Environmental Impact Assessment

Project Number: 54053-001
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NEP: South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project

Volume 2: Appendices

Prepared by Nepal Electricity Authority for the Asian Development Bank (ADB).

Appendix A – Environmental Management Plan

The following tables provide the feasible and cost-effective environmental mitigation and project standards required during the design, pre-construction and construction phases for the activities listed in Tables 1 to 4 to reduce potentially significant, adverse environmental impacts and risks to acceptable levels and generally ensure international good practice, and national environmental, health and safety requirements are followed.

Some commitments that must be commenced during the design and pre-construction phase will continue to be implemented by the contractor during the construction phase. Operational phase mitigation measures are primarily for NEA. 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.

Table A-1: Design Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
Siting and design of Project infrastructure	Finalization of new substation design and lay out, finalization of OHL and UG cable route alignments	<u>Applicable to all Components:</u> Comply with all applicable national and state environment, health, and safety (EHS) regulatory requirements in addition to the mitigation measures set out in the EMP – if there is any conflict between national requirements and measures set out in the EMP the most stringent provisions will take precedence • Designs to reflect the requirements of the EMP and international engineering best practice/good EHS practices • Preference shall be given to locating above ground equipment on modified habitat. • Identify presence of any unstable land/steep slopes and avoid these during the detailed design. • Where SS sites and NBTL towers are not on flat land conduct geotechnical/slope stability analysis with slopes to be graded with drainage installed to minimize landslide risk. Ensure resulting slope design/topography does not exacerbate surface erosion and/or trigger a landslide; all disturbed areas are to be revegetated. Bioengineering methods can be considered for providing slope protection. • Stability of slopes over 30% shall be checked and approved by the PSC prior to selection of tower location/substation layout and related foundation to be used. • Cut and fill requirements shall be minimized by design to reduce changes in topography and the extent of earthworks and thus dust generation during construction. Contractor shall quantify the extent of earthworks required and locations for disposal of excavated spoil such as through landscaping within SS site. • Identify presence of floodplain or depressions that get waterlogged in the rainy season and avoid these	• ADB SPS (2009) • IFC EHS General Guidelines • IFC EHS Electric Power T&D Guidelines • ADB SPS (2009) • IFC EHS General Guidelines • IFC EHS Electric Power T&D Guidelines	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC

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		during detailed design. • Conduct flood and drainage risk assessment and incorporate effective drainage design (allowing for climate change) to prevent possible flooding or waterlogging of SS equipment/towers during the wet season, whilst ensuring that surface runoff from the project site is no more than the greenfield runoff rate. • Carefully select the route/siting of towers to minimize impacts on existing structures (e.g., buildings) etc • Any temporary disturbance compensated for in accordance with the RIPP. • Minimize visual impact and clutter in locating above ground equipment. <u>Applicable only to Substations</u> • Substation transformers to be mounted on impermeable surface extending beyond the transformer footprint, bunded to 110% capacity and not connected to the surface water drainage system to collect oil spill, leaks, and overflows; transformers to be sited in a separately fenced area that can be kept locked. • Substation designs will include Soak Pit and Oil collecting pit. An oil soak pit shall be designed and provided below each oil filled transformer / reactor to accommodate at least 150% of total quantity of oil contained in the transformer / reactor with minimum 300 mm thick layer of gravels / pebbles of approximately 40 mm size (spread over a steel iron grating / trans rack) providing free space below the grating. Alternatively, an oil soak pit shall be provided below each transformer or reactor, to accommodate one third of total quantity of oil contained in the transformer / reactor with minimum 300 mm thick layer of gravels/ pebbles of approximately 40 mm size (spread over a steel iron grating/ trans rack) providing free space below the grating provided a common			

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		remote oil collecting pit of capacity at least equal to oil quantity in the largest size transformer or reactor is provided for a group of transformers or reactors and bottom of the soak pit below the transformer or reactor shall be connected to the common remote oil collecting pit with drain pipe of minimum 150 mm diameter with a slope not less than 1/96 for fast draining of oil or water through gravity from soak pit to the common remote oil collecting pit. Every soak pit below a transformer or reactor shall be designed to contain oil dropping from any part of the transformer or reactor. The common remote oil collecting pit and soak pit (when remote oil collecting pit is not provided) shall be provided with automatic pumping facility, to always keep the pit empty and available for an emergency. • Provision of oil-water separator on all surface water drainage. • Separation or fire barrier walls will be provided between the transformers or between transformer and nearby buildings. • Ensure maximum sound power level of equipment at 1 m is 85 dBA through use of sound attenuation, in areas where these noise levels will be exceeded OHS noise warning signage identifying that ear protection to be worn must be installed as part of design. • Provide well designed, covered, segregated materials and waste storage area of sufficient size to accommodate all anticipated storage requirements, ensure storage areas can be locked, are well-ventilated and will not reach extreme temperatures. Ensure space also provided in the storage area for solid and hazardous waste garbage bins to be stored. Fuel/oil/chemical/waste storage areas must have an impervious floor and be bunded so that the capacity of each bund is sufficient to contain at least 110% of the maximum design storage capacity within storage			

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		area, not connected to the surface water drainage system. • Provide spill prevention kits (sorbent pads, loose sorbent material, etc.) at storage areas and other at-risk locations within clearly labelled containers. • Locate new transformers; storage areas; and septic tanks/soak away at least 50m from waterbodies and borewells to reduce pollution risk, if closer proximity is required due to site layout further assessment to be carried out to demonstrate using a source-pathway-receptor model there will be no adverse impact on aquatic ecology or human health. • Ensure that ICNRP occupational and community EMF exposure levels (reference and peak values) will be achieved within the substation and outside of the fence line respectively. • All electrical hazards will feature written and visual warning signs that meet the IEEE standards to include the ISO 7010 "Hazard Type: Electrical Symbol" warning of the risk of electrocution • Include a secure boundary fence or wall that is sufficiently high it cannot be climbed over, provide a gated, surfaced vehicular access for entry/exit off public highway having adequate sight lines for all drivers and warning signs of entranceway for road users. • For control buildings provide adequate natural and/or artificial lighting levels to meet the IFC EHS Guidelines on Occupational H&S (Table 2.3.3. Minimum Limits for Workplace Illumination Intensity) and take a life-cycle approach to detailed design, considering the use of construction materials and the energy and water efficiency of the building during operation adopting the “green building” concept e.g., using natural ventilation for reducing the need for air conditioners. Detailed design is to include rainwater harvesting and enable NEA to readily fit solar panels on building			

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		rooftop once operational. • Control building design will provide for sanitation and welfare facilities as per national regulations and international GIIP including indoor toilets (separate for men and women) with hand washing facilities (minimum of 1 unit to 6 males and 1 unit for 6 females shall be provided) and a dedicated cooking area / clean eating area / rest area for staff on-site etc. • Provide access to a safe, secure, hygienic facility for female workers' children below five years of age; any room provided for this purpose must be segregated from the operational elements of the substation. • Dedicated shelter to be provided at the site entrance for use by security guards, shielding them from rain, wind, and extreme (hot / cold) temperatures. • All wastewater to be connected to existing sewerage system or septic tank with soak away so no untreated wastewater will be disposed of to surface water or ground in operation, septic tank/soakaway effluent to meet national general wastewater standards or IFC wastewater discharge limits, whatever is the most stringent. • Potable water will be supplied that meets national ISO 10500 drinking water standards (full suite). If this is unavailable, ensure regular supply of bottled water to the site during construction and operational phases. • Design of control building to include emergency exits with emergency exit signage • Provide automatic fire alarm and fire suppression system in control building. • Provide fully stocked, in-date first aid kit installed in a • prominent, signed position, first aid posters and emergency contacts to also be displayed. • Provide eye wash station and water supply to shower located near storage areas for fuel/oil/chemicals • Provide sand buckets, full of sand, placed in a			

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		prominent, signed location near to fire-risk locations such as transformers and oil storage areas • Provide fire extinguishers (including for oil and electric fires) in a prominent, signed location near to fire-risk locations such as transformers and oil storage areas with service and expiration dates clearly labelled along with posters on fire safety • Design to ensure all lighting is of energy efficient LED type with solar powered LED lighting where practical Use of fluorescent/HPSV lamps will be avoided since they are less energy efficient/classed as hazardous waste for purposes of disposal. • Outdoor lighting to be installed must be of low intensity with little or no blue wavelength and operated using passive infrared (PIR) technology movement sensors set at person height so as not to be kept permanently on overnight, it must be directional and shielded, so light does not fall outside substation boundaries.			
	Exposure to safety risk	• Ensure all relevant safety clearances and right of way are applied to NBTL per national standards. • During route survey identify presence of all buildings/properties within the ROWs with particular attention to mapping school compounds and playgrounds; minimum distances to center line to be inventoried. • Installation of NBTL above or adjacent (within the horizontal clearance) to residential properties or other locations intended for highly frequent human occupancy (e.g., schools or offices) to be avoided. No school compounds or playgrounds will fall within the horizontal safety clearance. • Barbed wire type anti-climbing device shall be provided and installed by the Contractor for all tower structures. The height of the anticlimbing device shall be approximately 3 m above	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC

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Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
	Visual impact of NBTL	• For the micro-siting of NBTL, the towers and lines to be located as far away as practical from residential dwellings and PCR sites identified in the EIA. • Include visibility of the towers among the factors considered during final tower positioning, including determining the proper balance between heights of towers and the number of towers.	• ADB SPS (2009) • IFC EHS Guidelines. Electrical Power Transmission and Distribution (2007)	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC
	Damage to socially/culturally sensitive and historical sites	• Contractors to conduct an inventory of physical cultural resources in and adjacent to the RoW prior to the start of any works including distances to the center line to confirm PCR findings in the EIA. • Prepare and implement the PCR Stakeholder Engagement Plan. • Careful selection of route alignments to avoid encroachment on socially, culturally, and archaeological sensitive areas (e.g., sacred groves, graveyards, religious worship place, monuments etc.) based on the findings and recommendations of the above items.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC
	Damage to private property, crops and water supplies etc.	• Alignment to avoid or minimize crop disturbance where lines cross private land by crossing uncultivated land (not natural habitat) as much as possible. • During route survey identify and inventory presence of any surface waterbodies including rivers/ponds and groundwater sources including springs/wells/pumps within the ROW and confirm if any are used by local communities for drinking water or other purposes documenting distance to the center line. • Alignment to avoid impacting on rivers/ponds and groundwater sources especially water sources including springs/wells/pumps used by local communities. • Alignment to avoid impacting on men and women's access to common land and community forests for uses	• ADB SPS (2009) • Project LARP	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC

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		such as fuelwood and fodder and water resources; use of common land and water resources to be identified through consultation with CFUGs			
	Access roads	• No new permanent access roads will be constructed except if no existing access exists; for NBTL existing access roads will be used in the first instance along with manual construction to minimize soil compaction from vehicle movements. • Method statements for access roads will be submitted for approval, no access roads will be cut into a hillside, or through Saimanina complex. • No access roads will be permitted within 500m of vulture feeding / nesting sites. • Access roads will be graded and sloped with drainage either side to prevent unnecessary flow of water across the road and to minimize soil erosion. • If new access roads are required, make the access suitable for use and shall take all reasonable precautions to avoid damage, including, if required, the erection of temporary fences or gates where permanent fences, hedges or gates have been removed.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC
	Drainage	• Final surface level of substation and tower foundations will be at least 0.5 m above the existing ground level or highest flood level including an allowance for climate change based on the findings of the climate change assessment prepared for the Project (whichever is higher) • Foundations to be constructed in such a way as to be adequately drained to prevent washouts and flooding impacts to adjacent land. • Junctions between new access roads and existing roads will not impede or damage the latter nor any associated drainage channels, irrigation infrastructure, etc.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC
Biodiversity	Habitat Loss, Tree Cutting	• Contractor to employ field ecologists and botanist to undertake ROW walkover, map habitats beneath	• ADB SPS (2009)	EPC Contractor	PMD ESMU / PSC

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		towers and ROW confirming if modified or natural habitat present, and listing species encountered. • During ecological surveys field ecologists will enumerate the number and species of trees requiring to be cut and lopped. In forest habitat the quality of forest cover lost will be confirmed. Submit ecological survey report alongside design. • Presence or absence of sensitive receptors and critical habitat species identified in EIA to be confirmed by field ecologists during route surveys including detailed species surveys as required by the EIA. Adaptive management measures to be applied according to the findings of the surveys, • Cutting or trimming of trees will only be planned when required to meet safety clearance requirements.		Include in EPC contract cost Before design approval for further implementation during construction phase	
	Vultures	• Implement the required measures for transponder study support and vantage point surveys for at least a one year period prior to the finalisation of design.	• ADB SPS (2009)	NEA	Environmental Support Consultants
		• Based on the survey and study data above a) identify additional high use/high exposure areas; 2) refine micrositing, as for the area near the Lalmatiya feeding station and nest/roost sites; 3) focus mitigation in areas where it will be most beneficial and most likely to result in tangible conservation benefits and avoided vulture mortality. Study findings may suggest that the preliminary mitigation recommendations described above are not optimal, and that those funds can be otherwise applied for greater conservation benefit to vulture species. • EIA to be updated based on the above.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC Environmental Support Consultants ADB
		• Ensure that detailed designs include the requirements of the updated EIA regarding re-routing of the alignment around vulture nesting sites and vulture feeding sites as required or any additional mitigation measures proposed from the surveys and studies	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost	PMD ESMU / PSC Environmental Support Consultants

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Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
				Before design approval for further implementation during construction phase	ADB
Equipment specifications and design parameters	Polychlorinated Biphenyls (PCB)	<u>Applicable to SS</u> • PCBs will not be permitted for use in any transformers at substations or in any other project facilities or equipment. • Provide NEA with material data sheets for the insulating oil used in transformers. • Processes, equipment, and systems not to use chlorofluorocarbons (CFCs) including halon.	• ADB SPS (2009) • Stockholm Convention	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC
	Exposure to electromagnetic interference	<u>Applicable to all Components</u> • Designs to comply with the reference levels of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) for EMF exposure. Contractor to provide EMF calculations to the PSC for review and approval. <u>Applicable to SS</u> • Use of shielding equipment/materials to decrease electromagnetic field exposure included at any substation where calculations identify levels above ICNIRP reference levels at properties close to the substation.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC
	Exposure to noise	<u>Applicable to all SS</u> • Design substations so operational noise complies with 1-hour LAeq 70 dB(A) at the site boundary, 55dB(A) outside the fence line if located within a commercial zone, 45 dB(A) at the nearest residential properties including located those in commercial zones, and 40dB(A) at 100m distance from silent zones. • Ensure transformers are located at least 100m from the nearest residential receptor from their point within the SS.	• ADB SPS (2009) • IFC EHS Guidelines – Noise Management (2007)	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC

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Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• An acoustically designed enclosure or wall will be installed around the transformers at the SS. • Diesel generator sets will similarly need to be located at least 50m away from the SS boundaries and enclosed within an acoustically designed enclosure. • Measurements must be carried out at the nearest SS residential receptor and cow sanctuary during detailed design and baseline noise calculations (modelling) considering low frequencies associated with transformer hum will be undertaken by the Contractor to demonstrate that the noise standards/guidelines can be met. If background noise levels already exceed the standards/guidelines the design must ensure that noise levels result in a <3dBA increase in background.			
	Hazardous Materials	<u>Applicable to all Components</u> • No asbestos containing materials of any type will be used in the design and construction of project facilities. <u>Applicable SS</u> • Batteries will be to national standards; use lithium-ion in preference to lead acid or cadmium nickel to minimize use of heavy metals. • Separate room for substation batteries will be provided with ventilation and exhaust fan for taking out fume gases in case of leaks and provision of monitoring of substation batteries (remote if not staffed substation) and exhaust fan will be made. • 24V, 30V, 48V, 110V, 220V DC batteries will ideally be lithium-ion type instead of lead acid or nickel cadmium to reduce hazardous waste generation although all battery types are e-waste. The batteries will conform to relevant national standards. A separate room for substation batteries will be provided with ventilation and exhaust fan for taking out fume gases and provision of remote monitoring of	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC

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		substation batteries (if not staffed) and exhaust fan will also be made.			
	Oil Management	<u>Applicable to SS</u> • Secure oil storage areas bunded to 110% of capacity with an impervious floor of sufficient size to accommodate all anticipated oil storage requirements will be provided. Ensure these storage areas covered, can be locked, are well- ventilated, will not reach extreme temperatures and are not connected to the surface water drainage system. • Substation transformers to be mounted on impermeable surface extending beyond the transformer footprint, bunded to 110% capacity and not connected to the surface water drainage system to collect oil spill, leaks, and overflows; transformers to be sited in a separately fenced area that can be kept locked.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC
	SF6	<u>Applicable to SS</u> • Use of alternative insulation medium (such as Hydrophobic Cycloaliphatic Epoxy) to be considered as the preferred option. • If no alternative the use of SF6 in gas insulated equipment must be minimized as part of design requirements. • Design of any gas insulated equipment will comply with international norms and standards for handling, storage, and management of SF6. • Equipment to be hermetically pressure sealed "sealed for life" units and be tested and guaranteed by the supplier at less than 0.1% leakage rate. • Installation designed and operated so that any leakage will trigger an alarm at the nearest concerned staffed substation requiring O&M staff to rectify the situation immediately. • Provide SF6 leakage detector at SS	• ADB SPS (2009) • Reducing SF6 Emissions in Electric Power Systems: Best Industry Practices – USEPA	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC

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		• SF6 in fire extinguishers provided at SS to be avoided.			
	Geohazards	• All designs shall incorporate specific measures, as required by national standards for Earthquake Resistant Design of Structures • All structural designs are to be checked for seismic safety by design team and an independent expert, separate to design team, to confirm national and international good practice standards are met. • EPC Contractors design team will conduct flood and drainage risk assessment and incorporate effective drainage design (allowing for climate change) to prevent possible flooding or waterlogging during the wet season, whilst ensuring that surface runoff from the project site is no more than the greenfield runoff rate. Further, the substation or switchyard shall be constructed above the highest flood level and, wherever required, flood protection walls shall also be provided. <u>Applicable to NBTL</u> • Thorough site evaluation of the areas prone to landslides and existing landslides. Avoidance of existing landslides and landslide-prone areas for the tower installation. • Thorough examination of the stability of tower locations before site preparation. If a tower must be in an unstable area, appropriate foundation design techniques will be employed.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design approval for further implementation during construction phase	PMD ESMU / PSC

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Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Implementation of re-vegetation and slope maintenance practices in disturbed areas to prevent erosion. • Application of proper landscaping techniques that combine bioengineering principles with civic structures at the tower sites. • Implementation of erosion prevention and minimization measures. • Provision of temporary access, diversions, and signboards for pedestrians. • Exposed soils will be stabilized and vegetated to prevent further erosions. • The final surface level of tower sites shall be at least 0.5 m above the existing ground level and highest flood level and shall be constructed in such a way as to be adequately drained to prevent washouts and flooding impacts to adjacent areas. The surface level shall also consider the findings of the climate change assessment prepared by ADB (final version in progress). • For non-navigable rivers, the clearance required for the crossing will be calculated based on the highest flood level (HFL). This approach takes into consideration the potential rise in water levels during flood events and ensures that the power lines remain at a safe distance above the water surface.			
	Water body / river crossings	• During route survey identify and inventory presence of any surface waterbodies including rivers/streams/ponds within 500m of NBTL RoWs and	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost	PMD ESMU / PSC

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Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		confirm if any are used by local communities for drinking water or other purposes. • All river/stream crossings required will be single span.		Before design Approval for further implementation during construction phase	
	Climate hazards	• All designs shall incorporate climate change adaptation measures per the climate risk assessment.	• ADB CRA (2023)	EPC Contractor Include in EPC contract cost Before design Approval for further implementation during construction phase	PMD ESMU / PSC
	Slope Stability	• Project components on slopes must incorporate slope stability measures such as bioengineering methods and retaining walls with adequate drainage to avoid exacerbating surface erosion and/or triggering a landslide. All designs for works in steep topography to be checked by design team and an independent geotechnical engineer, separate to design team, to confirm national and international good practice standards are met.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design Approval for further implementation during construction phase	PMD ESMU / PSC
Hazards to Life	OHS	<u>Applicable to all Components</u> • For all construction works undertake facilitated H&S risk assessment through a workshop during the design (and at other key stages) so it can inform both design and pre- construction preparations, considering both occupational and community H&S risks resulting from subsequent stages of the project. Facilitated workshop will involve the design and construction team of the contractors and NEA operational staff.	• ADB SPS (2009) • IFC EHS General Guidelines/Occupational and Community Health and Safety	EPC Contractor Include in EPC contract cost Before design approval	PMD ESMU / PSC
	Explosions / Fire	<u>Applicable to all Components</u> • All substations and other project facilities will be designed and constructed according to national fire safety standards.	• ADB SPS (2009) • IFC EHS General Guidelines/Occupational and Community Health and	EPC Contractor Include in EPC contract cost	PMD ESMU / PSC

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Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		Applicable to NBTL • Ensure detailed design of OHL HV power lines incorporates lightening protection to minimize forest fire risks.	Safety	Before design approval	
	Electrical	Applicable to all Components • Ensure designs are in accordance with all national safety standards	• ADB SPS (2009) • IFC EHS General Guidelines/Occupational and Community Health and Safety	EPC Contractor Include in EPC contract cost Before design approval	PMD ESMU / PSC
	Access to Facilities	Applicable to all Components • Designs will ensure that there can be no illegal access to substations. • Include in the design of all towers anti-climb features together with posting of written and visual warning signs to include the ISO 7010 "Hazard Type: Electrical Symbol" warning of the risk of electrocution.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design approval	PMD ESMU / PSC
	Building and tower safety	• All buildings will be designed in accordance with national building safety codes • All structural designs to be checked for building and seismic safety by design team and an independent expert, separate to design team, to confirm national and international good practice standards are met.	• ADB SPS (2009) • The Uttarakhand Building Construction and Development Bye Laws / Regulations, 2011	EPC Contractor Include in EPC contract cost Before design approval	PMD ESMU / PSC
Final Designs	Community Consultations	• Contractors to undertake and document meaningful consultations with potentially affected persons and local communities within 500m of the SS and NBTL RoWs ensuring representation of at least 30% women, as well as other stakeholders including local authorities and public utilities during design in order that any concerns raised can be reflected in the choice of SS site layout, NBTL route alignment and construction method. • Every individual on whose land the NBTL towers will be installed will also be consulted one-on-one by the EPC Contractor prior to finalization of the position	• ADB SPS (2009) •	EPC Contractor Include in EPC contract cost Before design approval	PMD ESMU / PSC

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		of the tower footings.			
	Review of documentation, update of the EIA	• Detailed designs will be reviewed by the contractor and NEA to confirm all measures required by the EIA/EMP have been adequately incorporated and that they reflect international engineering best practice/good EHS practice before they are approved. • Prior to NEA approval of the designs and commencement of construction, ensure that NEA have updated the EIA as required to reflect the final scope of SS works/design/route alignment, seeking ADB clearance of any updated EIA before works start by contractor.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before design approval	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
Management Planning	Unanticipated impacts and corrective actions	• Comply with the definite version of the EMP which is the version disclosed on ADB's website. This includes any measures in an updated EIA following design or any updates in response to unanticipated impacts. • Ensure all subcontractors and third parties, irrespective of being formally or informally employed also comply with the EMP and any updates to it, as well as the CSEMP and that this responsibility is cascaded down any chain involved. • Do not engage in any activities described on the ADB Prohibited Investment Activities List in Appendix 5 of ADB's SPS (2009) • Put in place appropriate incentives and/or penalties for (non-) compliance by workers related to use of PPE, and any violations of the Contractors Code of Conduct. • Comply with all applicable national and state	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		environment, health, and safety (EHS) regulatory requirements in addition to the mitigation measures set out in the EMP – if there is any conflict between national requirements and measures set out in the EMP the most stringent provisions will take precedence			
	CSEMP	Preparation for NEA approval and implementation of the CSEMP and its associated management sub plans reflecting the EMP requirements and international engineering best practice/good EHS practices- CSEMP shall include: • Construction Method Statement • Pollution Prevention Plan & Emergency Response Plan (including SF6 measures) • Occupational Health and Safety Plan & Emergency Response Plan • Community Health and Safety Plan & Emergency Response Plan • General Construction Biodiversity Management Plan • Tortoise Management Plan • Vulture Management Plan • Physical Cultural Resources Management Plan & Physical Cultural Resources Stakeholder Engagement Plan • Waste Management Plan • Traffic Management Plan • Labour Management Plan • Communication Plan	• ADB SPS (2009) • IFC EHS General Guidelines/Electric Power T&D Guidelines • ILO code of practice	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Training Plan			
Regulations, permits etc.	Unobtained licenses and permits	• Acquire all requisite environment, health, safety and labor permits and licenses for construction activities as required by national laws and regulations, prior to the commencement of works. • Statutory H&S and labor requirements including permits, licenses, and insurances for all workers to be obtained and maintained. • Contractors are to obtain Consent to Establish for all construction plant including DG sets and all other applicable national EHS permissions or requirements prior to construction. • Construction plant must not be operated by contractors until their Consent to Operate is obtained. • Medical insurance will be provided for all workers with sick leave allowance to ensure symptomatic workers do not attend site due to no work-no pay policies. • Insurance to include a community liability clause for payment of compensation in case of any accidents because of construction.	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC
Temporary facility	Selection of temporary construction facilities	• Local communities within 500m to be consulted when selecting sites for temporary project facilities prior to finalization. • Provide a central covered warehouse for storage of construction materials etc. Only volumes of material required for the day's work will be stored on-site • If other public or private land is required for temporary construction facilities noisy and dusty facilities or those that may generate sediment laden runoff or wastewater (e.g., centralized concrete batching plant, hot mix plant, refueling areas, maintenance yards, storage areas, temporary worker camps) must be sited 500m from residential property and other sensitive receptors (houses, schools, clinics, temples, etc.). Laydown and storage areas that are not potential	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		pollution sources may be located 50m distant but must not block accesses or road use. • No temporary construction or accommodation camp in forest or KBA. • No public or private land requiring clearance of vegetation or supporting forest habitat or having waterbodies is to be used. No cutting of trees or mature vegetation clearance will be allowed for temporary facilities. • Land use to be negotiated with private landowner, submit land ownership papers and copy of agreement for temporary land use with a photographic record of pre-project condition. • A photographic record will be made of the pre-construction condition of land used for temporary facilities before construction to inform the reinstatement works. • After completion of the construction work the temporary structures shall be completely removed and the land will be restored to its earlier condition.			
	Temporary access routes	• For transmission line in steep terrain the construction of new access track is not allowed. No temporary access tracks will not be cut into a hillside, especially immediately below a tower. • In steep terrain and forest area/habitat use will be made of existing access roads and tracks for transporting tower materials and machinery. In locations where access is restricted use of manual labor to transport, install and string the towers and lines. • Where possible, use existing paved and unpaved roads for the initial transportation of materials and equipment from the staging and storage areas to locations where they will be needed along the transmission line ROW. • If new access tracks on flat terrain are required the Contractor will make the access suitable for use and	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		take all reasonable precautions to avoid damage, including, if required the erection of temporary fences or gates where permanent fences, hedges or gates have been removed. • Temporary earth access tracks on flat terrain shall be suitably compacted, they will be graded and sloped to prevent the unnecessary flow of water across tower sites and to minimize any soil erosion. • Ensure that all unpaved access roads are kept as far as possible from residential properties to avoid vibration from the movement of heavy construction vehicles. • A photographic record will be made of the pre-construction condition of access roads and land which is used for any temporary access tracks before construction to inform the reinstatement works. • After completion of the construction work temporarily access roads/tracks shall be restored to their original condition.			
	Land Acquisition and Compensation	• Temporary impacts (e.g., land rentals) that are not within the assessed corridor of impact are to be compensated by the Contractor in line with the LARP entitlement matrix.	• ADB SPS (2009) • Project LARP	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD /PSC
Staffing	Inadequate staff to provide supervision and oversight	• Appoint a suitably qualified and experienced, dedicated Environment Manager and dedicated Health and Safety Manager for each contract package/lot to be based on site full-time. • Each active construction site is to have adequate health and safety supervision to ensure the health and safety of all workers and local communities to include a suitably qualified and experienced Senior Engineer having NEBOSH/IOSH certification or similar qualification who is based on-site full-time and nominated to the role of EHS Supervisor with responsibility for ensuring EMP implementation,	ADB SPS (2009)	EPC Contractor Include in EPC contract cost with BOQ line for staff Staff in place prior to the start of construction and ongoing through project Implementation	NEA PMD /PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		acting on the advice of, and reporting to their safeguards team. Each Senior Engineer will be supported by full-time on-site Health and Safety steward(s) with at least one steward to each 50 persons. • Do not discriminate and proactively encourage the employment of (i) suitably skilled women, and (ii) local employment for unskilled roles whilst ensuring suitably qualified and experienced workers for skilled roles; noting that all workers must be appropriately skilled given the hazardous nature of works. • No child will be employed, and no under 18s will be engaged on construction site (hazardous work). • Provide medical/accident insurance for all workers (formal and informal) for the duration of their contracts as well as at least 10 days of sick leave for all construction workers.			
	Induction and Orientation	• Ensure all members of contractor's safeguards team, design team, and construction management team attend NEA EMP trainings. • Contractor to conduct their own trainings for their construction management and provide all workers and visitors on site, irrespective of them being formally or informally employed by the contractor, subcontractor or third party with an EHS induction before being allowed on site – induction to cover orientation on EHS requirements and roles and responsibilities in relation to EMP implementation, dos and don'ts in relation to the construction site, employer provided staff accommodation, code of conduct and interaction with local communities, protected areas, forest land, interaction with wildlife etc. • Ensure topics covered by training and induction include, but are not limited to, good housekeeping at all times; environmentally safe and sound waste management practices; hygiene and communicable disease prevention including COVID-19 and HIV/AIDS;	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		gender-based violence and sexual exploitation, abuse and harassment prevention; code of conduct, interaction with local communities and culturally acceptable practices; biodiversity conservation awareness; fire safety prevention; forest fire risk; prohibition on firewood and NTFP collection by workers; prohibition on trapping, hunting, fishing, or poaching by workers; chance find procedures; H&S including use of PPE; etc. • Contractors to carry out awareness raising for all construction workers about the GRM at the start of their employment on site including disseminating GRM contact details on noticeboards at construction site offices and at employer provided staff accommodation. Suggestion boxes to be provided for construction workers at construction site offices and at employer provided staff accommodation. • Prepare with guidance of health experts HIV/AIDS/COVID-19 information video/brochures/leaflets for distribution to all workers during induction, covering factual health issues as well as behavior change issues (e.g., social distancing for COVID-19) around the transmission and infection of HIV/AIDS/COVID-19 and other communicable diseases. • Prepare with guidance of labor experts a worker Code of Conduct and information video/brochure/leaflet for distribution to all workers during induction addressing culturally acceptable practices etc. Code must be informed by the CSEMP and address the following aspects: o Zero tolerance in respect of health and safety o Requirement on always wearing PPE on site o Zero tolerance of bribery or corruption			

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		○ Respect for local community and customs, avoiding community conflict situations especially in tribal areas ○ Zero tolerance of illegal and unacceptable activities/behavior, including but not limited to engagement in: prostitution; gender-based violence/sexual exploitation, abuse, and harassment; illegal sale or purchase of alcohol; sale, purchase, or consumption of drugs; gambling; fighting ○ Alcohol and drugs policy and testing regime ○ Role of workers in good housekeeping ○ Role of workers in maintaining good hygiene including COVID-19 measures e.g., social distancing ○ Respect of wildlife and the environment Description of disciplinary measures for infringement of the code of conduct and other employer rules (e.g., immediate removal from site, fine etc.)			
Communications	Advance Notice	• No works will start until NEA has locally disclosed the EIA and any update to it with executive summary translated into local language via the NEA website, NEA offices, existing substations, and other construction site offices. • Brochures and posters on the main findings of the EIA and where the full version can be accessed, as well as a translation of the executive summary of the EIA, will be printed in local language and made available/displayed for public scrutiny at places easily accessible to affected persons. • Directly liaise one-on-one with receptors in the RoW for NBTL and specifically notify them about the commencement of work etc. • Local communities as well as individual property owners within 500m are to be consulted when selecting sites for temporary construction facilities outside of the SS prior to finalization of their location.	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
	GRM	• NEA with support of contractor to inform all potentially affected persons and local communities within 500m of SS and NBTL alignment of the existence of the GRM as well as the GRM process and means of submitting project grievance to. Inform all residents and businesses of the GRM in advance of works (at least one month). • Community awareness raising of the GRM will be undertaken verbally, through community meetings, one-on-one consultations with landowners; through the distribution of notices/pamphlets/posters; and through other media outlets. • Provide notice boards at SS, construction site offices and active work sites including details of the GRM including the name, designation, contact numbers including phone/SMS/What's App, address of both the NEA and contractor's GRM focal persons plus the timeline and process of redressal together with a suggestion box that will be regularly checked for any grievances received.	ADB SPS (2009) Project GRM	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC
Hydrology	Water Users	• Any drilling or excavation works within 50m of boreholes and wells used as a drinking water source by local communities will require pre-construction and post construction water quality monitoring against GoN drinking water standards to ensure there is no contamination of the supply. • Construction water to be sourced from an existing licensed commercial supplier (preferred option especially for potable water supplies) where available or rainwater harvesting. • If using an existing surface water or an existing borewell for construction water, permissions to be obtained from authorities together with the agreement of local communities. • Prior agreement is required from local community users to use any existing surface water/borewell or local piped water either temporarily during	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		construction or permanently for substations; in cases where use of local water source is not agreed contractor to import tanked water to the project area. • No groundwater will be used in districts without additional groundwater capacity – in other districts groundwater will not be used only after it has been confirmed through assessment there will be no additional stress on groundwater resources as a result. • Permissions for any new borewell installation (for construction or permanent supply to substation) shall be obtained.			
	Water Pollution	• If any surface waterbodies or groundwater sources are within 500m, undertake a baseline water quality sampling as per the EMoP to confirm their current water quality status at least one week prior to the commencement of any actively onsite. • Plan for designated impermeable fuel/oil/chemical hazardous materials/waste storage areas located at least 50m from surface water. • Diesel storage tanks will be sited in suitably sized and constructed bunded areas that are designed to be impervious to water and fuel. The bund volume will be designed to no less than 110% of the tank volume. Loading and off-loading connections will be located over secondary containment. • Refueling procedure will be developed, which will include a restriction on refueling within 50m of any watercourse.	• ADB SPS (2009) • IFC EHS Guidelines: wastewater and ambient water quality • ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC
Hazardous Materials	Release of chemicals and gases in receptors (Air, water, land)	• Contractor to undertake noise and air quality monitoring per the EMoP to confirm current background levels in the project area at least one week prior to the commencement of any actively on-site. • Equipment purchased for use on the Project to be accompanied by letter from the manufacturer and material safety data sheet for insulating oil used confirming that it is guaranteed PCB free and labelled as PCB free.	• ADB SPS (2009) • Stockholm Convention	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
				establishment then ongoing through project implementation	
Occupational Health and Safety	General	• Informed by risk assessment prepare H&S plan for approval by NEA in accordance with the IFC EHS General Guidelines on OHS, considering occupational and community H&S and including adherence to electrical safety standards and emergency preparedness and response plan with communication systems and protocols to report an emergency. • For all pre-construction and construction works comply with Government of Nepal rules and regulations for the protection of workers. • During construction works, ensure qualified first aider and trained fire marshal is always available on-site with an appropriately equipped first aid kit and appropriate fire extinguisher and other firefighting equipment immediately available for use. • Provide an ambulance for more serious cases to transport the patient to the hospital for treatment • Contractors will set up an accident reporting system for any health and safety incidents (near miss, minor, lost time, fatal) involving workers or community to be reported to NEA within 24 hours of occurrence with a response plan detailing the incident and how its reoccurrence will be avoided. Record of all incidents and response taken should include date, time, details of incident, treatment given and outcome, and lessons learnt for the future. Contractors will ensure all workers are covered by insurance to pay out in the event of a disability or fatality. • Emergency contact number and details for medical, fire, etc. are to be displayed in all construction sites.	• ADB SPS (2009) • IFC EHS Guidelines: Electrical Power and Distribution (2007) • IFC General EHS Guidelines: Occupational Health and Safety • IFC General EHS Guidelines: Community Health and Safety	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC
	Labour and accommodation	• Design of temporary worker camps/overnight accommodation to conform to national requirements and international good practice. Contractors to	ADB SPS 2009	EPC Contractor	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		provide all basic requirements (beds and beddings, mosquito nets, artificial lights, natural light, windows and ventilation, fans, emergency exits, firefighting equipment, kitchen and dining halls, mobile charging points, toilets and washing facilities, potable drinking water, recreational space etc. • No temporary worker camps/overnight accommodation will be established in forest area/habitat. • Shaded rest area that is accessible and can accommodate the number of workers on site • Source water from an existing licensed commercial supplier (preferred option) where available		Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	
	Sub-contractors	• All Project sub-contractors will be supplied with copies of the EMP and CSEMP. • Provisions will be incorporated into all sub-contracts to ensure the compliance with the CSEMP at all tiers of the sub-contracting. • All subcontractors will be required to appoint an OHS representative who will be available on each work site.	ADB SPS 2009	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC
	Grievance	• Establish a formal Grievance Mechanism for workers. • Carry out awareness raising amongst formally and informally employed workers including those of sub-contractors about the GRM at the start of their employment, including details of how to submit a grievance to PSC and/or to the Contractor.	ADB SPS 2009	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
				ongoing through project implementation	
Community Health and Safety	Delays	• Undertake face-to-face with all communities/residents and schools, health centres, places of worship and community centres within 500m of the substations and ROW NBTL to keep them fully informed of the nature of works and latest construction schedule, notifying them individually at least one month prior to the commencement of works of the intended start date and schedule. • Provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions at least 72 hours before any disruptions. • The authorities will be notified when oversize heavy loads need to be transported and the loads will be escorted by the Project.	ADB SPS 2009	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC
	Noise and vibration	• Contractor will be required to measure and confirm the distance from their construction works to sensitive receptors to confirm if the noise standards can be met based on their construction methods or if temporary acoustic barriers are required. • Contractor to avoid soil compaction, piling, blasting and other vibration inducing activities as much as possible • If piling, blasting or other vibration inducing activities are to be undertaken for construction a detailed construction noise/vibration assessment is to be undertaken by the contractor to demonstrate how construction noise and vibration levels/guidelines can be achieved at the site boundary and nearest receptors and a piling/blasting management plan is to be prepared for approval. • In locations where this is unavoidable Contractor to identify properties within the zone of influence and undertake pre-construction structural surveys to	ADB SPS 2009	EPC Contractor Include in EPC contract cost Before the start of start any related works including construction site establishment then ongoing through project implementation	PMD ESMU / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		identify level of risk. If risk of structural damage to properties identified due to current condition, consider alternative construction method or temporary relocation of occupants during works if at risk. Consider need to install monitors during construction to monitor structural movement. Structural or cosmetic damage to be repaired by Contractor to at least pre-project condition at their own cost. • Contractor to undertake pre-construction noise monitoring per EMoP to confirm current background noise levels in the project area at least one week prior to the commencement of any actively on-site.			
	Safety Awareness	• In conjunction with the local municipality or village/tribal head in rural areas plus the media organize health and safety campaigns including the distribution of posters, leaflets, and safety booklets to all households in local language with strong use of graphics for construction and electrical safety community awareness raising activities in local communities and schools within 500 m of the new substations and prior to construction and then again prior to commissioning of substations/energizing the transmission lines about how to avoid electrical incidents having greater emphasis on operational hazard and risks, etc. Materials will be written in non-technical language and will provide illustrations where practical. • Deliver face-to-face electrical safety awareness training to local children including their parents and/or their teachers at all educational facilities within at least 500m. • Provide construction work site safety awareness sessions at all educational facilities within at least 50m of any work zone. • Provide EMF awareness sessions at villages within 500m of NBTL alignment and substations. The	• ADB SPS (2009) • Project GRM • IFC EHS Guidelines: Community Health and Safety (2007)	EPC Contractor Include in EPC contract cost Before commencement of works and then ongoing through project implementation	NEA PMD / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		awareness sessions should provide information regarding the findings of the EIA on EMF and specifically discuss best practice reference limits for EMF and how they have been applied to the Project. • Develop and distribute leaflets/pamphlets/posters to the local community especially those living close to construction camps covering (i) health awareness including HIV/AIDS/STDs/Covid-19 and other communicable diseases, and (ii) the conduct of construction workers that can be expected. Materials will be written in non-technical language and will provide illustrations where practical. • Keep a record of the number of leaflets distributed and their locations.			
Physical Cultural Resources	Management Plans	Develop and Implement a Project specific Physical Cultural Resources Management Plan (PCR MP) as part of the Project EMS. Plan should include: • Physical Cultural Resources Stakeholder Engagement Plan (PCR SEP) • Physical Cultural Resources Treatment Plans to avoid, minimize, and/or mitigate impacts to individual physical cultural resources. • Chance Finds Procedure (CFP) to address potential impacts to previously unidentified physical cultural resources. • Physical Cultural Resource Grievance Mechanism	• ADB SPS (2009)	EPC Contractor in coordination with DoA	NEA PMD / PSC
	Alignment updates	Based on the results of the stakeholder engagement with community leaders and affected communities, develop resource specific treatment plans to avoid, minimize, and/or mitigate impacts to built/living heritage resources within 500 m of the proposed Project right-of-way and sacred trees or medicinal plants within Project vegetation clearance areas	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before commencement of works and then ongoing through project implementation	NEA PMD / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
Forest and habitat	Felling of the trees	Marking and felling of the trees • Acquisition of forest clearance permission • Enumeration and marking of the trees to be fell in collaboration with DFO, CFUG, and LHFUG • Ecological importance survey • Documentation and reporting of tree felling. • Tower height increase to reduce the number of tree felling	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before commencement of works and then ongoing through project implementation	NEA PMD / PSC
		• Compensation for lost forest area – an equivalent amount of land to GoN will be provided. • Forest clearance will be carried out in accordance with the Forest Act 2076/ Regulations 2079 and Standards and Work Procedures for Utilization of National Forest Areas for Projects of National Priority 2076.	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before commencement of works and then ongoing through project implementation	NEA PMD / PSC
		• Compensatory plantation for removal of trees. Will be carried out at the ratio of 1:10 at the standard of 1600 seedlings/ha. • Establishment of nursery, however, if procurement of seedlings is its viable from existing nurseries. • Coordination with respective DFO and User Groups in	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before commencement of	NEA PMD / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		this process. • NEA will be responsible for caring of the site for 5 years, and handover to respective DFO/ User Groups after this period. • Tree trimming in RoW in coordination with DFO/ User Groups and under the supervision of an ecologist. • Breeding periods will be avoided to minimize ecological impacts.		works and then ongoing through project implementation	
	Habitat	• Sensitive habitats that need to be avoided during construction (e.g., specific trees that are to be retained) will be marked for protection by the contractor's environmental specialist who shall with support of field ecologists make a pre-work survey of the work sites to identify and conduct an inventory of trees to be cut prior to the start of works with the PSC. • Demarcation of mature trees to be avoided and retained. Only the marked trees within the ROW are to be felled after joint verification and approval of tree list.	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before commencement of works and then ongoing through project implementation	NEA PMD / PSC
Procurement	Material Sourcing	• Considering relevant technical and commercial considerations, the Project will seek to purchase goods and services from within Nepal • Environmental considerations will be included in the Project procurement process. • Contractors will use locally sourced materials as far as practical to reduce transportation, but all raw materials will be sourced only from existing licensed sources. Records to be kept of all the materials used and source with copies of licenses etc. • Only already existing state licensed borrow pits for land raising will be allowed for use. Provide copies of the borrow pit operator's license and permit before any materials from the borrow pit are delivered to site.	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before commencement of works and then ongoing through project implementation	NEA PMD / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Procedures will be established to determine the acceptability of material storage conditions and to promote the minimization of storage volumes on-site.			
Economy Employment and Livelihoods	Employment	• Targets for local recruitment from the local communities will be agreed with NEA based on initial assessment of the labor market for unskilled and semi-skilled work force. • Seek to manage employment expectations by explaining the number and type of opportunities in advance to local communities. • Applications for employment will only be considered if submitted via the official application procedure. • Recruitment procedures will be transparent, public, and non-discriminatory and open with respect to ethnicity, religion, sexuality, disability or gender. • Clear job descriptions will be provided in advance of recruitment and will explain the skills required for each post. • Job vacancies will be advertised in the local communities through appropriate and accessible media. • For unskilled use a 'ballot' system to ensure that employment is fair and not weighted to connected people for unskilled roles. Repatriation of locals through recruitment measures will use online resources.	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before commencement of works and then ongoing through project implementation	NEA PMD / PSC
	Workers' Rights	• Contractor to allow collective bargaining and ensure that ILO core labor standards to which Nepal is a signatory are upheld. • All employees will receive at least the minimum wage as defined by national legislation. • All workers will have contracts describing their job description and conditions of work and will have the contents explained to them.	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before commencement of works and then ongoing through project implementation	NEA PMD / PSC

Table A-2: Pre-construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
	Staff Conditions and Community Relations	• Employee Code of Conduct will prohibit the workforce from participating in illegal activities, including use of illegal drugs, bribery and corruption or requesting or receiving gifts from communities. • Policy limiting alcohol consumption in construction camps will be applied • Workforce training will include a briefing on camp rules and awareness of local social issues and sensitivities. • No unauthorized access to, or use of, any camp facilities will be allowed. • Review measures to mitigate community health and safety impacts regularly, and consult community leaders every six months, informing them on the status of implementation and results, and discussing any changes needed to the Pollution Prevention Plan or the Community Health and Safety Plan in advance of proposed changes.	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Before commencement of works and then ongoing through project implementation	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
Training	Pollution Prevention	• Conduct bi-monthly training of workers on pollution prevention control including good housekeeping and how to clean up oil/fuel spills and dispose of contaminated sorbent material which would be treated as a hazardous waste. Include emergency preparedness and response procedures (drills) in case of spill. To include training for subcontractors before commencement of works. • Information will also be incorporated into the site induction process and will outline the role of personnel	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Bi-monthly throughout project implementation	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		in the management of waste and emissions from site and spill response procedures. Site induction training will be supplemented by regular toolbox talks with relevant personnel if inspections or audits highlight failings in waste management.			
	OHS	• Conduct daily toolbox talks on pertinent topics related to the day's work and weekly training on occupational health and safety for all construction workers including refreshers. To include training for subcontractors before commencement of works. • Ensure workers with a specific role have attended specialized health and safety trainings related that role e.g., health and safety stewards, first aiders, fire safety officers, as well as ensuring workers have received task-specific trainings for working at height, demolition, working with electricity, etc. • Only allow suitably trained and qualified workers to work on electrical equipment and at height, these workers must have training record of attending suitable training course on electrical safety and working at height and be provided with and wear the appropriate PPE for their role. • Untrained workers must not be permitted to work with live electricity or to work at height.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Emergency Response	• Conduct monthly training involving all workers on emergency preparedness and response procedures (drills) in case of an occupational or community health and safety incident during construction works including fire, natural disaster, disease outbreak etc. To include training for subcontractors before commencement of works. • Emergency preparedness and response training for construction management will include modules on first aid and fire safety including include training on how to use first aid and firefighting equipment provided on-site, and scenario of potential or confirmed COVID-19 infection.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Monthly and throughout project implementation	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
	Driver Training	• Driver training, monthly, to include advice on behaviors to reduce the potential for disturbance, including use of horn, loud radios with windows open, switching engines off when not in use, strictly observing speed limits and not accelerating or braking aggressively.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Monthly and throughout project implementation	NEA PMD / PSC
Communications	GRM	• Contractor's safeguards team will act as site GRM Focal and keep affected persons and local communities informed of the status of work and be readily available onsite to receive, document and deal with grievances at site level. • Encourage use of the GRM and clarify that this does not prevent affected persons from pursuing any legal action, if they feel it is needed, and inform communities about the ADB Accountability Mechanism and their possibility to resort to it if any grievance is not resolved by the project level GRM.	• ADB SPS (2009) • Project GRM	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Worker GRM	• GRM will be available to all workers for receiving and handling complaints about unfair treatment or unsafe living or working conditions, ensuring no coercion nor reprisal. • Construction workers will be given access to register any grievances with the contractors or direct access to the NEA GRM Focal			
Air Quality	Release of Exhaust Gases and Fugitive Emissions	• Emission sources (vehicles such as excavators) shall be positioned as far as is practical from sensitive receptors. • Equipment and vehicles will be regularly maintained in accordance with the manufacturer's recommendations to maximize fuel efficiency and help minimize emissions. • Use diesel fuel that has a low sulfur content, less than 0.1% • Construction equipment and vehicles will meet national emissions standards.	• ADB SPS (2009) • IFC EHS Guidelines: Air Emissions and Ambient Air Quality (2007)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Belching of black smoke is prohibited. • Limit engine idling to maximum 5 minutes. • The open burning of wastes generated by project-related activities is strictly prohibited. • Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery-powered equipment where practicable. • Stack emissions of temporary diesel generator set or hot mix to comply with national emission standards with the stack height designed according to both national requirements and IFC EHS General Guidelines.			
	Siting of Equipment	• Stationary emission sources (e.g., portable diesel generators, compressors, etc.) shall be positioned as far as is practical from sensitive receptors.			
	Dust	• Ensure an adequate supply of bowsers and carry out watering for dust control at least twice a day within 50m of work sites: in dry weather with temperatures of over 25°C, or in windy weather. Dust control measures will also be implemented on all access roads within 50m of residential / sensitive receptors. Avoid overwatering as this may make the surrounding muddy. • If temporary access tracks are constructed with a gravel surface, they will be routinely watered by during dry weather to reduce dust impacts. • Soil scattered on pavements and roads shall be immediately swept up to avoid windblown dust. • Vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency). • A strict Project speed limit of at most 30km/hr will be enforced for Project vehicles using unmade tracks. • Excavated materials will be stockpiled where practical away from sensitive receptors, such as homes, schools, and health facilities. Where this is not possible, ensure regular watering of stockpiles to prevent dust impacts.			

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Keep stockpiles of soil, aggregate and waste materials covered with canvas or tarpaulin when spoil heaps are not active to avoid suspension or dispersal of fine soil particles during windy days and to prevent disturbance by stray animals. • Earthwork operation will be suspended when the wind speed exceeds 20 km/h in areas within 500 m of any community. • Vehicles carrying fine aggregate materials will be sheeted with canvas or tarpaulin to help prevent dust blow and spillages. • Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g., suitable local exhaust ventilation systems. • Concrete batching (if required) will be sited at least 500m away from sensitive receptors • For SS a solid temporary fencing shall be installed around the boundary/works area to minimize the dispersion of dust, it will also function as a temporary acoustic noise fence to minimize the noise and visual impact. • Undertake weekly dust soiling checks of surfaces of adjacent properties during earthworks and help with cleaning of external surfaces of property if dust is evident. • If there is an increase in existing background air pollution or complaints are received contractor will be required to implement additional dust or noise mitigation e.g., barricading/isolating sources of dust, use of wheel wash etc. • Provide workers with N95 dust masks to be worn when ambient conditions are dusty or when dust generating activities take place.			
Geohazards	Flood risks	• Construction activities will be undertaken within a 100 m range on either side of river crossings and in floodplains during the dry season to avoid the flood	• ADB SPS (2009)	EPC Contractor	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		risks that could lead to accidents or water contamination.		Include in EPC contract cost Throughout project implementation	
Hydrology	Water resources	• Construction activities must not limit the availability of or restrict access to water sources (e.g., wells) used by local communities. • Natural flow of waterbodies must not be obstructed or diverted to another direction.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Water pollution	• Follow liquid management and storage requirements listed below under 'soils' • No untreated wastewater will be discharged direct to surface waterbodies or groundwater. • All wastewater to be connected to existing sewerage system or septic tank with soak away, septic tank/soakaway effluent to meet national general wastewater standards or IFC wastewater discharge limits, whatever is the most stringent. • Self-enclosed portable toilets may be used where the wastewater generated is enclosed in a container and will later be taken offsite to a municipal STP for wastewater treatment and disposal. • Use of pit latrines is prohibited as is open defecation and urination and uncivil use of roads or private premises by construction workers. • Concrete batching (if required) will be sited at least 50m away from sensitive receptors such as watercourses; wash pits to be lined with an impermeable liner. • Treated wastewater will be used for damping down earthworks and road surfaces to mitigate dust generation. • Construction camps will be located at least 50m from water courses.	• ADB SPS (2009) • IFC EHS Guidelines: Hazardous Materials Management (2007) • IFC EHS Guidelines: Wastewater and ambient water quality	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Locate mobile generators and site construction equipment at least 50m from groundwater resources and surface waters.			
Soils	Soil Compaction	• To avoid compaction impacts outside the cleared areas, i.e., tower foundations vehicle movements will be restricted to defined access routes and working areas (unless in the event of an emergency).	• ADB SPS (2009) • IFC EHS Guidelines: Contaminated Land (2007) • Stockholm Convention	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Topsoil and excavated materials	• Minimize removal of existing vegetation and topsoil. Topsoil disturbed will be separately stored and used to restore the surface of the excavated area. • On completion of works, stockpiled topsoil will be spread over the surface of disturbed areas (if not under hard surfaces) and used in the restoration of temporary construction facilities. Once the topsoil has been replaced it will be stone picked to remove any large stones which are not in keeping with the surrounding soil texture. Revegetation of the soils will follow using native seed mixes to Chure region • Soil exposed to oil leakage from transformer equipment that distribution lines are connecting to is to be removed from site for disposal as a hazardous waste. • Records of excavated soil, generated waste, and transfer records will be kept. • If topsoil is stored for more than six months, the stacks will be monitored for anaerobic conditions and manual aeration will be undertaken if they develop. • Stored subsoil and topsoil will be segregated in a manner that avoids mixing. • Topsoil stacks will be free draining. Topsoil will be stored outside the running track used by construction plant, equipment and vehicles. • Soil storage areas will be protected from vehicle movements to avoid soil compaction. • Excavation will be limited to within the agreed corridor of impact.			

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Infertile and rocky material will where possible be reused as fill material around foundations. If it needs to be taken off site, it will be disposed by licensed waste management operator at designated disposal area suitable for accepting inert wastes. • Upon completion of subsoil and topsoil reinstatement, disturbed areas will be inspected jointly for signs of erosion, slope instability, topographic diversity, surface water drainage capacity and function, and compaction with the contractor implementing remedial measures where required.			
	Soil erosion	• Schedule works during the dry season where practical to minimize any exposed areas subject to erosion by surface water runoff. • Temporary erosion control measures will be developed and implemented after initial land disturbance and if construction activity on the working areas is suspended over the wet season before full reinstatement of the site has been completed. • Rehabilitate any disturbed areas beyond footprint of the alignments and substation infrastructure footprint to at least original condition through revegetation using native species. • Slope stability measures to be implemented during construction to minimize landslide risk. • In steep terrain natural flows will be diverted around the tower site and the foundation protected by grading of excavated slopes, placing riprap or retaining wall, or other erosion control measures. • Temporary access tracks will not be cut into a hillside immediately below a tower. • Temporary access tracks will be graded and sloped to prevent unnecessary flow of water across them and to minimize soil erosion.			
	Soil Pollution	• Fuel, oil, and chemicals used to be kept under lock and key and stored in labelled, sealed containers on drip trays to provide secondary containment. They will be			

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		located on an impermeable surface and be under cover. This will be located at least 50m from any surface water course or seasonal water channel. • Mount plant containing oil and diesel on drip trays to catch leaks. • Refueling operations, equipment servicing and washdown to take place on an impermeable surface at least 50m from watercourses, springs and wells, with drainage directed through oil and grease interceptors before being discharged into a settling pond prior to discharge offsite. • Regular inspections and maintenance will be carried out of secondary containment areas to confirm that they are functioning effectively. • Provide sufficient absorbent materials (e.g., sorbents, dry sand, sandbags) on-site for soaking up fuel, oil or chemical leaks/spills. • Spill response equipment (absorbents etc.) will be available in hazardous materials storage areas. • All material safety data sheets (MSDS) are kept on site with the relevant materials. • Materials that can potentially react with each other will be segregated during storage. • Hazardous chemicals will be securely stored on site in a designated storage area. • Relevant personnel will be trained in safe use and handling of hazardous materials. • Relevant construction personnel will be trained in use of spill kits and disposal practices. • Vehicles delivering fuel or hazardous liquids will carry appropriate spill kits to allow an initial response to any spill to be deployed. • All mobile plant (excluding vehicles) will be integrally bunded or will be equipped with a bund or drip tray which will be regularly inspected and emptied to prevent rainwater accumulating.			

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
Biodiversity	Project footprint	• Minimize removal of existing vegetation and topsoil to that which is necessary. • Implement careful construction practices to avoid damage to trees. • In preference to being cut, trees in ROW that can survive it will be pruned in preference to being cut, such that they might re-establish quicker following works. • Demarcation of all working areas and avoid encroachment outside the agreed corridor of impact. • Vehicle movements will be restricted to demarcated working areas (unless in the event of an emergency) to reduce unnecessary impacts to habitat. • In wet conditions, minimize use of heavy machinery and consider temporary installation of removable steel plates to protect soil and its vegetation cover. • Contractor will not allow any works to be undertaken from 1 hour before sunset to 1 hour after sunrise to avoid disturbance to the fauna in (i) forest areas/habitat, and (ii) rural areas outside of settlements within the ESZ or within 10km of a protected area for which an ESZ has not been notified. • Prior to excavation, area will be checked by ecologist for any signs of burrows etc. If determined to be occupied, only manual digging under the supervision of ecologist will be permitted. • Excavated pits will be robustly fenced or covered to prevent fauna accidentally falling in, further an escape ramp will be provided to allow their escape – particularly in forest area/habitat. • Keep written record, supported by photographs, of any animal casualties, including a cause of death if known. • Strict prohibition on construction workers to enter forest area/habitat outside of their working hours. Strict prohibition on purchase, sale, and use of	• ADB SPS (2009) • IFC EHS Guidelines: Electrical Power and Distribution (2007)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		firewood, timber and NTFPs, hunting and poaching of fauna by workers. • Provide good standard of worker accommodation with heating and all meals to help discourage breaches of prohibition by the workers. • Strict prohibition of fuelwood or timber being cut by the construction workers. Contractor and construction workers will be prevented from the use of firewood for cooking their food and heating etc. • Contractor to provide alternative fuel source (e.g., kerosene/LPG, which will be stored in safe conditions) to communal kitchen and for heating of worker accommodation. • Contractor to undertake regular, compulsory awareness raising activities for all workers related to prohibitions including toolbox talks and posting of information and warning signs at site offices, worker camps, and at all work sites in forest area/habitat, patrols by security guards employed by the Contractor, regular inspections of the worker camps, and disciplinary procedures for any contravention by the workers. • Fuel will be stored outside of and refueling will take place outside of forest area/habitat to minimize the risk of forest fire. • Contractor to provide fire-fighting equipment at work site with compulsory basic fire training for all workers and training drills undertaken in preparation for forest fire. In case of forest fire, Contractor to act swiftly to minimize impacts on the environment and human life. • Record all trees removed during construction, compensation paid, and replacements planted (including location, species, size, and economic value) and monitor their current health and survival status, for up to two years following plantation. • Cut/trimmed trees and other vegetation trimmings will be removed off-site as soon as line is completed.			

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		Unless sold for reuse, to be disposed of to a suitably licensed waste management facility with all waste transfer records retained. • Temporarily store cut/trimmed trees and other vegetation trimmings away from the roadside. No blocking of accesses or roads with cut vegetation. • Any vegetation material not handed over to the landowner will be immediately removed from site for disposal by a licensed waste management contractor once cutting works are completed. No dumping of cut vegetation on agricultural fields. • Temporary works areas will be reinstated to original condition. Prompt revegetation of disturbed areas on the completion of works with plant species native to Uttarakhand. • Trees shall not be removed during the nesting season.			
	Reptiles	• The pre-monsoon and post-monsoon seasons are not ideal for construction work. If construction continues during these times, the increased presence of workers and villagers in the area will raise the likelihood of encounters with turtles and tortoises. • Regular monitoring of the habitat must be conducted throughout the construction period. • Educate workers on the importance of turtle and tortoise species. If construction occurs during the proposed season, species safety protocols must be followed to protect their habitat. Additionally, pollution, hunting, and fishing in the river system and adjacent areas are strictly prohibited. • Conduct awareness campaigns for local residents to highlight the ecological importance of turtles and tortoises and the impact of forest fires on their habitat.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC Environmental Support Consultants
	Vultures	• No construction works to commence until year long vulture surveys and studies are completed and any require additional mitigation has been incorporated into designs and an updated EIA.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost	NEA PMD / PSC Environmental Support Consultants

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• No laydown areas, access roads, camp sites, etc to be within 500m of vulture nesting / feeding sites. • Works within 2km of vulture nesting sites will be prohibited during the breeding season. • Wire markers will be fitted to the entire NBTL alignment. • wire markers should be deployed on the OHS and/or OPGW. On tower designs with a single OHS or OPGW, markers should be spaced at 5 m intervals. On designs with both OHS and OPGW, the spacing on each wire should be ~10 m, but staggered, so an approaching bird sees markers every ~5 m. • Markers shall be high contrast, with reflective and phosphorescent components, and manufactured by either Power Line Sentry (Wellington, Colorado, USA) or by P&R Tech (Beaverton, Oregon, USA) due to their established track record of effectiveness and durability.		Throughout project implementation	
	Pesticides	• Use of herbicides or burning to clear vegetation is strictly prohibited.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Invasive Species	• Removal and disposal of identified invasive plant species in an ecologically sound manner.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Nest Management	• Before cutting/trimming trees check for presence of nesting birds or roosting bats.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
				Throughout project implementation	
	Private Crops / Trees	• Where the Project results in loss of loss of fruit-bearing trees that have economic value compensate in accordance with the entitlement matrix in the Project LARP; the contractor will pay any subsequent compensation for loss or damage to private trees due to the fault of the contractor's work. • Schedule works to avoid or minimize crop disturbance where lines cross private land, such as undertaking works in between crops.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Loss of wildlife habitat	• Restriction in tree felling – trimming the top of the tree to maintain horizontal and vertical clearance while preserving the main structure, thus avoiding completing tree removal. • Manual tree clearing will cause minimal disturbance to the surrounding habitat. • Preference of local workforce reduce additional pressure on forest habitat. • Strict instruction and penalties for serving as deterrent and promoting responsible behaviors.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Loss of protected species trees and orchids	• Compensatory plantation for the protected species at the ratio of 1:10 • Ex-situ conservation of orchid by translocating them to Dhakeri Botanical Garden, Banke National Park, and Bardiya National Parks.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Pressure of forest resources	• Alternative sources of energy for cooking heating will be provided within the camp. • Awareness programs for all workers and locals will be organized for every project districts.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Strict rules will be enforced to prevent workers using forest resources.		Throughout project implementation	
	Frequency of forest fire might increase. This can also threaten construction workers and delay in project progress	• Firebreaks will be constructed. • Support DFO, DFRS and ICIMOD on early detection, monitoring, and rapid response. • Public awareness on forest fire – training and signages	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Prohibit hunting and poaching	• Enforcement of existing legislations on wildlife conservation. • Collaboration with line agencies on conservation and enforcement of rules on wildlife conservations. • Inclusion of anti-poaching and illegal hunting clauses in the contracts. • Awareness raising - Forest and Wildlife Conservation. • More Sensitivity to be maintained at AP 51 to AP 55 at Shivraj Municipality and AP 28 to AP 29 of Sainamaina and Banganga Municipality in addition to KBA and IBAs.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Minimize disturbance to wildlife	• Management of noise and vibration from construction work. • Construction management – avoid use of floodlight. • Coordination with stakeholders	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Protection of the Chure Conservation Area	• Consultations with the President Chure Terai Madhesh Conservation Development Board to align construction of transmission line along with their management plan and seek suggestions to improve mitigation measures. • Contractor will follow rules and regulations of Chure	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		Conservation Board to undertake construction activities. • Collaboration with Chure Conservation Board in their initiative to maintain environmental integrity of the area.			
Land Use	Damage to Property or cause detriment or inconvenience	• Construction work will make effort to cause as little damage to property or cause detriment and inconvenience. If caused, NEA shall make full compensation. • All unanticipated damage to existing public and private property shall be restored to pre-project condition and/or compensated at the cost of the contractor in line with the RIPP entitlement matrix.	• ADB SPS (2009) • Project RIPP	EPC Contractor Include in EPC contract cost Throughout project implementation	PSC
	Damage to trees and crops	• Route alignment to avoid or minimize tree cutting and crop disturbance where lines cross private land. For all trees which exist prior to placing of the overhead line, the person interested in the tree/crop shall be provided reasonable compensation. • EPC contractor will schedule works to avoid or minimize crop disturbance where lines cross private land, such as undertaking works in between crops	• ADB SPS (2009) • Project RIPP	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Avoidance of impacts to crops / agricultural land	• Use existing access roads and tracks traversing uncultivated, fallow land (not natural habitat) as much as possible to avoid additional crop damage. • Repair any temporary damage caused to agricultural fields after construction is completed. • Saving the top-soil and restoration of land will be done by the Contractor to previous use and farmers will be allowed to continue their cultivation post the construction. • Ensure continuous consultation with affected households and residents.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
Waste Management	General impacts	• Provide adequate facilities for handling and storage of construction materials to reduce the amount of waste that is caused by damage or exposure to the elements and a system for the collection/storage of wastes generated.	• ADB SPS (2009) • IFC EHS Guidelines: Waste Management (2007) • IFC EHS Guidelines: Contaminated Land (2007)	EPC Contractor Include in EPC contract cost	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Any plant or equipment that is rejected during the installation and commissioning due to damage or failure to immediately be removed from the site and returned to the supplier. • Ensure that the waste hierarchy is followed including prevention, minimization, reuse and recycling -- maximum reuse and recycling of waste and timely removal of unusable waste according to national waste management regulations. • Restrict use of plastics and polyethene and use recyclable/biodegradable materials during construction to the extent possible. • In locations where waste is dumped (existing site conditions) the contractor will clean the site and collect the waste for onward disposal before they commence their works. • Ensure sufficiently sized facilities are provided for the environmentally safe and sound collection, segregation and storage of waste (including from overnight accommodation) on-site, maximum reuse and recycling of waste by reputable, legitimate, licensed third parties and timely removal and safe transportation of unusable waste to a suitably licensed and engineered waste management facility with all waste transfer records retained. Keep copies of the waste management company's licenses on file. Document all volumes and types of wastes generated and removed off site (inert, solid, hazardous) using transfer • Leaving or disposing of construction wastes by burying them on-site or disposing of them at unlicensed waste management facilities is strictly prohibited. • Unsanitary open dumps are not to be used by the contractor or their third parties. • Municipal waste collection systems must not be used as this is likely to mean that the waste is open dumped, arrangements should be made for direct disposal to a		Throughout project implementation	

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		suitably licensed and engineered waste management facility with all waste transfer records retained. • Burning of waste on-site is also strictly prohibited. • No construction material or waste to be poured or thrown into drains • Provide regular training of staff in waste management issues.			
	Recycling	• All recyclable waste (plastic, metal, paper, etc.) will be sorted on source and sent for recycling where facilities for recycling of these materials exist.	• ADB SPS (2009) • IFC EHS Guidelines: Waste Management (2007) • IFC EHS Guidelines: Contaminated Land (2007)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Domestic and Inert Waste	• No domestic waste shall be left at work sites. • Ensure that wastes are not haphazardly dumped within the work sites and adjacent areas	• ADB SPS (2009) • IFC EHS Guidelines: Waste Management (2007) • IFC EHS Guidelines: Contaminated Land (2007)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Hazardous Waste	• Use containers suitable for each type of waste. • Mark containers adequately specifying the waste types. • Do not mix various waste streams. • Remove waste at the completion of the work day and return it for storage at the appropriate Contractor facility before final disposal via a state licensed contractor for hazardous waste removal and keep agreements with hazardous waste management company's active.	• ADB SPS (2009) • IFC EHS Guidelines: Waste Management (2007) • IFC EHS Guidelines: Contaminated Land (2007)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Excavation Waste	• Any spoil material from trenches and substation foundations will be removed from the site and sent to an appropriate state licensed waste management facility.	• ADB SPS (2009) • IFC EHS Guidelines: Waste Management (2007)	EPC Contractor Include in EPC contract cost	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
			• IFC EHS Guidelines: Contaminated Land (2007)	Throughout project implementation	
	Waste Tracking	• Keep copies of waste manifests on site. • Keep a record of waste on-site and waste removed.	• ADB SPS (2009) • IFC EHS Guidelines: Waste Management (2007) • IFC EHS Guidelines: Contaminated Land (2007)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
Noise and Vibration	Elevated noise levels	• Equipment and vehicles will be regularly maintained in accordance with the manufacturer's recommendations to help minimize noise emissions. • Contractor to use suitably designed mufflers or sound reduction equipment on breakers/drills and ensure all leaks in the air line are sealed on them. • Work will be undertaken in daytime hours only – in accordance with IFC EHS definitions (7am – 10pm). • Noisy construction activity at substations (especially earthworks) only between the hours of 8 am - 6 pm. • Noise generating construction-related activities will be avoided during evenings, school hours, exam periods, prayer times, religious or cultural events near the sensitive receptors. • No works on Sundays, holidays or festival days. • Sensitive receptors to be consulted with any other special days when they would wish noise levels to be minimized. • Loud construction noise, breaking and drilling activities, must be limited to very short periods of activity adjacent to receptors to minimize disturbance. • Construction noise in the vicinity of houses must be limited to 55dB(A) as 1hour LAeq – if nighttime work is permitted it must be limited to 45dB(A) as 1hour LAeq	• ADB SPS (2009) • IFC EHS Guidelines – Noise Management (2007) • IFC EHS Guidelines: Electrical Power and Distribution (2007)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• In silent zones it must be limited to 50dB(A) as 1hour LAeq – if nighttime work is permitted it must be limited to 40dB(A) as 1hour LAeq • In commercial zones it must be limited to 65dB(A) as 1hour LAeq – if nighttime work is permitted it must be limited to 55dB(A) as 1hourLAeq (if residential property is found in the commercial zone then the above limits apply for works in the vicinity of houses) • On the boundary of the substation construction noise will be limited to 1- hour LAeq 70 dB(A). • If these noise levels are exceeded, or background levels >3dBA where already exceeded at the nearest monitored substation, the contractor will be required to implement additional noise mitigation measures such as adjusting his working methods or placing of temporary noise barriers to ensure the noise standard is met. • No piling or blasting is to be undertaken for construction unless a piling/blasting management plan has been agreed. Any rock removal will be undertaken using pneumatic hammer (handheld or excavator mounted). • Use low noise generating equipment e.g., less than 55dBA sound pressure level at 1m. • The use of horns in areas where sensitive receptors are located (houses, schools, clinics, temples, etc.) will be prohibited. • If complaints are received from the local population regarding elevated noise levels, temporary noise screens shall be installed around the work site, shielding the identified receptors from the source of noise. • 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 e.g., 85 dB(A)			

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		during continuation of 8 working hours without wearing PPE.			
	Vibration	• No piling or blasting is to be undertaken for construction unless a piling/blasting management plan has been agreed. • Where rock is encountered, the excavations for tower footings shall preferably be drilled, but where blasting is to be resorted to as an economy measure, it shall be done with the utmost care to minimize the use of concrete for filling the blasted area.	• ADB SPS (2009) • IFC EHS Guidelines – Noise Management (2007) • IFC EHS Guidelines: Electrical Power and Distribution (2007)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
Utilities and Infrastructure	Outages, damage to utilities and private property	• All unanticipated damage to existing public utilities shall be restored immediately to pre-project condition and/or compensated at the cost of the contractor. • If existing structures (e.g., buildings) and roads, tracks, crops, or, canals, or drains are damaged by works, the Contractor will be required to rehabilitate them to at least their condition prior to construction works to the satisfaction of the property owner having reference to pre-condition surveys.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
Occupational Health and Safety	General	• For all construction works comply with Government of Nepal rules and regulations for the protection of workers. • Emergency contact number and details for medical, fire, etc. are to be displayed in all construction sites.	• ADB SPS (2009) • IFC EHS Guidelines: Electrical Power Transmission and Distribution (2007)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Fatalities	• In the event of any fatality occurring during the construction phase at any Project work site, provide NEA with the details of the fatality within one day of the event occurring in a Fatality Report (for onward reporting to ADB within 48 hours).			
	Work sites	• Contractor is responsible for ensuring H&S of everyone on construction site including visitors and sub-contractor workers regardless they have been formally or informally employed. • Ensure adequate health and safety supervision is always on site (if staff temporarily off sick or on short term leave of less than a fortnight contractor to			

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		provide a named alternate in advance; if safeguard staff are on longer term leave, are posted elsewhere, or resign, contractor to ensure replacement CV is submitted to NEA in seven days of the contractor becoming aware with the staff joining the site within one month). • Construction plant and equipment used will be modern and fitted with appropriate safety devices. • Temporary safety fences shall be erected around each work site. • Require workers to confirm they have seen and understood the requirements of the OHS plan before proceeding with the work. • Warning signs will be displayed around work sites to warn workers and members of the local community of potential risks in Hindi and other languages of the workers found on site. • MSDS are to be readily available to any exposed workers and the first-aid personnel. • All crews shall have a competent person responsible for first aid. • Only allow suitably trained and qualified workers to be allowed to work on electrical equipment and at height, these workers must have training record of attending suitable training course on electrical safety and working at height and have a recent medical checkup to confirm they are fit for work. • Require other workers to observe the minimum approach distances for excavations, tools, vehicles, pruning, and other activities when working around power lines. • Provide personal protective equipment (PPEs) for workers in accordance with national OHS regulations OHS with additional PPE provided as needed for COVID-19 risks. • Handwashing facilities with clean running water supply and soap as well as hand sanitizers and closed			

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		bins for disposal of hygiene-related wastes to be provided on-site during works. Display posters to promote handwashing and respiratory hygiene etc. • Sanitation and welfare facilities used by construction workers to be regularly cleaned and disinfected by the contractor. • Enforce disciplinary system (e.g., immediate removal from site) for non-compliance with PPE requirements. • Ensure proper grounding and deactivation of live power lines during construction /decommissioning work or before any work near the lines and this will be checked and certified by Health and Safety Officer in advance. • Require workers to observe IFC EHS Guideline on T&D requirements for working at height. • Require workers to test the structural integrity of towers prior to proceeding with the work. • Use fall protection measures when working on poles, i.e., mobile elevated working platform, all workers are required to wear body harness. • During construction works ensure qualified first aider and trained fire marshal is always available on-site with an appropriately equipped first aid kit and appropriate fire extinguisher and other firefighting equipment immediately available for use. • Every crew shall have a first aid box at the worksite. • Arrange with nearest Health Center and/or Hospital for emergency cares of workers. • Provide workers with access to an existing functional toilet facility (toilets and hand washing area) or provide a self-contained portable toilet with hand washing facilities (open defecation and use of pit latrines to be prohibited) generated wastewater to be disposed of to wastewater treatment plant. • Toilet facilities to be provided with adequate supplies of hot and cold running water, soap, and hand drying device.			

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Sufficient toilet facilities should be provided for the number of workers, and there should be an indication of whether the toilet facility is "in use" or "vacant" if not segregated.			
	EMF	• Measure exposure levels to electromagnetic fields (EMF) and provide workers working in zones where EMF levels are above reference levels with personal EMF monitoring device to be attached onto their PPE.			
	Food and drink	• Provide workers with access to clean eating area with supply of drinking water. • Adequate supplies of potable drinking water meeting national standards should be provided to workers.			
	Forced and Child Labour	• No forced or child labor to be employed in construction with the minimum age for employment on construction site to be 18 given hazardous nature of works involved. • Verifiable proof of age documentation is maintained for every worker. • Workers operate within the legal working hours and additional work hours are adequately compensated. • All overtime hours are voluntary; coercion, threats or penalties not used to pressure the workers into overtime. • Wages being paid to workers confirms to the minimum wage rated specified under applicable laws. • All wages including overtime are paid within legally defined time limits. • Pay statements shows earned wages, regular and overtime pay, bonuses and all relevant deductions • No unreasonable restraints on the workers freedom of movement. • Terms of employment outlined at the time of recruitment do not differ from the terms offered during the course of employment.	• ADB SPS (2009) • ILO Convention - Minimum Age Convention (1973) • ILO Convention - Worst Forms of Child Labour Convention (1999) • ILO Convention – Forced Labour • Child Labour (Prohibition and Regulation) Act, 1986 amended in 2016	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Labour and Accommodation Camps	Ensure the camps established for providing accommodation to labors engaged in construction activities meet the requirements specified in the IFC and EBRD	• ADB SPS (2009)	EPC Contractor	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		Workers Accommodation: Processes and Standards document	• World Bank Guidance Note on Managing Labor Influx, 2016 • IFC and EBRD Workers Accommodation: Processes and Standards, 2009	Include in EPC contract cost Throughout project implementation	
Community Health and Safety	Grievances	Implement the Grievance Procedure to provide opportunity for residents to raise concerns.	• ADB SPS (2009) • Project GRM • IFC EHS Guidelines: Community Health and Safety (2007) • Voluntary Principles on Security and Human Rights[1]	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Hazardous Work Sites	• Robustly fence and sign immediate working area including stores/stockpiles with security presence to prevent public access during construction works. • Do not allow children to play in or adjacent to the construction site • Do not leave hazardous conditions (e.g., unlit open excavations without means of escape) overnight unless no access by public can be ensured. • Prevent standing water as it may become a breeding habitat for mosquitoes etc. • All Project infrastructure will be labeled / signposted in accordance with national regulations to inform the public of the specific safety risks of each item. • All work sites will be appropriately signposted and isolated (through fencing or bunting) to prevent encroachment into these areas. Where there are open excavations then solid fencing barrier must be used.			
	Outages	• Provide 72 hours advance notice of any works (not including emergency works) to the local community.			
	Record Keeping	• Keep a specific record of any community accidents that occur during the construction phase. Report the numbers to NEA monthly.			
	Code of Conduct	• A strict code of conduct will be applied to the Project with specific requirements relating to worker behavior and GBV/SEAH.			

[1] https://www.voluntaryprinciples.org

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
	Conflict with Security Personnel	• The Project will implement the 'Voluntary Principles on Security and Human Rights' • During construction, due diligence will be applied to selection of security providers, rules of engagement will be devised, and training provided to all personnel. Performance will be monitored and audited periodically.			
Traffic Management	Traffic and Pedestrian Safety	• Implement agreed traffic management plan. Safe access to property and roads should be maintained and alternative routes and access provided where there are temporary diversions or blockages. Diversion works to be immediately dismantled on completion of works and the footpath and roads restored to their original condition. • Transport equipment only during non-rush hours i.e., avoid the hours of 9am to 11 am and 4pm to 6 pm to minimize traffic congestion. • In dense urban areas or on busy roads installation works affecting footpaths and roads to avoid rush hours i.e., avoid the hours of 9am to 11 am and 4pm to 6 pm. • Stockpiling of spoil and any new equipment (conductor reels, etc.) shall be away from properties and only in designated areas where no access or road use will be blocked. • Allow for adequate traffic flow around construction areas via diversions or temporary access roads. • Provide adequate traffic signs, appropriate lighting, well-designed traffic safety signs, barriers, and flag persons for traffic control. • Ensure that safe access ways to public and private amenities (including schools) are maintained, safe alternative routes provided and clearly signed where there are temporary diversions or blockages. • Safety guides should be provided where works are on footpaths or in locations of pedestrian crossings to	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		help guide pedestrians, especially vulnerable persons, safely around the working area. • Traffic management will need to be done in consultation with the affected communities to ensure they are aware of likely disruption. • Implement traffic management controls during construction works with advance warning signs or flag persons to ensure health and safety of construction workers and road users. • Construction traffic warning signs will be positioned at road crossings and other appropriate locations as determined by the Project, for example, along access routes before they are used by construction traffic. • Road safety and warning signs must be posted at 500m, 100m, and immediately in advance of the works at least two days prior to the works commencing to inform the public of the temporary blockage of one lane of the road. • For congested and narrow roads flagmen should be utilized to warn road users of the situation. • For stringing scaffolds and safety nets will be used to protect pedestrians and vehicles (and the conductor itself) from potential injury/damage – this will be used wherever stringing crosses over roads and securing a road closure is not possible, presenting a possible risk to traffic, waterbodies, or is in settlement presenting a possible risk to local communities where access cannot be completely prevented, especially in the vicinity of schools. • Where the execution of the works requires single-lane operation on/beside public road the contractor will provide and maintain all necessary barriers, warning signs and traffic control signals to the satisfaction of the local authority. Wherever traffic diversions, warning signs, traffic control signals, barriers and the like are required, the PSC prior to commencing the work, in that area.			

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the contractor shall remove all temporary installations and signs and reinstate all affected roads/sections and other structures or installations to the conditions that existed before the work started, as directed by the PSC.			
Training	Pollution Prevention	• Conduct bi-monthly training of workers on pollution prevent control including good housekeeping and how to clean up oil/fuel spills and dispose of contaminated sorbent material which would be treated as a hazardous waste.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	OHS	• Conduct weekly training on occupational health and safety for all construction workers including refreshers. To include training for subcontractors before commencement of works.	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
	Emergency Response	• Conduct monthly training of workers on emergency preparedness and response procedures in case of an occupational or community health and safety incident during construction works. To include training for subcontractors before commencement of works.	ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
GRM	GRM Communication and Implementation	• Disseminate GRM contact details and arrangements to the community through the distribution of pamphlets, prominently posted notices at work sites, community centers etc. • Ensure that throughout construction highly visible signage providing their and GRM Focals names and	• ADB SPS (2009) • Project GRM	EPC Contractor Include in EPC contract cost	NEA PMD / PSC

Table A-3: Construction Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		contact details are prominently displayed at all construction sites, storage areas, temporary worker camps, subproject site offices, road crossing points etc		Throughout project implementation	
		• Encourage affected persons to make use of the GRM yet clarify that this does not prevent them from pursuing legal action, if they feel that it is needed		EPC Contractor	
		• Keep a record of all grievances received and their resolution and to report on them.	• ADB SPS (2009) • Project GRM	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
Gender vulnerable groups	Promote gender equality and inclusion of vulnerable groups in the project	• No-discriminatory policy to be adopted by the project. • Priority to the affected HHs for project employment. • Livelihood support for the vulnerable groups. • Grievance redress mechanism effectively implemented. • Promote gender equality in decision making.	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC
Cultural Heritage	Chance finds and stakeholder engagement	Implement PCR MP as part of the Project EMP: • CFP to be implemented by one or more physical cultural resource monitors. • Physical Cultural Resources Grievance Mechanism to be incorporated into overall project Grievance Mechanism	• ADB SPS (2009)	EPC Contractor Include in EPC contract cost Throughout project implementation	NEA PMD / PSC

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
General	General impacts of O&M on environment, health, and safety and disturbance to local community	• Develop SOP for environmental, health and safety management of SS and NBTL operation and maintenance including inspections schedules etc. • SOP to cover pollution control, solid and hazardous waste management, health and safety risk assessments and management plans addressing both occupational and community risks and including permit to work system of critical activities such as electrical or work at height and emergency preparedness and response provisions. • Implementation of SOP environment, health and safety measures, provision of regular EHS trainings to O&M workers on SOP implementation and good housekeeping practices including how to clean up oil/fuel spills and dispose of contaminated sorbent material which would be treated as hazardous waste etc. • Continually improve compliance with national requirements and good international practice for EHS including health and safety and solid and hazardous materials and waste management in particular: • undertake regular visual and technical inspection of condition of substations and power lines and carry out maintenance as required, if encroachment into safety clearances of OHL, SF6 or an oil leak encountered these are to be immediately addressed. • During maintenance works provide signage detailing NEA contacts in case of grievance.	ADB SPS (2009) Project GRM WBG EHS Guidelines: Community Health and Safety (2007) WBG EHS Guidelines: Electrical Power and Distribution (2007)	NEA with support PSC for development of SOP	N/A

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Provide at least one-month advance notice to local community through the about the schedule of, location plan, and details of planned major maintenance works. • Mitigation measures applicable to the construction stage are also applicable to the O&M activities and workers. • During O&M, internal audits will be undertaken by the NEA EO and HSO.			
Climate change and pollution prevention	Climate change from fugitive emission of SF6, transformer oil spill and leakage, and forest fire risk at SS due to dry pine needles.	• Inventory to be maintained of all SF6 containing equipment at SS, their make and model, volume of SF6 contained, details of repair works undertaken, dates of SF6 replenishment, leakage incidents etc. • Inventory to be used to monitor SF6 leakage from SS. If trend of lowering gas pressure is observed investigate the cause and rectify any leak per the manufacturer's instruction. • SF_6 in fire extinguishers provided at substations to be avoided. • During operation, regular visual and technical inspections will be undertaken, SF_6 leakage detection kits will be provided at each substation, and remote gas pressure alarms are to be installed where daily inspection is not an option, such that any leaks can be immediately addressed. • Training of all project and O&M staff on the climate change impact of SF6, alternatives, H&S risks during O&M due to presence of toxic byproducts, leakage minimization, and environmentally sound and safe disposal	• ADB SPS (2009) • IFC EHS Guidelines: Waste Management (2007)	NEA	N/A

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Maintain inventory of transformers on site, make, model, risk of PCBs and other details including transformer test report, details any maintenance works undertaken, dates oil changes, leakage incidents etc. • Maintain transformers and other noise generating equipment to meet operational noise standards. • Carry out regular inspections and periodic preventive maintenance to minimize oil leakages; ensure values, nuts and bolts are fully functional and tightly secured, ensure rubber seals of radiators are intact • Maintenance of and handling of transformer oil to be carried out only by trained workers using appropriate PPE. • The acceptance of mineral oil at substation to be accompanied with Material Safety Data Sheet and certification that it is PCB free. • Unless transformers have been certified PCB free workers interacting with them must wear suitable chemical and/or oil resistant gloves, goggles, and protective clothing whilst taking samples and/or working with transformers. • Material Safety Data Sheets for all fuel/oil/chemical kept on site to be posted • Keep spill prevention equipment available on site at all times • Encourage recovery of recyclable wastes that could be reused or sold to recyclers, rather than disposing of it.			

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Document all wastes removed off site using transfer notes, to be taken by licensed waste contractors who should reuse/recycle or dispose of the waste to a suitably engineered and licensed solid waste management facility. • Hazardous wastes (asbestos, old wooden poles treated with preservatives, oily rags, etc.) must be disposed of. using appropriately licensed waste management company • Records volumes of waste generated and keep transfer records at the substation with copies of the waste management company's licenses on file. • Maintain spill management materials (sorbent pads, loose sorbent material, sand, etc.) next to storage areas for immediately soaking up any leaks or spills that do accidentally occur			
Health and Safety	Impacts on occupational health and safety due to exposure to live power and risks of accidents (electrocution, fire, etc.) Impacts to	• Maintain warning / advisory signs in good and visible condition. • For all maintenance works undertake risk assessment and prepare H&S plan in accordance with EHS Guidelines, considering occupational and community H&S and including adherence emergency preparedness and response plan with communication systems and protocols to report an emergency situation. • Mitigation measures applicable to the construction stage are also applicable to the O&M activities and workers.	• ADB SPS (2009) • Project GRM • WBG EHS Guidelines: Community Health and Safety (2007) • WBG EHS Guidelines: Electrical Power and Distribution (2007)	NEA	N/A

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
	community health and safety such as electrocution and fire, etc.	• Ensure EMF ICNRP occupational and community exposure limits (reference and peak values) are complied with. • Prohibit the use of herbicides, pesticides or burning to control any vegetation growth or to manage vegetation waste. • O&M to be performed only by suitably qualified and experience workers who are regularly trained staff of NEA or a contactor under supervision of a Health and Safety Officer with an appropriately equipped first aid kit and appropriate fire extinguishers immediately available for use • Restricting working at height and with electricity only by workers who are trained and certified to do so. • O&M workers to be given required PPE and other requisite safety equipment • Proper grounding and deactivation of live power lines during maintenance work or when working near the lines. <u>Applicable to SS</u> • Maintain incident logbook and medical tests / health check-up of staff • Provide everyone who enters the SS with an OHS induction • Keep vents/windows unblocked and replace defunct bulbs/lights immediately			

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Ensure all SS workers receive basic first aid and firefighting training with annual refreshers • Ensure that at least one staff at SS is fully trained as a first aider and fire marshal Maintain fully stocked, in-date first aid kit, keep first aid posters and emergency contact lists that are posted up to date • Maintain firefighting systems including in-date fire extinguishers and full sand buckets and keep fire safety posters up • Carry out regular inspections and periodic maintenance to ensure electrical standards are being upheld • Display clear emergency exits signs (in working order, if light signs, ensure they work) and keep exits clear of any blockages. Remove any trip hazards on the ground, e.g., materials, equipment, trash laying around. • Collect, segregate, and store in the designated and labelled storage areas all wastes including food wastes for onward disposal as per construction. • Undertake regular pest control using integrated pest management approach • Maintain vegetation at the SS that poses a health and safety hazard • Prohibit the use of herbicides, pesticides or burning to control any vegetation growth or to manage vegetation waste.			

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• O&M to be performed only by suitably qualified and experienced workers who are regularly trained staff of NEA or a contactor under supervision of a Health and Safety Officer following the SOP for H&S. • O&M workers to be given required PPE and other requisite safety equipment, provide sufficient PPE spares available on site for visitors etc. • Per national regulations artificial respirators are required and training on same will be provided. • Sanitation and welfare facilities as per construction will also be required for O&M workers. • Potable water will be supplied to workers that meets national drinking water standards and ISO 10500 drinking water parameters (full suite). • Cleaning of toilets on daily basis, use of disinfectant and floor cleaners; keep toilets/septic tank/soakaway maintained • Periodic spot monitoring using mobile phone app of noise levels and ambient EMF for substations at the boundary fence/near transformers to ensure they are below the occupational/community noise levels and ICNRP occupational/community EMF exposure levels • Maintain security and prevent entry by the local community and livestock by maintaining adequate boundary fencing or wall, always keeping control room doors and gates shut, and having security persons present 24x7 to prevent unauthorized public access and trespass.			

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• NEA in conjunction with local municipalities, ward/village heads, and the media with the support of CSOs to continue to organize health and safety campaigns on electrical safety community awareness raising activities in local communities and schools within 500 m of the substations <u>Applicable to NBTL</u> • Carry out regular inspections (at least monthly) on the power lines and periodic maintenance to ensure that integrity of the poles and line is in good condition including possible conductor snapping and de-energizing of the line within three cycles to avoid the potential for electrocution from a breakage, the clearances are maintained, and electrical standards are being upheld. • Inspection protocol should confirm electrical safety warning signs and lighting arrestors in place and identify any missing or corroded parts (including protection for birds) for immediate replacement. • If property is found to be encroaching into the safety clearances notification is to be immediately issued to the owner/occupier by NEA along with awareness raising materials with respect to the importance of maintaining the horizontal and vertical clearance from buildings and the matter will be taken up further in consultation with the appropriate authorities. • Regular pruning or lopping of trees ensure the integrity and safety of the OHL			

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Removal of invasive plant species during routine vegetation maintenance in an ecologically sound manner • Workers to observe guidelines to minimum approach distances to excavations, tools, vehicles, pruning, and other activities when working around power lines. • Testing of structural integrity prior to proceeding with the work and the use of fall protection measures such as harnesses, tool bags, ropes etc. • NEA in conjunction with local municipalities, ward/village heads, and the media with the support of CSOs to continue to organize health and safety campaigns on electrical safety community awareness raising activities in local communities and schools within 50 m of the ROWs			
Air Quality	SF6	• On disposal at end-of-life NEA must ensure SF_6 is first removed in accordance with International Electrotechnical Commission (IEC) standard 61634 to a very low pressure so losses of SF6 are less than 0.5% at end of life and then reused, recycled, or destroyed in a high-temperature incinerator. NEA will need to define a safe SF6 retrieval arrangement, with appropriate handling, storage, disposal process for end of life equipment in accordance with international good practice.	ADB SPS (2009)	NEA	N/A
Waste Management	Storage and Disposal of operational waste	• During this phase NEA will be responsible for ensuring waste management and disposal in line with national waste management regulations.	ADB SPS (2009)	NEA	N/A
Vultures	Fatalities	• Develop and implement a post-construction monitoring plan, with the help of international experts, to be integrated in the project CSEMP.	ADB SPS (2009)	NEA	ADB

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
		• Survey results will be analyzed with respect to efficiencies and biases, and used to scale residual impacts on the NBTL, which will then be fully offset by compensatory mitigation in the form of electrocution mitigation for high-risk distribution structures. Surveys will be ongoing for three years, or as determined in consultation with international and national experts.		Environmental Support Consultants	
	Guidelines	• Develop and implement, in consultation with international experts, an avian best practices guidance document to reduce avian risk posed by the NEA transmission and distribution grid in sensitive avian habitats. The guidance document will include avian friendly standards for construction and mitigation, procedures for incident response and reporting, and a discussion of mitigation techniques and approaches.	ADB SPS (2009)	NEA Environmental Support Consultants	ADB
	Compensatory Measures	• Implement electrocution mitigation on distribution poles to offset residual risk associated with vulture collision with the NBTL. Distribution poles shall be fitted with insulating devices to provide clearances protective of vulture species according to best international practice. Insulating devices shall be of best available quality as assured by third party testing in strict accordance with the IEEE 1656-2010 standard testing sequence. Testing shall be conducted at voltages representative of NEA's highest voltage distribution lines, or greater. • The scale of electrocution mitigation will be refined based on available data collected prior to construction and during NBTL operation; a preliminary estimate is 440 distribution poles. Principles of adaptive management will be employed to ensure that electrocution mitigation is used to meet or exceed the project standard of no net loss of biodiversity.	ADB SPS (2009)	NEA	ADB

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
Reptiles	Conservation Support	• NEA, with support from NGOs and national specialists, will develop a program of conservation support for elongated tortoise in Nepal.	ADB SPS (2009)	NEA	N/A
Chure Conservation Area	Conservation Support	• NEA will explore opportunities to support and enhance the conservation aims of the Chure Conservation Area. This collaboration may involve identifying ways in which NEA can contribute to the promotion and improvement of conservation efforts within the area. It will seek to establish a mutually beneficial relationship with the conservation development board.	ADB SPS (2009)	NEA	N/A
Forest and habitat	Pressure on the forest resource resulting in degradation	• Support DFO and user groups in (a) afforestation (b) robust vigilance of forests, (c) awareness program	ADB SPS (2009)	NEA	N/A
	Conservation of plants of conservation significance	• Compensation plantation 1:10 • Management and protection plantation area for 5 years and hand over to respective DFO/ user groups for long term management.	ADB SPS (2009)	NEA	N/A
	Conservation of biodiversity of the TL corridor	• Periodic trimming to maintain vertical and horizontal clearance might promote growth of understory vegetation, boosting biodiversity. • Prevent unauthorized encroachment in collaboration with the DFO and User Groups	ADB SPS (2009)	NEA	N/A

Table A-4: Operational Phase EMP					
Topic	Impact / Issue	Commitment	Applicable Project Standards / Best Practice	Implementation Responsibility	Monitoring Responsibility
Wildlife and habitat	Minimize loss and disturbance to wildlife and their habitat	• Restricted tree and vegetation clearance – trimming the top of the tree to maintain vertical clearance and avoid removal of ground vegetation. • Educate O&M personnel on wildlife sensitivity of the project area. • Monitoring and record keeping on animal casualty, safe vertical clearance, status of anti-climbing device	ADB SPS (2009)	NEA	N/A
	Access routes	• Any access road not required for future maintenance access to tower sites in forest areas will be closed and revegetated to prevent encroachment into these areas during the operational phase of the Project.	ADB SPS (2009)	NEA	N/A

Appendix B – Environmental Monitoring Plan

PUBLIC. This information is being disclosed to the public in accordance with ADB's Access to Information

Type	Indicator	Methods	Location	Schedule	Cost	Responsibility
Baseline monitoring						
Air quality	TSS, PM10, PM2.5, CO2, AQI	Air sampling and measurement Comparison of data with ambient standard	Settlement close to the transmission line Substation site and nearby settlement	Measurement during the construction of substation, tower, and stringing (4 quarterly measurements in a year)	10,000 USD	Contractor/ ESMU – PMD
Noise level	dBA	Decibel meter	Settlement close to the transmission line Substation site and nearby settlement	Measurement during the construction of substation, tower, and stringing (4 quarterly measurements in a year)	10,000 USD	Contractor/ ESMU – PMD
Water quality	Temperature, pH, conductivity, turbidity TSS, DSS, hardness, Ca, P, Mg, Na, K, As, Fe, Pb, Cu, Hg, Cl, Total N, NH_3 DO, BOD5, COD, planktonic algae, Chlorophyll, Total Coliforms and Fecal Coliforms	Sampling and lab analysis	Major river crossing Water bodies close to the tower and other construction sites	One measurement every four months before the starting of the construction works and continuously (once a week) during construction in dry season	10,000 USD	Contractor/ ESMU – PMD
Land stability	Landslides along the alignment	Observation of the sites Drone survey	Project area	Quarterly during the construction period	10,000 USD	Contractor/ ESMU – PMD
Vegetation	Vegetation density/ biomass	Vegetation sampling	Samples of forest area	Once in a year during	20,000 USD	Contractor/

Type	Indicator	Methods	Location	Schedule	Cost	Responsibility
	Species composition and diversity	Biodiversity index Biomass estimation	close to tower, RoW and substations	construction/ operation	per year	ESMU – PMD
Wildlife	Wildlife population Wildlife composition and diversity	Camera trapping Observation	Forests close to towers, RoW and substation	Reporting once in a year	50,000 USD per year	Contractor/ ESMU – PMD
Avia fauna	Bird population Bird migration	Camera trapping Observation	Area close to towers, RoW and substation	Reporting once in a year	30,000 USD per year	Contractor/ ESMU – PMD
Settlements	Trend of growth and expansion of settlement	Observation wards/ municipality records of building permission	Settlements close to the project alignment and substations	Once in a year	50,000 USD	
Health and Sanitation	Diseases prevailing in the area, outbreak of disease	Discussion with local Records from the local health post and district health office	Settlements close to the project alignment and substations	Once in a year		
Consumer prices	Price of local and imported consumer items - food, fuel, hotel fair, labor wage	Market survey and enumeration	Settlements close to the project area	Once in a year		
Law and order	Records crime, social nuisance in the project area	Discussion with local people and local police Grievance records with the project (GRM)	Wards related with the project	Quarterly during the construction period		EMSU - PMO/ Contractor
Compliance Monitoring - Construction phase						
Spoil / Hazardous material disposal	Spoil generation and disposal at the site Spoil disposed at the specified spoil disposal site Condition of the spoil disposal site	Inspection of the construction site and spoil disposal sites	Construction site Spoil disposal site	Quarterly during the construction period	Included in the operation costs	ESMU – PMD Contractor

Type	Indicator	Methods	Location	Schedule	Cost	Responsibility
Solid waste disposal	Training of the construction workers on waste management Sanitary condition of the construction sites and camps Waste collection bins Waste disposed according to the national and international standards Implementation of Construction Waste Management Plan (CWMP)	Review records of the training Inspection of the site and camps Observation of waste management systems Review of the records of waste disposal Effective implementation of CWMP	Construction sites and camps Waste disposal sites	Quarterly during the construction period	10,000 USD	ESMU – PMD Contractor
Air and noise	Sprinkling of the site to prevent dust pollution Air pollution from storage and stockpiles Noise from the machinery used Implementation of the construction pollution prevention plan (CPPP) Environmental standards of the equipment and vehicles used Speed limits applied for the vehicles in the project area	Observation of the sites and construction works Air and noise sampling at the construction sites Review of GRM records for air and noise pollution complaints, particularly from schools Review of CPPP and its effectiveness	Construction sites	Quarterly during the construction period	10,000 USD	ESMU – PMD Contractor

Type	Indicator	Methods	Location	Schedule	Cost	Responsibility
	Use of PPE by workers exposed to air pollution sites					
Restoration of the temporary sites	Records of restoration works Condition of restoration sites in compare to original condition of the sites	Review of the records Observation of the sites Consultation with the locals and project workers	Construction sites Temporarily acquired sites - camps, storage sites, spoil disposal sites	Annually after completion of the construction work at those sites	5000 USD per year	ESMU – PMD Contractor
Land stability	Slope stability condition at the tower site Measures of slope stabilization applied if the tower construction site is at insatiable slope	Observation of the sites Review of records of slope stability measure applied.	Construction sites (tower)	Quarterly during the construction period	5,000 USD per year	ESMU – PMD Contractor
Water quality	Construction works carried out during dry season in the sites close to the major water bodies. Implementation of construction pollution prevention plan (CPPP) Prevent sediments entering water bodies from the construction sites. Prevention of defecation/ urination by workers or disposal of camp toilet wastes into the water bodies	Observation of the construction sites Review of the construction records using water pollution prevention measures Review of CPPP and effectiveness of its implementation	Construction sites located near to the water bodies	Quarterly during the construction period	10,000 USD	ESMU – PMD Contractor

Type	Indicator	Methods	Location	Schedule	Cost	Responsibility
Habitat and biodiversity	Forest clearance permissions are obtained. Habitat and ecological values of the vegetation/ trees are studied. Minimize tree cutting. Trees to be cut are marked and recorded in coordination with the DFO. Management of felled trees Provide alternative to firewood and timber. Implementation of rules against forest encroachment by workers	Observation Review of the records Consultation with locals, forest users' groups, and DFO officials	ROW, Tower, and substation	Quarterly during the construction period	50,000 USD	ESMU – PMD Contractor/ CFUG/ DFO
Forest - trees and vegetation	Compensation of forest land/ allocation of budget and its use Compensatory plantation/ allocation of budget and its use	Observation Review of records	ROW, Tower, Substations, Compensatory Plantation sites Nursery	Quarterly during the construction period		ESMU – PMD Contractor/ CFUG/ DFO
Forest fragmentation	Conservation of ground vegetation having ethno-botanical and ecologically important species	Observation Review of records	ROW Towers	Quarterly during the construction period		ESMU – PMD Contractor/ CFUG/ DFO

Type	Indicator	Methods	Location	Schedule	Cost	Responsibility
	Avoid clearance of trees lower that 20 m (7 m horizontal clearance between tree's top of canopy and conductor)		Substation			
Rare, endangered, and threatened species	Compensatory plantation at the ratio of 1:25 Number of Sal, Bijay Sal, and Sati Sal removed. Orchid removed	Review of records Observation Consultation	ROW, Tower, Substations, Compensatory Plantation sites Nursery	Quarterly during the construction period		ESMU – PMD Contractor/ CFUG/ DFO
Compliance monitoring - operational phase						
Noise pollution	Noise level at substations Noise level from transformer Acoustic barrier if noise sources are close to settlements or schools	Noise measurements Site observation	Substations	Quarterly	To be included in the operation works	ESMU – PMD
Solid waste management	Waste disposal practices Segregation of domestic waste from O&M waste Waste collection bins Sanitary condition sites Open burning of waste prevented.	Observation Review of records	Substations	Once in a year	To be included in the operation works	ESMU – PMD

Type	Indicator	Methods	Location	Schedule	Cost	Responsibility
	Existence and operation of compositing facilities, if used Hazardous waste and their management					
Water pollution	Toilet waste disposal Source of waste supply to the substation Equipment used free of Polychlorinated biphenyls (PCB) Locate transformers, storage areas, septic tanks/soak pits at least 100m away from water bodies. Drainage trapping oil leakage to prevent them entering water bodies	Observation Water quality of water bodies close to sites. Review of records and designs	Substations	Once in a year	To be included in the operation works	ESMU – PMD
Impact monitoring-Construction phase						
Compensation of the land use change	Change in land use and pattern of land. Residual Impacts Temporary crop loss In the chosen alignments household will be affected	Observation Resettlement and Indigenous People's Plan (RIPP) EMP measures Local Topographical adjustment	Construction site			Contractor/NEA /property owners
Landslide	Landslide	Incorporated drainage	Tower installation sites			Contractor

Type	Indicator	Methods	Location	Schedule	Cost	Responsibility
and soil erosion	Flash flood	management Reinforcement measures for the stability of slope Re-vegetation and slope maintenance Proper landscaping by following the principles of Bioengineering				
Water pollution	Deterioration on water quality Erosion by surface water run-off. Changes in turbidity of water	Construction pollution prevention plan (CPPP) Conforming the water quality near to the sources within 100 m	Substation sites and near to the water bodies	At least one week before to commencement of any activity		Contractor
Air pollution	Air pollution and dust pollution from piling works Implementation of the construction pollution prevention plan (CPPP)	Inspection of air quality Prohibition of burning wastes in project area	Construction area and substation sites			Contractor
Noise pollution	Noise from piling works	Good construction management Following IFC EHS General Guidelines for Construction and Demolition	Construction site and near within 100m			Contractor

Type	Indicator	Methods	Location	Schedule	Cost	Responsibility
		Avoiding use of blasting and over vibration				
Solid Waste and Construction Waste management	Generation of hazardous, non-hazardous, and liquid waste	Waste Management Plan including hazardous waste management	Construction site			Contractor/NEA
Impact monitoring - Operation phase						
Solid waste and construction waste management	Prohibition on-site disposal of plastic bottles and adequate waste storage. Promote recycling and reuse of solid waste. Prohibit dumping of O and M wastes on-site, into drains, rivers, agriculture fields etc.	Promoting responsible waste management practices. Educate people about the benefit of recycling and the impact it has on the environment. Observation of sites.	Construction sites	Quarterly during the construction period		NEA and Contractor
Prevention of water Pollution	Identify the flood plains. Protection of riverbanks. Liquid storage.	Identifying the floodplain and must be 2m above the maximum flood level of the river crossing. Use of gabion wall and embankment including	Construction site located near the water bodies.	Quarterly during the construction period.		NEA and Contractor.

Type	Indicator	Methods	Location	Schedule	Cost	Responsibility
		bioengineer option. Ensuring that liquids storage is always locked.				
Mitigating the Climate Change impact	Good operational SF6 management. Control of any leak of SF6. Quality checking of gasses.	Education and awareness to all the PMD and staff on the Climate Change impact and risk of SF6. Regular visual and technical inspection of condition and maintenance should be carried out by NEA. Keeping the record of all the gas insulated switch gas and transformers if any quantity of SF6 is present or not.	Project area			Contractor
Electromagnetic field	Reduction of effect of EMF.	Conducting awareness programs on safety measures for project staff and residents. Relocating the existing houses outside the RoW.	Tower installation site			NEA and Contractor

Appendix C – Instrumental Monitoring Results

Air Quality Test Report

Report No.: 89A/80/81	Report Date: 22 May 2024
Sample No.: 78-A/080/81	
Work Order No.: Email (Date: 06 May, 2024)	
Name and address of Client: South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project (ETDSP), Kathmandu	
Contact person: Mr. Asish Dhakal	
Sampling Location: Rupandehi District, Devdaha Municipality Ward No. 6, (Jyotinagar)	
GPS Coordinates: 27°39'50"N 83°36'07"E	
Type of sampling: Ambient Air Quality Monitoring (24 Hours)	
Instrument used: Combine Sampler (GTI - 241) & Respirable Dust Sampler (GTI - 151), Greentech Instruments, India	
Sampling date: 12 - 13 May, 2024	
Sampled by: Environment Management And Analysis Services P. Ltd., Dillibazar, Kathmandu	

Result

Parameters	Result	NAAQS	Unit	Method
Total Suspended Particulate Matter (TSPM)	143.1	230.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter (PM_{10})	52.8	120.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter ($PM_{2.5}$)	13.6	40.0	µg/m^3	Federal Reference Method: 5(4):339-342, USEPA
Sulphur Dioxide (SO_2)	3.4	70.0	µg/m^3	IS 5182 (Part - 02):2006
Nitrogen Dioxide (NO_2)	4.3	80.0	µg/m^3	IS 5182 (Part - 06):2006
Carbon Monoxide (CO)	<1000.0	10000.0	µg/m^3	IS 5182 (Part - 10):2006

NAAQS: National Ambient Air Quality Standard, 2012

Remarks: The observed values complies with the NAAQS prescribed limits.

Air Quality Test Report

Report No.: 90A/80/81	Report Date: 22 May 2024
Sample No.: 78-A/080/81	
Work Order No.: Email (Date: 06 May, 2024)	
Name and address of Client: South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project (ETDSP), Kathmandu	
Contact person: Mr. Asish Dhakal	
Sampling Location: Rupandehi District, Devdaha Municipality Ward No. 10, (Charange Tole)	
GPS Coordinates: 27°40'27"N 83°30'12"E	
Type of sampling: Ambient Air Quality Monitoring (24 Hours)	
Instrument used: Combine Sampler (GTI - 241) & Respirable Dust Sampler (GTI - 151), Greentech Instruments, India	
Sampling date: 12 - 13 May, 2024	
Sampled by: Environment Management And Analysis Services P. Ltd., Dillibazar, Kathmandu	

Result

Parameters	Result	NAAQS	Unit	Method
Total Suspended Particulate Matter (TSPM)	136.4	230.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter (PM_{10})	58.9	120.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter ($PM_{2.5}$)	8.2	40.0	µg/m^3	Federal Reference Method: 5(4):339-342, USEPA
Sulphur Dioxide (SO_2)	<1.0	70.0	µg/m^3	IS 5182 (Part - 02):2006
Nitrogen Dioxide (NO_2)	3.8	80.0	µg/m^3	IS 5182 (Part - 06):2006
Carbon Monoxide (CO)	<1000.0	10000.0	µg/m^3	IS 5182 (Part - 10):2006

NAAQS: National Ambient Air Quality Standard, 2012

Remarks: The observed values complies with the NAAQS prescribed limits.

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Air Quality Test Report

Report No.: 91A/80/81	Report Date: 22 May 2024
Sample No.: 78-A/080/81	
Work Order No.: Email (Date: 06 May, 2024)	
Name and address of Client: South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project (ETDSP), Kathmandu	
Contact person: Mr. Asish Dhakal	
Sampling Location: Kapilvastu District**,** Butwal Sub-Metropolitan City, Ward No. 3	
GPS Coordinates: 27°42'59"N 83°28'00"E	
Type of sampling: Ambient Air Quality Monitoring (24 Hours)	
Instrument used: Combine Sampler (GTI - 241) & Respirable Dust Sampler (GTI - 151), Greentech Instruments, India	
Sampling date: 12 - 13 May, 2024	
Sampled by: Environment Management And Analysis Services P. Ltd., Dillibazar, Kathmandu	

Result

Parameters	Result	NAAQS	Unit	Method
Total Suspended Particulate Matter (TSPM)	174.1	230.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter (PM_{10})	66.5	120.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter ($PM_{2.5}$)	9.8	40.0	µg/m^3	Federal Reference Method: 5(4):339-342, USEPA
Sulphur Dioxide (SO_2)	2.2	70.0	µg/m^3	IS 5182 (Part - 02):2006
Nitrogen Dioxide (NO_2)	2.6	80.0	µg/m^3	IS 5182 (Part - 06):2006
Carbon Monoxide (CO)	<1000.0	10000.0	µg/m^3	IS 5182 (Part - 10):2006

NAAQS: National Ambient Air Quality Standard, 2012

Remarks: The observed values complies with the NAAQS prescribed limits.

Air Quality Test Report

Report No.: 92A/80/81	Report Date: 22 May 2024
Sample No.: 78-A/080/81	
Work Order No.: Email (Date: 06 May, 2024)	
Name and address of Client: South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project (ETDSP), Kathmandu	
Contact person: Mr. Asish Dhakal	
Sampling Location: Kapilvastu District, Banganga Municipality Ward No. 7, (Motipur Danda)	
GPS Coordinates: 27°41'32"N 83°07'14"E	
Type of sampling: Ambient Air Quality Monitoring (24 Hours)	
Instrument used: Combine Sampler (GTI - 241) & Respirable Dust Sampler (GTI - 151), Greentech Instruments, India	
Sampling date: 13 - 14 May, 2024	
Sampled by: Environment Management And Analysis Services P. Ltd., Dillibazar, Kathmandu	

Result				
Parameters	**Result**	**NAAQS**	**Unit**	**Method**
Total Suspended Particulate Matter (TSPM)	152.6	230.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter (PM_{10})	57.3	120.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter ($PM_{2.5}$)	12.6	40.0	µg/m^3	Federal Reference Method: 5(4):339-342, USEPA
Sulphur Dioxide (SO_2)	<1.0	70.0	µg/m^3	IS 5182 (Part - 02):2006
Nitrogen Dioxide (NO_2)	3.3	80.0	µg/m^3	IS 5182 (Part - 06):2006
Carbon Monoxide (CO)	<1000.0	10000.0	µg/m^3	IS 5182 (Part - 10):2006

NAAQS: National Ambient Air Quality Standard, 2012

Remarks: The observed values complies with the NAAQS prescribed limits.

Air Quality Test Report

Report No.: 93A/80/81	Report Date: 22 May 2024
Sample No.: 78-A/080/81	
Work Order No.: Email (Date: 06 May, 2024)	
Name and address of Client: South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project (ETDSP), Kathmandu	
Contact person: Mr. Asish Dhakal	
Sampling Location: Kapivastu District, Shivaraj Municipality Ward No. 1, (Bankas Basa)	
GPS Coordinates: 27°44'18"N 82°50'27"E	
Type of sampling: Ambient Air Quality Monitoring (24 Hours)	
Instrument used: Combine Sampler (GTI - 241) & Respirable Dust Sampler (GTI - 151), Greentech Instruments, India	
Sampling date: 13 - 14 May, 2024	
Sampled by: Environment Management And Analysis Services P. Ltd., Dillibazar, Kathmandu	

Result				
Parameters	**Result**	**NAAQS**	**Unit**	**Method**
Total Suspended Particulate Matter (TSPM)	126.8	230.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter (PM_{10})	49.1	120.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter ($PM_{2.5}$)	16.4	40.0	µg/m^3	Federal Reference Method: 5(4):339-342, USEPA
Sulphur Dioxide (SO_2)	4.2	70.0	µg/m^3	IS 5182 (Part - 02):2006
Nitrogen Dioxide (NO_2)	4.4	80.0	µg/m^3	IS 5182 (Part - 06):2006
Carbon Monoxide (CO)	<1000.0	10000.0	µg/m^3	IS 5182 (Part - 10):2006

NAAQS: National Ambient Air Quality Standard, 2012

Remarks: The observed values complies with the NAAQS prescribed limits.

Air Quality Test Report

Report No.: 94A/80/81	Report Date: 22 May 2024
Sample No.: 78-A/080/81	
Work Order No.: Email (Date: 06 May, 2024)	
Name and address of Client: South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project (ETDSP), Kathmandu	
Contact person: Mr. Asish Dhakal	
Sampling Location: Kapivastu District, Shivaraj Municipality Ward No. 9, (4 Number Dobato)	
GPS Coordinates: 27°46'36"N 82°49'04"E	
Type of sampling: Ambient Air Quality Monitoring (24 Hours)	
Instrument used: Combine Sampler (GTI - 241) & Respirable Dust Sampler (GTI - 151), Greentech Instruments, India	
Sampling date: 13 - 14 May, 2024	
Sampled by: Environment Management And Analysis Services P. Ltd., Dillibazar, Kathmandu	

Result

Parameters	Result	NAAQS	Unit	Method
Total Suspended Particulate Matter (TSPM)	121.7	230.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter (PM_{10})	58.2	120.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter ($PM_{2.5}$)	10.6	40.0	µg/m^3	Federal Reference Method: 5(4):339-342, USEPA
Sulphur Dioxide (SO_2)	<1.0	70.0	µg/m^3	IS 5182 (Part - 02):2006
Nitrogen Dioxide (NO_2)	3.6	80.0	µg/m^3	IS 5182 (Part - 06):2006
Carbon Monoxide (CO)	<1000.0	10000.0	µg/m^3	IS 5182 (Part - 10):2006

NAAQS: National Ambient Air Quality Standard, 2012

Remarks: The observed values complies with the NAAQS prescribed limits.

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Air Quality Test Report

Report No.: 95A/80/81	Report Date: 22 May 2024
Sample No.: 78-A/080/81	
Work Order No.: Email (Date: 06 May, 2024)	
Name and address of Client: South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project (ETDSP), Kathmandu	
Contact person: Mr. Asish Dhakal	
Sampling Location: Dang District, Rapti Municipality Ward No. 5, (Singhe)	
GPS Coordinates: 27°51'44"N 82°37'21"E	
Type of sampling: Ambient Air Quality Monitoring (24 Hours)	
Instrument used: Combine Sampler (GTI - 241) & Respirable Dust Sampler (GTI - 151), Greentech Instruments, India	
Sampling date: 14 - 15 May, 2024	
Sampled by: Environment Management And Analysis Services P. Ltd., Dillibazar, Kathmandu	

Result

Parameters	Result	NAAQS	Unit	Method
Total Suspended Particulate Matter (TSPM)	128.8	230.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter (PM_{10})	62.5	120.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter ($PM_{2.5}$)	14.0	40.0	µg/m^3	Federal Reference Method: 5(4):339-342, USEPA
Sulphur Dioxide (SO_2)	<1.0	70.0	µg/m^3	IS 5182 (Part - 02):2006
Nitrogen Dioxide (NO_2)	2.8	80.0	µg/m^3	IS 5182 (Part - 06):2006
Carbon Monoxide (CO)	<1000.0	10000.0	µg/m^3	IS 5182 (Part - 10):2006

NAAQS: National Ambient Air Quality Standard, 2012

Remarks: The observed values complies with the NAAQS prescribed limits.

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Air Quality Test Report

Report No.: 96A/80/81	Report Date: 22 May 2024
Sample No.: 78-A/080/81	
Work Order No.: Email (Date: 06 May, 2024)	
Name and address of Client: South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project (ETDSP), Kathmandu	
Contact person: Mr. Asish Dhakal	
Sampling Location: Dang District, Lamahi Municipality Ward No. 9, (Lauri, Rihar)	
GPS Coordinates: 27°54'07"N 82°21'08"E	
Type of sampling: Ambient Air Quality Monitoring (24 Hours)	
Instrument used: Combine Sampler (GTI - 241) & Respirable Dust Sampler (GTI - 151), Greentech Instruments, India	
Sampling date: 14 - 15 May, 2024	
Sampled by: Environment Management And Analysis Services P. Ltd., Dillibazar, Kathmandu	

Result

Parameters	Result	NAAQS	Unit	Method
Total Suspended Particulate Matter (TSPM)	112.3	230.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter (PM_{10})	48.6	120.0	µg/m^3	IS 5182 (Part -23):2006
Particulate Matter ($PM_{2.5}$)	16.4	40.0	µg/m^3	Federal Reference Method: 5(4):339-342, USEPA
Sulphur Dioxide (SO_2)	<1.0	70.0	µg/m^3	IS 5182 (Part - 02):2006
Nitrogen Dioxide (NO_2)	3.7	80.0	µg/m^3	IS 5182 (Part - 06):2006
Carbon Monoxide (CO)	<1000.0	10000.0	µg/m^3	IS 5182 (Part - 10):2006

NAAQS: National Ambient Air Quality Standard, 2012

Remarks: The observed values complies with the NAAQS prescribed limits.

Water Quality Analysis Report

Report No : 97/W/080-81 Date of sampling : 15 - 05 - 2024
Sample No. : 79-W/080/81 Date completed : 21 - 05 - 2024
Sample source : Ground Water (Well Water) Sampled by : EMAS P. Ltd.
Client : South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project (ETDSP), Kathmandu
Contact Person: Mr. Asish Dhakal GPS Coordinates: 27°54'07"N 82°21'08"E
Sampling Location: Dang District, Lamahi Municipality Ward No. 9, (Lauri, Rihar)

Parameters	Unit	NDWQS	Observed Values	Test Methods
pH	-	6.5 - 8.5*	6.9	4500-H^+ B, APHA, 22nd EDITION

Colour	-	5 (15)	<0.1	2120 B, APHA, 22nd EDITION
Turbidity	NTU	5 (10)	2.0	2130 B, APHA, 22nd EDITION
Total Suspended Solids	mg/l	-	<1.0	2540 D. APHA, 22nd EDITION
Total Dissolved Solids	mg/l	1000	158.0	2540 C., APHA, 22nd EDITION
Total Hardness	mg/l as $CaCO_3$	500	58.0	2340 C, APHA, 22nd EDITION
Chloride	mg/l	250	5.9	4500-Cl^- B, APHA, 22nd EDITION
Ammonia	mg/l	1.5	0.03	4500-NH_3 C., APHA, 17TH EDITION
Nitrate	mg/l as NO_3	50	3.2	4500-NO3- B., APHA, 22nd EDITION
Nitrite	mg/l as NO_2	3	0.06	4500-NO_2- B., APHA, 22nd EDITION
Lead	mg/l	0.01	<0.01	3111 B., APHA, 22nd EDITION
Cadmium	mg/l	0.003	<0.002	3111 B., APHA, 22nd EDITION
Chromium	mg/l	0.05	<0.05	3111 B., APHA, 22nd EDITION
Copper	mg/l	1	<0.01	3111 B., APHA, 22nd EDITION
Zinc	mg/l	3	0.21	3111 B., APHA, 22nd EDITION
Mercury	mg/l	0.001	<0.001	3112 B., APHA, 22nd EDITION
Iron	mg/l	0.3 (3)	0.09	3112 B., APHA, 22nd EDITION
Manganese	mg/l	0.2	0.04	3112 B., APHA, 22nd EDITION
Arsenic	mg/l	0.05	<0.01	3114 C,APHA, 22nd EDITION
Fluoride	mg/l	0.5-1.5*	0.04	4500F- D. APHA, 22nd EDITION
Aluminium	mg/l	0.2	<0.01	3500-Al B. APHA, 22nd EDITION
Total Coliform	CFU/100 ml	Nil	Nil	9221 C. , APHA, 22nd EDITION
E.Coli	CFU/100 ml	Nil	Nil	9221 C. , APHA, 22nd EDITION

NDWQS: National Drinking Water Quality Standard (2079), * - Values are upper and lower limit, () - Values are acceptable only when alternative is not available.

Remarks: Observed values of the specified parameters are within the limit of NDWQS.

Analyzed by Checked by Authorized
Signature

Water Quality Analysis Report

Report No : 98/W/080-81 Date of sampling : 15 - 05 - 2024
Sample No. : 79-W/080/81 Date completed : 21 - 05 - 2024
Sample source : Ground Water (Artesian Tube Well) Sampled by : EMAS P. Ltd.
Client : South Asia Subregional Economic Cooperation Electricity Transmission and Distribution Strengthening Project (ETDSP), Kathmandu
Contact Person: Mr. Asish Dhakal GPS Coordinates: 27°41'39"N 83°07'13"E
Sampling Location: Kapilvastu District, Banganga Municipality Ward No. 7, (Motipur Danda)

Parameters	Unit	NDWQS	Observed Values	Test Methods
pH	-	6.5 - 8.5*	7.1	4500-H^+ B, APHA, 22nd EDITION
Colour	-	5 (15)	<0.1	2120 B, APHA, 22nd EDITION
Turbidity	NTU	5 (10)	<1.0	2130 B, APHA, 22nd EDITION
Total Suspended Solids	mg/l	-	<1.0	2540 D. APHA, 22nd EDITION
Total Dissolved Solids	mg/l	1000	124.0	2540 C., APHA, 22nd EDITION
Total Hardness	mg/l as $CaCO_3$	500	43.0	2340 C, APHA, 22nd EDITION
Chloride	mg/l	250	2.8	4500-Cl^- B, APHA, 22nd EDITION
Ammonia	mg/l	1.5	<0.02	4500-NH_3 C., APHA, 17TH EDITION
Nitrate	mg/l as NO_3	50	1.2	4500-NO3- B., APHA, 22nd EDITION
Nitrite	mg/l as NO_2	3	<0.02	4500-NO_2- B., APHA, 22nd EDITION
Lead	mg/l	0.01	<0.01	3111 B., APHA, 22nd EDITION
Cadmium	mg/l	0.003	<0.002	3111 B., APHA, 22nd EDITION
Chromium	mg/l	0.05	<0.05	3111 B., APHA, 22nd EDITION
Copper	mg/l	1	<0.01	3111 B., APHA, 22nd EDITION
Zinc	mg/l	3	0.13	3111 B., APHA, 22nd EDITION
Mercury	mg/l	0.001	<0.001	3112 B., APHA, 22nd EDITION
Iron	mg/l	0.3 (3)	0.02	3112 B., APHA, 22nd EDITION
Manganese	mg/l	0.2	<0.02	3112 B., APHA, 22nd EDITION
Arsenic	mg/l	0.05	<0.01	3114 C,APHA, 22nd EDITION
Fluoride	mg/l	0.5-1.5*	0.07	4500F- D, APHA, 22nd EDITION
Aluminium	mg/l	0.2	<0.01	3500-Al B. APHA, 22nd EDITION
Total Coliform	CFU/100 ml	Nil	Nil	9221 C. , APHA, 22nd EDITION
E.Coli	CFU/100 ml	Nil	Nil	9221 C. , APHA, 22nd EDITION

NDWQS: National Drinking Water Quality Standard (2079), * - Values are upper and lower limit, () - Values are acceptable only when alternative is not available.

Remarks: Observed values of the specified parameters are within the limit of NDWQS.

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Signature

Appendix D – Draft Critical Habitat Assessment

South Asia Subregional Economic Cooperation (SASEC) Electricity Transmission and Distribution Strengthening Project, Nepal: Critical Habitat Assessment

Drafted for the Asian Development Bank by John Pilgrim Limited – 24th May 2024
Author: John D. Pilgrim

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1 Executive Summary

- This document is a rapid Critical Habitat Assessment (CHA) for nine of 12 components within a proposed South Asia Subregional Economic Cooperation (SASEC) Electricity Transmission and Distribution Strengthening Project in Nepal. These nine components are henceforth collectively referred to in this report as "the Project" but the broader project also includes other components not included in the assessment. The CHA supports a series of Initial Environmental Examinations (e.g., NEA 2023, 2024) for the project, which is proposed for financing by the Asian Development Bank (ADB).
- Based on information available for this rapid assessment, and acting on a precautionary basis, all of the project Areas of Analysis except that for Cluster 2 qualify as Critical Habitat, owing to the presence of one mammal, four birds, five reptiles, four amphibians, ten fishes, and two dragonflies, all known or suspected to occur at globally significant levels, as well as the presence of 15 internationally-recognized sites (protected areas and/or Key Biodiversity Areas) and a globally unique ecoregion (Table 1). The linear and disjunct nature of the Project, multiple Areas of Analysis, and potential to impact flying species (which in some cases may have their main habitat some way from Project infrastructure) increases the number of biodiversity features which qualify the area as Critical Habitat.
- This does not mean that the Project is likely to impact all of these features. Significant impacts are only likely, before mitigation, for three birds, two reptiles and three internationally-recognized sites (Table 1). These potential impacts are mostly associated with project Component 1 (construction of a 160 km overhead transmission line from New Butwal to Lamahi). Nonetheless, on a precautionary basis the features listed in Table 1 should all be considered priority biodiversity for the Project to avoid, mitigate and – if necessary – offset impacts upon.
- The ADB SPS (2009) requires all Project components overlapping protected areas to: (i) act in a manner consistent with defined protected area management plans; (ii) consult protected area sponsors and managers, local communities, and other key stakeholders on the proposed project; and (iii) implement additional programs to promote and enhance the conservation aims of the protected area. Such measures would also be appropriate – and are required by IFC (2019) – for project components overlapping Key Biodiversity Areas (i.e., project Component 1).

Table 1. Summary of Critical Habitat-qualifying biodiversity by Clusters of project components (Section 2). For further details, see Table 5 (Section 4.7). Those eight in bold are of highest priority for Project mitigation considerations.

Biodiversity type	Name	Project cluster represents Critical Habitat					Significant Project impacts likely without mitigation?
		1	2	3	4	5	
• Mammal	Hispid Hare (Caprolagus hispidus)	✓?					No
• Bird	White-rumped Vulture Gyps bengalensis	✓					Yes – owing to collision risks
• Bird	Slender-billed Vulture Gyps tenuirostris	✓?					Yes – owing to collision risks
• Bird	Bengal Florican Houbaropsis bengalensis	✓					Possibly– owing to collision risks
• Bird	Lesser Adjutant Leptoptilos javanicus	✓					Yes – owing to collision risks
• Reptile	Gharial Gavialis gangeticus	✓					No
• Reptile	Spotted Pond Turtle Geoclemys hamiltonii	✓?					Unlikely
• Reptile	Elongated Tortoise Indotestudo elongata			✓?			Possibly – Cluster 1 passes through a KBA for this species

Biodiversity type	Name	Project cluster represents Critical Habitat					Significant Project impacts likely without mitigation?
		1	2	3	4	5	
• Reptile	Three-keeled Land Tortoise Melanochelys tricarinata	✓?					Yes – Cluster 1 passes through possible Critical Habitat for this species
• Reptile	Indian Eyed Turtle Morenia petersi	✓?		✓?			Unlikely
• Amphibian	Torrent Paa Frog Nanorana ercepeae					✓	No
• Amphibian	Rara Paa Frog Nanorana rarica					✓	No
• Amphibian	Dubois' Paa Frog Nanorana rostandi					✓	No
• Amphibian	Nepal Lazy Toad Scutiger nepalensis					✓	No
• Fish	Kalabans Bangana dero	✓?					No
• Fish	Chagunius chagunio	✓?			✓?		No
• Fish	Annandale Garra Garra annandalei	✓?					No
• Fish	Pseudecheneis eddsi				✓		No
• Fish	Rainbow Minnow Psilorhynchus gracilis	✓?		✓?			No
• Fish	Psilorhynchus nepalensis	✓					No
• Fish	Stone Carp Psilorhynchus pseudecheneis	✓					No
• Fish	River Stone Carp Psilorhynchus sucatio			✓?			No
• Fish	Sisor rheophilus			✓?			No
• Fish	Mahseer Tor tor	✓?					No
• Dragonfly	Chloropetalia selysi				✓?		No
• Dragonfly	Somatochlora nepalensis					✓	No
• Site	Banke National Park	✓					No
• Site	Banke National Park Buffer Zone	✓					No
• Site	Bara Conservation Area			✓			No
• Site	Chitwan National Park and KBA	✓					No
• Site	Chitwan National Park Buffer Zone	✓					No
• Site	Chitwan World Heritage Site	✓					No
• Site	Chure Hills Environmental Protection Area	✓		✓		✓	Possibly – Cluster 1 passes through this area
• Site	Dang Deukhuri Foothill Forests and West Rapti Wetlands KBA	✓					Yes – Cluster 1 passes through this KBA
• Site	Farmlands in Lumbini area KBA	✓					No
• Site	Langtang National Park and KBA				✓		No
• Site	Langtang National Park Buffer Zone				✓		No
• Site	Nawalparasi forests KBA	✓?					No
• Site	Parsa National Park and KBA			✓			No
• Site	Parsa National Park Buffer Zone	✓					No
• Site	Phulchoki Conservation Area				✓		No
• Site	Rara National Park					✓	No
• Site	Rara National Park Buffer Zone					✓	No
• Site	Shey-Phoksundo National Park Buffer Zone					✓	No
• Site	Shivapuri-Nagarjun National Park				✓		No
• Site	Shivapuri-Nagarjun National Park Buffer Zone				✓		Yes – Cluster 4 passes through this KBA
• Site	Sohagibarwa Wildlife Sanctuary (India)	✓					No
• Site	Soheldev Wildlife Sanctuary (India)	✓					No
• Ecoregion	Eastern Himalayan broadleaf forests ecoregion				✓		Unlikely – though Cluster 4 passes through this area

✓= actually or likely qualifies area as Critical Habitat; ? = possibly qualifies area as Critical Habitat. Both based on available information.

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2 Introduction

1. Purpose and objectives

- This document supports an Environmental Impact Assessment (EIA) and a series of Initial Environmental Examinations (IEEs) for the South Asia Subregional Economic Cooperation (SASEC) Electricity Transmission and Distribution Strengthening Project in Nepal (e.g., NEA 2023, 2024), which has been categorized as "B" for environmental safeguards. Owing to time constraints, the scope of this assessment was restricted to five transmission line components of the broader project perceived as of higher risk. It does not include other components of the broader project which are highly unlikely to have any biodiversity impacts, specifically: construction of a data recovery center inside the existing New Butwal substation; smart meter installation; and consultancy services. This restricted scope is henceforth referred to as "the Project", and comprises at least five geographically-clustered sets of infrastructure (the Project was still in development when this document was produced):
    2. Cluster 1 – Component 1 (construction of a 160 km 400 kV overhead transmission line from New Butwal to Lamahi), Component 2 (construction of a new substation at Rihar of Lamahi Municipality-9), and Component 3a (expansion of New Butwal substation);
    3. Cluster 2 – Component 3b (expansion of Kushma substation);
    4. Cluster 3 – Component 5 (construction of a 65 km 400 kV transmission line from Nijgad-Ramauli-Pokhariya, and a new substation at Ramauli) and Component 6 (extension of Parwanipur and Pokhariya substations);
    5. Cluster 4 – Component 7 (construction of a 4km 220 kV Loop In Loop Out (LILO) line from Trishuli to Matatirtha, and a new substation at Teenpiple); and
    6. Cluster 5 – Component 8 (construction of an 82 km 132kV transmission line from Dailekh-Kalikot to Jumla, a new substation at Jumla, and a bay extension at Dailekh substation).
- The Project is proposed for financing under an ADB loan. The ADB Safeguard Policy Statement (ADB 2009) requires assessment of whether a project is planned in an area that may qualify as Critical Habitat. This document provides that assessment.

7. 2.2 Approach

- This CHA was rapidly developed through a desktop review of existing documentation related to the Project and other existing grey and published literature. It aligns with the ADB SPS (ADB 2009) and International Finance Corporation Performance Standard 6 and its accompanying Guidance Note (IFC 2012, 2019).
- Except where necessary, this document does not repeat information available in the Initial Environmental Examinations (e.g., NEA 2023, 2024).

8. Key constraints and information gaps

- The main constraints facing this assessment were limited time and data. As a result, simple AoAs with limited ecological relevance were defined, and assessment of species' populations in the Project AoAs was less rigorous than may sometimes be the case. These weaknesses impact the assessment but, as it is precautionary throughout and addresses infrastructure with limited footprint impacts, are unlikely to fundamentally alter its conclusions.
- At the time of this assessment, locations of Project infrastructure were available, but only limited information about Project design. There was also almost no Project-specific baseline information available for Critical Habitat-qualifying species (such as vultures, and their movements across proposed transmission line corridors) or their habitats (such as the quality of forest to be cleared for rights of way).
- This assessment should be viewed as preliminary, in light of all of these significant information gaps, and should be updated when more information becomes available to fill them.

3 Areas of analysis

- Critical Habitat assessment ideally takes place across sensible ecological or political units that are sufficiently large to encompass all direct and indirect impacts from a project. These areas of analysis (AoAs) are thus often much broader than the direct project footprint. AoAs may be separate or combined, depending on the ecology of the biodiversity concerned.
- Given the rapid desktop nature of this assessment, simple AoAs for this Project were defined for ecologically-similar biodiversity, namely: (i) aquatic biodiversity; (ii) birds at risk of collision with transmission lines; and (iii) terrestrial biodiversity.
- The AoAs for aquatic biodiversity were defined to encompass all infrastructure within each cluster. Hydrosheds (Lehner et al. 2008) are the units for which freshwater biodiversity data have been compiled by IUCN (2023). Level 9 hydrosheds were the most practical scale at which to develop aquatic AoAs that encompass potential areas of project impact. Single aquatic AoAs were chosen for each cluster in the absence of sufficient information on species' presence in the area to usefully identify multiple ecologically-suitable AoAs (Figure 1).
- Given the rapid desktop nature of this assessment and the linear nature of much Project infrastructure and impacts, defining an ecologically-appropriate area of analysis for birds at risk of collision with transmission lines was challenging. Some of the highest risk species which may sometimes occur in the Project area are vultures, which can regularly forage up to 500 km from breeding sites. Considering such large areas in a Critical Habitat assessment would, however, provide results of limited relevance to Project mitigation and management, particularly considering that components of this Project are managed quite independently. As a compromise between providing sufficiently fine-scale information that it is relevant to each Project component and assessing areas that are sufficiently large enough to acknowledge the mobility of at-risk species, AoAs for birds (and large bats, which are also susceptible to collision and electrocution risks) were defined for each cluster using a buffer of 25 km around transmission lines and 5 km around substations (following Pilgrim 2020b; Figure 1).
- The AoAs for other terrestrial biodiversity were defined to encompass all infrastructure in each geographic cluster, plus a precautionary 5 km buffer to encompass any likely significant impacts (Figure 1). The buffer is an arbitrary distance, but chosen to be sufficiently precautionary to ensure capture of impacts such as edge effects, hunting or disturbance by construction workers, and noise/dust/pollution impacts during construction. Single AoAs for each cluster were chosen in the absence of sufficient information on species' presence in the areas to usefully identify multiple ecologically-suitable AoAs.
- Identification of these AoAs does not mean that the project has any obligations across them. The aim of this Critical Habitat Assessment is to identify whether the broad units qualify as Critical Habitat and, if so, for which biodiversity features. This information helps to prioritize impact assessment and to focus mitigation efforts.

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Figure 1. Map of assessed Project infrastructure and Areas of Analysis

Imagery Sources: OpenStreetMap (2023).

4 Assessment of biodiversity which may qualify the area as Critical Habitat

- Each of the following sections considers candidate Critical Habitat-qualifying biodiversity identified within the Integrated Biodiversity Assessment Tool (IBAT: www.ibat-alliance.org) or other literature as actually or potentially present. In each case, reasons are identified for each biodiversity feature likely meeting or not meeting Critical Habitat. Two categories of biodiversity that might qualify the area as Critical Habitat were only considered briefly here, and should be assessed further by social experts – specifically areas that provide key ecosystem services and areas with biodiversity that has significant social, cultural or economic importance to local communities.

9. Critically Endangered and Endangered species

- Critically Endangered, Endangered, and (per IFC 2019) Vulnerable species and relevant subspecies were included in an initial screening if their IUCN range maps overlapped Project AoAs. Threat status is taken from the global IUCN Red List (IUCN 2023). Comparison with IUCN Red List Extent of Occurrence maps identified the potential for 77 Critically Endangered, Endangered, or Vulnerable species to occur in the Project AoA for Cluster 1, 35 in Cluster 2, 75 in Cluster 3, 50 in Cluster 4, and 49 in Cluster 5. These lists of candidate species were reduced to a total of 14 species after a quick screen of IUCN distribution maps against quantitative thresholds for Critical Habitat (IFC 2019). Based on the extremely limited extent of their global distribution known or likely to be within the AoA, it was very unlikely that other candidate species (Appendix A) would meet these thresholds. The 14 species are considered in more detail below.
- Nepal also has National Red Lists for birds (Inskipp et al. 2016) and mammals (Jnawali et al. 2011), aligned with IUCN categories and criteria. In these lists, eight mammals and 67 birds are considered nationally Critically Endangered, and 26 mammals and 38 birds nationally Endangered. Four of those highly-threatened mammals and three of the birds are also globally threatened and assessed below. For the others, no quantitative guidance is given by IFC (2019) on how to assess whether a nationally-listed species is present in 'important concentrations'. However, none of the other 132 nationally highly-threatened mammals and birds not assessed below had more than 0.5% of their global range in any relevant Project AoA. As such, it is not considered likely that any AoA would be considered to have 'important concentrations' of these species.

1. Red Panda (Ailurus fulgens)

This species is considered globally and nationally Endangered (Glatston et al. 2015; Jnawali et al. 2011), and Langtang National Park and KBA may hold >0.5% of the global population of the species (Section 4.6). However, the Project AoAs overlapping this site are avian and freshwater AoAs, and thus not of relevance to this species. Therefore, Red Panda does not qualify this Project as Critical Habitat.

2. Hispid Hare (Caprolagus hispidus)
This species is considered globally and nationally Endangered (Aryal & Yadav 2019; Jnawali et al. 2011), and more than 1% of its mapped global range overlaps the Cluster 1 terrestrial AoA. Although it occurs across the southern Himalaya – from Uttar Pradesh through southern Nepal, northern West Bengal to Assam, and into Bangladesh – it is known to have a restricted and fragmentary distribution within this overall mapped range, restricted to grasslands (Aryal & Yadav 2019). However, during a desktop assessment of this type, without the ability to check detailed distributional data within each AoA, it is precautionary to assume that more than 0.5% of its population might occur within that AoA, and thus that Hispid Hare might well qualify the Cluster 1 terrestrial AoA as Critical Habitat under Criterion 1.

3. Tiger (Panthera tigris)
This species is considered globally and nationally Endangered (Goodrich et al. 2022; Jnawali et al. 2011), and has several significant populations in Nepal. One of these (within Chitwan National Park) overlaps Project AoAs, with each holding more than 1% of the species' global population (Section 4.6). However, those AoAs are avian and freshwater AoAs, and thus not of relevance to this species. Therefore, Tiger does not qualify this Project as Critical Habitat.

4. Indian Rhinoceros (Rhinoceros unicornis)
This species is considered globally Vulnerable (Ellis & Talukdar 2019) and nationally Endangered (Jnawali et al. 2011), and Chitwan holds by far the largest population in Nepal. However, the Project AoAs overlapping this site are avian and freshwater AoAs, and thus not of relevance to this species. Therefore, Indian Rhinoceros does not qualify this Project as Critical Habitat.

5. White-rumped Vulture (Gyps bengalensis)
This globally and nationally (Inskipp et al. 2016) Critically Endangered species suffered extremely rapid declines across South Asia (BirdLife International 2023e), with a recent population estimate of about 6,000 individuals in India (Prakash et al. 2019). To qualify as Critical Habitat per IFC (2019), AoAs would have to regularly support 0.5% of the global population, i.e. at least 30 birds. Chitwan National Park and KBA holds such concentrations, as likely do the Dang Deukhuri Foothill Forests and West Rapti Wetlands KBA, the Farmlands in Lumbini area KBA, and possibly the Nawalparasi forests KBA (Section 4.6). In addition, some other important vulture nesting colonies fall outside currently identified protected areas and KBAs – for example, Bird Conservation Nepal (in litt. 2023) note a colony of 113 White-rumped Vulture nests at Rajapani, just 7 km south of the proposed Cluster 1 transmission line. All of these sites are overlapped by the Cluster 1 avian AoA. Given this, the Cluster 1 avian AoA qualifies as Critical Habitat for White-rumped Vulture under Criterion 1.

6. Slender-billed Vulture (Gyps tenuirostris)
This globally and nationally (Inskipp et al. 2016) Critically Endangered species is now largely restricted to northern India, southern Nepal and north/central Bangladesh (BirdLife International 2023f), with a remaining population estimated at only 1,500-3,750 individuals. To qualify as Critical Habitat per IFC (2019), an AoA would have to regularly support 0.5% of the global population and at least five reproductive units, i.e. at least 10 birds in five adult pairs. The Chitwan National Park and KBA, Dang Deukhuri Foothill Forests and West Rapti Wetlands KBA, and Farmlands in Lumbini area KBA may still hold such concentrations (Section 4.6). As such, the Cluster 1 avian AoA may qualify as Critical Habitat for Slender-billed Vulture under Criterion 1.

7. Bengal Florican (Houbaropsis bengalensis)
This globally and nationally (Inskipp et al. 2016) Critically Endangered species exists in two disjunct populations (BirdLife International 2023g), with approximately 450-500 adult birds estimated to remain in Nepal and North-East India (Collar et al. 2017) and 119–156 remaining in Cambodia

(Mahood et al. 2019). As a migratory species, it is also assessed in Section 4.3. The most important area in Nepal is around Koshi Tappu, with other recent records clustered in or around Chitwan and Suklaphanta National Parks. More than 2.5% of the species' mapped global range overlaps the avian AoA for Cluster 1, and almost 1.2% the avian AoA for Cluster 3. While the overlap for Cluster 3 is more an artefact of imprecision in the map, the range within the Cluster 1 AoA includes potential breeding areas and overlaps Chitwan National Park. Even given dramatically decreasing populations of the species in Nepal, these are reflected through much of the range and even the very small population in the Cluster 1 avian AoA is likely to represent >0.5% of the global population of the species. As such, the Cluster 1 avian AoA qualifies as Critical Habitat for Bengal Florican under Criterion 1.

8. Three-striped Roofed Turtle (Batagur dhongoka)
This lowland river species is considered globally Critically Endangered, because it is undergoing a rapid decline (Das et al. 2019). While it is known from India and Bangladesh, the few records from Nepal require confirmation (Das et al. 2019). As such, despite an almost 1% overlap of its mapped range with each of the Cluster 1 and 3 freshwater AoAs, this species is not currently predicted to qualify the Project as Critical Habitat under Criterion 1.

9. Gharial (Gavialis gangeticus)
This species is considered globally Critically Endangered (Lang et al. 2019), and has several significant populations in Nepal. One of these (within Chitwan National Park) overlaps the Cluster 1 freshwater AoA, holding more than 0.5% of the species' global population (Section 4.6). As such, the Cluster 1 freshwater AoA qualifies as Critical Habitat for Gharial under Criterion 1.

10. Spotted Pond Turtle (Geoclemys hamiltonii)
This globally Endangered species occurs in lowland standing water bodies (Praschag et al. 2019), and has 0.8% of its global range mapped within the Cluster 1 freshwater AoA. If 0.5% of its population occurs within this AoA, it would qualify as Critical Habitat (IFC 2019). With little detailed information on abundance through its range, it is precautionary to assume that 0.8% of range represents >0.5% of population, and thus that Spotted Pond Turtle may well qualify the Cluster 1 freshwater AoA as Critical Habitat.

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11. Elongated Tortoise (Indotestudo elongata)
This species is considered globally Critically Endangered, because it is undergoing a rapid decline owing to extensive collecting (Rahman et al. 2019). It is rare across its wide range, and so it is extremely challenging to identify sites likely to qualify as Critical Habitat for this species. Chitwan National Park was identified as a KBA for the species, and thus may represent Critical Habitat, but is solely overlapped by Project AoAs for birds or freshwater (Section 4.6) which are not relevant to this species. However, the terrestrial AoA for Cluster 1 overlaps the Shivapur Forest KBA and the terrestrial AoA for Cluster 3 overlaps the Parsa Wildlife Reserve KBA, both of which were identified for this species. Those KBAs were identified prior to updated KBA identification guidance, which incorporated quantitative criteria with which IFC Guidance Note 6 (2019) is now aligned. As such, they might possibly not meet current Critical Habitat criteria for Elongated Tortoise. A rapid survey in Shivapur for this Project identified very low populations of this species, owing to widespread hunting and frequent fire (Limbu 2024). On a precautionary basis, in the absence of more detailed information, Parsa – being more protected than Shivapur – may hold a globally-significant population (>0.5%) of this species and so the Cluster 3 terrestrial AoA might possibly qualify as Critical Habitat for Elongated Tortoise under Criterion 1.

12. Tricarinate Hill Turtle (Melanochelys tricarinata)
This terrestrial species is considered globally Endangered (Horne et al. 2020). Almost 0.5% of its mapped range overlaps the Cluster 1 terrestrial AoA. That AoA for Cluster 1 overlaps the Shivapur Forest KBA, which was identified solely for this species and Elongated Tortoise (see above). That KBA was identified prior to updated KBA identification guidance, which incorporated quantitative criteria with which IFC Guidance Note 6 (2019) is now aligned. A rapid survey in Shivapur for this Project identified very low populations of this species, owing to widespread hunting and frequent fire (Limbu 2024). As such, the KBA is very unlikely to meet current Critical Habitat criteria for Tricarinate Hill Turtle. However, given the presence of a significant proportion of the species' range in the AoA, the Cluster 1 terrestrial AoA might possibly still hold a globally-significant population (>0.5%) of this species. As such, the Cluster 1 terrestrial AoA might possibly qualify as Critical Habitat for Tricarinate Hill Turtle under Criterion 1.

13. Indian Eyed Turtle (Morenia petersi)
This freshwater turtle species is considered globally Endangered (Ahmed & Singh 2021). It occurs widely in low altitude waterbodies throughout the northern tributaries of the Ganga, Brahmaputra basin, and their delta region in northern India, Bangladesh, and southern Nepal. Although widespread, it has declined heavily in many locations owing to collection and trading for food. Just under 0.8% of its mapped range overlaps the Cluster 3 freshwater AoA, and almost 1% overlaps that of Cluster 1. Insufficient information is available to understand whether these areas have higher or lower population densities than other areas within the species' range, so it is precautionarily assumed that >0.5% of the species' global population may occur in each of the Cluster 1 and 3 freshwater AoAs. As such, Indian Eyed Turtle may qualify the Cluster 1 and 3 freshwater AoAs as Critical Habitat under Criterion 1.

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14. Chloropetalia selysi
This dragonfly species is considered globally Vulnerable (Dow 2009). More than 10% of its distribution as mapped by IUCN falls within the Cluster 4 freshwater AoA. This mapped distribution is perhaps only half of the true picture, as the species is also known from as far east as eastern Nagaland (Joshi 2014). Even the theoretical loss of the entire freshwater AoA would not result in uplisting of the species to Endangered, as it would still have a global distribution of almost 30,000 km^2. As such, Chloropetalia selysi does not qualify the Project as Critical Habitat under Criterion 1.

10. Endemic or restricted-range species

- Nepal is a mountainous country situated within the Himalaya, a mountain range with very high levels of endemism (e.g., Stattersfield et al. 1998; Wikramanayake et al. 2002), though plant endemism within Nepal is relatively low (Tiwari et al. 2019). Owing to time constraints, this assessment only focused on species assessed under the IUCN Red List, as these can be rapidly screened for restricted-range species. It is thus quite likely that additional restricted-range species occur in the Project area. Given the nature of the Project, however, there is a low likelihood of significant Project impacts to any such species – the major Project risks are to high-flying species, such as bats and birds.
- Following the IFC PS6 Guidance Note (IFC 2019), species were considered restricted-range if their global extent of occurrence was 50,000 km^2 or less (for terrestrial vertebrates) or, for riverine species, if their global range had less than 500 km linear geographic span. Comparison with IUCN Red List Extent of Occurrence maps identified the potential for 26 restricted-range species to occur in the Project AoA. This total of 30 candidate species was reduced to 15 after a quick screen of IUCN distribution maps against quantitative thresholds for Critical Habitat (IFC 2019) – based on the extremely limited extent of their global distribution known or likely to be within the AoA, it was very unlikely that the other 11 (Table 2) would meet these thresholds. The remaining 15 are considered in more detail below.
- Several bird species which occur in the Project AoAs have previously been considered restricted-range by BirdLife International but are now known to have Extents Of Occurrence (EOOs) >50,000 km^2 (e.g., Spiny Babbler Acanthoptila nipalensis and Grey-crowned Prinia Prinia cinereocapilla). Likewise, some other species have a small stated EOO on the IUCN Red List, but calculation of more accurate EOOs using minimum convex polygon methods reveal EOOs >50,000 km^2 (e.g., Wart Frog Minervarya pierrei: Kumar Shrestha & Ohler 2016). None of these species are considered further here, as they cannot be considered restricted-range species in the sense of IFC (2019).

1. Nepalese Field Mouse (Apodemus gurkha)
This restricted-range species is known only from high elevations (2,200-3,600 m) in central Nepal (Kennerley & Pearch 2016). Only about 0.1% of its mapped range overlaps the Cluster 5 terrestrial AoA. As such, Nepalese Field Mouse does not qualify the Project as Critical Habitat.

3. Siwalik Sitana (Sitana sivalensis)
This restricted-range lizard is only known from the foothills of the southern Himalaya in India and Nepal (Das & Bhattarai 2021), with >7% of its mapped range overlapping the Cluster 1 terrestrial AoA. Within that limited range, it is tolerant of at least a degree of human disturbance and degradation of habitat by invasive species. Although a large proportion of its range occurs in one AoA, there is no reason to believe that >10% of its population occurs there, and so Siwalik Sitana does not qualify the Project as Critical Habitat.

4. Olive Oriental Slender Snake (Trachischium laeve)
This restricted-range species occurs in a narrow elevational band in western Nepal and Uttarakhand, India (Das et al. 2022), with almost 1% of its mapped range overlapping the Cluster 5 terrestrial AoA. It is unlikely that any Project AoA holds >10% of the global population of this species so Olive Oriental Slender Snake does not qualify the Project as Critical Habitat.

5. Chitwan Frog (Hylarana chitwanensis)
This restricted-range species is considered Data Deficient because of uncertainty about its range. It is known with certainty only from Chitwan National Park, but was previously thought to occur more widely (IUCN SSC Amphibian Specialist Group 2022). Almost 14% of its mapped range overlaps the Cluster 1 freshwater AoA, but in most of this area its presence is considered uncertain. It is therefore unlikely that >10% of the global population of this species occurs in that AoA. As such, Chitwan Frog does not qualify the Project as Critical Habitat.

6. Torrent Paa Frog (Nanorana ercepeae)
This restricted-range species is known only from high altitudes (2,200-2,600 m) in western Nepal (Ohler et al. 2004b), with almost 13% of its mapped range overlapping the Cluster 5 freshwater AoA. It is therefore likely that >10% of the global population of this species occurs in that AoA. As such, Torrent Paa Frog qualifies the Cluster 5 freshwater AoA as Critical Habitat under Criterion 2.

7. Rara Paa Frog (Nanorana rarica)
This restricted-range species is considered Data Deficient, as it is only known with certainty from Lake Rara (Ohler et al. 2004c). Almost 15% of its mapped range overlaps the Cluster 5 freshwater AoA. On the basis of this information, it is therefore likely that >10% of the global population of this species occurs in that AoA. As such, Rara Paa Frog qualifies the Cluster 5 freshwater AoA as Critical Habitat under Criterion 2.

8. Dubois' Paa Frog (Nanorana rostandi)
This restricted-range species is considered Least Concern (IUCN SSC Amphibian Specialist Group 2023a). It has been found around high-altitude streams, springs, and other running water in forest and grassland. As almost 12% of its mapped range overlaps the Cluster 5 freshwater AoA, it is quite likely that >10% of the global population of this species occurs in that AoA. As such, Dubois' Paa Frog qualifies the Cluster 5 freshwater AoA as Critical Habitat under Criterion 2.

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9. Nepal Lazy Toad (Scutiger nepalensis)
This species is considered globally Near Threatened, and is only known from western Nepal where it occurs in alpine streams in grasslands (IUCN SSC Amphibian Specialist Group 2023b). As such, it is a restricted-range species. Almost 14% of its known range falls within the Cluster 5 freshwater AoA. It is therefore likely that >10% of the global population of this species occurs in that AoA. Given this, Nepal Lazy Toad qualifies the Cluster 5 freshwater AoA as Critical Habitat under Criterion 2.

10. Sphaerotheca maskeyi
This restricted-range frog species is known only from the central and eastern Himalayan foothills of Nepal (Ohler et al. 2004a), but its distribution is poorly known and it is expected to occur more widely. Just over 1% of its known distribution overlaps the Cluster 3 freshwater AoA. It is therefore very unlikely that >10% of the global population of this species occurs in that AoA. As such, Sphaerotheca maskeyi does not qualify the Cluster 3 freshwater AoA as Critical Habitat under Criterion 2.

11. Pseudecheneis eddsi
This restricted-range fish species is considered Data Deficient and only known from the Ganges River drainage in the highlands of central Nepal (Ng 2010b), with more than 11% of its mapped range overlapping the Cluster 4 freshwater AoA. It is therefore quite possible that >10% of the global population of this species occurs in that AoA. On a precautionary basis, Pseudecheneis eddsi likely qualifies the Cluster 4 freshwater AoA as Critical Habitat under Criterion 2.

12. Psilorhynchus nepalensis
This restricted-range fish species is known from tributaries of the Kali Gandaki, central Nepal, and the Kosi River in eastern Nepal, as well as Chitwan National Park (Singh 2010). More than 12% of its mapped range overlaps the Cluster 1 freshwater AoA. It is therefore quite possible that >10% of the global population of this species occurs in that AoA. On a precautionary basis, Psilorhynchus nepalensis likely qualifies the Cluster 1 freshwater AoA as Critical Habitat under Criterion 2.

13. Sisor rheophilus
This restricted-range fish species is considered Data Deficient. It is known from the Ganges River drainage in Uttar Pradesh, but predicted to also occur upstream in Nepal (Ng 2010c), with almost 9% of its mapped range overlapping the Cluster 3 freshwater AoA. It is therefore possible that >10% of the global population of this species occurs in that AoA. On a precautionary basis, Sisor rheophilus might possibly qualify the Cluster 3 freshwater AoA as Critical Habitat under Criterion 2.

14. Chloropetalia selysi
This restricted-range dragonfly species is considered globally Vunerable so is also considered in Section 4.1. More than 10% of its mapped range overlaps the Cluster 4 freshwater AoA. As such, on a precautionary basis, it is assumed that >10% of its population may also occur in that AoA, and that Chloropetalia selysi might possibly qualify the Cluster 4 freshwater AoA as Critical Habitat under Criterion 2.

15. Somatochlora nepalensis
This restricted-range dragonfly species is considered globally Data Deficient, owing to doubts about its taxonomic distinctiveness (Dow 2021). It is only known from four locations in Nepal (Dow 2021), with >45% of its mapped range overlapping the Cluster 5 freshwater AoA and >20% of its range overlapping the Cluster 5 terrestrial AoA. On the basis of current knowledge, it is therefore likely that >10% of the global population of this species occurs in those AoAs. As such, Somatochlora nepalensis qualifies the Cluster 5 freshwater and terrestrial AoAs as Critical Habitat under Criterion 2.

Table 2. Restricted-range species with marginal occurrence in Project AoAs

Biodiversity type	Common name	Scientific name	IUCN Category
• Mammal	Csorba's Mouse-eared Myotis	Myotis csorbai	DD
• Reptile	Himalayan Stripe-necked Snake	Liopeltis rappi	LC
• Reptile	Nagarkot Kukri Snake	Oligodon erythrogaster	NT
• Reptile	Habu Pit Viper	Protobothrops himalayanus	LC
• Reptile	Tibetan Pit Viper	Trimeresurus tibetanus	LC
• Fish		Pseudecheneis crassicauda	DD
• Fish	Nepalese Snowtrout	Schizothorax macrophthalmus	LC
• Fish	Rara Snowtrout	Schizothorax raraensis	CR
• Odonates		Idionyx stevensi	LC
• Odonates		Macromia sombui	DD
• Plant	Patwa	Meizotropis pellita	CR

11. Migratory or congregatory species

- Many freshwater species and birds in Nepal are migratory, owing to the country's high topographic variability and seasonal availability of resources at higher altitudes. Not all of these geographically aggregate on migration, in the sense that this Critical Habitat criterion is intended for application (IFC 2019). For example, vultures in Nepal are typically altitudinal migrants over a broad front. Such species are not considered in more detail in this section as they are not considered likely to qualify sites as Critical Habitat as migratory/congregatory species per se.
- Comparison with IUCN Red List Extent of Occurrence maps identified the potential for 316 migratory and/or congregatory species to occur in the Project AoA for Cluster 1, 215 in Cluster 2, 285 in Cluster 3, 271 in Cluster 4, and 240 in Cluster 5. While these included many migratory bird species, IBAs were taken as representative of priority areas for migratory and congregatory species. Ten IBAs for migratory birds have been identified in Nepal (Baral & Inskipp 2005), of which three are overlapped by Project avian AoAs, namely: Chitwan National Park IBA (Cluster 1); Farmlands in Lumbini area IBA (Cluster 1); and Jagdishpur Reservoir IBA (Cluster 1). Most of these sites were identified some time ago, under old IBA criteria, and it appears unlikely that they hold sufficient concentrations of migratory or congregatory species to qualify as Critical Habitat (>1% of the global population). However, two bird species are assessed in more detail below.

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- For species other than birds, migratory and congregatory species were identified by consultation of IUCN Red List accounts. Criterion 3 is focused on short-term aggregations of individuals, which cannot easily be identified (unlike Criteria 1 and 2) by assessing the percentage of a species' range in an AoA. Nonetheless, given the very rapid nature of this assessment, a rapid screening of migratory and congregatory species was undertaken to focus the assessment on those species which do overlap the Project AoAs by more than 1%. Through this process, eight migratory/congregatory fish species were considered to have potential to qualify Project AoAs as Critical Habitat, and so are assessed in more detail (below). This assessment remains precautionary, as global good practice is to only identify Critical Habitat for migratory species where an area represents a particular bottleneck along the migration flyway, is used as a resting area during migration, or is an area that migratory habits would lead to regular interaction with Project infrastructure (Sercx et al. 2018). This latter factor is not relevant for the fish species listed below, as no Project infrastructure directly impacts freshwater habitats.
- Given the coarse screening necessary during this rapid assessment, it is possible that some excluded migratory/congregatory species may qualify the Project AoAs as Critical Habitat under Criterion 3. It is unlikely, however, that the Project poses significant risk to these species as it has a relatively small footprint and few of the species (with some exceptions such as birds and Indian Flying Fox) are very susceptible to collisions with powerlines.

1. Bengal Florican (Leptoptilos javanicus)
This migratory species is considered globally Critically Endangered (BirdLife International 2023g), so is also assessed in Section 4.1. protected area is overlapped by two Project avian AoAs. More than 2.5% of the species' mapped global range overlaps the avian AoA for Cluster 1, and almost 1.2% the avian AoA for Cluster 3. Further, the range within the Cluster 1 avian AoA includes potential breeding areas, and overlaps Chitwan National Park. Even given dramatically decreasing populations of the species in Nepal, these are reflected through much of the range and even the very small population in this AoA may well represent >1% of the global population of the species. As such, the Cluster 1 avian AoA qualifies as Critical Habitat for Bengal Florican under Criterion 1.

2. Lesser Adjutant (Leptoptilos javanicus)
This congregatory species is considered globally Near Threatened. It occurs across South and South-East Asia, but has a global population that may be as low as 5,500 mature individuals (BirdLife International 2023o). Approximately 47 nests (1.8% of this minimum mature individual estimate) and 228 individuals were found in/around Chitwan National Park by Poudyal & Nepal (2016). This protected area is overlapped by the Cluster 1 avian AoA. While more up-to-date data are not available, it seems likely that the Cluster 1 avian AoA represents Critical Habitat for Lesser Adjutant under Criterion 3.

3. Kalabans (Bangana dero)
This migratory species is considered globally of Least Concern, and is known from the Ganga and Brahmaputra drainages of northern and northeastern India, Nepal and Bangladesh (Vishwanath 2010a), with >3% of its mapped range overlapping the Cluster 1 freshwater AoA. During a rapid assessment of this type, it is precautionary to assume this figure indicates potential migratory concentrations, and therefore that the Cluster 1 freshwater AoA may well represent Critical Habitat for Kalabans under Criterion 3.

4. Chagunius chagunio
This migratory species is considered globally of Least Concern, and is known from the Ganga and Brahmaputra drainages of northern and northeastern India, Nepal and Bangladesh (Vishwanath 2010b), with >1% of its mapped range overlapping the Cluster 1 freshwater AoA and almost 3% overlapping the Cluster 4 freshwater AoA. During a rapid assessment of this type, it is precautionary to assume these figures indicate potential migratory concentrations, and therefore that the Cluster 1 and 4 freshwater AoAs might possibly represent Critical Habitat for Chagunius chagunio under Criterion 3.

5. Annandale Garra (Garra annandalei)
This migratory species is considered globally of Least Concern, and is known from India, Nepal and Bangladesh (Rayamajhi & Jha 2010), with >1.7% of its mapped range overlapping the Cluster 1 freshwater AoA. During a rapid assessment of this type, it is precautionary to assume these figures indicate potential migratory concentrations, and therefore that the Cluster 1 freshwater AoA might possibly represent Critical Habitat for Annandale Garra under Criterion 3.

6. Deocata Pipefish (Microphis deocata)
This globally Near Threatened migratory species is known from the Ganges and Brahmaputra River drainages in India, West Bengal, Bihar, Assam, Uttar Pradesh) and Bangladesh, and predicted from Nepal (Pollom 2017) – where almost 1.5% of its mapped range overlaps the Cluster 1 freshwater AoA. Since the mapped range in Nepal appears to be entirely predicted (freshwater species are mapped at a watershed level), and the total extent is only just above Critical Habitat thresholds for migratory species, this species is not considered likely to qualify the Project as Critical Habitat.

7. Rainbow Minnow (Psilorhynchus gracilis)
This species is an altitudinal migrant, considered globally of Least Concern, and known from northeastern India, Nepal and Bangladesh (Dahanukar 2010a), with >1% of its mapped range overlapping the Cluster 1 freshwater AoA and just under 0.9% the Cluster 3 freshwater AoA. During a rapid assessment of this type, it is precautionary to assume these figures indicate potential migratory concentrations, and therefore that the Cluster 1 and 3 freshwater AoAs might possibly represent Critical Habitat for Rainbow Minnow under Criterion 3.

8. Stone Carp (Psilorhynchus pseudecheneis)
This migratory species is considered globally of Least Concern, and is known from eastern Nepal and northern India (Dahanukar 2010b), with almost 7% of its mapped range overlapping the Cluster 1 freshwater AoA. During a rapid assessment of this type, it is precautionary to assume these figures indicate potential migratory concentrations, and therefore that the Cluster 1 freshwater AoA may well represent Critical Habitat for Stone Carp under Criterion 3.

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9. River Stone Carp (Psilorhynchus sucatio)
This species is an altitudinal migrant, considered globally of Least Concern, and known from northeastern India, Nepal and Bangladesh (Dahanukar 2010c), with >1.5% of its mapped range overlapping the Cluster 3 freshwater AoA. During a rapid assessment of this type, it is precautionary to assume these figures indicate potential migratory concentrations, and therefore that the Cluster 3 freshwater AoA might possibly represent Critical Habitat for River Stone Carp under Criterion 3.

10. Mahseer (Tor tor)
This migratory species is considered globally Data Deficient, because of uncertainty on its taxonomy and therefore its overall distribution (Rayamajhi et al. 2018). At present, it is believed to occur in the southern Himalayan foothills and drainages of Nepal and India.
More than 4% of the species' mapped range overlaps the Cluster 1 freshwater AoA. Despite a lack of clarity on the overall distribution of the species, during a rapid assessment of this type it is precautionary to assume this figure indicates potential migratory concentrations within the Project area, and therefore that the Cluster 1 freshwater AoA might possibly represent Critical Habitat for Mahseer under Criterion 3.

12. Unique assemblages of species that are associated with key evolutionary processes

- As noted in Section 4.2, the Himalaya is an area of very high endemism. Nonetheless, many of these species have relatively long linear distributions within the Himalaya (so, for example, Nepal has surprisingly few endemic species).
- Wikramanayake et al. (2002) rank global ecoregions according to biological distinctiveness, including endemism. Project infrastructure overlaps six ecoregions: Eastern Himalayan broadleaf forests (Cluster 4); Himalayan subtropical broadleaf forests (Clusters 1, 2 & 5); Himalayan subtropical pine forests (Clusters 4 & 5); Terai-Duar savanna and grasslands (Clusters 1 & 3); Western Himalayan subalpine conifer forests (Cluster 5); and Western Himalayan broadleaf forests (Cluster 5). Of these, two ecoregions are considered 'Globally Outstanding' for biological distinctiveness. The Terai-Duar savanna and grasslands ecoregion is considered so distinctive owing to some of the highest densities of large mammal populations in Asia. However, the Eastern Himalayan broadleaf forests ecoregion is considered one of the few Indo-Pacific ecoregions that are globally outstanding for both species richness and endemism. The complex topography and geological history of the Himalaya are very much associated with key evolutionary processes.
- Given the globally outstanding endemism of the Eastern Himalayan broadleaf forests ecoregion, the Cluster 4 terrestrial AoA qualifies the Project area as Critical Habitat for unique assemblages of species associated with key evolutionary processes.
- From a freshwater perspective, the project overlaps two ecoregions: the Ganges Himalayan Foothills; and the Ganges Delta & Plain (Abell et al. 2008). Each of these is listed as holding 11 endemic fish species, a relatively low number within the global context (Abell et al. 2008). As such, neither freshwater ecoregion can be considered to hold particularly unique assemblages of species associated with key evolutionary processes.

13. 4.5 Areas having biodiversity of significant social, economic, or cultural importance to local communities (including ecosystem services)

- During this rapid assessment, very little information was available from the Project on ecosystem services. Subsistence hunting is illegal in Nepal, but still persists at a low level, and fishing and use of non-timber forest products are widespread and common. In particular, use of natural fodder and firewood remains common in Nepal – particularly in montane areas. Several national systems of land management explicitly recognize the value of provisioning services to local communities, including the system of community forests, and the Chure Hills Environmental Protection Area

(Section 4.6), both of which have the primary goal of sustainable natural resource use. There are also strong cultural attachments to biodiversity in many parts of Nepal, with sacred groves regularly identified and certain species considered of strong cultural value[2].

- It is beyond the scope of this rapid assessment to collect additional information on ecosystem services, and then to assess which may qualify the Project area as Critical Habitat. Nonetheless, the high rural population in Nepal, the high poverty levels, consequent high dependence on natural resources, and high cultural attachment to biodiversity in the country, all suggest it is extremely likely that many or all Project AoAs would qualify as Critical Habitat on the basis of ecosystem service values.

14. Legally protected areas and international recognized areas

- ADB recognizes that legally-protected and internationally-recognized areas may be Critical Habitat. IFC (2019) provides specific and more restrictive guidance, stating that "…certain internationally recognized areas of high biodiversity value may be recognized as Critical Habitat and should be given special attention during assessments…" including "Areas that meet the criteria of the IUCN's Protected Areas Categories Ia, Ib and II…".
- At least 19 protected area designations are overlapped by, or fall within, the Project AoAs (Table 3: IBAT[3]; Figure 2) – counting separately the overlapping Chitwan National Park and World Heritage Site, and protected areas and their buffer zones (which are listed separately by the Government of Nepal).
- ADB (2009) states that "Critical habitats include those areas either legally protected or officially proposed for protection, such as areas that meet the criteria of the Word [sic] Conservation Union classification…"). However, ADB broadly aligns with IFC (2019) in not automatically considering protected areas as Critical Habitat-qualifying. Following IFC (2019), sites aligned with IUCN protected area Category I or II are considered to qualify the AoA as Critical Habitat. Sites aligned with other IUCN protected area categories are considered on a case-by-case basis to assess whether they contain biodiversity sufficient to qualify the AoA as Critical Habitat. Recognizing, however that insufficient data are often available to make such an assessment – particularly on as broad a scale assessment as the current one – a precautionary approach is taken, whereby sites aligned with IUCN protected areas Category III-VI are considered to potentially be Critical Habitat if no data are available (recognizing that they were at least national/State priorities at the time of their designation).

- Official protected area data[4] appear to omit other sites which have been designated for some time, such as the Chure Hills Environmental Protection Area (this is also referred to as the Chure Hills Conservation Area but has a different protected area status to a conservation area: details in, e.g., Bishwokarma et al. 2016; Government of Nepal 2017; NEA 2020). It is thus possible that additional protected areas overlap the Project AoAs. However, it is likely that most of these are relatively recent sustainable use and/or co-management areas which would represent IUCN Category VI sites. Likewise, information on protected forests was not readily available during this assessment, but it is recognized that some of these are also likely to overlap the Project AoAs. Protected forests in Nepal likely equate to IUCN Category VI sites.

[2] E.g., https://visitworldheritage.com/en/buddha/buddha-and-the-sarus-crane/f008726c-a6ff-4d5c-a06f-ec7d61ea4d47.
[3] www.ibat-alliance.org.
[4] E.g., at www.protectedplanet.net.

Table 3. Protected areas overlapping, or falling within, Project AoAs

Name	Type	IUCN Category	Critical Habitat	Project components overlap PAs	Project Cluster AoAs overlapping PAs
Banke	National Park	II	Yes	No	1 (avian, freshwater)
Banke	National Park Buffer Zone	VI	Yes, as part of the Dang Deukhuri Foothill Forests and West Rapti Wetlands KBA (Table 4)	No	1 (avian, freshwater)
Bara	Conservation Area	VI?[5]	No?	No	3 (avian, freshwater, terrestrial)
Chitwan	National Park	II	Yes	No	1 (avian)
Chitwan	National Park Buffer Zone	VI	Yes, as part of a KBA (Table 4)	No	1 (avian, freshwater)
Chitwan	World Heritage Site	n/a	Yes, as part of a KBA (Table 4)	No	1 (avian)
Chure Hills	Environmental Protection Area	VI	At least in part, as overlaps a number of sites important for biodiversity, e.g. the Dang Deukhuri Foothill Forests and West Rapti Wetlands KBA (Table 4)	Yes (Cluster 1)	1 (avian, freshwater, terrestrial); 3 (avian, freshwater, terrestrial); 5 (avian)
Langtang	National Park	II	Yes	No	4 (freshwater)
Langtang	National Park Buffer Zone	VI	Yes?, as part of a KBA (Table 4)	No	4 (avian, freshwater)
Parsa[6]	National Park	II	Yes	No	3 (avian, freshwater)
Parsa	National Park Buffer Zone	VI	Yes, as part of a KBA (Table 4)	No	3 (avian, freshwater, terrestrial)
Phulchoki	Conservation Area	VI?[7]	No?	No	4 (avian, freshwater)
Rara	National Park	II	Yes	No	5 (avian, freshwater)
Rara	National Park Buffer Zone	VI	No	No	5 (avian, freshwater)
Shey-Phoksundo	National Park Buffer Zone	VI	No	No	5 (freshwater)
Shivapuri-Nagarjun	National Park	II	Yes	No	4 (avian, freshwater, terrestrial)
Shivapuri-Nagarjun	National Park Buffer Zone	VI	No	Yes	4 (avian, freshwater, terrestrial)
Sohagibarwa (India)	Wildlife Sanctuary	IV?[8]	No	No	1 (avian, freshwater)
Soheldev (India)	Wildlife Sanctuary	IV?[7]	No	No	1 (avian)

[5] The IUCN management category for Bara and Phulchoki Conservation Areas does not appear to have been declared, but it is here assumed to be the same as for other conservation areas in Nepal.
[6] Parsa has been upgraded to an IUCN Category II National Park (Government of Nepal undated).
[7] The IUCN management category for Bara and Phulchoki Conservation Areas does not appear to have been declared, but it is here assumed to be the same as for other conservation areas in Nepal.
[8] Details are not available for this protected area, but Wildlife Sanctuaries in India are usually classed as IUCN Category IV.

Figure 2a. Map of assessed Project Cluster 1 infrastructure and protected areas

Imagery Sources: OpenStreetMap (2023); protected area data downloaded from the Integrated Biodiversity Assessment Tool (IBAT) provided by BirdLife International, Conservation International, IUCN and UNEP-WCMC.

Figure 2b. Map of assessed Project Cluster 2 infrastructure and protected areas

Imagery Sources: OpenStreetMap (2023); protected area data downloaded from the Integrated Biodiversity Assessment Tool (IBAT) provided by BirdLife International, Conservation International, IUCN and UNEP-WCMC.

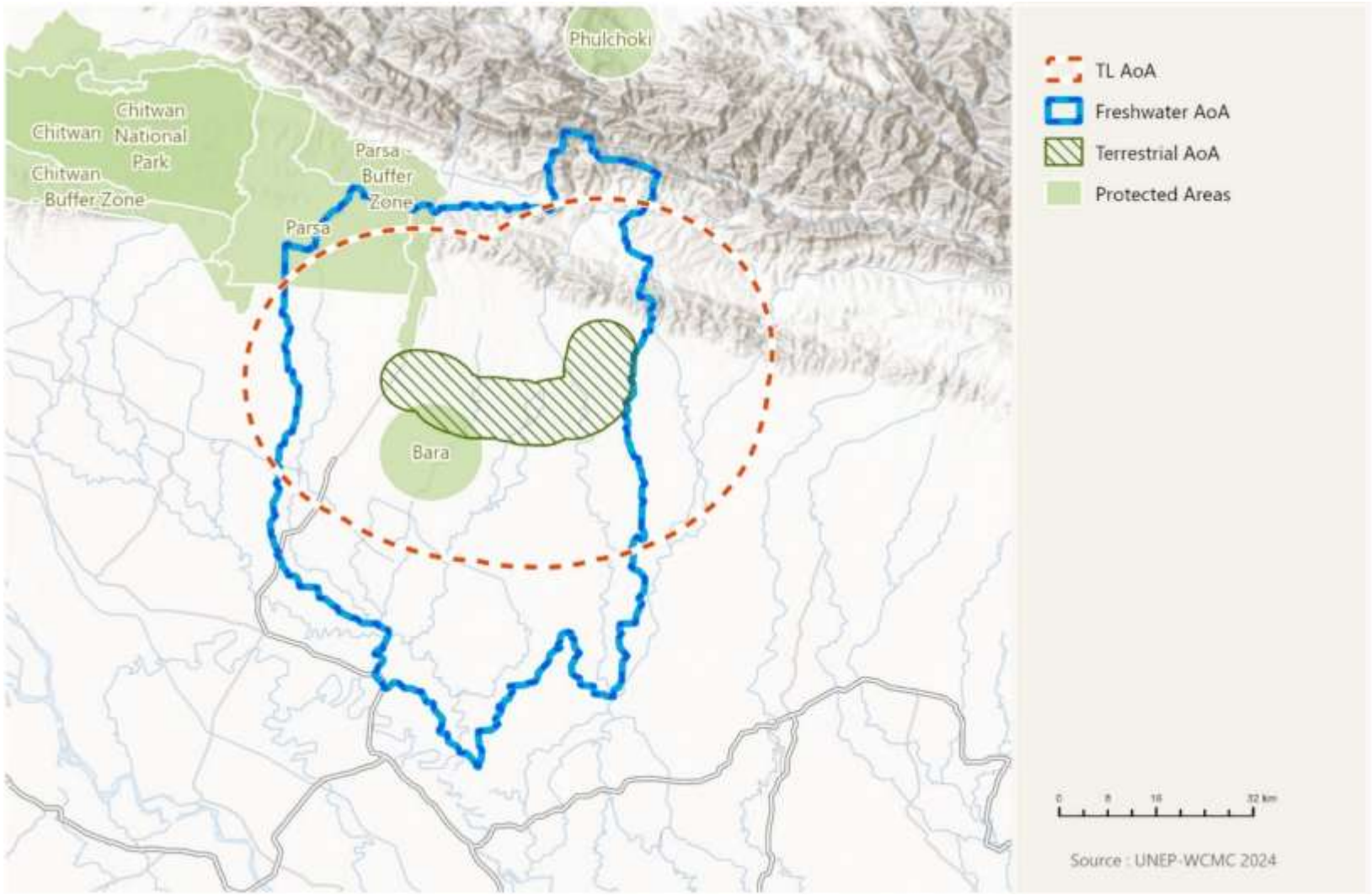

Figure 2c. Map of assessed Project Cluster 3 infrastructure and protected areas

Imagery Sources: OpenStreetMap (2023); protected area data downloaded from the Integrated Biodiversity Assessment Tool (IBAT) provided by BirdLife International, Conservation International, IUCN and UNEP-WCMC.

Figure 2d. Map of assessed Project Cluster 4 infrastructure and protected areas

Imagery Sources: OpenStreetMap (2023); protected area data downloaded from the Integrated Biodiversity Assessment Tool (IBAT) provided by BirdLife International, Conservation International, IUCN and UNEP-WCMC.

Figure 2e. Map of assessed Project Cluster 5 infrastructure and protected areas

Imagery Sources: OpenStreetMap (2023); protected area data downloaded from the Integrated Biodiversity Assessment Tool (IBAT) provided by BirdLife International, Conservation International, IUCN and UNEP-WCMC.

- IFC (2019) also states that '…certain internationally recognized areas of high biodiversity value may be recognized as Critical Habitat and should be given special attention during assessments…' including 'Key Biodiversity Areas (KBAs), which encompass Important Bird and Biodiversity Areas (IBAs)…'. 15 internationally-recognized KBAs are overlapped by, or fall within, the Project AoAs (Table 4; Figure 3). All but two of these (Gainda Tal and Shivapur Forest) are considered Important Bird Areas (IBAs), and all except seven (Farmlands in Lumbini area, Jiang Cun and Girijapur Barrage, Nawalparasi forests, Rara National Park, Sohagibarwa Wildlife Sanctuary, and Soheldev Wildlife Sanctuary) are also KBAs for species other than birds.

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Table 4. Important Bird Areas/Key Biodiversity Areas overlapping, or falling within, the Project AoA

Name	Also a protected area?	Reference	Critical Habitat as an IBA/KBA alone?	Project components overlap KBAs	Project Cluster AoAs overlapping KBAs
Chitwan National Park	Yes	KBA Partnership (2023b)	Yes	No	1 (avian, freshwater)
Dang Deukhuri Foothill Forests and West Rapti Wetlands	Partly	KBA Partnership (2023c)	Yes	Yes	1 (avian, freshwater, terrestrial)
Farmlands in Lumbini area	No	KBA Partnership (2023d)	Yes?	No	1 (avian, freshwater)
Gainda Tal	No	KBA Partnership (2023e)	No	No	1 (avian, freshwater, terrestrial)
Jagdishpur Reservoir	No	KBA Partnership (2023f)	No	No	1 (avian, freshwater)
Jiang Cun (PRC)	Partly	KBA Partnership (2023g)	No	No	4 (freshwater)
Langtang National Park	Yes	KBA Partnership (2023i)	Yes?	No	4 (avian, freshwater)
Nawalparasi forests	No	KBA Partnership (2023j)	Yes	No	1 (avian, freshwater, terrestrial)
Parsa Wildlife Reserve[9]	Yes	KBA Partnership (2023k)	Yes	No	3 (avian, freshwater, terrestrial)[10]
Phulchoki Mountain forests	Yes	KBA Partnership (2023l)	No	No	4 (avian, freshwater)
Rara National Park	Yes	KBA Partnership (2023m)	No	No	5 (avian, freshwater)
Shivapur Forest	No	KBA Partnership (2023n)	No	Yes	1 (avian, freshwater, terrestrial)
Shivapuri-Nagarjun National Park	Yes	KBA Partnership (2023o)	No	No[11]	4 (avian, freshwater, terrestrial)
Sohagibarwa Wildlife Sanctuary (India)	Yes	KBA Partnership (2023p)	No	No	1 (avian, freshwater)
Soheldev Wildlife Sanctuary (India)	Yes	KBA Partnership (2023q)	No	No	1 (avian)

[9] The existing name for this IBA/KBA is used, despite the protected area since being upgraded to a national park (Government of Nepal undated).
[10] The published IBA/KBA (KBA Partnership 2023k) only currently includes the previous protected area boundary, before expansion, but will be updated in future (per Bird Conservation Nepal).
[11] IBAT data show an overlap, but it is clear that the KBA has been offset, should instead align with PA boundaries, and that there is thus no actual overlap.

Figure 3a. Map of assessed Project Cluster 1 infrastructure and Key Biodiversity Areas

Imagery Sources: OpenStreetMap (2023); Key Biodiversity Area data downloaded from the Integrated Biodiversity Assessment Tool (IBAT) provided by BirdLife International, Conservation International, IUCN and UNEP-WCMC.

Figure 3b. Map of assessed Project Cluster 2 infrastructure and Key Biodiversity Areas

Imagery Sources: OpenStreetMap (2023); Key Biodiversity Area data downloaded from the Integrated Biodiversity Assessment Tool (IBAT) provided by BirdLife International, Conservation International, IUCN and UNEP-WCMC.

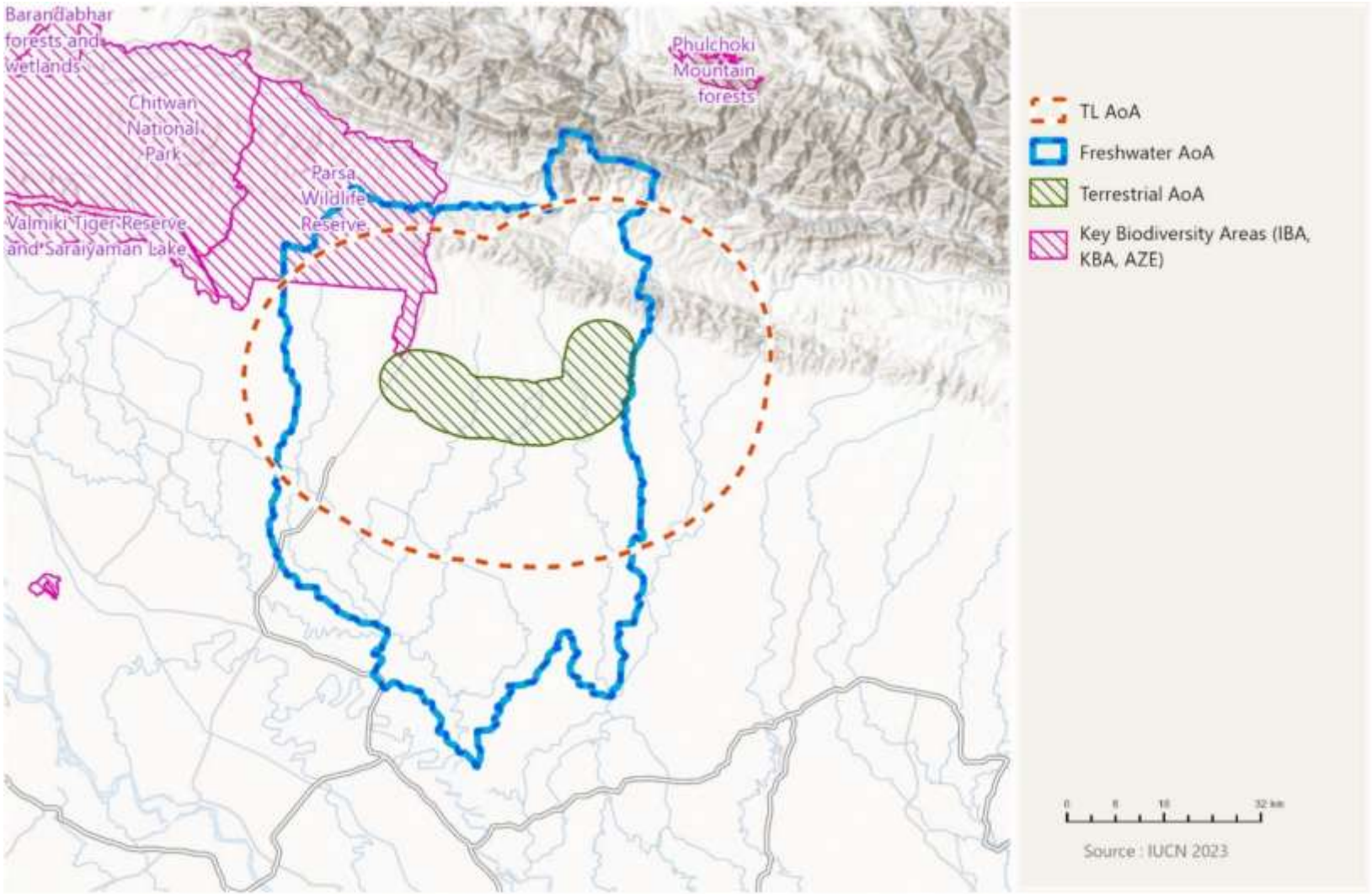

Figure 3c. Map of assessed Project Cluster 3 infrastructure and Key Biodiversity Areas

Imagery Sources: OpenStreetMap (2023); Key Biodiversity Area data downloaded from the Integrated Biodiversity Assessment Tool (IBAT) provided by BirdLife International, Conservation International, IUCN and UNEP-WCMC.

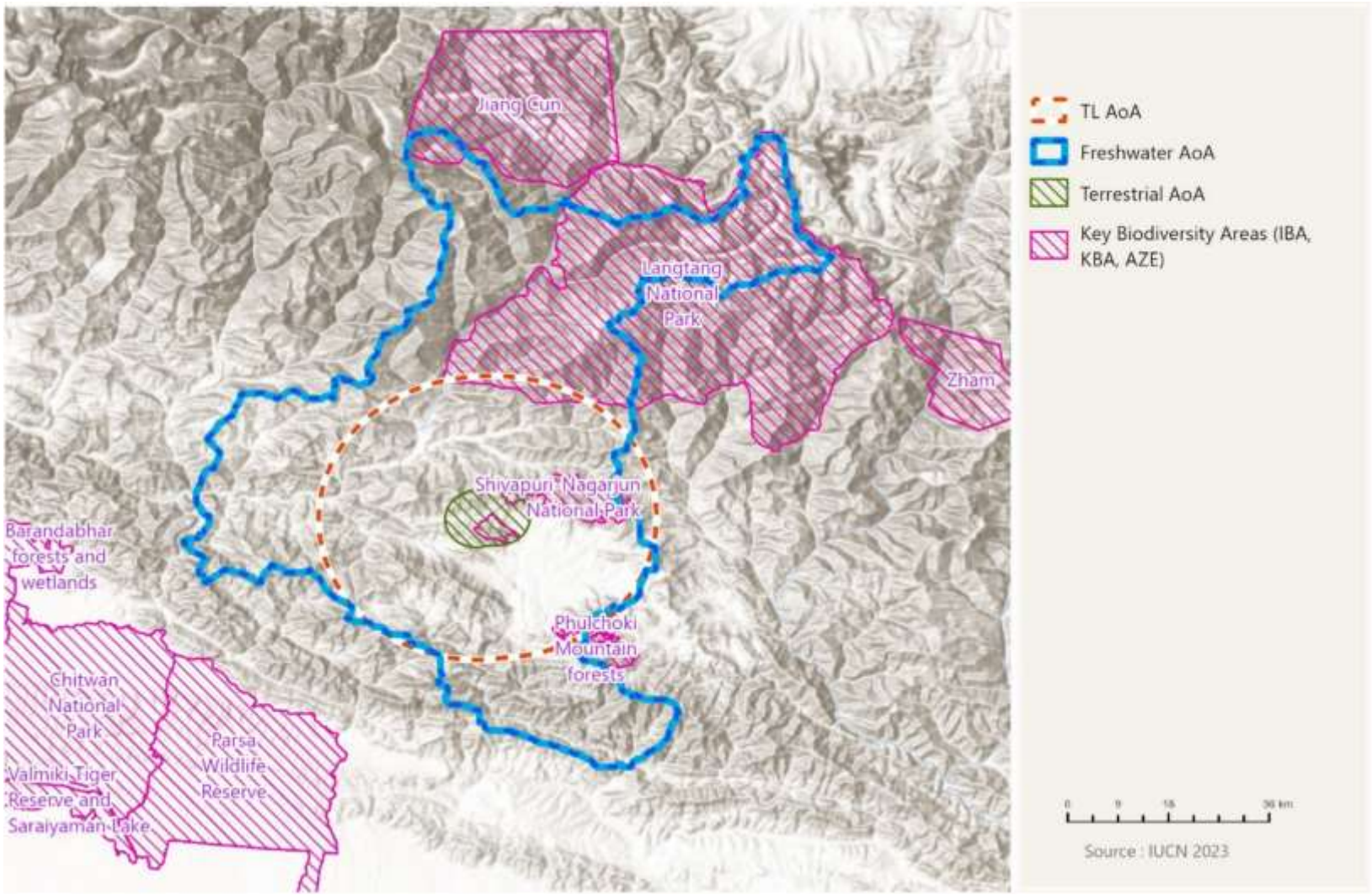

Figure 3d. Map of assessed Project Cluster 4 infrastructure and Key Biodiversity Areas

Imagery Sources: OpenStreetMap (2023); Key Biodiversity Area data downloaded from the Integrated Biodiversity Assessment Tool (IBAT) provided by BirdLife International, Conservation International, IUCN and UNEP-WCMC.

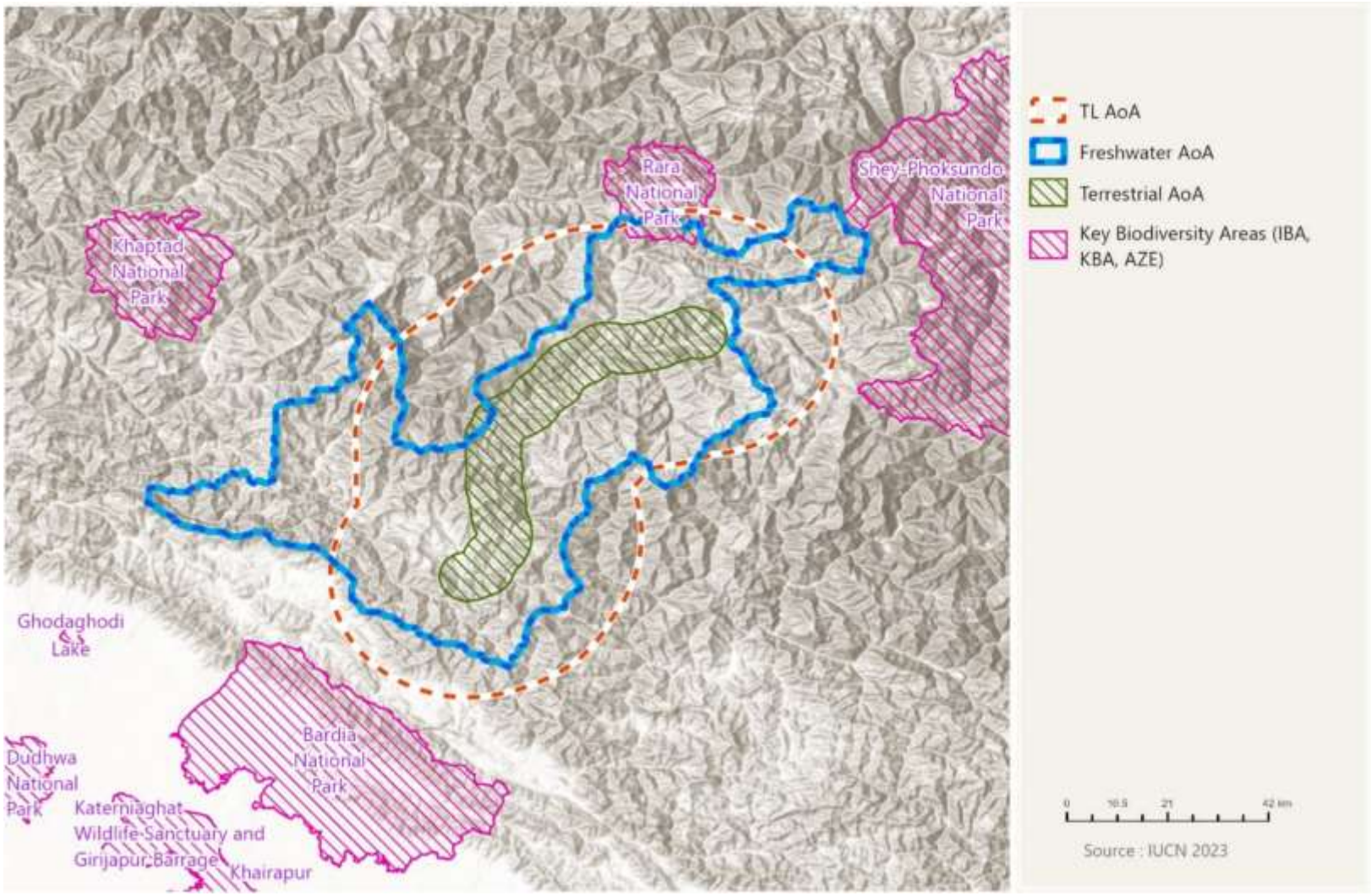

Figure 3e. Map of assessed Project Cluster 5 infrastructure and Key Biodiversity Areas

Imagery Sources: OpenStreetMap (2023); Key Biodiversity Area data downloaded from the Integrated Biodiversity Assessment Tool (IBAT) provided by BirdLife International, Conservation International, IUCN and UNEP-WCMC.

1. Chitwan National Park Key Biodiversity Area

This protected area was identified as a KBA for a number of biome-restricted and threatened species, including two globally Critically Endangered birds (White-rumped Vulture Gyps bengalensis and Slender-billed Vulture Gyps tenuirostris), three Endangered mammals (Asian Elephant Elephas maximus, Tiger Panthera tigris and Ganges River Dolphin Platanista gangetica), two Endangered birds (Bengal Florican Houbaropsis bengalensis and Lesser Florican Sypheotides indicus, two Critically Endangered reptiles (Gharial Gavialis gangeticus and Elongated Tortoise Indotestudo elongata), and a number of Vulnerable species – including 23 birds (KBA Partnership 2023b).

Most of the Vulnerable species qualify the site as Critical Habitat under current criteria (IFC 2019) because they would not merit up-listing to Endangered if the site was lost. However, Chitwan holds about a quarter of the global population of Indian Rhinoceros (Ellis & Talukdar 2019), and so Indian Rhinoceros qualifies the Chitwan National Park KBA as Critical Habitat.

Even Nepal as a whole is not thought to hold >0.5% of the global population of Asian Elephant (Williams 2020), and Chitwan only holds a very small population of Ganges River Dolphin (Adhikari 2019), and small numbers of visiting Greater Adjutant (BirdLife International 2023o) and only irregular visits of Lesser Florican. However, a number of other threatened species do qualify the site as Critical Habitat.

White-rumped Vulture is regularly recorded in numbers near or above thresholds for qualifying the site as Critical Habitat and, on a precautionary basis, it is possible Slender-billed Vulture also still occurs here in numbers qualifying the site as Critical Habitat (e.g., Chaudhary 2020; Joshi 2022; Mahato 2023; Rana 2023). It is also likely that Bengal Florican qualifies the Chitwan National Park KBA as Critical Habitat (Section 4.1).

Chitwan held at least 85 Tiger in 2018, representing 1.5-2.3% of the global population (Goodrich et al. 2022), so Tiger qualifies Chitwan National Park KBA as Critical Habitat.

Chitwan is estimated to hold 40-60 Gharial, representing 4-20% of the global population (Lang et al. 2019), so Gharial qualifies Chitwan National Park KBA as Critical Habitat.

Given limited information on its populations and distribution, it is also possible that Elongated Tortoise occurs at the site in globally-significant numbers, qualifying it as Critical Habitat.

Chitwan is also an IUCN Category II protected area and thus represents Critical Habitat on that basis (see above).

2. Dang Deukhuri Foothill Forests and West Rapti Wetlands Key Biodiversity Area

This area is substantially overlapped by part of the Chure Hills Environmental Protection Area. Very little information exists on the biodiversity of this area, in part owing to the security situation (BirdLife International 2023a). It is clear, however, that it is important for vultures, and it represents Critical Habitat for at least one, and potentially two, Critically Endangered vulture species. As a result, Dang District was declared the first Diclofenac Free District in Nepal in 2010 (Nepali et al. 2019). In 2003, a partial survey found 51 occupied White-rumped Vulture Gyps bengalensis nests, and it appears that more than 80 have been recorded in Dang District since (Rana et al. 2019). These represent the largest population in Nepal, and the species also remains common just across the international border (Tiwari 2017).

Shrestha & Devkota (2011) also recorded 21 Slender-billed Vulture Gyps tenuirostris from the area in 2009. Though there have been many fewer recent records, the species has also bred at the site (Bhusal et al. 2019), and up to four have been recorded recently just across the international border (Tiwari 2017). On a precautionary basis, it is possible that more than 10 individuals may be present

at the site, representing >0.5% of the global population (BirdLife International 2023f) and thus meeting Critical Habitat thresholds.

The site is also listed as important for Red-headed Vulture Sarcogyps calvus (BirdLife International 2023a). To qualify the area as Critical Habitat, >0.5% of the global population of this Critically Endangered species would need to occur there (IFC 2019). Based on the most recent global population estimates (BirdLife International 2023h), this equates to at least 18 or 19 adults. Shrestha & Devkota (2011) recorded 10 in 2009, but there appear to be few recent records of significant numbers at the site – or in neighboring India[12]. It thus seems unlikely that this site qualifies as Critical Habitat for this species.

KBA Partnership (2023c) also lists this site as a KBA for Smooth-coated Otter Lutrogale perspicillata and Tiger. The former does not meet Critical Habitat criteria (IFC 2019) because it is unlikely to merit up-listing to Endangered if the site was lost. The latter is unlikely to still occur at this site in significant numbers, as it was not identified as a source site for the species (Walston et al. 2010).

3. Farmlands in Lumbini area Key Biodiversity Area

This site was identified as a KBA for a number of biome-restricted species, as well as for two globally Critically Endangered birds (White-rumped Vulture Gyps bengalensis and Slender-billed Vulture Gyps tenuirostris) and six Vulnerable birds (KBA Partnership 2023d). None of the Vulnerable species qualify the site as Critical Habitat under current criteria (IFC 2019) because they would not merit up-listing to Endangered if the site was lost. However, both vulture species have recently been recorded in significant numbers (e.g., Desrochers 1017; Giri 2022; Gonelli 2018; Mulmi 2023), and so this KBA is likely to represent Critical Habitat for White-rumped and possibly also for Slender-billed Vulture.

4. Gainda Tal Key Biodiversity Area

This site was identified as a KBA solely for Indian Eyed Turtle Morenia petersi (KBA Partnership 2023e). However, even the loss of the site would be unlikely to result in up-listing of this Vulnerable species to Endangered (per IFC 2019), and so the site does not qualify as Critical Habitat.

5. Jagdishpur Reservoir Key Biodiversity Area

This qualifies as a KBA for a number of wetland species (including three Vulnerable birds and one reptile), as well as for two globally Critically Endangered birds (White-rumped Vulture Gyps bengalensis and Slender-billed Vulture Gyps tenuirostris) (KBA Partnership 2023f). None of the Vulnerable species qualify the site as Critical Habitat under current criteria (IFC 2019) because they would not merit up-listing to Endangered if the site was lost.

While Slender-billed Vulture does not appear to have been seen at the site in recent years, significant numbers of White-rumped Vulture have still been recorded at the site recently (e.g., Acharya 2021; Shrestha et al. 2023). Nonetheless, these seem unlikely to reach Critical Habitat thresholds of 0.5% of the population, i.e. upwards of 20 individuals (BirdLife International 2023e).

This site therefore does not qualify as Critical Habitat.

[12] E.g., at www.ebird.org.

6. Jiang Cun Key Biodiversity Area (PRC)

This site was listed as a KBA solely for the Near Threatened Tragopan satyra (KBA Partnership 2023g). It thus does not meet Critical Habitat criteria (IFC 2019).

7. Langtang National Park Key Biodiversity Area

This site is listed as important for the Critically Endangered Red-headed Vulture Sarcogyps calvus and Yellow-breasted Bunting Emberiza aureola (KBA Partnership 2023i), but there appear to be very few recent records of either species from the area[13].

KBA Partnership (2023i) also lists the site as important for the Endangered Red Panda Ailurus fulgens. The site is believed to hold just over 24% of the population of this species in Nepal, which in turn is believed to hold just under 2% of the global population (Government of Nepal 2010). On a precautionary basis, the site may thus hold >0.5% of the global population. Therefore, Langtang may well qualify as Critical Habitat for Red Panda.

This is an important site for the Vulnerable Wood Snipe Gallinago nemoricola (BirdLife International 2023c; KBA Partnership 2023i), but this and other Vulnerable species stated to qualify this site as a KBA (Asiatic Black Bear Ursus thibetanus, Sunda Clouded Leopard Neofelis diardi [formerly considered part of Clouded Leopard Neofelis nebulosa]). Greater Spotted Eagle Clanga clanga and Eastern Imperial Eagle Aquila heliaca) do not meet Critical Habitat criteria (IFC 2019) because they would not merit up-listing to Endangered if the site was lost

The site also holds good numbers of two species - Hoary-throated Barwing Sibia nipalensis and Nepal Cupwing Pnoepyga immaculata – which previously qualified as restricted-range species (BirdLife International 2023c), but are now known to be more widespread.

Langtang is also an IUCN Category II protected area and thus represents Critical Habitat on that basis (see above).

8. Nawalparasi forests Key Biodiversity Area

This site is listed as a KBA for two globally Critically Endangered birds (White-rumped Vulture Gyps bengalensis and Slender-billed Vulture Gyps tenuirostris) and two Vulnerable birds (KBA Partnership 2023j). There appear to be too few recent records for the latter species to qualify the area as Critical Habitat, but Critical Habitat-qualifying concentrations of White-rumped Vulture remained in the area – at least until recently (Pohkrel 2021). On a precautionary basis, Nawalparasi is considered to still represent Critical Habitat for White-rumped Vulture. The Vulnerable species do not meet Critical Habitat criteria (IFC 2019) because they would not merit up-listing to Endangered if the site was lost.

9. Parsa Wildlife Reserve Key Biodiversity Area

The existing name for this IBA/KBA is used here for consistency, despite the site being since upgraded to a national park (Government of Nepal undated). In 2016, Parsa was estimated to hold at least 17 Tiger Panthera tigris (Lamichhane et al. 2018), representing at most just over 0.4% of the estimated global number of adults of this species (Goodrich et al. 2022). As such, it is likely that Parsa does not represent Critical Habitat for Tiger.

Given limited information on its populations and distribution, it is possible that Elongated Tortoise occurs at the site in globally-significant numbers, qualifying it as Critical Habitat.

[13] E.g., at www.ebird.org.

Small numbers of Critically Endangered White-rumped Vulture Gyps bengalensis and Slender-billed Vulture Gyps tenuirostris are still regularly recorded at neighboring Chitwan National Park, but it seems unlikely that a large enough population of either species currently persists at Parsa to qualify it as Critical Habitat. Likewise, given the small population of Asian Elephant Elephas maximus in Nepal compared to the global population, it is highly unlikely that Parsa qualifies as Critical Habitat for these species.

The site is also important for several Vulnerable species (KBA Partnership 2023k) which do not meet Critical Habitat criteria (IFC 2019) because they would not merit up-listing to Endangered if the site was lost (Gaur Bos gaurus, Four-horned Antelope Tetracerus quadricornis, Dhole Cuon alpinus, Sloth Bear Melursus ursinus, Indian Rhinoceros Rhinoceros unicornis, Great Hornbill Buceros bicornis, and Grey-crowned Prinia Prinia cinereocapilla).

Parsa is also an IUCN Category II protected area and thus represents Critical Habitat on that basis (see above).

10. Phulchoki Mountain forests Key Biodiversity Area

This protected area is considered a KBA for a number of biome-restricted species (KBA Partnership 2023m), as well as Critically Endangered White-rumped Vulture Gyps bengalensis and Slender-billed Vulture Gyps tenuirostris, and the Vulnerable Wood Snipe Gallinago nemoricola and Sunda Clouded Leopard Neofelis diardi (formerly considered part of Clouded Leopard Neofelis nebulosa). Neither vulture appears to have been seen since in any numbers since the late 1980s/early 1990s[14]. The site does not meet Critical Habitat criteria (IFC 2019) for either of the Vulnerable species because they would not merit up-listing to Endangered if the site was lost.

While not representing Critical Habitat for specific KBA values, Phulchoki is a protected area and thus represents Critical Habitat for ADB on that basis (see above).

11. Rara National Park Key Biodiversity Area

This protected area is considered a KBA for a number of biome-restricted species (KBA Partnership 2023m), as well as the Vulnerable Cheer Pheasant Catreus wallichi. The site does not meet Critical Habitat criteria (IFC 2019) because Cheer Pheasant would not merit up-listing to Endangered if the site was lost.

While not representing Critical Habitat for specific KBA values, Rara is an IUCN Category II protected area and thus represents Critical Habitat on that basis (see above).

12. Shivapur Forest Key Biodiversity Area

This site is considered a KBA for the Critically Endangered Elongated Tortoise Indotestudo elongata and Vulnerable Three-keeled Land Tortoise Melanochelys tricarinata (KBA Partnership 2023n). A rapid survey in Shivapur for this Project identified very low populations of both species, owing to widespread hunting and frequent fire (Limbu 2024). It seems unlikely that Elongated Tortoise now occurs at the site in globally-significant numbers which would qualify it as Critical Habitat. The site does not meet Critical Habitat criteria (IFC 2019) for Three-keeled Land Tortoise because it would not merit up-listing to Endangered if the site was lost.

[14] E.g., www.ebird.org.

13. Shivapuri-Nagarjun National Park Key Biodiversity Area

Among other things, this site has been considered an Important Bird Area for Spiny Babbler Acanthoptila nipalensis (BirdLife International 2023d). This was previously considered, but no longer qualifies as, a restricted-range species (BirdLife International 2023d). The site is also important for two Vulnerable mammals (KBA Partnership 2023o) which do not meet Critical Habitat criteria (IFC 2019) because they would not merit up-listing to Endangered if the site was lost (Asiatic Black Bear Ursus thibetanus and Sunda Clouded Leopard Neofelis diardi [formerly considered part of Clouded Leopard Neofelis nebulosa]).

While not representing Critical Habitat for specific KBA values, Shivapuri-Nagarjun is an IUCN Category II protected area and thus represents Critical Habitat on that basis (see above).

14. Sohagibarwa Wildlife Sanctuary Key Biodiversity Area (India)

This site is listed as a KBA solely for the Vulnerable Swamp Francolin Francolinus gularis and Sarus Crane Grus antigone (KBA Partnership 2023p). The site does not meet Critical Habitat criteria (IFC 2019) for either species because they would not merit up-listing to Endangered if the site was lost.

While not representing Critical Habitat for specific KBA values, Sohagibarwa is a protected area and thus represents Critical Habitat for ADB on that basis (see above).

15. Soheldev Wildlife Sanctuary Key Biodiversity Area (India)

This site is listed as a KBA solely for the Vulnerable Swamp Francolin Francolinus gularis (KBA Partnership 2023q). The site does not meet Critical Habitat criteria (IFC 2019) for this species because it would not merit up-listing to Endangered if the site was lost.

While not representing Critical Habitat for specific KBA values, Soheldev is a protected area and thus represents Critical Habitat for ADB on that basis (see above).

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15. Summary

- Based on available information during this rapid assessment, and acting on a precautionary basis, all of the Project Areas of Analysis except that for Cluster 2 qualify as Critical Habitat, owing to the presence of one mammal, four birds, five reptiles, four amphibians, ten fishes, and two dragonflies, all known or suspected to occur at globally significant levels, as well as the presence of 15 internationally-recognized sites (protected areas and/or Key Biodiversity Areas) and a globally unique ecoregion (Table 5).

Table 5. Critical Habitat-qualifying biodiversity in the Project AoAs

Biodiversity type	Name	Critical Habitat criterion qualified[15]						Project cluster (Section 2.1)					Justification
		1	2	3	4	5	6[16]	1	2	3	4	5	
• Mammal	Hispid Hare (Caprolagus hispidus)	✓?						✓					>0.5% of the global population of this globally Endangered species might well occur in the Cluster 1 terrestrial AoA.
• Bird	White-rumped Vulture Gyps bengalensis	✓						✓					>0.5% of the global population of this globally Critically Endangered species likely occurs in the Cluster 1 avian AoA.
• Bird	Slender-billed Vulture Gyps tenuirostris	✓?						✓					>0.5% of the global population of this globally Critically Endangered species may occur in the Cluster 1 avian AoA.
• Bird	Bengal Florican Houbaropsis bengalensis	✓		✓				✓					>1% of the global population of this globally Critically Endangered migratory species likely occurs in the Cluster 1 avian AoA.
• Bird	Lesser Adjutant Leptoptilos javanicus			✓				✓					>1% of the global population of this migratory species likely occurs in the Cluster 1 avian AoA.
• Reptile	Gharial Gavialis gangeticus	✓						✓					>0.5% of the global population of this globally Critically Endangered species occurs in the Cluster 1 freshwater AoA.
• Reptile	Spotted Pond Turtle Geoclemys hamiltonii	✓?						✓					>0.5% of the global population of this globally Endangered species may well occur in the Cluster 1 freshwater AoA.
• Reptile	Elongated Tortoise Indotestudo elongata	✓?								✓			>0.5% of the global population of this globally Critically Endangered species might occur in the Cluster 3 terrestrial AoA.
• Reptile	Tricarinate Hill Turtle Melanochelys tricarinata	✓?						✓					>0.5% of the global population of this globally Endangered species might possibly occur in the Cluster 1 terrestrial AoA.
• Reptile	Indian Eyed Turtle Morenia petersi	✓?						✓		✓			>0.5% of the global population of this globally Endangered species may well occur in the Cluster 1 and 3 freshwater AoAs.
• Amphibian	Torrent Paa Frog Nanorana ercepeae		✓									✓	>10% of the global population of this restricted-range species likely occurs in the Cluster 5 freshwater AoA.
• Amphibian	Rara Paa Frog Nanorana rarica		✓									✓	>10% of the global population of this restricted-range species likely occurs in the Cluster 5 freshwater AoA.
• Amphibian	Dubois' Paa Frog Nanorana rostandi		✓									✓	>10% of the global population of this restricted-range species likely occurs in the Cluster 5 freshwater AoA.

[15] ✓= actually or likely qualifies area as Critical Habitat; ? = possibly qualifies area as Critical Habitat. Both based on available information.

[16] Per ADB (2009), rather than IFC (2019).

Biodiversity type	Name	Critical Habitat criterion qualified[15]						Project cluster (Section 2.1)					Justification
		1	2	3	4	5	6[16]	1	2	3	4	5	
• Amphibian	Nepal Lazy Toad Scutiger nepalensis		✓									✓	>10% of the global population of this restricted-range species likely occurs in the Cluster 5 freshwater AoA.
• Fish	Kalabans Bangana dero			✓?				✓					>1% of the global population of this migratory species may well occur in the Cluster 1 freshwater AoA.
• Fish	Chagunius chagunio			✓?				✓			✓		>1% of the global population of this migratory species might possibly occur in the Cluster 1 and 4 freshwater AoAs.
• Fish	Annandale Garra Garra annandalei			✓?				✓					>1% of the global population of this migratory species might possibly occur in the Cluster 1 freshwater AoA.
• Fish	Pseudecheneis eddsi		✓								✓		>10% of the global population of this restricted-range species likely occurs in the Cluster 4 freshwater AoA.
• Fish	Rainbow Minnow Psilorhynchus gracilis			✓?				✓		✓			>1% of the global population of this migratory species might possibly occur in the Cluster 1 and 3 freshwater AoAs.
• Fish	Psilorhynchus nepalensis		✓					✓					>10% of the global population of this restricted-range species likely occurs in the Cluster 1 freshwater AoA.
• Fish	Stone Carp Psilorhynchus pseudecheneis			✓				✓					>1% of the global population of this migratory species may well occur in the Cluster 1 freshwater AoA.
• Fish	River Stone Carp Psilorhynchus sucatio			✓?						✓			>1% of the global population of this migratory species might possibly occur in the Cluster 3 freshwater AoA.
• Fish	Sisor rheophilus		✓?							✓			>10% of the global population of this restricted-range species might possibly occur in the Cluster 3 freshwater AoA.
• Fish	Mahseer Tor tor			✓?				✓					>1% of the global population of this migratory species might possibly occur in the Cluster 1 freshwater AoA.
• Dragonfly	Chloropetalia selysi		✓?								✓		>10% of the global population of this restricted-range species might occur in the Cluster 4 freshwater AoA.
• Dragonfly	Somatochlora nepalensis		✓									✓	>10% of the global population of this restricted-range species likely occurs in the Cluster 5 freshwater and terrestrial AoAs.
• Site	Banke National Park						✓	✓					An IUCN Category II protected area.
• Site	Banke National Park Buffer Zone						✓	✓					An IUCN Category VI protected area.
• Site	Chitwan National Park and KBA						✓	✓					An IUCN Category II protected area, which actually or likely holds >0.5% of the global population of the Critically Endangered White-rumped Vulture, Slender-billed Vulture, Gharial and Elongated Tortoise, and Endangered Tiger and Bengal Florican, and also qualifies as Critical Habitat for Indian Rhinoceros.
• Site	Chitwan National Park Buffer Zone						✓	✓					An IUCN Category VI protected area, and part of Chitwan National Park KBA (which actually or likely holds >0.5% of the global population of the Critically Endangered White-rumped Vulture, Slender-billed Vulture, Gharial and Elongated Tortoise, and Endangered Tiger and Bengal Florican, and also qualifies as Critical Habitat for Indian Rhinoceros).
• Site	Chitwan World Heritage Site						✓	✓					Part of Chitwan National Park KBA (which actually or likely holds >0.5% of the global population of the Critically Endangered White-rumped Vulture, Slender-billed Vulture, Gharial and Elongated Tortoise, and Endangered Tiger and Bengal Florican, and also qualifies as Critical Habitat for Indian Rhinoceros).

Biodiversity type	Name	Critical Habitat criterion qualified[15]						Project cluster (Section 2.1)					Justification
		1	2	3	4	5	6[16]	1	2	3	4	5	
• Site	Chure Hills Environmental Protection Area						✓	✓		✓		✓	An IUCN Category VI protected area which is partially overlapped by a number of sites of high importance for biodiversity, including the Dang Deukhuri Foothill Forests and West Rapti Wetlands KBA (which supports >0.5% of the global population of the Critically Endangered White-rumped Vulture, and likely also >0.5% of the global population of the Critically Endangered Slender-billed Vulture).
• Site	Dang Deukhuri Foothill Forests and West Rapti Wetlands KBA						✓	✓					Supports >0.5% of the global population of the Critically Endangered White-rumped Vulture, and likely also >0.5% of the global population of the Critically Endangered Slender-billed Vulture.
• Site	Farmlands in Lumbini area KBA						✓	✓					Likely to support >0.5% of the global populations of the Critically Endangered White-rumped Vulture and Slender-billed Vulture.
• Site	Langtang National Park and KBA						✓				✓		An IUCN Category II protected area, which may well support >0.5% of the global population of the Endangered Red Panda.
• Site	Langtang National Park Buffer Zone						✓				✓		An IUCN Category VI protected area, and part of Langtang National Park KBA (which may well support >0.5% of the global population of the Endangered Red Panda).
• Site	Nawalparasi forests KBA						✓?	✓					May support >0.5% of the global population of the Critically Endangered White-rumped Vulture.
• Site	Parsa National Park and KBA						✓			✓			An IUCN Category II protected area, which may support >0.5% of the global population of the Critically Endangered Elongated Tortoise.
• Site	Parsa National Park Buffer Zone						✓	✓					An IUCN Category VI protected area, and part of Langtang National Park KBA (which may support >0.5% of the global population of the Critically Endangered Elongated Tortoise).
• Site	Rara National Park						✓					✓	An IUCN Category II protected area.
• Site	Shivapuri-Nagarjun National Park						✓				✓		An IUCN Category II protected area.
• Ecoregion	Eastern Himalayan broadleaf forests ecoregion				✓						✓		A unique assemblage of species associated with key evolutionary processes, which is considered globally outstanding.

5 Assessment of Natural Habitat

- Where feasible, the presence of Natural Habitat in Project AoAs was assessed using the National Land Cover Monitoring System for Nepal, which is based on 2000-2019 Landsat data (FRTC 2022). In some cases, AoAs also overlap India. In those cases, FRTC (2022) data were supplemented with European Space Agency WorldCover data, based on 2020-2021 Sentinel data (Zanaga et al. 2022). Visual comparison of the two datasets for project areas in Nepal showed close alignment in classification. Based on these two datasets, the extent of Natural versus Modified Habitat within Project AoAs is shown in Table 6. The extent of Natural Habitat within Project AoAs varies considerably, from 32% in Cluster 6 to almost 70% in Cluster 1.
- For the sake of this desktop assessment, Modified Habitat was considered to comprise cropland and built-up areas. During field assessments, additional Modified Habitat can be identified, specifically areas of grass or scrub where forest would naturally have occurred, and tree plantations of non-native species (or in areas where forests would not naturally have occurred). 'Modified' refers to habitats which are really nothing like those which would naturally have been present. Conversely, even quite degraded habitats can still be considered Natural, such as heavily logged forest.

Table 6. Extent of Modified and Natural Habitat in the Project terrestrial AoAs

Project Cluster	Modified Habitat		Natural Habitat	
	Area within AoA (km^2)	% of AoA	Area within AoA (km^2)	% of AoA
1	509	30.34%	1168	69.66%
2	36	42.95%	48	57.05%
3	307	67.81%	146	32.19%
4	53	45.27%	64	54.73%
5	323	35.42%	589	64.58%

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Appendix A

Table A1. Globally-threatened species with very marginal occurrence, if present at all, in the Cluster 1 AoAs

Biodiversity type	Common name	Scientific name	IUCN Category
• Mammal	Asian Small-clawed Otter	Aonyx cinereus	VU
• Mammal	Hog Deer	Axis porcinus	EN
• Mammal	Gaur	Bos gaurus	VU
• Mammal	Mainland Serow	Capricornis sumatraensis	VU
• Mammal	Dhole	Cuon alpinus	EN
• Mammal	Asian Elephant	Elephas maximus	EN
• Mammal	Smooth-coated Otter	Lutrogale perspicillata	VU
• Mammal	Indian Pangolin	Manis crassicaudata	EN
• Mammal	Chinese Pangolin	Manis pentadactyla	CR
• Mammal	Sloth Bear	Melursus ursinus	VU
• Mammal	Himalayan Muskdeer	Moschus leucogaster	EN
• Mammal	Clouded Leopard	Neofelis nebulosa	VU
• Mammal	Leopard	Panthera pardus	VU
• Mammal	Ganges River Dolphin	Platanista gangetica	EN
• Mammal	Fishing Cat	Prionailurus viverrinus	VU
• Mammal	Barasingha	Rucervus duvaucelii	VU
• Mammal	Sambar	Rusa unicolor	VU
• Mammal	Four-horned Antelope	Tetracerus quadricornis	VU
• Mammal	Asiatic Black Bear	Ursus thibetanus	VU
• Bird	Eastern Imperial Eagle	Aquila heliaca	VU
• Bird	Steppe Eagle	Aquila nipalensis	EN
• Bird	Tawny Eagle	Aquila rapax	VU
• Bird	Baer's Pochard	Aythya baeri	CR
• Bird	Common Pochard	Aythya ferina	VU
• Bird	Great Hornbill	Buceros bicornis	VU
• Bird	Cheer Pheasant	Catreus wallichii	VU
• Bird	Greater Spotted Eagle	Clanga clanga	VU
• Bird	Indian Spotted Eagle	Clanga hastata	VU
• Bird	Yellow-breasted Bunting	Emberiza aureola	CR
• Bird	Saker Falcon	Falco cherrug	EN
• Bird	Sarus Crane	Grus antigone	VU
• Bird	Indian Vulture	Gyps indicus	CR

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Biodiversity type	Common name	Scientific name	IUCN Category
• Bird	Black-capped Kingfisher	Halcyon pileata	VU
• Bird	Pallas's Fish-eagle	Haliaeetus leucoryphus	EN
• Bird	Egyptian Vulture	Neophron percnopterus	EN
• Bird	Swamp Francolin	Ortygornis gularis	VU
• Bird	Grey-crowned Prinia	Prinia cinereocapilla	VU
• Bird	Red-headed Vulture	Sarcogyps calvus	CR
• Bird	White-throated Bushchat	Saxicola insignis	VU
• Bird	Bristled Grassbird	Schoenicola striatus	VU
• Bird	Black-bellied Tern	Sterna acuticauda	EN
• Bird	River Tern	Sterna aurantia	VU
• Bird	Lesser Florican	Sypheotides indicus	CR
• Bird	Sociable Lapwing	Vanellus gregarius	CR
• Reptile	Red-crowned Roofed Turtle	Batagur kachuga	CR
• Reptile	Mugger	Crocodylus palustris	VU
• Reptile	Crowned River Turtle	Hardella thurjii	EN
• Reptile	Indian Flapshell Turtle	Lissemys punctata	VU
• Reptile	Indian Softshell Turtle	Nilssonia gangetica	EN
• Reptile	Indian Peacock Softshell Turtle	Nilssonia hurum	EN
• Reptile	King Cobra	Ophiophagus hannah	VU
• Reptile	Indian Roofed Turtle	Pangshura tecta	VU
• Reptile	Yellow Monitor	Varanus flavescens	EN
• Reptile	Painted Keelback	Xenochrophis cerasogaster	VU
• Fish		Bagarius bagarius	VU
• Fish	Snow Trout	Schizothorax plagiostomus	VU
• Fish	Golden Mahseer	Tor putitora	EN
• Fish		Wallago attu	VU
• Freshwater snail		Tricula mahadevensis	VU
• Plant	Yellow Himalayan Fritillary	Fritillaria cirrhosa	VU
• Plant		Oryza malampuzhaensis	VU
• Plant	Love Apple	Paris polyphylla	VU
• Plant	Indian Nard	Nardostachys jatamansi	CR
• Plant		Picrorhiza kurroa	EN

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Table A2. Globally-threatened species with very marginal occurrence, if present at all, in the Cluster 2 AoAs

Biodiversity type	Common name	Scientific name	IUCN Category
• Mammal	Red Panda	Ailurus fulgens	EN
• Mammal	Asian Small-clawed Otter	Aonyx cinereus	VU
• Mammal	Mainland Serow	Capricornis sumatraensis	VU
• Mammal	Dhole	Cuon alpinus	EN
• Mammal	Chinese Pangolin	Manis pentadactyla	CR
• Mammal	Himalayan Muskdeer	Moschus leucogaster	EN
• Mammal	Leopard	Panthera pardus	VU
• Mammal	Tiger	Panthera tigris	EN
• Mammal	Greater One-horned Rhino	Rhinoceros unicornis	VU
• Mammal	Sambar	Rusa unicolor	VU
• Mammal	Asiatic Black Bear	Ursus thibetanus	VU
• Bird	Eastern Imperial Eagle	Aquila heliaca	EN
• Bird	Steppe Eagle	Aquila nipalensis	VU
• Bird	Common Pochard	Aythya ferina	EN
• Bird	Cheer Pheasant	Catreus wallichii	CR
• Bird	Saker Falcon	Falco cherrug	EN
• Bird	Wood Snipe	Gallinago nemoricola	VU
• Bird	White-rumped Vulture	Gyps bengalensis	EN
• Bird	Slender-billed Vulture	Gyps tenuirostris	VU
• Bird	Pallas's Fish-eagle	Haliaeetus leucoryphus	VU
• Bird	Egyptian Vulture	Neophron percnopterus	CR
• Bird	Red-headed Vulture	Sarcogyps calvus	EN
• Bird	River Tern	Sterna aurantia	EN
• Reptile	Mugger	Crocodylus palustris	VU
• Reptile	Yellow Monitor	Varanus flavescens	EN
• Fish		Bagarius bagarius	VU
• Fish	Snow Trout	Schizothorax plagiostomus	VU
• Fish	Golden Mahseer	Tor putitora	EN
• Fish		Wallago attu	VU
• Freshwater snail		Tricula mahadevensis	VU
• Plant	Indian Nard	Dactylorhiza hatagirea	EN
• Plant	Yellow Himalayan Fritillary	Fritillaria cirrhosa	VU
• Plant	Indian Nard	Nardostachys jatamansi	CR

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Biodiversity type	Common name	Scientific name	IUCN Category
• Plant	Love Apple	Paris polyphylla	VU
• Plant	Himalayan Trillium	Trillium govanianum	EN

Table A3. Globally-threatened species with very marginal occurrence, if present at all, in the Cluster 3 AoAs

Biodiversity type	Common name	Scientific name	IUCN Category
• Mammal	Asian Small-clawed Otter	Aonyx cinereus	VU
• Mammal	Hog Deer	Axis porcinus	EN
• Mammal	Gaur	Bos gaurus	VU
• Mammal	Mainland Serow	Capricornis sumatraensis	VU
• Mammal	Hispid Hare	Caprolagus hispidus	EN
• Mammal	Dhole	Cuon alpinus	EN
• Mammal	Asian Elephant	Elephas maximus	EN
• Mammal	Smooth-coated Otter	Lutrogale perspicillata	VU
• Mammal	Indian Pangolin	Manis crassicaudata	EN
• Mammal	Chinese Pangolin	Manis pentadactyla	CR
• Mammal	Sloth Bear	Melursus ursinus	VU
• Mammal	Mandelli's Mouse-eared Myotis	Myotis sicarius	VU
• Mammal	Clouded Leopard	Neofelis nebulosa	VU
• Mammal	Leopard	Panthera pardus	VU
• Mammal	Ganges River Dolphin	Platanista gangetica	EN
• Mammal	Fishing Cat	Prionailurus viverrinus	VU
• Mammal	Sambar	Rusa unicolor	VU
• Mammal	Four-horned Antelope	Tetracerus quadricornis	VU
• Mammal	Asiatic Black Bear	Ursus thibetanus	VU
• Bird	Eastern Imperial Eagle	Aquila heliaca	VU
• Bird	Steppe Eagle	Aquila nipalensis	EN
• Bird	Tawny Eagle	Aquila rapax	VU
• Bird	Baer's Pochard	Aythya baeri	CR
• Bird	Common Pochard	Aythya ferina	VU
• Bird	Great Hornbill	Buceros bicornis	VU
• Bird	Jerdon's Babbler	Chrysomma altirostre	VU
• Bird	Greater Spotted Eagle	Clanga clanga	VU
• Bird	Indian Spotted Eagle	Clanga hastata	VU
• Bird	Yellow-breasted Bunting	Emberiza aureola	CR

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Biodiversity type	Common name	Scientific name	IUCN Category
• Bird	Saker Falcon	Falco cherrug	EN
• Bird	Sarus Crane	Grus antigone	VU
• Bird	Indian Vulture	Gyps indicus	CR
• Bird	Black-capped Kingfisher	Halcyon pileata	VU
• Bird	Pallas's Fish-eagle	Haliaeetus leucoryphus	EN
• Bird	Great Slaty Woodpecker	Mulleripicus pulverulentus	VU
• Bird	Egyptian Vulture	Neophron percnopterus	EN
• Bird	Swamp Francolin	Ortygornis gularis	VU
• Bird	Grey-crowned Prinia	Prinia cinereocapilla	VU
• Bird	Red-headed Vulture	Sarcogyps calvus	CR
• Bird	White-throated Bushchat	Saxicola insignis	VU
• Bird	Bristled Grassbird	Schoenicola striatus	VU
• Bird	Black-bellied Tern	Sterna acuticauda	EN
• Bird	River Tern	Sterna aurantia	VU
• Bird	Lesser Florican	Sypheotides indicus	CR
• Bird	Sociable Lapwing	Vanellus gregarius	CR
• Reptile	Red-crowned Roofed Turtle	Batagur kachuga	CR
• Reptile	Mugger	Crocodylus palustris	VU
• Reptile	Crowned River Turtle	Hardella thurjii	EN
• Reptile	Indian Flapshell Turtle	Lissemys punctata	VU
• Reptile	Tricarinate Hill Turtle	Melanochelys tricarinata	EN
• Reptile	Indian Softshell Turtle	Nilssonia gangetica	EN
• Reptile	Indian Peacock Softshell Turtle	Nilssonia hurum	EN
• Reptile	King Cobra	Ophiophagus hannah	VU
• Reptile	Indian Roofed Turtle	Pangshura tecta	VU
• Reptile	Yellow Monitor	Varanus flavescens	EN
• Reptile	Painted Keelback	Xenochrophis cerasogaster	VU
• Fish		Bagarius bagarius	VU
• Fish	Snow Trout	Schizothorax plagiostomus	VU
• Fish	Golden Mahseer	Tor putitora	EN
• Fish		Wallago attu	VU
• Freshwater snail		Tricula mahadevensis	VU
• Plant	Yellow Himalayan Fritillary	Fritillaria cirrhosa	VU
• Plant	Indian Nard	Nardostachys jatamansi	CR
• Plant		Oryza malampuzhaensis	VU

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Biodiversity type	Common name	Scientific name	IUCN Category
• Plant	Love Apple	Paris polyphylla	VU

Table A4. Globally-threatened species with very marginal occurrence, if present at all, in the Cluster 4 AoAs

Biodiversity type	Common name	Scientific name	IUCN Category
• Mammal	Asian Small-clawed Otter	Aonyx cinereus	VU
• Mammal	Gaur	Bos gaurus	VU
• Mammal	Mainland Serow	Capricornis sumatraensis	VU
• Mammal	Hispid Hare	Caprolagus hispidus	EN
• Mammal	Dhole	Cuon alpinus	EN
• Mammal	Chinese Pangolin	Manis pentadactyla	CR
• Mammal	Himalayan Muskdeer	Moschus leucogaster	EN
• Mammal	Mandelli's Mouse-eared Myotis	Myotis sicarius	VU
• Mammal	Clouded Leopard	Neofelis nebulosa	VU
• Mammal	Leopard	Panthera pardus	VU
• Mammal	Tiger	Panthera tigris	EN
• Mammal	Snow Leopard	Panthera uncia	VU
• Mammal	Greater One-horned Rhino	Rhinoceros unicornis	VU
• Mammal	Sambar	Rusa unicolor	VU
• Mammal	Asiatic Black Bear	Ursus thibetanus	VU
• Bird	Eastern Imperial Eagle	Aquila heliaca	VU
• Bird	Steppe Eagle	Aquila nipalensis	EN
• Bird	Common Pochard	Aythya ferina	VU
• Bird	Cheer Pheasant	Catreus wallichii	VU
• Bird	Greater Spotted Eagle	Clanga clanga	VU
• Bird	Saker Falcon	Falco cherrug	EN
• Bird	Wood Snipe	Gallinago nemoricola	VU
• Bird	Sarus Crane	Grus antigone	VU
• Bird	White-rumped Vulture	Gyps bengalensis	CR
• Bird	Slender-billed Vulture	Gyps tenuirostris	CR
• Bird	Pallas's Fish-eagle	Haliaeetus leucoryphus	EN
• Bird	Egyptian Vulture	Neophron percnopterus	EN
• Bird	Grey-crowned Prinia	Prinia cinereocapilla	VU
• Bird	Red-headed Vulture	Sarcogyps calvus	CR
• Bird	White-throated Bushchat	Saxicola insignis	VU

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Biodiversity type	Common name	Scientific name	IUCN Category
• Bird	Black-bellied Tern	Sterna acuticauda	EN
• Bird	River Tern	Sterna aurantia	VU
• Reptile	Mugger	Crocodylus palustris	VU
• Reptile	Elongated Tortoise	Indotestudo elongata	CR
• Reptile	Yellow Monitor	Varanus flavescens	EN
• Fish		Bagarius bagarius	VU
• Fish	Chirruh Snowtrout	Schizothorax esocinus	VU
• Fish	Snow Trout	Schizothorax plagiostomus	VU
• Fish	Golden Mahseer	Tor putitora	EN
• Fish		Wallago attu	VU
• Freshwater snail		Tricula mahadevensis	VU
• Fungus	Chinese Caterpillar Fungus	Ophiocordyceps sinensis	VU
• Plant		Dactylorhiza hatagirea	EN
• Plant	Yellow Himalayan Fritillary	Fritillaria cirrhosa	VU
• Plant	Indian Nard	Nardostachys jatamansi	CR
• Plant	Love Apple	Paris polyphylla	VU
• Plant	Himalayan Trillium	Trillium govanianum	EN

Table A5. Globally-threatened species with very marginal occurrence, if present at all, in the Cluster 5 AoAs

Biodiversity type	Common name	Scientific name	IUCN Category
• Mammal	Red Panda	Ailurus fulgens	EN
• Mammal	Asian Small-clawed Otter	Aonyx cinereus	VU
• Mammal	Mainland Serow	Capricornis sumatraensis	VU
• Mammal	Hispid Hare	Caprolagus hispidus	EN
• Mammal	Dhole	Cuon alpinus	EN
• Mammal	Smooth-coated Otter	Lutrogale perspicillata	VU
• Mammal	Indian Pangolin	Manis crassicaudata	EN
• Mammal	Chinese Pangolin	Manis pentadactyla	CR
• Mammal	Himalayan Muskdeer	Moschus leucogaster	EN
• Mammal	Leopard	Panthera pardus	VU
• Mammal	Tiger	Panthera tigris	EN
• Mammal	Snow Leopard	Panthera uncia	VU
• Mammal	Ganges River Dolphin	Platanista gangetica	EN
• Mammal	Greater One-horned Rhino	Rhinoceros unicornis	VU

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Biodiversity type	Common name	Scientific name	IUCN Category
• Mammal	Sambar	Rusa unicolor	VU
• Mammal	Four-horned Antelope	Tetracerus quadricornis	VU
• Mammal	Asiatic Black Bear	Ursus thibetanus	VU
• Bird	Eastern Imperial Eagle	Aquila heliaca	VU
• Bird	Steppe Eagle	Aquila nipalensis	EN
• Bird	Common Pochard	Aythya ferina	VU
• Bird	Cheer Pheasant	Catreus wallichii	VU
• Bird	Yellow-breasted Bunting	Emberiza aureola	CR
• Bird	Saker Falcon	Falco cherrug	EN
• Bird	Sarus Crane	Grus antigone	VU
• Bird	White-rumped Vulture	Gyps bengalensis	CR
• Bird	Slender-billed Vulture	Gyps tenuirostris	CR
• Bird	Pallas's Fish-eagle	Haliaeetus leucoryphus	EN
• Bird	Great Slaty Woodpecker	Mulleripicus pulverulentus	VU
• Bird	Egyptian Vulture	Neophron percnopterus	EN
• Bird	Grey-crowned Prinia	Prinia cinereocapilla	VU
• Bird	Red-headed Vulture	Sarcogyps calvus	CR
• Bird	River Tern	Sterna aurantia	VU
• Bird	Lesser Florican	Sypheotides indicus	CR
• Reptile	Mugger	Crocodylus palustris	VU
• Reptile	Elongated Tortoise	Indotestudo elongata	CR
• Fish		Bagarius bagarius	VU
• Fish	Snow Trout	Schizothorax plagiostomus	VU
• Fish	Rara Snowtrout	Schizothorax raraensis	CR
• Fish	Golden Mahseer	Tor putitora	EN
• Fish		Wallago attu	VU
• Freshwater snail		Tricula mahadevensis	VU
• Fungus	Chinese Caterpillar Fungus	Ophiocordyceps sinensis	VU
• Plant		Dactylorhiza hatagirea	EN
• Plant	Yellow Himalayan Fritillary	Fritillaria cirrhosa	VU
• Plant		Meizotropis pellita	CR
• Plant	Indian Nard	Nardostachys jatamansi	CR
• Plant	Love Apple	Paris polyphylla	VU
• Plant		Picrorhiza kurroa	EN
• Plant	Himalayan Trillium	Trillium govanianum	EN

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Appendix E – Tortoise Survey

Assessment of elongated Tortoise and Tricarinate hill turtle along additional two reptile's species in Shivapur Forest, for the Power Transmission and Distribution Strengthening Project, Nepal

Background

Nepal's turtle fauna includes 18 species across 11 genera and three families: freshwater turtles (Geoclemydidae), land turtles or tortoises (Testudinidae), and softshell turtles (Trionychidae) (Rai et al., 2022). The only tortoise species in Nepal is the elongated tortoise (Indotestudo elongata), which inhabits low to mid-elevation areas, preferring evergreen and deciduous forests, grasslands, and secondary forests (Kästle et al., 2013; Schleich & Kästle, 2002), widely distributed across Southeast Asia. This medium-sized tortoise, known for its yellowish-brown carapace with black blotches, is omnivorous, feeding on a diverse diet including fruits, mushrooms, insects, and carrion (Ihlow et al., 2016). In Nepal, it is found primarily in Sal-dominated forests below 1000 meters elevation, with records from Jhapa to Shuklaphanta National Park (Aryal et al., 2010). The species is IUCN critically endangered, with a population decline of 80% due to habitat loss, hunting, and trade for food, traditional medicine, and religious purposes. This decline is exacerbated by pressures from local communities and collectors (Rahman et al., 2019). In the case, Tricarinate Hill-turtle (Melanochelys tricarinata) is distributed primarily in the Himalayan foothills and riverine grasslands, extending its range into the Sal (Shorea robusta) forests of Nepal (Kästle et al., 2013; Schleich & Kästle, 2002). In these regions, the species occupies diverse habitats including dense forests and areas near rivers, thriving in moist, leafy environments that provide ample cover and food resources (Schleich & Kästle, 2002). Despite its adaptability, Melanochelys tricarinata faces significant threats in Nepal, primarily due to habitat destruction from deforestation, agricultural expansion, and urbanization. Additionally, illegal collection for the pet trade and local consumption exacerbates the decline of this species and listed as IUCN red list of endangered species (Horne et al., 2020).

While both of them are legally protected under wildlife conservation acts 1974 (DNPWC, 1974), enforcement is often inadequate, leading to continued pressure on its populations. Conservation efforts are further hindered by the lack of comprehensive field studies, which are essential for developing effective management strategies to preserve this vulnerable turtle species in its natural habitat.

The Yellow Monitor Lizard (Varanus flavescens) and Siwalik Sitana (Sitana sivalensis), both native to Nepal, exhibit distinct ecological preferences and face common conservation challenges. Varanus flavescens, typically found in the Terai lowlands, thrives in wetland habitats, riverbanks, and agricultural fields, where it preys on small mammals, birds, and invertebrates (Schleich & Kästle, 2002). In contrast, Sitana sivalensis, a small agamid lizard, inhabits the dry, open grasslands and scrub

forests of the Siwalik Hills (Schleich & Kästle, 1998). Both species face significant threats due to habitat loss from deforestation, agricultural expansion, and urban development. Additionally, the Yellow Monitor Lizard is heavily hunted for its skin and meat, exacerbating its population (Horne et al., 2020). Sitana sivalensis is also impacted by the fragmentation of its habitat, which limits its range and breeding opportunities (Das & Bhattarai, 2021).

The surveys pertain to a proposed transmission line (TL) through Shivapur forest as part of the South Asia Subregional Economic Cooperation (SASEC) Electricity Transmission and Distribution Strengthening Project in Nepal. These surveys aim to assess the project risks to four reptile species: the Elongated turtle, Tricarinate hill turtle, Siwalik sitana, and Yellow monitor lizard. It is due to Shivapur forest has been identified as a Key Biodiversity Area for the two primary target species, and this region, along with nearby areas, represents survey gaps noted in the 2023 Initial Environmental Examination (IEE).

Methodology of the work

As per the recommendation, a reconnaissance survey was be conducted along designated routes and to maximize species detection within a 50–100-meter range, four people conducted surveys along routes, maintaining a 10–20-meter distance from each other as spatial replicates. Additionally, local individuals familiar with the species and area were also included in the survey. We focused on likely habitats such as open canopies, dense vegetation (potential hiding spots), creek areas (moist environments), and water pools (breeding sites). The hill turtle and elongated tortoise, being slow moving species, are directly impacted by forest fires, affecting their distribution, feeding, and breeding ecology. We also recorded both active and passive forest fires. We conducted a survey with a total of 81 survey hours. The survey covered an aerial distance of approx. 14 kilometers and a foot distance of 25 kilometers.

During the survey, 25 structured interviews (attached structured questionnaire) had been taken to the local people adjacent to the Sivapur forest area to know if they are familiar with the species and also to know their population trends, perception and local threats to the species. A semi-structured interview was carried out in three areas: Gabdawa (eastern side), Sonwagad (central area), and Bhulaki and Mainnar (western side) of different age group between 30-90. The survey effort for the semi-structured interview was 12 hrs.

Result

During our survey, we found one dead Hill turtle, likely due to a forest fire, three Sitana sivalensis (Siwalik lizards), eight dead carapaces of Hill turtle and one carapace of lissymes punctata from local

areas that has been from adjacent villages. We also documented one active and 40 passive forest fires for threat assessment and identified ten probable breeding pools for turtles and tortoises.

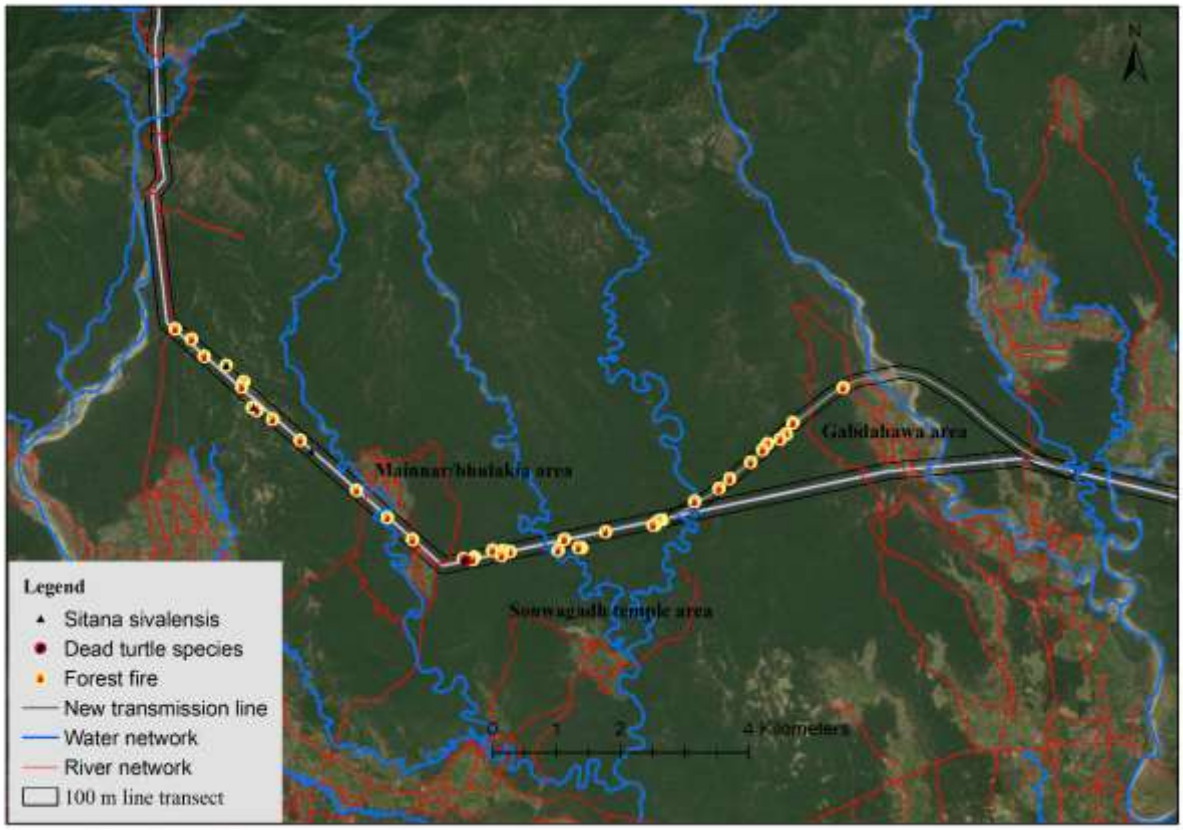

Figure 1: This figure depicts the survey map, including records of Sitana sivalensis, instances of burned or dead turtle species, and locations of forest fires. It highlights three areas where questionnaires were distributed: the Gabdaha area, the Sonwagadh temple area, and the Mainpur/Bhulakia area. The red lines indicate the river network, while the blue lines represent the river network.

We interviewed 25 individuals (15 males and 10 females). Among them, 8% (n = 2) identified the elongated turtle, 16% (n = 4) identified the Tricarinate hill turtle, and 72% (n = 18) identified both species. One individual (4%) could not identify any turtle species in the Sivapur Forest area.

Of the 20 individuals who spotted the elongated turtle, 65% (n = 13) located it in the forest, 25% (n = 5) in both forest and wetland areas, and 5% (n = 1) solely in wetland areas. Similarly, among the 22 individuals who spotted the tricarinate hill turtle, 13.6% (n = 3) saw it by the riverside, 9% (n = 2) in wetlands, and 77.2% (n = 17) in forest areas. Additionally, 12% were unaware of any turtle or tortoise killing incidents, while 88% reported having witnessed such incidents within the past five years. We were unable to quantify the number of individuals killed over the past five years because most respondents did not provide exact numbers, and the interviews were conducted in limited areas, leading to potential overlap in the reported data. Additionally, we did not ask how many species they had collected or killed during this period (Appendix 1)

Similarly, 32% (n = 8) reported that the major factors contributing to the decline of turtles and tortoises in the Sivapur area are excessive consumption and forest fires, and another 32% cited excessive consumption for food. Additionally, 12% (n = 3) attributed the decline solely to forest fires, and another 12% to meat and medicine. The remaining 8% mentioned medicinal purposes and forest fires combined with deforestation. One individual (4%) had no idea about the reasons for the decline of turtles (Figure 2).

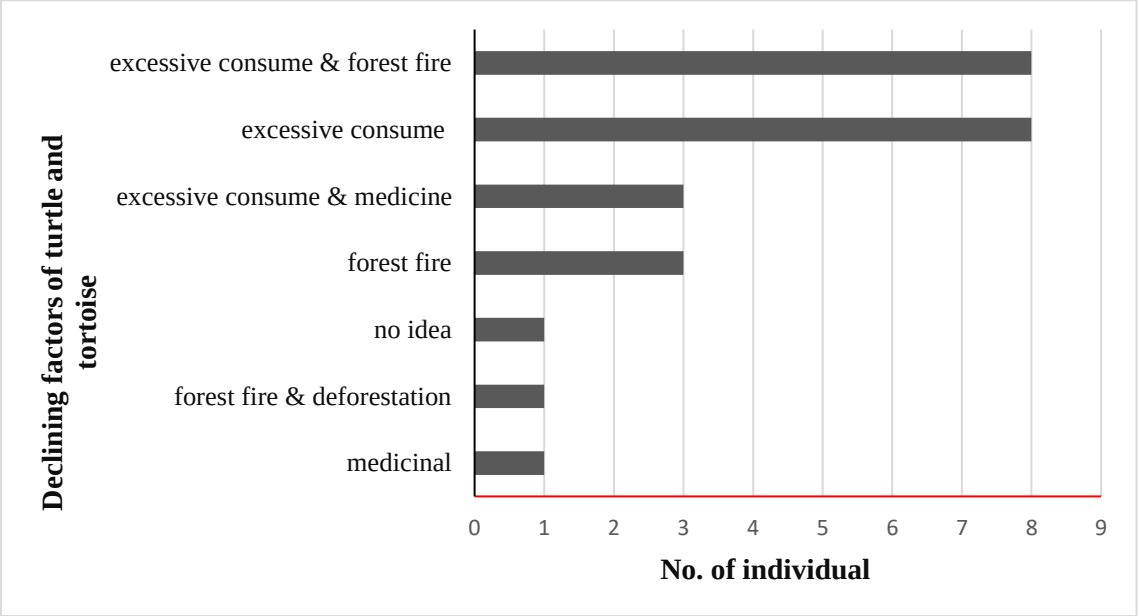

Figure 2: Representing the major reason behind the turtle and tortoise declining in the Sivapur forest areas.

Discussion

Through this survey, we discovered that the population of turtles and tortoises was extremely scarce. We only have records of dead turtles, which were killed by forest fires and nearby residents. The number of carapaces found indicates a significant incidence of killings. Whenever people encounter turtles or tortoises, regardless of size, they consume them mainly for their meat. There is also evidence that the ethnic Tharu community kills them for medicinal purposes.

Most of the surveyed areas experienced forest fires within the past one or two years. These fires were primarily caused by human activities, either through negligence or intentional acts. However, natural or climatic factors such as extreme droughts, high temperatures, and wind could also have contributed to these fires. The ongoing forest fires not only kill the slow-moving turtles and tortoises but also affect their diet. These animals also rely on small pools for feeding, cooling off during heat, avoiding predators, and breeding (Schleich & Kästle, 2002). We observed that many of these pools were polluted, filled with nutrient-rich ash from vegetation, causing high eutrophication and very low dissolved oxygen levels, which hinder their feeding and breeding of the turtle species.

Additionally, we also noticed many small tracks created by humans for movement, fodder collection, berry picking, and fishing near the river. We also found cattle in the forest, indicating a high level of human dependence on forest resources in the surveyed areas.

All the aforementioned information gathered points to excessive killing for consumption, constant forest fires harming the species and their habitats, and a lack of awareness among people, leading to a very low number of turtle and tortoise species. The impact of the transmission line on the population dynamics of these species is not significant, though precautions should still be taken when constructing it.

Recommendation

16. Unfavorable construction period: The pre-monsoon and post-monsoon seasons are not ideal for construction work. If construction continues during these times, the increased presence of workers and villagers in the area will raise the likelihood of encounters with turtles and tortoises.
17. Continuous habitat monitoring: Regular monitoring of the habitat must be conducted throughout the construction period.
18. Worker training and awareness campaign: Educate workers on the importance of turtle and tortoise species. If construction occurs during the proposed season, species safety protocols must be followed to protect their habitat. Additionally, pollution, hunting, and fishing in the river system and adjacent areas are strictly prohibited.
19. Community education and engagement: Conduct awareness campaigns for local residents to highlight the ecological importance of turtles and tortoises and the impact of forest fires on their habitat

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Photos of the field

A. Dead *Melanochyles* sp. by fire
B. *Sitana Sivalensis*
C. *Melanochelys* sp. carapace
D. Carapace of three *Melanochelys* and one *lissemys* sp. carapace
E. Forest fire
F. Women fishing in a favorable breeding pool of tortoise and turtle species

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Appendix 1.

Transmission line area	Respondent	Gender	Age	General turtle species	habitat found	Killing incident	People perception	Declining factors
Gabdahawa area	1	male	55	Yellow headed	wetland	Yes (8)	save	forest fire
				tricarinate hill turtle	forest			
	2	female	84	Yellow headed	forest	Yes (many)	save	forest fire & deforestration
				tricarinate hill turtle	forest			
	3	female	35	Yellow headed	forest	Yes (many)	kill	excessive consume & forest fire
				tricarinate hill turtle	forest			
	4	male	90	Yellow headed	forest,wetland	Yes (many)	no idea	excessive consume
				tricarinate hill turtle	forest			
	5	female	45	Yellow headed	forest	Yes (no idea)	kill	excessive consume & medicine
				tricarinate hill turtle	forest			
	6	male	55	Yellow headed	forest	Yes (no idea)	kill	excessive consume
				tricarinate hill turtle	forest			
	7	male	73	Yellow headed	forest	Yes (many)	save	excessive consume & forest fire
				tricarinate hill turtle	forest			
	8	female	55	Yellow headed	forest	Yes (no idea)	no idea	excessive consume
				tricarinate hill turtle	forest			
	9	male	62	Yellow headed	forest	Yes (6)	save	forest fire
				tricarinate hill turtle	forest			
Sonwagadh temple area	10	male	75	Yellow headed	forest	Yes (no idea)	no idea	excessive consume & forest fire
				tricarinate hill turtle	forest			
	11	female	50	Yellow headed	forest	Yes	kill	excessive consume & medicine
	12	male	38	couldn't identified	agriculture	no idea	no idea	no idea
	13	male	41	Yellow headed	forest	Yes (no idea)	kill	excessive consume
				tricarinate hill turtle	forest			
	14	female		tricarinate hill turtle	riverside	Yes (many)	kill	excessive consume
	15	female		tricarinate hill turtle	wetland	Yes (2)	save	excessive consume
Mainnar/bhulakia area	16	male	43	Yellow headed	forest,wetland	Yes (no idea)	save	forest fire

				tricarinate hill turtle	forest			
	17	male	55	Yellow headed	forest, wetland	Yes (no idea)	save	excessive consume & forest fire
				tricarinate hill turtle	forest			
	18	male	54	Yellow headed	forest, wetland	Yes (around 25)	save	excessive consume & medicine
				tricarinate hill turtle	near wetland			
	19	female	30	Yellow headed	forest	Yes (no idea)	no idea	excessive consume & forest fire
	20	female	42	Yellow headed	forest	no idea	save	excessive consume & forest fire
				tricarinate hill turtle	forest			
	21	male	38	Yellow headed	forest	Yes (20)	save	excessive consume & forest fire
				tricarinate hill turtle	forest			
	22	male	59	Yellow headed	forest	Yes (no idea)	no idea	excessive consume
				tricarinate hill turtle	forest			
	23	male	38	tricarinate hill turtle	riverside	no idea	save	medicine
	24	male	51	Yellow headed	forest	Yes (no idea)	Kill	excessive consume & forest fire
				tricarinate hill turtle	forest			
	25	female	64	tricarinate hill turtle	riverside	Yes (6)	Kill	excessive consume

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