.
- Ensuring adherence to ADB's Safeguard Policy Statement (2009) and the related IFC Environment, Health and Safety (EHS) general and power transmission and distribution guidelines (2007) and the International Labor Organization's Safety and Health in Construction guidelines.
- Ensuring the detailed design reflects the EMP requirements; seeking to ensure it has the same or no worse impact than the feasibility design or sample, indicative route alignments which were assessed in the IEE.
- Distribution Component, distribution lines and DTRs - liaising with the Environment and Forest Department of Assam and undertaking ecological surveys using experienced field ecologists for all the distribution lines during route survey for fixing alignments with focus on critical habitat species as well as confirming the absence of sensitive receptors. In case of confirmed presence of any critical habitat species either directly observed by the ecologist or as confirmed from other sources the field ecologists will conduct a species-specific survey to inform the final route alignment and design.
- Distribution Component, distribution lines and DTRs - liaising with Directorate of Archaeology of Assam to ensure physical cultural resources including archaeological sites are avoided.
- Distribution Component - ensuring all distribution lines and related facilities comply with the criteria/principles set out in the IEE.
- Distribution Component - ensuring the completion of environmental assessment forms and consultation proformas for each site/distribution line.
- Supporting APDCL PMU or NGEAL to update (as required) the IEE in respect of the detailed design by providing sufficient details to inform a revised project description and any subsequent reassessment of impacts and risks.
- Undertaking and documenting a facilitated health and safety (H&S) risk assessment considering for all phases.

- Preparing a Construction Environment Management Plan (CEMP) and sub-plans as specified in the EMP for review and approval by APDCL/NGEAL prior to the commencement of works including site establishment -- sub-plans will include a Biodiversity Management Plan with wildlife identification and rescue protocol, Cultural Heritage Management Plan including chance find protocol, Pollution Prevention Plan, Construction Waste Management Plan, Labor Management Plan, Occupational Health and Safety Plan, Community Health and Safety Plan, and Traffic Management Plan plus Emergency Response Plans, Communication Plan, Training Plan etc.
- Ensuring adequate budget, staff and other 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.
- Ensuring suitably qualified and experienced environment safeguard team, as per the EMP requirements have been appointed to undertake regular on-site supervision and monitoring activities before the commencement of works.
- 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.
- Obtaining all necessary CTE, CTO (if required), insurances, labor and other permissions before the commencement of related work, share copies of all clearances, permits, licenses, and insurances obtained.
- Providing – in part with the support from APDCL/NGEAL– and ensuring attendance at EHS training courses for formal and informal construction workers and other personnel as required.
- Ensuring that all construction workers including all formal and informal employees and subcontractors understand their responsibilities to implement the EMP and mitigate environmental impacts and risks associated with pre-construction and construction activities.
- Supporting APDCL/NGEAL in undertaking ongoing 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 APDCL/NGEAL.
- Undertaking environmental monitoring as set out in the EMoP (**Appendix 14**) during pre-construction and construction and documenting qualitative and quantitative monitoring results; for quantitative monitoring the contractor is to hire NABL/MOEF&CC accredited, and quality assured, third-party laboratories.
- Submitting monthly environmental management reports to APDCL/NGEAL (monthly EMP reports will be stand-alone but included as part of the contractors' monthly progress reports) relating to the work undertaken over the reporting period including weekly checklists to an agreed format, 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 APDCL/NGEAL immediately in case of any approved detailed design changes or unanticipated environmental impacts occurring during implementation, and as required, provide any information needed to APDCL/NGEAL to enable them to promptly update the IEE/EMP for clearance by ADB before any changes are implemented.
- Informing APDCL/NGEAL and forest/wildlife officials of any wild animals found within the work area.
- Informing APDCL/NGEAL within 24 hours in case of chance find or accident on site and providing within 48 hours an incident report with corrective action detailing how reoccurrence will be prevented.

- Informing APDCL/NGEAL immediately in case of any non-compliance and help them to prepare as necessary a corrective action plan for clearance by ADB, the contractor is required to implement all necessary corrective action requested by APDCL/NGEAL/PMC to ensure the project remains in compliance with national and state regulatory requirements, ADB's SPS 2009, the project's loan covenants and EMP requirements.
- Construction workers employed formally or informally by the contractors and their subcontractors will need to abide, in their behaviour and work, to directives issued by their employer with regards to environmental, health and safety management.

297. **Roles and responsibilities of the PMC**

- Support APDCL/NGEAL including EHS safeguards staff and other officers with environmental responsibilities in ensuring compliance with loan covenants related to environmental safeguards as well as state and national environment laws and regulations;
- Support APDCL/NGEAL to develop an environment, health and safety (labor) training plan and provide formal environmental management trainings at the appropriate stage in project implementation as set out in the EMP (and agreed training plan) including preparation of all training materials in a format that can be used for future reference, document attendees for trainings through photographs and attendance list;
- Undertake gap analysis of APDCL/NGEAL's current practice versus national requirements and international good practice on pollution risk management and control for the design, operation and maintenance of BESS, substations, storage yards, and maintenance workshops and develop an easy to understand good practice manual (standard operating procedures) with photos/drawings for APDCL/NGEAL in order to facilitate adherence to national requirements and adoption international good practice;
- Develop environment management checklists based on the EMP for use by officers and resident PMC staff with environmental responsibilities who will be undertaking daily checks in undertaking their supervision and monitoring activities during detailed design and pre-construction, construction, operation and maintenance;
- Support APDCL/NGEAL and their contractors in understanding the national laws and regulations, international good practices for environmental management, and the mitigation and monitoring requirements set out in the IEE and EMP including the corrective actions required for the existing substations and feeder terminals;
- Assist APDCL/NGEAL to monitor and supervise implementation of the project EMP by themselves and their contractors;
- Review and confirm that necessary EMP provisions as well as a copy of the disclosed EMP (which may have been updated since bidding stage) are included in the contracts for further implementation and compliance;
- Review and verify in the field the environmental assessment checklists and consultation proformas prepared by the contractors for all final alignments. Help APDCL/NGEAL to update the IEE (e.g. prepare addendum to the IEE report) to reflect final alignments/siting of related equipment including undertaking any site-specific assessment and identifying mitigation measures required;
- Help APDCL to check distribution lines and related facilities comply with the criteria/principles set out in the IEE. Check all final alignments/sites for those inside, ESZ and Elephant Reserve/Reserved Forest land and KBAs/IBAs. In helping APDCL update the IEE conduct site-specific assessments and management planning as required to demonstrate if criteria/principles are met.
- If in ESZ and Elephant Reserve/Reserved Forest land, support APDCL in applying for and securing (even for existing RoWs) from the Environment and Forest Department of Assam, all intimation/no-objection certificates or copies of existing forest clearances required for the final distribution line alignments/sites of related equipment proposed

- by the contractors to be obtained before works commence;
- Review and confirm the detailed designs adequately incorporate all EMP measures and conform with the IFC EHS General and Transmission/Distribution Line Guidelines requirements prior to their approval, identify if any forest clearances or other permits are needed for works and thus if any additional site- specific construction measures needed;
 - Review and confirm that all pre-construction requirements and relevant clearances and permits have been obtained prior to commencement of works. Maintain records and copies of all clearances, permits, licenses and insurances obtained by APDCL/NGEAL and contractors;
 - Review consultation records of APDCL/NGEAL and contractors, and confirm that meaningful consultations including with women and vulnerable groups have been completed before commencement of works;
 - Assist APDCL/NGEAL in reviewing and approving the contractor's preconstruction documentation as required by the EMP (e.g. CEMP) and confirm they conform with EMP and CEA, IFC EHS General and Transmission/Distribution Line Guidelines requirements as well as national laws and regulations;
 - Review documentation and undertake site visits to confirm that all corrective actions for existing facilities (substations, including BESS linked substation) have been adequately implemented prior to a contractor being given access (unless included in the contractor's scope of works);
 - Facilitate monthly EHS meetings/site walkovers ensuring PMC has undertaken at least monthly site visits to all active project sites across all contract packages during the construction period to check PMU supervision and monitoring activities and adequate implementation of EMP measures and, advise APDCL/NGEAL and their contractors if improvements are needed, document each site visit in field visit note including photographs;
 - Conduct ecology surveys of all sites pre-construction and provide ecologist to supervise all vegetation clearance, earthworks, and all works located within 500m of areas of high biodiversity value (WLS/ESZ/Elephant Reserve/Reserved Forest/KBA/IBA) or traversing natural forest habitat, even if degraded and not controlled by the Environment and Forest Department of Assam.
 - Assist APDCL/NGEAL in undertaking quantitative monitoring required by the EMP and provide advise (e.g. templates) for adequate record keeping for environmental monitoring purposes;
 - Prepare monthly/quarterly updates and assist APDCL/NGEAL in preparing the semi-annual environmental monitoring reports in accordance with template agreed with ADB;
 - Help APDCL/NGEAL to update the IEE (additional assessment and consultations) and EMP in the event of unanticipated impact, including a change in scope or design, or the siting or routing of project components.
 - In addition to monthly site visits carry out at least quarterly in-depth environmental audits and random spot checks of all contractors to verify compliance to applicable requirements during construction.
 - Record and help APDCL/NGEAL to develop and implement corrective action as necessary to address exceedance of performance standards or non- compliance issues;
 - Support APDCL/NGEAL and contractors to locally disclose the IEE/EMP per the EMP requirements, prepare a community liaison plan, and continue to disclose information on and conduct meaningful consultations with the affected communities especially in relation to sites with adjacent properties and the distribution line routings.
 - Support APDCL/NGEAL to operationalize and effectively implement the grievance redress mechanism, including raising awareness of its existence with affected communities, resolving grievances related to environmental issues that have been

- submitted, and keeping adequate documentation.
- Support APDCL/NGEAL to respond to any EHS related grievances.
- Prepare operational SOP/ in line with the requirements set out in the EMP to be adopted by APDCL/NGEAL and providing them with training on their operationalization.
- Prepare a final environmental monitoring report setting out in detail how the project complied with all the EMP requirements to date and how APDCL/NGEAL has been capacitated to continue to comply with the operational EMP requirements as part of the project completion report.
- Prepare an Environmental and Social Management System (ESMS) in relation to the equity contribution to allow the NGEAL JV to address environment, health and safety, labor and social safeguard impacts and risks associated with its operations, including policies and procedures for operating the project BESS and implementing all its future BESS development.

298. **Roles and responsibilities of ADB**

- Review, clear and disclose updated IEE/EMP on ADB's website as required on the finalization of route alignments and in the event of any unanticipated impacts.
- Undertake supervision and monitoring of the EMP implementation by APDCL/NGEAL in accordance with ADB's Safeguard Policy Statement 2009.
- APDCL/NGEAL and their contractors will provide ADB with access to the site and all requested information, their contractors will provide all ADB staff/consultants with a site health and safety induction and all the necessary PPE.

Supervision and reporting

299. APDCL/NGEAL will carry out the following actions to supervise and monitor EMP implementation (not an exclusive list) and ensure intended environment safeguards outcomes are being achieved by the distribution component:

- (i) Environment safeguard officer of safeguard unit team of APDCL/NGEAL with support of PMU/NGEAL Project Engineer/PMC is to convene monthly EHS meetings attended by all safeguard staff at PMU/PIU level with contractor/O&M team including site walkover inspections to determine the status of EMP implementation and random "spot check" site visits to audit in more depth EMP implementation by the contractors and upon operation the Electrical Division's or BESS' O&M team.
- (ii) Obtaining monthly reports from contractors and APDCL/NGEAL O&M team and reviewing qualitative and quantitative monitoring results to identify any issues of concern.
- (iii) Identifying areas for improvement, unsafe acts, and any non-compliances with the EMP and instructing corrective action to be taken by them to bring implementation back on track.
- (iv) Keeping records of all monthly reports, meetings, inspections, and audits and timebound corrective actions instructed.
- (v) Supervising and monitoring the implementation of any corrective actions alongside EMP implementation to ensure they are implemented in a timely manner.

300. In addition to standard contract monitoring systems established by the PMU/NGEAL for the preconstruction and construction stages, the environment safeguard officer and safeguard unit team with the support of PMU/NGEAL Project Engineer/PMC will introduce formal systems and templates for monitoring and reporting on EMP implementation, with the following reporting lines. The reporting frequency of submission are provided in Table 8.1 and

the initial list of the different reporting formats is provided in Table 8.2. Those responsible shall ensure monitoring is well documented and the timely submissions of monitoring reports with an acceptable level of detail:

- (i) Contractors will establish their own internal systems for monitoring and reporting their EMP implementation.
- (ii) Contractors as the main executors of the EMP will formally submit monthly and quarterly summary environmental management reports per an agreed template to the PIU/Project Engineer who will share the report with the environment safeguard officer and safeguard unit team.
- (iii) Once works commence on site the EHS supervisors (PIU or NGEAL) and EHS field officers (PIU) under the direction of the environment safeguard officer and safeguard unit team from PMU/NGEAL will keep daily records and photo logs of site observations reporting their findings in at least monthly reports to them with written quarterly summaries of progress submitted – their quarterly summary reports will be attached to the EMRs submitted to ADB.
- (iv) Complete photographic records will be kept by both the contractor and EHS field officers (PIU/NGEAL) covering all activities on site as well as key locations such as the construction site, receptors adjacent to the BESS, substations, DTRs, and ROWs of distribution lines, off-site access roads, stores, sanitation and welfare facilities, temporary worker camps or overnight accommodation etc. Photographs of key areas will be taken prior to construction activities begin, to provide the environmental baseline. Copies of all geo-referenced photographs will be submitted to the PMU/NGEAL environment safeguard officer and safeguard unit team along with the contractor's monthly report and EHS supervisors (PIU) written monthly summaries.
- (v) PMU/NGEAL environment safeguards officer with safeguard unit team to convene monthly EHS meetings to be attended by PIU Head or NGEAL Project Engineer, EHS supervisors and EHS field officers (PIU), PMC safeguards consultants, and contractor's management and environment safeguard team to discuss progress; initially progress will be discussed in relation to detailed design actions and as the project progresses will move onto pre-construction and contraction actions.
- (vi) During the monthly EHS meetings areas for improvement, unsafe acts, and any non-compliances, time-bound corrective actions, and responsibilities to address them will be discussed, agreed, and documented – minutes of monthly EHS meetings will be attached to EMRs submitted to ADB.
- (vii) PMU/NGEAL environment safeguards officer and H&S officer will be able to instruct the PMU/PIU/Project Engineer/Site Engineer and be given delegated authority to instruct the contractor to take corrective action at any time in relation to EMP implementation.
- (viii) PMU/NGEAL environment safeguards officer together with the safeguard unit staff will maintain the time-bound corrective action plan, monitoring and reporting of corrective actions will be undertaken alongside monitoring and reporting of EMP implementation.

301. For the operational stages, APDCL and NGEAL will establish an internal system (ESMS for BESS) under the watch of the safeguards unit to monitor and report on EMP implementation along the same lines as that established for construction. APDCL/NGEAL will be responsible for obtaining and maintaining documentation and ensuring document control with access by and distribution to relevant personnel. Documentation and records to be kept by all parties in hard copy as well as electronic format for access at the project sites and to be made available for inspection at any time are as follows (not an exclusive list):

- (i) Bid and contract documents (copy submitted to ADB with first EMR)
- (ii) Definitive IEE and EMP (as disclosed on the ADB website)
- (iii) Legal register (of applicable national and state legislation)
- (iv) Forest clearances and NOCs

- (v) CTE and CTO – for construction plant, and ancillary facilities like DG
- (vi) Vehicle emission test certificates etc.
- (vii) Training plan and training records
- (viii) Community liaison plan and records of all consultations undertaken
- (ix) Records of emergency preparedness and response drills
- (x) Document review and approval records
- (xi) Contractor's CEMP and sub-plans and copies of approval records
- (xii) H&S risk assessments
- (xiii) Contracts, timesheets and payroll records
- (xiv) Contractor's certifications and insurances
- (xv) Completed site checklists and photographic records
- (xvi) Corrective action instructions
- (xvii) Contractor's and operational accident record and incident reports
- (xviii) GRM register
- (xix) Copies of correspondence related to EHS issues
- (xx) Material inventories and consumption records
- (xxi) Waste management records
- (xxii) Change find records (if any)

302. APDCL/NGEAL will facilitate ADB to carry out the following monitoring actions to supervise project implementation:

- (i) Conduct periodic site visits during the project implementation to confirm compliance with the EMP, loan covenants, ADB's Safeguard Policy Statement 2009 and IFC EHS General and Transmission and Distribution Guidelines.
- (ii) If required, conduct supervision missions with detailed review by ADB's safeguard specialists/officers or consultants.
- (iii) Review and comment on the periodic EMRs submitted by APDCL/NGEAL to ensure that adverse impacts and risks are mitigated as was planned and agreed with ADB, that any corrective actions have been duly implemented, and that the GRM is fully functional.
- (iv) Work with APDCL/NGEAL to rectify to the extent possible any failures to comply with their safeguard commitments, as covenanted in the loan agreement, and exercise remedies to re-establish compliance as appropriate.
- (v) Prepare a project completion report that assesses whether the objective and desired outcomes of the EMP have been achieved, considering the baseline conditions, and monitoring results.

303. For this purpose, APDCL/NGEAL and their contractors will provide ADB with access to the site and all requested information on the project. For any ADB supervision missions to ongoing construction works APDCL/NGEAL and their contractors will provide all ADB staff with a project site health and safety induction and adequate PPE in accordance with Table 2.7.1 of the IFC E-S General Guidelines - Occupational Health and Safety Section.

Table 8.1 Minimum Reporting Frequencies

Contractor	EHS Supervisor(s) in PIU or at NGEAL		Safeguard Unit within PMU or NGEAL	
	Supervision	Reporting to Safeguard Unit of PMU	Supervision	Report to ADB
Pre-Construction and Construction Stage				
Monthly Report Quarterly Summary Report	Day to Day	Monthly Report Quarterly Summary Report, Incidents to be	Monthly	Semi-annual EMR from loan effectiveness to completion of construction, and

Contractor	EHS Supervisor(s) in PIU or at NGEAL		Safeguard Unit within PMU or NGEAL	
Reporting to PIU or NGEAL	Supervision	Reporting to Safeguard Unit of PMU	Supervision	Report to ADB
		reported in 24 hours		incidents to be reported in 48 hours
Operation Stage				
n/a	Day to Day	Quarterly Report, Annual Summary Report, Incidents to be reported in 24 hours	Quarterly	Annual EMR until issuance of ADB's PCR, and incidents to be reported in 48 hours

Source: ADB's TA Consultant

Table 8.2 Summary Details of Reporting Formats of Contractor

Format No.	Item	Stage	Contractor	PIU or NGEAL with support from PMC	
			Reporting to PIU or NGEAL	Supervision	Reporting to Safeguard Unit
RF 1	Site-Specific Checklist and Consultation Proforma to inform IEE update by APDCL in relation to distribution lines and DTRs	Pre-Construction	One Time	One Time	One Time
RF 2	Approval of Detailed Design / CEMP including H&S risk assessment / CTE and CTO etc.	Pre-Construction	One Time pre-construction (then update through construction as needed)	One Time (then as updated)	One Time (then as updated)
RF 3	Ecology Survey and Tree Inventory	Pre-Construction	One Time	One Time	One Time
RF 4	Environmental Quality Monitoring	Pre-Construction	One Time	One Time	One Time
		Construction	Per EMoP Requirement	Day to Day	Monthly
		Commissioning	One Time	One Time	One Time
RF 5	Deviations and Corrective Action Plans	Construction	In case of non-compliance or unanticipated impact until closed out	Day to Day	Monthly
RF 6	Vehicles Used and Pollution Control	Construction	Monthly	Day to Day	Monthly
RF 7	Pollution Incident Reporting	Construction	Monthly (Immediate for major incident)	Day to Day	Monthly (Immediate for major incident)
RF 8	Work Force Management (Labor)	Construction	Monthly	Day to Day	Monthly
RF 9	Details of PPE Stocks	Construction	Monthly	Day to Day	Monthly

Format No.	Item	Stage	Contractor	PIU or NGEAL with support from PMC	
			Reporting to PIU or NGEAL	Supervision	Reporting to Safeguard Unit
RF 10	Occupational and Community Safety Measures	Construction	Monthly	Day to Day	Monthly
RF 11	H&S Incident Reporting	Construction	Monthly (Immediate for LTI and Fatalities)	Day to Day	Monthly (Immediate for LTI and Fatalities)
RF 12	Consultation Activities	Construction	Monthly	Day to Day	Monthly
RF 13	GRM during Construction	Construction	Monthly	Day to Day	Monthly
RF 14	Training Records	Construction	Monthly	Day to Day	Monthly
RF 15	Waste Records (split solid, hazardous and e-waste)	Construction	Monthly	Day to Day	Monthly

Source: ADB's TA Consultant

Environmental management implementation schedule

304. 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 PMU has received and approved the contractor's CEMP including all sub-plans. Tentative implementation schedule of the project is listed in the Table 8.3. The contractors will submit a detailed implementation schedule for the detailed design, pre-construction, and construction once the contract is awarded.

Table 8.3 Key EMP Milestones in Implementation Schedule

	Milestone	Indicative Time Frame
1	Project Implementation	
A	Bidding Documents	Q3 2024
B	Procurement	Q3 2024 – Q4 2024
C	Construction commencement	Q1 2025
D	Construction Completion	Q4 2031
E	Defects Liability Period (DLP)	12 months
2	Pre-Construction Phase	
A	Implementation of mitigation measures and conduct environmental monitoring for which PMU is responsible	Immediate implementation, noting EMP requirements must be reflected in contract for which bidding documents may be issued prior to ADB project approval
B	Establishment of GRM	Immediate implementation, latest within one month of loan effectiveness
C	Appointment of PMU and NGEAL E&S safeguards officers (safeguards unit)	Latest within one month of loan effectiveness for the PIU safeguard support, before equity contribution for NGEAL, and in any case before start of works on site.
D	Appointment of PMC	PMC must be appointed within three months of loan effectiveness and prior to the approval of detailed design, CEMP approval, site establishment, site preparation, etc.
E	Implementation of mitigation measures and conduct environmental monitoring for which contractor is responsible	Upon award of the contract

	Milestone	Indicative Time Frame
F	Completion of environmental assessment forms and consultation proformas for siting and route alignments Updating the IEE/EMP to reflect final route alignments and obtaining ADB clearance of update	Prior to approval of the detailed design, and before any works commence on site for the route alignments in question
G	Submission and approval of the Construction Environmental Management Plan (CEMP)	One month before the start of works including any site establishment, site preparation, demolition, and earthworks
3	Construction Phase	
A	Implementation of mitigation measures and conduct of environmental effects monitoring following the EMP.	After award of the contract
B	Monthly EMR for Project's Monthly Progress Report	5 th day after effective month (covering the month prior)
C	Semi-Annual EMR during construction for submission to ADB	15 th day after effective 6-months; the last construction EMR will be submitted after the commissioning and DLP of all works by the implementing agency documenting in depth how all pre-construction and construction activities were complied with
D	Restoration of construction sites	Before demobilization of contractor
4	Operation Phase	
A	Implementation of mitigation measures and monitoring activities for operational period	Upon commissioning
B	Annual EMR during construction for submission to ADB	15 th day after effective 6-months; the first operational EMR will be submitted 12 months after the last construction EMR was submitted up until the ADB Project Completion Report is issued

Source: ADB's TA Consultant

D. Capacity Building

305. In addition to the establishment of the safeguard unit/staff at PMU or in NGEAL and nomination of EHS supervision at PIU level, capacity building and training will be required as existing setup and safeguard capacity of APDCL/NGEAL is inadequate to implement the IEE/EMP. To build capacity in the PMU/PIU/NGEAL and reinforce capacity of contractors for implementation of the EMP and other safeguard requirements, a training programme will be delivered. The training programme will be implemented as per training modules provided in Table 8.4, training needs will be further determined by the APDCL/NGEAL and elaborated in a training plan.

306. Training modules can be changed during construction phase based on requirements of PMU/PIU/NGEAL and contractors. The basic objective of giving training to the different stakeholders is to enhance their capabilities for implementation of the EMP and EMoP during construction and operation. Delivery of the training program is part of the ADB project cost that includes institutional strengthening, capacity building and training whilst APDCL/NGEAL attendance will be from counterpart support, and the contractor will factor in their attendance within the contract amount. Training to be given:

- (i) Upon the award of contracts to the contractor
- (ii) Before the start of construction work
- (iii) Refresher during construction
- (iv) Before demobilization of contractor and commencement of O&M

Table 8.4 Training Requirement

Training Session/ Project Stage	Required Attendees	Delivery Mode	Delivered by	Estimated Total Amount (\$)	Budget Source
Pre-construction					
Introduction to ADB's Safeguard Policy Statement (2009), IFC EHS and ILO Guidelines, Government of India/Government of Assam requirements, and Project EMP including EMoP	PMU, PIU, NGEAL project team, Contractors' Management and Environment Safeguards Teams*	Lecture session, presentation, and discussion. In Person/ 1 day	Safeguard Unit of APDCL/NGEAL Environmental specialist, H&S and labor experts of PMC	2000	PMC Budget
Corrective action plan for BESS/substations including O&M	PMU, PIU, NGEAL project team, substation and Contractors' Management and Environment Safeguards Teams if any actions delegated	Lecture session, presentation, and discussion. In Person/ 1 day	Safeguard Unit of NGEAL/APDCL Environmental specialist and H&S experts of PMC	2000	PMC Budget
EMP implementation for detailed design	PMU, PIU, NGEAL project team, Contractors' Design Teams and Environment Safeguards Teams*	Lecture session, presentation, and discussion. In Person/ 1 day	Safeguard Unit of NGEAL/APDCL Environment specialist and H&S Experts of PMC	2000	PMC Budget
EMP requirements for works in ESZ, Elephant Reserves/Reserved Forests, KBAs/IBAs and natural habitat	PMU, PIU, Contractors' Design Teams and Environment Safeguards Teams*	Lecture session, presentation, and discussion. Online/ 0.5 day	Environment officers of APDCL Environment specialist and ecologist of PMC with support of Environment and Forest Department of Assam officials	1000	PMC Budget
Determination of natural and critical habitat, critical habitat qualifying species, threatened and WPA Schedule I and II species and ecological survey requirements	PMU, PIU Contractors' Design Teams and Environment Safeguards Teams*	Lecture session, presentation, and discussion. Online/ 0.5 day	Environment officers of APDCL Environment specialist and ecologist of PMC supported by PMC expert input on natural and critical habitat assessment	1000	PMC Budget
Bird/wildlife sensitive design for distribution lines (detailed design)	PMU, PIU Contractors' Design Teams and Environment Safeguards Teams*	Lecture session, presentation, and discussion. Online/ 0.5 day	Environment officers of APDCL Environment specialist and ecologist of PMC supported by PMC expert input on bird/wildlife sensitive design	1000	PMC Budget

Training Session/ Project Stage	Required Attendees	Delivery Mode	Delivered by	Estimated Total Amount (\$)	Budget Source
PCB awareness raising and environmentally safe and sound transformer design	Substation/BESS staff, PMU, PIU, NGEAL project team, Contractors' Management, Design Teams and Environment Safeguards Teams*	Lecture session, presentation, and discussion. Online/ 0.5 day	Environment officers of APDCL/NGEAL Environmental specialist of PMC supported by PMC expert input on pollution control and PCB management	1000	PMC Budget
SF6 awareness raising	Substation/BESS staff, PMU, PIU, NGEAL project team, Contractors' Management, Design Teams, and Environment Safeguards Teams*	Lecture session, presentation, and discussion. Online/ 0.5 day	Environment staff of APDCL/NGEAL Environmental specialist of PMC supported by PMC expert input on SF6 management	1000	PMC Budget
Facilitated H&S workshop (detailed design)	PMU, PIU, NGEAL project team, Contractors Management, Detailed Design, and Environment Safeguards Teams*	Facilitated workshop In Person/ 1 day	Safeguard Unit of APDCL/NGEAL H&S Expert of PMC	2000	PMC Budget
GRM operation (initial run at start of project, and then again, on handover to operational staff)	All GRM levels- GRM Focal Points, GRC, PMU, PIU, NGEAL project team, Contractors Management, Environment Safeguards Team, Local Government Representatives* GRM Focal Points of Contractors*	Lecture session, presentation, and discussion. In Person/ 1 day	Safeguard Unit of APDCL/NGEAL Environmental specialist of PMC	4000	PMC
EMP implementation for pre-construction and construction, including workshop on CEMP preparation	PMU, PIU, NGEAL project team, Contractors' Construction Teams and Environment Safeguards Teams*	Lecture session, presentation, and discussion. In Person/ 1 day	Safeguard Unit of APDCL/NGEAL Environmental specialist and H&S Experts of PMC	2000	PMC Budget
Facilitated H&S workshop (construction stage)	PMU, PIU, NGEAL project team, Contractors Management, Construction, and Environment Safeguards Staff	Facilitated workshop In Person/ 1 day	H&S Staff of APDCL/NGEAL Safeguard Unit H&S Expert of PMC	2000	PMC Budget
National labor laws and ILO guidelines on worker accommodation	PMU, PIU, NGEAL project team, Contractors	Facilitated workshop In Person/ 0.5 day	Safeguard Unit of APDCL/NGEAL Labor Expert of PMC	1000	PMC Budget

Training Session/ Project Stage	Required Attendees	Delivery Mode	Delivered by	Estimated Total Amount (\$)	Budget Source
	Management, Construction and Environment Safeguards Teams*				
Waste management awareness raising including e-wastes (construction)	PMU, PIU, NGEAL project team, Contractors Management, Construction and Environment Safeguards Teams*	Facilitated workshop In Person/ 0.5 day	Safeguard Unit of APDCL/NGEAL Environment Expert of PMC	1000	PMC Budget
Environmental quality monitoring requirements; site supervision and monitoring including use of detailed monitoring framework (checklists) and preparing period Environmental Monitoring Reports	PMU, PIU, NGEAL project team, Contractors Management and Environment Safeguards Teams*	Lecture session, presentation, and discussion. In Person/ 2 days	Safeguard Unit of APDCL/NGEAL Environmental specialist and H&S Experts of PMC	4000	PMC Budget
Site restoration	PMU, PIU, NGEAL project team, Contractors Management, Construction, and Environment Safeguards Staff	Lecture session, presentation, and discussion. Online/ 0.5 day	Safeguard Unit of APDCL/NGEAL Environmental specialist of PMC	1000	PMC Budget
EMP implementation for O&M, including, workshop on SOP preparation	PMU, PIU, NGEAL project team	Lecture session, presentation, and discussion. In Person/ 1 day	Safeguard Unit of APDCL/NGEAL Environmental specialist and H&S Experts of PMC; ESMS consultant for BESS	2000	PMC Budget
Facilitated H&S Workshop (Operation Stage)	PMU, PIU, NGEAL project team	Facilitated workshop In Person/ 1 day	H&S Staff of APDCL/NGEAL Safeguards Unit H&S Expert of PMC	1000	PMC Budget
Waste management awareness raising including e-wastes (operations)	PMU, PIU, NGEAL Project team	Facilitated workshop In Person/ 0.5 day	Safeguard Unit of NGEAL/APDCL Environmental specialist and H&S Experts of PMC; ESMS consultant for BESS	1000	PMC Budget
			Sub-Total Training Budget	32,000	

*Cost of contractors' staff attendance at all formal trainings and capacity development activities will be included in contract price.

Source: ADB's TA Consultant

E. Budget

307. Costs will be associated with implementation of the mitigation plan, EMoP and capacity building. Necessary budgetary provisions must be planned and allocated by APDCL or NGEAL for implementing the environmental measures as part of the EMP. The main EMP budget items have been identified for implementing the environmental management and monitoring and capacity building activities required, and an indicative budget allocated for each. The budget in Table 8.5 will be refined during project implementation but enables preparedness for financial requirements. For contract related costs these are only an estimate based on an estimate of the construction and installation cost, since the contracts are subject to competitive bidding it will be for the contractor/consultants to reflect in their BOQ and ensure adequate budget is provided in their bids for the EMP implementation. The construction EMoP will be part of the Contractor's contract, whereas the operational EMoP will be the responsibility of APDCL or NGEAL's O&M team. The indicative EMoP budget provided in Table 8.6.

308. If the construction period extends beyond 36 months, then the budget will need to be increased prorata. Operational cost is an annual cost, it will be incurred annually for each year the distribution components are in operation.

Table 8.5 Indicative EMP budget

Item	Quantity	Estimated Rate (\$)	Estimated Total Amount (\$)	Budget Source
CONSTRUCTION				
APDCL Safeguard Staffing during substation and line construction				
Environment Safeguard Officer x 1	36 person months full time	1,125 pm	40,500	APDCL
Social Safeguard Officer x 1	36 person months full time	562.5 pm	20,250	APDCL
Health and Safety x 1	36 person months full time	562.5 pm	20,250	APDCL
		Sub-total	81,000	
NGEAL Safeguard Staffing during BESS construction				
Environment Safeguard Officer x 1	12 person months full time	1,125 pm	13,500	NGEAL JV
Health and Safety x 1	12 person months full time	562.5 pm	6,750	NGEAL JV
EHS Supervisor x 1	12 person months full time	562.5 pm	6,750	NGEAL JV
		Sub-total	27,000	
PMC Safeguard Specialists				
Environmental Specialist (national position, also supported by 15 person months of international position costed under EMP for Outputs 1 and 2)	12 person months over 36-month period (including one site visit per month and logistics during site visits)	6,000 pm	72,000	PMC Contract
Health and Safety Specialist (national position, also supported by 12 person months of international position costed under EMP for Outputs 1 and 2)	9 person months over 36-month period (including one site visit per month and logistics during site visits)	6,000 pm	54,000	PMC Contract

Item	Quantity	Estimated Rate (\$)	Estimated Total Amount (\$)	Budget Source
Ecologist	18 person months over 36-month period (including logistics during site visits)	5,000 pm	90,000	PMC Contract
Health and Safety Specialist	9 person months over 36-month period (including one site visit per month and logistics during site visits)	6,000 pm	54,000	PMC Contract
Labor Expert	15 person months over 36-month period (including logistics during site visits)	3,000 pm	45,000	PMC Contract
Resident EHS Supervisors x 2	30 person months x 2 consultants (18 pm for DL and 12 pm for BESS)	2,000 pm	60,000	PMC Contract
ESMS Expert (BESS) Consultant	6 person months over 12 months period (home based) x 1 consultant	6000 pm	36,000	PMC Contract
		Sub-total	357,000	
Cost of implementing CAP				
Cost of implementing substation CAP	4	10,000 per substation	40,000	APDCL and NGEAL (AEGCL) counterpart
		Sub-total	40,000	
APDCL Contractor's Environment Safeguards Team				
Environment	36 person months full time x 2 lots*	1,000 pm	72,000	Construction Contract/BOQ
Ecologist	18 person months full time x 2 lots (note, for substations input will be part time)	1,000 pm	36,000	Construction Contract/BOQ
Health and Safety with NEBOSH / IOSH	36 person months full time x 2 lots	1,000 pm	72,000	Construction Contract/BOQ
Pollution Control Expert	36 person months full time x 2 lots (input will be part time)	1,000 pm	72,000	Construction Contract/BOQ
Labor Expert	36 person months full time x 2 lots	1,000 pm	72,000	Construction Contract/BOQ
Social and Community Liaison	36 person months full time x 2 lots	1,000 pm	72,000	Construction Contract/BOQ
EHS Supervisors (multiple staff required)	36 person months full time x 1 lots	1,000 pm	36,000	Construction Contract/BOQ
H&S Stewards (multiple staff required)	36 person months full time x 1 lots	1,000 pm	36,000	Construction Contract/BOQ
		Sub-total	468,000	
BESS Contractor's Environment Safeguards Team				
Environment	18 person months full time	1,000 pm	18,000	Construction Contract/BOQ
Ecologist	3 person months part time	1,000 pm	3,000	Construction Contract/BOQ
Health and Safety with NEBOSH / IOSH	18 person months full time	1,000 pm	18,000	Construction Contract/BOQ

Item	Quantity	Estimated Rate (\$)	Estimated Total Amount (\$)	Budget Source
Pollution Control Expert	3 person months part time	1,000 pm	3,000	Construction Contract/BOQ
Labor Expert	12 person months full time	1,000 pm	12,000	Construction Contract/BOQ
EHS Supervisor	12 person months full time	1,000 pm	12,000	Construction Contract/BOQ
		Sub-total	66,000	
Contractors EMP Costs				
Contractor's EMP implementation cost (including PPE provision)	Estimated % of the contractor's civil works cost (civil works estimated as 15% of total project costs)	2% of estimated civil works	130,200	Construction Contract/BOQ
Bird/Wildlife Sensitive Design Measures for distribution component in addition to installation of CC and ABC	\$12/pole. One pole every 200m for up to 540 km	Lump sum estimate	32,400	Construction Contract/BOQ
Pre-construction/construction environmental quality monitoring	36 months	Ref. Table 8.6	76,400	Construction Contract/BOQ
Commissioning environmental quality monitoring	Once at all 3 substations and 1 BESS facility	Ref. Table 8.6	2,800	Construction Contract/BOQ
		Sub-total	241,800	
Training and capacity building	Ref. Table 8.4	Lump sum estimate	32,000	PMC Contract
Ongoing Consultation, GRM Implementation, for Consultation or GRC Meetings to cover ad hoc cost of printing leaflets, hire of venue or food purchase etc.		Lump sum estimate	8,500	APDCL counterpart
Sub-Total			1,329,550	
Contingency (e.g. if tree cutting required, etc)		10%	132,955	
Construction Sub-Total			1,462,505	
OPERATION				
APDCL Safeguard Unit during operation	12 person months full-time x 4 staff (annual cost repeats)	3,375 pm	40,500	APDCL Counterpart Cost
NGEAL Safeguard unit for BESS operation	12 person months full-time x 2 staff (annual cost repeats)	1,687.5 pm	20,250	NGEAL Counterpart Cost
Operation environmental quality monitoring	12 months (annual cost repeats)	Ref. Table 8.6	4,000	APDCL and NGEAL Counterpart Cost
Operation Sub-Total			64,750	

* tentative 2 packages with 3 lots - 1 for substation R&M, 1 for distribution line; and 1 for BESS.
Source: ADB's TA Consultant

Table 8.6 Environmental quality monitoring budget

Item	Sites	Quantity	Estimated Rate (\$)	No.	Estimated Total Amount (\$)
Pre-Construction					
Ecological surveys/tree counts	3 existing and 1 BESS site, along distribution lines DTR	4 (transient sites tbc)	-	1	Included in contractor's ecologist cost
Drinking water source for potability	3 existing and 1 BESS linked substation	4	500	1	2,000
Polychlorinated biphenyl	Existing transformers (PTR) at substations and existing DTR on distribution network	3 x 2 5 nos. in BESS linked substation (existing DTR tbc)	100	11	1,100
Asbestos and soil contamination	3 existing and 1 BESS linked substation	4	500	1	2,000
Construction					
Noise semi-annually	Per IEE baseline, SS, BESS site	8	200	48	9,600
Air quality semi-annually		7	400	42	16,800
Surface water quality semi-annually		8	500	48	24,000
Ground water quality semi-annually		4	500	24	12,000
Drinking water source for potability	Construction sites (worker supply)	4 (transient sites tbc)	500	24	12,000
Commissioning					
Noise	3 existing substations and 1 BESS	4	200	1	800
Drinking water source for potability	3 substations and 1 BESS	4	500	1	2,000
Total Contractor's Monitoring Budget					79,200
Operation					
Drinking water source for potability	3 substations and 1 BESS	4	500	2	4,000
Total O&M Monitoring Budget					4,000

Source: ADB's TA Consultant

IX. CONCLUSION AND RECOMMENDATIONS

309. The project is unlikely to cause any significant irreversible, diverse or unprecedented environmental impacts. For Outputs 3 and 4 there will not be any major, large-scale civil or structural works involved (civil works include foundation installation, building construction and pole erection), with most works are electrical and mechanical. Construction of one new building of up to two floors (200 square foot) for the BESS control room will be the largest civil or structural works. For Output 4, criteria and principles set out in the IEE will be followed to ensure distribution lines with potentially significant impacts are avoided. Overall pre-construction, construction, operation and maintenance of the project is likely to give rise to direct, indirect, cumulative and, induced environmental impacts that are mostly moderate/medium to minor/low in magnitude, site-specific, generally reversible, temporary and of short duration, primarily during construction works. Potential impacts and risks can be easily mitigated through the adoption of international good practices for environmental management as set out in the International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines, including the General Guidelines, and those on Electric Power Transmission and Distribution, as well as wildlife sensitive design features e.g., adequate height, spacing and insulation on distribution lines to prevent electrocution of elephants in elephant movement areas, birds etc. The selection and design of new equipment will comply with national requirements as well as considering international good practice per the IFC EHS Guidelines, particularly with respect to avoiding the use of polychlorinated biphenyl (PCB) oil in the purchase of new transformers (already banned in India) and the use of all asbestos-containing materials in new construction.

XIII. The detailed route alignments of the various distribution lines under Output 4 will be determined by the contractors upon mobilization. Although 11 kV lines have been screened in this IEE, the impact of the final routings will need to be confirmed. Since they have not been mapped yet, most LT lines and DTR sites cannot be screened by the IEE. The criteria APDCL and their contractors will adopt to ensure significant impacts are avoided by distribution lines including LT lines are: (i) lines and their related equipment in natural habitat will only be installed where significant conversion or degradation of ADB-defined natural habitat can be avoided, (ii) lines and their related equipment in ADB-defined critical habitat (all areas of the districts) will only be installed where site-specific biodiversity assessment demonstrates significant adverse impacts can be avoided, (iii) no lines or related facilities in Wildlife Sanctuaries will be taken up, (iv) no lines or related facilities in Elephant Reserves or Reserved Forests (including District Council Reserved Forests) which are requiring Wildlife or Forest Clearance will be taken up—existing RoWs will only be used if the Forest Clearance has already been granted and a No Objection Certificate is available, (v) in Elephant Reserves and Reserved Forests (including District Council Reserved Forests) only covered conductor 11 kV and ABC LT lines following existing RoWs without minor diversions (unless they remain in existing road RoWs) and not requiring new access track construction will be taken up having first received a written no-objection from the Environment and Forest Department of Assam, (vi) in the eco-sensitive zones (ESZ) of Wildlife Sanctuaries of Assam or Nagaland only covered conductor 11kV and ABC LT lines following existing RoWs without minor diversions (unless they remain in existing road RoWs) and not requiring new access track construction will be taken up with intimation to and the confirmation of the Environment and Forest Department of Assam and Nagaland Forest Department (if applicable) that no further permission is required, (vii) in Key Biodiversity Areas (KBAs) and Important Bird Areas (IBAs) only covered conductor 11kV and ABC LT lines following existing RoWs without minor diversions (unless they remain in existing road RoWs) and not requiring new access track construction will be taken up, (viii) no lines or related facilities in the protected or regulated zone of Archaeological Survey of India and Directorate of Archeology Assam protected monuments will be taken up, and (ix) lines and related facilities will only be installed where significant damage to local physical cultural resources can be avoided and physical cultural resources do not need to be removed from their current location. In addition, APDCL will avoid

or minimize damage to existing trees, especially private trees, properties and public utilities. Safety clearances will be met and if there is encroachment into existing RoWs minor diversions will take place to ensuring these are maintained, routing over school compounds, playgrounds or other areas where children as vulnerable members of the community assemble without parental supervision will be avoided. Wildlife sensitive design features will be adopted e.g., adequate height, spacing and insulation on distribution lines to prevent electrocution of elephants, birds etc. Once the 11 kV and LT distribution lines have been mapped by the contractors those not meeting the criteria and principles in the IEE will be immediately dropped.

XIV. Since the distribution routes assessed are only indicative and will not be finalized until the contractors are on board, during project implementation site-specific assessment checklist and consultation proformas will be completed by the contractors, then this IEE and EMP will need to be updated and cleared by ADB with any government clearances or permissions obtained before routings are approved by APDCL and works commence. For the IEE, site visits (reconnaissance surveys) to sample 11kV and LT distribution lines were conducted. Approximately 15 km (15%) or 15 number (14%) of 11 kV lines (including DTR associated new lines and lines for reconductoring with covered conductors) out of a total 98.5 km, and 65 km (18%) of 0.4 kV LT lines out of a total of 448.25 km of low-tension lines (including DTR associated new lines and lines for reconductoring with ABC) were conducted. The main mitigation will be pre-construction ecological checks along all routes for Critical Habitat-qualifying species by an ecologist familiar with the species of Assam, followed by re-routing or micro-siting to avoid any impacts, prior to tree trimming/lopping/vegetation clearing or earthworks. These checks will also involve consultation with local communities since there are individual trees of cultural heritage value to the local communities/Indigenous Peoples that must not be damaged. In addition, mitigation will include prohibiting poaching and firewood collection by construction workers. For all distribution lines, the District Forest Officers will be actively engaged by APDCL and the contractors throughout project implementation. A wildlife identification and rescue protocol will be adopted by the contractors, to be further developed in consultation with Environment and Forest Department of Assam as per site-specific requirements with all vegetation clearance and earthworks undertaken under ecological supervision. Local physical cultural resources were identified along the sample distribution lines, some temples and churches were observed that could be directly impacted if lines pass across or near to them. However, the works will be supervised with fencing used, if required, to avoid damage to those adjacent to the route alignment. Many existing distribution lines to be re-conducted, especially LT lines, were observed to be passing over houses/shops/businesses with poles located in private compounds whilst some were seen to cross or be near to school compounds. To uphold safety clearances and minimize community health and safety risks during operation, rerouting is required as part of reconductoring works with great care taken and appropriate health and safety measures implemented in dismantling the existing conductors.

XV. Other potential environmental impacts were identified in relation to the design, location, construction, operation and maintenance of the BESS and distribution infrastructure and mitigation has been developed in respect of all temporary environment impacts identified. Potential construction impacts relate to disturbance of land in the ROWs of new distribution lines as well as adjacent communities, with pollution, health and safety risks to workers and the community if the construction activities are not well managed by APDCL, the JV and their contractors. The most significant impacts include hazardous waste disposal (including oil and end of life batteries and other electrical equipment) plus traffic congestion, dust and noise when working in semi-urban and dense settlement areas. The community health and safety risk is also significant since many poles and DTRs were also observed to be broken, sagging or low hanging and non-compliant to safety clearances in settlement areas, thus exposing the local community to electrocution risk particularly if a person, tree, or structure is near a live line where the safe horizontal or vertical clearances are compromised. Pollution, health and

safety risks to workers, health and safety risks due to working at height and with electricity etc., and the community will remain during operation and maintenance works. It was identified that occupational and community accident records are not kept by ADPCL, and the standard operating procedures of APDCL for health and safety are basic. An environmental audit for the four existing substations (including one AEGCL substation for the BESS bay extension) did not identify any transformers containing PCB oil, based on assessment against United Nations Industrial Development Organization (UNIDO) guidance. However, the project includes the installation of 88 new distribution transformers, some of which will replace existing ones that may contain PCBs. Transformer oil will be tested for PCBs and any handling, temporary removal, packaging, labelling, storage, transport, and reinstatement on fenced, bunded plinths of 110% capacity for ground-mounted transformers will be done by the contractor in accordance with international good practice and the Government of India's regulations with any PCB containing transformers dechlorinated or disposed of in an environmentally sound manner. The Government of India regulations require APDCL to complete the de-chlorination or the removal of all PCB-contaminated transformers before 31 December 2025.

XVI. An EMP has been prepared for Outputs 3 and 4 of the project. The EMP includes (i) corrective action for existing facilities i.e. four existing substations; (ii) mitigation measures for environmental impacts during implementation. It takes into account biodiversity and physical cultural resource measures, high seismic and flood risk in the state, and the need for climate change adaptation measures; upholding safety clearances especially where existing lines pass over houses and rerouting is needed; avoiding passing over school compounds or playgrounds; adhering to electromagnetic field (EMF) exposure, dust and noise guideline levels; drinking water quality for workers; approving contractor's pollution prevention, solid and hazardous waste management, and health and safety management plans prior to works; prohibiting PCB use in new transformers and asbestos containing materials in construction; and, community awareness raising activities by the APDCL and the contractors on the health and safety risks of distribution infrastructure; (iii) an environmental monitoring program, including monitoring of health and safety incidents; (iv) institutional arrangements including capacity building; and (v) the EMP budget required during implementation of Outputs 3 and 4. The responsible entity for mitigation, monitoring, and reporting is APDCL but some responsibilities will be delegated to NGEAL (JV) and contractor. Mitigation measures will be assured by a program of environmental supervision and monitoring to be conducted during the construction and operation stages. Any unanticipated impacts or requirements for corrective action during implementation of the distribution component will be reported by the APDCL to ADB.

XVII. APDCL Project Management Unit and NGEAL (JV) will hire/depute environment safeguard officers and health and safety officers—one of each for the BESS component, and, one of each for the distribution component, plus a social safeguard officer for the distribution component, and EHS supervisor for the BESS, to support EMP implementation, supervision, and monitoring during construction and operation plus decommissioning for the BESS component. For Output 4 the PMU will be supported by the PIU having adequate numbers of field staff acting as environment, health and safety supervisors (EHSS) to implement the EMP and undertake day-to-day supervision. Given the limited capacity of APDCL and the newly formed NGEAL JV and to assist with site-specific assessment and provide on-site support, as well as capacity building and trainings, the PMC will include qualified and experienced environmental specialists, ecologists/botanists, health and safety specialists with professional certification, labor experts, residential EHS supervisors for the BESS and distribution components, and other necessary experts. An ESMS consultant will also be hired to prepare an Environmental and Social Management System (ESMS) to allow the NGEAL JV to address environment, health and safety, labor and social safeguard impacts and risks associated with its operations, including policies and procedures for operating the project BESS and implementing all its future BESS development. The PMC will also provide expert capacity

building and support in relation to specialist topics such as critical and natural habitat assessment, wildlife sensitive design features, PCB management etc. Further, the Engineering, Procurement and Construction (EPC) Contractors will be required to have suitably qualified and experienced, dedicated full time on-site counterpart staff including a (a) full time Environment Manager; (b) part time Pollution Control, Oil and PCB Expert; (c) full time Health and Safety Manager with NEBOSH/IOSH, supported by several health and safety stewards on-site; (d) full time Labor Manager; (e) full time Social and Community Liaison Officer—distribution component, and (f) full time (lines) part time (BESS/substations) Ecologist/Botanist—distribution component from commencement to closure of the contract. Given the biodiversity and cultural heritage values involved in the distribution component, APDCL will need to adequately budget for and ensure they have sufficient environmental expertise available to be able to address all of the EMP requirements. The PMC will help APDCL and NGEAL JV to develop standard operating procedures (SOP) addressing the environment, health and safety impacts and risks of its operational substations and the BESS, maintenance of these facilities and the distribution lines, including recording of any occupational and community health and safety incidents since they will be responsible for this phase of the project.

XVIII. This IEE including EMP are considered sufficient to meet the environmental assessment requirements of ADB for the BESS and distribution components. However, as the distribution component is based on an indicative route alignment for only a sample of the new and existing 11kV and LT distribution lines with locations of DTRs still to be finalized it will need to be updated after mobilization of the EPC contractors and finalization of the route alignments. Following detailed route surveys of distribution lines, updating can be done in a phased manner during implementation of Output 4. The commencement of works in respective sections of distribution lines shall only be taken up upon clearance of the updated IEE / addendum to IEE report by ADB. Further, the IEE and EMP will also be updated and revised, if necessary, if there are any unanticipated impacts including a scope or design change. Any changes to the IEE and EMP will be subject to ADB review, clearance, and disclosure

