Initial Environmental Examination

October 2022

Pakistan: Second Power Transmission Enhancement Investment Program (Tranche 4)

Subproject 5: Procurement of goods for the construction of about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Bahawalpur grid stations

Prepared by the National Transmission and Despatch Company Limited (NTDC) for the Asian Development Bank.

Initial Environmental Examination

Project Number: 48078-006
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CURRENCY EQUIVALENTS

As of 1 October 2022

Currency Unit – Pak Rupees (Pak Rs.)

Pak Rs 1.00 = $ 0.0044

US$1.00 = Pak Rs. 228.08

ABBREVIATIONS

AC	Alternating Current
ADB	Asian Development Bank
AOI	Area of Influence
DISCO	Distribution Company
EARF	Environmental Assessment and Review Framework
EIA	Environmental Impact Assessment'
EHS Guidelines	The World Bank Group's Environmental, Health and Safety Guidelines
EHS Manager	Environmental, Health, and Safety Manager (under ESIC)
EMF	electromagnetic field
EMP	Environmental Management Plan
EPA	Environment Protection Agency
ESIC	Environment and Social Impact Cell
ETL	Electricity Transmission Line
FMC	Facility Management Consultant
FMC-IESS	FMC's International Environmental Safeguards Specialist
FMC-NESS	FMC's National Environmental Safeguards Specialist
FMC-NEI	FMC's National Environmental Inspector
GSHAP	Global Seismic Hazard Assessment Program
HESCO	Hyderabad Electric Supply Company
HSE	Health, Safety and Environment
HTLS	high-temperature low sag
IBAT	Integrated Biodiversity Assessment Tool
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
LARP	Land Acquisition and Resettlement Plan
MEPCO	Multan Electric Power Company
MFF	Multi Tranche Financing Facility
NEQS	National Environmental Quality Standards

NOC	No Objection Certificate
NTDC	National Transmission and Despatch Company
PBC	Pakistan Building Code
Pak-Act	Pakistan Environmental Protection Act (1997)
PEPA	Pakistan Environmental Protection Agency
Punjab-Act	Punjab Environmental Protection Act (1997)
PM	Particulate Matter
PMU	Project Management Unit
Punjab EPA	Punjab Environmental Protection Agency
PPE	Personal Protective Equipment
RoW	Right of Way
SEPCO	Sukkur Electric Power Company
SPS	Safeguard Policy Statement (2009)
SSEMP	Site-specific EMP
USEPA	Environmental Protection Agency in the United States of America
WAPDA	Water & Power Development Authority
WHO	World Health Organization

WEIGHTS AND MEASURES

µg/m^3	Microgram per cubic meter
amsl	Above mean sea level
dB(A)	decibels (A-weighted)
km	Kilometer
km2	Square kilometer
m	Meter
m3/sec	Cubic meter per second

CONVERSIONS

1 meter	= 3.28 feet
1 hectare	= 2.47 acre

NOTES

In this report, "$" refers to US dollars.

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Executive Summary

1. The Government of Pakistan signed a loan agreement with the Asian Development Bank (ADB) for financial support for the construction of the Power Enhancement Projects in Pakistan. The multi-tranche financing facility for the Second Power Transmission Enhancement Investment Program (Multi Tranche Financing Facility [MFF] II or the Program)1 expands and reinforces Pakistan's power transmission system, enabling the system to provide a reliable and quality service capable of meeting increasing customer demand and supporting economic growth. MFF II comprises four tranches.
2. Environmental Assessment and Review Framework (EARF)[2] was prepared for MFF II in May 2016. This EARF is applicable for subprojects under MFF II and Tranche-I, funded by ADB. The EARF outlines the policy, procedures, and institutional requirements for preparing the subprojects. These subprojects need to be processed under ADB Safeguards Policy Statement (2009) (SPS).
3. Under Tranche 4 Readiness, National Transmission and Despatch Company Limited (NTDC) is planning to construct new 220 kV ETLs, construction of a grid station, augmentation of 10 existing grid stations and procurement of grid station equipment, through 6 Subprojects listed hereunder:
    1) Subproject 1 is the turnkey contract for design, supply, installation, testing and commissioning of approximately 70 km of 220kV double circuit transmission line for looping in/out of the proposed Hala Road-Jamshoro single circuit transmission line at 220kV Mirpur Khas New Grid Station
    2) Subproject 2 is the turnkey contract for design, manufacture, supply, installation, testing and commissioning of approximately 20 km of 220kV double circuit transmission line for looping in/out one circuit of the existing 220kV Jamshoro - T.M. Khan double circuit transmission line at Hala Road 220kV Grid Station
    3) Subproject 3 involves procurement of goods for the addition and augmentation of the six existing grid stations to remove NTDC system constraints (500kV Dadu grid station, 500kV Faisalabad West grid station, 500kV Lahore (Sheikhpura) grid station, 500kV New Multan grid station, 500kV Rahim Yar, 220kV Guddu grid station
    4) Subproject 4 involves procurement of goods for the construction of a new 220kV Jamrud grid station and approximately 20 km of the associated 220kV Jamrud-Sheikh Muhammadi transmission line in the south-western area of Pakistan.
    5) Subproject 5 involves procurement of goods for the construction of about 105 km of 220kV Daharki – Rahim Yar and about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Daharki and 220kV Bahawalpur grid stations for interlinking of 220kV Daharki – Rahim Yar Khan and Bahawalpur grid stations in the south-eastern area of Pakistan
    6) Subproject 6 involves procurement of goods for operation and maintenance of NTDC assets to reduce the grid stations breakouts (550kV, 245kV, and 145kV circuit breakers and replacement of one 500/220 kV, 450 MVA Auto Transformer Bank (ATB) at the existing 500 kV Rawat Grid Station.
4. This document is the Initial Environmental Examination (IEE) for the proposed construction of about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Bahawalpur grid station. The Project passes through three districts; Rahimyar Khan, and Bahawalpur in Punjab province.

[1] 48078-002: Second Power Transmission Enhancement Investment Program | Asian Development Bank (adb.org)
[2] Second Power Transmission Enhancement Investment Program: Environmental Assessment and Review Framework | Asian Development Bank (adb.org)

Legal and Policy Framework

5. *Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations* (the federal IEE-EIA Regulations, 2000)[3] provides the necessary details on the preparation, submission, and review of the IEE and the EIA. The categorization of projects for IEE and EIA is one of the main components of the federal IEE-EIA Regulations (2000). The transmission line Projects with 11kV or higher are kept in Schedule II of the regulations and thus an EIA is required for such projects.

6. The Project[4] requires filing an EIA with Punjab Environmental Protection Agency (Punjab EPA) for No Objection Certificate (NOC). NDTC will prepare an EIA and submit to Punjab EPA, to obtain *environmental* approval or no objection certificate (NOC) before commencement of any civil works.

7. The applicable law binds the Agency to inform the proponent (NTDC in this case) on the approval in four months from the date of filing EIA, failing which the EIA shall be deemed to have been approved as per the Act,[5] to the extent to which it does not contravene the provisions of the Act and the rules and regulations.

8. According to ADB's Safeguard Policy Statement (2009) (SPS), Tranche 4 is classified as Category B for environment, therefore requires an IEE. IEEs are prepared, following the EARF (footnote 2) prepared for MFF II, respectively for Subprojects 1, 2, 4 and 5, while environmental audit report (of existing facility) was prepared for Subprojects 3 and 6. This IEE covers part (construction of about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Bahawalpur grid stations) of Subproject 5.

Project Description

9. Subproject 5 involves procurement of goods for the construction of about 105 km of 220kV Daharki – Rahim Yar and about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Daharki and 220kV Bahawalpur grid stations for interlinking of 220kV Daharki – Rahim Yar Khan and Bahawalpur grid stations in the south-eastern area of Pakistan. This IEE covers construction of about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Bahawalpur grid stations. The Project passes through three districts namely Rahimyar Khan, and Bahawalpur, in Punjab province.

10. Project Area of Influence (AOI) majorly consists of agricultural land (79.7%) and sandy plain (10.4%). The rest of the land is comprised of barren lands, roads and water bodies.

11. The Project proponent (NTDC) plans to have the tranche-4 completed within 2 to 3 years, after completing the necessary arrangements, on the fast track.

Description of Environment

12. Summary of existing environmental condition of the Project area is presented below.

Physical Environment

13. The topography in the Project area, passing through the districts of Rahimyar Khan and Bahawalpur is flat. The land elevation varies in the districts from 93 m, msl (mean sea level) (Rahimyar Khan district) to 128 m msl (Bahawalpur district).

[3] https://environment.gov.pk/SiteImage/Misc/files/Regulations/IEE%20EIA%20Regulation%202000.pdf.
[4] Each subproject under Tranche 4 requires an independent EIA to be submitted to provincial EPAs.
[5] https://environment.gov.pk/SiteImage/Misc/files/Regulations/IEE%20EIA%20Regulation%202000.pdf.

14. The land use of the transmission line AoI comprises mostly agricultural land (79.7%). The remaining land consists of sandy plains/ dunes (10.4%), built-up area (4.5%), and barren land (1.7%) followed by vegetation clusters (2.2%) and roads and railway tracks (1.0%).

15. The Project is in Zone 2A in Pakistan Building Code (PBC) 2007 classification which is for minor to moderate risk zone.

16. The climate of the Project area is arid subtropical continental. It is extremely hot and dry in the summer season while in winter is usually dry and cold. The summer season is longer than the winter season. The Project area receives less rainfall throughout the year; therefore, the area remains dry. Monsoon season brings most of the rain in the month of July through September. Recent record shows that the area received about 290 mm of rainfall in the month of July 2022 which is one of the highest records rainfalls for this area.

17. The Project is located in a riverain area where the people highly depend on the Indus River, Sutlej River, Harka River and the canal irrigation system. The rainfall in this region is low therefore, people are dependent on canals for agricultural water and groundwater for other anthropogenic uses. The riverain area of the Rahim Yar Khan District lies close to the river Indus and Panjnad. To the Southwest of this area lies the canal irrigated area. The major canals in this district are Abbasia Canal, Sadiq Branch Panjnad, Sem Nullah, Rahim Yar Khan Branch, Minchin Branch, Panjnad Main Canal and Dallas Wah Canal.

18. All the water quality parameters of analyzed groundwater samples W-3 and W-5 were found within the World Health Organization (WHO) Standards for drinking water and the PEQS drinking water limits. However, in the groundwater sample, W-4, taste, turbidity, total hardness, TDS, and chloride are detected higher than the Punjab Environmental Quality Standards (PEQS) and WHO guidelines.

19. At all sampling locations, Particulate Matter (PM_{10} and $PM_{2.5}$) measured values were found within PEQS.

20. The noise measurement values in the AoI were found within the PEQS (N-3, N-4, and N-5) for both daytimes as well as for nighttime readings. Measures noise levels were also within IFC guideline values for both, daytime, and nighttime.

Fauna and Flora

21. Rahimyar khan and Bahawalpur areas are physically varied and have three key physical features: a desert region known as the Cholistan, a riverside area, and an area that is irrigated by canals. Consequently, it has a diversified natural environment.[6] The primary land use in most of the area is irrigated farmland of wheat, gram, oilseed, and pulses in Rabi and cotton, sugarcane, rice, and millets in harif. The remaining land is largely utilized for grazing and is uncultivated. Prosopis spicigera, Acacia jacquemontii, Salvadora oleoides, Capparis aphylla, Tamarix articulata, Tamarix sp., Calotropis procera are among the natural vegetation.

22. The Project area is dominated by plant species such as Crotalaria burhia, Prosopis juliflora, Aerva javanica, Calotropis procera, Suaeda fruticosa, Acacia nilotica, and Tamarix aphylla. During the August 2022 survey, one invasive plant species; *Prosopis juliflora* was observed in the Terrestrial Study Area. However, two other invasive plant species Ricinus communis and Xanthium strumarium were observed in some parts of the Project area.

23. None of the species observed in the AoI or the study area or surroundings were found to be globally/nationally threatened species, endemic species, or protected species.

24. Mammal species found in the wider area of the study area include Golden Jackal Canis aureus, Red Fox Vulpes, Desert Fox Vulpes bengalensis, Small Indian Mongoose

[6] Shahid, M. R., & Shinwari, M. I. (2017). 15. Documentation of indigenous and local knowledge of medicinal plants in the Rahim Yar Khan district of Pakistan. *Knowing our Lands and Resources*, 177.

Herpestes javanicus, Jungle Cat Felis chaus, Indian Crested Porcupine Hystrix indica, Small Indian Civet Viverricula indica, Black Buck Antilope cervicapra, Nilgai Boselaphus tragocamelus, Wild Boar Sus scrofa, Short-tailed Mole Rat Nesokia indica, and Desert Hare Lepus nigricollis. Based on the IUCN Red List Criteria none of the documented species from the wider area of the study area are listed as threatened except the Black Buck which is listed as Near Threatened globally.

25. Of the bird species reported from the Project area, none are listed as threatened on the IUCN Red List of Threatened Species. Of the observed bird species in the terrestrial study area, the Oriental-honey Buzzard *Pernis ptilorhynchus*, Long-legged Buzzard *Buteo rufinus*, and black kite (*Milvus migrans*) are included in CITES Appendix II.[7]

26. No wetlands which are notified by the GOP lie within the project area of the Project alignment in any Angle Marking of the project. Thus, there will be no impact on any wetland biodiversity.

27. The proposed project route will not pass through or cross any protected areas i.e., Game Reserves, National Parks, and Wildlife Sanctuaries, etc. The proposed Project, therefore, will not cause any impact on the flora and fauna of the Reserved Forest.

Socioeconomic Environment

28. According to the census of 2017, the total population of Bahawalpur District is 3,668,106 and Rahim Yar Khan District is 4,814,006. The estimated population for the year 2022 for Bahawalpur district is 4,108,279 and Rahim Yar Khan is 5,391,687.

29. Based on the current social survey, the overall average household size of district Bahawalpur is 6.20 and district Rahim Yar Khan is 6.77 average family size.

30. The main castes and groups of the Bahawalpur and Rahim Yar Khan districts are Arain, Jatt, Rajput, Pathan, Gujjar, Baloch, Qureshi, Dahar, Mahar, Shar, Solangi, Panhawar, Mazari, Dhama, Lorai, Dasti Ghuman Abasi, and Syed.

31. Saraiki is the predominant language being spoken by majority of the population of the area followed by Urdu; However, Punjabi, Sindhi, Balochi, Marwari, and Pushto are also spoken. All the Subproject affected people understand Urdu.

32. The literacy rate of Bahawalpur district is 36% and Rahim Yar Khan district is 33.1% according to the census of 2017.

33. The total metaled road length in Rahim Yar Khan is 4023.7 km and in Bahawalpur is 2678.3 km. These metaled roads are linked with Lodhran, Bahawalnagar, Daharki, Sukkar Muzaffargarh and Rajanpur districts. M5 Multan to Sukkur motorway passes through the area. Besides roads, the district has also a fully functioning railway network.

34. Majority of the houses are pacca and semi-pacca in both districts, while there are 40% kacha houses on Rahim Yar Khan and 43% in Bahawalpur.

35. Sanitation facilities are available to 63% of the population in Bahawalpur district and 59% of the population in Rahim Yar Khan District.

Environmental Management Plan

36. An environmental management plan (EMP), which establishes the linkages between the environmental impacts, mitigation strategy and the agencies responsible for execution. The EMP covers:

[7] CITES (convention on international trade in endangered species of wild fauna and flora) is an international agreement between governments. its aim to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species. Cites appendix II: species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.

- A comprehensive listing of mitigation measures (actions).
- The institution(s)/ person(s) responsible for implementation of specific actions.
- The parameters to be monitored to ensure the effective implementation of the actions.
- A timescale for the implementation of actions has been indicated subject to the project life cycle.
- A plan for impact mitigation and monitoring for the construction and operation activities

37. Proposed Project activities were reviewed and their potential impacts on the physical, biological, and socio-economic environment were assessed. Where appropriate, mitigation measures have been proposed to keep potential adverse environmental impacts within acceptable limits.

38. An EMP has been developed in this report to effectively implement the mitigation measures identified in the impact assessment. Contractor will develop Site-specific EMP (SSEMP) based on the EMP before construction activities start. No access to the site will be allowed until the SSEMP is approved by the Environment and Social Impact Cell (ESIC; Project Management Unit [PMU] of NTDC).

Information Disclosure

39. The executive summary of the IEE and the EMP will be translated to Urdu language[8] for disclosure along with complete existing document (in English). Within 2 weeks after ADB's clearance of the IEE, the summary (including the EMP) in Urdu language will be disclosed on NTDC's website. The summary will also be placed at main gate of Rahimyar Khan and Bahawalpur Grid Stations for public access.

Conclusion and Recommendations

40. If the Project construction and operation activities, including the implementation of all proposed mitigation measures, are carried out as described in this document, the anticipated impact of the project on the area's natural and socioeconomic environment shall remain well within acceptable limits.

41. The major proposed mitigation measures are summarized as follows:

- Temporary labor camps will be developed inside the grid station boundary and will be facilitated with proper drainage facilities.
- Soil erosion and contamination, water contamination, air pollution, and high noise levels will be controlled with the use of good engineering practices.
- The contractor will develop subplans (listed in footnote 121 on page 202 of this IEE) as part of SSEMP before starting the construction activities. No access to the site will be allowed until the SSEMP is approved by the ESIC.
- Fair and negotiated compensation following the prevailing market prices will be made for the loss of crops and trees during the construction activities of the project.
- The erection of towers in the water bodies will be avoided as far as possible. However, at places where realignment of the ETL is unavoidable, towers with the maximum span will be used to minimize the number of towers in the water body.
- The contractor will take due care of the local community and its sensitivity towards local customs and traditions.

[8] Saraiki is the predominant language being spoken by majority of the population of the Subproject area followed by Urdu; However, Punjabi, Sindhi, Balochi, Marwari, and Pushto are also spoken. All the Subproject affected people understand Urdu (see para. 360 on page 95).

42. Following requirements of ADB SPS, NTDC will apply pollution prevention and control technologies and practices consistent with international good practice as reflected in internationally recognized standards such as EHS Guidelines (footnotes 24, 25 and 26 on page 29 of this IEE). When Government regulations differ from these levels and measures, NTDC will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, NTDC will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.
43. This IEE will be updated if unanticipated environmental impacts become apparent and will be submitted to ADB for clearance and disclosure at ADB website.
44. NTDC will have the right to suspend works or payments if the Contractor is in violation of any of his obligations under the EMP and SSEMP.

1. Introduction

1. The Government of Pakistan signed a loan agreement with the Asian Development Bank (ADB) for financial support for the construction of the Power Enhancement Projects in Pakistan. The multi-tranche financing facility for the Second Power Transmission Enhancement Investment Program (MFF II or the Program) will expand and reinforce Pakistan's power transmission system, enabling the system to provide a reliable and quality service capable of meeting increasing customer demand and supporting economic growth. MFF II comprises four tranches and Projects located in different areas of the country.

2. Under Tranche 4 Readiness, NTDC is planning to construct new 220 kV electrical transmission lines (ETL), construction of a grid station, argumentation of 10 existing grid stations and procurement of grid station equipment. The name of these subprojects is listed hereunder:

1) Subproject 1 is the turnkey contract for design, supply, installation, testing and commissioning of approximately 70 km of 220kV double circuit transmission line for looping in/out of the proposed Hala Road-Jamshoro single circuit transmission line at 220kV Mirpur Khas New Grid Station;
2) Subproject 2 is the turnkey contract for design, manufacture, supply, installation, testing and commissioning of approximately 20 km of 220kV double circuit transmission line for looping in/out one circuit of the existing 220kV Jamshoro - T.M. Khan double circuit transmission line at Hala Road 220kV Grid Station;
3) Subproject 3 involves procurement of goods for the addition and augmentation of the six existing grid stations to remove NTDC system constraints (500kV Dadu grid station, 500kV Faisalabad West grid station, 500kV Lahore (Sheikhpura) grid station, 500kV New Multan grid station, 500kV Rahim Yar, 220kV Guddu grid station);
4) Subproject 4 involves procurement of goods for the construction of a new 220kV Jamrud grid station and approximately 20 km of the associated 220kV Jamrud-Sheikh Muhammadi transmission line in the south-western area of Pakistan;
5) Subproject 5 involves procurement of goods for the construction of about 105 km of 220kV Daharki – Rahim Yar and about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Daharki and 220kV Bahawalpur grid stations for interlinking of 220kV Daharki – Rahim Yar Khan and Bahawalpur grid stations in the south-eastern area of Pakistan;
6) Subproject 6 involves procurement of goods for operation and maintenance of NTDC assets to reduce the grid stations breakouts (550kV, 245kV, and 145kV circuit breakers and replacement of one 500/220 kV, 450 MVA Auto Transformer Bank (ATB) at the existing 500 kV Rawat Grid Station.

3. This IEE covers part (construction of about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Bahawalpur grid stations) of Subproject 5. The Project passes through three districts namely Rahimyar Khan, and Bahawalpur, in Punjab province.

1.1 Brief Description of the project and Background

4. The 150 km - long 220 kV transmission line (TL) of subproject 5 (Interlinking of 220 kV Daharki - Rahim Yar Khan - Bahawalpur Grid Stations) will connect at 220 kV Rahimyar Khan Grid Station and 220 kV Bahawalpur Grid Station.

5. The location of the Project in Punjab province is shown in **Figure 1-1**.

1.2 Environmental Category

6. According to ADB's Safeguard Policy Statement (2009) (SPS), Tranche 4 is classified as Category B for environment, therefore requires an IEE. IEEs are prepared, following the EARF (footnote 2) prepared for MFF II, respectively for Subprojects 1, 2, 4 and 5, while environmental audit report (of existing facility) was prepared for Subprojects 3 and 6. This IEE covers part (construction of about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Bahawalpur grid stations) of Subproject 5.

7. However, in local regulations, the transmission lines (11 kV and above) and distribution projects are included in Schedule II which requires an EIA. NDTC will prepare an EIA, and submitted to Punjab EPA, to obtain environmental approval or NOC before commencement of any civil works.

1.3 Project Proponent and Study Consultants

8. The Proponent of the proposed Project is NTDC. NTDC was incorporated on 6 November 1998 and took over all the properties, rights and assets obligations and liabilities of the network of 220 kV and 500 kV Grid Stations and ETLs owned by Pakistan Water and Power Development Authority (WAPDA).[9]

1.4 Approach to the IEE

9. An EARF (footnote 2) was prepared for MFF II in May 2016. This EARF is applicable for subprojects under MFF II and Tranche-I, funded by ADB. The EARF outlines the policy, procedures, and institutional requirements for preparing the subprojects. These subprojects need to be processed under ADB SPS.

10. The IEE was performed in five main phases described below and was prepared following the EARF.

1.4.1 Phase 1 – Scoping

11. The activities included in this phase are:

- Project Data Compilation: A generic description of the proposed Project activities was compiled.
- Published Literature Review: Secondary data on physical, ecology and the socioeconomic environment was compiled.
- Legislative Review: Information on relevant legislation, regulations, guidelines, and standards were compiled including those of Asian Development Bank (ADB)'s policies and guidelines.
- Evaluation of Project Activities: Based on available information on Project activities including land requirement according to the Project options, construction, operations, and maintenance.
- An impact assessment methodology was defined by identifying significance of impact through both the *consequence* and the *likelihood of occurrence* of the impact.
- Identification of Potential Impact: The information collected in the above steps was reviewed, and potential environmental and socio-economic issues were identified with impact significance in the Project Area of Influence (AOI).

1.4.2 Phase 2 – Baseline Studies

12. Following the scoping exercise, the AoI of the Project was surveyed to collect primary data during the field visit conducted between 26 August 2022, and 7 September 2022.

[9] http://www.ntdc.com.pk.

1.4.3 Phase 3 – Stakeholder Consultation

13. Local communities were identified in AoI as the major stakeholder, which can affect the Project or be affected by the Project. The socioeconomic team conducted community consultations to establish community perception of the proposed development. The institutions that may have an interest in the proposed Project were also consulted.

1.4.4 Phase 4 – Impact Assessment Methodology

14. The baseline studies conducted for the Project and the available Project description were used to assess the potential environmental impact of the proposed Project. The significance of impact was determined. Significance of the potential impacts can be determined by considering both the consequence and the likelihood of occurrence of the impact.

15. The consequence of the proposed activity is evaluated by comparing it against recognized significance criteria, such as institutional recognition, technical recognition, scientific or technical knowledge, or judgment of recognized experts, public recognition, and professional and experience-based interpretation of the evaluator.

16. The issues studied included potential Project impacts on:

- Geomorphology and Soils
- Surface and groundwater
- Ambient air quality
- Noise and traffic
- Ecology of the area, including aquatic ecology and terrestrial flora and fauna
- Socioeconomic environment of the area
- Community health and safety including electric and magnetic fields (EMF) impacts during operations

17. Mitigation measures were identified to address these impacts. The mitigation measures are designed to reduce the potential adverse impact to acceptable levels and wherever feasible to further reduce it as far as possible.

18. After implementation of the mitigation measures, the identification of the residual impact significance is evaluated.

1.4.5 Phase 5 – Documentation

19. Finally, this IEE report has been prepared according to the relevant environmental legislation. The report includes the findings of the assessment, identifies the Project impacts, and suggests mitigation measures to be implemented during the execution and operations.

1.5 Project Benefits

20. The benefits associated with the proposed Project mainly include:

- Improvement in power supply position at/around 220 kV Bahawalpur, Rahimyar Khan and Daharki Grid Stations.
- Increase in system capacity to meet future load demands of the area.
- Improvement in voltage profile of the existing 132 kV grid station in Bahawalpur, Rahimyar Khan and Ghotki.
- Reduction in transmission system losses.
- Additional source of supply to 220 kV Bahawalpur & Lal Suhana Grid Stations.
- The proposed project will provide the resynchronization of the NTDC network during collapse due to severe bad weather conditions.

- Improvement in the reliability of NTDC, MEPCO, SEPCO and HESCO system networks.
- The sub-Project will help to provide an uninterrupted power supply to underdeveloped areas of Punjab province.
- Implementation of the Project will help to uplift the social life of the area, creation of new jobs and business opportunities
- Additional revenue to government exchequer from the levy of taxes on finished goods, electricity duty due to additional sale of power & associated government taxes.

21. The other benefits of the proposed Project are as follows:

- Increase in the available system capacity to meet future load growth at/around the proposed Project.
- Improvement in the reliability of NTDC and local Distribution Companies (DISCOs) system networks.
- Serve 220 kV source of power to feed the local DISCOs load center.
- Improvement in the power supply position of local DISCOs.

22. Envisaged social benefits of the Project are:

- Provision of a more reliable supply of electricity to the consumers.
- Fulfillment of power demand for rural electrification program etc.
- Improvement in living standards of the local communities.
- Creation of small business services.
- Creation of new job opportunities for local communities.
- Development of new accommodation facilities and the local people will be exposed to new income generation opportunities.
- Socio-economic uplifts of the community such as improved production, incomes, and market activities.
- Tube wells electrification which will provide additional water for irrigation, increase cropped areas and production.
- The development of new industries in the area will create gainful employment for the increasing workforce.
- Additional revenues to Government exchequer from the levy of taxes on finished goods, electricity duty due to additional sale of power and associated taxes, etc.
- In the overall analysis, the improvement in ecological environments coupled with higher production is envisaged to bring out substantial economic gains for the people living in the Project area.

1.6 Organization of the Report

23. Section 1 (Introduction) provides an introduction of the Project and outlines the objectives of the IEE.

24. Section 2 (Policy, Legal, and Administrative Framework) presents the legislative requirements that need to be followed while conducting an IEE study.

25. Section 3 (Project Description) contains information about the key features of the proposed Project and describes the proposed Project activities.

26. Section 4 (Description of the Environment (Baseline Data) provides a detailed existing physical, ecological and socioeconomic conditions around the Project site.

27. Section 5 (Anticipated Environmental Impacts and Mitigation Measures) presents an assessment of the Project's impact to the physical, biological, and socioeconomic

environment, as well as proposed mitigation measures. The section also discusses the alternatives of the proposed Project that were considered.

28. Section 6 (

29. Analysis of Alternatives)discusses the alternatives of the proposed Project that were considered.

30. Section 1417318421. (Information Disclosure, Consultation, and Participation) presents the objectives and outcomes of the public consultation that were conducted during the IEE study. The section also covers the information disclosure steps and grievance redress mechanism (GRM) prepared for this project.

31. Section 8 (Environmental Management Plan) facilitates the implementation and monitoring of the mitigation measures identified in the IEE.

32. Section 9 (Conclusion and Recommendations)summarizes the findings and recommendations of this IEE study and concludes the report.

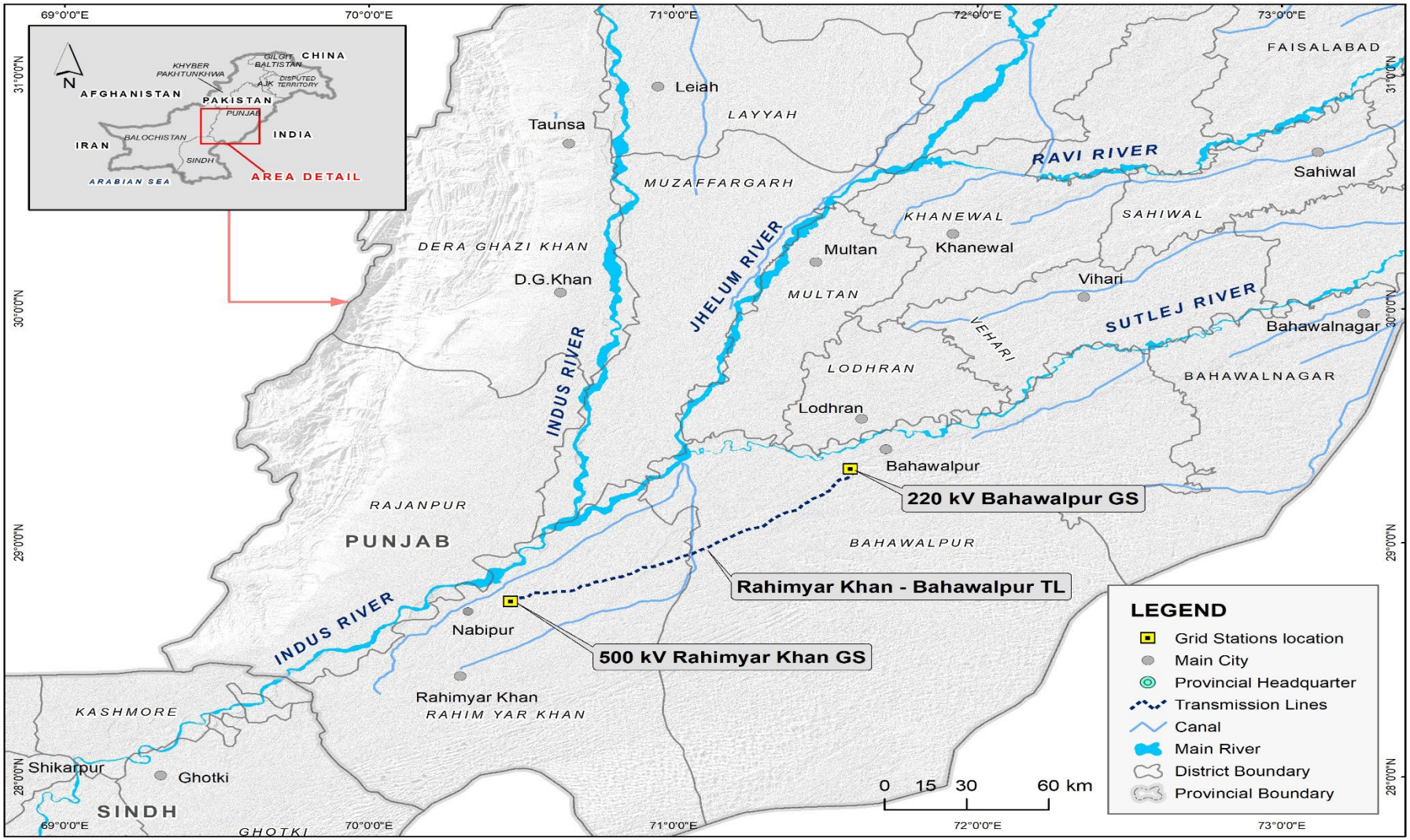

Figure 1-1: Project Location

2. Policy, Legal, and Administrative Framework

33. This section outlines the Project category, environmental and social legislation, standards, and codes of practice governing the IEE and the Project.

2.1 Historical and Constitutional Context

34. The development of statutory and other instruments for environmental management has steadily gained priority in Pakistan since the late 1970s. The Pakistan Environmental Protection Ordinance, 1983 was the first piece of legislation designed specifically for the protection of the environment. The promulgation of this ordinance was followed, in 1984, by the establishment of the Pakistan Environmental Protection Agency (Pak–EPA), the primary government institution at that time dealing with environmental issues. Significant work on developing the environmental policy was carried out in the late 1980s, which culminated in the drafting of the Pakistan National Conservation Strategy. Provincial environmental protection agencies were also established at about the same time. The National Environmental Quality Standards (NEQS) were established in 1993. In 1997, the Pakistan Environmental Protection Act (Pac-Act, 1997) was enacted to replace the 1930 Ordinance. Pac-Act (1997) conferred broad-based enforcement powers to the environmental protection agencies. This was followed by the publication of the *Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations* (the federal IEE-EIA Regulations, 2000, footnote 3) which provided the necessary details on the preparation, submission, and review of initial environmental examinations (IEE) and environmental impact assessments (EIA).

35. Before the 18th Amendment to the Constitution of Pakistan in 2010, the legislative powers were distributed between the federal and provincial governments through two 'lists' attached to the Constitution as Schedules. The Federal list covered the subjects over which the federal government had exclusive legislative power, while the 'Concurrent List' contained subjects regarding which both the federal and provincial governments could enact laws. The subject of 'environmental pollution and ecology' was included in the Concurrent List and hence allowed both the national and provincial governments to enact laws on the subject. However, as a result of the 18th Amendment, this subject is now in the exclusive domain of the provincial government. The main consequences of this change were as follows:

- The Ministry of Environment at the federal level was abolished. Its functions related to the national environmental management were transferred to the provinces. To manage the international obligations in the context of the environment, a new ministry—the Ministry of Climate Change—was created at the federal level.
- Pac-Act (1997) was technically no longer applicable to the provinces. The provinces were required to enact their own legislation for environmental protection. However, to ensure legal continuity Pac-Act (1997) continued to be the legal instrument for environmental protection in the provinces till the enactment of the provincial law.

36. All four provinces have enacted their environmental protection laws. These provincial laws are largely based on Pac-Act (1997) and, hence, provide the same level of environmental protection as the parent law.

Provincial Law and Regulations

2.2 Punjab Environmental Protection Act (Punjab Act, 1997)

37. The Punjab Environmental Protection Act (Punjab-Act, 1997) is the basic environmental legislation that governs the conduct of environmental assessment in Punjab. The Act was enacted in 2012 by the Punjab Legislative Assembly by amending Pac-Act (1997) following the devolution of powers, including among other the power to legislate on

environmental issues, from the federal to the provincial governments under the 18th Amendment to the Constitution. All rules, regulations, standards, and guidelines promulgated under Pac-Act (1997) by the federal government remain in force until explicitly repealed or amended by the provincial government.

38. Key provisions of Punjab-Act (1997) that may affect the functioning of the Project are:

- Article 11 prohibits discharge or emission of any effluent or waste or air pollutant or noise in an amount, concentration, or level which is in excess of the Punjab Environmental Quality Standards.
- Article 12 makes it mandatory to undertake an IEE or EIA (as applicable) and obtain its approval from the Punjab EPA before commencing the construction and operation of a project.
- Article 13 prohibits the import of hazardous waste into Punjab.
- Article 14 imposes licensing requirements in order to "generate, collect, consign, transport, treat, dispose of, store, handle or import" any hazardous substance.
- Article 15 regulates gaseous emissions and noise from motor vehicles.

2.3 Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Impact Assessment Regulations (the federal IEE-EIA Regulations, 2000)

39. These regulations provide criteria for projects requiring IEE and EIA. They also briefly describe the preparation and review of environmental reports. These Regulations are also available at the official website of EPD, Punjab.

40. The federal IEE-EIA Regulations (2000, footnote 3) provides the necessary details on the preparation, submission, and review of the IEE and the EIA. The categorization of projects for IEE and EIA is one of the main components of the federal IEE-EIA Regulations (2000). Projects have been classified based on the expected degree of adverse environmental impact. Project types included in Schedule II of the regulations include those that are likely to have a potentially significant impact on the environment and thus an EIA is required for such projects, whereas those included in Schedule I are listed as having potentially less adverse effects and therefore require an IEE.

41. The ETL Projects with 11kV or higher are kept in Schedule II of the regulations and thus an EIA is required for such projects.

2.4 Punjab Water Act, 2019

42. The Punjab Water Act 2019 comprehensively manages and regulates water resources in Punjab in the interest of conservation and sustainability.

2.5 Institutional Framework

43. Under Punjab-Act (1997), Punjab EPA is an autonomous agency for administrative purposes and performs the following functions:

- Implements the provisions of Punjab-Act (1997) and the rules and regulations made there under.
- Issues approvals in wake of environment for different projects
- Certifies the environmental laboratories in Punjab
- Prepares and establishes the Punjab Environmental Quality Standards (PEQS) with approval of the council and their enforcement
- Resolves public complaints regarding environmental issues

- Takes measures to promote research and development of science and technology which may contribute to the protection of the environment and sustainable development
- Promotes tree plantation for Clean Green Pakistan
- Promotes environmental awareness through seminars/workshops/training
- Implements international treaties
- Identifies the needs for, and initiates legislation in various sectors of the environment
- Ensures field visits for an anti-dengue campaign in four designated areas
- Provides information and guidance to the public on environmental matters
- Specifies safeguards for the prevention of accidents and disasters which may cause pollution
- Encourages formation and working of non-government, community, and village organizations to prevent and control pollution in order to promote sustainable development
- Takes all necessary measures for protection, conservation, rehabilitation, and improvement of the environment, and prevention and control of pollution

2.6 Requirements for Environmental Assessment

44. Punjab EPA will be responsible for the review and approval of the EIA of the proposed Project.

45. The articles of Punjab-Act (1997) that have a direct bearing on the environmental assessment of the proposed Project are:

- Article 12(1): '*No proponent of a project shall commence construction or operation unless he has filed with the Agency*[10] *an initial environmental examination or an environmental impact assessment and has obtained from the Agency approval in respect thereof.*'
- Article 12(3): '*Every review of an environmental impact assessment shall be carried out with public participation…*'

46. The Punjab IEE-EIA Regulations are still to be formulated and so the federal IEE-EIA Regulations (2000, footnote 3) are still valid in the province, provides the necessary details on the preparation, submission, and review of the IEE and the EIA. The categorization of projects for IEE and EIA is one of the main components of the federal IEE-EIA Regulations (2000). Projects have been classified based on the expected degree of adverse environmental impact. Project types included in Schedule II of the regulations include those that are likely to have a potentially significant impact on the environment and thus an EIA is required for such projects, whereas those included in Schedule I are listed as having potentially less adverse effects and therefore require an IEE. The ETL Projects with 11 kV or higher are kept in Schedule II of the regulations and thus an EIA is required for such projects.

47. The Project[11] requires filing an EIA with Punjab EPA for NOC. The applicable law binds the Agency (Punjab EPA) to inform the proponent (NTDC in this case) on the approval in four months from the date of filing EIA, failing which the EIA shall be deemed to have been approved as per para.16 of the federal IEE-EIA Regulations (2000)[12], to the extent to which it does not contravene the provisions of the rules and regulations. The approval once granted is valid for 3 years from the date of issue. If the construction work does not start or complete within the 03 years an application required to submit with the Agency for extension to maximum another 03 years period. Punjab EPA will be responsible for the review and approval of the EIA of the proposed Project.

[10] The term 'Agency' refers to the Punjab EPA.
[11] Each subproject under Tranche 4 Readiness will require an independent EIA to be submitted to provincial EPAs.
[12],paragraph 16.

2.6.1 Administrative Framework on Environmental Issues

48. The Project is legally required to comply with the PEQS. The environmental standards applicable in Punjab are NEQS as developed by Pakistan Environmental Protection Agency before the 18th Amendment.

49. Punjab EPA notified seven sets of PEQS on 12 August 2016 (Table 2-1).[13]

50. PEQS for air quality are presented in **PEQS** = Punjab Environmental Quality Standard

51. Table 2-2. Table 2-3 provides a comparison of PEQS (local standards) with international standards and guideline values.

52. PEQS for effluent water and drinking water are presented in **Table 2-4** and **Table 2-5**.

53. **Table 2-6** provides local noise standards and a comparison of these (local standards) with international standards is presented in **Table 2-7**.

Table 2-1: PEQS Applicable to the Project

Standard	Applicability During Construction	Applicability During Operation
PEQS for industrial gaseous emission	Emissions from power generators	Not applicable
PEQS for noise	Noise levels in the nearby community	Noise levels in the nearby community
PEQS for ambient air	Incremental air pollutants due to the construction work (clearing and preparation of the site, operation of construction machinery and equipment, and movement of Project vehicles)	Incremental air pollutants from road facilities such as from equipment installed at toll plaza buildings, etc.
PEQS for municipal and liquid industrial effluents	Effluent from the construction activities (camp sanitary waste, surface run-off, and other waste)	Sanitary waste from road facilities such as from equipment installed at toll plaza buildings, etc.
PEQS for drinking water	Water supplied to the construction staff	Water supplied to operation staff such as staff of toll plaza buildings, etc.
PEQS for motor vehicle exhaust and noise	Exhaust and noise from Project vehicles	Exhaust and noise from Project vehicles
PEQS for treatment of liquid and disposal of bio-medical waste	Not applicable	Not applicable

PEQS = Punjab Environmental Quality Standard

Table 2-2: PEQS Limits for Ambient Air Quality

Pollutants	Time-weighted Average	Standards (µg/m^3)
Sulfur Dioxide (SO_2)	Annual*	80
	24 hours**	120
Oxide of Nitrogen as (NO)	Annual	40
	24 hours	40
Oxide of Nitrogen as (NO_2)	Annual	40
	24 hours	80
Ozone (O_3)	1 hour	130
Suspended Particulate Matter (SPM)	Annual	360
	24 hours	500

[13] http://epd.punjab.gov.pk/rules_regulations. Retrieved on 22 August 2017.

Pollutants	Time-weighted Average	Standards (µg/m³)
Respirable particulate Matter. PM_{10}	Annual *	120
	24 hours**	150
Respirable Particulate Matter. $PM_{2.5}$	24 hours*	15
	Annual Average **	35
Lead (Pb)	Annual Average	1
	24 hours	1.5
Carbon Monoxide (CO)	8 hours	5,000
	1 hour	10,000

PEQS = Punjab Environmental Quality Standard

* Annual arithmetic means of minimum 104 measurements in a year taken twice a week, hourly and uniform interval

** 24 hourly/8 hourly values should be met 98% in a year, 2% of the time. It may exceed but not on two consecutive days.

Table 2-3: Comparison of Local and International Standards

Pollutant	PEQS		WHO	
	Avg. Time	Avg. Time	Avg. Time	Standards
SO_2	Annual Mean	80 µg/m³	24 hours	40 µg/m³
	24 hours	120 µg/m³	10 Minutes	500 µg/m³
CO	8hours 1 hour	5 mg/m³ 10 mg/m³	24 hours 8 hours 15 minute	4 µg/m³ 10 µg/m³ 100 µg/m³
NO_2	Annual Mean 24 hours	40 µg/m³ 80 µg/m³	1 Year 24 hour 1 hour	10 µg/m³ 25 µg/m³ 200 µg/m³
O_3	1 hour	135 µg/m³	8 hours Peak season	100 µg/m³ 60 µg/m³
TSP	24 hours	500 µg/m³		
PM_{10}	24 hours	150 µg/m³	1 Year 24 Hours	15 µg/m³ 45 µg/m³
$PM_{2.5}$	24 hours	15 µg/m³	1 Year 24 Hours	5 µg/m³ 15 µg/m³

PEQS = Punjab Environmental Quality Standard

Note: The standards highlighted in green for each pollutant are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed Project.

The green color shows more rigorous standards applicable to the Project.

Table 2-4: PEQS Limits for Wastewater/ Effluents

(mg/l, unless otherwise defined)

Parameter	PEQS (Into Inland Waters)	PEQS (Sewage Treatment)	IFC[14]
Temperature increase*	Less than or equal to 3°C	Less than or equal to 3°C	< 3°C
pH value	6 to 9	6 to 9	6 to 9
Five–day biochemical oxygen demand (BOD) at 20°C	80	250	50
Chemical oxygen demand (COD)	150	400	250
Total suspended solids (TSS)	200	400	50
Total dissolved solids (TDS)	3500	3500	
Grease and oil	10	10	10
Phenolic compounds (as phenol)	0.1	0.3	0.5
Chlorides (as Cl')	1000	1000	
Fluorides (as F')	10	10	
Cyanide total (as CN')	1.0	1.0	
Anionic detergents (as MBAS)	20	20	
Sulfates (SO_4^{2-})	600	1000	
Sulfides (S^{2-})	1.0	1.0	1.0
Ammonia (NH_3)	40	4.0	10
Pesticides	0.15	0.15	
Cadmium	0.1	0.1	0.1
Chromium (trivalent and hexavalent)	1.0	1.0	0.1
Copper	1.0	1.0	0.5
Lead	0.5	0.5	0.1
Mercury	0.01	0.01	0.01
Selenium	0.5	0.5	0.1
Nickel	1.0	1.0	0.5
Silver	1.0	1.0	0.5
Total toxic metals	2.0	2.0	10
Zinc	5.0	5.0	2.0
Arsenic	1.0	1.0	0.1
Barium	1.5	1.5	
Iron	8.0	8.0	3.5
Manganese	1.5	1.5	
Boron]	6.0	6.0	
Chlorine	1.0	1.0	0.2

Notes: The standards highlighted in green for each pollutant are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed project.

[14] Limits for Process Wastewater, Domestic Sewage, and Contaminated Stormwater Discharged to Surface Waters, for General Application.

PEQS = Punjab Environmental Quality Standard

*The effluent should not result in a temperature increase of more than 3°C at the edge of the zone where initial mixing and dilution take place in the receiving body. In case the zone is not defined, use 100 meters from the point of discharge.

Table 2-5: Drinking Water Quality Standards

(mg/l, unless otherwise defined)

Parameter	Unit	PEQS Drinking Water	WHO Guideline Values for Drinking Water
Physical			
Temperature	°C	NGVS	–
Odor		Non- Objectionable	–
Color	TCU	≤ 15	,<15
Taste		Non- Objectionable	–
pH		6.5-8.5	6.5 – 8.5
Total Hardness (as CaCO3)	mg/l	< 500	<500
Total dissolved solids	mg/l	< 1000	< 1000
Turbidity	NTU	< 5	< 5
Chemicals			
Aluminum (Al)	mg/l	0.2	0.2
Antimony (Sb)	mg/l	≤ 0.005	0.02
Arsenic (As)	mg/l	≤0.05	0.01
Barium (Ba)	mg/l	0.7	0.7
Boron (B)	mg/l	0.3	0.3
Cadmium (Cd)	mg/l	0.01	0.003
Chloride (Cl)	mg/l	≤ 250	250
Chromium (Cr)	mg/l	≤ 0.05	0.05
Copper (Cu)	mg/l	2.0	2.0
Cyanide (CN-)	mg/l	≤ 0.05	0.07
Fluoride (F-)	mg/l	≤ 1.5	1.5
Lead (Pb)	mg/l	≤ 0.05	0.01
Manganese (Mn)	mg/l	≤ 0.5	0.5
Mercury (Hg)	mg/l	≤ 0.001	0.001
Nickel (Ni)	mg/l	≤0.02	0.02
Nitrate (NO3-)	mg/l	≤50	50
Nitrite (NO2-)	mg/l	≤3	3
Selenium (Se)	mg/l	≤ 0.01	0.01
Residual Chlorine	mg/l	0.2 – 0.5	0.2 – 0.5
Zinc (Zn)	mg/l	5.0	3.0
Biological			
Total Coliforms	mL CFU	0/ 100	0/ 100

Parameter	Unit	PEQS Drinking Water	WHO Guideline Values for Drinking Water
Fecal Coliforms	mL CFU	0/ 100	0/ 100
Compounds			
Phenolic Compounds (as Phenols)	mg/l	<0.002	
Pesticides	mg/l	NGVS	
Polynuclear Aromatic Hydrocarbons (as PAH)	g/l	0.01 (By GC/MS method)	0.01

PEQS = Punjab Environmental Quality Standard

Note:

TCU	True color unit	NGVS	No Guideline Value Set
CFU	Colony Forming Unit	NTU	Nephelometric Turbidity Unit

The green color shows more rigorous standards applicable to the Project.

Table 2-6: PEQS for Noise

No.	Category of Area/Zone	Effective from 1 July 2013	
		Limit in dB(A) Leq*	
		Day Time	Nighttime
1.	Residential are (A)	55	45
2.	Commercial area (B)	65	55
3.	Industrial area (C)	75	65
4.	Silence zone (D)	50	45

PEQS = Punjab Environmental Quality Standard

Note:

1. Day time hours: 6 .00 am to 10.00 pm
2. Nighttime hours: 10.00 pm to 6.00 am
3. Silence zone: Zones that are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts, and courts.
4. Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.
5. *dB(A) Leq: a time-weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

Table 2-7: Comparison of Local and International Standards

Category of Area/Zone	Limit in dB(A) Leq			
	PEQS		WHO/ IFC	
	Nighttime (22:00-06:00)	Daytime (06:00-22:00)	Nighttime (22:00-07:00)	Daytime (07:00-22:00)
Residential area (A)	45	55	45	55
Commercial area (B)	55	65	70	70
Industrial area (C)	65	75	70	70
Silence zone (D)	45	50	45	55

PEQS = Punjab Environmental Quality Standard

Note: The standards highlighted in green for each respective Area/Zone are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed Project.

The green color shows more rigorous standards applicable to the Project.

2.6.2 Other Applicable Laws

54. There are several other laws in the statute books of Pakistan which have a bearing on the environmental performance of the Project. These are listed in **Table 2-8**.

Table 2-8: Laws Relevant to the Project

Law	Description	Applicability to the Project
The Canal and Drainage Act, 1873	The act prohibits fouling of channels, watercourses, and reservoirs by industrial and/or domestic waste.	Discharges to the canals fall on Corridor of Impact (CoI)
The Forest Act of 1927 or the Punjab Forest (Amendment) Act 2016	The act authorizes provincial forest departments to establish forest reserves and protected forests and imposes restrictions on activities with the forest.	As there are no forest reserves or protected forests in the area, this law is not applicable. However, the trees on the road bank are maintained by the Forest Department and coordination with them will be required if the trees are to be removed.
Land Acquisition Act, 1894	The Act empowers the government to acquire land for the public interest (including for projects of national importance whether in the public or private sector). The law sets out procedures for land acquisition, valuation of land, payment of compensation to landowners, including any damage caused to their properties, crops, and trees by a Project.	The law will be applicable only if the province decides to acquire private land for the Project and transfer it to the Proponent. In case, the land is acquired directly through private negotiations, this law has no implications.

Law	Description	Applicability to the Project
The Punjab Wildlife Protection Act 1974	This act was enacted to protect the province's wildlife resources directly and other natural resources indirectly. It classifies wildlife by degree of protection, i.e., animals that may be hunted on a permit or special license, and species that are protected and cannot be hunted under any circumstances. The Act specifies restrictions on hunting and trade in animals, trophies, or meat. The Act also defines various categories of wildlife-protected areas, i.e., National Parks, Wildlife Sanctuaries, and Game Reserves.	The Project area does not include any protected wildlife species; therefore, this law is not applicable to the Project.
Fisheries West Pakistan. Ordinance 1961	This law a) prohibits the destruction of fish by explosives, poisoning water, and the hunting of protected fish species, and b) grants power to the Director-General of Fisheries to issue permits to catch fish.	The law will not be applicable as the canal has a limited fish resource and is not subject to licensing from the Fisheries Department.
Factories Act 1934	Requirements for occupational health and safety at the workplace	Applicable to workers' accommodation and rights during construction and operations
The Building Code of Pakistan (2008)	Requirements for safety to be included in the design of buildings in Pakistan. The Building Code of Pakistan – Fire Safety Provisions (2016) provides the requirements for fire prevention, life safety in relation to fire and fire protection of buildings and building-like structures.	Applicable in both construction and operations phases of the Project.
The Antiquities Act of 1975	The Act ensures the protection of Pakistan's cultural resources. The Act defines 'antiquities' as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc.	Not applicable as no archeological or historical site was found on the RoW of the Project. One mosque may be required relocation. This will be applicable it is unavoidable.

2.7 Asian Development Bank Policies and Guidelines

1. ADB SPS builds upon the three previous safeguard policies on the environment, involuntary resettlement, and indigenous peoples, and brings them into one single policy that enhances consistency and coherence, and more comprehensively addresses environmental and social impacts and risks.

55. ADB SPS aims to promote sustainability of Project outcomes by protecting the environment and people from Project's potential adverse impacts by avoiding adverse impacts of projects on the environment and affected people, where possible; minimizing, mitigating, and/or compensating for adverse project impacts on the environment and affected people when avoidance is not possible; and helping borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

56. The following ADB policies and guidelines may apply to the proposed Project:

- ADB SPS – Safeguards Requirement (SR) 1 on Environment, SR2 on Involuntary Resettlement (IR), and SR 3 on Indigenous Peoples (IP)
- ADB Social Protection Strategy (2001)
- ADB Gender and Development Policy (1998)
- Access to Information Policy (2018);[15] and
- Relevant ADB Operations Manual (OM) such as OMF1 for ADB SPS, OML3 for Access to Information Policy[16], OMD10 for Non-sovereign Operations, OMC3 for Incorporation of Social Dimensions into ADB Operations, OMC2 for Gender and Development;[17]
- ADB's Accountability Mechanism Policy (2012)[18]

57. ADB SPS is grounded in its Poverty Reduction Strategy and its Long-Terms Strategic Framework. To ensure the reduction of poverty through environmentally sustainable development, ADB SPS contains five main elements: (i) promoting environment and natural resource management interventions to reduce poverty directly, (ii) assisting developing member countries to mainstream environmental considerations in economic growth, (iii) helping maintain global and regional life support systems that underpin future development prospects, (iv) building partnerships to maximize the impact of ADB lending and non-lending activities, and (v) integrating environmental considerations across all ADB operations.

58. Under the last element, the ADB pledges to address the environmental aspects of its operations through the systematic application of procedures for (i) environmental analysis for country strategy and programming; (ii) environmental assessment of project loans, program loans, sector loans, loans involving financial intermediaries, and private sector loans; (iii) monitoring and evaluation of compliance with environmental requirements of loans; and (iv) implementation of procedures for environmentally responsible procurement. In the context of policy-based lending and policy dialogue, the ADB will identify opportunities to introduce policy reforms that provide incentives to improve environmental quality and enhance the sustainability of natural resource management.

59. ADB classifies projects into category A (with potentially significant environmental impact); category B (with potentially less significant environmental impact); or, category C (unlikely to have a significant environmental impact).[19] An IEE is required for category B projects and an EIA, requiring greater depth of analysis, for category A projects. No environmental assessment is required for category C projects although their environmental implications nevertheless need to be reviewed. The proposed Project has been classified as a category B project for the environment.

60. The ADB requires public consultation and access to information in the environmental assessment process. It specifies the need for meaningful consultation, which involves two-way communication between the borrower/client and the affected communities and stakeholders. It also involves the active participation of affected communities and stakeholders

[15] Asian Development Bank (ADB), September 2018, Access to Information Policy, Available at https://www.adb.org/sites/default/files/institutional-document/450636/access-information-policy.pdf. Accessed on 18 June 2019.

[16] Asian Development Bank (ADB), January 2019, Access to Information Policy Operations Manual, Available at https://www.adb.org/sites/default/files/institutional-document/31483/om-l3.pdf.

[17] Asian Development Bank (ADB), September 2016, Operations Manual, Institutional Document, ADB, Available at https://www.adb.org/documents/operations-manual.

[18] Asian Development Bank (ADB), 2012, Accountability Mechanism Policy, ADB Available at https://www.adb.org/sites/default/files/institutional-document/33440/files/accountability-mechanism-policy-2012.pdf.

[19] A fourth category, FI (credit line for subprojects through a financial intermediary, or equity investment in a financial intermediary), requires that an appropriate environmental management system should be developed and assessment carried out.

in various stages in the project design and implementation. The following principles apply to meaningful consultations:[20]

- begins early and is carried out on an ongoing basis throughout the project cycle,
- ensures timely disclosure of relevant information,
- is free of intimidation or coercion,
- is gender-inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups, and
- incorporates relevant views of affected people and other stakeholders into project design and decision-making.

2.7.1 ADB's Safeguard **Policy Statement (SPS, 2009)**

61. ADB SPS consists of three operational policies on the environment, indigenous people, and involuntary resettlement. A brief detail of all three operational policies has been mentioned below:

- **Environmental *Safeguard**:*** This safeguard is meant to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. The requirements apply to all ADB-financed and/or ADB-administered sovereign and non-sovereign projects, and their components regardless of the source of financing, including investment projects funded by a loan; and/or a grant; and/or other means, such as equity and/or guarantees (hereafter broadly referred to as projects). This policy and its requirements about environmental assessment, baseline, and impact assessment will apply to this project and the EIA will be undertaken to ensure that the project is designed to comply with the policy.
- **Involuntary *Resettlement Safeguard**:*** This safeguard has been placed to avoid involuntary resettlement whenever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups. This policy and its requirements will apply to this project and the EIA and LARP will be undertaken to ensure that the project is designed to comply with the policy.
- ***Indigenous Peoples Safeguard**:*** This safeguard looks at designing and implementing projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they receive culturally appropriate social and economic benefits; do not suffer adverse impacts as a result of projects; and participate actively in projects that affect them. Based on the available information no indigenous people live in the project area. However, this will be further confirmed during the study.
- ***Information, Consultation, and Disclosure**:*** Consultation and participation are essential in achieving the safeguard policy objectives. This implies that there is a need for prior and informed consultation with affected persons and communities in the context of safeguard planning and for continued consultation during project implementation to identify and help address safeguard issues that may arise. The consultation process begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle. It provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people and is undertaken in an atmosphere free of intimidation or coercion. Also, it is gender-inclusive and responsive and tailored to the needs of disadvantaged and vulnerable groups and enables the incorporation of all relevant views of affected people and other stakeholders into decision

[20] Asian Development Bank (ADB), Environmental Safeguards: A Good Practice Sourcebook Draft Working Document, December 2012.

making. ADB requires the borrowers/clients to engage with communities, groups or people affected by proposed projects and with civil society through information disclosure, consultation and informed participation in a manner commensurate with the risks to and impacts on affected communities. For projects with significant adverse environmental, involuntary resettlement or Indigenous Peoples impacts, ADB project teams will participate in consultation activities to understand the concerns of affected people and ensure that such concerns are addressed in project design and safeguard plans.

2. Following requirements of ADB SPS, NTDC will apply pollution prevention and control technologies and practices consistent with international good practice as reflected in internationally recognized standards such as EHS Guidelines (footnotes 24, 25 and 26 on page 29 of this IEE). When Government regulations differ from these levels and measures, NTDC will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, NTDC will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

2.7.2 Social Protection Requirements

62. ADB SPS requires the Borrower to comply with applicable labor laws concerning the project, and take the following measures to comply with the core labor standards[21] for the ADB financed portion of the project:

- carry out its activities consistent with the intent of ensuring legally permissible equal opportunity, fair treatment and non-discrimination about recruitment and hiring, compensation, working conditions and terms of employment for its workers (including prohibiting any form of discrimination against women during the hiring and providing equal work for equal pay for men and women engaged by the Borrower)
- not restrict its workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of employment
- engage contractors and other providers of goods and services:
- who do not employ child labor[22] or forced labor[23];
- who have appropriate management systems that will allow them to operate in a manner which is consistent with the intent of (A) ensuring legally permissible equal opportunity and fair treatment and non-discrimination for their workers, and (B) not restricting their workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of employment; and
- whose subcontracts contain provisions which are consistent with paragraphs (i) and (ii) above.

2.7.3 Access to Information Policy (2018)

63. The objective of The Access to Information Policy (2018) is to promote stakeholder trust in ADB and to increase the development impact of ADB activities. The policy reflects ADB's commitment to transparency, accountability, and participation by stakeholders in ADB-

[21] The core labor standards are the elimination of all forms of forced or compulsory labor; the abolition of child labor; elimination of discrimination in respect of employment and occupation; and freedom of association and the effective recognition of the right to collective bargaining, as per the relevant conventions of the International Labor Organization.

[22] Child labor means the employment of children whose age is below the statutory minimum age of employment in the relevant country, or employment of children in contravention of International Labor Organization Convention No. 138 'Minimum Age Convention" (www.ioo.org).

[23] Forced labor means all work or services not voluntarily performed, that is, extracted from individuals under threat of force or penalty.

supported development activities in Asia and the Pacific. It also recognizes the right of people to seek, receive, and impart information about ADB's operations.

64. The policy applies to documents and information that ADB produces, requires to be produced by its borrowers or clients, or is produced and provided to ADB by other parties in the course of ADB operations.

2.7.4 Climate Change Risk Management Framework

65. The climate risk management approach of the ADB aims to reduce risks resulting from climate change to investment projects in Asia and the Pacific. ADB's framework identifies climate change risks to project performance in the early stages of project development and incorporates adaptation measures in the design of projects at risk. ADB climate risk management framework comprises the following steps:

- context-sensitive climate risk screening at the concept development stage to identify projects that may be at medium or high risk
- climate change risk and vulnerability assessment during the preparation of projects at risk
- a technical and economic evaluation of adaptation options
- identification of adaptation options in project design; and
- monitoring and reporting of the level of risk and climate-proofing measures.

2.8 IFC Performance Standards

66. The IFC Performance Standards were published in April 2006 and revised in 2012. Information on the IFC standard and applicability for the project is provided in Table 2-9.

67. PS 1 establishes the importance of integrated assessment to identify the social and environmental impacts, risks and opportunities of projects, effective community engagement through disclosure of Project-related information and consultation with local communities on matters that directly affect them, and management of social and environmental performance throughout the life of the project.

68. PS 2 through 8 establishes requirements to avoid, reduce, mitigate, or compensate for impacts on people and the environment, and to improve conditions where appropriate.

Table 2-9: IFC Performance Standards

IFC Performance Standards	Applicability
Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts	Applicable to the IEE process.
Performance Standard 2: Labor and Working Conditions	Applicable to employment and labor polices of the Project.
Performance Standard 3: Pollution Prevention and Abatement	Applicable to the Project's pollution prevention and abatement options.
Performance Standard 4: Community Health, Safety, and Security	Applicable to the potential community health and safety risk and the security system of the Project.
Performance Standard 5: Land Acquisition and Involuntary Resettlement	Applicable to the land acquired for the Project.
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Not likely to be applicable. However, part of biodiversity conservation will be covered in ecological assessment in IEE process under PS1.
Performance Standard 7: Indigenous Peoples	Not applicable.

IFC Performance Standards	Applicability
Performance Standard 8: Cultural Heritage	Not applicable.

2.9 The World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines)

69. EHS Guidelines[24] were initially published in 2007 and 2008.

70. The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice, as defined in IFC's Performance Standard 3 on Pollution Prevention and Abatement.

71. The General EHS Guidelines[25] and EHS Guidelines for Electric Power Transmission and Distribution[26] will be applied to the Project.

2.10 International Treaties and Agreements

72. Table 2-10 lists important international environmental treaties that have been signed by Pakistan and may have relevance to the Project. They concern climate change and depletion of the ozone layer; biological diversity and trade in wild flora and fauna; desertification; waste and pollution; and cultural heritage.

[24] Environmental, Health, and Safety Guidelines (ifc.org)
[25] https://www.ifc.org/wps/wcm/connect/29f5137d-6e17-4660-b1f9-02bf561935e5/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES&CVID=nPtguVM
[26] https://www.ifc.org/wps/wcm/connect/7b65ce6b-129d-4634-99dc-12f85c0674b3/Final%2B-%2BElectric%2BTransmission%2Band%2BDistribution.pdf?MOD=AJPERES&CVID=nPtfp32&id=1323162154847

Table 2-10: International Environmental Treaties Endorsed by Pakistan

Topic	Convention	Date of Treaty	Entry into Force in Pakistan
Climate change and the ozone layer	United Nations Framework Convention on Climate Change - the primary objective is the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.	1992	1994
	Kyoto Protocol to the United Nations Framework Convention on Climate Change - enabled by the above Convention on Climate Change. It has more powerful and legally binding measures. It sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas emissions.	1997	2005
	Vienna Convention for the Protection of the Ozone Layer - acts as a framework for the international efforts to protect the ozone layer with a primary objective to protect human health and the environment against adverse effects resulting from human activities that modify or are likely to modify the ozone layer.	1985	1993
	The Montreal Protocol on Substances that Deplete Ozone Layer and associated amendments - enabled by the Vienna Convention, it is designed to protect the ozone layer by phasing out the production and consumption of several substances believed to be responsible for ozone depletion.	1987	1993
Waste and pollution	Basel Convention on the Control of Trans Boundary Movements of Hazardous Wastes and their Disposal - regulates the transboundary movement of hazardous waste and other waste with a stated purpose to protect human health and the environment against the adverse effects from generation and management of hazardous waste and other waste. The Convention provides for three sets of measures with binding obligations. These are Strict control of the transboundary movement of hazardous waste; Environmentally sound management of hazardous waste; and Enforcement and implementation of the provisions of the convention at international and national levels.	1989	1994
	International Convention on Oil Pollution Preparedness, Response and Co-operation	1990	1995
	Stockholm Convention on Persistent Organic Pollutants - seeks to protect human health and the environment from Persistent Organic Pollutants, which are chemicals that remain intact in the environment for long periods, become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife.	2001	2008
	International Convention for the Prevention of Pollution from Ships (MARPOL) – is the main international convention that covers the prevention of pollution of the marine environment by ships from operational or accidental causes. The Convention includes regulations aimed at preventing and minimizing pollution from ships, both accidental pollution and that from routine operations, and currently includes six technical Annexes.	1983	

Topic	Convention	Date of Treaty	Entry into Force in Pakistan
Desertification	International Convention to Combat Desertification –to combat desertification and mitigate the effects of drought. It is supported by international cooperation and partnership arrangements, to achieve sustainable use of land and water resources and sustainable development in affected areas.	1994	1997
Biodiversity and the protection of plants and animals	Convention on Biological Diversity – covering ecosystems, species, and genetic resources and also the field of biotechnology. The objectives are: • conserve of biological diversity; • sustainable use of its components; and • fair and equitable sharing of benefits arising from genetic resources.	1992	1994
	Cartagena Protocol on Biosafety to the Convention on Biological Diversity - addresses potential risks posed by living modified organisms resulting from modern biotechnology.	2000	2009
	Bonn Convention on the Conservation of Migratory Species of Wild Animals - aims to conserve terrestrial, marine and avian migratory species throughout their range. It is concerned with the conservation of wildlife and habitats on a global scale.	1979	1987
	Memorandum of Understanding concerning Conservation Measures for the Siberian Crane - parties undertake to provide strict protection to Siberian Cranes and identify and conserve wetland habitats essential for their survival.	1998	1999
	Convention on International Trade in Endangered Species of Wild Fauna and Flora - to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	1973	1976
	International Plant Protection Convention (1997 Revised Text) - to prevent the international spread of pests and plant diseases. It requires maintenance of lists of plant pests, tracking of pest outbreaks, and coordination of technical assistance between member nations.	1951/52	1954
	Agreement for the Establishment of the Near East Plant Protection Organization - to establish the Near East Plant Protection Organization (NEPPO), which promotes international co-operation to implement the International Plant Protection Convention.	1993	2009
	Plant Protection Agreement for the Asia and Pacific Region and amendments – establishes the Asia and Pacific Plant Protection Commission to review and promote the region's progress in the implementation of the Agreement. Trade-in plants and plant products are regulated by certification, prohibition, inspection, disinfection, quarantine, destruction, etc., as necessary.	1955 (amendment 1967)	1958 (amendment 1969)

Topic	Convention	Date of Treaty	Entry into Force in Pakistan
	Convention on Wetlands of International Importance especially as Waterfowl Habitat and associated protocols and amendments - to promote conservation and sustainable use of wetlands. The Ramsar List of Wetlands of International Importance now includes almost 1,800 sites (known as Ramsar Sites). There are currently 19 Ramsar sites in Pakistan.	1971 (amended 1987)	1976 (amended 1994)
Cultural heritage	Convention concerning the Protection of the World Cultural and Natural Heritage - requires parties to adopt a general policy on the protection of the natural and cultural heritage, to set up services for such protection, to develop scientific and technical studies, to take appropriate legal, technical, scientific and administrative measures and to foster training and education for such protection.	1972	1976

2.11 Electric and Magnetic Field (EMF) Exposure Guidelines

73. EMF are invisible lines of force emitted by and surrounding any electrical device such as power lines.

74. **Table 2-11** lists exposure limits for general public exposure to EMF published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP)[27] while **Source**: ICNIRP

75. Table 2-12 provides the exposure limits for occupational exposure.

Table 2-11: Electric and magnetic fields (EMF) General Public Exposure Limits

Frequency	Electric Field (V/m)	Magnetic Field (uT)
50 Hz	5,000	100
60 Hz	4,150	83

Source: ICNIRP

Table 2-12: Electric and magnetic fields (EMF) Occupational Exposure Limits

Frequency	Electric Field (V/m)	Magnetic Field (uT)
50 Hz	10,000	500
60 Hz	8,300	415

Source: ICNIRP

[27] ICNIRP (1998): "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz).

3. Project Description

76. This section describes the main elements of the Project, including associated construction and operation activities. In the description, particular emphasis has been placed on those aspects that can potentially affect the environment.

3.1 Project Detail

77. Subproject 5 involves procurement of goods for the construction of about 105 km of 220kV Daharki – Rahim Yar and about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Daharki and 220kV Bahawalpur grid stations for interlinking of 220kV Daharki – Rahim Yar Khan and Bahawalpur grid stations in the south-eastern area of Pakistan. This IEE covers construction of about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Bahawalpur grid stations. The Project passes through three districts namely Rahimyar Khan, and Bahawalpur, in Punjab province.

3.2 Location and the Layout

78. The 150 km ETL passes through following two districts:

- Rahim Yar Khan district, Punjab province
- Bahawalpur district, Punjab province

79. The location map is provided in Figure 1-1.

3.3 Land Use on the Project Site

80. Project AoI majorly consists of agricultural land (79.7%) and sandy plain (10.4%). The rest of the land is comprised of barren lands, roads and water bodies.

3.4 Road Access

81. The available existing roads will be used during the construction of the Project. Temporary access roads will be built where no track or road access is available to a tower location after consultation with the local community and compensation for damages to the crops will be done as per requirement.

3.5 Vegetation Features of the Project Site

82. The primary land use in most of the area is irrigated farming of wheat, gram, oilseed, and pulses in Rabi and cotton, sugarcane, rice, and millets in Kharif.

83. The remaining land is largely utilized for grazing and is uncultivated. Prosopis spicigera, Acacia jacquemontii, Salvadora oleoides, Capparis aphylla, Tamarix articulata, Tamarix sp., Calotropis procera are among the natural vegetation.

3.6 Cost and Magnitude of the Operations

84. The construction cost of Subproject 5, as per the estimate made in October 2017 was 4,122.31 million Pak Rupees.[28]

85. The total length of ETL part of the Project is 150 km. Tower erection will be carried out on the concreted pile pad locations with the help of derrick poles or cranes. The required working area for this activity is about 50 - 100 m^2 for each tower. The tower is erected in panels. The panels are assembled on the ground, lifted in parts with the help of derrick

[28] PC-1, 220kV Daharki-RYK-Bahawalpur ETL, NTDC, 2018.

poles/crane and then joined together with nuts and bolts, which are tightened at the specified torque.

3.7 Schedule of Implementation

86. The Project proponent (NTDC) plans to have the tranche-4 completed within 2 to 3 years, after completing the necessary arrangements, on the fast track. There will not be any significant land acquisition or compensation process except for the crop compensation of the ETL towers. Designs, power transmission arrangements, access, review of environmental management and construction processes will need to be completed in about three months. When the detailed designs are completed, tendering and award of contract will take place over about three to six months. The construction period will follow, and best estimates indicate between eighteen to twenty-four months.

3.8 Project Design

87. Project design or construction flow is discussed below.

3.8.1 Project Alignment

88. As the components of the Project are on a 'turn-key' basis i.e., construction by a contractor or developer and handover to NTDC in a ready-to-use condition which includes design, supply, and installation. In this context, the proposed design provided by NTDC will be finalized by the contractor at the stage of implementation. The Survey & Investigation (S&I) wing of NTDC has marked the route alignment of the ETL on the grand trunk sheet (G.T. Sheet). Thus, it is pointed out that although the proposed alignment/ route alignment of ETL including design and RoW was provided by the concerned section of NTDC (i.e., Survey & Investigation), this will be finalized by the contractor/ developer. Once the detailed design work has been completed, NTDC will review these designs before contracts are finalized and modifications will be incorporated, if considered necessary.

3.8.2 Width of Right of Way (RoW)

89. In consultation with the Survey & Investigation section and the Environment and Social Impact Cell (ESIC), of Project Management Unit (PMU) of NTDC, the width of RoW for ETL considered was 30 m, i.e. 15 m on either side from the center of ETL and it was 225 m^2 (i.e. 15m x15m) in case of tower spotting.

3.8.3 Design Standards for Transmission Line

90. NTDC has developed design parameters for the planning and design of transmission systems in Pakistan (**Table 3-1)**. The design parameters are based on standard NTDC's existing specifications and practices for the existing as well as proposed grid stations and ETLs.

Table 3-1: Permissible Conductor Clearance at 65°C (for 220 kV ETL)

No	Description	Clearance (m)
1	Across country (including across/along street)	8.23
2	Roads and highways	9.45
3	Rivers and major canals (from high flood line)	9.14
4a	Railway track – inside the station	11.89
4b	Railway track – outside the station	9.14
5a	Building part – vertical	7.62

No	Description	Clearance (m)
5	Building part – horizontal	9.14
6	Earth part of lines	4.57
7	Telegraph lines	4.57
8	400 volts (and below), 11 kV, and 33 kV lines	3.96
9	66 kV and 132 kV lines	4.88

3.8.4 Climatic Consideration

91. Local climatic conditions, i.e., the temperature, wind velocity, thunderstorm levels, relative humidity, etc., control the selection of materials to be used.

92. **Table -:** climate parameters considered in the design criteria

Maximum Temperature	41.5°C
Minimum Temperature	2.1°C
Annual Mean temperature	29.6°C (maximum) to 14.6°C (minimum)
Maximum Rainfall	420 mm/month
Annual Relative Humidity	60.1%

3.8.5 Civil Works and Other Facilities

93. Civil work for erection of towers will be required for construction of 220 kV double circuit ETL, for which necessary provision has been made in the cost estimate.

3.8.6 Equipment & Machinery

94. **Table 3-2** identifies some key equipment required for the Project Construction.

Table 3-2: List of Equipment Required

220kV D/C T/L from R.Y. Khan GS to Bahawalpur GS (150 km)

No.	Item	Unit	Qty.
1.	TOWERS	To be estimated during detailed design	
	Light angle (DA1)	No.	92
	Heavy angle (DD1)	No.	68
	Suspension (DS1)	No.	295
	Total		**455**
2.	Conductor (Rail)	Km	1,890
3.	OPGW	Km	158
4.	INSULATORS		
	Suspension 80 KN 160KN	No.	29,279 95,256
	Total		**124,535**

No.	Item	Unit	Qty.
585.	HARDWARE	Lot	1

Tower Structures for Transmission Line

95. All the towers shall be self-supporting type, lattice steel structures, fabricated from galvanized structural steel shapes. The steel employed will be following the latest edition of the standards implemented by NTDC at various ETL projects. All towers will be equipped with danger plates, number plates, and anti-climbing devices.

96. The normal foundations (inverted T shaped) as shown in Figure 3-1 would be laid/ applied for the erection of new towers which would be placed on a plain field. The tower height will be 5 to 10 meters higher, and the foundation span will be changed 1 to 5 meters wider.

97. The choice of foundation is usually influenced by the type of terrain encountered and the underlying geotechnical conditions. The actual size and type of foundation to be installed will depend on the soil bearing capacity (actual sub-soil conditions).

98. All towers will be equipped with danger plates, number plates, and anti-climbing devices. The other tower designs to be used are provided in Figure 3-2 and Figure 3-3.

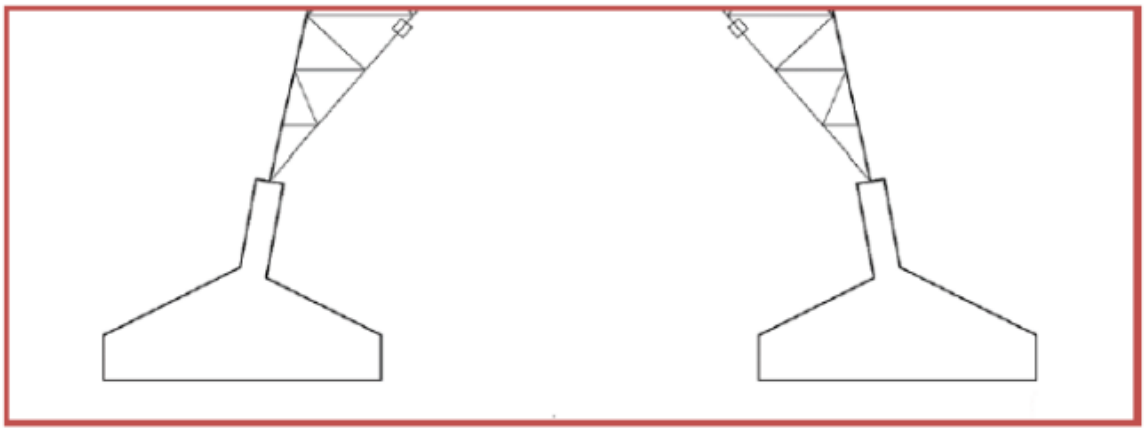

Figure 3-1: Inverted ‘T’ Type Tower Foundation

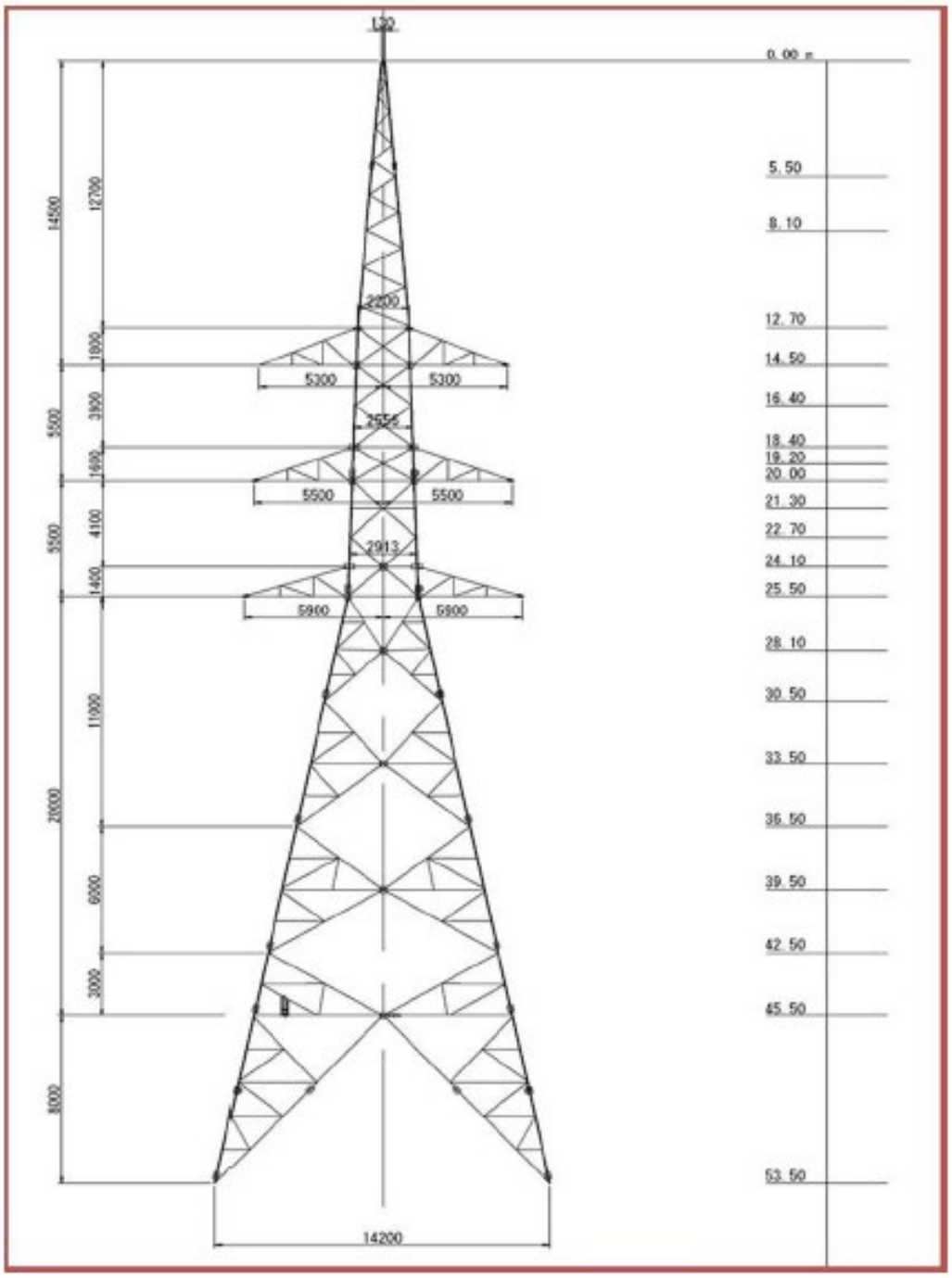

Figure 3-2: Proposed Elevation of Strain Tower

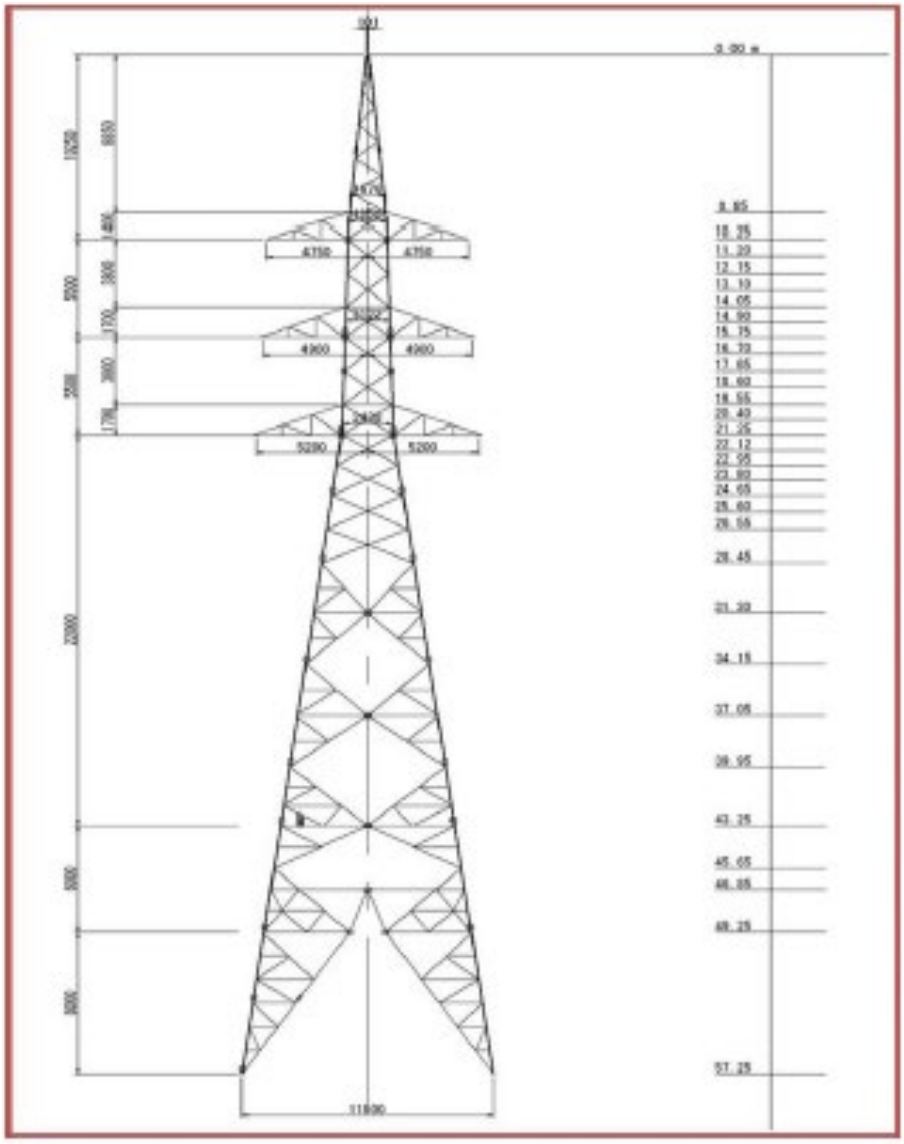

Figure 3-3: Proposed Elevation of Suspension Tower

Safety Parameters

99. For extra-high voltage (EHV) lines, safety considerations are of two types. One is related to the safety of the system, while others are those that are related to the public. It is for this reason that NTDC has adopted a 3 m wide (25 m either side from the centerline) corridor as the ROW for the allied 500 kV ETL and 30 m for 220 kV ETL in this Project. The aspects are to be considered in this regard are as under:

3.9 System Safety

100. Conductor to Tower Clearance: For the safety of the system, any factor that may interrupt the power supply must be considered in the design. The clearance of the conductor from tower legs and trusses is of prime importance. Therefore, in the design, a minimum clearance of 1.55 m has been adopted under extreme wind conditions. This is based on regulations of Government of Pakistan /WAPDA and minimum requirements of the National Electric Safety Code (ANSI C2). With this clearance, there is a 99% probability of withstanding switching surge of 3-sigma margin due to maximum overvoltage under adverse climatic conditions.

101. Earthing of the System: Every tower is connected to an earthing system. This is to keep tower footings resistance at a level lower than 10 ohms. For this, two earth electrodes of copper-clad steel rods are sunk vertically into the ground to a minimum depth of 3 m and at the locations where the required resistance is not achieved, crow footing will be done.

102. Lightning Performance: The tower geometry, clearance, and insulation of the system are designed to perform safely within the permitted lighting intensities. In this respect, consideration has been given to the tower footing resistance and the Isokeraunic level of the area. The accepted level is one trip out/ 100 km/ year due to lightning.

103. Security Arrangements: Given the prevailing law and order and security position in the area around the proposed project area, the necessary armed security staff is necessary. Reinforced security will be required at work base, labor camp, material depot, equipment yard and the locations where work is in progress.

104. Personal Protective Equipment (PPE): Grid Station and allied ETL construction is a special job and the labor working on such activities requires special protective uniform and personal protection equipment to cope up with safety and health requirements. It will be ensured that the labor engaged in handling rough construction materials, mixing of concrete and handling ETLs, etc. will have all necessary PPEs, including but not limited to, long boots, steel toe shoes, overall dresses, goggles, gloves, and safety hats. They will invariably have their company identity cards worn around their necks with the help of a ribbon. As an overall safety, health and environment measure, anyone going into the construction area will also wear a safety helmet and safety shoes. Special arrangements must be made for fire protection by way of providing appropriate types of fire extinguishers with firefighting training to concerned personnel.

3.10 Public Safety

105. General Aspects: Because of public safety, NTDC has adopted a policy that the existing orchards having fruit trees with a height of not exceeding 2.5 m can remain under the lines. Similarly, open wells, including Persian wheels, can remain under the ETLs. However, tube wells and peter pumps are not permitted under the high voltage conductors. This is to prevent piping and cranes used to refurbish such wells encountering the lines.

106. No residential or other public buildings like factories, schools, hospitals, etc. are permitted within the corridor. However, farm buildings, which are not used for residential purposes can remain under the high voltage lines, provided a 7.0 m minimum clearance is maintained. The height of the towers can be increased to accommodate such buildings.

3.10.1 Conductor to Ground Clearance

107. The conductor to ground clearance has been planned to be worked out based on over-voltage due to switching surge. In this consideration, safe clearance is required to be provided for moving objects under the line with a height of 4.5 m, withstanding switching surge of 3-sigma margin with 99.7% probability under adverse atmospheric conditions. This should keep the maximum voltage gradient at ground level and maximum current induced in a person less than the internationally allowable values. As such, the total conductor to ground clearance shall in no way be less than 7.0 meters. This is following the regulations of Government of Pakistan and NTDC practice.

3.10.2 Tower Erection and Scale of the Project

108. Tower erection is carried out on the concreted pile pad locations with the help of derrick poles or cranes. The required working area for this activity is about 50-100 m^2 for each tower. The tower is erected in panels. The panels are assembled on the ground, lifted in parts with the help of derrick poles/crane and then joined together with nuts and bolts, which are tightened at the specified torque.

109. In aligning the high-voltage ETL the design aims to avoid cultivated fields and pass through the area as thinly populated as possible. As such, accessibility will not be a problem. There are rough tracks and trail ways, and the contractor may have to develop a few tracks for transporting the materials. This should result in very little if any, damage to the vegetation or disruption of the farmland in the vicinity of the route of the ETL. The ETL route is easily accessible mostly through metaled roads or by rough tracks or village roads. Almost all the village tracks are linked to the metaled roads and are thus accessible to vehicles. The contractor is unlikely to need to transport the materials manually. In any event, care will be taken to ensure that the disruption to the vegetation is kept to a minimum.

110. The whole project tract is flat, and no considerable elevation difference exists except for small depressions present at some locations.

3.10.3 Associated Facilities

Access Tracks

111. The ETL route passes through agricultural fields and settlements. Already available access routes will be used. New tracks will be made only when access route is not available. Complete compensation will be given to the landowners as per market rates for damages and the land will be rehabilitated after completion of the construction activities.

Construction Camps

112. The ETL total length is 105 km and 2 construction camps will be constructed. However, the exact location of these camps will be decided by contractors as per their work plan. The construction camps will include residential quarters, washing areas, kitchen, toilets, fuel storage, water storage, sewage disposal arrangements, firefighting arrangements, electric generators, and others. Preference will be given to establishing these camps within the NTDC-owned premises or settled areas. Otherwise, the land for these camps will be obtained on a rental or lease basis. Proper waste (solid and liquid) handling facilities will be developed, and the waste will be disposed of as per recommendations in this IEE.

113. On average domestic water uses in Pakistan per capita consumption varies significantly from 30 liter per capita per day to 350 liters per capita per day.[29] On average 50 gallons per capita per day if taken for estimate purposes, and if there will be 50 persons on-board in two camps then about 2,500 gallons per day water will be required for the camps. 3-5 times more water will be required at construction sites. An estimate of daily wastewater flows of approximately 30 gallons per person per day and so based on 50 persons on-board, 1,500 gallons per day wastewater will be generated from the two camps.

114. On average 0.613 kg[30] of solid waste generation is estimated per person per day and if there will be 50 persons on board in two camps then about 23 kg per day solid waste will be generated from the camps. A similar number of wastes is expected at construction sites.

115. The contractor, before mobilization for construction, a site camping layout plan will share as part of Site-Specific EMP. The layout plan will clearly show all camp facilities including runoff and sewerage drainage streams and end disposal points.

116. A machinery yard will also be needed for each construction team; it can be combined with the construction camp or established separately. The machinery yard will be parking bays, maintenance, and washing bays, fueling arrangements, oil and fuel storage, firefighting arrangements, and tools and parts storage.

Batching Plants

[29] https://ssms.jp/img/files/2019/04/sms10_183.pdf.
[30] https://epd.punjab.gov.pk/solid_waste.

117. The contractors may need to establish concrete mixing and batching plants for tower foundation construction. These plants will be established at appropriate places based upon the distance from and accessibility to the tower locations. The batching plants will be complete with dust control arrangements and away from water bodies and settlements.

118. Due diligence studies on batching plant locations will be prepared by the contractor and shared with FMC and ESIC for review / clearance.

3.11 Material and Human Resource Usage

119. The Project will be required about 100 - 150 skilled and unskilled workers. Unskilled workers will be engaged from the locals. Skilled workers if not available locally then will be hired from other regions of the province.

120. The tower and circuit materials will be provided by NTDC. Material for concrete and reinforcement will be acquired from Hyderabad.

3.12 Restoration and Rehabilitation Plans

121. All damaged areas including access tracks will be rehabilitated upon completion of the construction work to near pre-construction conditions and natural areas impacted during construction will be rehabilitated with locally indigenous grasses typical of the representative botanical unit. The restoration and rehabilitation plan have been discussed in **Section 8.3** in more detail.

3.13 Other Government Department Approvals

122. No designated forest or protected area falls on the RoW. The approvals required from other departments will be sorted before the start of construction. Examples of such departments include the National Highway Authority (NHA) and provincial highways department where ETL crosses a national highway or provincial highway.

4. Description of the Environment (Baseline Data)

123. This section describes the existing physical, ecological, and socioeconomic conditions in the Project area. The information presented in this section was collected from the field surveys and the available literature.

4.1 Project Area of Influence

124. For the impact assessment, the definition of the AoI given in IFC Performance Standard 1 (IFC PS1) is used.

125. "The area likely to be affected by: (i) the Project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the Project; (ii) impacts from unplanned but predictable developments caused by the Project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent"

126. For the Project, the direct AoI is the spatial extent of the Project footprint and related facilities as well as on the associated effects on the receiving environment (**Figure 4-1**). This encompasses the ETL RoW to 1.5 km on each side of the ETL project.

4.2 Physical Environment

127. The physical baseline includes a description of the topography, land use, geology and soils, seismicity, climate, water resources, water quality, ambient air quality and sound levels in the AoI of the Project.

128. The field survey plan that was adopted for field data collection is provided in Annexure II.

4.2.1 Topography, Geology, and Soil

129. The topography in the Project area, passing through the districts of Rahimyar Khan and Bahawalpur is flat. The land elevation varies in the districts from 93 m, msl (mean sea level) (Rahimyar Khan district) to 128 m msl (Bahawalpur district).

130. The topography of the Project area is shown in **Figure 4-2**.

131. The soil up to 10 m, the topsoil in the Project area is generally silty and sandy loam associated with the active flood plain, upper areas of the flood plain calcareous loamy and clayey.[31]

132. District Bahawalpur is a fertile tract of alluvial clay. The active floodplain in Bahawalpur is a narrow strip along the active channel of the Sutlej River inundated almost every year during monsoon. The area has gently undulating topography with silty in nearly level areas, sandy on bars/levees and clayey in back swamps. Subrecent floodplains are the land surfaces where river flooding has ceased to occur for a long time. This is the principal landscape that gradually merges with the active floodplains in the north and extends to the Cholistan desert margin in the south. The soils occurring in the level plains are mainly coarse silty while fine silty/clayey in basins/channels.[32]

133. According to the agroecological zoning of Pakistan, the districts of Rahim Yar Khan and Bahawalpur lies in the Southern and Northern irrigation plains while the eastern areas of the districts are sandy deserts. The southern plains represent the lower Indus Plain formed by the meandering of the Indus River. Climate is arid sub-tropical continental with hot summer

[31] https://pcrwr.gov.pk/wp-content/uploads/2020/Water-Management-Reports/Groundwater-Investigation-and-mapping-in-the-lower-indus-plain-2020.pdf.

[32] Rahim, S. M. A., Hasnain, S., Jabeen, F., & Malik, S. Land evaluation/classification of choice of trees species on farmlands in district Bahawalpur, Punjab, Pakistan.

and mild winter. The desert area comprises sandy soils and moving sand dunes, undulating sand ridges 20-25 m high and 1-3 m long while the western part has strips of clayey soils.[33]

134. Geologically, Rahim Yar Khan is underlain by a thick sequence of sediments consisting of sand, silt, and clay deposits of fluvial and aeolian origin, ranging in age from Pleistocene to most recent. The sediments, formed as channel infills, levees and overbank flood plain deposits, show both lateral and vertical lithologic variation. This is due to the cyclic shifting in the course of the Indus River and its tributaries which laid down these sediments. The grain size decreases laterally from northeast to southwest, which points to heterogenic conditions of deposition, and a cause for variation in the permeability values of the layers. The absence of continuous clay layers, in general, is indicative of the presence of unconfined aquifers in the fluvial sediments.[34]

135. Bahawalpur district is a part of the Indus basin and can be considered an extension of Rajasthan Jaisalmer's Basin. The Pre-Cambrian crystalline basement is about 2-4 km deep, progressively increasing the depth westward and northward. The evaporates and the Pre-Cambrian basin have encountered in two wells with mixed lithology of clastics and carbonates, followed by the Cambrian clastics and carbonates sequence of the Cambrian age.

136. The surface geology of the Project area is mainly composed of Alluvium and Extrusive Mud Older Eolian Deposits and Stream deposits The alluvial plain is located adjacent to the Indus River. Other geological composition of the district includes Deposits of Extinct Streams, Older Terrace Deposits, Floodplain deposits (lower terrace), Stream bed and Meander-Belt Deposits.

137. The Project area has irrigated cropping of wheat, gram, oilseed, and pulses in Rabi and cotton, sugarcane, mustard seeds, rice, and millets in Kharif with perennial/seasonal canal supplies supplemented by canals and tube wells. Tobacco, jawar, moong, mash, masoor and maize are also grown in abundance in this area. The remaining area is lying uncultivated and is mostly used as poor grazing land.

138. The major fruits grown in this area are citrus, mango, dates, guava, and pomegranate. The vegetables mostly produced in these districts include garlic, potato, turnip,

139. The geology of the Project area is shown in **Figure 4-3**.

[33] Argo-Ecological Zones of Punjab, FAO (2019).
[34] Geological Survey of Pakistan (1998).

4.2.2 Land Use

140. The land use of the ETL AoI comprises mostly of agricultural land (79.7%). The remaining land consists of sandy plain/ dunes (10.4%), built-up area (4.5%) and barren land (1.7%) followed by vegetation cluster (2.2%) and roads and railway tracks (1.0%).

141. Land use in the AoI is summarized in **Table 4-1** and shown in **Figure 4-4**.

Table 4-1: Land Use in the AoI

Land use Area	Agricultural Land	Sandy Plains/ Dunes	Built-up Area	Barren Land	Water Body	Vegetation Cluster	Sealed Road
%	79.7	10.4	4.5	1.7	0.5	2.2	1.0
Area, km2 404.6	322.6	42.1	18.1	7.0	2.0	8.8	4.0

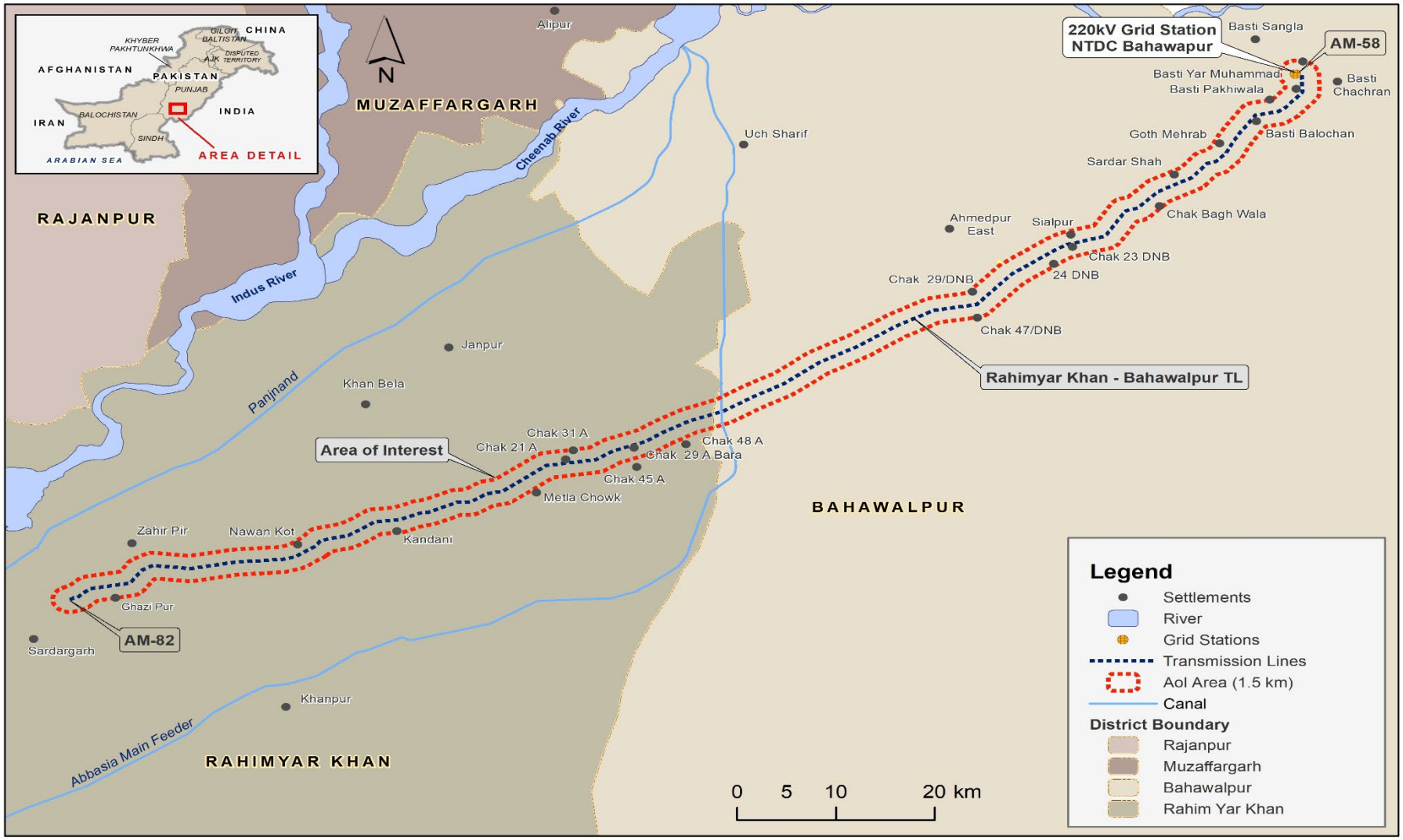

Figure 4-1: Project Area of Influence

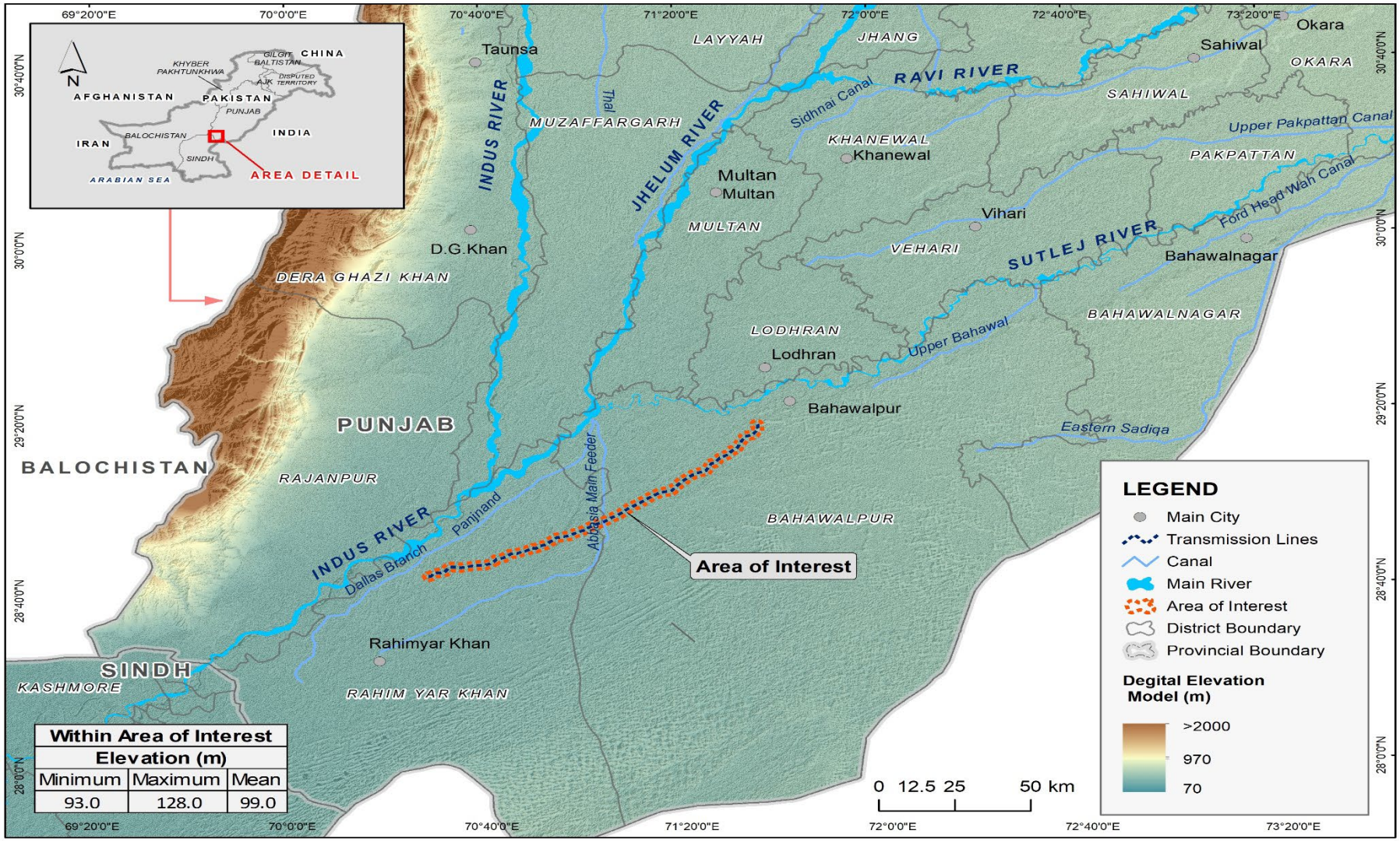

Figure 4-2: Topography

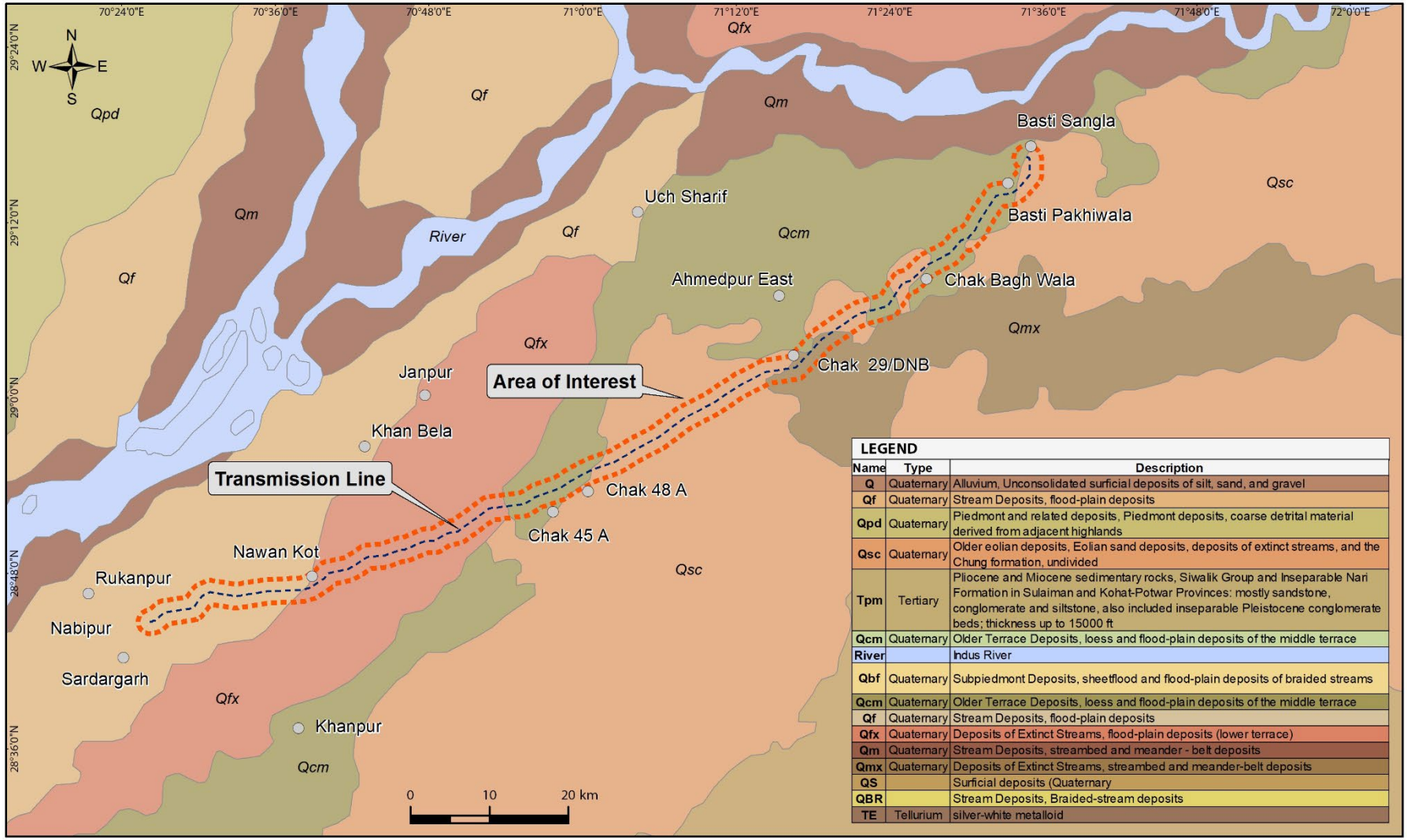

Figure 4-3: Geology of the Subproject Area

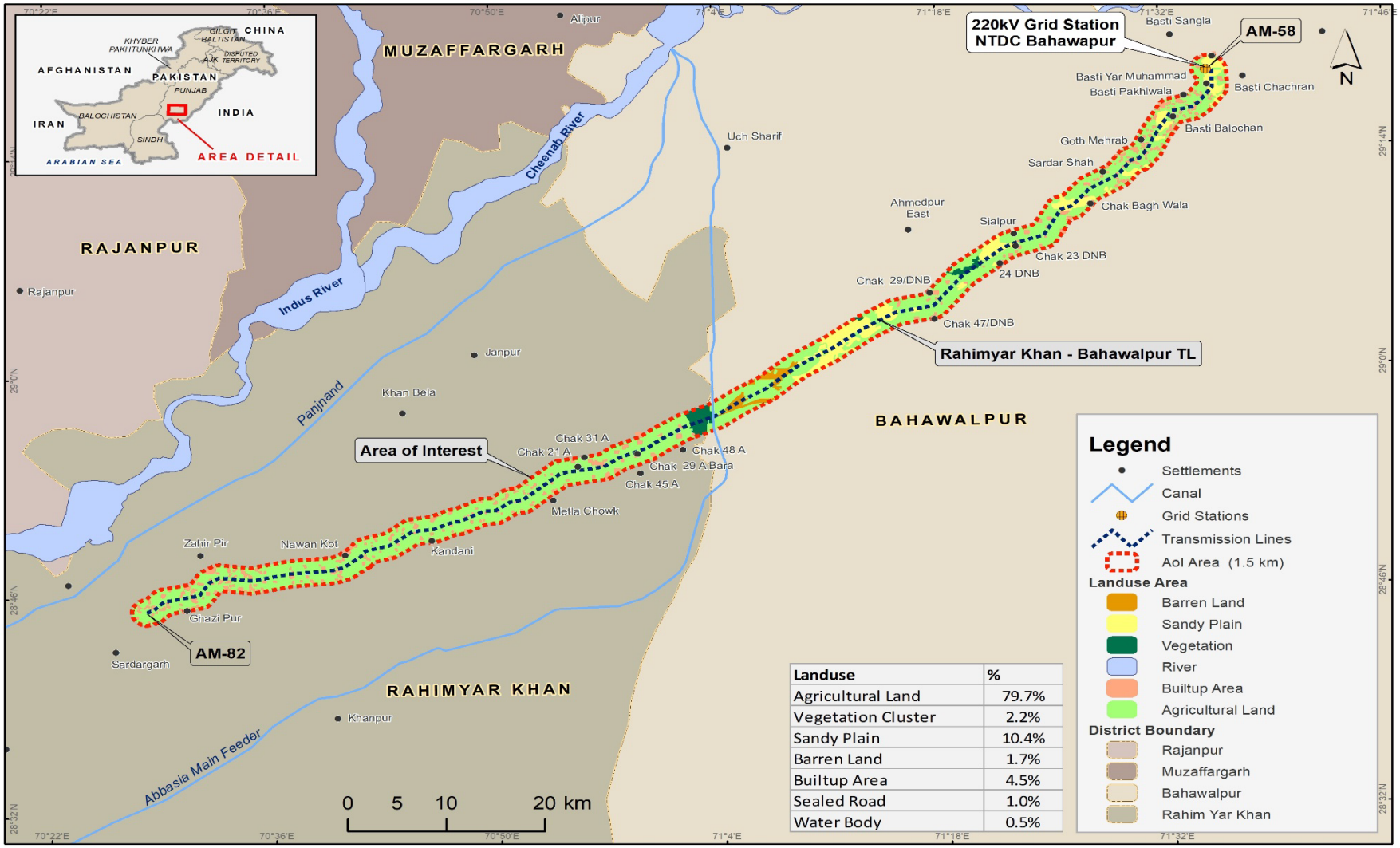

Figure 4-4: Land Use in AoI

4.2.3 Seismicity

142. In 2007, Pakistan Building Code (PBC) revised the seismic zone categorization to 5 seismic zones based on peak ground acceleration[35] as provided in **Table 4-2** and **Table 4-3**.

143. According to this classification, The Project is located in Zone 2A and Zone 2B or between 0.08 and 2.4 m/s^2. The Project area falling in Ghotki, and Rahimyar Khan districts is in Zone 2A.

Table 4-2: Seismic Zone Categorization, PBC 2007

Seismic Zone	Peak Horizontal Ground Acceleration
1	0.05 to 0.08g
2A	0.08 to 0.16g
2B	0.16 to 0.24g
3	0.24 to 0.32g
4	> 0.32g

Note: g is the acceleration due to gravity, where g = 9.81 m/s^2.

144. The Global Seismic Hazard Assessment Program (GSHAP)[36] launched in 1992, conducted a seismicity analysis in 1999. The Seismic Hazard Map of Pakistan is shown in **Figure 4-5**. Based on GSHAP, [37] the peak ground acceleration (PGA), with 10% probability of exceedance in 50 years with a return period of 475 years, is between 0.08 and 1.6 m/s^2

Table 4-3: Seismic Zone Categorization, PBC 1986

Seismic Zone	Peak Horizontal Ground Acceleration
0	Negligible damage
1	Minor damage, distant earthquakes may cause damage to structures with fundamental periods greater than 1.0 seconds, corresponds to intensity V and VI of the M.M. scale
2	Moderate damage, corresponds to intensity VII of the M.M. scale
3	Major damage, corresponds to intensity VII and higher of the M.M. scale

145. According to these classifications, the Project is in Zone 2A in PBC 2007 classification which is for minor to moderate risk zone.

[35] Peak ground acceleration is equal to the maximum ground acceleration that occurred during earthquake shaking at a location. PGA is equal to the amplitude of the largest absolute acceleration recorded on an accelerogram at a site during an earthquake. Its units are g = 9.8 m/s$^{2.}$

[36] www.ndma.gov.pk/sep/researchpapers/r2.pdf (accessed 3 January 2017).

[37] Giardini, D., Grünthal, G., Shedlock, K. M. and Zhang, P. The GSHAP Global Seismic Hazard Map. Annali di Geofisica 42 (6), 1225-1228, 1999.

Source: Adapted from Giardini, D., Grünthal, G., Shedlock, K. M. and Zhang, P. The GSHAP Global Seismic Hazard Map. Annali di Geofisica 42 (6), 1225-1228, 1999.

Figure 4-5: Seismic Hazard Map

4.2.4 Climate

146. The climate of the Project area is arid subtropical continental. It is extremely hot and dry in the summer season while in winter is usually dry and cold. The summer season is longer than the winter season.

- Summer: The summer begins in the month of April and carries on until the month of October. The maximum temperature reaches 48 °C. Wind and dust storms are frequent in summer. Fierce hot winds are common during the months of May, June, and July.
- Winter: Winter season starts from November to March. The winter is pleasant. The coldest months are December, January, and February. During this period the mean maximum and mean minimum temperatures are 21 and 5 degrees centigrade respectively.
- Autumn: The autumn sets in during November and lasts for a month or two at the most.

147. There are weather stations installed in both Rahim Yar Khan city and Bahawalpur city by the Pakistan Meteorological Department (PMD). The data from these stations has been considered for explaining climate of the Project area.

148. Historical meteorological data over the period of 1981-2010 shows that the month of May, June and July are the hottest months of the year. While, the months of December, January and February are the coldest with temperatures recorded as low as 5.2 °C. Comparing this data for the two districts, it can be observed that overall, the maximum temperature for Rahim Yar Khan is slightly higher than Bahawalpur. Indicating the southern region of the Project area is hotter than the northern part. A summary of historical data is shown in **Table 4-4** and **Figure 4-6**.

Table 4-4: Project Area Temperature Data

Average of 1981-2010

Month	Rahim Yar Khan		Bahawalpur	
	Max Temp(°C)	Min Temp (°C)	Max Temp(°C)	Min Temp (°C)
January	21.7	5.2	21	6
February	25.1	8.5	23.8	8.8
March	31.7	14.2	29.2	14
April	38.8	19.7	36.4	19.4
May	43.3	24.4	41.3	25
June	43.2	26.9	42.2	27.9
July	40.9	27.2	39.5	28.3
August	39	26.7	37.8	27.3
September	37.9	24	36.6	24.6
October	36.1	19	34.2	18.5
November	30.5	12.1	29.5	12.2
December	24.4	6.9	23.8	7.2

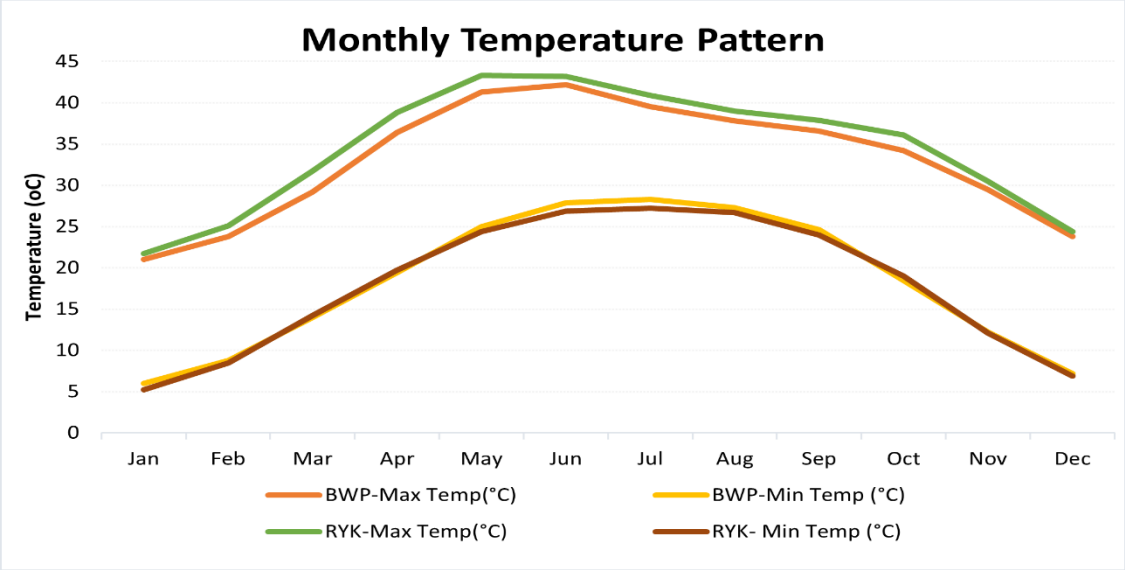

Figure 4-6: Monthly Maximum and Minimum Temperature of Project Area

149. The Project area receives less rainfall throughout the year; therefore, the area remains dry. Monsoon season brings most of the rain in the month of July through September.

150. Based on the 30 years (1981- 2010) data of Pakistan Meteorological Department data of Rahim Yar Khan Station the average monthly rainfall is provided in **Table 4-5**.

151. Overall, the southern region of Project Area (Rahim Yar Khan) receives less rainfall when compared to the Bahawalpur district.

Table 4-5: Monthly Mean Rainfall in Project Area

Month	Rahim Yar Khan	Bahawalpur
January	2.6	7.4
February	10.8	10
March	10.8	10
April	5.4	10.5
May	1.9	7.1
June	9.4	16.2
July	24.5	40.4
August	37.4	39.1
September	20.1	16.5
October	5.8	4.7
November	1.4	1.4
December	5.9	4.7

152. The recent meteorological data from the year (Aug 2021- July 2022) for Rahim Yar Khan are shown in **Table 4-6**.

153. Recent record shows that the area received about 290 mm of rainfall in the month of July 2022 which is one of the highest records rainfalls for this area.

Table 4-6: Current Year Meteorological Data

Average Data of Aug 2021-July 2022

Month	Rahim Yar Khan				Bahawalpur			
	Avg Temp(° C)	Max Temp(° C)	Min Temp(° C)	Rainfall (mm)	Avg Temp(°C)	Max Temp(°C)	Min Temp(° C)	Rainfall (mm)
July-22	33	37	27	290	32.9	37.2	28	270
Jun-22	35.5	41	26	57	36	44	30.2	48
May-22	37	45	28	5	34.5	44.8	27.4	0
Apr-22	34.3	43.4	23	0	32.6	44	23.1	0
Mar-22	26.2	36.5	17.3	0.2	26	35.3	17.2	0
Feb-22	19	28	9.7	1	17.4	26.4	9.2	2.7
Jan-22	14.7	24	6.8	17.4	13	20.6	5.7	14.8
Dec-21	15.2	24	7.6	0.6	13.7	22.8	6.4	1.3
Nov-21	21.5	31.8	13	0	19.4	28.4	11.3	0
Oct-21	27.5	36.7	20.6	34	26.4	34.1	18.3	23
Sept-21	30.5	37.9	25.9	0	30	37	37.6	1
Aug-21	33.3	41.1	27.5	0	32.5	37.2	27	20

154. The maximum recorded wind speed and average monthly wind speed for Rahim Yar Khan and Bahawalpur districts are shown in **Figure 4-7**.

155. The highest value for wind speed has been recorded as 14 km/hr for Rahim Yar in the month of April, while for Bahawalpur the highest value has been recorded as 15 km/hr in the month of May. Overall, the winds are the fastest during the month of April and May.

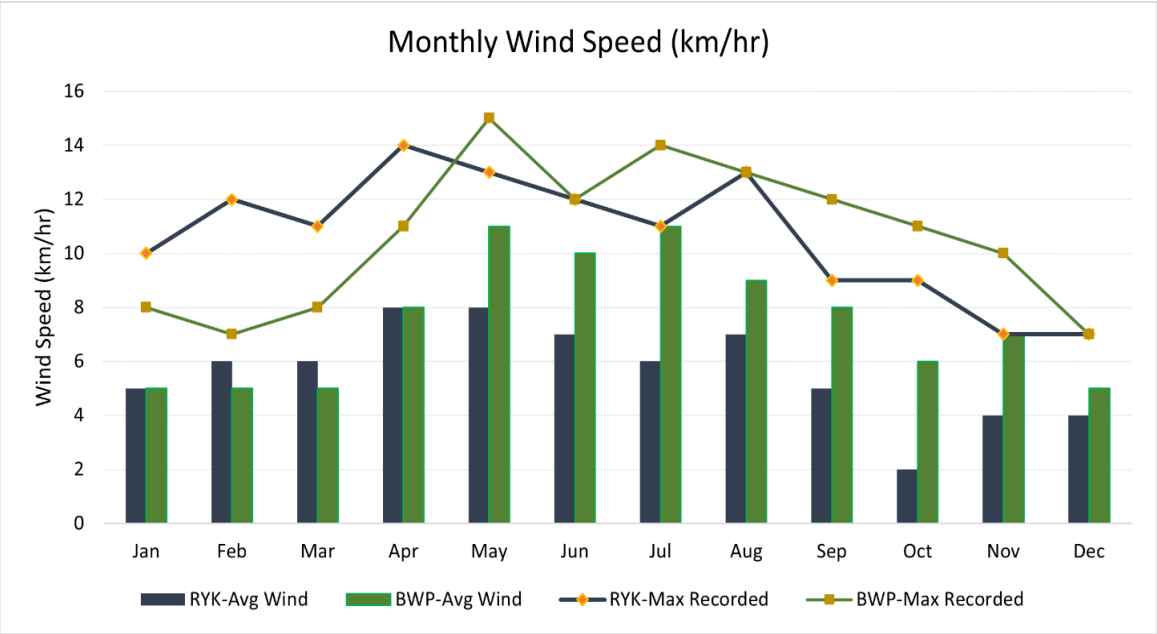

Figure 4-7: Project Area Monthly Wind Pattern

4.2.5 Climate Change and Flooding

Temperature Trend

156. As per the Climate Risk and Vulnerability Assessment (CRVA)[38], Pakistan's national level, warming is strongly biased towards the more southerly regions, with Punjab, Sindh, and Balochistan all experiencing winter warming in the region of 0.91°C - 12°C over the same period, and Khyber Pakhtunkhwa in the north experiencing only 0.52°C.

157. The rise in average daily maximum temperatures (0.87°C between 1961–2007) has been slightly stronger than the rise in average temperatures. A concurrent increase in the frequency of heat wave days has been documented. [39]

Precipitation Trend

158. As per the Climate Risk and Vulnerability Assessment (CRVA)[40], the early 20th century was characterized by a prolonged decline in annual rainfall, but since 1960, a slight increasing trend has prevailed. The number of heavy rainfall events has increased since 1960, and the nine heaviest rains recorded in 24 hours were recorded in 2010.[41]

159. Pakistan's annual climate cycle is presented in **Figure 4-8** [42] and **Figure 4-9** Pakistan provides a complex historical precipitation profile.[43]

2022 Floods

160. A preliminary assessment of July and August 2022 by the UN Satellite Centre (UNOSAT) comparing satellite data from 1 to 7 September to data from 8 to 14 September indicates that many districts in Sindh, two in Balochistan and one in Punjab were affected by increasing floodwaters, while floodwaters appear to be stagnating or receding in many other parts of the country. Large floods were observed to still be inundating villages and agricultural areas along the Indus River, while in Sindh increasing floodwater was observed in Jamshoro, Malir Karachi, Thatta, Tando Allahyar, Mirpur Khas, Umer Kot and Tharparkar districts, and increasing floodwater was also observed in Gwadar and Lasbela districts in Balochistan and in Khusbab district in Punjab.[44]

161. This year the country has been hit by the largest amount of rainfall in three decades[45] (**Figure 4-10**).

162. The Project is fall in the districts of Bahawalpur and Rahimyar Khan in Punjab province. District Rahimyar Khan received rains spills (up to 53 mm)[46] and Bahawalpur (up to 51 mm)[47] in August 2022. Therefore, local rains did not create any flooding situation.

163. However, Indus River passes from the Rahimyar Khan district which flooded many villages in August 2022. There was a high level of flood in River Indus at Chachadan Sharif and hundreds of villages, hundreds of acres of crops near to the Indus River of Rahim Yar Khan have been flooded.[48]

164. Bahawalpur district was relatively safe from river and flash flooding compared to the neighboring district of Rahimyar Khan from recent floods of August 2022.

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[38] https://www.adb.org/sites/default/files/linked-documents/49026-002-sd-03.pdf.
[39] Ibid.
[40] Ibid.
[41] https://www.adb.org/publications/climate-risk-country-profile-pakistan.
[42] Ibid.
[43] Ibid.
[44] https://earthobservatory.nasa.gov/images/150279/devastating-floods-in-pakistan.
[45] PMD Data 1961-1910 and BBC Report.
[46] https://en.climate-data.org/asia/pakistan/punjab/rahimyar-khan-3016/t/august-8/.
[47] Ibid.
[48] https://news.topurdu.com/30/08/2022/rahim-yar-khan-high-level-flood-in-the-river-at-chachadan-sharif.

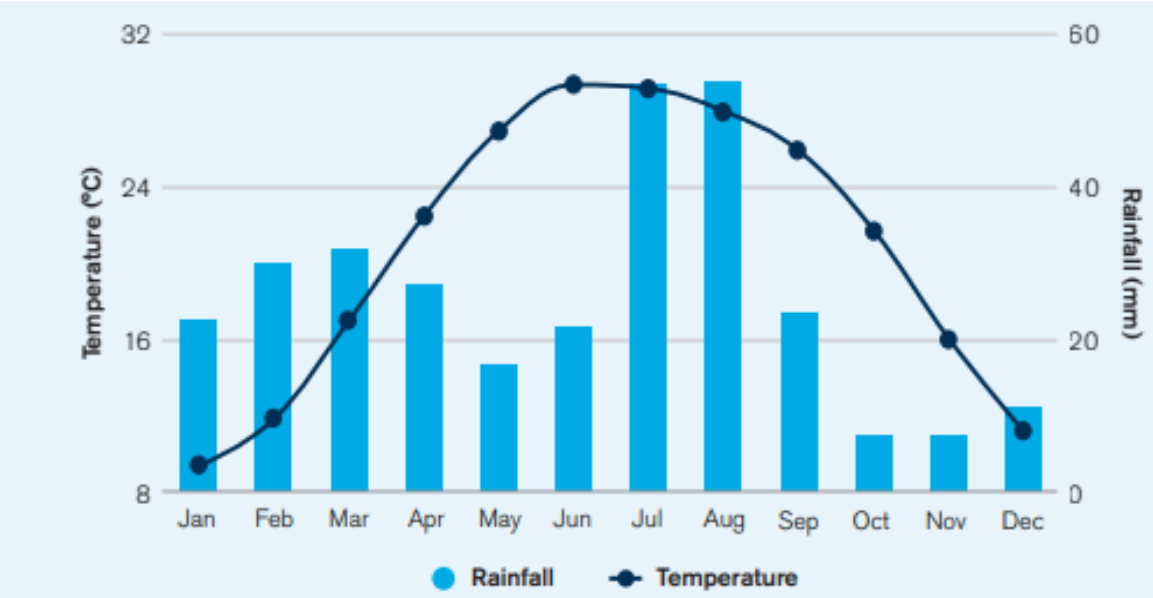
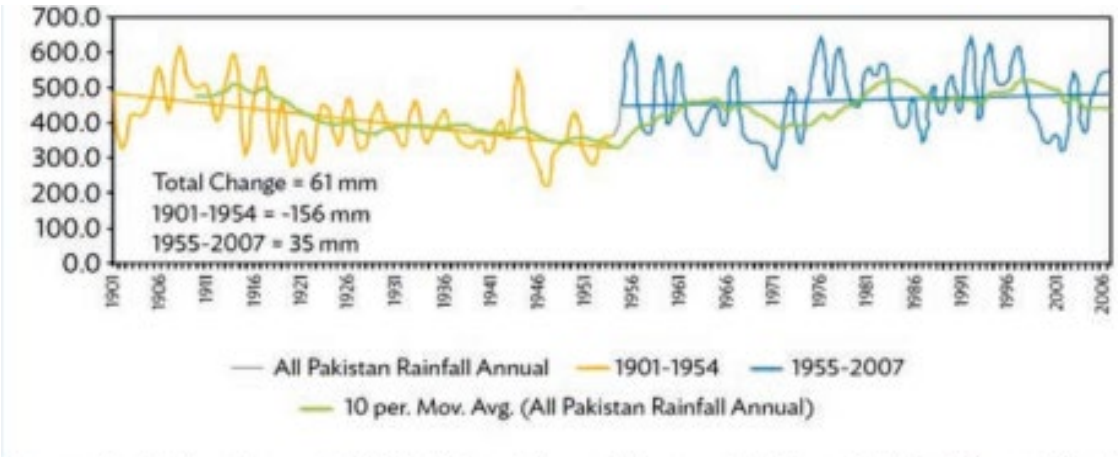


Figure 4-8: Annual Climate Cycle



Source: Q. Z. Chaudhry et al. 2009. *Climate Change Indicators of Pakistan*. Technical Report. No. 22. Islamabad: Pakistan Meteorological Department.

Figure 4-9: Historical Precipitation Profile

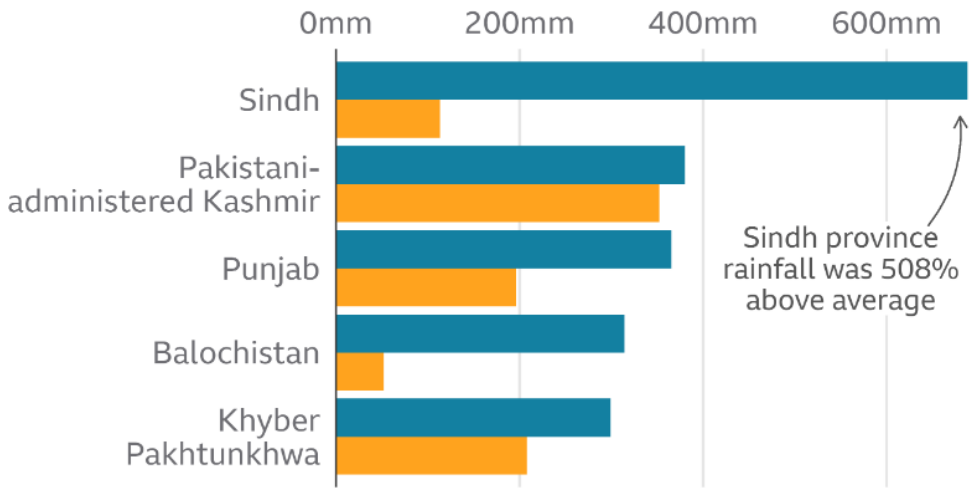


Figure 4-10: Historical Precipitation vs 2022 Rainfall

4.2.6 Water Resources

4.2.7 Water Resources

165. The Project is located in a riverain area where the people highly depend on the Indus River, Sutlej River, Hakra River and the canal irrigation system. The rainfall in this region is low therefore, people are dependent on canals for agricultural water and groundwater for other anthropogenic uses.

166. Sutlej River flows on the north side of the Bahawalpur district. Its length is 176 km from Head Islam to Head Panjnad. The major source of irrigation was the water of the Hakra River but with the drying of the river, the area was desiccated and left with only grazing lands. These rivers overflow during monsoon seasons, flooding the adjoining area. The frequency of floods has diminished under the Indus Basin Treaty. Many flood protection structures have been put in place which include the left marginal bund near Head Panjnad, Minchin Bund, Empress bund, Fatuwali bund, and Khanwah Weeslan Bund.[49]

167. The main headworks or barrages in this area are Panjnad Headwork and Islam Headworks which are built at Sutlej River. Panjnad Barrage was constructed during 1925–1929 under the Sutlej Valley Project with a designed discharge capacity of 0.45 million cusecs of water. The Barrage was recommissioned in 1932 for design discharge of 0.7 million cusecs. The Barrage Pond area falls in Tehsil Alipur (District Muzaffargarh) and Tehsil Ahmadu East (District Bahawalpur). Three canals i.e., Panjnad Canal, Abbasia Canal and Abbasia Link Canal with design discharge of 7,769 cusecs, 1,064 cusecs and 5,600 cusecs respectively, off take from the left side of the Barrage. The Barrage has a gross command area (GCA) of 1.81 million acres and provides irrigation supplies a to cultivated command area (CCA) of 1.62 million acres (0.66 million ha) falling mainly in the District Rahim Yar Khan (96%).[50]

168. The riverain area of the Rahim Yar Khan District lies close to the river Indus and Panjnad. To the Southwest of this area lies the canal irrigated area. The major canals in this district are Abbasia Canal, Sadiq Branch Panjnad, Sem Nullah, Rahim Yar Khan Branch, Minchin Branch, Panjnad Main Canal and Dallas Wah Canal. There are many minor canals which act as distributary canal to irrigate an area of about 525,000 hectares.

169. The main source of irrigation in the district is canals. The major canals include Qasim Canal, Bahawal Canal Upper, Bahawal Canal Lower, Panjnad Canal and Abbasia Canal These major canals along with hundreds of minor distributary canals help irrigate an area of 1,141,000 hectares in Bahawalpur district.[51]

4.2.8 Water Quality

170. The water quality was defined based on primary data collected during the current survey. In order to establish the baseline water quality conditions, water samples were collected from Project AoI between 26th August and 1st September 2022.

171. A total of three drinking water samples were taken. The samples were selected based on the land use of the AoI and sensitive receptors i.e., near a settlement in a densely populated

[49] Anwar, M. M., & Bureste, J. (2011). Water management and conservation practices in Arid Zone: a case study of Bahawalpur, Pakistan. *Sindh University research journal (Science series)*, *43*(2), 169-172.
[50] Tayyab, A. (2020). Pakistan: Trimmu and Panjnad Barrages Improvement Project (additional finance).
[51] Punjab Irrigation Department, (2010).

area (W-3 and W-4) and near a sparsely populated settlement area surrounded by agricultural lands (W-5).

Sampling and Methodology

172. **Table 4-7** provides information on sampling points and containers collected and the rationale for selection.

173. **Photo 4-1** provides photographs during the sample collection.

174. The sampling locations are shown in **Figure 4-11**.

Table 4-7: Description of Water Quality Sampling Location

Sample ID	Coordinates	Sample Taken	Location	Rationale of Selection
W3	28°44'24"N 70°27'52" E	Drinking-Water (Handpump Well)	Ghazipur, Zahir Pir, Rahimyar Khan	This point is located near Rahim Yar Khan Grid Station which is surrounded by agriculture and residential area.
W4	28°55'47"N 70°59'17" E	Drinking-Water (Handpump Bore)	Liaquat Pur, Rahimyar Khan	This point is near RoW and is close to sensitive environmental Receptors i.e., densely populated residential areas and agricultural lands.
W5	29°16'27.8"N 71°34'3.6" E	Drinking-Water (Handpump Bore)	Samma Satta, Bahawalpur	This point is located near a residential area surrounded by agricultural land.

Results and Analysis

175. The results of the groundwater quality sampling are summarized in Table 4-8. The complete results are given in **Annexure III**.

176. From the measured values the following conclusions can be drawn:

- All the water quality parameters of W-3 and W-5 samples were found within the World Health Organization (WHO) Standards for drinking water and the PEQS drinking water limits.
- At location W-4, taste, turbidity, total hardness, TDS, and chloride are higher than the PEQS and WHO guidelines.
- Usually, groundwater systems that have limestone bedrock or that contain interbeds of limestone or calcareous material have alkalinity. The soils occurring in the level plains are fine silty and calcareous. A considerable part is affected by salinity.[52]
- Another reason for these high parameter levels can be a result of human interference in the form of irrigation networks which damages the natural environment through increased cultivation, waterlogging and salinity.[53]

[52] Aamer, M., & Sabir, M. F. (2014). Irrigation Water Quality Based on Hydro Chemical Analysis, District Rahim Yar Khan, Pakistan. Journal of Resources Development and Management, 4(0), 52-56.

[53] Aamer, M., Iqbal, F., Iqbal, M., & Javed, Q. (2015). Physico-chemical properties and fertility status of District Rahim Yar Khan, Pakistan. *J Environ Earth Sci*, *5*(19), 11-16.

Water Sample (W-3), Ghazipur, District Rahimyar Khan (August 2022)

Water Sample (W-4), Liaquat Pur, Rahimyar Khan (August 2022)

Water Sample (W-3), Samma Satta, Bahawalpur (August 2022)

Photo 4-1: Water Quality Sampling Photographs

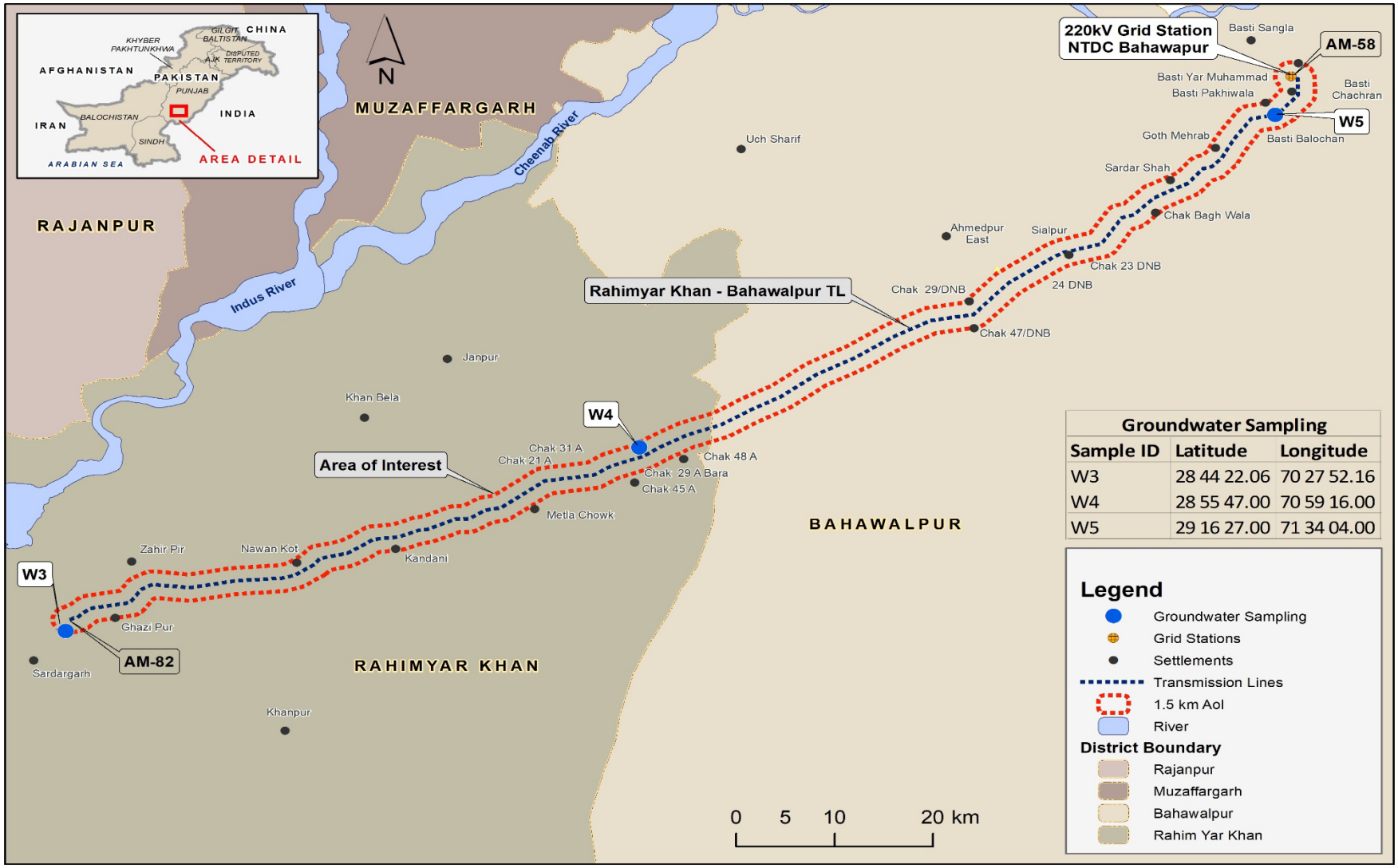


Figure 4-11: Water Quality Sampling Locations

Table 4-8: Water Quality Sampling Results

Parameter	Analysis Method	Units	PEQS for Drinking Water	WHO Guideline Values for Drinking Water	W-3 Ghazipur	W-4 Liaquatpur	W-5 Samma Satta
Color	SMWW 2120 C	TCU	≤ 15	<15	0	0	0
Taste	SMWW 2160 C		Non-Objectionable	-	Non Objectionable	Salty	Non Objectionable
Odor	SMWW 2150 B		Non-Objectionable	-	Non Objectionable	Non Objectionable	Non Objectionable
Turbidity	SMWW 2130 B	NTU	< 5	< 5	4.69	27.1	0
Total Hardness (as CaCO3)	SMWW 2340 C	mg/l	< 500	< 500	165	1,548	288
Total Dissolved Solids (TDS)	SMWW 2540 C	mg/l	< 1000	< 1000	555	2040	412
pH	SMWW 4500 H+ B		6.5- 8.5	6.5 – 8.5	7.54	7.12	7.63
Aluminum (Al)	SMWW 3111 B	mg/l	0.2	-	0.006	0.007	<0.005
Antimony (Sb)	SMWW 3114 B	mg/l	≤ 0.005	-	0.006	0.007	<0.005
Arsenic (As)	SMWW 3114 B	mg/l	≤0.05	0.01	<0.005	<0.005	<0.005
Barium (Ba)	SMWW 3113 B	mg/l	0.7	0.7	0.02	0.02	0.02
Boron (B)	SMWW 3113 B	mg/l	0.3	0.3	0.02	<0.02	<0.02
Cadmium (Cd)	SMWW 3113 B	mg/l	0.01	0.03	<0.006	<0.006	<0.006
Chloride (Cl-)	SMWW 4500 Cl- B	mg/l	≤ 250	250	39.9	286	46
Chromium (Cr)	SMWW 3113 B	mg/l	≤ 0.05	0.05	<0.004	<0.004	<0.004
Copper (Cu)	SMWW 3111 B	mg/l	2.0	2	<0.164	<0.164	<0.164
Cyanide (CN-)	SMWW 4500 CN- F	mg/l	≤ 0.05		0	0	0
Fluoride (F-)	SMWW 4500 F- D	mg/l	≤ 1.5	1.5	0.35	0.93	0.94
Lead (Pb)	SMWW 3114 B	mg/l	≤ 0.05	0.01	<0.005	<0.005	<0.005

Parameter	Analysis Method	Units	PEQS for Drinking Water	WHO Guideline Values for Drinking Water	W-3 Ghazipur	W-4 Liaquatpur	W-5 Samma Satta
Manganese (Mn)	SMWW 3113 B	mg/l	≤ 0.5	0.5	<0.015	<0.015	<0.015
Mercury (Hg)	SMWW 3114 B	mg/l	≤ 0.001	0.001	<0.001	<0.001	<0.001
Nickel (Ni)	SMWW 3113 B	mg/l	≤0.02	0.02	<0.02	<0.02	<0.02
Nitrate (NO_3-)	SMWW 4500 NO3- B	mg/l	≤50	50	2	0	0
Nitrite (NO_2-)	SMWW 4500 NO2- B	mg/l	≤3	3	2.5	0.37	0
Selenium (Se)	SMWW 3114 B	mg/l	≤ 0.01	0.01	<0.01	<0.01	<0.01
Residual Chlorine (Cl_2)	SMWW 4500 Cl- B	mg/l	0.2 – 0.5	0.2 – 0.5	0	0	0
Phenolic Compounds (as Phenols)	SMWW 5530 D	mg/l		-	0.032	0	0
Zinc (Zn)	SMWW 3113 B	mg/l	5.0	5	0.054	0.055	0.051
Microbiological Analysis							
Total Coliforms	SMWW 9222 B	mL CFU	0/ 100	-	0	0	0
Fecal Coliforms	SMWW 9222 D	mL CFU	0/ 100	-	0	0	0

PEQS = Punjab Environmental Quality Standard
"-"means not available

4.2.9 Air Quality

177. There are no major anthropogenic sources in the AoI other than local roads and cooking stoves in villages. The agricultural land results in windblown dust in dry conditions. The pollutants selected for evaluation, based on the expected emissions from the Project activities and the level of risk to human health posed by these pollutants, are as follows:

- Respirable particulate matter—Coarse (PM_{10})[54], Fine ($PM_{2.5}$)[55] and Particulate Matter (PM Total)
- Sulfur dioxide (SO_2)
- Oxides of Nitrogen (NO_X)—Mainly Nitrogen dioxide (NO_2) and Nitric oxide (NO)
- Carbon Monoxide (CO)

Methodology and Sampling Locations

178. Air quality sampling was carried out for 24 hours at each location and total three locations in the AoI between 26 August and 1 September 2022.

179. The samples were selected based on the land use of the AoI and sensitive receptors i.e., near a settlement in a densely populated area (A-3 and A-4) and near a sparsely populated settlement area surrounded by agricultural lands (A-5).

180. A description of sampling locations and the rationale of selection is given in **Table 4-9**.

Table 4-9: Details of Air Quality Sampling Locations

Sample ID	Coordinates	Location	Pollutants Sampled	The rationale for Site Selection
A-3	28°44'24" N 70°27'52" E	Ghazipur, Zahir Pir, Rahim Yar Khan	CO, SO2, NO2, and NO PM10, PM2.5 and PM Total	This point is located near Rahim Yar Khan grid station which is surrounded by agriculture and residential area.
A-4	28°55'47" N 70°59'17" E	Liaquat Pur, Rahimyar Khan	CO, SO2, NO2, and NO PM10, PM2.5 and PM Total	This point is near RoW and is close to sensitive environmental Receptors i.e. densely populated residential areas and agricultural lands.
A-5	29°16'27.79" N 71°34'3.59" E	Samma Satta, Bahawalpur	CO, SO2, NO2, and NO PM10, PM2.5 and PM Total	This point is located near residential area surrounded by agricultural land.

181. Particulate matter was sampled using MP101M (Automatic particulate Analyzer) Portable Air Sampler. This instrument has high accuracy and not influenced by the physicochemical nature, color or shape of particles. Sampling flowrate continuously regulated to the atmospheric temperature and pressure, reduces evaporation artifacts of volatile compounds (mandatory for $PM_{2.5}$ according to EU regulations). The instrument has a regulated sampling tube (RST) compliant with CEN PM10 and USEPA standards.

182. CO was measured using CO12e (Carbon Monoxide Analyzer). The CO12e is a continuous carbon monoxide analyzer with a detection limit of 0.035 ppm. Its measurement principle is based on carbon monoxide detection by absorption of infrared light.

[54] PM_{10} is particulate matter 10 micrometers or less in diameter.
[55] $PM_{2.5}$ is particulate matter 2.5 micrometers or less in diameter.

183. NO and NO_2 were measured using AC32e (Nitrogen Oxide Analyzer) which has embedded Communication Protocol for XR® Management Software with automatic recognition and configuration.

184. SO_2 was measured AF22e (Sulfur Dioxide Analyzer). The AF22e is a continuous ambient air-quality monitoring analyzer (CAMs), based on the ultraviolet fluorescence principle, which is the standard method for the measurement of SO_2 concentration (EN 14212).

185. The sampling location, along with nearby settlements and roads are shown in **Figure 4-12**. The method, duration of sampling and laboratory for analysis is summarized in **Table 4-10**. Photographs of the particulate matter and diffusion tube sampling sites are shown in **Photo 4-2**.

Table 4-10: Methodology and Duration of Sampling

Parameter	Equipment	Date and Duration of Sampling	Laboratory for Analysis
CO	CO12e Carbon Monoxide Analyzer	26 August and 1 September 2022 24 hours each location	Asian Environmental Services, Lahore
NO and NO_2	AC32e Nitrogen Oxide Analyzer	26 August and 1 September 2022 24 hours each location	Asian Environmental Services, Lahore
SO_2	AF22e Sulfur Dioxide Analyzer	26 August and 1 September 2022 24 hours each location	Asian Environmental Services, Lahore
PM_{10}, $PM_{2.5}$ and PM Total	MP101M Automatic particulate Analyzer	24 hours each location 24 hours each location	Asian Environmental Services, Lahore

186. Note: Hourly reading was taken from the arithmetic mean of 12 readings recorded by the monitoring instrument with five-minute interval. For 24 Hours Value, athematic means of hourly average is considered to depict conditions of each hour.

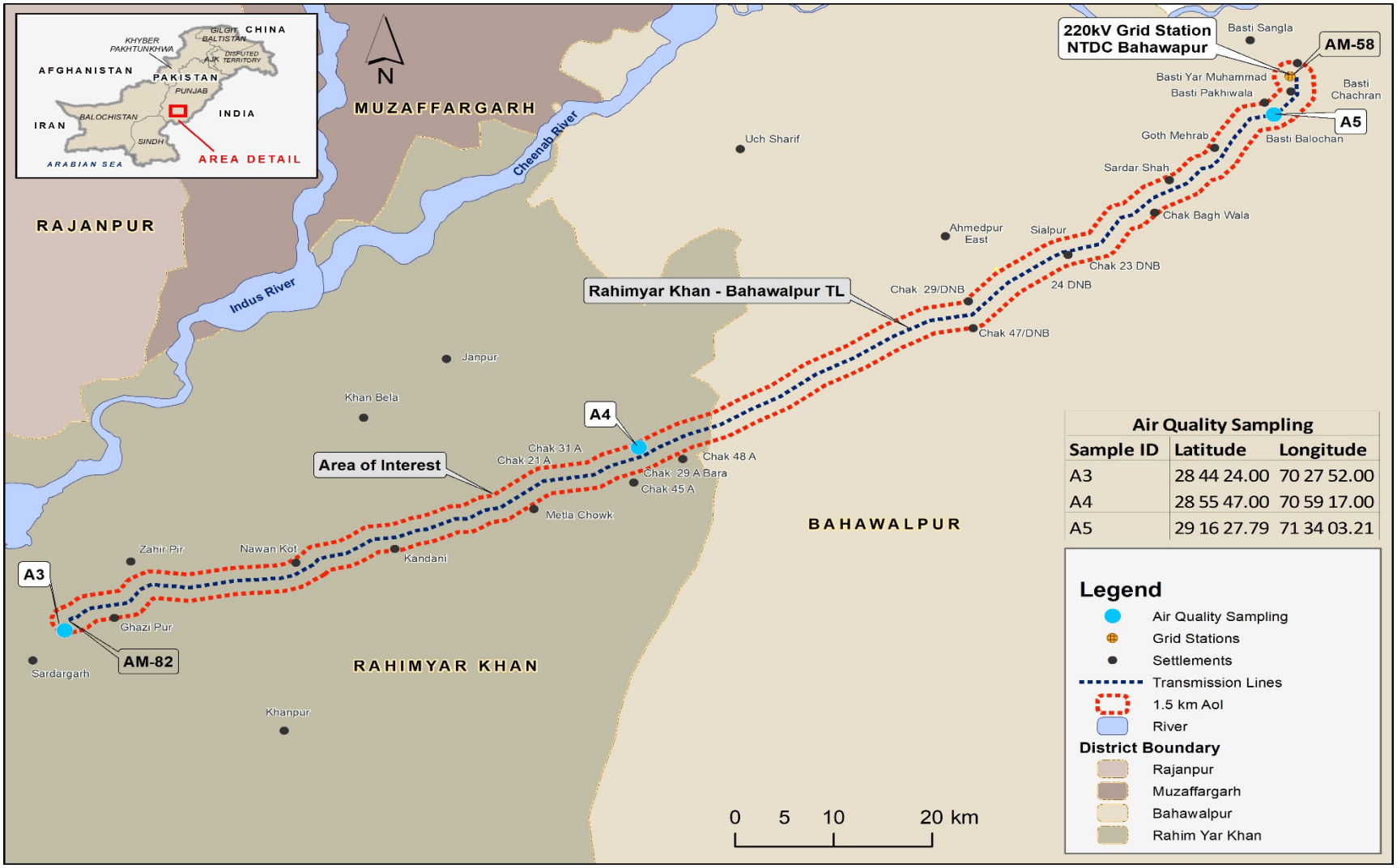


Figure 4-12: Air Quality Sampling Locations

Ambient Air Quality Equipment Installation A-3 (August 2022)

Ambient Air Quality monitoring at A-4 (August 2022)

Ambient Air Quality Monitoring at A-5 (August 2022)

Photo 4-2: Ambient Air Quality Sampling Site Photographs

Ambient Air Quality Results

187. The sampling results are provided in **Table 4-11** and the complete results are given in **Annexure III**.

188. At all sampling locations, NO and NO_2 were found within PEQS. The sampling points were near to roads and these higher levels may be result of vehicular traffic on the nearby roads.

189. At all sampling locations, Sulfur Dioxide (SO_2) measured values were found within PEQS.

190. At all sampling locations, Particulate Matter (PM_{10}) measured values were found within PEQS.

191. At all sampling locations, Particulate Matter ($PM_{2.5}$) measured values were found within PEQS.

192. The higher value of particulate matter is seeming to be a local air quality condition due to the dust from non-metaled roads and traffic on roads as well as agricultural activities and combustion of gasoline and wood are also contributing factors toward high particulate matter (both PM_{10} and $PM_{2.5}$) in ambient air.

Table 4-11: Results of Ambient Air Quality Sampling

(µg/m^3) unless otherwise specified

Parameter	Monitoring Duration	LDL	Parameter	PEQS	WHO AGQ Level	A-3 (Ghazipur)	A-4 Liaquatpur	A-5 Samma Satta
Nitrogen Dioxide	24Hours	1	NO2	80	25	27.88	26.28	19.79
Nitrogen Oxide	24Hours	1	NO	40	25	13.1	13.05	9.82
Nitrogen Oxides	24Hours	1	NOx	120	-	40.93	39.27	29.58
Sulphur Dioxide	24Hours	1	SO2	120	40	34.97	35.86	27
Carbon Monoxide	8-hours	0.01	CO	5	4	0.85	0.88	0.79
Particulate Matter	24Hours	1	PM10	150	45	108.25	109.75	98.24
Particulate Matter	24Hours	1	PM2.5	35	15	31.8	32.38	31.65
Total Particulate Matter	24Hours	1	TSP	500	-	210.72	216.55	208.65

PEQS = Punjab Environmental Quality Standard

Note: '- ' means information is not available or not applicable.

*24- hours Interim target-1, target-2 and target-3 (75, 50 and 37.5 respectively) [IFC Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines].

** 24- hours Interim target-1, target-2 and target-3 (150, 100 and 75 respectively)

4.2.10 Noise

193. This section defines the baseline ambient noise levels in the AoI in a manner that can be used for the assessment of the noise impact of the proposed Project. Noise levels were measured at three selected locations considered representative of the nearby receptors of possible noise disturbance from the Project.

194. The following is a brief description of the terminology used in this assessment:

- Sound: A vibratory disturbance created by a vibrating object, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone
- Noise: Sound that is loud, unpleasant, unexpected, or otherwise undesirable
- Decibel (dB): A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals
- A-Weighted Decibel (dB A): An overall frequency-weighted sound level in decibels, which approximates the frequency response of the human ear. The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. Therefore, when assessing potential noise impacts on people, an electronic filter is used that de-emphasizes certain frequencies in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies. All the noise levels reported in this Section are A-weighted
- Equivalent Sound Level (Leq): The equivalent steady-state sound or vibration level, which is a stated period, typically one hour, would contain the same acoustical or vibration energy.

Sampling Methodology

195. Noise measurements were taken at one location listed in Table 4-12. Noise readings were taken for 24 hours at the sampling sites.

196. The sampling points were selected based on the land use of AoI and sensitive receptor i.e., near populated settlement area.

197. The noise levels were measured using portable BSWA308 (Type 1 Sound Level Meter). The BSWA308 has a dynamic range of 102 dB and always measure noise from 29 dBA to 131 dBA in a single range. It can measure three parameters simultaneously with the A, C, and Z frequency weightings and with F, S, and I time weightings. Besides, the equivalent continuous sound pressure level, maximum and minimum values are calculated. The BSWA308 is ideal sound level sound for general purposes of noise measurements where the Class 1 accuracy is required.

198. The meter was calibrated at the start of measurement at each site, using CA111 Sound Calibrator. The calibrator can be used on 1/2-inch and 1/4-inch microphones with an adapter. It conforms to IEC 60942:2003 Class 1, ANSI S1.40-1984 and GB/T 15173-1994. - Calibration of measurement microphones, sound level meters and other sound measurement equipment.

199. The instrument was mounted on a tripod, to avoid interference from reflecting surfaces within the immediate neighborhood, and a windshield was used in all measurements.

200. The noise levels measurement locations map is provided in **Figure 4-13**.

Table 4-12: Noise Sampling Locations

Sample ID	Coordinates	Location	Date and Duration	The rationale for Site Selection
N-3	28°44'24" N 70°27'52" E	Ghazipur, Zahir Pir, Rahim Yar Khan	26th August and 1st September 2022. 24 hours each location	This point is located near Rahim Yar Khan Grid Station which is surrounded by agriculture and residential area.
N4	28°55'47" N 70°59'17" E	Liaquat Pur, Rahimyar Khan	26th August and 1st September 2022. 24 hours each location	This point is near RoW and is close to sensitive environmental Receptors i.e., densely populated residential areas and agricultural lands.
N5	29°16'27.79" N 71°34'3.59" E	Samma Satta, Bahawalpur	26th August and 1st September 2022. 24 hours each location	This point is located near residential area surrounded by agricultural land.

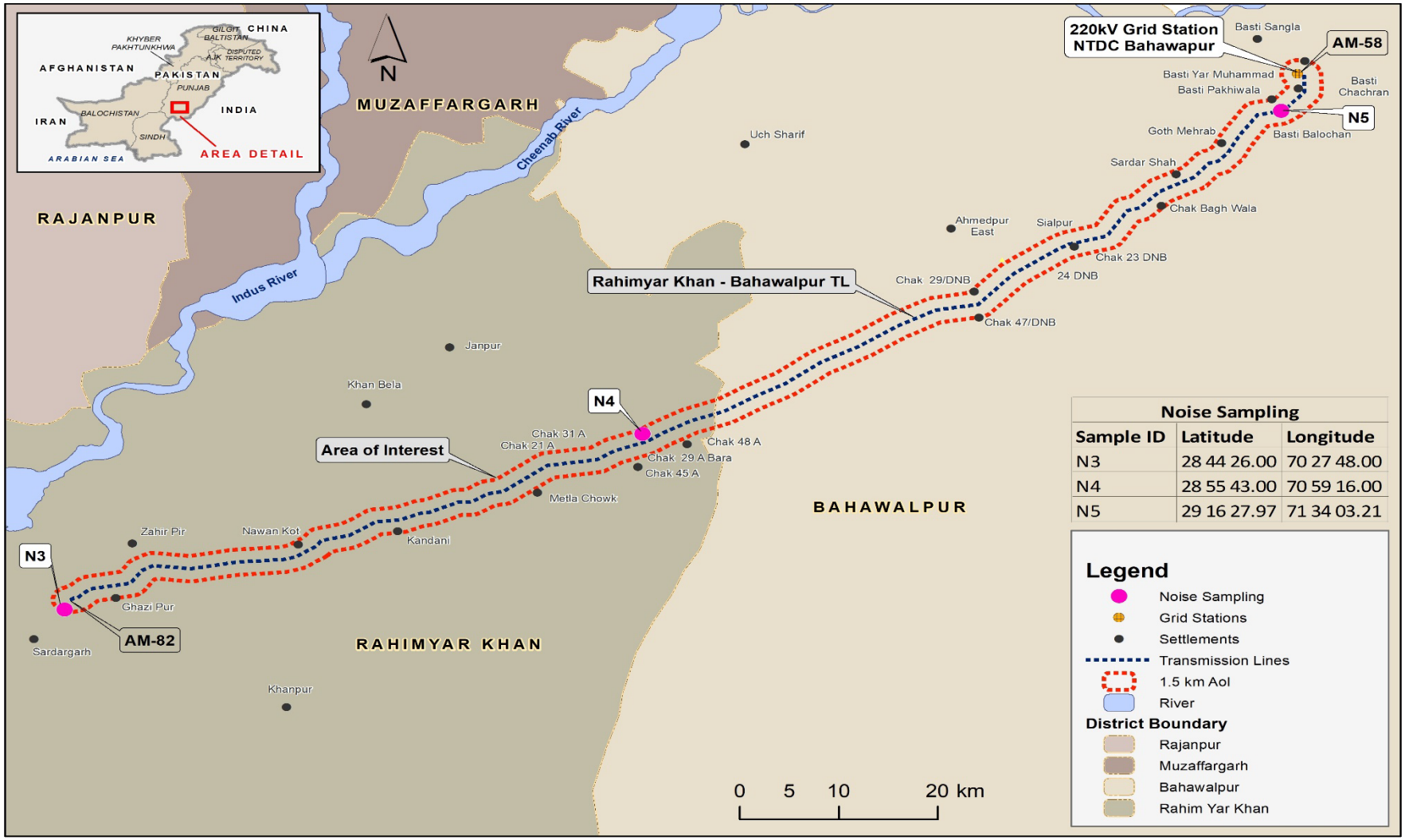


Figure 4-13: Noise Sampling Locations

Noise Measurement Results and Analysis

201. A summary of results is provided in **Table 4-13** with an hourly Leq values in **Table 4-14** and **Figure 4-14**. The complete data provided by the testing team are presented in **Annexure III**.

202. From the measured values the following conclusions can be drawn:

- The values measured within the PEQS (N-3, N-4 and N-5) for both daytime as well as for the nighttime readings.
- Measures noise levels were also, within IFC guideline values for both, daytime, and nighttime.
- Overall, daytime noise values are measured higher compared to nighttime values. This may be due to anthropogenic sources such as traffic and other human activities.

Table 4-13: Noise Measurement Levels

Average Values for Nighttime and Daytime, Leq, dB A

Measurement Point/ Reference Values	Daytime	Nighttime
N-3	46.4	38.8
N-4	48.4	38.5
N-5	46.7	37.0
PEQS	55	45
IFC Guideline Values	45	45

PEQS = Punjab Environmental Quality Standard

Table 4-14: Hourly Noise Measurement Values

Leq, dB A

Time (hours)	PEQS (dB A)	IFC Guidelines (dB A)	Sound Leq (dB A)		
			N-3	N-4	N-5
12:00	55	55	46.81	47.85	50.36
13:00	55	55	46.57	49.44	50.43
14:00	55	55	48.12	50.89	50.92
15:00	55	55	49.37	51.5	49.09
16:00	55	55	48.81	50.15	47.31
17:00	55	55	46.81	48.57	45.53
18:00	55	55	44.26	47.5	43.54
19:00	55	55	41.51	46.47	41.23
20:00	55	45	37.86	44.95	39.3
21:00	45	45	36.42	42.54	37.54
22:00	45	45	36.4	40.69	35.67
23:00	45	45	36.44	39.19	35.81
0:00	45	45	35.74	36.98	34.55
1:00	45	45	35.73	35.19	34.4

2:00	45	45	37.33	34.65	35.42
3:00	45	45	39.29	36.37	36.36
4:00	45	45	41.3	37.83	37.51
5:00	45	45	43.37	39.71	40.13
6:00	45	45	45.54	41.87	42.35
7:00	55	55	46.11	44.61	44.19
8:00	55	55	47.32	46.99	46.56
9:00	55	55	48.36	48.54	45.93
10:00	55	55	48.75	49.49	50.26
11:00	55	55	49.37	50.27	49.19

PEQS = Punjab Environmental Quality Standard

Note: PEQS daytime means from 06:00 hours to 22:00 hours and nighttime from 22:00 to 06:00 hours.
IFC daytime means from 07:00 to 22:00 hours and nighttime hours from 22 hours to 07:00 hours.
[a] for getting Leq[56] levels, anti-log [10^xx/10] of instantaneous level then log [10*log10*Average Energy Levels).

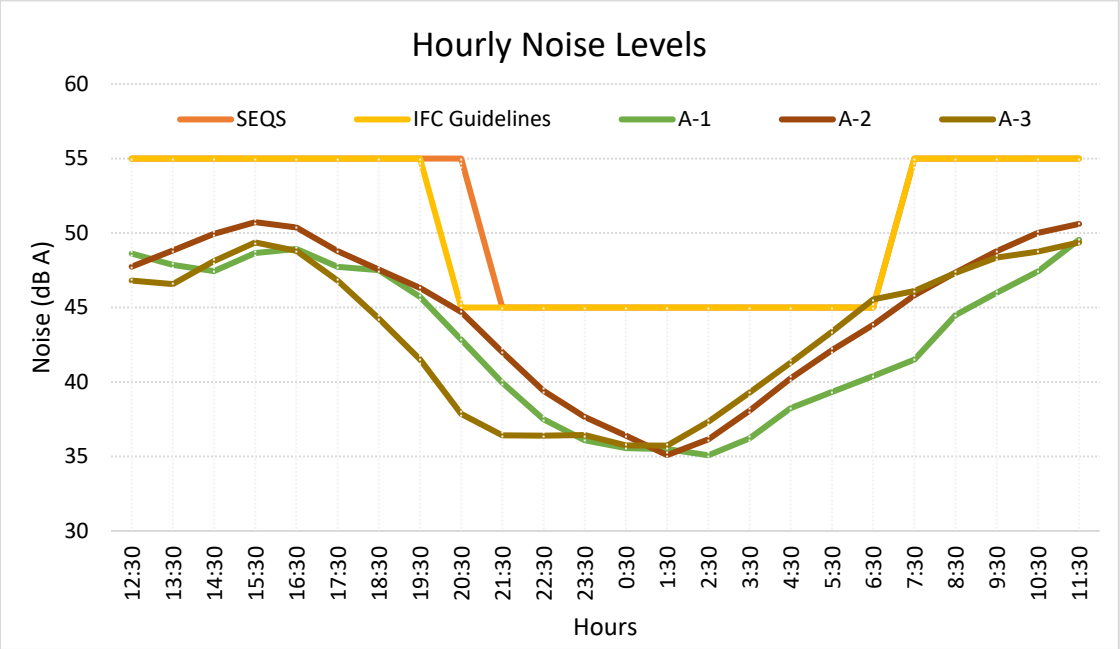


Figure 4-14: Hourly Noise Measurement Values and Standards

[56] Leq is the equivalent continuous sound level and represents the total sound exposure for the period of interest or an energy average noise level for the period of interest

4.2.11 Environmental Sensitive Receptors

203. Sensitive receptors are people/places more susceptible to the adverse effects of exposure to pollutants and social disturbance, due to the developmental projects. Thus, sensitive receptors are necessary to be identified, to evaluate the potential impacts of the proposed project on public health and the environment and adopt necessary mitigation measures to minimize the impact.

204. The sensitive receptors identified for the proposed project within AOI are residential areas; educational institutions; health facilities; and religious places (graveyards and mosques). They are prone to sensitivity during the construction phase, due to emission of air pollutants, noise and vibration, traffic jams/access, the temporary edifice of construction camps, and mobilization issues.

205. The sensitivity feature of receptor is divided into a three-scale score considering sensitivity and risk to the receptors. These include High, Medium, and Low risk. **Table 4-15**shows a description of the risk scale.

206. The sensitive receptor and environmental values in the AOI are mentioned in **Table 4-16** shown in **Figure 4-15**.

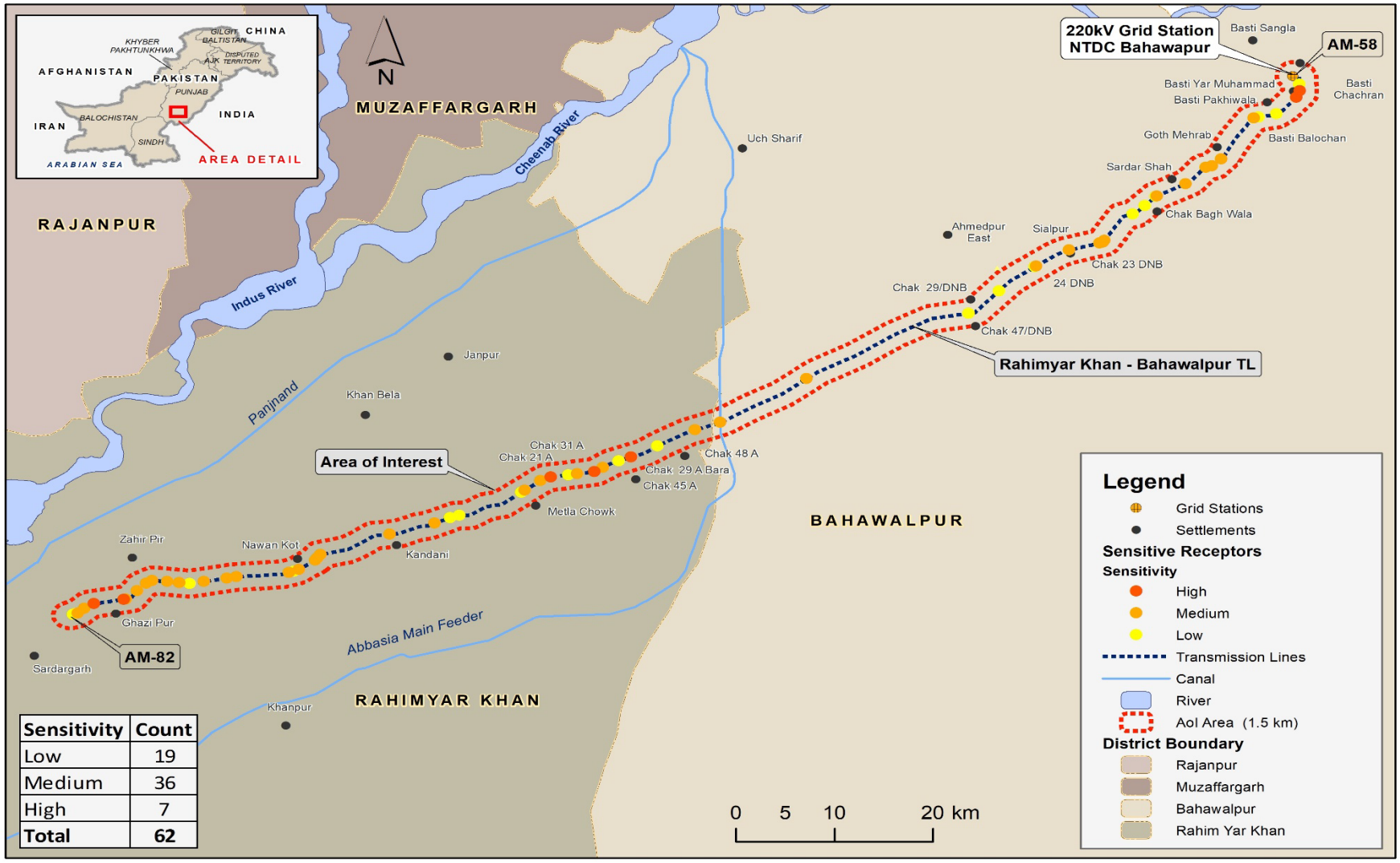
207. Detailed list of sensitive receptors (covering type, and orientation) is provided in Annexure IV.

Table 4-15: Sensitivity Risk Scale

Risk Category	Description
High	Definite susceptible to a potential impact of project activity and the high priority of mitigation
Medium	Moderate susceptible to a potential impact of project activity and the mitigation of impact is required
Low	Unlikely (or low likelihood) impact, minor deterioration and/or short–term impact and/or small footprint

Table 4-16: Sensitive Receptors and Environmental Values

Feature Category	Feature Sensitivity	Number of Features Found
Agricultural Land Area	Medium	2
Settlements - Medium (<30 houses)	High	5
Settlements – Small (<15 houses)	Medium	17
Major Roads	High	2
Medium Blacktop Roads	Medium	5
Water Bodies (Canal and Nullahs)	Medium	14
Poultry Farm	Low	3



Sensitivity	Count
Low	19
Medium	36
High	7
Total	**62**

Figure 4-15: Sensitive Receptors in AOI

4.3 Ecology

208. The ecology baseline has been prepared to provide an overview of the ecological conditions in the terrestrial study area and surroundings.

209. Sources of information for preparation of this baseline included published literature, reports, scientific journals as well as information obtained from national and globally recognized sources such as the International Union for Conservation of Nature (IUCN), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

210. In addition, a field survey was also carried out from August 26, 2022, to August 28, 2022, to collect field data and information about the terrestrial ecological resources in and around the Project area.

211. The proposed study for terrestrial ecological resources (vegetation, mammals, birds, and herpetofauna) was carried out within a 1.5 km buffer area of the proposed ETL referred as AoI in this report.

212. A map of the study area for terrestrial ecological resources is given in **Figure 4-16**.

213. The sampling was carried out in three major habitats (agriculture fields, sand dunes, and vegetation) found in the AoI with the aim to obtain quality information regarding different species of different classes.

214. The reason for selecting different sampling locations in different habitats is mainly because of the affiliation of some flora and fauna species to a specific habitat.

4.3.1 Terrestrial Sampling Locations

215. The sampling locations for terrestrial ecology are provided in **Figure 4-17**. The locations were selected considering three main habitat types identified using *Google Earth* satellite imagery.

216. These include Agricultural Land, Sand Dunes, and Vegetation.

217. The number of sampling locations was based on the percentage representation of the habitats in the Terrestrial AoI.

218. Four sampling locations were selected each in the agriculture fields and sand plain or dunes while three sampling locations were in the vegetation habitat.

219. Photographs of different habitats found in the AoI are given in **Photo 4-3**.

220. The habitat type at each sampling location is listed in **Table 4-17**.

4.3.2 Survey Methodology

221. The methodology used to collect data on the terrestrial ecological resource is summarized below.

Terrestrial Vegetation

222. The usual means of sampling vegetation for floristic composition is the quadrat. The vegetation in the terrestrial AoI was sampled by the quadrate method, taking 3 quadrates of 5m x 5m at each sampling site. The first quadrat was taken at the beginning of the transect, the second at 250 meters, and the third at 500 m.

223. Plants from each quadrate were noted. Additional plant species in the area adjacent to the quadrate were also noted down. Cover, relative cover, density, relative density, frequency, relative frequency percentages, and Importance Value Index (IVI) for each species from the AoI was calculated.

224. The sampling locations for terrestrial vegetation are shown in **Figure 4-17**.

225. The observed information (GPS reading, habitat type, species name, number of each species counted, and circumference of each species) at each sampling location were noted on a survey form.

Mammals

226. Line transects (500 m long and 20 m wide) were placed at each sampling location to record all mammals or their signs.

227. All the mammal species sighted, or their signs (footmarks, droppings, dens, burrow, etc.) found were identified with necessary information like coordinates of the site, species, sign type, sign age (on the base of freshness), etc.

228. GPS coordinates of the location and habitat type were also documented.

229. Anecdotal information regarding specific mammals like large carnivores was also collected from the local people and relevant literature was also used for mammals' baseline.

230. The sampling locations for mammals are shown in **Figure 4-17**.

Birds

231. Line transect sampling involves an observer traveling along a predetermined line of a consistent length, recording the total number of birds, nests, and other relevant sites detected.[57]

232. To count birds of different species, a total of 11 transects were placed at different locations in different habitats of the study area, each with an approximate length of 500 m long and 50 m wide.

233. A single observer spends approximately 40 min walking along each transect and counted all birds of each observed species on both sides of the transect.[58]

234. Binoculars (Nikon 8245 ACULON A211 8 × 42) were used for observation and transects were walked at the times of peak bird activity, i.e., early in the morning (4 hr of surveying) and late in the afternoon (2.5 hr of surveying).

235. All the associated habitats of the transect and the GPS location of each transect were marked.

236. A digital camera was used for the photography of birds and associated habitats.

237. The abundance of birds (number of individuals of each species observed) and diversity (number of species observed) were calculated.

238. The sampling locations for birds are shown in **Figure 4-17**.

Herpetofauna

239. For the herpetofauna survey, line transects of 500 m long and 20 m wide were walked at each sampling location.

240. Active searching was carried out along the line transect to record the presence of herpetofauna species.

[57] Gibbons, D. W., and R. D. Gregory (2006). Birds. In Ecological Census Techniques: A Handbook (W. J. Sutherland, Editor). Second Ed. Cambridge University Press, Cambridge, UK.

[58] Subedi, T. R., Virani, M. Z., Gurung, S., Buij, R., Baral, H. S., Buechley, E. R., Anadón, J. D., and Sah, S. A. (2018). Estimation of Population Density of Bearded Vultures Using Line-Transect Distance Sampling and Identification of Perceived Threats in the Annapurna Himalaya Range of Nepal. Journal of Raptor Research, 52(4), 443-453.

241. The specimens were identified with the help of the most recent key available in the literature.

242. Density and diversity were calculated for each sampling point.

243. Microhabitats (e.g., stagnant water bodies) were also searched for herpetofauna species, particularly for the presence of amphibians.

244. The sampling locations for herpetofauna are shown in **Figure 4-17**.

Table 4-17: Habitat Types for the Terrestrial Sampling Locations

Habitat Type	Sampling Locations
Agriculture Field	SP-8, SP-9, SP-10, and SP-11
Sand Dunes	SP-1, SP-3, SP-4, and SP-5
Vegetation	SP-2, SP-6, and SP-7

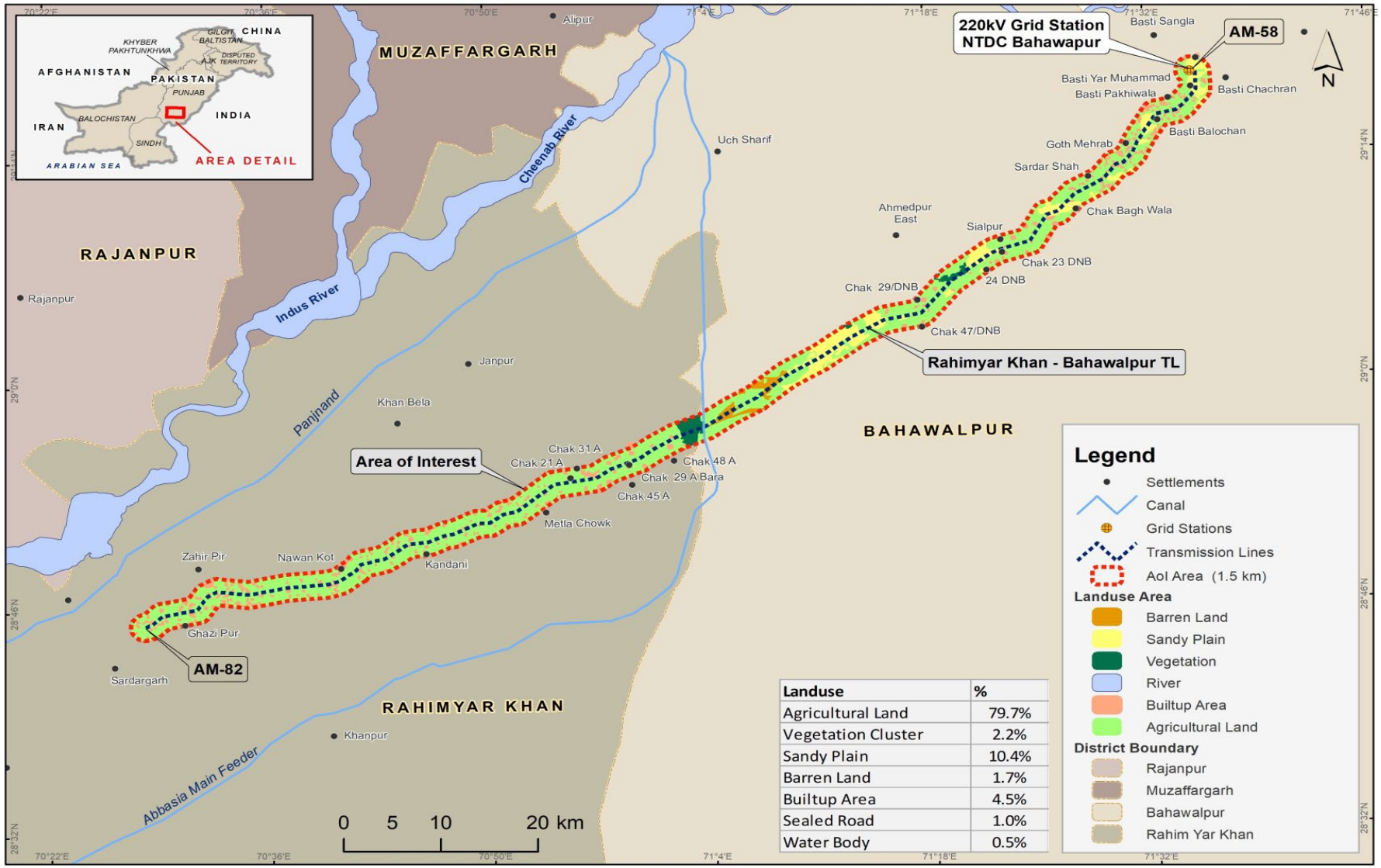


Figure 4-16 Terrestrial Study Area

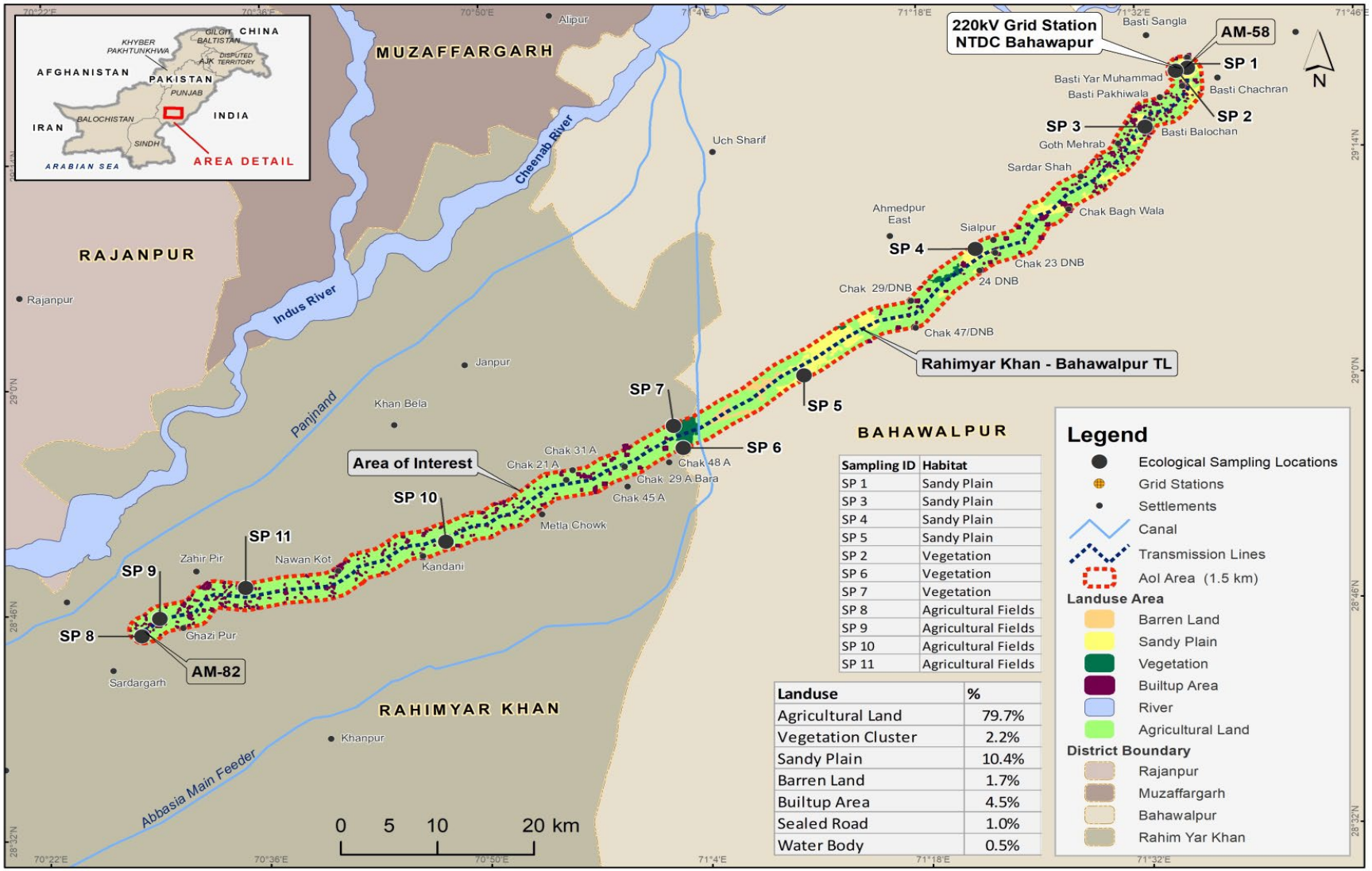


Figure 4-17 Sampling Locations for Terrestrial Flora and Fauna

August 2022

Photo 4-3: Different Habitat Types in the Terrestrial Study Area

4.3.3 Terrestrial Ecological Resources

245. This section provides an overview of terrestrial ecological resources in and around the study area based on a review of available literature and recent field surveys. Terrestrial sampling locations are shown in **Figure 4-17**.

Literature Review

246. The Cholistan desert's flora study shows that there are 154 plant species in the desert, belonging to 106 genera and 38 families.

247. Of the 38 families, 33 are represented by dicotyledon families, 4 monocotyledon families, and 1 gymnosperm family.[59] Poaceae was discovered to be the biggest family, with 45 species.[60]

[59] Wariss, H. M., Mukhtar, M., Anjum, S., Bhatti, G. R., Pirzada, S. A., & Alam, K. (2013). Floristic composition of the plants of the Cholistan Desert, Pakistan. *American Journal of Plant Sciences*, *2013*.

[60] Wariss, H. M., Ahmad, S., Alam, K., Sarwer, N., & Anjum, S. (2017). Floristic inventory of Baghdad-ul-jadeed campus, the Islamia university of Bahawalpur, Pakistan. *South Asian J Life Sci*, *5*(1), 5-18.

248. Arshad and Rao (1994) enlisted 118 plant species from 82 genera and 32 families. From this area, 56 plant species belonging to 20 groups were recorded by Hameed et al. (2002).[61]

249. In their 2013 report, Rafey et al. (2013) documented 27 grass species belonging to 16 genera in the family Poaceae.[62]

250. Rahimyar Khan and Bahawalpur areas are physically varied and has three key physical features: a desert region known as Cholistan, a riverside area, and an area that is irrigated by canals. Consequently, it has a diversified natural environment.[63]

251. The primary land use in most of the area is irrigated farming of wheat, gram, oilseed, and pulses in Rabi and cotton, sugarcane, rice, and millets in Kharif.

252. The remaining land is largely utilized for grazing and is uncultivated. Prosopis spicigera, Acacia jacquemontii, Salvadora oleoides, Capparis aphylla, Tamarix articulata, Tamarix sp., Calotropis procera are among the natural vegetation.

253. Other species include Desmostachya bipinnata, Alhagi camelorum, Acacia arabica, Zizyphus jujuba, and Tamarix diocia.[64]

254. Waheed et al. (2009) documented 37 weed species belonging to 33 genera and 17 families in the area. Poaceae (24.3%), one of the primary families, contributed significantly to the weed flora of the wheat crops.[65]

Current Survey Result

255. During the August 2022 survey, a total of 24 species of plants were observed in the study area. The indicators, including plant cover, plant count, and diversity per sampling location describe the floral conditions within the study area.

256. The AoI is dominated by plant species such as Crotalaria burhia, Prosopis juliflora, Aerva javanica, Calotropis procera, Suaeda fruticosa, Acacia nilotica, and Tamarix aphylla.

257. Among plant species, most dominant plant species are represented by small size plants and large-sized trees are rare. Therefore, low plant cover was observed in the study area.

258. The highest number of plant species was observed at sampling locations SP-4 and SP-3 where a total of 10 and eight plant species were observed respectively.

259. Seven plant species were observed each at sampling locations SP-5 and SP-7 (**Annexure V**).

260. Plant count and the cover of each species at each sampling location are provided in **Annexure V**.

261. The vegetation cover, plant count, and diversity in the study area are provided in **Table 4-18**.

262. The phytosociological attributes for the species in the three habitat types for the August 2022 Survey are provided in **Table 4-19**.

[61] Wariss, H. M., Pirzada, S. A., Alam, K., Anjum, S. H. A. Z. I. A., & Qureshi, R. (2014). Flora of Lal Suhanra National Park, Bahawalpur, Punjab, Pakistan. *Pak. J. Bot*, *46*(4), 1331-1341.

[62] Rafay, M., Khan, R. A., Yaqoob, S., & Ahmad, M. (2013). Floristic composition of grass species in the degrading rangelands of Cholistan desert. *Pak. J. Agri. Sci*, *50*(4), 599-603.

[63] Shahid, M. R., & Shinwari, M. I. (2017). 15. Documentation of indigenous and local knowledge of medicinal plants in the Rahim Yar Khan district of Pakistan. *Knowing our Lands and Resources*, 177.

[64] Reconnaissance Soil Survey Reports of Rahim Yar Khan (1972). Cholistan, 1974 and Dera Ghazi Khan, 1974. Soil Survey of Pakistan, Multan Road, LAHORE, Pakistan.

[65] Waheed, A., Qureshi, R., Jakhar, G. S., & Tareen, H. (2009). Weed community dynamics in wheat crop of District Rahim Yar Khan, Pakistan. *Pak. J. Bot*, *41*(1), 247-254.

263. Photographs of plant species observed in the study area are given in **Photo 4-4**.

Table 4-18: Vegetation Cover, Plant Count, and Diversity by Habitat Type

August 2022 Survey

NO.	Habitat	Plant Count			Plant Cover (%)			Diversity (No. of Species per Sampling Location
		Max	Min	Avg	Max	Min	Avg	
1	Agriculture Field	44	5	11.50	170.10	0.70	26.60	4.75
2	Sand Dunes	64	23	39.75	320.26	66.61	166.73	4.50
3	Vegetation	42	24	32.67	558.69	362.07	486.70	4.33

Table 4-19: Phytosociological Attributes of Plant Species in Habitats

August 2022 Survey

Species Name	D1, Density	D3, Relative Density	C1, Average Cover	C3, Relative Cover	F1, Frequency	F3, Relative Frequency	IVI, Importance Value Index
Aerva javanica	23.33	210.84	10.42	77.39	4.33	154.17	147.46
Salsola imbricata	4	34.38	5.94	7.44	1.34	47.22	29.68
Capparis decidua	5.00	51.14	0.70	189.70	2.33	86.39	109.08
Citrullus colocynthis	1.67	15.83	1.57	17.44	0.66	25.00	19.42
Zizyphus sp.	1.00	14.89	0.57	13.69	0.66	29.17	19.25
Tamarix aphylla	2.33	41.58	0.04	62.87	1.33	54.17	52.87
Suaeda fruticosa	5.33	67.11	2.12	3.98	1.00	35.00	35.36
Salvadora oleoides	1.00	15.79	0.01	46.25	0.67	25.00	29.01
Calotropis procera	8.67	104.54	15.15	8.12	3.00	102.78	71.81
Saccharum bengalense	3.33	32.26	0.85	29.50	0.67	25.00	28.92
Crotalaria burhia	1.67	16.13	2.78	4.50	0.33	12.50	11.04
Saccharum spp.	2.00	16.67	0.78	15.80	0.33	11.11	14.53
Prosopis juliflora	10.00	111.11	2.15	40.45	2.67	85.56	79.04
Datura innoxia	4.00	39.44	3.72	2.32	0.67	20.00	20.59
Dalbergia sissoo	5.00	89.42	0.69	122.97	2.67	102.22	104.87
Ficus religiosa	0.33	4.17	0.02	8.91	0.33	11.11	8.06
Eucalyptus camaldulensis	4.33	50.93	0.04	148.31	2.00	66.67	88.63
Phoenix dactylifera	0.33	4.17	0.11	1.67	0.33	11.11	5.65
Arundo donax	2.00	22.22	13.20	0.13	0.33	11.11	11.15

Species Name	D1, Density	D3, Relative Density	C1, Average Cover	C3, Relative Cover	F1, Frequency	F3, Relative Frequency	IVI, Importance Value Index
Acacia nilotica	6	118.33	0.14	227.77	3.67	145.56	163.88
Eucalyptus globulus	0.33	12.50	0.01	21.76	0.33	16.67	16.98
Saccharum bengalense	4.33	68.52	0.46	35.38	1.33	53.33	52.41
Nerium oleander	0.33	10.00	0.03	8.78	0.33	16.67	11.81
Albizia lebbeck	1.33	35.88	0.08	37.38	0.67	33.33	35.53

D1: Density The number of individuals of a species counted on a unit area.
C1: Average cover in sq m for a single species
C3: Relative cover The proportion of the total cover of a species to the sum of the cover of all the species in the area.
F3: Relative frequency the proportion of the total frequency of a species to the sum of the frequency of all the plants of all species in the area.

D3: Relative density The proportion of a density of a species to that of a stand as a whole.

F1: Frequency Percentage of sampling plots in which a given species occurs.

IVI: Importance value index It can be obtained by adding the values of relative density, relative cover, and relative frequency and dividing them by 3

Saccharum spp August 2022)

Calotropis procera August 2022)

Capparis decidua (August 2022)

Tamarix aphylla August 2022)

Photo 4-4: Plant Species in Study Area, August 2022 Survey

Invasive Plant Species

264. During the August 2022 survey, one invasive plant species; *Prosopis juliflora* was observed in the Terrestrial Study Area. However, two other invasive plant species *Ricinus communis* and *Xanthium strumarium* were observed in some parts of the Study Area.

265. *Prosopis juliflora* is a nitrogen-fixing, perennial, evergreen plant, found both as a bush and medium size tree with a sizeable crown and an open canopy growing to an average height of 5-10 m.[66]

266. *Prosopis juliflora* was introduced to Sindh province in 1857 for purpose of dunes stabilization followed by the Government of Pakistan in1950s and 1960s.[67] *Prosopis juliflora* is considered one of the most dangerous invasive species for biodiversity and in affected areas of Pakistan, this invasive species is eliminating the habitat of indigenous species at a catastrophic level. [68]

[66] Kazmi, S.J.H., Shaikh, S., Zamir, U.B., Zafar, H., Rasool, A., Tariq, F., Afzal, A. and Arif, T., 2009. Ecological and socio-economic evaluation of the use of Prosopis juliflora for bio-char production in Pakistan. *Pakistan: Drynet*, pp.1-54.

[67] Pasiecznik, N.M., Felker, P., Harris, P.J., Harsh, L., Cruz, G., Tewari, J.C., Cadoret, K. and Maldonado, L.J., 2001. *The Prosopis juliflora-Prosopis pallida complex: a monograph* (Vol. 172). Coventry: HDRA.

[68] Qureshi, H., Arshad, M. and Bibi, Y., 2014. Invasive flora of Pakistan: a critical analysis. International Journal of Biosciences, 4(1), pp.407-427.

Conservation and Protection Status

267. None of the species observed in the AoI or the study area or surroundings were found to be globally/nationally threatened species, endemic species, or protected species.

4.3.4 Mammals

Literature Review

268. The mammal species of the study area have not been studied in detail, however, based on the available literature on the wider area of the study area a total of about 13 species are documented.

269. Mammal species found in the wider area of the study area include Golden Jackal Canis aureus, Red Fox Vulpes, Desert Fox Vulpes bengalensis, Small Indian Mongoose Herpestes javanicus, Jungle Cat Felis chaus, Indian Crested Porcupine Hystrix indica, Small Indian Civet Viverricula indica, Black Buck Antilope cervicapra, Nilgai Boselaphus tragocamelus, Wild Boar Sus scrofa, Short-tailed Mole Rat Nesokia indica, and Desert Hare Lepus nigricollis.[69][70]

270. Based on the IUCN Red List Criteria none of the documented species from the wider area of the study area are listed as threatened except the Black Buck which is listed as Near Threatened globally.

Survey Results

271. Sampling was carried out at 11 sampling locations during the August 2022 Survey to study the mammalian species abundance and diversity within the Terrestrial Study Area. The locations of these are shown in **Figure 4-17.**

272. The results of the surveys, based on the sightings or signs of the mammals observed are provided in **Table 4-20**.

273. Photographs of the mammalian signs and sightings observed are shown in **Photo 4-5**

274. In the present survey signs and sightings of five mammalian species were confirmed in the AoI. The Five Striped Palm Squirrel was the most abundant mammalian species in the study area. This species was observed in all three habitats of the AoI.

275. The locals were also interviewed about the mammalian species occurrence in the study area. Based on the local's information the Indian Crested Porcupine and Desert Hare are also found in the Project area.

276. Field data collected during the August 2022 survey is given in **Annexure V**.

[69] Khan, B.N., Ahmad, R., Ali, Z., Yasmeen, R., Azhar, M., Abid, F., Mehmood, S. and Raza, H., 2018. Study of vertebrate diversity at Lal Suhanra National Park, Pakistan. *JAPS: Journal of Animal & Plant Sciences*, *28*(6).
[70] Roberts, T.J. and Bernhard (principe d'Olanda.), 1977. The mammals of Pakistan.

Table 4-20: Mammal Signs and Sightings in the Project Area

August 2022 Survey

NO	Common Name	Scientific Name	IUCN Status	Agriculture Fields		Sand Dunes		Vegetation		Total
				Sighting	Sign	Sighting	Sign	Sighting	Sign	
1	Golden Jackal	*Canis aureus*	Least Concern	-	-	-	-	2	-	**2**
2	Red Fox	*Vulpes*	Least Concern	-	-	-	3	-	-	**3**
3	Small Indian Mongoose	*Herpestes javanicus*	Least Concern	2	-	-	-	-	-	**2**
4	Five Striped Palm Squirrel	*Funambulus pennantii*	Least Concern	4	-	6	-	12	-	**22**
5	Wild Boar	*Sus scrofa*	Least Concern	-	-	-	-	3	-	**3**
6	Rodent spp.			-	-	-	9	-	-	**9**

Active Burrow of Golden Jackal (August 2022)

Five Striped Palm Squirrel (August 2022)

Golden Jackal (August 2022)[71]

Small Indian Mongoose (Roadside Kill) (August 2022)

Photo 4-5: Mammalian Species Sign/Sighting in Project Area

4.3.5 Birds

Literature Review

277. No published literature is available about the bird diversity of the proposed project area however study on the wider area shows that about 170 bird species are present in wider area.

278. Conservational important bird species found in the wider area are included White-rumped Vulture Gyps bengalensis which is globally listed as Critically Endangered.

279. The Endangered species found in the wider area of the project are included Steppe Eagle Aquila nipalensi, and Egyptian Vulture Neophron percnopterus.

280. Besides the globally threatened species, a number of migratory bird species also pass through the proposed project area each year during winter following the Indus Flyway (**Figure 4-18**).

Survey Results

281. Surveys for bird diversity and abundance were carried out in the Terrestrial Study Area in August 2022.

282. A total of 11 locations were sampled covering all types of habitats within the study area.

[71] Photograph credit, Mr. Hadi.

283. A summary of the results by sampling locations including the bird abundance and diversity is provided in **Table 4-21**.

284. Photographs of some bird species observed in the study area are given in **Photo 4-6**.

Table 4-21: Total Birds Sightings, Density, and Diversity by Habitat Type

August 2022 Survey

Habitat	No. of Sampling Points	Total Sighting	Density	No. of Species
Agriculture Fields	4	403	100.75	34
Sand Dunes	4	184	46.00	24
Vegetation	3	176	58.67	23
Total	**11**	**763**	**69.36**	**51**

285. A total of 763 bird individuals belonging to 51 species were observed.

286. Maximum abundance was observed at Sampling Locations SP-10 and SP-9 where a total of 185 and 110 birds individuals were observed respectively.

287. The abundant bird species in the terrestrial study area were House Crow *Corvus splendens*, Red-wattled Lapwing *Vanellus indicus*, Little-green Bee Eater *Merops orientalis*, Common Myna *Acridotheres tristis*, Little Egret *Egretta garzetta*, Baya Weaver *Ploceus philippinus*, etc.

288. Maximum diversity was observed at Sampling Location SP-11. A total of 21 bird species were observed at this Sampling Location.

289. The other diversity-rich sampling locations were SP-10, SP-5, and SP-2 where a total of 20, 18, and 15 bird species were observed respectively.

290. A list of the bird species observed in the study area is provided in **Annexure V**.

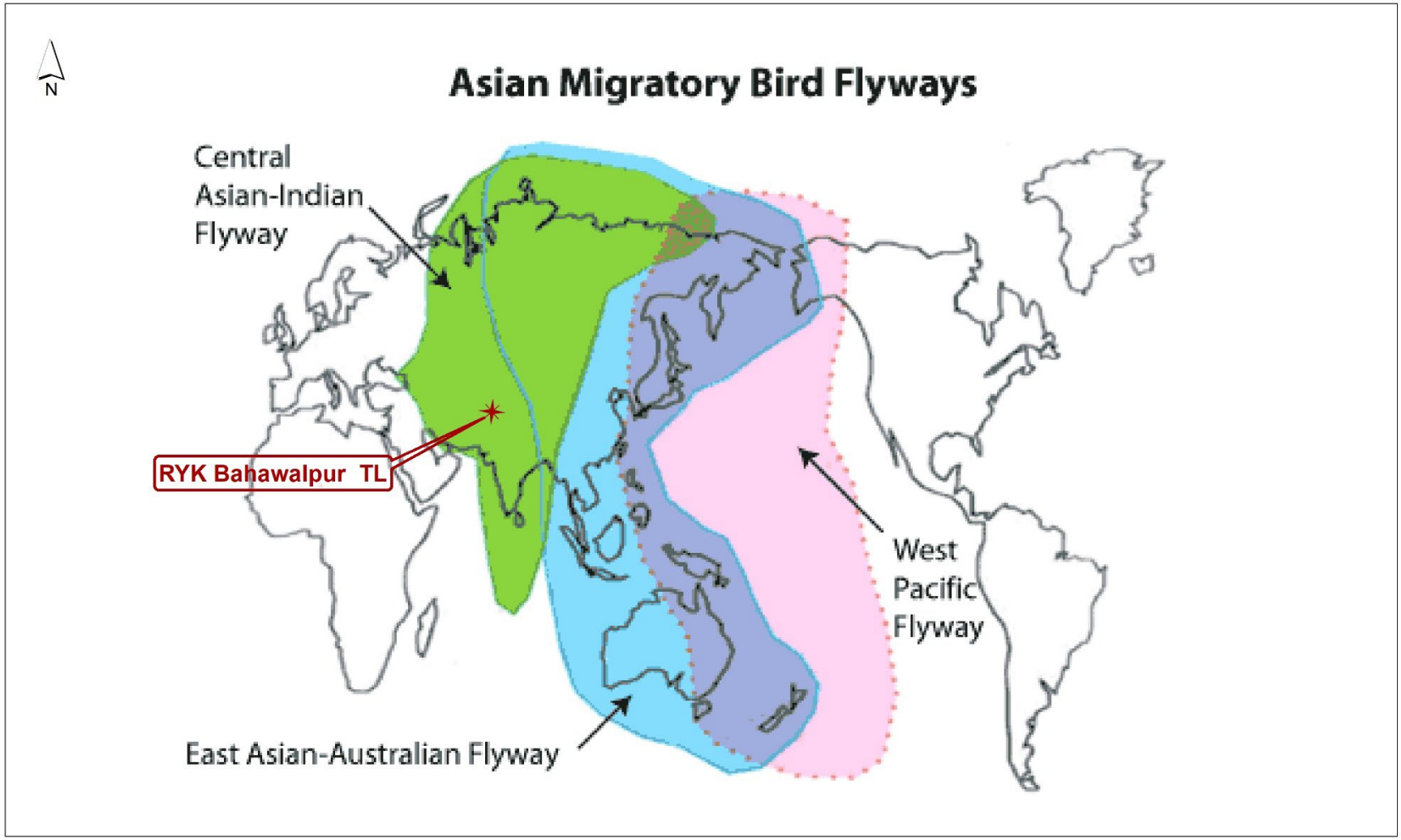


Figure 4-18: Asian Migratory Birds Flyways

Red-vented Bulbul (August 2022)

Red-wattled Lapwing (August 2022)

Greater Coucal (August 2022)

Nests of Baya Weavers (August 2022)

Little-green Bee Eater (August 2022)

Laughing Dove (August 2022)

Photo 4-6: Bird Species Photographed in the Project Area

Conservation and Protection Status

291. Of the bird species reported from the Project area, none are listed as threatened on the IUCN Red List of Threatened Species. Of the observed bird species in the terrestrial study

area, the Oriental-honey Buzzard *Pernis ptilorhynchus*, Long-legged Buzzard *Buteo rufinus*, and black kite (*Milvus migrans*) are included in CITES Appendix II.[72]

4.3.6 Herpetofauna

Literature Review

292. The herpetofauna of the proposed project has not been studied in detail. However, the presence of about 32 herpetofauna species in the wider area of the Project area can be assumed from the literature.

293. These are represented by five species of amphibians, five species of freshwater turtles, nine species of lizards, and 13 species of snakes.[73]

294. Spotted Pond Turtle *Geoclemys hamiltonii* and Indian Narrow-headed Softshell Turtle *Chitra indica* are listed as Endangered globally while the Indian Spiny-tailed Lizard *Uromastyx hardwickii* is listed as Vulnerable on the IUCN Red Data Book.

295. Of the documented herpetofauna species from the wider area of the project, the Bengal Monitor Lizard *Varanus bengalensis* is included in CITES Appendices I,[74] Cobra *Naja,* Sand Boa *Eryx johnii,* Brown Roofed Turtle *Kachuga smithi*, Indian Flap shell Turtle *Lissemys punctate, Indian Spiny-tailed Lizard,* and Indian Bullfrog *Hoplobatrachus tigerinus* are included in the CITES Appendices II.[75]

Survey Results

296. A total of 11 locations were sampled for herpetofauna during the August 2022 Survey. The locations of these are shown in **Figure 4-17**.

297. A total of seven herpetofauna species were observed in the terrestrial study area.

298. The most abundant herpetofauna species observed in the Project area was the Skittering Frog.

299. A total of 73 individuals of Skittering Frog were observed at different sampling locations.

300. The second abundant and widely distributed species in the study area were Boa and Indian Fringe-fingered lizard.

301. A summary of the herpetofauna species observed in different habitats of the study area is given in **Table 4-22**.

302. Photographs of the herpetofauna species sighted in the terrestrial study area are provided in **Photo 4-7**.

303. Herpetofauna species observed at each sampling location in the terrestrial study area are given in **Annexure V**.

[72] CITES (convention on international trade in endangered species of wild fauna and flora) is an international agreement between governments. its aim to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species. Cites appendix II: species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.

[73] Khan, B.N., Ahmad, R., Ali, Z., Yasmeen, R., Azhar, M., Abid, F., Mehmood, S. and Raza, H., 2018. Study of vertebrate diversity at Lal Suhanra National Park, Pakistan. *JAPS: Journal of Animal & Plant Sciences*, *28*(6).

[74] Cites Appendix I: in this appendix those species are included which are threatened with extinction. trade in specimens of these species is permitted only in exceptional circumstances, Cites Appendix III: species that are protected in at least one country which has asked other cites parties for assistance in controlling the trade. Not listed: species with no trade restrictions.

[75] CITES. Checklist of CITES Species. Accessed on September 05, 2022. Available at https://checklist.cites.org/#/en.

Table 4-22: Herpetofauna Signs and Sightings in the Study Area

August 2022 Survey

NO	Common Name	Scientific Name	IUCN Status	Sampling Habitate			Total
				Agriculture Fields	Sand Dunes/ Barren	Vegetation	
1	Indian Fringe-fingered lizard	*Acanthodactylus cantoris*	Least Concern		4	1	**5**
2	Indian Spiny-tailed Lizard	*Uromastyx hardwickii*	Vulnerable		2		**2**
3	Punjab Snake-eyed Lacerta	*Ophisops jerdonii*	Least Concern	2			**2**
4	Sand Boa	*Eryx johnii*	Near Threatened		6		**6**
5	Asian Garden Lizard	*Calotes versicolor*	Least Concern	1			**1**
6	Skittering Frog	*Euphlyctis cyanophlyctis*	Least Concern	33	40		**73**
7	Indian Flap shell Turtle	*Lissemys punctata*	Least Concern	1			**1**

Traces of Sand Boa (August 2022)

Indian Flap-shell Turtle (August 2022)

Skittering Frog (August 2022)

Asian Garden Lizard (August 2022)

Photo 4-7: Herpetofauna Species Observed in Terrestrial Project Area

Conservation and Protection Status

304. Of the reported species, only Indian Spiny-tailed Lizard is listed as Vulnerable in the IUCN Red Data Book while Sand Boa is listed as Near Threatened.

305. Of the documented herpetofauna species the Indian Spiny-tailed Lizard, Indian Flap shell Turtle, and Sand Boa are included in CITES Appendix II.

4.3.7 Critical Habitat Assessment

306. Performance Standard 6 (PS6) "Biodiversity Conservation and Sustainable Management of Living Natural Resources" requires the categorization of habitats into modified, natural, and critical.

307. Critical Habitats are a subset of modified or natural habitats. They are habitats of high biodiversity value.[76]

Natural and Modified Habitats

308. Natural and Modified Habitats are defined and described in IFC PS6.[77] Their definitions, according to IFC PS6, are as follows:

[76] International Finance Corporation. January 2012. Policy on Social and Environmental Sustainability, Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, The World Bank Group.

[77] International Finance Corporation. January 2012. Policy on Social and Environmental Sustainability, Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, The World Bank Group.

- Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition. Under IFC PS 6 No Net Loss is required in Natural Habitats.
- Modified habitats are areas that may contain a large proportion of plant and/or animal species of non–native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.

309. The terrestrial study area is classified as a modified habitat. Most of the area is agriculture land habitat type. Human populations are present in and around the Project area.

Critical Habitat

310. Critical Habitat is a requirement under the International Finance Corporation's (IFC) Performance Standards (PS).

311. Critical habitat is an area that has high biodiversity value and may include sites that are legally protected or officially proposed for protection. These may include Areas protected by the International Union for Conservation of Nature (Categories I–VI) (IUCN, 1994), wetlands of international importance (according to the Ramsar Convention), important bird areas (defined by Birdlife International), and biosphere reserves (under the UNESCO Man and the Biosphere Program).[78]

312. The Project does not fulfill any of these characteristics.

313. Critical Habitat Assessment as per IFC PS6 requires the definition of a Discrete Management Unit (DMU). This is based on the following:

314. "For Criteria 1 through 3, the project should determine a sensible boundary (ecological or political) which defines the area of habitat to be considered for the Critical Habitat Assessment. This is called the "discrete management unit," an area with a definable boundary within which the biological communities and/or management issues have more in common with each other than they do with those in adjacent areas (adapted from the definition of discreteness by the Alliance for Zero Extinction).

315. A discrete management unit may or may not have an actual management boundary (e.g., legally protected areas, World Heritage sites, KBAs, IBAs, community reserves) but could also be defined by some other sensible ecologically definable boundary (e.g., watershed, interfluvial zone, intact forest patch within a patchy modified habitat, seagrass habitat, coral reef, concentrated upwelling area, etc.). The delineation of the management unit will depend on the species (and, at times, subspecies) of concern."[79]

316. The criterion for Critical Habitat Assessment based on IFC's PS6 along with their application to the biodiversity within the Project area is provided below.

Habitat of significant importance to Critically Endangered and/or Endangered species:

317. According to IFC's Guidance Note 6, Tier 1 sub–criteria for Criterion 1 are defined as:

- Habitat required sustaining ≥ 10 percent of the global population of an IUCN Red–listed Critically Endangered (CR) or Endangered (EN) species".

[78]Hagler Bailly Pakistan (2018). Arkari Gol Hydropower Project Environmental and Social Impact Assessment. Report Prepared for Master Hydro (Pvt.) Limited.

[79] International Finance Corporation. January 2012. Policy on Social and Environmental Sustainability, Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, The World Bank Group.

- Habitat with known, regular occurrences of CR or EN species where the habitat is one of 10 or fewer discrete management sites globally for that species.

318. Tier 2 sub–criteria for Criterion 1 are defined as follows:

- Habitat that supports the regular occurrence of a single individual of an IUCN Red–listed CR species and/or habitat containing regionally–important concentrations of an IUCN Red–listed EN species where the habitat could be considered a discrete management unit for that species.
- Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long–term survivability of the species. As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR, or equivalent national/regional listing.

319. Based on information available from the literature and August 2022 survey, there is no endangered species reported from the terrestrial study area therefore the result does not trigger any IFC criteria for critical habitat.

Habitat of significant importance to endemic and/or restricted–range species:

320. According to IFC's GN6, Tier 1 sub-criteria for Criterion 2 is defined as follows:

- Habitats know to sustain ≥ 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species (e.g., a single–site endemic).

321. Tier 2 sub–criteria for Criterion 2 are defined as follows:

- Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted–range species where the habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment

322. No endemic and/or restricted-range species have been reported from the terrestrial study area. Therefore, Critical Habitat is not triggered for Criterion 2 for the terrestrial study area.

Habitat supporting globally significant concentrations of migratory species and/or congregatory species:

323. According to IFC's GN6, Tier 1 sub–criteria for Criterion 3 are defined as follows:

- Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 of the global population of a migratory or congregatory species at any point of the species lifecycle where that habitat could be considered a discrete management unit for that species.

324. Tier 2 sub–criteria for Criterion 3 are defined as follows:

- Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.
- For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance.
- For species with large but clumped distributions, a provisional threshold is set at ≥5 percent of the global population of terrestrial species. Source sites that contribute ≥ 1 percent of the global population of recruits.

325. Within the terrestrial study area, some migratory and congregatory bird species are expected to be found. However, these bird species are widespread. According to expert judgment, the migratory bird populations are small and do not trigger Tier 1 or Tier 2 sub–criteria for Criterion 3 and the terrestrial study area is not a Critical Habitat for migratory birds.

Highly threatened and/or unique ecosystems

326. There is no information that indicates the study area, or any part of them, is a highly threatened and/or unique ecosystem. Furthermore, no information indicates the study area is a part of a threatened or unique ecosystem.

Areas with unique assemblages of species or which are associated with key evolutionary processes or provide key ecosystem services:

327. No information indicates the study area, or any part of them, is associated with key evolutionary processes or provides key ecosystem services. While the species are functioning components of ecosystems, there are no unique assemblages of species or association of key evolutionary processes in the study area.

Areas with biodiversity that has significant social, cultural or economic importance to local communities.

328. No information indicates the study area or any part of them is associated with biodiversity that has significant social, cultural, or economic importance to local communities.

329. Therefore, the terrestrial study area is not biodiversity of significant social, cultural, or economic importance for the local communities, and Critical Habitat is not triggered for this criterion.

4.3.8 IBAT Assessment

330. Based on the Integrated Biodiversity Assessment Tool (IBAT) presence of many global conservation important species of different classes of vertebrates are predicted in the 50 km buffer area of the proposed ETL.

331. Most of the IBAT assessments are valid particularly for birds and reptiles, however; their assessments about a few species particularly for mammals and some bird species are not valid. For example,

- the IBAT predicted the presence of Common Leopard Panthera pardus in the 50 km buffer area of the project but IUCN Data and local database shows that Common Leopard is extirpated from this region.
- Similarly, the IBAT predicted the presence of White-browed Bushchat *Saxicola macrorhynchus* but according to Grimmet et al 2008, this species is extirpated from Pakistan.
- Similarly, the presence of Indus Dolphin *Platanista gangetica minor*, Hog Deer *Axis porcinus*, Macqueen Bustard *Chlamydotis macqueenii*, and Jerdon Babbler *Chrysomma altirostre* presence is shown by IBAT in the 50 km buffer area of the project but IUCN data shows that the distribution range of these species does not fall in the proposed project area.
- IBAT findings report is presented in Annexure VI.

332. Since the baseline data has been interpolated based on literature review and primary data collected during current survey, therefore this data is more reliable for interpretation of ecological resources in the Project area.

4.4 Socioeconomic Environment

333. The sub-section provides information on socio-economic environments existing in and around the AoI including methodology, administrative setup, demographic characteristics, educational and institutional facilities, transportation, water supply, income sources, religious/archeological and historical sites (if any) existing in the area.

4.4.1 Methodology and Data Sources

334. Information required for the socioeconomic baseline is based on information collected from a literature review; other key secondary sources of information for this baseline study include official statistics, such as maps, census reports and other available documentation on the history of the people and the area from a broad selection of recent and reliable sources, both published and unpublished. A field visit was conducted between August and September 2022 in the settlements were visited and key informant interviews conducted to support the literature sources.

4.4.2 Administrative Setting

335. The proposed project includes installation of towers and ETLs. The land required for the construction of proposed ETL of 150 km fall in the jurisdiction of two districts namely Rahimyar Khan and Bahawalpur, districts of Punjab province, Pakistan,

336. The potential administration system is more or less identical all over the country. Union Council (UC) is the lowest tier of the local government. A village council in Pakistan is an elected local government body headed by a chairman (which is equivalent to a mayor) and a Naib /Chairman (Deputy Mayor). Union councils are the fifth tier of government in Pakistan and are often known as "village councils" in rural areas, the territory represented by a village council usually comprises a large village and surrounding areas, often including nearby small villages. The term "union council" may be used for localities that are part of cities.

337. Headed by a union Chairman, each union council has 13 elected members or councilors. Besides elected members, there are several government employees and functionaries in every union council, who report to the secretary of the union council. The territory of a union council or village council is usually part of a tehsil (a district subdivision).

338. Taluka/Tehsil Council is the next tier of local government. About 4 to 5 UCs fall in the Taluka/Tehsil Council (TC). Taluka/Tehsil is a sub-unit of the district, which is the highest tier of the local government system, dealing with administrative matters at the district level.

339. A district is composed of 3 to 5 Talukas/Tehsils and is governed by the District Coordination Officer (DCO). The local government system comprises UCs consisting of members directly elected through an open competition, which is also from the Electoral College for the selection of the members for the next higher tier. District Bahawalpur has its district headquarters at Bahawalpur city. This district has five talukas, District Rahim Yar Khan has its district headquarters at Rahimyar Khan city. This district has four tehsils, named: Khanpur Liaquatpur Rahim Yar Khan and Sadiqabad.

340. Union Council chairman is responsible to collect and maintain statistical information for socio-economic surveys in the community and to consolidate village and neighborhood development needs and priorities them into union-wide development proposals with the approval of the Union Council and make recommendations thereof to the district government of Tehsil Municipal Administration, as the case may be. Union council Nazim also manages O&M of public resources such as drinking water, including wells, water pumps, tanks, ponds, and other works for the supply of water. Union council chairman has access to Tehsil and District Chairman. The district government takes funds from the provincial government and district Chairman allocate funds with the coordination of DCO.

4.4.3 Demographics

Population

341. According to the census of 2017, the total population of Bahawalpur District is 3,668,106 and Rahimyar Khan District is 4,814,006. Based on the 2.4% population growth rate of Pakistan, the estimated population for the year 2022 for Bahawalpur district is 4,108,279 and Rahimyar Khan is 5,391,687. The gender-wise of the population of Bahawalpur and Rahimyar Khan is latest census of 2017 Pakistan is given in **Figure 4-19** and **Figure 4-20**.

342. The male population is high 51% as compared to the female population which is 49% of the total population.

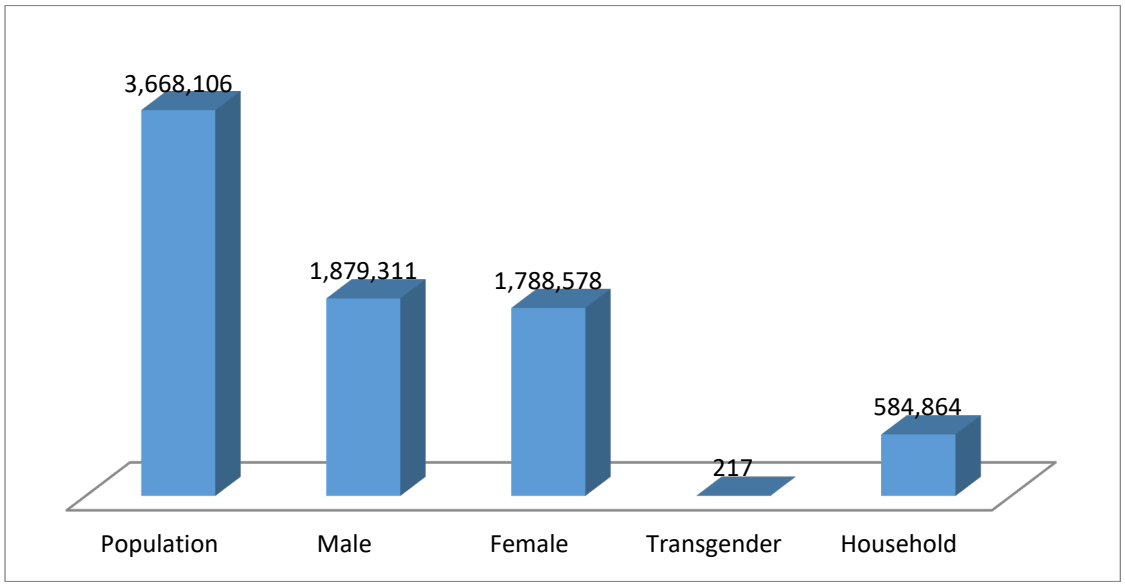


Figure 4-19: Population of Bahawalpur District, 2017 Census

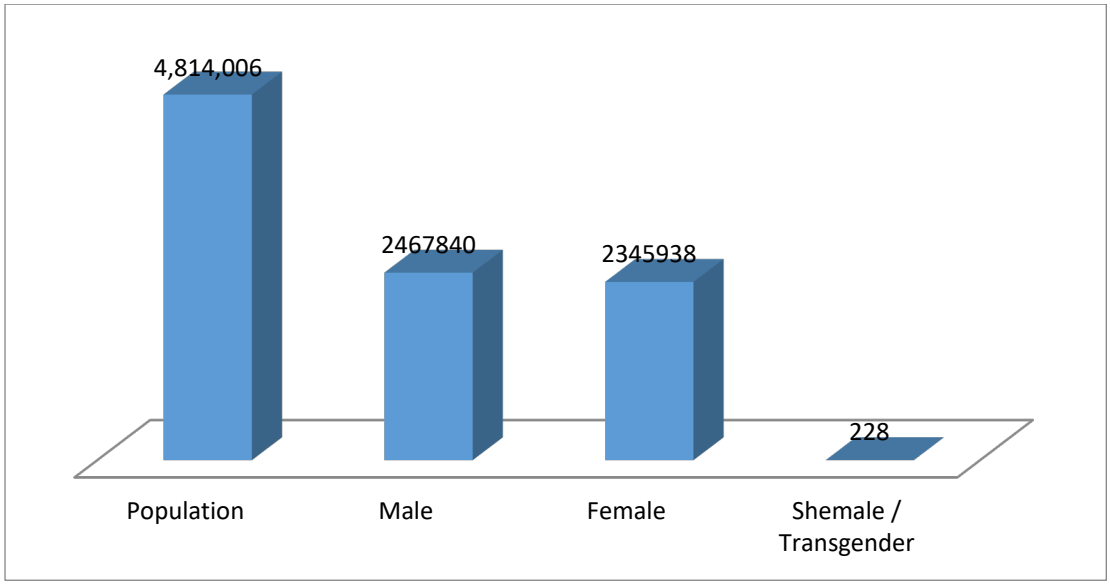


Figure 4-20: Population of Rahim Yar Khan District, 2017 Census

Family / Household Size

343. Based on the social survey, the overall average household size of district Bahawalpur is 6.2 and district Rahim Yar Khan is 6.77 average family size.

344. The joint family system is common throughout the project area, whereas only a small percentage of families are living like a single family (called a nuclear family system). In a few areas, the tribal system exists, thus people give preference to live as a joint family. During the discussions with the locals, it was clarified that the larger family size is treated as the strength of the family.

Ethnicity/ Caste Groups

345. The main castes and groups of the Bahawalpur and Rahim Yar Khan districts are Arain, Jatt, Rajput, Pathan, Gujjar, Baloch, Qureshi, Dahar, Mahar, Shar, Solangi, Panhawar, Mazari, Dhama, Lorai, Dasti Ghuman Abasi, and Syed. These casts have been further sub-divided in various sub- caste and sub-tribes.

346. The population of the area is predominantly Muslims i.e., 98.1 percent. The next higher percentage is of Hindu with 0.9 points followed by Christian 0.6 percent. While other minorities like Ahmadis, Schedule Castes etc.

Languages Spoken

347. Saraiki is the predominant language being spoken by majority of the population of the area followed by Urdu; However, Punjabi, Sindhi, Balochi, Marwari, and Pushto are also spoken. All the Subproject affected people understand Urdu.

4.4.4 Social Infrastructure

Health

348. Health conditions are one of the major determinants of a society's social development and quality of life. Healthy manpower is imperative for advancement and economic growth. The total health facilities available in the district Bahawalpur is 161. There are District Headquarter Hospital, Tehsil headquarters Hospital at each Tehsil along with M.C. Health Centre, Primary Rural Health Centers, Primary Dispensaries, Basic Health Units, TB Centers and 72 dispensaries. In district Rahimyar Khan there are 104 health facilities.

349. In the project areas overall, health facilities are inadequate in the project area. The people in the project area trend to get treatment from traditional indigenous healers, due to the lack of suitable and sufficient health facilities. Bad sanitary conditions, insufficient medical facilities, and meager parental care, all contribute to the prevalence of poor health and the high rate of mortality in the project area.

Literacy Status

350. The literacy rate of Bahawalpur district is 36% according to the census of 2017, of which 53% literacy people are male while 47% area female. There are over 1600 government primary schools- 45% of which are for girls. Middle schools are 226, over 60% are for girls, and 39% for boys, while high schools are 125 and 62% are for boys. As level of education increases, percentage of boys' schools increases in the district. However, higher secondary schools are the same in the district, 14 each. Total number of arts and science degree colleges are 18 having enrolment of almost 20,000 students and teaching strength of 543. The higher education institutions in Bahawalpur district include Islamia University of Bahawalpur, Asian college of Technology, Quaid-e-Azam Medical College (QAMC), Government Sadiq Egertin College (SE College),

351. The overall literacy rate of Rahim Yar Khan district is 33.1% and it is ranked 30th out of 34 districts of Punjab in terms of literacy rates. There are 3,903 Public schools in District Rahim Yar Khan, 3,375 are Primary schools, 316 middle schools, 168 are High schools and 44 are Higher Sec./ Inter Colleges/ Degree Colleges.

352. The literacy rate is measured as the number of literate people among the population of 10 years and above. The literacy rate in the project area is lower compared to the national level.

4.4.5 Physical Infrastructure

353. The area has a weak infrastructure when compared to other districts provincially and nationally. It is discussed in this section.

Roads and Communication

354. Road network is considered as a vehicle for economic development and social change. Efficient road network not only develops a quick and efficient transportation system. It brings about social integration among rural and urban sectors and greatly assists in providing access to basic amenities such as education, health facilities, etc.

355. The total metaled road length in Rahim Yar Khan is 4023.7 km and in Bahawalpur is 2678.3 km. These metaled roads are linked with Lodhran, Bahawalnagar, Daharki, Sukkar Muzaffargarh and Rajanpur districts. M5 Multan to Sukkur motorway passes through the area. Besides roads, the district has also a fully functioning railway network. The main Peshawar-Karachi railway line passes through these districts. There is only one landing strip in the district located at Khanpur. There is an international airport (Sheikh Zaid Intl Airport) in Rahim Yar Khan and a domestic airport in Bahawalpur.

Housing

356. The housing condition is also an important parameter for the assessment of the living standard/household well-being of the locals. Pacca houses are constructed with bricks, cement, and concrete having wooden and steel doors and windows. Semi pacca houses are made of bricks (joint with mud) and their roofs are mostly of wood, iron sheet and partially bricks, whereas kacha houses are made of mud and other local material such as sticks, reeds, and iron sheet.

357. **Figure 4-21** shows the data on the housing condition of the districts based on the construction material. Majority of the houses are pacca and semi-pacca in both districts, while there are 40% kacha houses on Rahim Yar Khan and 43% in Bahawalpur.

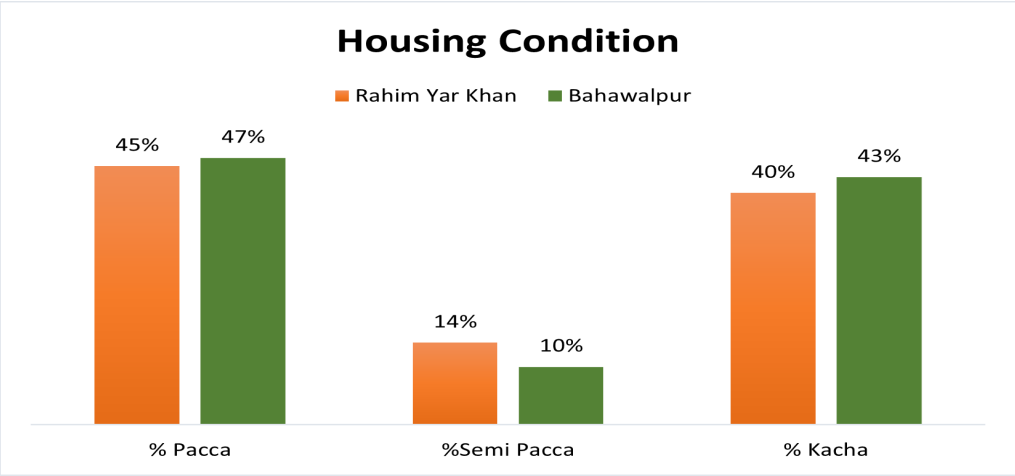


Figure 4-21: Housing Condition in the districts

Electricity

358. The electricity supply is available to almost all the villages and settlements along the line route. Electricity is provided by the Multan Electric Power Company (MEPCO).

Sanitation / Drainage Facilities and Solid Waste

359. Sanitation facilities are available to 63% of the population in Bahawalpur district and 59% of the population in Rahim Yar Khan District.

360. A proper sewerage system is available in most of the urban area and only a few villages of the project area are connected with the sewerage system. However, there are no wastewater treatment facilities and in most of the cases, the wastewater is disposed of into open spaces or nearby ponds. Ultimately, wastewater is drained into a pond/nullah, thus it becomes a source of pollution. Similarly, there is inadequate arrangement for the disposal of solid waste.

Sui Gas (Natural Gas)

361. Natural gas (or Sui Gas) is available to 75% of the household in the project area.

362. Data reveals that most people are using locally available wood and animal dung for cooking purposes, while gas is the second-highest source for cooking. Compared to wood, only a few people use kerosene oil because of the high prices of kerosene oil. The rationale to utilize wood for cooking is because it is cheap and easily available in rural areas as compared to other methods.

Education

363. During the field visit, it was observed that in the project area, educational buildings are available. Educational institutions were found but were observed to be in poor condition. Due to the non-availability of students as well as teachers, most of the school buildings have collapsed or are in poor condition. Examples of school and mosque within the Project area are shown in **Photo 4-8**.

August 2022

August 2022

Photo 4-8: School and Mosque in the Project Area

Telecommunication

364. Mobile phone communication is widely spread in the RoW and the project area, the frequent use of the mobile phone was observed. Landline facilities are available in the project area outside the RoW. The landline facilities are available in urban areas only.

365. Besides, the roads are available to 99% of the households, however, the local people are not happy on the available road infrastructure, as mostly required extensive maintenance.

Post Offices and Banks

366. Postal, money order and bank facilities exist throughout the vicinity of the project area.

Water Supply

367. Potable drinking water supply is available to 55% of the houses and people are only relying on the groundwater, extracted either manually through hand pump or electrically through the electric pump. There are the cases that people bring the drinking water from the

tube well, being installed for irrigation purposes. Examples of water facility within the Study Area are shown in **Photo 4-9**.

August 2022

Photo 4-9: Water Sources in the Project Area

4.4.6 Sources of Income and Livelihood

368. District Bahawalpur and Rahim Yar Khan are agro-based rural districts where 84% of the population reside in the rural areas, the sources of livelihood are less diversified for the resident population. While agriculture is the main source of employment for the rural population, in the urban areas of the district people are engaged in various other economic activities like trade, services, industry, personal business, and government and private jobs. Sadiq Abad, Rahim Yar Khan, Liaquatpur, Khanpur, Ahmedpur Sharkia, Zahirpir and Bahawalpur are the main trading centers of this area, here mega industries also provide livelihood earning opportunities to the resident population. 60% male population are engaged in agricultural activities.

369. It is useful to study the household's economic pattern that ultimately facilitates better planning and execution of the project. Numerous income-generating activities are practiced in the project area as reported by the survey. These include employment in government and private sector, wage labor, operating own business such as running fuel station, traders, shopkeepers, and transporter. Field investigation reveals that the farming is the dominant profession in the area, as 73% of the households have their affiliation with the farming practices along with the livestock rearing while 27% have alternate non-farming income sources like a job in government and private sector and labor work.

Agriculture

370. The local economy the district Rahim Yar Khan and Bahawalpur is mainly driven by agriculture sector with a good yield of different cash crops along with production of fruits. The main crops grown in districts are wheat, cotton, and sugarcane whereas mangoes and citrus are main fruits produced in this region. Examples of cotton crop within the Study Area are shown in **Photo 4-10**.

August 2022
Photo 4-10: Cotton Crop in the Project Area

Industry

371. According to the records of the Government of Punjab, there are 311 major industrial units of different sectors in the district of Rahim Yar Khan. The type of industry includes cotton ginning and pressing (184), flour mills (62), textile weaving (12), sugar (5), poultry feeds(5), agricultural implements(3), rice mills, seed processing, fans/coolers, seed processing, fertilizer, cement products, soap, and detergent etc.

372. The main industries of the Bahawalpur district are cotton ginning and pressing (153), textile (10), flour mills (39), sugar, cottonseed oil, edible oil, soap, beverage making, agricultural implements manufacturing and fertilizer, manufacturing. Cottage industry includes ginning, pottery/clay products, electric desert cooler, agricultural machinery, handicrafts, food industry, and embroidery.

Livestock

373. The livestock sector maintains a unique position within the agriculture sector of this area. Most people living in the Rahim Yar Khan and Bahawalpur own livestock i.e., cattle, buffalo, goat, and sheep to meet their daily needs.

374. Socioeconomic survey findings depicted that 10% household depends on the livestock. People keep these animals for producing milk, ghee/butter, and other dairy products. Horses and Donkeys are also reared as livestock animals in the Project area. They are used for cart driving, transport and riding etc. There are many commercial-level dairy farms in the area.

5. Anticipated Environmental Impacts and Mitigation Measures

375. This section discusses the Project's potential impact on the area's physical, ecology and socioeconomic environment and mitigation measures that will reduce, if not eliminate, its adverse impact. The mitigation measures then become part of the environmental management plan (EMP) for implementation provided in **Section 8**.

5.1 Methodology for Impact Assessment

376. Environmental and socioeconomic impacts are assessed in the following stages:

- **Scoping:** Scoping is a broad term that refers to the process through which potential environmental issues associated with the proposed project are identified. Potential impacts are identified by various means. These include, for example, concerns expressed by the community, formal checklists, and previous experience of the experts. The outcome of the exercise is the identification of all issues that need further investigation and screening out of issues that are not relevant.
- **Prediction of potential impacts:** This step refers to the evaluation and prediction, quantitatively, if possible, of the anticipated impacts of the proposed Project on various environmental factors.
- **Evaluation of the significance of predicted impacts:** Significance of the potential impacts can be determined by considering both the *consequence* and the *likelihood of occurrence* of the impact. The consequence of the proposed activity is evaluated by comparing it against recognized significance criteria, such as institutional recognition, technical recognition, scientific or technical knowledge, or judgment of recognized experts, public recognition, and professional and experience-based interpretation of the evaluator.
- **Mitigation measures:** If it is determined that the predicted impact is significant, practicable mitigation measures are identified to reduce impacts for each activity to acceptable levels.
- **Residual impacts:** This step refers to the identification of the anticipated remaining impacts after mitigation measures have been applied.
- **Management actions and** monitoring**:** The last step in the assessment process is the identification of the monitoring requirements to confirm that the residual impacts are within the predicted limits and to provide timely information if the impacts exceed predicted limits.

5.1.1 Evaluation of Significance of Potential Impacts

377. The significance of potential or the predicted impacts are evaluated based on their associated risk levels or effects on the receiving environment.

378. Risk is assessed as the likelihood that the activity will have an effect on the environment as well as the consequence of the effect occurring. It is often described like this:

Risk = Likelihood X Consequence

379. Likelihood definition, consequence scale and risk score evaluation approach is provided in **Table 5-1, Table 5-2** and **Table 5-3**.

Table 5-1: Evaluation of Impact Significance Matrix (Likelihood Scale**)**

Likelihood	Definition	Scale
Certain	Will certainly occur during the activity at a frequency greater than every week if preventative measures are not applied	5
Likely	Will occur more than once or twice during the activity but less than weekly if preventative measures are not applied	3
Unlikely	May occur once or twice during the activity if preventative measures are not applied	2
Rare	Unlikely to occur during the project	1

Table 5-2: Evaluation of Impact Significance Matrix (Consequence Scale)

Consequence	Definition	Score
Catastrophic	The action will cause unprecedented damage or impacts on the environment or surrounding communities	5
Major	The action will cause major adverse damage to the environment or surrounding communities	3
Moderate	No or minimal adverse environmental or social impacts	2
Minor	No or minimal adverse environmental or social impacts	1

Table 5-3: Evaluation of Impact Significance Matrix (*Risk Score Table*)

	Consequence			
	Catastrophic	Major	Moderate	Minor
Certain	**25**	**15**	**10**	5
Likely	**15**	**9**	**6**	3
Unlikely	**10**	**6**	4	2
Rare	5	3	2	1

Risk:
Critical: 15 – 25, Significant/ Moderate: 6 – 10, Low: 1 - 5
Critical and moderate risks will be addressed in EMP.

5.2 Pre-construction (design) phase Impacts

380. Proper planning during project design can significantly reduce the negative impacts at the time of construction and operation.

381. A summary of screening of potential impacts at the pre-construction (design) phase, based on methodology discussed in ***Section 5.1***, is provided in **Table 5-4**.

Table 5-4: Screening of Potential Impacts at Pre-construction (design) phase

No.	Potential Impact	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Score (Critical, Significant/ Moderate, Low)	Residual Impact (Critical, Significant/ Moderate, Low)
1	Lack of integration of IEE/EMP/EIA requirements into construction bid documents	3 Likely	3 Major	9 Significant	Low
2	Lack of planning in ETL design[80]	3 Likely	3 Major	9 Significant	Low
3	Improper Location of Camps Leading to Environmental and Social Issues	3 Likely	3 Major	9 Significant	Low
4	Lack of Project environmental safeguards (human resource) capacity	3 Likely	3 Major	9 Significant	Low
5	Removal of vegetation/trees	3 Likely	3 Major	9 Significant	Low
6	Noise caused by construction equipment	3 Likely	2 Moderate	6 Moderate	Low
7	Land acquisition	3 Likely	3 Major	9 Significant	Low
8	Waste generation	3 Likely	2 Moderate	6 Moderate	Low
9	Disruption to existing drainage pathways and utilities	3 Likely	2 Moderate	6 Moderate	Low
10	Impacts on Sensitive and High Value Areas	2 Unlikely	2 Moderate	4 Low	Low
11	EMF	3 Likely	2 Moderate	6 Moderate	Low
12	Impact on Community Safety due to Structure/ Mechanical Failure of the overhead conductors	2 Unlikely	3 Major	6 Moderate	Low
13		2	2	4	

1. [80] Covering (i) Route Selection, (ii) Transmission, (iii) Structure Design, (iv) Tower Placement Add-ons, (v) Visual Amenity, and (vi) Mechanical Failure of the Overhead Conductors.

No.	Potential Impact	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Score (Critical, Significant/ Moderate, Low)	Residual Impact (Critical, Significant/ Moderate, Low)
	Natural hazard risks (flooding, earthquakes, etc.)	Unlikely	Moderate	Low	

Critical Risk Level

Significant/ Moderate Risk Level

Low Risk Level

5.2.1 Lack of Integration of IEE/EMP/EIA Requirements into Construction Bid Documents

Assessment

382. The bidding documents must reflect the requirement to select a qualified and experienced Contractor from the perspective of ensuring implementation of required safeguards during project development.

Mitigation Measures

383. The mitigation measures described below will be implemented while completing the final design of the Project.

- The ESIC should be assigned the task to check that design and bid documents are responsive to key environmental, social, and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP.
- The bid documents must include the EMP, and its implementation cost must be reflected in the bill of quantity (BoQ).

5.2.2 Lack of Planning in ETL Design[81]

Assessment

384. Vulnerability to climate change and natural disasters poses an additional significant challenge to the sustainable and reliable electricity supply, as witnessed by the monsoon rains and the subsequent flashfloods in July and August 2022, which wreaked tremendous devastations in Pakistan.[82] As per the NTDC's Rapid Flood Damage Assessment of its network, no damage was reported on 500 kilovolt (kV) and 220kV grid stations except two high voltage ETLs with a total of thirteen towers collapsed as a result of floods.[83] The Climate Risk and Vulnerability Assessment (CRVA)[84] of September 2022 concluded that changes in intensity and frequency of extreme weather events and unseasonal deviations from average weather will affect current and future energy infrastructure, supply reliability, and the energy sector's profitability. Therefore, additional investment is required to ensure the transmission network resilient to climate change and natural disaster.

The pre-construction (design) phase planning is very important for the following parameters. Better planning will produce less environmental and social impacts during later phases of construction and operations.

- Route Selection
- Transmission Structure Design
- Tower Placement
- Add-ons
- Visual Amenity

[81] Covering (i) Route Selection, (ii) Transmission, (iii) Structure Design, (iv) Tower Placement Add-ons, and (v) Visual Amenity, (vi) Mechanical Failure of the Overhead Conductors.
[82] Islamic Relief Pakistan. 2022. *Rapid Assessment: Flood Emergency – Balochistan and Sind (28 August 2022).*
[83] One tower on 220kV Khuzdar-Dadu transmission lines and 12 towers on 220kV Dadu-Sibbi transmission line.
[84] The Climate Risk and Vulnerability Assessment is in Appendix 12.

- Mechanical Failure of the Overhead Conductors

Mitigation Measures

385. The mitigation measures described below will be implemented while completing the final design of the Project.

- Using corridor-sharing with existing ETLs for minimize RoW requirements. Preference will be given to a route with a minimum community displacement and minimum tree cutting requirement
- Better planning during the selection of RoW will generate less negative socioeconomic impacts on the affected persons.
- Selection and use of the latest available technology for reducing the EMF from ETLs.

a. ETLs to be designed for higher resilience to climate change impacts to ensure the transmission network resilient to climate change and natural disaster.

- Choosing a ETL tower with aesthetic appeal such as the darker color of oxidized steel structures may blend in better with forested backgrounds.
- Making minor adjustments in tower locations to avoid archeological sites or minimize effects on agricultural operations.
- Adding flight diverters to conductors to minimize bird collisions with the wires.
- Location of high-voltage transmission and distribution lines in less populated areas, where possible, to mitigate the impact on visual amenity and noise. This will also create less land acquisition and resettlement issues.

5.2.3 Improper Location of Camps Leading to Environmental and Social Issues

Assessment

386. The selection of campsites for construction and field residence is very important step to be taken by the contractors before mobilization for construction. Poor planning in selection of the sites and poor camping facilities, can cause environmental and social issues during construction.

Mitigation Measures

387. The mitigation measures described below will be implemented while completing the final design of the Project.

- Camp locations at least 200-300 m from the sensitive receptors including settlements and water bodies.
- Development of the campsite plans indicating walkways, car parking, recreational areas, rooms, kitchen, dining, storm run-off, toilets and sewerage lines and treatment, disposal, freshwater storage, and lines, etc.

5.2.4 Lack of Project environmental safeguards (human resource) capacity

Assessment

- The lack of environmental and social safeguards team and lack of capacity within project proponent and contractors creates implementation issues of project environmental safeguard documents including local law requirements, ADB SPS requirements, IEE, EIA, SSEMP, and NOC.

Mitigation Measures

388. The mitigation measures described below will be implemented while completing the final design of the Project.

- The ESIC/PMU to make sure that it is staffed by EHS Manager, Deputy EHS Manager and Assistant EHS Manager in addition to social safeguard staff.
- The ESIC/PMU to ensure, contractor's environmental safeguards capacity before construction starts. Make sure that the Construction Contractor assigns and retains a full-time and qualified ESO and a full-time and qualified HSO.

5.2.5 Removal of vegetation/trees

Assessment

389. Due to the proposed project, 350-400 trees of varying species and sizes, may be affected by the project. This impact will be permanent and moderate adverse. Lack of planning in clearing RoW from trees can cause unnecessary cutting trees.

Mitigation Measures

390. The proposed mitigation measures will include:

- Incorporate technical design measures to minimize the removal of these trees, as far as possible.
- Compensatory planting of ten (10) trees against each fallen tree of similar floral function will be planted; and,
- The plantation plan will prefer the prevalent indigenous species of plants and ensure that there will be no exotic species in the plantation plan with known environmental setbacks.

5.2.6 Noise caused by construction equipment

Assessment

391. Increase in ambient noise levels are expected in construction phase of the Project especially in areas near to sensitive receptors. An early assessment in pre-construction (design) phase, at sensitive receptors, will be useful.

Mitigation Measures

392. The following measures will be implemented to ensure that the cumulative noise impacts are within acceptable limits during construction activities:

- Conduct detailed acoustic assessment for all residential buildings, schools, (other sensitive structures) within 50 m of RoW.
- After the assessment, identify the areas where noise barriers are required. Also, suggest noise reducing devices on equipment such as mufflers and silencers.
- The audible noise of the ETL is most severe under wet conditions. During detailed design, it will be ensured that audible noise under wet conditions is within acceptable limits.
- During detail design, it will be ensured that audible noise as per CISPR18-2 "Methods for measurement of RI characteristics of overhead power lines and high voltage equipment" will be either category-I (which is Interference not audible) or category-ii (which is Interference just perceptible).

5.2.7 Land Acquisition

Assessment

393. Though no land will be acquired permanently, however, damages (crops and trees) to the land will be happened during ETL construction. This may result in loss of land, assets and livelihood associated with the loss of crops and trees. This impact will be permanent and high adverse in nature.

Mitigation Measures

394. Mitigation measures will involve careful alignment selection by the designer to minimize the impact by avoiding the acquisition of residential and commercial areas. Also, an adequate budget will be provided in the project cost for the compensation to the affected people as per the Land Acquisition Act, 1894 and framing of a judicious and fair compensation package for the provision of compensation on the prevailing market rates.

- NTDC to select the route in a way that minimum impact on trees and crops occur.
- Assessment of loss of land, trees and crops (if any) due to construction of ETL towers.
- Preparation of land acquisition and resettlement plan (LARP) for the proposed Project before commencement of construction activities.
- All the impacts identified by the IEE will be incorporated into the project LARP and relevant entitlements will be included into the Entitlement Matrix.
- All the payments / entitlements are paid according to the Entitlement Matrix, prepared according to the LARP.

395. According to Land Acquisition Act 1894, the following points are to be considered while determining compensation to the project affectees:

- The market value of the land at the date of publication of the notification under section 4 sub section (1).
- The damage sustained by the person interested, because of the taking of any standing crops, or trees which may be on the land at the time of the collector's taking possession thereof.
- The damage if any sustained by the person interested at the time of the collector's taking possession of the land because of acquisition injuriously affecting his other property, moveable, or immoveable, in any other manner, or his earning; and
- As a consequence of the acquisition of the land by the collector, the person affected is compelled to change his residence or place of business, the reasonable expenses incidental to such change.

5.2.8 Waste Generation

Assessment

396. The appropriate disposal of waste and management of spills needs to be assessed at pre-construction (design) phase and its implementation cost must be reflected in BoQ.

Mitigation Measures

397. The following measures will be implemented to ensure that adequate disposal options for all wastes are in place:

- Identify enough locations for disposal of transformer oils, unsuitable soils, scrap metal "cradle to grave".

- Include in contracts for unit rates for re-measurement for disposal.
- Designate disposal sites in the contract and cost unit disposal rates accordingly.

5.2.9 Disruption to Existing Drainage Pathways and Utilities

Assessment

398. The construction of Project may affect the drainage system and irrigation crossings and other public utilities within RoW.

Mitigation Measures

399. The possible mitigation measures, to be include in preliminary and detailed designs, are as follows:

- Identify locations where drainage or irrigation crossing, utilities within RoW may be affected by works.
- Include in protection works contract as a payment milestone(s).

5.2.10 Impacts on Sensitive and High Value Areas

Assessment

400. The construction and operation of the Project will result in several impacts including air, noise and water pollution, electrocution, collisions, aesthetics, EMF and community health and safety.

401. However, the impact will be low as 1) the majority length of the ETL passes from the least populated area, 2) the ETL RoW is not located in any protected or ecologically sensitive area) there is no mosque, graveyard, tomb or any other religious/archaeological site within 100 m boundary from the edge of the Project.

Mitigation Measures

402. The following mitigation measures will be implemented:

- Siting the Project facilities away from any residential area.
- If, siting of Project facilities cannot be avoided altogether, the area of disruption should be minimized, and the impacts should be mitigated.

5.2.11 Electromagnetic field (EMF)

Assessment

403. Electric fields are produced by voltage and increase in strength as the voltage increases whereas EMF result from the flow of electric current and increase in strength as the current increases. The operation of the Project will result in the production of EMF which needs to be controlled to protect environment and public health.

404. EMF are also created by electrical household appliances such as motors in refrigerators, vacuum cleaners, microwaves, televisions, and computers. Due to the proximity of humans to household appliances, the level of EMF is often far greater than those levels produced by ETLs fixed on high towers **(Figure 5-1**).[85]

405. EMF generated by electric lines are in the extremely-low-frequency (ELF) range of the electromagnetic spectrum. The energy from these EMF is very small. EMF from

[85] https://psc.wi.gov/Documents/Brochures/EMF.pdf

appliances and ETLs cannot break molecular bonds. The highest frequency electromagnetic radiation, like gamma rays, can break apart DNA and lead to cancer. Low frequency radiations such as microwaves do not have enough energy to break molecular bonds but can heat food items.[86]

406. For overhead ETLs, the EMF typically range from about 5 to 150 mG (**Table 5-5**) depending on current load, separation of the conductors, and distance from the lines. In general, at a distance of about 300 feet from an ETL, measured EMF are similar to typical ambient background levels found in most homes.[87]

407. The EMF interference is significantly dependent on the power line configurations, separation distance between ETL and objects underneath, separation distance between conductors of ETL, the ETL tower height, existence of the earth wire, and the length of system parallelism.[88]

408. In the literature, EMF data are presented in either units of Gauss (G) or Tesla (T). A milligauss (mG) is equal to one-thousandth of a Gauss (G). One Tesla is equal to 10,000 Gauss. A microtesla (μT) is equal to one-millionth of a Tesla or 10 mG.

409. EMF strength and distances from overhead ETLs is provided in **Figure 5-2**. This generalized graphic view is showing on how EMF quickly diminish with distance.[89]

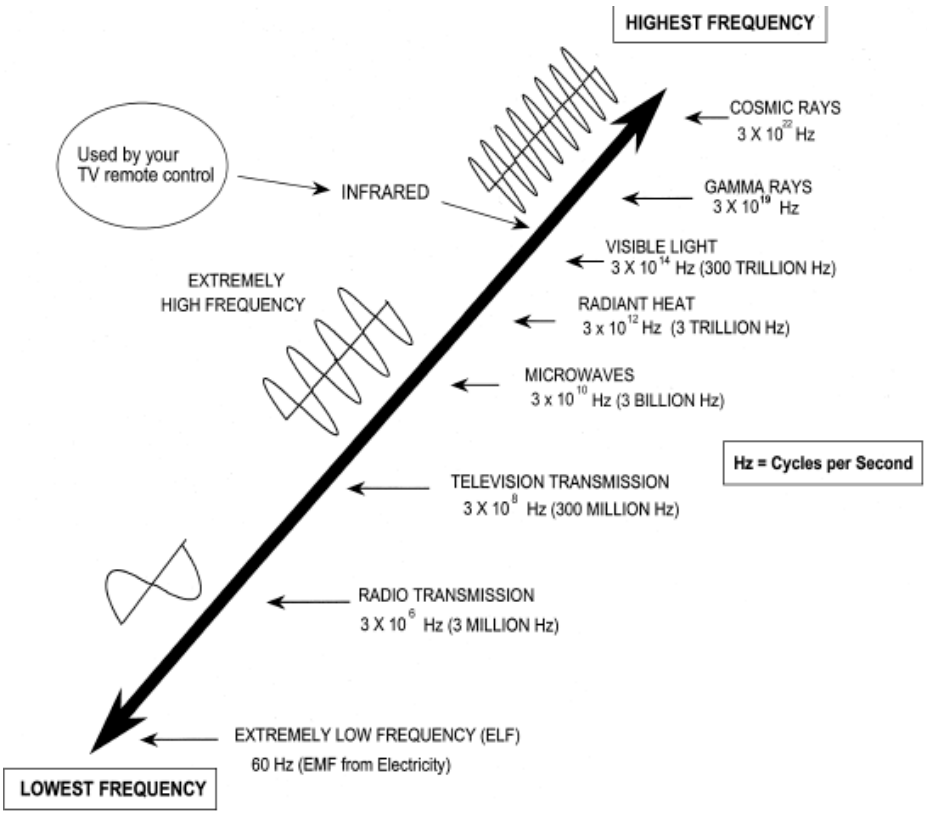


Figure 5-1: Electromagnetic Spectrum

[86] https://psc.wi.gov/Documents/Brochures/EMF.pdf.
[87] Ibid.
[88] Chaaban, Farid & Hassan, Heba. (2009). Modelling and Measurements of the Electromagnetic Field of High Voltage Transmission Lines: A Practical Case in Lebanon.
[89] Ibid.

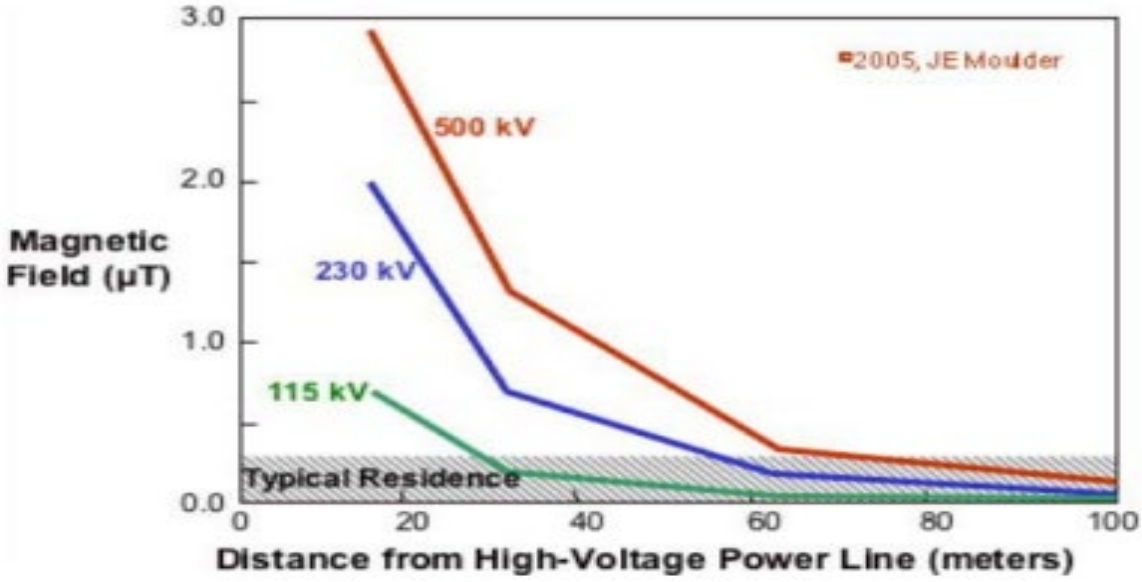


Figure 5-2: Magnetic Strength from Overhead Transmission Lines

Table 5-5: Magnetic Fields Observed for Overhead Transmission Lines

Overhead Transmission Line Voltages	Usage	Typical Magnetic Field Measurements (mG)				
		Maximum in ROW	Approximate Distance From Centerline (Feet)			
			50	100	200	300
115 kV	Average	30	7	2	0.4	0.2
	Peak	63	14	4	0.9	0.4
230 kV	Average	58	20	7	1.8	0.8
	Peak	118	40	15	3.6	1.6
500 kV	Average	87	29	13	3.2	1.4
	Peak	183	62	27	6.7	3.0

Table 5-6: Safety Distances for 220 kV Transmission Line

Description[90]	Distance (meters)
Minimum Approach Distance for People	3m (Authorized person) 6m (Ordinary)
Minimum Safe Vertical Distance	8 m
Clearance distance from ETL to ground and road	7m
Clearance distance to trees/hedges	4.6
Clearance distance to water course	7.6 m
Vertical Passing clearance (if vehicles will below the power line)	2.4 m

[90] UK Power Network Standards -EI 02-2019

410. Many studies have been conducted by researchers through animal experiments, clinical studies, computer simulations, and human population (epidemiological) to determine the relationship between exposure to EMF and impact on health such as childhood leukemia[91], cardiovascular disease, cancer etc. In the past, numerous reports have presented conflicting information. Some of these reports have provided evidence of adverse health effects like anxiety, poor sleep[92] ; while results of most of these studies did not indicate any correlation between the EMF and chronic diseases emanating from power lines.[93] ,[94],[95]

411. Birds use electrical power lines, and towers for perching, and nesting. Therefore, many bird species, like humans, are exposed to EMFs throughout their lives.[96]

412. The significance of impact for this Project is moderate to major, because the ETL is passing overhead of a seelment near Hala Road Grid Station. The ETL will use the RoW of an exisiitng 132 kV ETL.

413. This Project involves dismantling of the low-line exisiitng 132 kV ETL owned by local distribution company and the same will be built again with similar standards as it planned for the Project and will result in decrease EMF effects on the residents due to increased height. The Project ETL will be designed with a better tower structure and technology compared to the existing transmission system at the Hala Road Grid Station and surroundings, as discussed in Section 3.

Mitigation Measures

414. The following mitigation measures will be implemented at pre-construction (design) phase to reduce the future impact on environment:

- NTDC's standard operating procedures (SOPs) of a minimum vertical ground clearance for ETL conductor of 7 meters will be ensured.
- Raising conductor height above the ground to 8 m, typically by increasing tower height, will be ideal.
- Reducing conductor spacing.
- Arranging phases so that fields tend to cancel.
- Increasing transmission voltage (since EMF intensities are a function of current, and increased voltage, all things being equal, will result in reduced current).
- Reducing loads (and therefore, currents).

[91] Tynes, T., & Haldorsen, T. (1997). Electromagnetic fields and cancer in children residing near Norwegian high-voltage power lines. *American journal of epidemiology*, *145*(3), 219-226.

[92] Bagheri Hosseinabadi, M., Khanjani, N., Ebrahimi, M. H., Haji, B., & Abdolahfard, M. (2019). The effect of chronic exposure to extremely low-frequency electromagnetic fields on sleep quality, stress, depression and anxiety. *Electromagnetic biology and medicine*, *38*(1), 96-101.

[93] Liu, J., Dawalibi, F. P., Ma, J., & Mitskevitch, N. (2006, August). Modeling techniques for analyzing electromagnetic interference caused by high voltage power lines to neighboring communication cables. In *The 2006 4th Asia-Pacific Conference on Environmental Electromagnetics* (pp. 235-243). IEEE.

[94] Valberg, P. A. (1996). Electric and magnetic fields (EMF): What do we know about the health effects. *International archives of occupational and environmental health*, *68*(6), 448-454.

[95] Kim J Fernie and S James Reynolds. The effects of electromagnetic fields from power lines on avian reproductive biology and physiology: a review. *Journal of toxicology and environmental health. Part B, Critical reviews.* Vol. 8(2).

[96] Biasotto, L. D., & Kindel, A. (2018). Power lines and impacts on biodiversity: A systematic review. *Environmental Impact Assessment Review*, *71*, 110-119.

- Identification of potential exposure levels in the work area including surveys of exposure levels and establishment of safety zones.
- Safety signs and warning zone will be highlighted to indicate EMF in the area
- Limit access to properly trained workers and those equipped with appropriate PPE when entering safety zones.
- Increasing RoW widths or buffer zone widths, to move people further from ETLs.

5.2.12 Impact on Community Safety due to Structure/ Mechanical Failure of the overhead conductors

Assessment

415. Risks related to EMFs and natural hazards, such as earthquakes, landslides, and rockfalls, can result in adverse impacts during operation. Structure failure, especially near or at residential areas, may create public safety issues if better design and technology is not recommended.

Mitigation Measures

416. The following mitigation measures will be implemented at pre-construction (design) phase:

- Ensure all safety aspects related to safety of structure is considered.
- Ensure seismic design requirements are incorporated in the Project design.
- The ETL will be constructed using very robust design and there is very low probability of mechanical failure even under extreme weather conditions. Nonetheless, following special arrangements will be made in this section to ensure safety in case of mechanical failure of the ETL conductors.
- Installation of special tower/pole structures that would support a long span of up to 500 m so that no tower/pole has to be installed inside the streets.
- Special tower/pole structures will be designed with load safety margin factor of 2.5 instead of generally used 1.5, thus having an extraordinary strength bearing margin to cater for any untoward mechanical hazardous situation.
- Special tower/pole structures will be designed to achieve enhanced vertical ground clearance of 15-20 meters whereas the standard requirement of ground clearance of 220 kV line is 7.1 meter.
- Installation of grounded metallic mesh beneath the lowest conductor to act as fall arrester in case of mechanical failure of the conductor in residential areas.

5.3 Construction Phase Impacts

417. The construction phase impacts on the physical environment, ecology, and socioeconomic environment are listed separately in the below sections.

418. A summary of potential impacts at the construction phase, based on methodology discussed in *Section 5.1*, is provided in **Table 5-7**.

Table 5-7: Potential Impacts at Construction Phase

No.	Potential Impact	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Score (Critical, Significant/ Moderate, Low)	Residual Impact (Critical, Significant/ Moderate, Low)
1	Dust from construction activity and Air emissions from construction equipment and vehicles	3 Likely	3 Major	9 Significant	Low
2	Noise from construction vehicles and heavy equipment	3 Likely	3 Major	9 Significant	Low
3	Sediment run-off from construction sites	3 Likely	3 Major	9 Significant	Low
4	Impact on Water Resources Quality and Quantity	3 Likely	3 Major	9 Significant	Low
5	Untreated disposal of effluent from worker camps and batching plant(s)	3 Likely	3 Major	9 Significant	Low
6	Vibrations	3 Likely	3 Major	9 Significant	Low
7	Traffic Congestions	3 Likely	2 Moderate	6 Moderate	Low
8	Disposal of spoils and waste materials	3 Likely	2 Moderate	6 Moderate	Low
9	Impact on Occupational Health and Safety	3 Likely	3 Major	9 Significant	Low
10	Habitat loss and impact on mammals, amphibians, birds, and reptiles	2 Unlikely	3 Major	6 Moderate	Low
11	Increased employment opportunities and local economy (positive impact)	 –	 –		
12	Overburden on local resources	3 Likely	2 Moderate	6 Moderate	Low
13		3	2	6	Low

No.	Potential Impact	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Score (Critical, Significant/ Moderate, Low)	Residual Impact (Critical, Significant/ Moderate, Low)
	Social Conflicts due to Influx of Workers	Likely	Moderate	Moderate	
14	Impact on Community Health and Safety Risk	2 Unlikely	3 Major	6 Moderate	Low
15	Impact on Physical Cultural Resources (PCRs)	2 Unlikely	3 Major	6 Moderate	Low
16	Uncontrolled Solid Waste Disposal, Communicable Diseases	3 Likely	3 Major	9 Significant	Low
17	Natural Hazard Risks (Flooding, Earthquakes etc.)	2 Unlikely	3 Major	6 Moderate	Low

Critical Risk Level

Significant/ Moderate Risk Level

Low Risk Level

5.3.1 Physical Environment

5.3.1.1 Dust from construction activity and Air emissions from construction equipment and vehicles

Assessment

419. Fugitive dust and other emissions are expected from earthwork, construction site camps, vehicle traffic, and other construction activities including land clearing activities and materials stockpiles.

420. The baseline values for particulate matter were deducted 108 to 120 µg/m^3 for PM_{10} and 30 to 33 µg/m^3 for $PM_{2.5}$. The values are well within prescribed standard but exceeding WHO guideline values indicating already degraded environment for this pollutant.

421. The construction works will be carried out within RoW i.e. 15 m on both sides of ETL route. The nearest sensitive receptors such as settlements are located at about 40 m from center of ETL route. Therefore, at least a distance of about 25 m is expected from work sites to nearby settlements along ETL route. Fugitive dust and other emissions are expected from earthwork, construction site camps, vehicle traffic, and other construction activities including land clearing activities and materials stockpiles.

422. The major activities related to construction which will generate dust emissions (or PM) during the construction phase include vehicular movement, site preparation, loading/unloading of materials, and stockpiles.

423. The amount of dust generation is highly dependent on the activity type, construction methods, and weather conditions during the activity hence any estimation of dust generation is highly uncertain therefore a worst-case area-based emission factor has been used to estimate the dust emissions from the construction activities. Level 1 general emission factor suggested in '*Improvement of Specific Emission Factors (BACM Project No. 1)' report (MRI 1996) prepared for the South Coast Air Quality Management District*' have been used to estimate the emissions from the construction activities (Muleski, G.E, Garman G. 1996).[97] The suggested emission factor of 0.11 ton/acre-month for average conditions and 0.40 ton/acre-month for worst-case scenarios (construction sites with active large-scale earth moving operations) were considered and worst-case scenario has been used for impact assessment.

- Emission Factor: 0.40 ton/acre-month
- Project Site Active Area: 1,112 Acre [a]
- Construction Phase time: 18 months
- Total Emission = 0.40 × 1,112 × 18 = 8,006.8 tons in 18 months
- Emission Rate: 1.052×10^{-10} g/s/m^2 (260 hours per month Assumed)

Notes: [a] Right of way of 30 m and 150 km long and two campsites of approximately 6 acres land.

424. Although the estimated emission rates are not significant, but as discussed before, the baseline concentrations of PM in the area are higher than the WHO AQGs values,

[97] Muleski, G.E, Garman G. (1996). Improvement of Specific Emission Factors (BACM Project No. 1); Prepared for South Coast Air Quality Management District, Contract 95040; Diamond Bar, CA.

therefore, additional dust could further deteriorate the quality of air in the area. If not mitigated.

425. During the construction phase, the area of probable impact for air can typically reach 500 m from the boundary of the construction site. It is envisaged that in areas more than 500 m away from the construction area, the impact due to fugitive dust will be insignificant due to settling effects, unless there are exceptional gusts of wind, in which case a small amount of very fine dust particles (<10µm in diameter) could reach up to 1,000 m. Apart from human health impacts and nuisance, PM_{10} and $PM_{2.5}$ when deposited on vegetation inhibits photosynthesis and potentially degrades habitats and also affect the crop yield of agricultural fields nearby.

426. Therefore, based on the above discussions, unmitigated air quality impacts due to dust emissions are considered to be significant.

Mitigation Measures

427. A Dust Management Plan must be prepared by the Contractor. A sample plan has been provided in Annexure VIII**.**

428. The following mitigation measures will be used to limit dust generation during construction activities:

- Water will be sprinkled through a dedicated water-bowser at source, around the construction site and along the routes used for construction activities to prevent the generation of dust and to minimize the levels of dust within the vicinity of orchards and fruit farms.
- A speed limit of not more than 30 kilometers per hour (km/h) will be imposed on the vehicles in areas where the potential of dust generation is greater including unpaved roads.
- Fuel-efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions.
- Vehicles transporting soil, sand and other construction materials will be covered.
- The movement of vehicles through densely populated areas will be avoided.
- Water will be sprayed at bare areas that are prone to high dust emissions.
- Stockpiled soil and sand will be kept slightly wet before loading, particularly in windy conditions.
- Dust emissions at the camp and construction sites to be minimized by implementing good housekeeping and sound management practices.
- All project vehicles and other equipment will be maintained as per PEQS for vehicular emissions.
- The construction material will be stored in the boundary wall and no disturbance to surrounding areas is expected. The contractor will be, however, required to provide a traffic management plan before the commencement of work at the site.
- The need for large stockpiles will be minimized by careful planning of the supply of materials from controlled sources. Stockpiles (if required) will not be located within 50 m of schools, hospitals or other public amenities such as wells and pumps and should be covered with tarpaulins when not in use and at the end of the working day to enclose dust.
- Concrete plants will not be located close to any sensitive receptors.

- A check will be kept by the NTDC that no construction will be allowed within 100 m of the ETL.

429. Once the mitigation measures given above are incorporated, it is expected that the project will not have any significant incremental impacts on the baseline dust and gaseous levels of the area. The effectiveness of the mitigation measures will be monitored during the construction, restoration, and operation phases.

5.3.1.2 Noise from construction vehicles and heavy equipment

Assessment

430. No blasting is anticipated. As per noise baseline values discussed in **Section 0**, levels found within the PEQS and IFC guidelines.

431. Construction activity employing heavy machinery such as powered mechanical equipment and heavy traffic such as trucks for transportation of construction materials and supplies can generate significant noise and vibration. The cumulative effects of several machines can be significant.

432. The RoW of ETL falls in agricultural land and the nearest sensitive receptors such as settlements are located at about 50 m from center of ETL route. Therefore, at least a distance of about 25 m is expected from work sites to nearby settlements along ETL route.

433. **Table 5-8** represents typical noise levels from various construction equipment items. It should be noted that the values indicated in the table may differ depending on the brand and age of machinery provided/used by the construction company.

Table 5-8: Construction Equipment Noise Ranges, dB (A)

Equipment	Quantity	Usage Factor		Distance ft	Actual Lmax (50ft)	Lmax	Leq
Batch Plant		15%	0.15	1066	83	56.4	48.2
Concrete Mixers	1	40%	0.40	1066	78.8	52.2	48.2
Crane	1	16%	0.16	1066	80.6	54.0	46.1
Excavator	1	40%	0.40	1066	80.7	54.1	50.1
Tractor/Trolley	2	40%	0.40	1066	80	53.4	49.4
Bulldozers		40%	0.40	1066	80	53.4	49.4
Paver		50%	0.50	1066	77	50.4	47.4
Compactor	1	20%	0.20	1066	83	56.4	49.4
Pumps		50%	0.50	1066	77	50.4	47.4
Generators	1	50%	0.50	1066	80.6	54.0	51.0
Vibrators	1	20%	0.20	1066	76	49.4	42.4
Drilling machines		10%	0.10	1066	90	63.4	53.4
Compressors	2	40%	0.40	1066	77.7	51.1	47.1
Dump Truck	1	40%	0.40	1066	76.5	49.9	45.9

Equipment	Quantity	Usage Factor		Distance ft	Actual Lmax (50ft)	Lmax	Leq
Welder	1	40%	0.40	1066	74	47.4	43.4

Mitigation Measures

434. A Noise Management Plan must be prepared by the Contractor. A sample plan has been provided in Annexure XXI**.**

435. The following specific measures will be adopted to mitigate any potential issues.

- Noise monitoring will be carried out at edge of RoW or at boundary wall of communities located within 100 m of RoW, if required, to assess compliance with day and nighttime noise limits of 55 dBA and 45 dBA prescribed in the PEQS / IFC guideline values.
- No nighttime work will be allowed in populated areas of ETL's RoW.
- All heavy equipment and machinery will be maintained as per PEQS/ IFC guideline values and with effective noise controlling devices in place such as silencers.
- The noise level from construction activity can be reduced by regular maintenance of machinery. Noise can be controlled through engineering control e.g., hammering actions can be substituted by hydraulic.
- Ensure that the workers are wearing necessary personal protection equipment (PPE's) such as earplugs, earmuffs, etc. where engineering control is not applicable to reduce the impact of noise.
- Equipment emitting excessive noise in comparison with other similar equipment will not be allowed to operate.
- Equipment under use will be regularly maintained, tuned, and provided with mufflers and speed controls to minimize noise levels.
- Blowing horns on all access roads except under emergency conditions will be prohibited.
- Muffled breakers and silenced diesel generators and compressors will be used to reduce construction noise.
- Contractor will take necessary measures to minimize noise nuisance using acoustic enclosures and barriers.
- A check will be kept by the NTDC that no construction will be allowed within 100 m of the ETL.

436. Once the mitigation measures given above are incorporated, it is expected that the project will not have any significant incremental impacts on the baseline noise levels of the area. The effectiveness of the mitigation measures will be monitored during the construction, restoration, and operation phases.

5.3.1.3 Sediment run-off from construction sites

Assessment

437. Construction of the Project will require clearing of some vegetation, excavation, and stockpiling of excavated and construction material.

438. The following potential impacts on the geomorphology and soil are identified:

- Loss of soil fertility due to loss of topsoil
- Contamination of soil due to the accidental release of solvents, oils, and lubricants.
- Failure of stockpile areas resulting in increased erosion and sediment flash.
- Generation of waste (hazardous and non-hazardous)
- Soil erosion and surface run-off from materials sourcing areas and site preparation activities.
- Potential for hazardous materials and oil spills associated with heavy equipment operation and fueling activities.

439. The project involves excavation. Therefore, find a chance is to be considered while digging or excavation. In case of chance finding, The Contractor must follow procedures provided in Annexure IX**.**

440. The significance criteria were found significant based on the methodology discussed in **Section 5.1**.

Mitigation Measures

441. The mitigation measures described below will be implemented to reduce the impacts listed above:

- All construction workers will be provided awareness training on the prevention of waste generation and spill prevention.
- The topsoil can be preserved and used after the restoration of construction campsites and storage areas after the construction period.
- Surplus excavated material will be disposed of at appropriate or designated sites and will be disposed of in a manner that does not disturb the natural and community drainages and tracks.
- Equipment will be maintained properly to minimize oil or fuel leakages from construction machinery. Clean-up will be undertaken in the event of an oil spill larger than half a liter. This will include the removal of contaminated soil and disposal at a proper location.
- A Spill Prevention and Response Plan will be prepared including the induction of staff for spill prevention and management.
- All storage fuel tanks will be marked with their contents and stored in diked areas with an extra 10% of the storage capacity of the fuel tank. The area will be lined with an impervious base.
- Grease traps will be constructed wherever needed, to prevent the flow of oily water into drainage channels or waterbodies.
- Spill cleanup kits (shovels, plastic bags, and absorbent materials) will be available near fuel and oil storage areas. Should any accidental spills occur, the immediate cleanup will be undertaken, and all cleanup materials will be stored in a secure area for further disposal. Disposal of such will be undertaken by a waste management company contracted by the Contractors. The waste management company must have the required licenses to transport and dispose any hazardous waste before any such waste is removed from the site. The Contractors will keep copies of the company's licenses and provide waste transfer manifests at their camp site for routine inspection by the engineer.
- Cleanup kits will be carried in all fuel trucks.

- Fueling of construction vehicles and machinery will take place at designated places or over impermeable surfaces for fixed machinery.
- Hazardous materials will be stored in designated places having impervious linings.

442. In addition to above, the following measures will also be implemented to specifically mitigate soil erosion and surface run-off:

- Schedule works in sensitive areas (e.g. water body) for dry season.
- Temporary erosion control plan one month before commencement of works.
- Proper installation of TD and EC before works within 50 m of water bodies.
- Cut areas will be treated against flow acceleration while filled areas will be carefully designed to avoid improper drainage.
- Stockpiles will not be formed within such distances behind excavated or natural slopes that would reduce the stability of the slopes.
- In the short-term, either temporary or permanent drainage works will protect all areas susceptible to erosion.
- Measures will be taken to prevent pounding of surface water and scouring of slopes. Newly eroded channels will be backfilled and restored to natural contours.
- Contractor will arrange to adopt suitable measures to minimize soil erosion during the construction period. Contractor will consult concerned authorities in the area before deciding mitigation measures.
- Clearing of green surface cover to be minimized during site preparation.
- Replanting trees to be done before the site is vacated and handed back to NTDC with appropriate trees (other vegetation cover as appropriate) to ensure interception of rainwater and the deceleration of surface run-off.

443. After the mitigation measures given above are incorporated, it is expected that the Project will not have any significant residual impacts on the area's geomorphology or soils. The effectiveness of the mitigation measures will be monitored during the construction and restoration phases.

5.3.1.4 Impact on Water Resources Quality and Quantity

Assessment

444. As stated in **Section 4.2.7**, the major surface water feature in the area include the Sutlej Rive with Panjnad and Islam headworks irrigation canal system. The major canals in this district are Abbasia Canal, Sadiq Branch Panjnad, Sem Nullah, Rahim Yar Khan Branch, Minchin Branch, Panjnad Main Canal and Dallas Wah Canal. The Row crosses few irrigation canals and distributary channels therefore the impact has been determined significant and need mitigation measures for minimizing those.

445. The following are the potential impacts on water resources that may result during the construction of the ETL Project:

- Contamination of surface and groundwater due to improper handling of materials, leakage of oil and fuels and discharge from construction activities.
- Increased usage of local water resources due to its use in construction activities; and Blockade of natural drainage ways due to foundations construction.

446. The wastewater may be generated from the construction site or camp if constructed nearby may produce a major impact on these if not disposed of properly.

However, the impact of construction activities on water availability may not be significant as there are few water resources available in the area.

Mitigation Measures

447. The following specific measures will be adopted to mitigate any potential issues:

- Erosion and sediment flash-control measures will be employed and maintained where necessary.
- Washing vehicles will be allowed only in designated places such as local car wash or a similar facility to be built at the site with the provision of oil-water separators (OWS) and waste collection pits
- Equipment will be maintained properly to minimize oil or fuel leakages from construction machinery.
- No effluents will be released to the environment untreated, as per procedures discussed in **Section 8.3**.
- All types of solid and liquid wastes will be handled as per procedures discussed in **Section 8.3**.
- The natural drainages will be restored after completion of civil works of the tower foundations in areas where tower locations fall within the catchment of dry stream beds.
- The source of water for construction from authorized abstraction sources will be agreed between the local communities, local government, and the contractor.
- Water conservation techniques will be developed and implemented by the contractor.
- Access routes of the community to water sources will be kept clear and open so that the community's ability to meet its water requirements are not compromised.
- Care will be exercised while moving heavy machinery to avoid damage or blockage of natural waterways and channels.
- Records will be kept of water usage in all Project activities.
- Construction camp and residential camp will not be built nearby water bodies.

448. In addition to above, the following are specific measures to mitigate hydrology and drainage aspects:

- Consideration of weather conditions when construction activities are undertaken.
- Limitations on excavation depths in use of recharge areas for material exploitation or spoil disposal.
- Use of landscaping as an integrated component of construction activity as an erosion control measure.
- Minimizing the removal of vegetative cover as much as possible and providing for its restoration where construction sites have been cleared of such areas.

449. In addition to above, the following are specific measures to mitigate water quality impacts:

- Compile temporary drainage management plan one month before commencement of works.
- Proper installation of Temporary Drainage (TD) and Erosion Control (EC) before works within 50 m of water bodies.

- Proper construction of TD and EC measures, maintenance and management including training of operators and other workers to avoid pollution of water bodies by the considerate operation of construction machinery and equipment.
- Storage of lubricants, fuels, and other hydrocarbons in self-contained dedicated enclosures >50 m away from water bodies.
- Proper disposal of solid waste from construction activities and labor camps.
- Cover the construction material and spoil stockpiles with a suitable material to reduce material loss and sedimentation and avoid stockpiling near to water bodies.
- Topsoil stripped material will not be stored where natural drainage will be disrupted.
- Borrow sites (if required) will not be close to sources of drinking water.

450. Once the mitigation measures listed above are incorporated, it is expected that the project will not have any significant impacts on the area's water resource. The effectiveness of the mitigation measures will be monitored during the construction and restoration phases.

5.3.1.5 Untreated disposal of effluent from worker camps and batching plant(s)

Assessment

451. The workers camp and construction camp facilities such as batching plant (s) will produce effluent during construction and if not handled and treated appropriately, it can contaminate local land, surface, and groundwater resources.

Mitigation Measures

452. The following specific measures will be adopted to mitigate any potential issues:

- Ensure safe storage and handling of fuels, oils, and other hazardous substances according to standard safety practices. Disposal should be carried out through Punjab EPA approved contractors and facilities.
- All efforts will be made for the proper disposal of solid waste, applying principles of reducing waste as far as possible, reusing what is practical and recycling all recyclable materials.
- The solid waste generated during construction and campsites will be safely disposed of in demarcated waste disposal sites and the contractor will provide a proper waste management plan.
- The sewage system for camps will be properly designed (pit latrines or, as required, septic tanks) to receive all sanitary wastewaters.
- The solid residue from the septic tanks will be transported to the nearby municipal sewage disposal site.
- Lined wash areas will be constructed within the campsite or at the site, for the receipt of wash waters from construction machinery; and ensure proper labeling of containers, including the identification and quantity of the contents, hazard contact information, etc.
- Construction workers and supervisory staff will be encouraged and educated to practice waste minimization, reuse, and recycling to reduce the quantity of waste.

5.3.1.6 Vibration

Assessment

453. Piling-induced ground vibrations can lead to human disturbance and structural damage.

454. Other construction activity employing heavy machinery such as powered mechanical equipment and heavy traffic such as trucks for transportation of construction materials and supplies can also generate vibration. The cumulative effects of several machines can be significant.

455. The construction works will be carried out within RoW i.e., 15 m on both sides of ETL route.

456. Construction activities generate vibration. These activities include site clearing, site grading and soil compaction, pile driving, installation of deep foundations and industrial dynamic sources such as forge hammers etc. This vibration-inducing equipment used for land clearing are excavators, dozers, loaders, and large trucks.

457. For comparison, building impact vibration levels are often noted as a single number quantifying the peak particle velocity (PPV), in in/sec or mm/sec.[98]

458. **Table 5-9** provides typical construction equipment vibration level. **Table 5-10** provide predicted minimum separation between piling operations and sensitive buildings.[99]

459. According to The United States Bureau of Mines (USBM) RI 8507 vibration limits for 1- and 2-story houses which are the most typical structures in urban and rural areas, the vibration limits in the resonance zone are 12.7 mm/s and 19.0 mm/s for walls with plaster and dry walls, respectively. [100]

460. British Standard provides vibration guidelines for two types of buildings.

- Industrial and heavy commercial buildings the limit of 51 mm/s is used for frequencies from 4 to 100 Hz.
- Residential or light commercial type buildings, the limits are: 15 mm/s at 4nHz increasing to 20 mm/s at 15 Hz and then increasing to 50nmm/s at 40 Hz and above.[101]

Table 5-9: Construction Equipment Vibration Level

measured at 7.6 m from the source

Equipment	PPV, in in/sec or mm/sec
Vibratory Roller	5.6
Mounted Impact Hammer (Hoe Ram)	2.3
Grader	2.3
Compaction Machine	2.3
Excavator	2.3
Large Bulldozer	2.3
Loaded Trucks	1.9

[98] Svinkin, Mark R. "A choice of proper criteria for soil and structural vibrations from construction and industrial sources." *ICSMGE 2017â€“19th International Conference on Soil Mechanics and Geotechnical Engineering, Seoul, pp 1589â*. Vol. 1592. 2017.

[99] http://www-civ.eng.cam.ac.uk/geotech_new/people/bolton/mdb_pub/117_DFC_2002_363_371.pdf.

[100] FTA Report No. 0123 (2018), Transit noise and vibration impact assessment manual, U.S. Department of Transportation, Federal Transit Administration.

[101] BS 735-2:1993 (1993), Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration (British Standard).

Equipment	PPV, in in/sec or mm/sec
Crane	1.9
Semi-Trucks	1.9
Cement Trucks	1.9
Dump Trucks	0.9
Jack Hammer	0.9

Table 5-10: Predicted Minimum Separation between Piling Operations and Sensitive Buildings

Building type (vibration limit from Eurocode 3)	Piling method					
	Press-in method (Eq^{n} 4)	Impact hammer (stiff clay / medium dense sand; (C=0.75) (Eurocode 3)		Vibrator (Eurocode 3) kJ/cycle		
		5 kJ/blow	25 kJ/blow	2 kJ/cycle	10 kJ/cycle	50 kJ/cycle
Architectural merit (2 mm/s)	3.5 m	26.5 m	59 m	16 m	36 m	78 m
Residential area (4 mm/s)	1.75 m	13 m	30 m	8 m	18 m	39 m
Light comercial (10 mm/s)	0.7 m	5 m	12 m	3.1 m	7 m	16 m
Heavy Industrial (15 mm/s)	0.5 m	3.6 m	8 m	2.1 m	5 m	10 m

Mitigation Measures

461. A Vibration Management Plan must be prepared by the Contractor**.**

462. The following specific measures will be adopted to mitigate any potential issues:

- construction will not be allowed during nighttime (10 PM to 6 AM) and will only be conducted during daytime.
- Vibration from the construction of piles to support pads may be required for some tower construction and maybe a significant impact but this should be for a short duration. Where vibration could become a major consideration (within say 100 m of schools, religious premises, hospitals or residences) a building condition survey will take place before construction.
- Use of better equipment with less vibration effects will be used such as Free-Suspended Vibrators (FSV).[102]
- The physical effect of piling will be assessed before construction and measures will be discussed with the local population as well as the timing of the works to serve as a vehicle for further public consultation at the implementation stage and to assist in public relations. At nearby schools, the contractor will discuss with the school principals the agreed time for operating these machines and completely avoid machine use near schools during examination times, if such a need arises.

[102] https://www.vpgroundforce.com/gb/footer-links/useful-links/industry-resources/reducing-ground-vibrations-during-the-piling-proce/

- Ensure that the workers are wearing necessary personal protection equipment (PPE's) such as earplugs, earmuffs, etc. where engineering control is not applicable to reduce the impact of noise.
- Equipment under use will be regularly maintained, tuned, and provided with mufflers and speed controls to minimize noise levels.

463. Once the mitigation measures given above are incorporated, it is expected that the vibration impacts will be significantly reduced at nearby buildings to RoW.

5.3.1.7 Traffic Congestions

Assessment

464. There will be limited traffic during construction of the Project and will have little or no incremental effects on the existing traffic on the national or provincial highways.

465. There will be an increase in traffic on the internal roads, used for the transportation of construction materials, spoils, equipment and machinery. However, the increase will be for a limited period i.e., during construction activities.

Mitigation Measures

466. Contractor to provide a traffic management plan as part of SSEMP. A template for typical traffic plan is provided in Annexure X**.**

467. The following measures will be employed to minimize potential impacts:

- Efforts will be made to minimize the use of heavy trucks by preferring transport of equipment and supplies using 4x4 pickups, wherever possible, and
- A speed limit of not more than 30 km/h will be imposed near settlements, on unpaved roads and link roads for reducing traffic accident risks and dust generation.
- A traffic management plan, if required, will be prepared and submitted to NTDC one month prior to start of works. Vicinity of schools, hospitals and communities will be considered while preparing plans and will be avoided to the extent feasible.
- Plan of alternate routes for heavy vehicles will be formulated and implemented. Existing roads will be used wherever practical for transportation of materials and a 'no-short-cut' policy will be used.
- While preparing plan of access routes, existing conditions of roads and bridges will also be considered to see for any requirement of widening and upgrading of access paths and roads.
- Traffic warning signs will be installed, and traffic regulations will be enforced during transportation of materials and equipment and machinery.
- Nighttime construction traffic will be avoided as much as possible.
- Drivers will be instructed to give way to locals while driving on access tracks, to keep a close watch for wild/domestic animals and children while driving and to not throw any litter or cigarettes out of vehicle.
- The use of canal flood protection bunds for the movement of heavy vehicles will be minimized. Wooden/damaged bridges on canal/river/ other crossings will not be used for the movement of heavy vehicles.
- Dry stream beds will not be used as access routes.
- Any damage to access tracks, metaled roads, watercourses or the canal/river protection bunds, etc., will be appropriately repaired to bring these structures to their

pre-construction condition. Any damage, which may cause hardship to the local community or wildlife, will be immediately repaired.

5.3.1.8 Disposal of spoils and waste materials

Assessment

468. There is a possibility of the generation of hazardous and non-hazardous solid waste during construction such as used vehicle oil filters, oil-contaminated cloths, used batteries, iron and copper, cotton and kitchen waste, solid residue from the septic tanks, etc. These can create a nuisance to the environment if not handled appropriately.

469. It is anticipated that demolition of an existing ETL will be required. The demolition will not generate or relates to hazardous wastes such as PCB's, asbestos containing materials etc. However, if found then suitable waste disposal plans dealing with this type of wastes will be prepared and implemented.

Mitigation Measures

470. Measures that will be implemented are as follows:

- Ensure safe storage and handling of fuels, oils, and other hazardous substances according to standard safety practices. Disposal should be carried out through Punjab EPA approved contractors and facilities.
- Management and storage of fuel, waste oil, hazardous waste will be planned in accordance with EHS General Guidelines on Hazardous Materials Management.[103] This includes the use of appropriate secondary containment structures capable of containing the larger of 110 % of the largest tank or 25% of the combined tank volumes in areas with above-ground tanks with a total storage volume equal or greater than 1,000 liters.
- All efforts will be made for the proper disposal of solid waste, applying principles of reducing waste as far as possible, reusing what is practical and recycling all recyclable materials.
- The solid waste generated during construction and campsites will be safely disposed of in demarcated waste disposal sites and the contractor will provide a proper waste management plan as part of SSEMP. A framework waste management plan is attached as Annexure XII**.**
- The sewage system for camps will be properly designed (pit latrines or, as required, septic tanks) to receive all sanitary wastewaters.
- The solid residue from the septic tanks will be transported to the nearby municipal sewage disposal site.
- Lined wash areas will be constructed within the campsite or at the site, for the receipt of wash waters from construction machinery; and Ensure proper labeling of containers, including the identification and quantity of the contents, hazard contact information, etc.
- Construction workers and supervisory staff will be encouraged and educated to practice waste minimization, reuse, and recycling to reduce the quantity of waste.

[103] https://www.ifc.org/wps/wcm/connect/90231ba8-5bb3-40f4-9255-eaf723d89c32/1-5%2BHazardous%2BMaterials%2BManagement.pdf?MOD=AJPERES&CVID=nPtgwml.

5.3.1.9 Impact on Occupational Health and Safety

Assessment

471. The occupational health and safety hazards associated with the construction of ETLs mainly include:

- Exposure to fall hazards from working at heights for poles and structures
- Exposure to EMFs to workers as the workers typically have a higher exposure to EMF than the general public due to working in proximity to electric power lines.
- The construction activities and vehicular movement at the construction site and access service roads may also result in roadside accidents particularly inflicting local communities who are not familiar with the presence of heavy equipment and machinery.

Mitigation Measures

472. The contractor will prepare OHSE Management Plan as part of SSEMP. A template for OHSE Management Plan is provided in Annexure XII**.**

473. The following are prevention and control measures will be implemented to the extent feasible to mitigate any issue related to occupational health and safety:

- Provide adequate personal protective equipment (PPE) and working platforms as per the job requirements
- Install occupational safety warning signs at construction sites and camps.
- Provide workers with skull guard or hard hat.
- Allow only trained and certified workers to install electrical equipment with safety and insulation measures in place.
- Test structures for integrity prior to undertaking work.
- Prepare and implement fall protection program that will include training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others.
- The fall protection system will be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point and fixtures will be installed, wherever possible, to facilitate the use of fall protection systems.
- Provide adequate work-positioning device system for workers to the extent possible.
- Properly maintained hoist equipment will be used along with properly trained personnel.
- Proper safety belts will be provided. The Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength.
- Use a backup safety strap when operating power tools at height.
- Remove signs and other obstructions from poles or structures prior to undertaking work.
- Provide an approved tool bag for raising or lowering tools or materials to workers on structures.
- Prepare and implement EMF safety program to prevented or minimize occupational hazards due to exposure to EMF.

- The contractor will prepare OHSE Management Plan as part of SSEMP. Also include provision of a safety champion program to be initiated on a monthly basis to encourage workers to adhere with H&S requirements.
- The plan will also include impacts and mitigation measures related with COVID-19. COVID-19 health and safety management plan is attached as Annexure XIII**.**
- The plan will also include details related with labour working conditions and details on prohibit child labour.
- Identify potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities.
- Train workers in the identification of occupational EMF levels and hazards.
- Establish and identify safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers.
- Prepare and implement action plans to reduce adverse impact of EMF and to address occupational exposure. Action plans may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.
- Worker's Accommodation Plan will be prepared in reference to Workers' Accommodation: Processes and Standards[104] as part of SSEMP and implemented.

474. Once the mitigation measures given above are incorporated, it is expected that the project will not have any significant incremental impacts. The effectiveness of the mitigation measures will be monitored during the construction, restoration, and operation phases.

5.3.2 Ecological Environment

475. This section assesses the impacts on ecology in and around the Project site and outlines the mitigation measures proposed for the management of those impacts.

5.3.2.1 Habitat loss and impact on mammals, amphibians, birds, and reptiles

Assessment

476. The Area of Habitat Loss is defined as the area that will be occupied due to the construction and operation of the Project infrastructure and from where vegetation will be cleared for the Project-related activities.

477. Since the proposed ETL passes through mostly covered with seasonal crops and mango and other fruit tree orchards so an estimate of 250-300 trees may be required to clear from RoW during construction.

478. Due to construction-related activity the fragmentation of habitat, and loss of wildlife habitat including bird nesting sites due to removal of vegetation.

479. The disturbance created by heavy types of machinery and the movement of the heavy vehicle will disturb fauna.

480. During the excavation period, accidental death of small mammals and reptiles may occur particularly if the excavation-related activities are performed in winter because reptile species mostly went hibernation during this period of the year.

[104] A guidance note by IFC and the EBRD Workers' Accommodation: Processes and Standards (August 2009)

481. Due to construction-related disturbances, many mammalian and bird species may leave their habitats.

482. Existing threats to biodiversity could be exacerbated by project-related indirect impacts caused by road access, wildlife hunting/poaching particularly Desert Hare and Indian Spiny-tailed Lizard, and migratory birds.

483. Project construction-related activities may cause the spread of invasive plant species such as *Prosopis juliflora, Cannabis sativa*, *Parthenium hysterophorus*, etc. through the import of material and reinstatement activities

484. As described in **Section 4.3**, *Ecology*, no plant species of conservation importance has been observed or reported from the Area of Habitat Loss or AOI. Similarly, none of the mammal species from the AOI are included in the IUCN Red List of Threatened Species. There are no threatened or endemic herpetofauna species. Therefore, there is a moderate impact on significance scale.

485. No critical or endangered species found in the AoI. IBAT identifies no key biodiversity areas or protected areas within a buffer of 10 km around The Project area.

486. For these reasons, project construction is not likely to have a significant impact on ecology. Though there will be irreversible harm to some ecological receptors (individuals), the species will not suffer, as the area of habitat occupied by the Project infrastructure or disturbed by construction will be in an already disturbed and modified habitat.

Mitigation Measures

487. The following mitigation measure will be followed during the project construction activities to minimize the impact on ecology:

- If tree cutting is unavoidable for RoW clearance, the contractor will keep a record of cut trees. During plantation, ten-time (1 x 10 times) more plants will be planted. Before the plantation campaign, the forest department will be consulted on the selection of local species. A tree management plan will be prepared as part of SSEMP. Annexure XVI provides a framework plan for tree plantation.
- Provide adequate knowledge to the Project workers on relevant government regulations and punishments for illegal poaching to prevent hunting, trapping and exploitation of wildlife
- Minimize disturbance to, or movement of, soil and vegetation to prevent soil damage and erosion leading to spread of alien invasive plant species
- Revegetate disturbed areas with native plant species
- Ensure that solid and liquid waste is disposed only at designated locations, to prevent pollution of the water bodies in the AOI and vicinity.
- In addition to this, spray water twice or thrice a day (as per needed) to avoid dispersal of dust on the adjacent flora.
- Lights used in the camps, during the construction of towers will be kept to the minimum requirement. Upward scattering lights will preferably be used.
- Vehicle speed will be controlled to avoid incidental mortality of small mammals and reptiles.
- The contractor's staff and labor will be strictly directed not to damage any vegetation such as trees or bushes.

- Clearing of green surface cover for construction, for borrow for development, cutting trees and other important vegetation during construction will be minimized.
- Provide awareness training identifications of animal hazards (such as venomous snakes); what to do if dangerous animals are encountered; report kills of large mammals and other migratory birds particularly designated species of conservation concern.
- Provide adequate knowledge to the workers on relevant government regulations and punishments for illegal poaching and trade in animals and plants; incorporate in contract documents regulations for Project staff and contractors to avoid illegal poaching of wild animals.
- The relevant stakeholders should ensure the protection of all wildlife species particularly species which are highly trafficked like Indian Pangolin and Indian Spiny-tailed Lizard.
- Reflective balls or a moving tag with different colors should be installed on lines for diverting the birds flight. Reflective ball installment is very important for reducing mortality, especially among the nocturnal migrant species.
- A line space of about 1.4 m should be ensured between different conductors and between conductors and grounded wires or hardware. This mitigation will minimize the electrocution of large size birds such as vultures and other raptor species.

5.3.3 Socioeconomic Environment

488. The Project will have both positive and negative socio-economic impacts during the construction phase. Positive socio-economic impacts of the project are the creation of job opportunities and a boost to the local economy, while negative impacts include a disturbance to the privacy of locals due to the influx of workers and increased risks of community and occupational safety due to construction machinery and vehicles. The following sections provide impact assessment, significance and mitigation measures for the positive and negative impacts of the project and measures to maximize the benefits of the project.

5.3.3.1 Increased Employment Opportunities and Local Economy

Assessment

489. Direct, indirect, and induced employment at the local level, resulting in increased prosperity and wellbeing due to higher and more stable incomes of people. The impact has positive and high significance as the Project will provide economic opportunities for local people.

Enhancement Measures

490. To maximize benefits to the local community, the following mitigation, enhancement, and good-practice measures will be adopted.

- The contractor and sub-contractors will explain the recruitment process to local communities.
- Local candidates will be given preference for jobs provided they have the required qualifications and skills for the announced positions;
- Coordinate efforts to recruit unskilled labor, if any are required under the Project, from the adjacent areas.

- Determine what is ‘fair and transparent’ in the distribution of jobs between different community groups in consultation with local communities and their leaders.
- As the nearby economy is mostly based on agriculture, it will be ensured that construction activities do not disturb or disrupt agricultural activities in the surrounding areas.
- Local communities will be consulted before the start of work.

5.3.3.2 Overburden on Local Resources

491. During the construction, overburden on local resources is possible if construction facilities such as workers camp and construction camp built near rural areas and can create problems for local communities.

Mitigation Measures

492. Proposed mitigation measures include:

- Construction Contractor will prepare a resource conservation plan as per template given in Annexure XV**.**
- The use of water will not disturb public water availability and the source of water will be selected carefully.
- Contractor to source raw material and camp utilities from nearby major cities to avoid overburden on local resources.

5.3.3.3 Social Conflicts due to Influx of Workers

Assessment

493. The influx of workers into the AOI can potentially result in the deterioration of social values and an increase in social conflict in the communities due to the in-migration of employees and jobseekers. The presence of outsiders can also restrict the movement of local women, affecting their economic and social opportunities. The growth in population and associated economic disparity can result in increased crime, such as theft and robbery.

494. The impact has moderate impact as most of the workers will be hired from local communities as this will provide a monetary benefit to the contractor as well by saving overheads on housings and food if hired personnel from other areas.

Mitigation Measures

495. Proposed mitigation, enhancement, and good-practice measures include.

- Require non-locals employed by the Project to adhere to a social ‘code of conduct’ in terms of relations with local communities including restricting their movement to stay within camping sites
- Provide employees and visitors with cultural awareness training.

5.3.3.4 Impact on Community Health and Safety

Assessment

496. During the construction phase, there will be a health and safety risks to community members and there is risk of spreading communicable diseases.

Mitigation Measures

497. To mitigate these risks the following measures are proposed:

- The camping sites of the Project site will be completely fenced off before the commencement of any other construction activities.
- Access to the site will be controlled and unauthorized people will not be allowed to enter. Workers will not allow socializing with local communities.
- Potential for the spread of vector-borne and communicable diseases (such as COVID-19, HIV infection, etc.) from labor camps will be suppressed through worker awareness orientation and appropriate accommodation and sanitation systems.
- Children will not be allowed to enter the site under any circumstances.
- The prescribed vehicle speed limit will be strictly enforced for community and worker safety.
- Dust emissions due to vehicular traffic will be minimized by enforcing the speed limit. Water will be sprinkled on unpaved surfaces where necessary.
- All vehicles used by the project will undergo regular maintenance and will be tuned following the requirements of the PEQS.
- The labor works with different transmittable diseases will be restricted within the construction site.
- Efforts will be made to create awareness about road safety among the drivers operating construction vehicles.
- Timely public notification on planned construction works.
- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity & social links;
- Seeking cooperation with local educational facilities (schoolteachers) for road safety campaigns;
- Provision of proper safety and diversion signage, particularly at sensitive/accident-prone spots;
- The use of water will not disturb public water availability and the source of water will be selected carefully.

5.3.3.5 Impact on Physical Cultural Resources (PCRs)

Assessment

498. The location of mosques and other cultural and other heritage sites has been reviewed. There is no mosque, graveyard, tomb or any other religious/archaeological site within 100 m boundary from the edge of the Project; therefore, no impact on the site is expected.

Mitigation Measures

499. However, a chance find procedure is presented in Annexure IX in case of finding any artifact during construction activities.

5.3.3.6 Uncontrolled Solid Waste Disposal, Communicable Diseases

Assessment

500. The main issues of concern are uncontrolled or unmanaged disposal of solid and liquid wastes into watercourses and natural drains, improper disposal of stormwater and black water and open defecation by construction workers.

501. Wherever water can accumulate in temporary drainage facilities, due to improper stormwater management, or improper disposal of wastewater generated from the site, there is the risk of mosquitoes and another insects breeding.

502. The impact has a significant impact on local communities if appropriate mitigation measures are not taken.

Mitigation Measures

503. To mitigate these risks the following measures are proposed:

- To maintain proper sanitation around construction sites, access to the nearby public lavatories will be allowed or provision of temporary toilets will be made. Construction worker camps will be necessary, based on the scale of the works needed. The construction camp will be provided with toilets with soakage pits or portable lavatories or at least pit latrines.
- Disposal of surplus materials will also be negotiated through local authority approvals before the commencement of construction. The Project work will not involve any significant cutting and filling, but minor excavations (down to 4m) and piling may be required to create the foundations for towers (if required). It is expected (depending on the mode of contract) that the surface under the towers will need to be scrabbled to remove unstable materials, or to stockpile topsoil.
- If surplus materials arise from the removal of the existing surfaces from specific areas, it will be used elsewhere on the Project before additional soil, rock, gravel, or sand is brought in. The use of immediately available material will generally minimize the need for additional rock-based materials extraction from outside.
- Contractual clauses will require the contractor to produce a materials management plan (one month before construction commences) to identify all sources of cement and aggregates and to balance cut and fill. The plan will clearly state the methods to be employed before and during the extraction of materials and all the measures to be employed to mitigate nuisances to residents. Financial compensation will not be allowed as mitigation for environmental impacts or environmental nuisance.
- Contractual clauses will require the contractor to produce a solid waste management plan so that the proper disposal of waste can be ensured.
- Claims/complaints of the people on construction nuisance/damages close to RoW will be considered and responded promptly by the Contractor.
- Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds.
- The contractor will organize temporary means of access and make alternative arrangements to avoid access problems to local community and to avoid such short-term negative impacts.
- Potential for the spread of vector-borne and communicable diseases (such as COVID-19, HIV infection, etc.) from labor camps will be avoided through worker awareness orientation and appropriate sanitation systems.

5.3.3.7 Natural Hazard Risks (Flooding, Earthquakes etc.)

Assessment

504. According to the classifications in **Section 4.2.3**, the Project is located in minor to moderate risk zone for earthquakes and unprecedented precipitation events as observed

in the current year (see current data in **Section 4.2.4)**, It is predicted to receive more rainfalls in the following years.

Mitigation Measures

- The structures of the ETL such as tower bases should be built as per the rules of Pakistan Building Code (PBC).
- The tower bases should be built considering the local climatic conditions including flooding.
- Project construction facilities should be built considering climatic conditions such as risk of flash flooding in case of high precipitation events.
- Material testing and tensile strength of conductors must be checked before commencement of works.

5.4 Operation Phase

505. The operation phase impacts on the physical environment, ecology, and socioeconomic environment are listed separately in the below sections.

506. A summary of potential impacts during operation phase, based on methodology discussed in *Section 5.1*, is provided in **Table 5-11**.

Table 5-11: Potential Impacts at Operation Phase

No.	1. Potential Impact	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Score (Critical, Significant/ Moderate, Low)	Residual Impact (Critical, Significant/ Moderate, Low)
1	Noise	2	2	4	Low
		Unlikely	Moderate	Low	
2	Impact of Faulted SF6	2	2	4	Low
		Unlikely	Moderate	Low	
3	Electrocution and Collision of birds	3	3	9	Low
		Likely	Major	Significant	
4	Occupational Health and Safety	3	3	9	Low
		Likely	Major	Significant	
5	Community Health and Safety Risk	3	3	9	Low
		Likely	Major	Significant	
6	Visual Amenity	3	3	9	Low
		Likely	Major	Significant	
7	Aircraft Navigation Safety	2	2	4	Low
		Unlikely	Moderate	Low	
8	Reduced Pressure for Local Resources	3	3	9	Low
		Likely	Major	Significant	

Critical Risk Level

Significant/ Moderate Risk Level

Low Risk Level

5.4.1 Physical Environment

5.4.1.1 Noise

Assessment

507. The Project works will extend the power distribution. Maintenance works will be very small in scale and infrequent. The operation of the ETL project is not likely result in atmospheric pollution during operation and generate liquid or solid waste during operation.

508. However, the operations may cause increased audible noise specially in raining times. This will have a major impact in areas where ETL is passing through settlements.

Mitigation Measures

509. The height of ETL and RoW as per NTDC standard for 220 kV ETL discussed in **Section 3** will be maintained to avoid audible noise issues.

510. In addition to above, much more robust design for ETL and its ground clearance with much higher levels have been proposed for this project due to the Project passing through settlements in parts of the RoW.

5.4.1.2 Impact of Faulted SF6

Assessment

511. Sulfur Hexafluoride (SF6) used as circuit breaker in electric transmission operations. Toxic decomposition products are formed when SF6 gas is subjected to an electric arc. The decomposition products are metal fluorides and form a white powder. Toxic gases are also formed which have the characteristic odor of rotten eggs.

512. Faulted Sulfur Hexafluoride (SF6) will be handled carefully ensuring standard industry practices. EHS Guidelines on Electric Transmission and Distribution (footnote 26) will also be followed to handle SF6.

Mitigation Measures

- Do not breathe the vapors remaining in a circuit breaker where arcing or corona discharges have occurred in the gas.
- Evacuate the faulted SF6 gas from the circuit breaker and flush with fresh air before working on the circuit breaker
- Arc products which do not recombine, or which combine with any oxygen or moisture present, are normally removed by the molecular sieve filter material within the circuit breaker.

5.4.2 Ecological Environment

5.4.2.1 Electrocution and Collision of birds

Assessment

513. Operations and maintenance will be very small in scale and infrequent and involve a few changes to the existing situation. The practice of allowing some re-growth of vegetation along the RoW will also have ecological benefits as it will allow plants and animals to re-colonize.

514. The combination of the height of transmission towers and distribution poles and the electricity carried by transmission and distribution lines can pose significant risk to birds and bats through collisions and electrocutions.

515. The following possible risks of bird's collision can occur during operation of the Project:

- Electrocution: spacing of conductors (the current-carrying wires) and the availability of perches affect electrocution risk. The risk of electrocution of large birds by ETL is real as they provide a structure for birds from which they can hunt and roost.
- Electrocution occurs when a bird encounters two wires or when it perches on a conductive pylon and comes into simultaneous contact with a wire. The impact of electrocution of birds depends on the electrotechnical design of a pylon and the natural features surrounding it.[105] In short, the birds may be electrocuted by power lines in one of three ways:
    - Simultaneously touching an energized wire and a neutral wire;
    - Simultaneously touching two live wires; and
    - Simultaneously touching an energized wire and any other piece of equipment on a pole or tower that is bonded to the earth through a ground wire.
- Collisions may also occur if the ETLs are difficult to see. Earth wires (sometimes called the static or ground wires, which protect the power line from lightning strikes) are thought to be responsible for a much higher rate of collisions than the thicker, often bundled conductor wires. This is because they are harder for birds to see and are typically positioned at the top of the wire array, putting them in the flight path of birds which have taken avoiding action to fly over the conductors.
- In addition to above, bird collisions with power lines may result in power outages and fires.

516. The net impact of electrocution of large birds is not considered significant because there is an EMF around the high voltage ETLs which produces noise and the excessive noise deters birds.[106] However, even if the birds sit on the conductors, the danger will arise if two phases of the current meet, but as there is sufficient distance between the two opposite phased conductors; therefore, no danger to birdlife is expected. The collision and siting of birds will be further avoided by installing visibility enhancement objects such as marker balls, bird deterrents, or diverters.

Mitigation Measures

517. The following mitigations are proposed to avoid the electrocution and collision affects:

- Maintain 1.5 meter (60-inch)[107] spacing between energized components and grounded hardware or, where spacing is not feasible, covering energized parts and hardware.
- Install visibility enhancement objects such as marker balls, bird deterrents, or diverters.[108]
- Make power lines less of an 'obstacle' for birds to collide with
- Keep birds away from the power line by making the power lines more visible by placing colorful/fluorescent tape on the towers to make them conspicuous enough to enable birds to see them.
- Keep power line cables lower to the ground to the extent feasible as these are better for preventing bird collision.
- Keep vertical separation of cables as less to the extent feasible, as it poses less of an 'obstacle' for birds to collide with.

105 EIA, 132kV ETL, Nikachhu Pothead Yard to Mangdechhu Pothead Yard, ADB, 2014.

106 https://sciencing.com/sounds-frighten-birds-7807173.html, and https://en.wikipedia.org/wiki/Bird_scarer.

107 Manville, Albert M. 2005. Tall Structures: Best Management Practices for Bird- Friendly Tall Buildings, Towers and Bridges – U.S. Fish and Wildlife Service Recommendations to Address the Problem. Prepared for the U.S. Fish and Wildlife Service.

108 Crowder, Michael R. and Olin E. Rhodes, Jr. 1999. Avian Collisions with Power Lines: A Review. Proceedings of a workshop on Avian Interactions with Utility and Communication Structures Charleston, South Carolina, December 2-3, 1999. Edited by Richard G. Carlton. Electric Power Research Institute.

- Provide horizontal separation of conductors and construct cage box on conductors to prevent birds from sitting or making nest on the towers; and
- Construct self-supporting towers, which do not require stay wires.

5.4.3 Socioeconomic Environment

5.4.3.1 Occupational Health and Safety

Assessment

518. The occupational health and safety hazards associated with operation, repair, and maintenance, and decommissioning of ETLs mainly include:

- Exposure with live power lines.
- Exposure to fall hazards from working at heights for poles and structures.
- Exposure to EMFs to workers as the workers typically have a higher exposure to EMF than the general public due to working in proximity to electric power lines.

519. The impact has a significant impact related to occupational safety if appropriate mitigation measures are not taken.

Mitigation Measures

520. The following are prevention and control measures will be implemented to the extent feasible to mitigate any issue related to occupational health and safety:

- All associated ETLs will be shut down before conducting any repair and maintenance work as per the NTDC's operation and maintenance procedures.
- Adherence to the standards Occupational Health and Safety Guidelines.
- Allow only trained and certified workers to maintain, or repair electrical equipment with safety and insulation measures in place.
- Deactivate and properly ground the live power distribution prior to performing work on or in proximity to the ETLs.
- Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system.
- Ensure worker is properly isolated and insulated from the energized part with gloves or other approved insulation and energized part is properly insulated from the worker.
- Test structures for integrity prior to undertaking work.
- Prepare and implement fall protection program that will include training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others.
- The fall protection system will be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point and fixtures will be installed, wherever possible, to facilitate the use of fall protection systems.
- Provide adequate work-positioning device system for workers to the extent possible.
- Properly maintained hoist equipment will be used along with properly trained personnel.
- Proper safety belts will be provided. The Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength.
- Use a backup safety strap when operating power tools at height.
- Remove signs and other obstructions from poles or structures prior to undertaking work.
- Provide an approved tool bag for raising or lowering tools or materials to workers on structures.

- Prepare and implement EMF safety program to prevented or minimize occupational hazards due to exposure to EMF.
- Identify potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities.
- Train workers in the identification of occupational EMF levels and hazards;
- Establish and identify safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers.
- Prepare and implement action plans to reduce adverse impact of EMF and to address occupational exposure. Action plans may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.
- Signs and barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers) will be used.

5.4.3.2 Community Health and Safety

Assessment

521. The community health and safety impacts associated with operation, and decommissioning of ETLs include:

- **Electrocution:** Electrocution through direct contact with high-voltage electricity or from contact with devices or equipment that are in contact with high-voltage electricity
- **Noise:** Noise in the form of buzzing or humming can often be heard around transformers or high voltage power lines producing corona. Noise from ETLs reaches its maximum during periods of precipitation, including rain, sleet, snow or hail, or as the result of fog. The sound of rain typically masks the increase in noise produced by the ETLs, but during other forms of precipitation (e.g. snow and sleet) and fog, the noise from overhead power lines can be troubling to nearby residents.
- **Aircraft Navigation Safety:** Power transmission towers, if located near an airport or known flight paths, can impact aircraft safety directly through collision or indirectly through radar interference. There is an international airport in Rahim Yar Khan city at about 30 km from ETL route and domestic airport in Bahawalpur is 15 km southeast of the ETL
- **Impacts of EMF:** The local people believe that their movement will be restricted in the project area due to EMF, and it may have adverse impacts on their health. However, there has been much research on the health and environmental impacts of EMF since the 1970s, but most research and laboratory studies have failed to show strong associations between exposure to EMF and health effects. Several scientific panels convened by national and international health agencies and the U.S. Congress reviewed the research and concluded that there was insufficient evidence to prove the same. However, they also concluded that there is insufficient evidence to prove that EMF exposure is safe.[109] Since the Project has been planned in the least populated area, even if some effects due to EMF are envisaged, these will be minimal due to safe distance. More assessment on EMF has been provided in **Section 5.2.11.**

Mitigation Measures

522. The following are prevention and control measures that will be implemented, to the extent feasible, to mitigate impacts related to community health and safety:

- Signs and barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers) will be used.

[109] EIA, 132kV ETL, Nikachhu Pothead Yard to Mangdechhu Pothead Yard, ADB, 2014

- Conducting objects (e.g. fences or other metallic structures), installed near power lines, will be grounded to prevent shock.
- A vertical clearance, required as per international standards, will also be maintained especially near the populated areas. If required, application of engineering techniques will be considered to reduce the EMF produced by power lines and grid stations such as increasing height of transmission towers, modification to size, spacing, and configuration of conductors, shielding with metal alloys (This is effective for reduction of electric field exposure, but not for reduction of EMF exposure.).
- During the operation stage, a check will be kept by the NTDC that no construction will be allowed within 100 m of the ETL.
- Power lines will be designed, with due consideration to landscape views and important environmental and community features.
- Use of noise barriers or noise canceling acoustic devices will be considered as necessary.
- Adherence to regional or national air traffic safety regulations.
- Use of buried lines when installation is required in flight sensitive areas.

5.4.3.3 Visual Amenity

523. Impact on visual amenity due to the transmission and distribution facilities to communities may be visually intrusive and undesirable to nearby residents

524. However, it is common practice to create some local hard and soft landscaping and successful planting of fruit trees at such sites. This practice should be encouraged as far as practicable. Other opportunities for enhancements can be assessed before construction and proposed enhancements will be discussed with the local population to serve as a vehicle for further public consultation at the implementation stage and to assist in public relations.

5.4.3.4 Aircraft Navigation Safety

Assessment

525. Power transmission towers and ETL, if located near an airport or known flight paths, can impact aircraft safety directly through collision or indirectly through radar interference. There is an international airport in Rahim Yar Khan city at about 30 km from ETL route and domestic airport in Bahawalpur is 15 km southeast of the ETL. Therefore, aircraft collision or radar interferences are not likely to occur due to the Project operations.

Mitigation Measures

526. The following are prevention and control measures that will be implemented, to the extent feasible:

- Use of buried lines when the installation is required in flight sensitive areas.
- Making the power lines more visible by placing colorful/fluorescent tape on the towers and colorful balls on the conductor to make them visible.
- Keep power line cables lower to the ground to the extent feasible.

5.4.3.5 Reduced Pressure for Local Resources

527. During the operation phase, no negative social impacts are anticipated. Instead, the people will benefit positively due to the availability of uninterrupted power and reduced pressure on demand of liquid petroleum gas, kerosene, diesel, and fuelwood.

5.5 Cumulative, and Induced impacts

Assessment

528. Cumulative impacts are those impacts that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important based on scientific concerns and/or concerns of affected communities (local communities directly affected by the Project).[110]

529. The Project is being developed and will connect existing Rahimyar Khan and Bahawalpur Grid Stations that already having many other ETLs and distribution lines.

530. Other ETLs of Rahimyar khan GS include 500KV RYK-Guddu ETL and 500KV RYK-Multan ETL along with Two 500kV RYK-Moro ETL This Grid station feeds six nos. 132kV circuits. 132kV Khanpur-I ETL & Khanpor-II ETL were commissioned on 10 February 2018 arid, 132kV RYK-I ETL & RYK-II ETL, 132kV Feroza-I ETL and Feroza-II ETL.[111] Other ETLs of Bahawalpur GS include, Muzaffargarh- Bahawalpur ETL and Quaid-e-Azam Solar Park through 220 kV Double Circuits. This GS is also feeding 5 number 11 kV local DESCO feeders.[112]

531. The incremental EMF impacts are expected, and local population concern will be increased with the addition of this ETL.

Mitigation Measures

532. The measures to be taken in the pre-construction (design) phase **Section 5.2.11** above will also further reduce the incremental EMF impacts of this ETL. The measures include,

- NTDC's standard operating procedures (SOPs) of a minimum vertical ground clearance for ETL conductor of 7 meters will be ensured.
- Raising conductor height above the ground to 8 m, typically by increasing tower height, will be ideal.
- Reducing conductor spacing.
- Arranging phases so that fields tend to cancel.
- Increasing transmission voltage (since EMF intensities are a function of current, and increased voltage, all things being equal, will result in reduced current).
- Reducing loads (and therefore, currents).
- Identification of potential exposure levels in the work area including surveys of exposure levels and establishment of safety zones.
- Safety signs and warning zone will be highlighted to indicate EMF in the area
- Limit access to properly trained workers and those equipped with appropriate PPE when entering safety zones.
- Increasing RoW widths or buffer zone widths, to move people further from ETLs.

[110] Cadinale, Pablo, and Lorne Greig. "Cumulative Impact Assessment and Management: Guidance for Private Sector in Emerging Markets." In Good Practice Handbook: International Finance Corporation and ESSA Technologies Ltd, 2013.
[111] https://ntdc.gov.pk/220kv-gird-station
[112] Ibid.

6. Analysis of Alternatives

533. The Project is a subproject of Tranche 4 of MFF. Tranche 4 will expand the 220 kV transmission systems in the provinces of Sindh and Punjab and Khyber Pakhtunkhwa. It will also upgrade the supervisory control and data acquisition system across the national grid to enable the NTDC to monitor and control the grid in real-time, and to prevent network outages or reduce their duration, thereby increasing grid stability, reliability, and resilience to accommodate more intermittent renewable energy.

534. Several alternatives, including no project alternative, layout and design alternatives were considered for the proposed Project. The consideration of these alternatives is detailed below.

6.1 No Project Alternative

535. Based on the available information, the predictions have indicated that without the power enhancement projects, the supply will not be reliable. This Project is a part of an overall strategic improvement to the system.

536. In the absence of the Project, the potential for interruptions to the power supply will increase and socio-economic development, especially in the low-income areas of the province will be affected in the short to medium term.

537. In an un-enhanced state, the wear and tear on existing facilities will rise and further power disruptions may have occurred.

6.2 Alternative Construction Methods

538. The feasibility and constructability of the ETL towers are well established locally, and the installation of equipment is well-practiced in the international context (even if some types of equipment are new to Pakistan). The process includes the transportation of equipment to the site and the assembly of prefabricated units' in-situ. Thus, the impacts of construction activities are very manageable from the environmental viewpoint.

539. An alternative to overhead tower-based ETL is buried ETL which was proposed but not implemented. Special towers will be designed for section of ETL passing through the residential areas for power evocation considering community safety.

6.3 Design/Technology Alternatives

540. This project will promote high-level technologies and climate change resilient transmission system. It will promote deployment of high-temperature low sag (HTLS) conductors which can operate at higher ambient temperature within requested vertical clearance. Comparing to equivalently sized conventional aluminum conductor steel reinforced (ACSR) conductors, the HTLS conductors can also transfer more current with less loss. This project will also support the replacement of porcelain insulators with fog-resistant insulators such as glass or composite types in the heavily polluted area. Moreover, this project will contribute to the reduction of CO_2, due to loss reduction and improved efficiency.

541. The total conductor to ground clearance will in no way be less than 7.0 meters.

6.4 Alternative Alignments for Transmission Line

542. The design and route of the ETL is as short as it can be and avoids the local villages by erecting angle towers. The ETL route is of total 105 km and the settlements have been avoided by passing the line through cultivated and semi forested land. Some further detailed surveys may be carried out for the detailed design to determine the exact construction

methods and locations, but no private land acquisition is envisaged to be involved in this Project.

6.5 Economic Alternatives

543. The proposed Project is considered highly economical viable. The project's useful economic life has been assumed as 40 years and will help in reduction in transmission system losses apart of improvement in reliability of NTDC, MEPCO, SEPCO and MEPCO system networks. [113]

544. The project will provide additional source of supply to 220 kV Bahawalpur and Lal Suhana Grid Stations

545. The proposed project will provide the resynchronization of the NTDC network during collapse due to severe bad weather conditions.

546. It has been visualized that if the project is delayed then the cost of the project is going to escalate each year. The cost escalation impact for each year can be estimated @ 6.5% p.a.[114]

[113] PC-1, 220kV Jamrud Substation along with associated 220 kV Transmission Line, NTDC, Oct 2017
[114] Ibid.

7. Information Disclosure, Consultation, and Participation

547. Stakeholders are groups and individuals that are affected by or can affect the outcome of a project. Stakeholder engagement is a broad, inclusive, and continuous process between a developer of a project and its stakeholders. This process comprises of a range of coherent approaches and activities that spans the entire life cycle of the project. This is achieved by informing the stakeholders on time about the proposed project and its potential consequences on the environment and by encouraging their feedback.

548. The purpose of this exercise is to inform all the stakeholders about the project and include their concerns, suggestions, and opinions and develop confidence amongst them that the project will be developed responsibly.

549. A continuous engagement with the local community and other stakeholders will be carried out throughout the project lifecycle including the construction and operation phases.

7.1 Consultation Methodology

550. A stakeholder is an individual, group or organization who is impacted by the outcome of a project. There are two types of stakeholders, i.e., community and institutions. Firstly, these stakeholders were identified. Then separate consultations have been done with both and their concerns, suggestions, and opinions have been recorded on a consultation form. Their concerns, suggestions, and opinions are included in the project's potential impacts and mitigation measures are advised for each of the impacts.

551. The baseline data for the IEE for this ETL was collected from the field through field surveys conducted from 6 September to 13 September 2022.

7.1.1 Consultation Material

552. During field survey for IEE of the project, a Basic Information Document (BID) was prepared in English and Urdu for communities living nearby the RoW. BID was distributed to stakeholders during the consultation to inform the stakeholders about the project. The BID contained information about the project and the IEE process.

553. A consultation form was used to record the issues, concerns, and suggestions of the stakeholders. The BID and consultation form used for the project is included as Annexure XIII.

7.1.2 Community Consultation Mechanism

554. The focus of this consultation is the population living near the proposed ETL route i.e., the population that is living around the radius of 30 m to around 1.5 km of the proposed ETL.

555. To conduct the consultations more inclusively, the vulnerable population of the AoI including women and elderly were made a part of the consultation process.

556. The list of the communities consulted is given in **Table 7-1**. The dates of consultations, names and contact details of community consultation participants are given in **Table 7-2**.

557. The location of these communities is shown with a ETL passing near these villages in **Figure 7-1**.

558. Photographs from the public consultation campaign are presented in **Photo 7-1**.

559. The community consultations were conducted in Punjabi and Urdu language[115] to make consultations understandable to the communities. The meetings progressed in the following manner:

- Stakeholders were introduced to the visiting team and briefed about the consultation process and its objectives
- The main points of the BID were read out to the stakeholders in Urdu. Through the BID an overview of the project and IEE/EIA process was provided
- Stakeholders could raise queries or concerns regarding the project. Queries were responded to, and concerns were documented.

Table 7-1: List of Communities Consulted

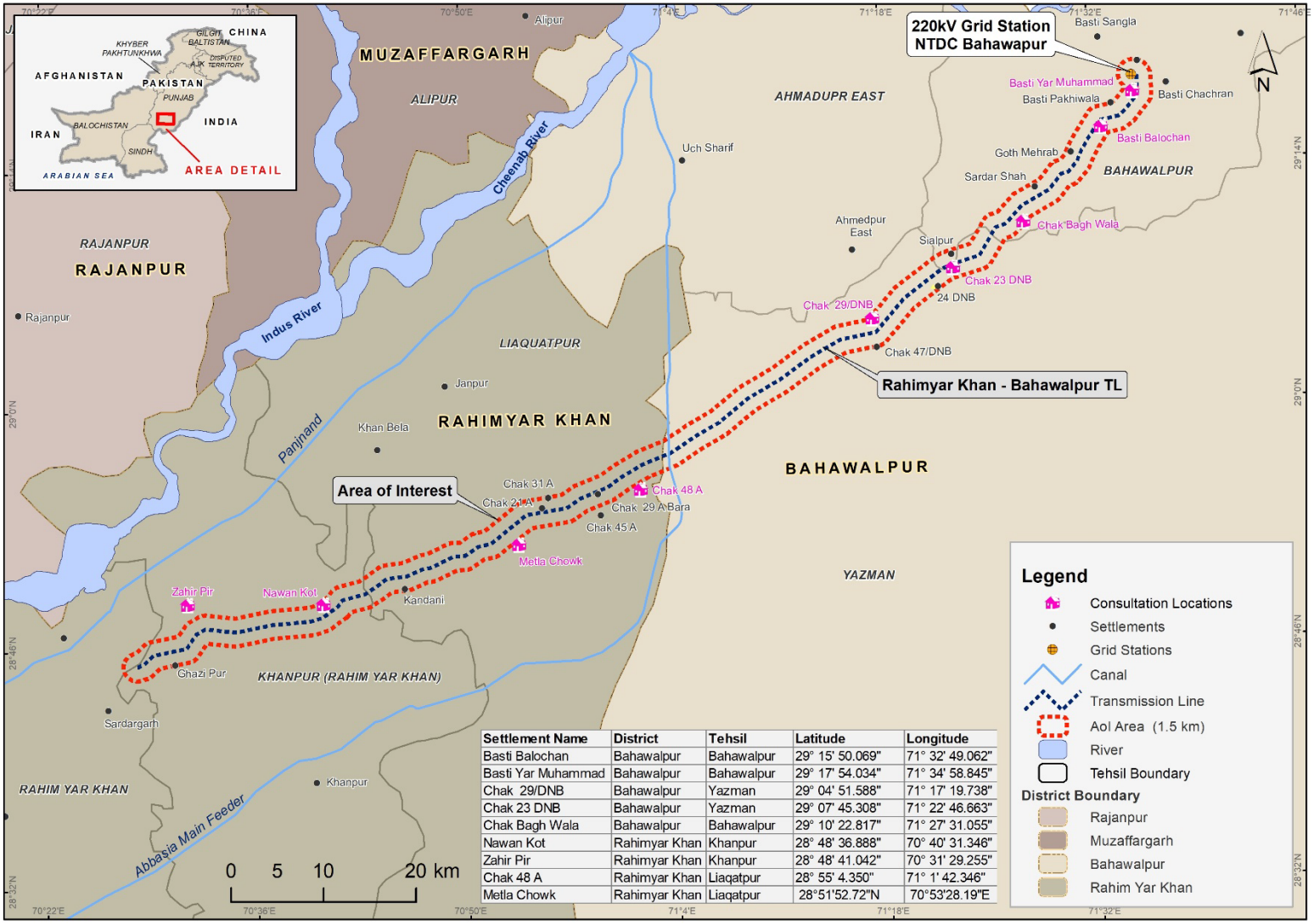
Communities within Study Area
Zahir Pir
Nawan Kot
Chowk Metla
Chak 48 Bara
Chak 29DNB
Chak 23 DNB
Chak Bagh wala
Basti Balochan
Basti Yar Muhammad

Table 7-2: Participant of the Community Consultations

No.	Participant Name	Village/Area	Date Consulted
1	Fida Hussain 03032 2091195 Kalimullah Khan Muhammad Anas 0333 6497735 Haji Khan Javed Hussain Hotel owner Muhammad Bilal	Zahir Pir	September 10, 2022
2	Islam Din 0304 937027 Ahmed Nawaz 0336 0366813 Faisal Ahmed Naveed Ahmed Nasir Hussain 0300 8483423	Nawan Kot	September 10, 2022
3	Muhammad Insha 0300 6962480 Suhail Ahmed Muhammad Aijaz 0305 3646434 Muzafar Hussain	Chowk Metla	September 10, 2022

[115] Saraiki is the predominant language being spoken by majority of the population of the Subproject area followed by Urdu; However, Punjabi, Sindhi, Balochi, Marwari, and Pushto are also spoken. All the Subproject affected people understand Urdu (see para. 360 on page 95).

No.	Participant Name	Village/Area	Date Consulted
	Mujeeb u Rahaman Talha		
4	Nasir Hussain 0301 6381622 Abdul Rasheed Mazahar Ali Muhammad Aslam Sadam khan Asif Ali 0307 3757505	Chak 48 Bara	September 10, 2022
5	Muhammad Ali 0305 3617433 Zaheer Ahmed Aamir Shaikh Umeer Bhatti 0307 3797501 Muzamil Hussain	Chak 29DNB	September 11, 2022
6	Mujeeb u Rahman 0345 3150510 Mujahid Kaleem Iqrar Hassan Ahmed Ali Shah 03008615130	Chak 23 DNB	September 11, 2022
7	Faisal Ahemd 0307 8112286 Hasnain Munawar Muneer Ahmed 0306 738109 Usman Ahmed 0305 8722867	Chak Bagh wala	September 11, 2022
8	Asghar Ali 0307 7980150 M Ramzan 0304 9194812 Mushtaq Ahmed M Saifullah Sajad Ahmed 0300 9195911	Basti Balochan	September 11, 2022
9	Muzamill Hussain Shahid Hameed 03009 650206 Muhammad Faraz Ahsan Ahmed 0301 3250497 Ali Nawaz 0311 4707278 Muhammad Yasir	Basti Yar Muhammad	September 12, 2022



Settlement Name	District	Tehsil	Latitude	Longitude
Basti Balochan	Bahawalpur	Bahawalpur	29° 15' 50.069"	71° 32' 49.062"
Basti Yar Muhammad	Bahawalpur	Bahawalpur	29° 17' 54.034"	71° 34' 58.845"
Chak 29/DNB	Bahawalpur	Yazman	29° 04' 51.588"	71° 17' 19.738"
Chak 23 DNB	Bahawalpur	Yazman	29° 07' 45.308"	71° 22' 46.663"
Chak Bagh Wala	Bahawalpur	Bahawalpur	29° 10' 22.817"	71° 27' 31.055"
Nawan Kot	Rahimyar Khan	Khanpur	28° 48' 36.888"	70° 40' 31.346"
Zahir Pir	Rahimyar Khan	Khanpur	28° 48' 41.042"	70° 31' 29.255"
Chak 48 A	Rahimyar Khan	Liaqatpur	28° 55' 4.350"	71° 1' 42.346"
Metla Chowk	Rahimyar Khan	Liaqatpur	28°51'52.72"N	70°53'28.19"E

Figure 7-1: Locations of Community Consultations

Community Consultation at Village Basti Balochan (August 2020)

Community Consultation at village Yar Muhammad (August 2020)

Community Consultation at village Zahir pir (August 2020)

Community Consultation Male (August 2020)

Community Consultation Male (August 2020)

Community Consultation with Women (August 2020)

Community Consultation with Women (August 2020)

Community Consultation with Women (August 2020)

Photo 7-1: Community Consultations

7.1.3 Institutional Consultation Mechanism

560. Various important Government departments were consulted to accumulate their concerns concerning the project activities. The list of institutional stakeholders is given in **Table 7-3**.

561. The meetings progressed in the manner mentioned below.

- The institutions were provided with the BID in advance of the meeting. Stakeholders were provided with an overview of the project description.
- The IEE/EIA process that will be undertaken for the project was briefly described, and the structure of the IEE/EIA report was presented to facilitate understanding of the process.
- Their opinion, concern, and issues related to the physical environment, socioeconomic environment and other general views about the project was documented.

562. Photographs from the public consultation campaign are presented **Photo 7-2**.

Table 7-3: List of Institutional Stakeholders

No.	Institutional Stakeholders	Date Consulted
1	Forest Department, Bahawalpur	September 13, 2022
2	Agriculture Department, Bahawalpur	September 13, 2022
3	Wildlife Department Bahawalpur	September 13, 2022
4	District Councial Member	September 07, 2022

No.	Institutional Stakeholders	Date Consulted
5	Sugar Mill	September 07, 2022
6	Environment Department, Rahim Yar Khan	September 08, 2022
7	Agriculture Department, Rahim Yar Khan	September 08, 2022
8	Wildlife Department, Rahim Yar Khan	September 09, 2022
9	Forest Department, Rahim Yar Khan	September 09, 2022

Institutional Consultation with Agriculture Department Bahawalpur (August 2020)

Institutional Consultation with Forest Department, Bahawalpur (August 2020)

Institutional Consultation with Agriculture Department Rahim Yar Khan (August 2020)

Institutional Consultation with Environmental Protection Agency Rahim Yar Khan (August 2020)

Institutional Consultation with Wildlife Department, Rahim Yar Khan (August 2020)

Institutional Consultation with Wildlife Department (August 2020)

Institutional Consultation with District Council (August 2020)

Institutional Consultation with Forest Department, Rahim Yar Khan (August 2020)

Institutional Consultation with Sugar Mill Field Manager (August 2020)

Photo 7-2: Institutional Stakeholder Consultations

7.2 Summary of Concerns Raised by Stakeholders

563. Stakeholders raised various issues during the consultation process. The most raised issues were that the ETL will damage the crops and will impact the residents living near the ETL. The other significant point of view highlighted by the stakeholder was to provide timely and fair compensation to the affected people whose crops, trees or land might be affected by the project.

564. In the stakeholder consultations, the other topics which were discussed with communities and government officials are noise pollution, dust pollution, environmental monitoring, EMF effect of ETL, water pollution, solid waste and chemical handling, disturbing residents, and some ecological issues. A detailed summary of the concerns raised by the community and institutions with responses is provided in **Table 7-4** and **Table 7-5**.

565. The consultation logs are provided in Annexure VIII.

Table 7-4: Summary of the Concerns Raised by Community

Environmental Parameter	*Opinion, Concern, and Issues*	*Response Provided*
Physical Environment		
Damage to Vegetation	Minimum wastage of crops & orchids. avoid construction during the peak cropping season i.e. July to Sep	Minimum vegetation will be damaged and a proper record will be kept of vegetation loss.
Air Pollution	Dust and noise should be minimum near the residential areas	Proper control measures will be taken to reduce the impacts on the local community. The mitigation measures for the suppression of the dust generated by the project are discussed in **Section 7.3.2** (Physical Environment).
Soil Pollution	Agricultural land should not be polluted as it affects soil productivity and crop yield.	Precautionary measures will be adopted to ensure minimum disturbance to the crops and agricultural fields. The mitigation measures for minimizing soil pollution are discussed in **Section 7.3.2** (*Physical Environment*).
Socioeconomic Environment		
Compensations	Fair & timely compensation of crops	A resettlement plan will be prepared to compensate for all the affectees of the project.
Jobs	The project should offer jobs to the affected persons and compensation should be provided according to shares in crops.	The project will generate job and business opportunities for locals.
Cultural Issues	Company workers should take care of the local culture during the installation of ETL During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.	Contractor camp will be set away from the residential area and the local culture will not be disturbed
Local employment	Employment should be given to local men	Locals will be preferred for the job.
Gender	As the project area lies close to the rural areas and rural community, women activities in the field may become affected due to the construction activities	Labor mobility will be ristricted.

Environmental Parameter	*Opinion, Concern, and Issues*	*Response Provided*
	The induction of outside labor may create social and gender issues due to the unawareness by them of local customs and norms. It will also cause hindrance to the mobility of local women.	
General		
Intimation of work	Early information before the start of work	The contractor will inform the locals before commencing the construction works
Privacy	Company works should not disturb the local during agricultural activities	The construction works will be limited to the project area and the privacy of the locals will not be disturbed. The construction crew's interaction with the local population will be minimized
Health hazards for existing ETL	Rehabilitation of the existing ETL.	The existing conductors' loss height and is damaging crops as well as posing community health hazards; therefore; the people requested the rehabilitation of the existing ETL.

ETL = Electricity Transmission Line, IEE = initial environmental examination

Table 7-5: Summary of the Concerns Raised by Institutions

Concern/Issue	*Stakeholder*	*Response Provided*
Physical Environment		
Develop a Grievance Redress Mechanism (GRM) to resolve community reservations and issues.	Environment Department, Rahim Yar Khan	Environmental mitigation and monitoring plan are prepared to minimize the negative impacts of the project and are discussed in **Section 7.3.2.**
Socioeconomic Environment		
The contractor should promote local employment for skilled as well as non-skilled tasks.	District Councle Membre	Noted.
Most of the people in the region are farmers, the contractor should train them for non-skilled jobs and hire them	District Councle Membre	
Construction activities should not disturb the existing facilities such as gas or sewage water pipeline facilities.	Agriculture Office Rahim Yar Khan	
Ecology		

Concern/Issue	*Stakeholder*	*Response Provided*
Major crops and orchards in the surrounding of the proposed ETL are mostly Banana, Mango, Sugarcane, Cotton, and vegetables.	Agriculture Office	Noted. The concern will be made part of IEE/EIA.
Discussed the payment mechanism against tree cutting involving both public and private stakeholders	Forest Department	
The Chief conservator very graciously offered technical support needed for the tree plantation campaign in order to offset the negative impacts of the project	Forest Department	
Engage landowners prior tree cutting	Forest Department	
Note down Girth and species carefully while estimation of compensation amount	Forest Department	
Physical Environment		
The construction waste should not be left unattended. There should be wastewater and solid waste management plan for domestic and hazardous waste disposal.	Environment Department	Environmental mitigation and monitoring plan are prepared to minimize the negative impacts of the project and are discussed in **Section 7.3.2.**
Develop a Grievance Redress Mechanism (GRM) to resolve community reservations and issues.	Environment Department, Rahim Yar Khan	Environmental mitigation and monitoring plan are prepared to minimize the negative impacts of the project and are discussed in **Section 7.3.2.**
Government institutions need to be contacted for stakeholder consultations such as Agriculture, Wildlife, Board of Revenue, and Irrigation Department.	Environment Department, Rahim Yar Khan	Noted
Soil analysis must be carried out before the project execution.	Environment Department, Rahim Yar Khan	Noted
Residential areas in the Right of Way (RoW) should be identified and the EIA report should incorporate relevant impacts and mitigation measures	Environment Department, Rahim Yar Khan	Site-Specific Environmental Management Plan will be prepared for the project.
Earthing wires of the towers can be dangerous for domestic animals and farmers during rainy seasons as some cases have been reported of getting electrocuted from the earthing wires. EMF from high voltage wires may affect pollination, which in turn causes low crop and fruit yields.	Agriculture Department Rahim Yar Khan	Warning signs will be installed at the towers and awareness of the local community will be done. The ETL will be at a very height from the crops and EMF will not disturb the crops and pollination

Concern/Issue	*Stakeholder*	*Response Provided*
Socioeconomic Environment		
The contractor should promote local employment for skilled as well as non-skilled tasks.	Agriculture Office Bahawalpur	Noted.
Most of the people in the region are farmers, the contractor should train them for non-skilled jobs and hire them	Agriculture Office Rahim Yar Khan	
Construction activities should not disturb the existing facilities such as gas or sewage water pipeline facilities.	Agriculture Office Bahawalpur	
Compensation against the loss of the crops/trees should be paid effectively and in time. The revenue department should be consulted for compensation of damage as per local rates.	Agriculture Office Bahawalpur	Compensation will be paid for the damage done to the crops as per LARP.
The revenue department should be engaged for compensation against the damage to crops.	Agriculture Office Rahim Yar Khan	
Ecology		
Major crops and orchards in the surrounding of the proposed ETL are mostly Banana, Mango, Sugarcane, Cotton, and vegetables.	Agriculture Office Rahim Yar Khan	Noted. The concern will be made part of IEE/EIA.
The construction activities may affect the route of migratory birds. Construction activities to be minimized in the migratory season of birds, especially from the resting areas of these birds.	Forest Department Dahrki and Rahim Yar Khan	
Minimize dust pollution so that the migratory birds find no hindrance during migratory season. Dust may also disturb the locals of the area.	Forest Department Rahim Yar Khan	
Avoid cutting trees especially large canopy shady trees during construction activities	Forest Department Rahim Yar Khan	
Route for heavy machinery and equipment should be planned and to avoid traffic congestion and damage to orchards while going offroad.	Forest Department Rahim Yar Khan	
The contractor should ensure no hunting policy during the whole construction phase of the project.	Forest Department Bahawalpur	
Major crops and trees of the area include Conocarpus, babul and a wide range of vegetables	Forest Department Bahawalpur	

Concern/Issue	*Stakeholder*	*Response Provided*
Orchards and big trees must be avoided from the cutting. Minimum trees should be cut and for each tree cut plantation should be done.	Forest Department Rahim Yar Khan	
Hunting of local fauna must be prohibited by the contractor during the construction phase. Training on ecological preservation should be delivered to contractor staff.	Forest Department Bahawalpur	
Tree plantation drive must be carried out in the affected areas of project facilities and also promote landscaping to enhance the aesthetic beauty of the area.	Forest Department Bahawalpur	
Major crops in the area include wheat, sugarcane, rice, etc	Agriculture Department Rahim Yar Khan	
The area where the towers will be constructed will no longer be used by the farmers and will have economic effects on them.	Agriculture Department Rahim Yar Khan	
avoid construction activities in major cropping season to minimize the loss of the crops.	Local Gov Department Dahrki	
Migratory birds such as Partridges and Geese should not be interrupted in migratory season, also breeding shelters for the birds should be undisturbed.	Wildlife Department Rahim Yar Khan	
Wildlife species in the project surrounding such as reptiles, Indian pangolin, snakes and lizards, should be of major concern.	Wildlife Department Rahim Yar Khan	
Worker camps construction should be made away from residential areas and resting areas of animals and birds.	Wildlife Department Rahim Yar Khan	

NTDC = National Transmission and Despatch Company

7.3 Information Disclosure

566. ADB SPS environmental Policy Principle #6 requires the borrower to "Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders."

567. The executive summary of the IEE and the EMP will be translated to Urdu language[116] for disclosure along with complete existing document (in English). Within 2 weeks after ADB's clearance of the IEE, the summary (including the EMP) in Urdu language will be disclosed on NTDC's website. The summary will also be placed at main gate of Rahimyar Khan and Bahawalpur Grid Stations for public access. During

[116] Saraiki is the predominant language being spoken by majority of the population of the Subproject area followed by Urdu; However, Punjabi, Sindhi, Balochi, Marwari, and Pushto are also spoken. All the Subproject affected people understand Urdu (see para. 360 on page 95).

construction phase, complete document along with translated executive summary to Urdu language will be kept at main gate of construction camp for access to public.

568. Provincial EPA will also disclose EIA on its website before the public hearing and NOC award. The disclosure on the website with the invitation for participation in public hearings, which is required by the law before approval is granted, will be announced by EPA through public advertisement in the local and national newspapers.

7.4 Grievance Redress Mechanism

569. NTDC will establish a mechanism to receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance. NTDC at site will be the PMU. The PMU will overall be responsible for executing the work at site. The Executive Engineer/Resident engineer will be in charge of the project. The Executive Engineer will be supported with Sub Divisional Officers and other supporting staff.

570. The GRM will be established at each project location as described below:

571. A grievance mechanism will be available to allow affected persons appealing any disagreeable decision, practice or activity arising from land or other assets compensation. affected persons will be fully informed of their rights and of the procedures for addressing complaints whether verbally or in writing during consultation, survey, and time of compensation.

572. Affected persons/ local community will enter their complaints/ concerns and issues formally including the information of date, name and address of complainant, description of complain. The Assistant Manager (social mobilization) at PMU will maintain a register named as *"community complaint register (CCR)"*. The register will include the information such as date, name and address of complainant, description of complaints, and will enter the complaints in a date covering the minimum information of name and address of complaint, description of complaints, action taken, status of redress of complaints and reasons in case issue not resolved.

573. Prior to the contractor's mobilization to the project site NTDC ESIC will assist the affected communities to establish a Grievance Redress Committee (GRC) and identify local representatives to act as Grievance Focal Points (GFP) for that community. GRC will work at field level, while unsettled issues will be referred to the PMU at sub-project level. The field level PMU will inform the affected persons about GRC and its mechanism by passing the information at known places. The GRC will comprise of:

- Executive Engineer (NTDC)
- EHS Manager under ESIC, NTDC
- FMC-IESS, FMC-NESS, and FMC-NEIs
- Representative of Contractor; and
- GFP of relevant community

574. The function of the GRC is to address the project related grievances of the affected parties that are unable to be resolved satisfactorily through the initial stages of the GRM procedure.

575. The GFPs are designated personnel from within the community who will be responsible for: i) acting as community representatives in formal meetings between the project team (contractor, FMC, EHS Manager under ESIC, ESIC and the local community

he/she represents and ii) communicating community members' grievances and concerns to the contractor during project implementation.

(i) A pre-mobilization public consultation meeting will be convened by ESIC and attended by GFPs, contractor, FMC, ESIC representatives and other interested parties (e.g. District level representatives, NGOs). The objectives of the meeting will be as follows: Introduction of key personnel of each stakeholder including roles and responsibilities.

(ii) Presentation of project information of immediate concern to the communities by the contractor (timing and location of specific construction activities, design issues, access constraints etc.). This will include a brief summary of the EMP - its purpose and implementation arrangements.

(iii) Establishment and clarification of the GRM to be implemented during project implementation including routine (proactive) public relations activities proposed by the project team (contractor, FMC, ESIC) to ensure communities are continually advised of project progress and associated constraints throughout project implementation.

(iv) Identification of members of the GRC;

(v) Elicit and address the immediate concerns of the community based on information provided above.

576. Following the pre-mobilization public consultation meeting, environmental complaints associated with the construction activity will be routinely handled through the GRM as explained below and shown schematically in **Figure 7-2**:

(i) Individuals will lodge their environmental complaint/grievance with their respective community's nominated GFP.

(ii) The GFP will bring the individual's complaint to the attention of the Contractor.

(iii) The Contractor will record the complaint in the onsite Environmental Complaints Register (ECR) in the presence of the GFP.

(iv) The GFP will discuss the complaint with the Contractor and have it resolved.

(v) If the Contractor does not resolve the complaint within one week, then the GFP will bring the complaint to the attention of the CSC's Environmental Specialist. The SC's Environment Specialist will then be responsible for coordinating with the Contractor in solving the issue.

(vi) If the Complaint is not resolved within 2 weeks, the GFP will present the complaint to the GRC.

(vii) The GRC will have to resolve the complaint within a period of 2 weeks and the resolved complaint will have to be communicated back to the community. The Contractor will then record the complaint as resolved and closed in the Environmental Complaints Register.

(viii) Should the complaint not be resolved through the GRC, the issue will be adjudicated through local legal processes.

(ix) In parallel to the ECR placed with the Contractor, each GFP will maintain a record of the complaints received and will follow up on their rapid resolution.

(x) ESIC will also keep track of the status of all complaints through the Monthly Environmental Monitoring Report submitted by the Contractor to the FMC and will ensure that they are resolved in a timely manner.

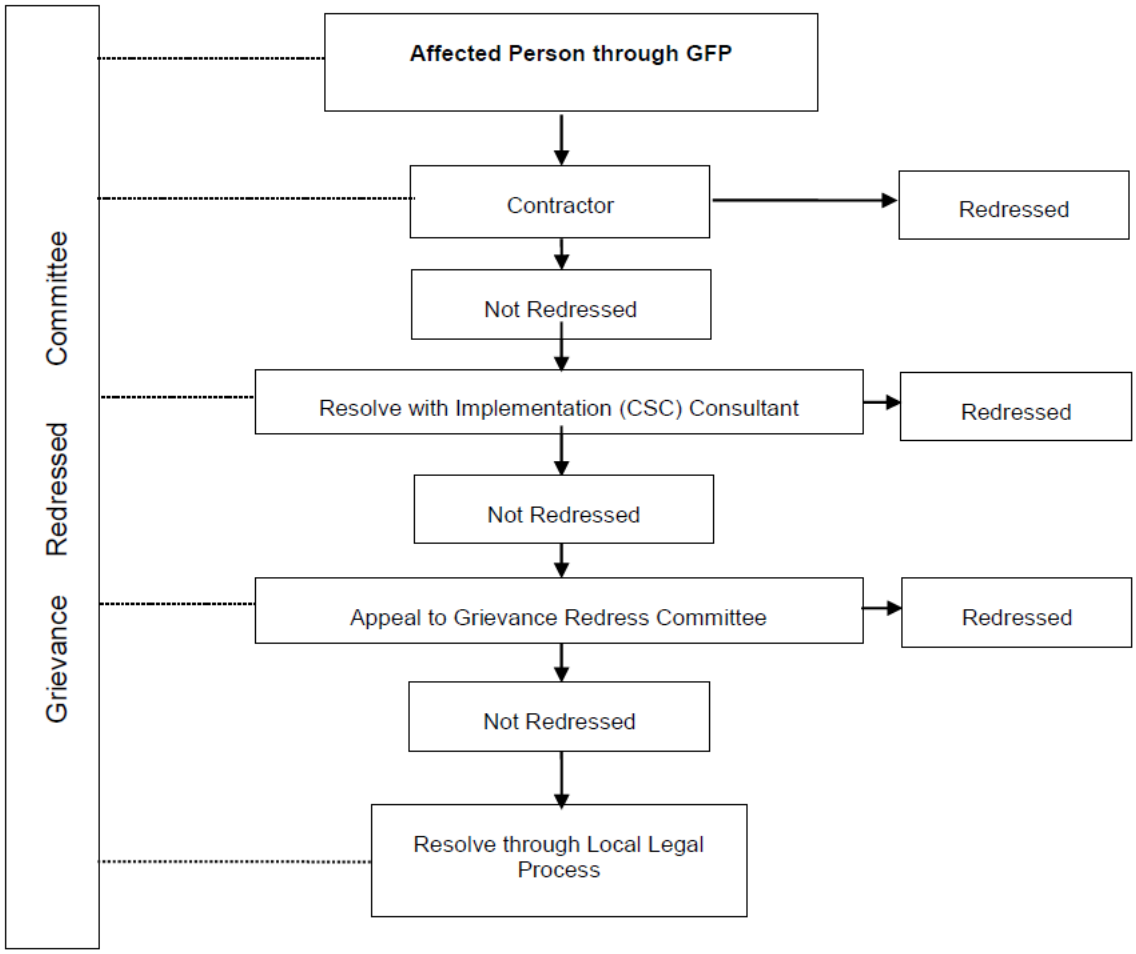


Figure 7-2: Grievance Redress Mechanism

577. An Organogram showing the institutional arrangements has been illustrated through a diagram presented in **Figure 7-3.**

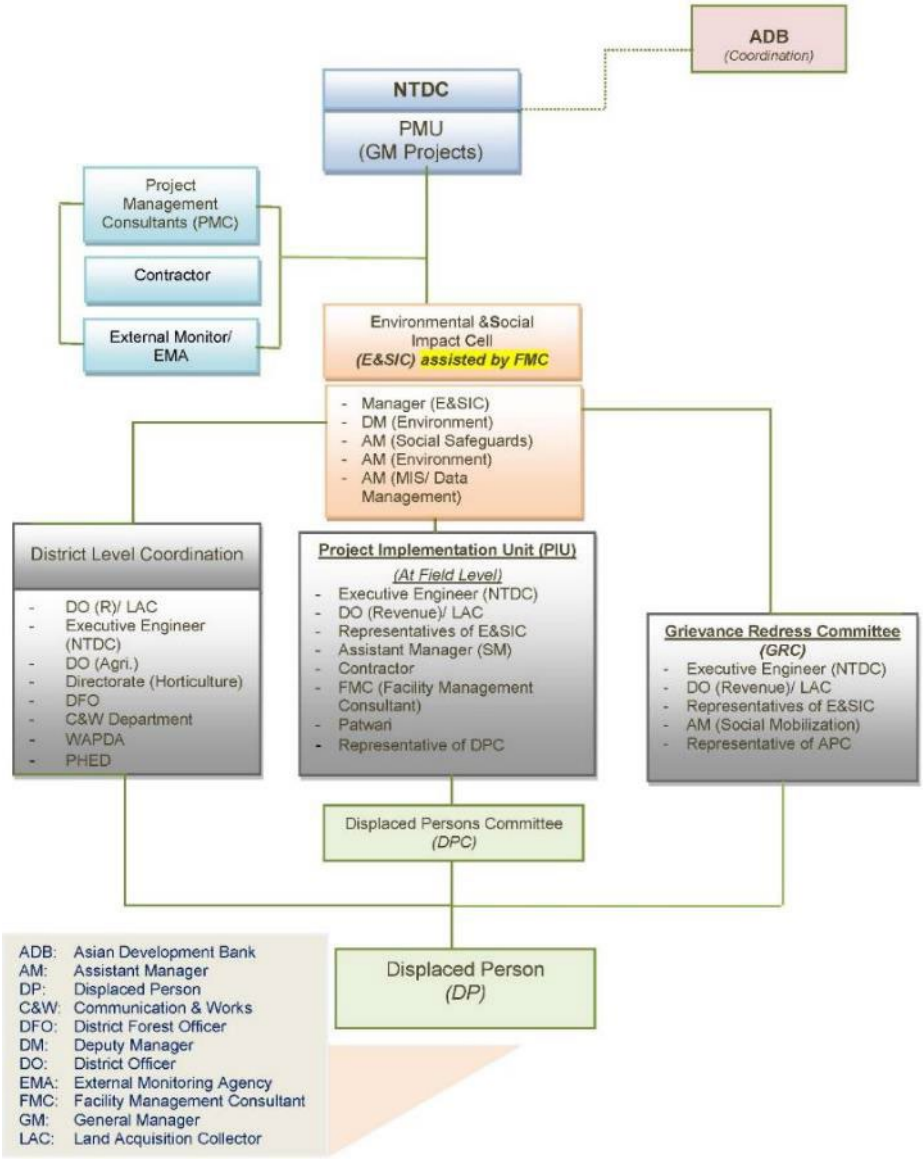


Figure 7-3: Institutional set-up

8. Environmental Management Plan

578. This section provides an overall approach for managing and monitoring the environment-related issues and describes the institutional framework and resource allocations proposed by NTDC to implement the Environmental Management Plan (EMP) for the ETL construction.

579. The bid documents must include the EMP, and its implementation cost must be reflected in the bill of quantity (BoQ).

8.1 General

580. The main objectives of EMP are to:

- Provide the details of the project impacts along with the proposed mitigation measures, and a corresponding implementation schedule.
- Define the responsibilities of the project proponent, contractor, supervisory consultants, and other role players, and effectively communicate environmental issues among them.
- Define a monitoring mechanism, reporting frequency, auditing and identifying monitoring parameters to ensure that all the mitigation measures are completely and effectively implemented.
- Identify the resources required to implement the EMP and outline the corresponding financing arrangements.

8.2 Construction Schedule

581. As mentioned in **Section 3.7**, The Project Proponent (NTDC) plans to have the tranche-4 completed within 2 to 3 years, after completing the necessary arrangements, on the fast track. There will not be any significant land acquisition or compensation process except for the crop compensation of the ETL towers. Designs, power transmission arrangements, access, review of environmental management and construction processes will need to be completed in about three months after tranche 4 readiness approval by ADB. When the detailed designs are completed, tendering and award of contract will take place over about three to six months. The construction period will follow, and best estimates indicate between eighteen to twenty-four months.

582. **Table -: Implementation Arrangements for Tranche 4**

Aspects	Arrangements
Implementation period	January 2023–June 2026
Estimated completion date	30 June 2026
Estimated loan closing date	23 August 2026

8.3 Summary of Impacts and Mitigation Measures

583. The environmental protection and enhancement are achieved in various ways. These approaches should begin right at the embryonic stage i.e. i) project location, ii) design, specifications and tender/contract documents, iii) construction activities and iv) post completion activities i.e. operation and maintenance stage. Appropriate environmental management measures are required to be exercised in a cascade order by NTDC at each stage of the project.

584. An EMP establishes the linkages between the environmental and social impacts, mitigation strategy and the agencies responsible for execution. Thus, the EMP in **Table 8-1** cover:

- A comprehensive listing of mitigation measures (actions).
- The institution(s)/ person(s) responsible for implementation of specific actions.
- The parameters to be monitored to ensure the effective implementation of the actions.
- A timescale for the implementation of actions has been indicated subject to the project life cycle and indicated as During Construction or During Restoration.
- Set out a basis for preparing SSEMP by the Contractor.

585. The Instrumental Environmental Monitoring Plan is presented in **Table 8-4**.

Table 8-1: Environmental Management Plan (EMP)

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
Pre-construction (design) phase					
Lack of Integration of IEE/EMP/EIA Requirements into Construction Bid Documents	1. The ESIC should be assigned the task to check that design and bid documents are responsive to key environmental, social, and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP. 2. The bid documents must include the EMP, and its implementation cost must be reflected in the bill of quantity (BoQ).	Bid Preparation	BOQ	NTDC	ESIC, NTDC
586. Lack of planning in ETL design[117] •	3. Using corridor-sharing with existing ETLs to minimize RoW requirements. 4. Preference will be given to a route with a minimum community displacement and minimum tree cutting requirement 5. Better planning during the selection of RoW will generate fewer negative socioeconomic impacts on the affected persons. 6. Selection and use of the latest available technology for reducing the EMF from ETLs. 1. ETLs to be designed for higher resilience to climate change impacts to ensure the transmission network resilient to climate change and natural disaster. 7. Choosing a ETL tower with aesthetic appeal such as the darker color of oxidized steel structures may blend in better with forested backgrounds.	Well before the commencement of the construction phase	RoW of ETL	NTDC with the design consultant	NTDC

2. [117] Covering (i) Route Selection, (ii) Transmission, (iii) Structure Design, (iv) Tower Placement Add-ons, and (v) Visual Amenity, (vi) Mechanical Failure of the Overhead Conductors.

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	8. Making minor adjustments in tower locations to avoid archeological sites or minimize effects on agricultural operations. 9. Adding flight diverters to conductors to minimize bird collisions with the wires. 10. Location of high-voltage transmission and distribution lines in less populated areas, where possible, to mitigate the impact on visual amenity and noise. This will also create fewer land acquisition and resettlement issues.				
Improper Location of Camps Leading to Environmental and Social Issues	11. Camp locations at least 200-300 m from the sensitive receptors including settlements and water bodies. 12. Development of the campsite plans indicating walkways, car parking, recreational areas, rooms, kitchen, dining, storm run-off, toilets and sewerage lines and treatment, disposal, freshwater storage, and lines, etc.	Well before the commencement of the construction phase	Camps Location	Construction Contractor with FMC	NTDC
Lack of Project environmental safeguards (human resource) capacity	13. The ESIC/PMU to make sure that it is staffed by EHS Manager, Deputy EHS Manager and Assistant EHS Manager in addition to social safeguard staff. 14. The ESIC/PMU to ensure, contractor's environmental safeguards capacity before construction starts. Make sure that the Construction Contractor assigns and retains a full-time and qualified ESO and a full-time and qualified HSO.	During bidding and before construction starts	Bid document and contractor human resources	ESIC/ PMU	NTDC
Removal of vegetation/trees	15. Incorporate technical design measures to minimize the removal of these trees, as far as possible. 16. Compensatory planting of ten (10) trees against each fallen tree of similar floral function will be planted. 17. The plantation plan will prefer the prevalent indigenous species of plants and ensure that there will	Well before the commencement of the construction phase	RoW of ETL	NTDC with the design consultant	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	be no exotic species in the plantation plan with known environmental setbacks.				
Noise caused by construction equipment	18. Conduct detailed acoustic assessment for all residential buildings, schools, (other sensitive structures) within 50 m of RoW. 19. After the assessment, identify the areas where noise barriers are required. 20. Also, suggest noise-reducing devices on equipment such as mufflers and silencers. 21. The audible noise of the ETL is most severe under wet conditions. During detailed design, it will be ensured that audible noise under wet conditions is within acceptable limits. 22. During detail design, it will be ensured that audible noise as per CISPR18-2 “Methods for measurement of RI characteristics of overhead power lines and high voltage equipment” will be either category-I (which is Interference not audible) or category-ii (which is Interference just perceptible).	Well before the commencement of the construction phase	RoW of ETL	Construction Contractor with FMC	NTDC
Land Acquisition	23. NTDC to select the route in a way that minimizes impact on trees and crops occur. 24. Assessment of loss of land, trees, and crops (if any) due to the construction of ETL towers. 25. Preparation of land acquisition and resettlement plan (LARP) for the proposed Project before the commencement of construction activities. 26. All the impacts identified by the IEE will be incorporated into the project LARP and relevant entitlements will be included in the Entitlement Matrix.	Well before the commencement of the construction phase	RoW of ETL	NTDC with the design consultant	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	27. All the payments/entitlements are paid according to the Entitlement Matrix, prepared according to the LARP.				
Waste Generation	28. Identify enough locations for disposal of transformer oils, unsuitable soils, and scrap metal “cradle to grave”. 29. The unit rates to include in contracts to cover the cost of disposal. 30. Designate disposal sites in the contract and cost unit disposal rates accordingly.	Well before commencement of the construction phase	RoW of ETL	NTDC with the design consultant	NTDC
Disruption to Existing Drainage Pathways and Utilities	31. Identify locations where drainage or irrigation crossing, and utilities within RoW may be affected by works. 32. Include in protection works contract as a payment milestone(s)	Well before the commencement of the construction phase	RoW of ETL	Construction Contractor with FMC	NTDC
Impacts on Sensitive and High Value Areas	33. Siting the Project facilities away from any residential area. 34. If, siting of Project facilities cannot be avoided altogether, the area of disruption should be minimized, and the impacts should be mitigated.	Well before the commencement of the construction phase	RoW of ETL	Construction Contractor with FMC	NTDC
EMF	35. NTDC’s standard operating procedures (SOPs) of a minimum vertical ground clearance for ETL conductor of 7 meters will be ensured. 36. Raising conductor height above the ground to 8 m, typically by increasing tower height, will be ideal. 37. Reducing conductor spacing. 38. Arranging phases so that fields tend to cancel. 39. Increasing transmission voltage (since EMF intensities are a function of current, and increased	Well before the commencement of the construction phase	RoW of ETL	Construction Contractor with FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	voltage, all things being equal, will result in reduced current). 40. Reducing loads (and therefore, currents). 41. Identification of potential exposure levels in the work area including surveys of exposure levels and establishment of safety zones. 42. Safety signs and warning zone will be highlighted to indicate EMF in the area 43. Limit access to properly trained workers and those equipped with appropriate PPE when entering safety zones. 44. Increasing RoW widths or buffer zone widths, to move people further from ETLs.				
Impact on Community Safety due to Structure/ Mechanical Failure of the overhead conductors	45. Ensure all safety aspects related to the safety of the structure are considered. 46. Ensure seismic design requirements are incorporated in the Project design. 47. The ETL will be constructed using very robust design and there is a very low probability of mechanical failure even under extreme weather conditions. 48. Nonetheless, following special arrangements will be made in this section to ensure safety in case of mechanical failure of the ETL conductors. 49. Installation of special tower/pole structures that would support a long span of up to 500 m so that no tower/pole has to be installed inside the streets. 50. Special tower/pole structures will be designed with load safety margin factor of 2.5 instead of generally used 1.5, thus having an extraordinary strength	Well before the commencement of the construction phase	RoW of ETL	Construction Contractor with FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	bearing margin to cater for any untoward mechanical hazardous situation. 51. Special tower/pole structures will be designed to achieve enhanced vertical ground clearance of 15-20 meters whereas the standard requirement of ground clearance of 220 kV line is 7.1 meter. 52. Installation of grounded metallic mesh beneath the lowest conductor to act as fall arrester in case of mechanical failure of the conductor in residential areas.				
Construction Phase					
Dust from construction activity and Air emissions from construction equipment and vehicles	1. Water will be sprinkled through a dedicated water-bowser at source, around the construction site and, along the routes used for construction activities to prevent the generation of dust and to minimize the levels of dust within the vicinity of orchards and fruit farms. 2. A speed limit of not more than 30 kilometers per hour (km/h) will be imposed on the vehicles in areas where the potential for dust generation is greater including unpaved roads. 3. Fuel-efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions. 4. Vehicles transporting soil, sand and other construction materials will be covered. 5. The movement of vehicles through densely populated areas will be avoided. 6. Water will be sprayed at bare areas that are prone to high dust emissions.	During Construction	Project-wise facilities and construction sites	Construction Contractor Oversee by FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	7. Stockpiled soil and sand will be kept slightly wet before loading, particularly in windy conditions. 8. Dust emissions at the camp and construction sites to be minimized by implementing good housekeeping and sound management practices. 9. All project vehicles and other equipment will be maintained as per PEQS for vehicular emissions. 10. The construction material will be stored in the boundary wall and no disturbance to surrounding areas is expected. The contractor will be, however, required to provide a traffic management plan before the commencement of work at the site. 11. The need for large stockpiles will be minimized by careful planning of the supply of materials from controlled sources. Stockpiles (if required) will not be located within 50 m of schools, hospitals or other public amenities such as wells and pumps and should be covered with tarpaulins when not in use and at the end of the working day to enclose dust. 12. Concrete plants will not be located close to any sensitive receptors. 13. A check will be kept by the NTDC that no construction will be allowed within 100 m of the ETL.				
Noise from construction vehicles and heavy equipment	14. Noise monitoring will be carried out at edge of RoW or at boundary wall of communities located within 100 m of RoW, if required, to assess compliance with day and nighttime noise limits of 55 dBA and 45 dBA prescribed in the PEQS. 15. All heavy equipment and machinery will be maintained as per PEQS for vehicular noise emissions and with effective noise controlling devices in place such as silencers.	During Construction	Project-wise facilities and construction sites	Construction Contractor Oversee by FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	16. Noise from the construction of Grid Stations is not covered under any regulations however to keep in line with the best international practice, construction will not be allowed during nighttime (10 PM to 6 AM) and will not only be conducted during daytime. 17. Vibration from the construction of piles to support pads may be required for some tower construction and maybe a significant impact but this should be for a short duration. Where vibration could become a major consideration (within say 100 m of schools, religious premises, hospitals or residences) a building condition survey will take place before construction. 18. The physical effect of piling will be assessed before construction and measures will be discussed with the local population as well as the timing of the works to serve as a vehicle for further public consultation at the implementation stage and to assist in public relations. 19. At nearby schools, the contractor will discuss with the school principals the agreed time for operating these machines and completely avoid machine use near schools during examination times, if such a need arises. 20. The noise level from construction activity can be reduced by regular maintenance of machinery. 21. Noise can be controlled through engineering control e.g. hammering actions can be substituted by hydraulic. Ensure that the workers are wearing necessary personal protection equipment (PPE's) such as earplugs, earmuffs, etc. where engineering control is not applicable to reduce the impact of noise.				

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	22. Equipment emitting excessive noise in comparison with other similar equipment will not be allowed to operate. 23. Equipment under use will be regularly maintained, tuned, and provided with mufflers and speed controls to minimize noise levels. 24. Blowing horns on all access roads except under emergency conditions will be prohibited. 25. Muffled breakers and silenced diesel generators and compressors will be used to reduce construction noise. 26. Contractor will take necessary measures to minimize noise nuisance using acoustic enclosures and barriers. 27. A check will be kept by the NTDC that no construction will be allowed within 100 m of the ETL.				
Sediment run-off from construction sites	28. All construction workers will be provided awareness training on the prevention of waste generation and spill prevention. 29. The topsoil can be preserved and used after the restoration of construction campsites and storage areas after the construction period. 30. Surplus excavated material will be disposed of at appropriate or designated sites and will be disposed of in a manner that does not disturb the natural and community drainages and tracks. 31. Equipment will be maintained properly to minimize oil or fuel leakages from construction machinery. Clean-up will be undertaken in the event of an oil spill larger than half a liter. This will include the removal of contaminated soil and disposal at a proper location.	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	32. A Spill Prevention and Response Plan will be prepared including the induction of staff for spill prevention and management. 33. All storage fuel tanks will be marked with their contents and stored in diked areas with an extra 10% of the storage capacity of the fuel tank. The area will be lined with an impervious base. 34. Grease traps will be constructed wherever needed, to prevent the flow of oily water into drainage channels or waterbodies. 35. Spill cleanup kits (shovels, plastic bags, and absorbent materials) will be available near fuel and oil storage areas. Should any accidental spills occur, the immediate cleanup will be undertaken, and all cleanup materials will be stored in a secure area for further disposal. Disposal of such will be undertaken by a waste management company contracted by the Contractors. The waste management company must have the required licenses to transport and dispose any hazardous waste before any such waste is removed from the site. The Contractors will keep copies of the company's licenses and provide waste transfer manifests at their camp site for routine inspection by the engineer. 36. Cleanup kits will be carried in all fuel trucks. 37. Fueling of construction vehicles and machinery will take place at designated places or over impermeable surfaces for fixed machinery. 38. Hazardous materials will be stored in designated places having impervious linings. 39. Schedule works in sensitive areas (e.g. water bodies) for the dry season.				

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	40. Temporary erosion control plan one month before the commencement of works. 41. Proper installation of TD and EC before works within 50 m of water bodies. 42. Cut areas will be treated against flow acceleration while filled areas will be carefully designed to avoid improper drainage. 43. Stockpiles will not be formed within such distances behind excavated or natural slopes that would reduce the stability of the slopes. 44. In the short-term, either temporary or permanent drainage works will protect all areas susceptible to erosion. 45. Measures will be taken to prevent pounding of surface water and scouring of slopes. Newly eroded channels will be backfilled and restored to natural contours. 46. Contractor will arrange to adopt suitable measures to minimize soil erosion during the construction period. Contractor will consult concerned authorities in the area before deciding mitigation measures. 47. Clearing of green surface cover to be minimized during site preparation. 48. Replanting trees to be done before the site is vacated and handed back to NTDC with appropriate trees (other vegetation cover as appropriate) to ensure interception of rainwater and the deceleration of surface run-off.				
Impact on Water Resources Quality and Quantity	49. Erosion and sediment flash-control measures will be employed and maintained where necessary. 50. Washing vehicles will be allowed only in designated places such as local car wash or a similar facility to be built at the site with the provision of oil-water	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	separators (OWS) and waste collection pits. Further details on the construction of OWS, waste collection pits, and the handling of contaminated waste are included in the Spill Prevention and Waste Generation sections. 51. Equipment will be maintained properly to minimize oil or fuel leakages from construction machinery. 52. No effluents will be released to the environment untreated, 53. All types of solid and liquid wastes will be handled and disposed of as per disposal plan. 54. The natural drainages will be restored after completion of civil works of the tower foundations in areas where tower locations fall within the catchment of dry stream beds. 55. The source of water for construction from authorized abstraction sources will be agreed between the local communities, local government, and the contractor. 56. Water conservation techniques will be developed and implemented by the contractor. 57. Access routes of the community to water sources will be kept clear and open so that the community's ability to meet its water requirements are not compromised. 58. Care will be exercised while moving heavy machinery to avoid damage or blockage of natural waterways and channels. 59. Records will be kept of water usage in all Project activities. 60. Construction camp and residential camp will not be built nearby water bodies.				

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	61. Consideration of weather conditions when construction activities are undertaken. 62. Limitations on excavation depths in use of recharge areas for material exploitation or spoil disposal. 63. Use of landscaping as an integrated component of construction activity as an erosion control measure. 64. Minimizing the removal of vegetative cover as much as possible and providing for its restoration where construction sites have been cleared of such areas. 65. Compile temporary drainage management plan one month before commencement of works. 66. Proper installation of Temporary Drainage (TD) and Erosion Control (EC) before works within 50 m of water bodies. 67. Proper construction of TD and EC measures, maintenance and management including training of operators and other workers to avoid pollution of water bodies by the considerate operation of construction machinery and equipment. 68. Storage of lubricants, fuels, and other hydrocarbons in self-contained dedicated enclosures >50 m away from water bodies. 69. Proper disposal of solid waste from construction activities and labor camps. 70. Cover the construction material and spoil stockpiles with a suitable material to reduce material loss and sedimentation and avoid stockpiling near to water bodies. 71. Topsoil stripped material will not be stored where natural drainage will be disrupted.				

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	72. Borrow sites (if required) will not be close to sources of drinking water.				
Untreated disposal of effluent from worker camps and batching plant(s)	73. Ensure safe storage and handling of fuels, oils, and other hazardous substances according to standard safety practices. Disposal should be carried out through Punjab EPA approved contractors and facilities. 74. All efforts will be made for the proper disposal of solid waste, applying principles of reducing waste as far as possible, reusing what is practical and recycling all recyclable materials. 75. The solid waste generated during construction and campsites will be safely disposed of in demarcated waste disposal sites and the contractor will provide a proper waste management plan. 76. The sewage system for camps will be properly designed (pit latrines or, as required, septic tanks) to receive all sanitary wastewaters. 77. The solid residue from the septic tanks will be transported to the nearby municipal sewage disposal site. 78. Lined wash areas will be constructed within the campsite or at the site, for the receipt of wash waters from construction machinery; and ensure proper labeling of containers, including the identification and quantity of the contents, hazard contact information, etc. 79. Construction workers and supervisory staff will be encouraged and educated to practice waste minimization, reuse, and recycling to reduce the quantity of waste.	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
Vibration	80. Construction will not be allowed during nighttime (10 PM to 6 AM) and will only be conducted during daytime. 81. Vibration from the construction of piles to support pads may be required for some tower construction and maybe a significant impact but this should be for a short duration. Where vibration could become a major consideration (within say 100 m of schools, religious premises, hospitals or residences) a building condition survey will take place before construction. 82. Use of better equipment with less vibration effects will be used such as Free-Suspended Vibrators (FSV).[118] 83. The physical effect of piling will be assessed before construction and measures will be discussed with the local population as well as the timing of the works to serve as a vehicle for further public consultation at the implementation stage and to assist in public relations. At nearby schools, the contractor will discuss with the school principals the agreed time for operating these machines and completely avoid machine use near schools during examination times, if such a need arises. 84. Ensure that the workers are wearing necessary personal protection equipment (PPE's) such as earplugs, earmuffs, etc. where engineering control is not applicable to reduce the impact of noise. 85. Equipment under use will be regularly maintained, tuned, and provided with mufflers and speed controls to minimize noise levels.	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

[118] https://www.vpgroundforce.com/gb/footer-links/useful-links/industry-resources/reducing-ground-vibrations-during-the-piling-proce/

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
Traffic Congestions	86. Efforts will be made to minimize the use of heavy trucks by preferring transport of equipment and supplies using 4x4 pickups, wherever possible, and, 87. A speed limit of not more than 30 km/h will be imposed near settlements, on unpaved roads, and on link roads for reducing traffic accident risks and dust generation. 88. A traffic management plan, if required, will be prepared and submitted to NTDC one month prior to start of works. Vicinity of schools, hospitals, and communities will be considered while preparing plans and will be avoided to the extent feasible. 89. Plan of alternate routes for heavy vehicles will be formulated and implemented. Existing roads will be used wherever practical for transportation of materials and a 'no-short-cut' policy will be used. 90. While preparing a plan of access routes, existing conditions of roads and bridges will also be considered to see for any requirement of widening and upgrading access paths and roads. 91. Traffic warning signs will be installed, and traffic regulations will be enforced during the transportation of materials and equipment, and machinery. 92. Nighttime construction traffic will be avoided as much as possible. 93. Drivers will be instructed to give way to locals while driving on access tracks, to keep a close watch for wild/domestic animals and children while driving, and to not throw any litter or cigarettes out of the vehicle. 94. The use of canal flood protection bunds for the movement of heavy vehicles will be minimized. Wooden/damaged bridges on canal/river/ other	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	crossings will not be used for the movement of heavy vehicles. 95. Dry stream beds will not be used as access routes. 96. Any damage to access tracks, metaled roads, watercourses or the canal/river protection bunds, etc., will be appropriately repaired to bring these structures to their pre-construction condition. Any damage, which may cause hardship to the local community or wildlife, will be immediately repaired.				
Disposal of spoils and waste materials	97. Ensure safe storage and handling of fuels, oils, and other hazardous substances according to standard safety practices. Disposal should be carried out through Punjab EPA approved contractors and facilities. 98. Management and storage of fuel, waste oil, hazardous waste will be planned in accordance with EHS General Guidelines on Hazardous Materials Management.[119] This includes the use of appropriate secondary containment structures capable of containing the larger of 110 % of the largest tank or 25% of the combined tank volumes in areas with above-ground tanks with a total storage volume equal or greater than 1,000 liters. 99. All efforts will be made for the proper disposal of solid waste, applying principles of reducing waste as far as possible, reusing what is practical and recycling all recyclable materials. 100. The solid waste generated during construction and campsites will be safely disposed of in demarcated waste disposal sites and the contractor will provide a proper waste management plan as part	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

[119] https://www.ifc.org/wps/wcm/connect/90231ba8-5bb3-40f4-9255-eaf723d89c32/1-5%2BHazardous%2BMaterials%2BManagement.pdf?MOD=AJPERES&CVID=nPtgwmI

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	of SSEMP. A framework waste management plan is attached as **Annexure XII.** 101. The sewage system for camps will be properly designed (pit latrines or, as required, septic tanks) to receive all sanitary wastewaters. 102. The solid residue from the septic tanks will be transported to the nearby municipal sewage disposal site. 103. Lined wash areas will be constructed within the campsite or at the site, for the receipt of wash waters from construction machinery; and ensure proper labeling of containers, including the identification and quantity of the contents, hazard contact information, etc. 104. Construction workers and supervisory staff will be encouraged and educated to practice waste minimization, reuse, and recycling to reduce the quantity of waste.				
Impact on Occupational Health and Safety	105. Provide adequate personal protective equipment (PPE) as per the job requirements and install warning signs at construction sites and camps. 106. Allow only trained and certified workers to install electrical equipment with safety and insulation measures in place. 107. Test structures for integrity prior to undertaking work. 108. Prepare and implement fall protection program that will include training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others.	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	109. The fall protection system will be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point and fixtures will be installed, wherever possible, to facilitate the use of fall protection systems. 110. Provide adequate work-positioning device system for workers to the extent possible. 111. Properly maintained hoist equipment will be used along with properly trained personnel. 112. Proper safety belts will be provided. The Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength. 113. Use a backup safety strap when operating power tools at height. 114. Remove signs and other obstructions from poles or structures prior to undertaking work. 115. Provide an approved tool bag for raising or lowering tools or materials to workers on structures. 116. Prepare and implement EMF safety program to prevented or minimize occupational hazards due to exposure to EMF. 117. The contractor will prepare OHSE Management Plan as part of SSEMP. Also include the provision of a safety champion program to be initiated monthly to encourage workers to adhere with H&S requirements. 118. The plan will also include impacts and mitigation measures related with COVID-19. COVID-19 control and prevention. 119. The plan will also include details related to labor working conditions and details on prohibiting child labor.				

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	120. Identify potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities. 121. Train workers in the identification of occupational EMF levels and hazards. 122. Establish and identify safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers. Prepare and implement action plans to reduce adverse impact of EMF and to address occupational exposure. Action plans may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials. 123. Worker's Accommodation Plan will be prepared in reference to Workers' Accommodation: Processes and Standards[120] as part of SSEMP and implemented.				
Habitat loss and impact on mammals, amphibians, birds, and reptiles	124. If tree cutting is unavoidable for RoW clearance, the contractor will keep a record of cutting trees. 125. During plantation, ten-time (1 x 10 times) more plants will be planted. 126. Before the plantation campaign, the forest department will be consulted on the selection of local species. 127. Provide adequate knowledge to the Project workers on relevant government regulations and	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

[120] A guidance note by IFC and the EBRD Workers' Accommodation: Processes and Standards (August 2009)

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	punishments for illegal poaching to prevent hunting, trapping and exploitation of wildlife 128. Minimize disturbance to, or movement of, soil and vegetation to prevent soil damage and erosion leading to spread of alien invasive plant species. 129. Revegetate disturbed areas with native plant species 130. Ensure that solid and liquid waste is disposed only at designated locations, to prevent pollution of the water bodies in the AOI and vicinity. 131. In addition to this, sprinkle water twice or thrice a day (as per needed) to avoid dispersal of dust on the adjacent flora. 132. Lights used in the camps, during the construction of towers will be kept to the minimum requirement. 133. Upward scattering lights will preferably be used. 134. Vehicle speed will be controlled to avoid incidental mortality of small mammals and reptiles. 135. The contractor's staff and labor will be strictly directed not to damage any vegetation such as trees or bushes. 136. Clearing of green surface cover for construction, for borrow for development, and cutting trees and other important vegetation during construction will be minimized.				
Increased Employment Opportunities and Local Economy	137. The contractor and sub-contractors will explain the recruitment process to local communities. 138. Local candidates will be given preference for jobs provided they have the required qualifications and skills for the announced positions;	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	139. Coordinate efforts to recruit unskilled labor, if any are required under the Project, from the adjacent areas. 140. Determine what is 'fair and transparent' in the distribution of jobs between different community groups in consultation with local communities and their leaders. 141. As the nearby economy is mostly based on agriculture, it will be ensured that construction activities do not disturb or disrupt agricultural activities in the surrounding areas. 142. Local communities will be consulted before the start of work.				
Overburden on Local Resources	143. Construction Contractor will prepare a resource conservation plan. 144. The use of water will not disturb public water availability and the source of water will be selected carefully. 145. Contractor to source raw material and camp utilities from nearby major city to avoid overburden on local resources.	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC
Social Conflicts due to Influx of Workers	146. Require non-locals employed by the Project to adhere to a social 'code of conduct' in terms of relations with local communities including restricting their movement to stay within camping sites. 147. Provide employees and visitors with cultural awareness training.	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC
Impact on Community Health and Safety	148. The camping sites of the Project site will be completely fenced off before the commencement of any other construction activities.	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	149. Access to the site will be controlled and unauthorized people will not be allowed to enter. Workers will not allow socializing with local communities. 150. Potential for the spread of vector-borne and communicable diseases (such as COVID-19, HIV infection, etc.) from labor camps will be suppressed through worker awareness orientation and appropriate accommodation and sanitation systems. 151. Children will not be allowed to enter the site under any circumstances. 152. The prescribed vehicle speed limit will be strictly enforced for community and worker safety. 153. Dust emissions due to vehicular traffic will be minimized by enforcing the speed limit. Water will be sprinkled on unpaved surfaces where necessary. 154. All vehicles used by the project will undergo regular maintenance and will be tuned following the requirements of the PEQS/ NEQS. 155. The labor works with different transmittable diseases will be restricted within the construction site. 156. Efforts will be made to create awareness about road safety among the drivers operating construction vehicles. 157. Timely public notification on planned construction works. 158. Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity & social links. 159. Seeking cooperation with local educational facilities (schoolteachers) for road safety campaigns.				

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	160. Provision of proper safety and diversion signage, particularly at sensitive/accident-prone spots; 161. The use of water will not disturb public water availability and the source of water will be selected carefully.				
Impact on Physical Cultural Resources (PCRs)	162. A chance find procedure is presented in Annexure IX in case of finding any artifact during construction activities				
Uncontrolled Solid Waste Disposal, Communicable Diseases	163. Maintain proper sanitation around construction sites, access to the nearby public lavatories will be allowed or provision of temporary toilets will be made. 164. The construction camp will be provided with toilets with soakage pits or portable lavatories or at least pit latrines. 165. Disposal of surplus materials will also be negotiated through local authority approvals before the commencement of construction. 166. The Project work will not involve any significant cutting and filling, but minor excavations (down to 4m) and piling may be required to create the foundations for towers (if required). 167. It is expected (depending on the mode of contract) that the surface under the towers will need to be scrabbled to remove unstable materials, or to stockpile topsoil. 168. If surplus materials arise from the removal of the existing surfaces from specific areas, it will be used elsewhere on the Project before additional soil, rock, gravel, or sand is brought in.	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	169. The use of immediately available material will generally minimize the need for additional rock-based materials extraction from outside. 170. Contractual clauses will require the contractor to produce a materials management plan (one month before construction commences) to identify all sources of cement and aggregates and to balance cut and fill. 171. The plan will clearly state the methods to be employed before and during the extraction of materials and all the measures to be employed to mitigate nuisances to residents. 172. Financial compensation will not be allowed as mitigation for environmental impacts or environmental nuisance. 173. Contractual clauses will require the contractor to produce a solid waste management plan so that the proper disposal of waste can be ensured. 174. Claims/complaints of the people on construction nuisance/damages close to RoW will be considered and responded to promptly by the Contractor. 175. Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds. 176. The contractor will organize temporary means of access and make alternative arrangements to avoid access problems to the local community and to avoid such short-term negative impacts. 177. Potential for the spread of vector-borne and communicable diseases (such as COVID-19, HIV infection, etc.) from labor camps will be avoided				

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	through worker awareness orientation and appropriate sanitation systems.				
Natural Hazard Risks (Flooding, Earthquakes etc.)	178. The structures of the ETL such as tower bases should be built as per the rules of Pakistan Building Code (PBC). 179. The tower bases should be built considering the local climatic conditions including flooding. 180. Project construction facilities should be built considering climatic conditions such as risk of flesh flooding in case on high precipitation events. 181. Material testing and tensile strength of conductors must be checked before commencement of works	During design and before construction starts	Project-wise facilities and construction sites	NTDC design, Construction Contractor with FMC	NTDC
Operation Phase					
Noise	182. The height of ETL and RoW as per NTDC standard for 220 kV ETL discussed in **Section 3** will be maintained to avoid audible noise issues. 183. In addition to above, much more robust design for ETL and its ground clearance with much higher levels have been proposed for this project due to the Project passing through settlements in parts of the RoW.	During operations	Project-wise facilities and construction sites	ESIC	NTDC
Impact of Faulted SF6	184. Do not breathe the vapors environment remaining in a circuit breaker where arcing or corona discharges have occurred in the gas. 185. Evacuate the faulted SF6 gas from the circuit breaker and flush with fresh air before working on the circuit breaker 186. Arc products that do not recombine, or which combine with any oxygen or moisture present, are	During Operations	RoW of ETL	NTDC	ESIC, NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	normally removed by the molecular sieve filter material within the circuit breaker.				
Electrocution and Collision of birds	187. Maintain 1.5 meter (60-inch) spacing between energized components and grounded hardware or, where spacing is not feasible, covering energized parts and hardware. 188. Install visibility enhancement objects such as marker balls, bird deterrents, or diverters. 189. Make power lines less of an 'obstacle' for birds to collide with. 190. Keep birds away from the power line by making the power lines more visible by placing colorful/fluorescent tape on the towers to make them conspicuous enough to enable birds to see them. 191. Keep power line cables lower to the ground to the extent feasible as these are better for preventing bird collision. 192. Keep vertical separation of cables as less to the extent feasible, as it poses less of an 'obstacle' for birds to collide with. 193. Provide horizontal separation of conductors and construct cage box on conductors to prevent birds from sitting or making nests on the towers; and 194. Construct self-supporting towers, which do not require stay wires.	During Operations	RoW of ETL	NTDC	ESIC, NTDC
Occupational Health and Safety	195. All associated ETLs will be shut down before conducting any repair and maintenance work as per the NTDC's operation and maintenance procedures. 196. Adherence to the standards Occupational Health and Safety Guidelines.	During Operations	RoW of ETL	NTDC	ESIC, NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	197. Allow only trained and certified workers to maintain, or repair electrical equipment with safety and insulation measures in place. 198. Deactivate and properly ground the live power distribution prior to performing work on or in proximity to the ETLs. 199. Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system. 200. Ensure the worker is properly isolated and insulated from the energized part with gloves or other approved insulation and energized part is properly insulated from the worker. 201. Test structures for integrity prior to undertaking work. 202. Prepare and implement a fall protection program that will include training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others. 203. The fall protection system will be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point and fixtures will be installed, wherever possible, to facilitate the use of fall protection systems. 204. Provide adequate work-positioning device system for workers to the extent possible. 205. Properly maintained hoist equipment will be used along with properly trained personnel. 206. Proper safety belts will be provided. The Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength.				

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	207. Use a backup safety strap when operating power tools at height. 208. Remove signs and other obstructions from poles or structures prior to undertaking work. 209. Provide an approved tool bag for raising or lowering tools or materials to workers on structures. 210. Prepare and implement EMF safety program to prevent or minimize occupational hazards due to exposure to EMF. 211. Identify potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities. 212. Train workers in the identification of occupational EMF levels and hazards. 213. Establish and identify safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers. 214. Prepare and implement action plans to reduce adverse impact of EMF and to address occupational exposure. Action plans may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials. 215. Signs and barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers) will be used.				
Community Health and Safety Risk	216. Signs and barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers) will be used.	During Operations	RoW of ETL	NTDC	ESIC, NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	217. Conducting objects (e.g. fences or other metallic structures), installed near power lines, will be grounded to prevent shock. 218. A vertical clearance, required as per international standards, will also be maintained especially near the populated areas. If required, the application of engineering techniques will be considered to reduce the EMF produced by power lines and Grid Stations such as increasing the height of transmission towers, modifying to size, spacing, and configuration of conductors, and shielding with metal alloys (This is effective for reduction of electric field exposure, but not for reduction of EMF exposure.). 219. During the operation stage, a check will be kept by the NTDC that no construction will be allowed within RoW of the ETL. 220. Power lines will be designed, with due consideration to landscape views and important environmental and community features. 221. Use of noise barriers or noise canceling acoustic devices will be considered as necessary. 222. Adherence to regional or national air traffic safety regulations. 223. Use of buried lines when installation is required in flight sensitive areas.				
Visual Amenity	224. Impact on visual amenity due to the transmission and distribution facilities to communities may be visually intrusive and undesirable to nearby residents. 225. However, it is common practice to create some local hard and soft landscaping and successful planting of fruit trees at such sites. This practice should be encouraged as far as practicable. Other opportunities	During Operations	RoW of ETL	NTDC	ESIC, NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	for enhancements can be assessed before construction and proposed enhancements will be discussed with the local population to serve as a vehicle for further public consultation at the implementation stage and to assist in public relations.				
Aircraft Navigation Safety	226. Use of buried lines when the installation is required in flight sensitive areas. 227. Making the power lines more visible by placing colorful/fluorescent tape on the towers and colorful balls on the conductor to make them visible. 228. Keep power line cables lower to the ground to the extent feasible	During Design	RoW of ETL	NTDC	ESIC, NTDC
Cumulative, and Induced impacts	229. NTDC's standard operating procedures (SOPs) of a minimum vertical ground clearance for ETL conductor of 7 meters will be ensured. 230. Raising conductor height above the ground to 8 m, typically by increasing tower height, will be ideal. 231. Reducing conductor spacing. 232. Arranging phases so that fields tend to cancel. 233. Increasing transmission voltage (since EMF intensities are a function of current, and increased voltage, all things being equal, will result in reduced current). 234. Reducing loads (and therefore, currents). 235. Identification of potential exposure levels in the work area including surveys of exposure levels and establishment of safety zones. 236. Safety signs and warning zone will be highlighted to indicate EMF in the area	During Construction	Project-wise facilities and construction sites	Construction Contractor with FMC	NTDC

Potential Impacts	Mitigation Measures (MM)	Timing to Implement MM	Location to Implement MM	Implementation Responsibility	Monitoring Responsibility
	237. Limit access to properly trained workers and those equipped with appropriate PPE when entering safety zones. 238. Increasing RoW widths or buffer zone widths, to move people further from ETLs.				

COVID-19= Coronavirus Disease 2019, EMF= Electromagnetic Field, ESIC = Environment and Social Impact Cell, ETL = Electricity Transmission Line, HIV= human immunodeficiency virus, LARP= Land Acquisition and Resettlement Plan, NEQS= National Environmental Quality Standards, NTDC =National Transmission and Despatch Company, PEQS = Punjab Environmental Quality Standard, PMU = Project Management Unit, PPE= Personal Protective Equipment, RoW= Right of Way

8.4 Capacity Building and Training

587. Personnel, including Contractors' personnel, working for or on behalf of the Project will receive training to maintain awareness of relevant environmental and social aspects, impacts and risks associated with the Project and corresponding controls. The training will also maintain awareness of the environmental benefits of improved personal performance and the potential consequences of departure from specified procedures.

588. Visitors to Project sites will receive relevant environmental and social awareness training as part of site induction training. Environmental training will help to ensure that the requirements of this IEE and EMP are clearly understood and followed by all Project personnel in the course of the construction phase.

589. The Contractors will have primary responsibility for providing training to all construction personnel in line with the Training Plan shown in **Table 8-2**. The plan will be finalized before the commencement of the training.

Table 8-2: Training Schedule

Target Audience	Trainers	Contents	Schedule
Contractor Supervisors/ Managers	NTDC's ESIC Team/FMC	Induction training per 'Training Plan'	Before the start of construction activities
Selected management staff from contractor	Contractor	Key findings of IEE Mitigation measures EMP	Before the start of construction activities
All site personnel	Contractor	Mitigation measures of EMP and IEE SSEMP Camp rules	Before and during construction activities
Construction crew	Contractor	EMP Waste disposal procedures	Before and during construction activities
Drivers	Contractor	Road safety Defensive driving Road access restrictions Vehicle movement restrictions Waste disposal	Before and during the construction phase
Construction Staff	Contractor	Waste disposal Vehicle movement restrictions	Before and during the construction phase
Camp staff	Contractor	Camp operation Waste disposal Natural resource conservation Housekeeping Camp Rules	Before and during the construction phase

ESIC = Environment and Social Impact Cell, FMC = Facility Management Consultant

8.5 Site-Specific Environmental Management Plan (SSEMP)

590. The EMP and other safeguard requirements (including any conditions stipulated in the EIA approval) will be included in bidding documents and civil works contracts. The bidders will be required to submit, as part of their bids, the expected costs of implementing the EMP to ensure that sufficient resources are allocated for EMP implementation. The Contractor(s) will be required to prepare SSEMP outlining how they intend to implement the EMP. They will describe the precise locations of the required mitigation/monitoring, the persons responsible for the mitigation/monitoring, the schedule and reporting methodology.

591. The SSEMP needs to include COVID-19 health and safety management plan and emergency response plan.[121] These plans will be prepared based on a risk assessment following relevant government regulations, guidelines, and international best practices. The Contractor(s) will be required to submit the SSEMP to ESIC for approval before taking possession of any work site. No access to the site will be allowed until the SSEMP is approved by ESIC. NTDC will have the right to suspend works or payments if the Contractor is in violation of any of his obligations under the EMP and SSEMP. A template for SSEMP is provided as Annexure XVI**.**

8.6 Equipment Maintenance Details

Construction

592. Equipment during the construction phase includes dump trucks, loader trucks, excavators, cranes, front-end loaders, fuel tankers, water bowser, cars, etc. This equipment and other machinery will only be repaired at designated sites at the warehouse.

Operations

593. Limited vehicle movement by the maintenance team will be required on a need basis.

8.7 Waste Management

594. This section provides the key elements to be included in a waste management plan or operating procedure to be developed by the Contractor that will be employed during the construction activities of the Project. The plan or operating procedure will be approved by ESIC, NTDC.

595. The Contractor will prepare a detailed Waste Management Plan as part of SSEMP. A framework plan has been provided as **Annexure XII.**

596. Every effort will be made to minimize the waste generated while the project is in progress. The main types of waste that will be generated are:

- Used oils and chemicals
- Garage Waste
- Sewage
- Camp waste

[121] Other subplans to be included in the SSEMP are tree management plan, waste management plan, vibration management plan, traffic management plan, camp management plan, worker accommodation plan, resource conservation plan, spill prevention and response plan, emergency response plan, chance finds procedure, dust management plan, OHSE management plan, fire management and protection plan, construction noise and vibration management plan, and worker accommodation plan.

- Medical waste
- Packing waste
- Excess construction material.

597. The solid and liquid waste to be generated from the project activities and camps is to be disposed of as per measures discussed in **Table 8-1.**

8.8 Worker Accommodation Plan

598. Worker's Accommodation Plan for the Project covers guidelines, the standards and practices to be used in the design and management of workers accommodation by NTDC, its contractors and subcontractors. The Worker's Accommodation Plan will largely be implemented by the Contractor. The scope and applicability of the Worker's Accommodation Plan are limited to the design and management of the worker accommodations provided during the construction phase of the Project. NTDC and its contractors will ensure sufficient resources are allocated on an on-going basis to achieve the effective implementation of the worker accommodation plan.

599. Worker accommodations will be located within the Project site and will be provided during the construction phase of the Project. The worker accommodations will encompass areas where it will not interfere with the construction activities.

600. Alongside the construction planning, the Contractor along with the Project Management Unit (PMU) of NTDC, will conduct a space assessment of accommodations.

601. Worker's Accommodation Plan will be prepared by contractor as part of SSEMP. A template plan has been provided in Annexure XVI.

602. An emergency response plan and fire management plan will be prepared by contractor as part of SSEMP. The template plans are given in provided in Annexure XVIII and Annexure XIX.

8.9 Environmental Monitoring and Reporting

603. Implementation of the EMP during construction will be done by the contractors and supervised by FMC and ESIC.

604. The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the environmental monitoring plan (EMoP) prepared as part of the EMP (**Table 8-3** and **Table 8-4**).

605. The EMoP identifies environmental monitoring activities to ensure that negative environmental impacts are addressed properly. It identifies environmental parameters to be monitored, frequency of monitoring, applicable standards, agencies and institutions responsible for monitoring; and provide indicative monitoring costs. The FMC will assist the PMU in this regard. During construction, monitoring will be undertaken by contractors and the FMC. PMU and NTDC ESIC will monitor contractor's environmental performance. During the operation stage, monitoring will be the responsibility of NTDC.

606. The main objectives of the pre-construction and construction phase EMoP will be:

- The compensation for loss of assets will be monitored during the pre-construction activities as per the latest rates announced by the government as every year rates have to be revised by the government. This aspect will be strictly monitored.

- Monitor the actual impact of the construction activities on the project corridor's physical, biological and socio-economic receptors. This will indicate the adequacy of the IEE.
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds that anticipated in the IEE.
- Ensure compliance with legal and community obligations including safety at construction sites.
- Monitor the impacts on land, water resources, air quality, noise level and cutting of trees in the project area as described in the EMP.

607. The main objectives of EMoP during the operation phase will be to:

- Appraise the adequacy of the IEE concerning the project's predicted long-term impact on the corridor's physical, biological, and socio-economic environment.
- Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements, if necessary

608. Compile periodic accident data to support the analysis that will help to minimize future risks.

609. The contractors will report the results and conclusions of EMP implementation and environmental monitoring to the PMU and ESIC NTDC monthly. The budget for environmental monitoring will be included as part of civil works contracts.

610. NTDC through its PMU will:

(i) Establish and maintain procedures to monitor the progress of implementation of EMPs;

(ii) Verify the compliance with environmental measures and their progress toward intended outcomes.

(iii) Document and disclose monitoring results and identify necessary corrective and preventive actions in the periodic monitoring reports.

(iv) Follow up on these actions to ensure progress toward the desired outcomes,

(v) Submit SAEMRs to ADB.

611. PMU through NTDC's ESIC will submit semiannual environmental monitoring reports (SAEMRs), which cover all subprojects under Trance 4, to ADB for review and disclosure, within 30 days after completion of each monitoring period. SAEMRs will be prepared and submitted to ADB, starting after Tranche 4 becomes effective, until ADB's Project Completion Report (PCR) is issued. Within three months after completion of all civil works, a report on the project's environmental compliance performance (including lessons learned that may help the NTDC in their environmental monitoring of future projects) will also be prepared. This report will be part of the input to the overall PCR.

612. NTDC, with the support of the FMC, will translate the summary of these documents into Sindhi[122] and Urdu languages,[123] and post them on NTDC website with the full reports (in English), within two weeks after ADB's clearance of each document. In case the FMC's liability period ends before ADB's PCR issuance, the NTDC ESIC itself will prepare the

[122] In the areas of Subprojects 1, 2, and a part of Subproject 5 (of "220kV Daharki – Rahim Yar Khan"), Sindhi is spoken as a mother tongue, although Urdu and Punjabi are also spoken in the areas.

[123] Saraiki is the predominant language being spoken by majority of the population of the Subproject area followed by Urdu; However, Punjabi, Sindhi, Balochi, Marwari, and Pushto are also spoken. All the Subproject affected people understand Urdu (see para. 360 on page 95).

SAEMRs. In addition to the above-mentioned reports, in case of any accident related to occupational and community health and safety causing fatality or near-fatal event, NTDC will to (i) report to ADB within 24 hours of any fatal or near-fatal event, (ii) prepare and submit to ADB an incident notification form within 48 hours, and (iii) prepare and submit to ADB an incident root cause investigation and corrective action form within 72 hours.

Table 8-3: Environmental Monitoring Plan (EMoP)

Environmental Concern	Performance Indicator	Frequency to Monitor	Timing to Check	Locations to implement	Responsible to implement	Resp supervision
Pre-Construction Phase						
1. Possible encroachment on reserved forests	Route survey to define alternative alignments (Field mapping with Global Positioning System (GPS) Equipment preferable)	1-time survey to finalize design	During detailed design	All transmission and Substation and ETL sites	NTDC / PMU through route survey contractor	NTDC
Construction Phase						
2. Dust, equipment emissions, erosion, noise control, and Waste management	Incorporation of appropriate clauses in construction contracts (Field inspections to ensure that appropriate measures are implemented, and facilities are installed)	Once	Before construction	All construction contracts for all ETL sites	NTDC and PMU to include in bidding documents.	NTDC, ESIC
3. Encroachment and Physical Disfiguration	Landscape Conditions, Baseline Environment	Once (update monthly as necessary)	One Month after Construction Work	All NTDC'S alignment	Contractor	NTDC, ESIC
4. Soil Erosion	Soil Compression, Land Clearing, Vegetation Removal	Once (update monthly as necessary)	Before construction. Update monthly	All NTDC'S alignment	Contractor	NTDC, ESIC
5. Soil Contamination	Fuels Spillage, Chemicals Containers	Monthly	During Construction	All NTDC'S alignment	Contractor	NTDC, ESIC
6. Ecological Resources	Land Clearing, Habitat destruction	Monthly	Update monthly	All NTDC'S alignment	Contractor	NTDC, ESIC

Environmental Concern	Performance Indicator	Frequency to Monitor	Timing to Check	Locations to implement	Responsible to implement	Resp supervision
7. Loss of Barani Crops	Number of People affected due to unavailability of Opportunistic Agriculture	Once (update monthly as necessary)	During Construction	All NTDC'S alignment	Contractor	NTDC, ESIC
8. Local Community Work Force	Disturbance due to Stringing, good engineering practices adopted	Once (update monthly as necessary)	Update monthly	All NTDC'S alignment	Contractor	NTDC, ESIC
9. Safety Hazards	Zero near miss, minor, major and fatal accidents	Monthly	Update monthly	All NTDC'S alignment	Contractor	NTDC, ESIC
Operational Phase						
10. Electric Current	Earthing of the Towers, Safety Plan by the contractor to be followed	Monthly	During Operation	All NTDC'S alignment	Contractor	NTDC, ESIC
11. Breaking of Conductors	Frequency of Conductors Tripping, Complaints reported	Quarterly	Throughout the Project	All NTDC'S alignment	Contractor	NTDC, ESIC
12. Towers Collapse	Soil Geology, Climatic Conditions, Records on displacement (if any)	Six Monthly	During Implementation Phase	All NTDC'S alignment	Contractor	NTDC, ESIC
13. Avifauna Movement	The reported death of Birds, Audit Report by the ESIC cell	Quarterly	After ETL is erected	All NTDC'S alignment	Contractor	NTDC, ESIC

ESIC = Environment and Social Impact Cell, ETL = Electricity Transmission Line, NTDC = National Transmission and Despatch Company, PMU= Project Management Unit

Table 8-4: Instrumental Environmental Monitoring Plan

No.	Monitoring Parameter	Monitoring Location	Frequency	Responsibility	Resource Requirement	Criteria for Triggering Action	Documentation
Construction Phase							
1.	Water quality: pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), total suspended solids (TSS), hydrocarbon and PCBs Solid waste generation and disposal	At representative existing wells (if any) within 100 m of the campsite	Every six months	Contractors to implement, PMU staff to provide oversight via regular field inspections	Resources for water sample collection and analysis	Water quality deterioration that can be attributed to the effluents released by the project facsimiles	A complete record of sample collection and analyses.
2.	Ambient Air Quality: Suspended particulate matter (SPM)	• Campsite • Access road • Communities within 100 m of RoW, campsite or access road	Every six months	Same as above	Resources for monitoring dust generation	To ensure compliance against PEQS for emissions	Records of measured values to be maintained
3.	Noise	• Campsite • Access road • Communities within 100 m of RoW, campsite or access road	Every six months	Same as above	Noise meter (1-hr concentration levels)	Exceeding World Bank limits (55 dBA during the day, 45 dBA during the night, measured at the receptor; or an increase of 3 dBA if the background noise is higher than the above-specified levels)	Records of measured values to be maintained
4.	Visual check for exhaust emissions from equipment and vehicles	• Campsite • Access road • RoW • Other construction sites	Routine visits	Contractor	-	Personal judgment	Records of abnormal emissions.
5.	Visual check for soil erosion	• Campsite • Access road	Routine Visits	Contractor	-	Visible signs of any soil erosion	Photographic record

No.	Monitoring Parameter	Monitoring Location	Frequency	Responsibility	Resource Requirement	Criteria for Triggering Action	Documentation
Construction Phase							
		• RoW • Other construction sites					
6.	Grievances of the local communities	• Campsite • Access road • RoW • Other construction sites	During field activities	Contractor	Monitoring register	Complaints	Complete grievance record to be maintained in the social complaint register.
Operation Phase							
7.	Dust, equipment emissions, and erosion control Waste management (Same parameters as during construction period)	• All ETLs	As necessary based on inspections and complaints	NTDC through PMU	Same resource as during construction period	Spot checks based on visual inspections and any complaints as necessary based on inspections and complaints	SAEMRs

PEQS = Punjab Environmental Quality Standard, ETL = Electricity Transmission Line, NTDC =National Transmission and Despatch Company, PMU = Project Management Unit, RoW = Right of Way, SAEMR = semi-annual environmental monitoring report

8.10 Institutional Arrangement

613. The lack of an environmental and social safeguards team and lack of capacity within project proponents and contractors creates implementation issues of project environmental safeguard documents including IEE, EIA, SSEMP, and NOC. To overcome this, NTDC will ensure institutional arrangements as described below.

614. The NTDC has established a PMU to implement MFF II. The PMU's day-to-day project management includes procurement, project execution, financial management, and monitoring of and reporting on project progress. The PMU of NTDC which already exists and executes other tranches of the MFF II Program will implement environmental safeguard requirement through its dedicated wing, the ESIC. The ESIC is staffed by EHS Manager, Deputy EHS Manager and Assistant EHS Manager in addition to social safeguard staff. Further resources for environmental safeguards management will be provided by FMC.

Table -: Implementation Arrangements for Tranche 4

Aspects	Arrangements
(i) Oversight body	Ministry of Energy (Power Division) Mr. Zafar Abbas (chair) Mr. Hammad Raza (member)
(ii) Executing agency	National Transmission and Despatch Company Limited (NTDC)
(iii) Implementation unit	Program Management Unit (PMU) established in NTDC
Consulting services	NTDC consulting firm National Engineering Services Pakistan (NESPAK), recruited by NTDC from its resources, will provide supervision support to NTDC.

615. Specific roles and responsibilities for environmental monitoring are provided in **Table 8-5**.

616. Institutions responsible for executing and monitoring the environmental aspects of this project are:

8.10.1 National Transmission and Despatch Company Limited (NTDC)

617. NTDC, the proponent of the ETL, is the executing agency of the Project. NTDC will monitor the implementation of the investment program and all tranches under the program.

8.10.2 Project Management Unit (PMU) under NTDC

618. The existing PMU established in NTDC under the first MFF 0007-PAK: Power Transmission Enhancement Investment Program (MFF I)[124] will be responsible for day-to-day project implementation for the physical outputs relating to the transmission system and operation (as defined under their transmission license). PMU will also be responsible for complying with the safeguard's requirements and design and monitoring framework, and loan covenants.

619. EHS Manager of ESIC under PMU will be responsible for environmental and social safeguards requirement implementation during design, construction and operations of the ETL though Deputy EHS Manager and Assistant EHS Manager in addition to social safeguard staff.

[124] 37192-013: MFF - Power Transmission Enhancement Investment Program | Asian Development Bank (adb.org)

620. The top management of ESIC of PMU will be ultimately responsible to ensure that the SSEMP/EMP is implemented through a monitoring mechanism. For this purpose, ESIC will develop and maintain internal institutional capacity for environmental management.

621. ESIC should be assigned the task to check that design and bid documents are responsive to key environmental, social, and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP. Further, PMU to ensure, the contractor's environmental safeguards capacity before construction starts.

622. ESIC within the PMU, with the assistance of FMC, will be responsible for:

- Preparing environmental screening checklists and classifying subprojects that have not been yet classified.
- Based on the checklist and as per the requirements of ADB SPS, Pak-Act (1997) and relevant provincial Environmental Protection Acts, preparing IEEs and EMPs.
- Submitting the checklists and IEE reports to ADB.
- Ensuring that EMPs are included in Tender documents.
- Ensuring that all regulatory clearances are obtained before starting civil works for the subproject.
- Ensuring that the EMPs, including all proposed mitigation measures and monitoring programs are properly implemented.
- Undertaking monitoring of subprojects and preparing SAEMRs every six months, to be delivered to ADB.
- In the case of unpredicted environmental impacts occurring during project implementation, preparing and implementing a Corrective Action Plan (CAP).
- In the case that a subproject needs to have its siting or alignment changed or its environmental classification reconfirmed, reviewing it to determine whether a supplementary study is required. If so (where unanticipated environmental impacts become apparent), carry out the study and implement any amendments to the original EMP.
- Approving SSEMP to be submitted by each construction contractor.
- Providing awareness training in environmental management for all employees working on the subproject.
- Ensuring that meaningful public consultations (including both men and women) are undertaken with affected groups and local NGOs. The list of people attending the consultation, time and locations, subjects discussed during consultation will be recorded in a systematic manner.
- Sharing information and disclosure of environmental safeguard documents (including any Corrective Action Plans prepared in cases of change to original project design) as required.

8.10.3 Facility Management Consultant (FMC)

623. Overall tranche supervision will be supported by the FMC: National Engineering Services Pakistan (NESPAK) funded by NTDC's own resources. The FMC (NESPAK) will have following positions for catering environment safeguards requirements of the Project. Person-months indicated here are exclusively for Tranche 4.

- International Environmental Safeguards Specialist (FMC-IESS, 04person-months, intermittent)
- National Environmental Safeguards Specialist (FMC-NESS, 1 Position, 24 person-months full-time)
- National Environmental Inspectors, (FMC-NEIs, 2 Positions, 24 months each full-time)

624. The FMC will be responsible for

- To maintain adequate staff for implementation of IEE and EMP including one FMC-IESS, one FMC-NESS and two FMC-NEIs.
- Supervising the Project's Contractors and ensuring that all the contractual obligations related to the design and construction, as well as environmental and social compliance, are met.
- Ensuring that the day-to-day construction activities are carried out in an environmentally and socially sound and sustainable manner and developing 'good practices' construction guidelines to assist the Contractors and PMU staff in implementing the EMMP
- Assisting the Chief Engineer (EHV-II) in coordinating with the provincial EPAs, provincial agriculture, forest and Wildlife departments, NGOs/CBOs and other public/private sector organizations.

8.10.4 Construction Contractor

625. Only one Engineering, Procurement, Construction (EPC) contractor (Construction Contractor) is expected to be mobilized for Subproject 5 (construction of about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Bahawalpur grid stations) while the EPC contractor can hire sub-contractors for timely completion of the Project. The Construction Contractor will assign and retain a full-time and qualified Environmental Safeguards Officer (ESO) and a full-time and qualified Health and Safety Officer (HSO). The contractor is responsible for developing similar arrangement in the subcontractor hierarchy. ESIC of NTDC will make sure the positions are filled with appropriate human resource.

626. The Contractor will be primarily responsible for the implementation of the EMP and SSEMP. Contractor will develop an internal monitoring and reporting mechanism for all activities undertaken.

627. Contractor is also responsible for developing Site-specific EMP (SSEMP) or making necessary changes to the SSEMP if and as required as a result of any changes in design or location, and ongoing reviews and requirements.

Table 8-5: Roles and Responsibilities for Implementation of EMP

Aspect	NTDC's ESIC Responsibilities	Contractor's Responsibilities	Relevant Documentation
Contracting	Ensure that the SSEMP/ EMP implementation and internal monitoring and reporting requirements are included in the contract between NTDC and the Contractors.	Understand the requirements and estimate the required resources.	The contract between NTDC and Contractors

Aspect	NTDC's ESIC Responsibilities	Contractor's Responsibilities	Relevant Documentation
SSEMP and subsequent Updates	Review and approve SSEMP.	Preparing SSEMP. Update SSEMP if any changes to design happened	SSEMP Revised SSEMP
Resources	Ensure the availability of resources required for EMP implementation, monitoring of Contractors and preparing reports to authorities	Ensure the availability of resources required for EMP implementation and internal monitoring throughout the construction duration and reporting to NTDC.	Project SSEMP implementation and monitoring plans and budgets.
Environmental personnel	Assign and retain full-time and qualified EHS Manager, Deputy EHS Manager and Assistant EHS Manager for the Project	Assign and retain a full-time and qualified ESO and a full-time and qualified HSO	Job descriptions.
Monitoring surveys and inspections	Undertake periodic inspections and carry out field measurements, where needed over and above those of Contractor. Review Contractor monitoring.	Systematically observe and collect data on environmental performance, undertake inspections, and carry out surveys	Inspection and survey reports.
Environmental inspections	Conduct periodic internal inspections of the construction sites and commissioning third-party (external) inspections	Conducting periodic internal audits.	Audit reports.
Reporting	Ensure that periodic environmental monitoring reports are received from the Contractors and are reviewed. Prepare reports to authorities if necessary	Generate monthly environmental monitoring reports and disseminating these to the management and appropriate staff members.	Periodic reports.
Corrective actions	Verify that the activities that are carried out comply with the IEE or EIA and EMP and identify corrective actions if needed.	Carry-out the required corrective actions.	Corrective action record.
Maintenance of record	Maintain monitoring data and record of all incidents of environmental significance and related corrective measures.	Maintain monitoring data and record of all incidents of environmental significance and related corrective measures.	Environmental databases.

ESIC = Environment and Social Impact Cell, ESO = Environmental Safeguards Officer, NTDC = National Transmission and Despatch Company, HSO = Health and Safety Officer, SSEMP = Site-specific Environmental Management Plan

8.11 Change Management

628. The Change Management System proposed for the project recognizes three orders of changes in the project design or project area:

629. **First-Order:** A first-order change is one that leads to a significant departure from the project described in IEE and consequently requires a reassessment of its environmental impact. Examples of first-order changes include:

- Shifting of the project area by more than 5 km
- Increasing the total length of RoW by over 50 km
- Using technology that has significantly greater effects
- Increasing the crew size by more than 50%
- Re-routing the RoW through any sensitive wildlife areas.

630. A new environmental assessment will be conducted, and a revised IEE report submitted to the provincial EPAs for a first-order change in the project.

631. **Second Order:** A second-order change is one that entails project activities not significantly different from those described in the IEE.

632. A second-order change may alter the project's impact, but not its overall magnitude. In case of such changes, the ESIC will be required to reassess the impact of the activity on the environment, specify additional mitigation measures, if necessary, and report the changes to the provincial EPAs. Examples of such changes include:

- Shifting of the project area by 1 to 5 km
- Increasing the total length of RoW by 10 to 50 km
- Using a different technology that is as disturbing, or less disturbing than that proposed
- Increasing the crew size by more than 10% but less than 50%.

633. **Third Order:** A third-order change or uncertainty is of little consequence to the IEE findings. Where unanticipated environmental impacts become apparent during project implementation, NTDC will update this IEE and EMP or prepare a new IEE and EMP to assess the potential impacts, evaluate the alternatives, and outline mitigation measures and resources to address those impacts.

634. Examples of third-order changes are:

- Shifting of the project area by 1 km or less
- Increasing the total length of RoW by less than 10 km
- Changing the layout of the campsites or construction sites.

635. The examples given above are hypothetical and have been given to illustrate the magnitude of the three types of changes. At this stage, no changes are under consideration. Any change in the project design will be evaluated based on the criteria provided above, and appropriate action will be taken. The record will be maintained in the Change Record Register.

8.12 Environment Management Cost

636. An estimated cost for implementation of mitigation measures prescribed in the Environmental Management Plan (EMP) has been provided in **Table 8-6**, **Table 8-7** and **Table 8-8**.

637. The cost includes the hiring of staff, arrangements for water sprinkling, provision of PPEs to workers, the arrangement of first aid kits at the site and waste management, etc. The budget for tree plantation and landscaping is also included in the given cost where required.

638. The cost does not cover the implementation of mitigation measures prescribed in the Environmental Management Plan (EMP) for the operational phase which will be included as part of NTDC's ongoing environment management program.

Table 8-6: Estimated Cost for Contractor's EMP Implementation[125]

Item	Quantity	Unit cost	Estimated cost
SSEMP preparation	Lumpsum	$7,000	$7,000
SSEMP implementation (construction mitigation measures)	Lumpsum	$7,000	$7,000
Planting of trees	4,000[126]	$2	$8,000
Mobile toilets for workers at each construction site	15	$150	$2,250
PPEs and safety measures like signages, barricading etc.	Lumpsum	$8,000	$8,000
Hazardous Waste Disposal[127]	24 months	$500	$12,000
Instrumental Environmental Monitoring			
Water Quality	16 samples[128]	$300	$4,800
Ambient Air Quality	16 samples[129]	$500	$8,000
Noise Level	16 samples[130]	$150	$2,400
Mobilization of ESO	24 months	$350	$8,400
Mobilization of HSO	24 months	$350	$8,400
		Total	$**72,450**

ESO = Environmental Safeguards Officer, HSO = Health and Safety Officer, SSEMP = site-specific environmental management plan

Table 8-7: Estimated Cost for FMC's EMP Implementation

Item	Quantity	Unit Cost	Estimated Cost
International Environmental Safeguards Specialist (FMC-IESS)	4 months (intermittent)	$20,000	$80,000
National Environmental Safeguards Specialist (FMC-NESS)	24 months (full-time)	$1,200	$28,800
National Environmental Inspectors (FMC-NEIs)	24 months (full-time) x 2	$350	$16,800
Training on EMP and GRM	Lumpsum	$2,500	$2,500
		Total	**$128,100**

EMP = environmental management plan, GRM = grievance redress mechanism
Note: The cost of FMC represents for complete MMF T-4 Program covering all subprojects

Table 8-8: Estimated Cost for ESIC's EMP Implementation

Item	Quantity	Unit Rate, PKR	Estimated Cost, PKR
EHS Manager	24 months (full-time)	$2,000	$48,000
Deputy EHS Manager	Same as above	$1,500	$36,000
Assistant EHS Manager	Same as above	$1,200	$28,800

[125] The construction period will be between eighteen to twenty-four months. (para. 615 on page 161)
[126] Due to the proposed project, 350-400 trees of varying species and sizes, may be affected by the project. Compensatory planting of ten (10) trees against each fallen tree of similar floral function will be planted (paras. 421 and 422 on page 106)
[127] Contaminated soil or residue of sewerage waste, used filters, other)
[128] 4 locations (at representative existing wells [if any] within 100 m of the campsite) x 4 times (every six months) (See **Table 8-4**)
[129] 4 locations (Campsite, Access Road and Communities within 100 m of RoW, campsite, or access road) x 4 times (every six months) (See **Table 8-4**)
[130] 4 locations (Campsite, Access Road and Communities within 100 m of RoW, campsite, or access road) x 4 times (every six months) (See **Table 8-4**)

		Total	$**112,800**

EMP = environmental management plan, GRM = grievance redress mechanism
Note: The cost of ESIC represents for complete Tranche 4 covering all subprojects

9. Conclusion and Recommendations

9.1 Conclusion

639. This IEE covers part (construction of about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Bahawalpur grid stations) of Subproject 5.

640. An EARF (footnote 2) was prepared for MFF II in May 2016. This EARF is applicable for subprojects under MFF II and Tranche-I, funded by ADB. The EARF outlines the policy, procedures, and institutional requirements for preparing the subprojects. These subprojects need to be processed under ADB SPS.

641. An IEE has been conducted following the EARF to assess the environmental and socioeconomic impact of NTDC's proposed Project following ADB SPS.

642. Key components of the Project, construction materials, transport infrastructure, water requirements, generated emissions and schedule and staffing for the Project are also discussed in the IEE.

3. An EIA report in accordance with the local environmental requirements to be prepared and submitted to Punjab EPA and approval or NOC to be sorted before start of construction activities.

643. Alternatives related to the construction method, technology, and ETL RoW were analyzed. The 'No Project Alternative' was also discussed in detail, to ensure that the Project is sufficiently benefitting the local economy and is not unnecessarily degrading the environment.

644. Baseline environmental and socioeconomic information was collected from a variety of sources, including published literature, and field surveys. Baseline studies were conducted on the physical, ecology and socioeconomic environment conditions of the AoI around the Project site.

645. Proposed Project activities were reviewed and their potential impacts on the physical, biological, and socio-economic environment were assessed. Where appropriate, mitigation measures have been proposed to keep potential adverse environmental impacts within acceptable limits.

646. An EMP has been developed in this report to effectively implement the mitigation measures identified in the impact assessment. Contractor will develop SSEMP before construction activities start. The bid documents must include the EMP, and its implementation cost must be reflected in the bill of quantity (BoQ).

647. Therefore, if the Project's construction and operation activities, including the implementation of all proposed mitigation measures, are carried out as described in this document, the anticipated impact of the project on the area's natural and socioeconomic environment shall remain well within acceptable limits.

648. Following requirements of ADB SPS, NTDC will apply pollution prevention and control technologies and practices consistent with international good practice as reflected in internationally recognized standards such as EHS Guidelines (footnotes 24, 25 and 26 on page 29 of this IEE). When Government regulations differ from these levels and measures, NTDC will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, NTDC will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

649. This IEE will be updated if unanticipated environmental impacts become apparent and will be submitted to ADB for clearance and disclosure at ADB website.

650. NTDC will have the right to suspend works or payments if the Contractor is in violation of any of his obligations under the EMP and SSEMP.

9.2 Recommendations

651. Comprehensive mitigation measures have been proposed in **Section 5** and **Section 8** of this report to minimize the negative impacts and to enhance the positive impacts of the project. However, major recommended mitigation measures are summarized as follows:

- Temporary labor camps will be developed inside the grid station boundary and will be facilitated with proper drainage facilities.
- Soil erosion and contamination, water contamination, air pollution, and high noise levels will be controlled with the use of good engineering practices.
- The contractor will develop subplans (listed in footnote 121 on page 202 of this IEE) as part of SSEMP before starting the construction activities. No access to the site will be allowed until the SSEMP is approved by the ESIC.
- Fair and negotiated compensation following the prevailing market prices will be made for the loss of crops and trees during the construction activities of the project.
- The erection of towers in the water bodies will be avoided as far as possible. However, at places where realignment of the ETL is unavoidable, towers with the maximum span will be used to minimize the number of towers in the water body.
- The contractor will take due care of the local community and its sensitivity towards local customs and traditions.

Initial Environmental Examination Annexures

Project Number: 37192-044
Date: October 2022

Pakistan: Second Power Transmission Enhancement Investment Program (Tranche 4)

Subproject 5: Procurement of goods for the construction of about 150 km of 220kV Rahim Yar – Bahawalpur transmission lines and extension of 220kV Bahawalpur grid stations

Prepared by the Environment & Social Impact Cell of National Transmission and Despatch Company (NTDC) for Asian Development Bank

Annexures

Annexure I: ADB's Rapid Environmental Assessment (REA) Checklist

Rapid Environmental Assessment

Project Name: MFF Power Transmission Enhancement Investment Program II Tranche 4

Date: June 2022

Environmental Screening and Categorization Report for

- 220kV Jamrud Substation along with associated 20 km 220 kV Transmission Line
- Inter Linking 220 kV TL for Daharki,-Rahim Yar Khan-Bahawalpur, and Chishtian Grid Stations
  - 220kV Daharki to Rahimiyar Khan TL (105 km)
  - 220kV Rahimiyar Khan to Bahawalpur TL (150 km)

Prepared by: TA-9756 PAK: Environmental Safeguards Experts - Environmental Safeguard Consultant

CURRENCY EQUIVALENTS

As of June 24, 2022,	Currency Unit – Pak Rupees (Pak Rs.)
Pak Rs 1.00 = $ 0.0048	US$1.00 = Pak Rs. 206.7

WEIGHTS AND MEASURES

kV	Kilovolt
km	Kilometer
km^2	Square kilometer
MW	Megawatt
m	Meter

GLOSSARY

EIA	Environmental Impact Assessment is a process of evaluating the likely environmental impacts of a proposed project or development, considering inter-related socio-economic, cultural, and human-health impacts, both beneficial and adverse.
IEE	Initial Environmental Examination is a preliminary small study to see project impacts, both beneficial and adverse to the environment while the EIA is a full assessment of the effects.
NOC	No Objection Certificate is the clearance or certificate given by the authority (EPA) for the specific project after evaluation of IEE/EIA. NOC is granted with or without conditions.

NOTE{S}

1. The fiscal year (FY) 2021 of the Government of Pakistan ends on 30 June.
2. In this report, "$" refers to United States dollars unless otherwise stated.

Acronyms

ADB	Asian Development Bank
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environment Protection Agency
ESIC	Environment and Social Impact Cell
GoP	Government of Pakistan
GS	Grid Station
IEE	Initial Environmental Examination
MFF	Multi-tranche Financing Facility
NTDC	National Transmission and Despatch Company
PAK	Pakistan
PTEIP	Power Transmission Enhancement Investment Program
RoW	Right of Way
SC	Single Circuit
TL	Transmission Line
WAPDA	Water & Power Development Authority

Contents

Appendices

Figures

Tables

1. Introduction

1 The Government of Pakistan (GoP) signed a loan agreement with the Asian Development Bank (ADB) for financial support for the construction of the Power Enhancement Projects in Pakistan. The multi-tranche financing facility for the Second Power Transmission Enhancement Investment Program (MFF II or the Program) will expand and reinforce Pakistan's power transmission system, enabling the system to provide a reliable and quality service capable of meeting increasing customer demand and supporting economic growth. MFF II comprises four tranches and Projects located in different areas of the country.

1.1 Brief Program Background

2 Tranche 4 will help evacuate power to load centers in central Pakistan through the construction of 500 & 220 kV transmission lines in Khyber Pakhtunkhwa, Punjab & Sindh and will reduce the existing system constraints through an augmentation of the existing 500/220 kV grid stations in Punjab & Sindh.

1.2 Subproject Background

3 This basic information report relates to the Rapid Environmental Assessment (REA) of the proposed Project 48078-006 MFF Power Transmission Enhancement Investment Program II Tranche 4 and covers two subprojects listed hereunder:

- 220kV Jamrud Substation along with associated 20 km 220 kV Transmission Line
    - 220kV substation at Jamrud with two 220/132kV, 250 MVA transformers along with allied equipment and accessories.
    - 220kV double circuit transmission line on twin bundle Rail conductor from Jamrud to 500 kV Peshawar (Sheikh Muhammadi) Grid Station (20km)
- Inter Linking 220 kV TL for Daharki,-Rahim Yar Khan-Bahawalpur, and Chishtian Grid Stations
    - 220kV Daharki to Rahimiyar Khan TL (105 km)
    - 220kV Rahimiyar Khan to Bahawalpur TL (150 km)

4 The subproject locations in Sindh, Punjab, and Khyber Pakhtunkhwa, are shown in **Figure 1-1** and **Figure 1-2**.

5 A completed REA checklist for transmission line projects is provided in **Appendix A**.

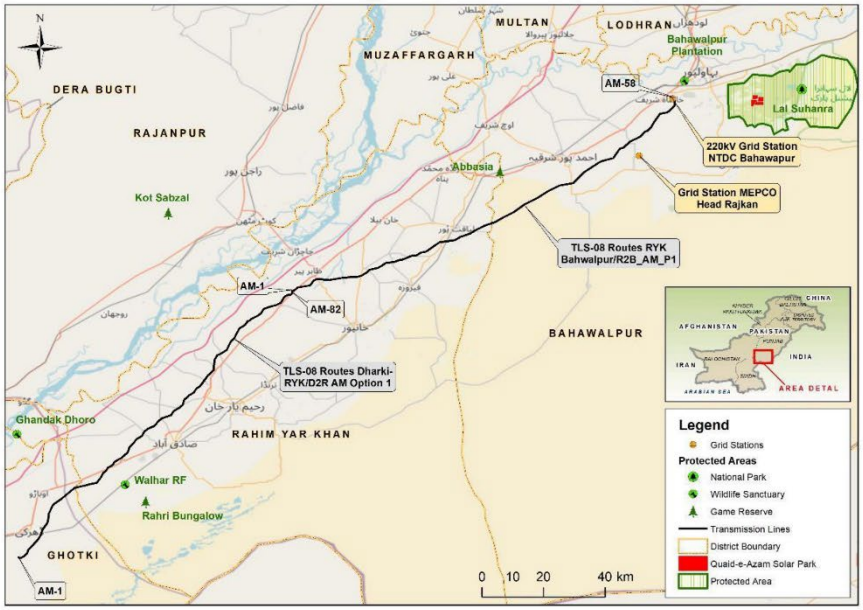


Figure 1-2: 255 km 220 kV TL for Dharki,-Rahim Yar Khan-Bahawalpur Substations Inter Linking

2. Salient Features of the Subprojects

220kV Jamrud Substation along with 20 km TL

6 The subproject 220kV Jamrud Substation is located in Khyber district of Khyber Pakhtunkhwa (KP) and the 20 km proposed transmission line route falls in Khyber and Peshawar district of KP.

7 Within the 100 m of the TL route on each side, the area consists of barren land, open areas, agricultural fields and sparsely populated areas in Khyber district and Peshawar district.

8 The construction cost as per the estimate made in October 2017 was 2,398 Million Pak Rupees. [1]

9 No protected area is located within 5 km of the subprojects i.e. Reserved Forest, Game Reserves, National Parks, and Wildlife Sanctuaries, which fall on the transmission line route (**Figure 1-1**).[2]

10 No wetlands were found along the entire transmission line route notified by the GoP or Govt of Khyber Pakhtunkhwa.

11 Findings of the IBAT Assessment

- IBAT Assessment report identifies Bilyamin Game Reserve in Khyber district as protected areas (**Appendix B**) within 5km buffer.
- However, above information seems incorrect. As per the GIS data of the area and actual location, Bilyamin Game Reserve is located in Hangu district at a distance of 40 km in south of the TL route (**Appendix C**).

220 kV TL for Daharki -Rahim Yar Khan-Bahawalpur Substations Inter Linking, 255 km

12 The subproject 220 kV TL for Daharki,-Rahim Yar Khan-Bahawalpur Substations Inter Linking, 255 km passes through Ghotki district of Sindh province and, Rahimyar Khan and Bahawalpur districts of Punjab province.

13 Within the 100 m of the TL route on each side, the area consists of barren land, open areas, agricultural fields, and sparsely populated areas in all three districts.

14 The construction cost as per the estimate made in April 2018 was 7,016.52 Million Pak Rupees for the transmission line construction and 721 Million Pak Rupees for substation rehabilitation and argumentation for four substations of Daharki, Rahimyar Khan, Bahawalpur, and Lal Suharna [3].

[1] PC-1, 220kV Jamrud Substation along with associated 220 kV Transmission Line, NTDC, Oct 2017

[2] The Protected Area in close vicinity of the subprojects was assessed using the data from different sources including Bird Life International, Punjab Wildlife, Fisheries and Forest Departments, IUCN, WWF Pakistan and World Data Base on Protected Area. This was further verified by assessing the area using the IBAT tool.

[3] PC-1, 220kV Daharki,-Rahim Yar Khan-Bahawalpur Substations Inter Linking, 255 km, April 2017

15 No protected area is located within 5 km of the subprojects i.e. Reserved Forest, Game Reserves, National Parks, and Wildlife Sanctuaries, which fall on the transmission line route (**Figure 1-2**).[4]

16 No wetlands were found along the entire transmission line route notified by the GoP or Govt of Punjab.

17 Findings of the IBAT Assessment

- 220kV Daharki to Rahimiyar Khan TL (105 km)
  - IBAT Assessment report identifies No protected areas and no key biodiversity areas in 5 km of the TL route (**Appendix B**).
- 220kV Rahimiyar Khan to Bahawalpur TL (150 km)
  - IBAT Assessment report identifies Abbasia Game Reserve and Bahawalpur Plantation Sites as protected areas (**Appendix B**).
  - However, as per the GIS data these two important areas are located at a distance of 3-4 km from the proposed TL route (see **Figure 1.2**).

[4] The Protected Area in close vicinity of the subprojects was assessed using the data from different sources including Bird Life International, Punjab Wildlife, Fisheries and Forest Departments, IUCN, WWF Pakistan and World Data Base on Protected Area. This was further verified by assessing the area using the the IBAT tool.

3. Anticipated Environmental Impacts

18 The proposed subprojects were assessed for anticipated environmental impacts during construction and operations. The impacts are listed in **Table 3-1**.

Table 3-1: Anticipated Environmental Impacts in Construction and Operations

Major Issues and Concerns During the Design and Construction Phase	Major Issues and Concerns During the Operation Phase
• Proper planning during project design can significantly reduce the negative impacts at the time of construction and operation during route selection, transmission structure design, tower placement, add-ons, and visual amenity reducing EMF impacts, avoiding densely populated and high values areas, and minimizing bird collisions.	• Noise in the form of buzzing or humming can often be heard around transformers or high voltage power lines producing corona. Noise from transmission lines reaches its maximum during periods of precipitation. In the operation phase, power disbursement of electric power may create a low noise which can be noticeable by the nearby residents. However, TL for the projects has been designed to avoid human settlements.
• Dust generation is expected from earthwork, construction site camps, vehicular traffic, and other construction activities.	• A small team will occasionally visit to the TL route for maintenance works which will be very small in scale and infrequent and involve a few changes to the existing situation related to traffic, dust, and other nuisances.
• Construction activity employing heavy machineries such as powered mechanical equipment and heavy traffic such as trucks for transportation of construction materials and supplies can generate significant noise and vibration.	• Operations and maintenance of the TL will not incur major ecological impacts as there will be no new towers to be erected. Maintenance works will be very small in scale and infrequent and involve a few changes to the existing situation. The practice of allowing some re-growth of vegetation along the route of TL will also have ecological benefits as it will allow plants and animals to re-colonize.
• Construction of the Project will require clearing of some vegetation, excavation, and stockpiling of excavated and construction material.	• Reduced pressure on local resources
• Contamination of surface and groundwater due to improper handling of materials, leakage of oil and fuels and discharge from construction activities; and; Increased usage of local water resources due to its use in construction activities. Blockade of natural drainage ways due to foundation construction.	• Risk of electrocution and accidents during maintenance works

Major Issues and Concerns During the Design and Construction Phase	Major Issues and Concerns During the Operation Phase
• There is a possibility of the generation of hazardous and non-hazardous solid waste during construction such as used vehicle oil filters, oil-contaminated cloths, used batteries, iron and copper, cotton and kitchen waste, and solid residue from the septic tanks, etc.	• The local people believe that their movement will be restricted in the project area due to EMF, and it may have adverse impacts on their health.
• Surface stripping of vegetation cover will remove the plant species, and this may cause the accidental death of small mammals and reptiles. Construction-related activities such as noise, vibration, illumination, and vehicular pollution will lead to a localized reduction in food, shelter, and range for mammals, birds, and herpetofauna.	• Power transmission towers, if located near an airport or known flight paths can create obstructions.
• The Project will have both positive and negative socio-economic impacts during the construction phase. Positive socio-economic impacts of the project are the creation of job opportunities and a boost to the local economy, while negative impacts include a disturbance to the privacy of locals due to the influx of workers and increased risks of community and occupational safety due to construction machinery and vehicles.	• Impact on the visual amenity of residents due to the transmission and distribution of power from power facilities to communities may be visually intrusive and undesirable to nearby residents

4. Environmental Categorization

19 The proposed projects were evaluated for environmental settings and anticipated environmental and social impacts.

20 There will not be any land acquisition or compensation process per the prevailing law of the country except for the crop compensation of the transmission line towers.

21 Rapid Environmental Assessment (REA) was conducted, followed by the ADB checklist by REA provided in **Appendix A**.

22 The ADB's Safeguard specialist staff will confirm the categorization of the proposed projects as per ADB SPS 2009 based on the information provided in this document, i.e., sensitive receptor mapping, the scale of the project works with an assessment of the expected impacts also provided in the enclosed.

23 However, based on the information in **Section 2** and **Section 3**, the environmental categorization for the projects has been proposed and provided in **Table 4-1**.

24 As far as the host country's approval following national guidelines is concerned, considering the scale of this project and the scale of the works involved, and the capital expenditure to be incurred to develop it, this project falls under Schedule II.

25 The transmission lines (11 kV and above) and distribution projects are included in Schedule II which requires an EIA[5] under the Sindh Environmental Protection Act, 2014, the Review of Initial Environmental Examination, and Environmental Impact Assessment Regulations (IEE-EIA Regulations 2014).

Table 4-1: Summary of Proposed Environmental Category

S/No.	Sub-project City	Scoping Findings	Proposed Environment Category
1	• 220kV Jamrud Substation along with associated 20 km 220 kV Transmission Line ○ 220kV substation at Jamrud with two 220/132kV, 250 MVA transformers along with allied equipment and accessories. ○ 220kV double circuit transmission line on twin bundle Rail conductor from Jamrud to 500 kV Peshawar (Sheikh Muhammadi) Grid Station (20km)	• Barren Land/ Open Areas and Agricultural land • Limited Tree Cuttings • No significant number of settlements fall on the TL route • No protected area is located within 5 km of the subprojects i.e., Reserved Forest, Game Reserves, National Parks, and Wildlife Sanctuaries, which fall on the transmission line route. • No wetlands were found along the entire	Category 'B'

5 https://epasindh.gov.pk/Rules/EIA%20IEE%20Regulations%202014.pdf

		transmission line route notified by the GoP. • The land to be acquired for substation construction part	
2	• Inter Linking 220 kV TL for Daharki,-Rahim Yar Khan-Bahawalpur, and Chishtian Grid Stations ○ 220kV Daharki to Rahimiyar Khan TL (105 km) ○ 220kV Rahimiyar Khan to Bahawalpur TL (150 km)	• Barren Land/ Open Areas and Agricultural land • Limited Tree Cuttings • No significant number of settlements fall on the TL route • No protected area is located within 3-4 km of the subprojects i.e., Reserved Forest, Game Reserves, National Parks, and Wildlife Sanctuaries, which fall on the transmission line route. • No wetlands were found along the entire transmission line route notified by the GoP. • No land acquisition is involved.	Category 'B'

A.2 220 kV TL for Daharki,-Rahim Yar Khan-Bahawalpur Substations Inter Linking, 255 km

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to Environment and Safeguards Division (SDES) for endorsement by Director, SDES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: Pak/ MFF II Tranche 4 Subprojects

Sector Division:

Screening Questions	Yes	No	Remarks
A. Project siting Is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		No	There are not any such sites within 100 m of the TL route on each side.
▪ Protected area		No	There are not any such sites within 100 m of the TL route on each side.
▪ Wetland		No	There are not any such sites within 100 m of the TL route on each side.
▪ Mangrove		No	There are not any such sites within 100 m of the TL route on each side.
▪ Estuarine		No	There are not any such sites within 100 m of the TL route on each side.
▪ Buffer zone of protected area		No	There are not any such sites within 100 m of the TL route on each side.
▪ Special area for protecting biodiversity		No	There are not any such sites within 100 m of the TL route on each side.
B. Potential environmental impacts Will the project cause…			
▪ encroachment on historical/cultural areas, disfiguration of landscape and increased waste generation?		No	The TL does not pass or encroach on historical/cultural areas, disfiguration of landscape, and increased waste generation. The spoil/ overburden material will be backfilled after the base construction of the tower then restoring of preserved topsoil cover. No such acts are anticipated during construction or operations
▪ encroachment on precious ecosystem (e.g. sensitive or protected areas)?		No	No such acts are anticipated during construction or operations

Screening Questions	Yes	No	Remarks
▪ alteration of surface water hydrology of waterways crossed by roads and resulting in increased sediment in streams affected by increased soil erosion at the construction site?		No	Existing public roads will be used for material transport. Local water bodies will be protected during access route construction.
▪ damage to sensitive coastal/marine habitats by construction of submarine cables?		No	No such acts are anticipated during construction or operations
▪ deterioration of surface water quality due to silt runoff, sanitary wastes from worker-based camps and chemicals used in construction?	Yes		Construction camps generate solid and liquid wastes therefore they should be built appropriately and away from settlements.
▪ increased local air pollution due to rock crushing, cutting and filling?		No	There is no such activity involved in the project construction.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	Yes		Significant occupational health and safety hazards will exist at the construction sites considering the tower erecting, and in operations.
▪ chemical pollution resulting from chemical clearing of vegetation for construction site?		No	No such method will be adopted.
▪ noise and vibration due to blasting and other civil works?	Yes		During the construction phase, significant noise and dust emissions are expected from the movement of construction vehicles and equipment.
▪ dislocation or involuntary resettlement of people?		No	No dislocation or involuntary resettlement of people is expected.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		No	No such impacts are expected on the poor while no indigenous peoples are in the project area that would get affected.
▪ social conflicts relating to inconveniences in living conditions where construction interferes with pre-existing roads?		No	No such impacts are expected
▪ hazardous driving conditions where construction interferes with pre-existing roads?	Yes		The TL project is expected to pass local roads. Hazardous driving conditions may have arisen during the movement of construction machinery and equipment.
▪ creation of temporary breeding habitats for vectors of disease such as mosquitoes and rodents?	Yes		The temporary breeding habitats for vectors of disease such as mosquitoes and rodents can be created at camps sites if sewage waste and surface runoff do not handle appropriately.
▪ dislocation and compulsory resettlement of people living in right-of-way of the power transmission lines?		No	No dislocation or involuntary resettlement of people is expected.
▪ environmental disturbances associated with the maintenance of lines (e.g. routine control of vegetative height under the lines)?	Yes		A significant part of the Mirpur Khas TL passes through mango orchards where a routine control of vegetative height under the lines will be required

Screening Questions	Yes	No	Remarks
▪ facilitation of access to protected areas in case corridors traverse protected areas?		No	No protected areas are falling on the TL route.
▪ disturbances (e.g., noise and chemical pollutants) if herbicides are used to control vegetative height?		No	No such methods will be adopted to control vegetative height.
▪ large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)?		No	No such conflicts are expected since local labor will be utilized as far as possible.
▪ social conflicts if workers from other regions or countries are hired?		No	No such conflicts are expected since local labor will be utilized as far as possible.
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?	Yes		The temporary breeding habitats for vectors of disease such as mosquitoes and rodents can be created at camps sites if sewage waste and surface runoff do not handle appropriately.
▪ risks to community safety associated with maintenance of lines and related facilities?		No	NTDC applies strict procedures for community safety associated with the maintenance of lines, so the risk is negligible.
▪ community health hazards due to electromagnetic fields, land subsidence, lowered groundwater table, and salinization?		No	NTDC applies strict procedures for community safety associated with the maintenance of lines, so the risk is negligible.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		No	No such material is envisaged or required during the construction of the TL.
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., high voltage wires, and transmission towers and lines) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?	Yes		The risks to the community exist, particularly during the operation of the TL, considering the proximity of the site to residential settlements in some areas of the route.

Checklist for Preliminary Climate Risk Screening

Country/Project Title:

Sector:

Subsector:

Division/Department:

Screening Questions		Score	Remarks[7]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather-related events such as floods, droughts, storms, landslides?	0	No such events are likely to occur during construction or operations
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	No such steps are required during construction or operations
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	No such events are likely to occur during construction or operations
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	No such events are likely to occur during construction or operations
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	No such events are likely to occur during construction or operations

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be

[7] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high-risk project.

Result of Initial Screening (Low, Medium, High): Low Risk

Other Comments:_____

Prepared by: _____

Annexure II: Field Sampling Plan (Physical Environment)

Fieldwork Schedule for IEE

at

220kV Rahim Yar Khan to Bahawalpur TL (150 km)

The Government of Pakistan (GoP) signed a loan agreement with the Asian Development Bank (ADB) for financial support for the construction of the Power Enhancement Projects in Pakistan. The multi-tranche financing facility for the Second Power Transmission Enhancement Investment Program (MFF II or the Program) will expand and reinforce Pakistan's power transmission system, enabling the system to provide a reliable and quality service capable of meeting increasing customer demand and supporting economic growth. MFF II comprises four tranches and Projects located in different areas of the country.

Tranche 4 will help evacuate hydro and wind power to load centers in central Pakistan through the construction of 500 & 220 kV transmission lines in Khyber Pakhtunkhwa, Punjab & Sindh and will reduce the existing system constraints through an augmentation of the existing 500/220 kV grid stations in Punjab & Sindh.

The proposed Project 48078-006 MFF Power Transmission Enhancement Investment Program II Tranche 4 and covers two subprojects . One of them is inter Linking 220 kV TL for Daharki,-Rahim Yar Khan-Bahawalpur, and Chishtian Grid Stations.

This document provides information on the team, and schedule for execution of IEE fieldwork for collection of physical environment samples for the 220KV Transmission Line from Rahim Yar Khan to Bahawalpur (150 km).

Team

The HBP team members are:

	Name	*Role*	*Cell Number/Email*
1	Salman Ali	Field Manager	+9231 7 0121830
2	M. Usman (AES)	Field Chemist	+92304 7236982
3	Assistant Field Chemist (AES)		

Tentative Schedule

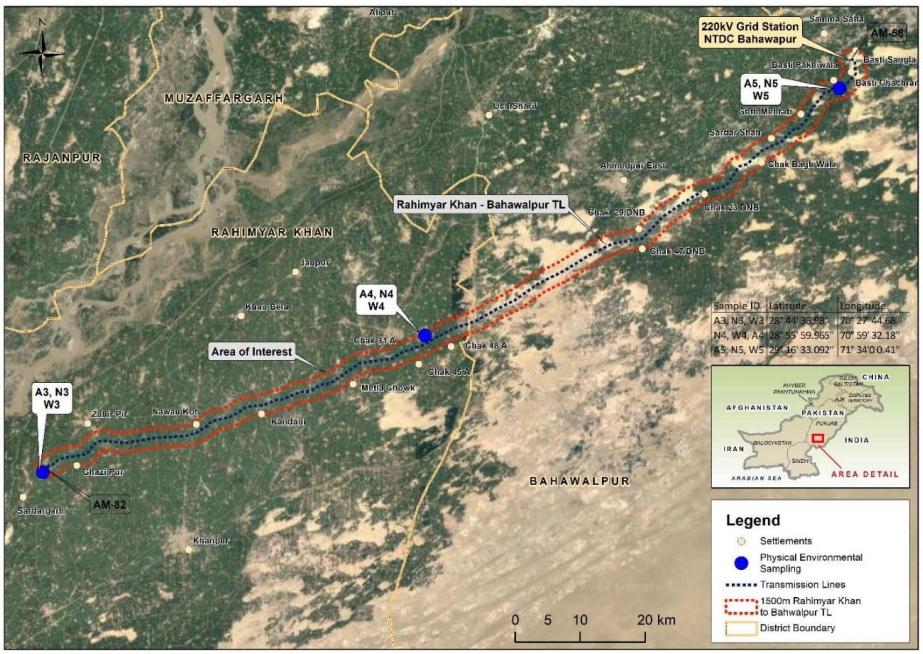
The team is planning to arrive in the field on 29th August 2022 and will completed the fieldwork in 4 days.

Sampling Plan

During this field work, the team will collect samples and data about the physical environment including water, noise, and air. The details of the sampling locations are provided in the table below:

Sampling ID	Coordinates (Lat, Long)	Rationale
A3, N3, W3	28 ° 44' 36.98" , 70 ° 27' 44.68"	This sampling point is near the Grid station which is surrounded mainly by agricultural land and some residential area.
A4, N4, W4	28 ° 55' 59.965" , 70 ° 59' 32.18"	This sampling point is located near settlement area of people and agricultural land.
A5, N5, W5	28 ° 16' 33.092" , 70 ° 34' 0.41"	This sampling point is located near settlement area of people and agricultural land.

Sampling Points Location Map



Annexure III: Laboratory Provided Analysis Reports

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ENVIRONMENTAL MONITORING & ANALYSIS REPORT

TRANSMISSION LINE PROJECT: DAHARKI-RYK-BAHAWALPUR

- Ambient Air Monitoring
- Noise Level Monitoring
- Ground Water Analysis

Reference No.: AES-ENV-HB-03/2022 | Dated: 07 September, 2022

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Document No. AES/LMS/FRM-110, Date of Issue 22 June, 2020, Revision No. 00

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ISO 9001:2015 ISO 14001:2015 ISO 45001:2018

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Location for Ambient Air Monitoring 03

GHAZIPUR, ZAHIR PIR

Rahimyar Khan

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Document No. AES/LMS/FRM-110, Date of Issue 01 April, 2022, Revision No. 01

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-03	**Sampling Point**	Ghazipur, Zahir Pir, Rahimyar Khan
Date of Monitoring	26-Aug-2022 to 27-Aug-2022	**Sampling Coordinates**	28°44'24" **N** 70°27'52" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Sr. No.	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1	13:00	1.06	15.72	31.23	46.89	37.92
2	14:00	1.10	16.24	31.72	47.89	38.61
3	15:00	1.10	15.61	32.46	48.01	37.08
4	16:00	1.00	14.69	31.95	46.59	36.96
5	17:00	0.92	15.20	30.91	46.05	35.29
6	18:00	0.89	15.42	29.79	45.16	32.85
7	19:00	0.92	15.39	28.56	43.89	30.88
8	20:00	0.89	14.15	27.90	42.00	32.64
9	21:00	0.76	13.26	27.74	40.95	33.29
10	22:00	0.76	12.02	25.82	37.80	30.85
11	23:00	0.79	11.30	25.63	36.88	30.52
12	00:00	0.83	10.69	26.45	37.09	29.59
13	01:00	0.73	11.11	23.99	35.05	29.52
14	02:00	0.65	10.09	23.91	33.96	28.52
15	03:00	0.65	8.90	22.13	30.99	30.78
16	04:00	0.57	10.36	23.01	33.32	32.37
17	05:00	0.64	11.69	22.82	34.46	35.34
18	06:00	0.75	11.94	25.31	37.20	37.56
19	07:00	0.75	12.19	27.48	39.62	38.76
20	08:00	0.81	12.37	29.14	41.46	41.40
21	09:00	0.92	14.28	29.04	43.27	40.18
22	10:00	1.00	13.37	30.89	44.20	37.25
23	11:00	1.01	14.10	30.03	44.08	40.31
24	12:00	0.98	14.37	31.12	45.43	40.82
	Average Concentration	**0.85**	**13.10**	**27.88**	**40.93**	**34.97**

Monitored By | **Reviewed By (TM)** | **Approved By (QM)**

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-03	**Sampling Point**	Ghazipur, Zahir Pir, Rahimyar Khan
Date of Monitoring	26-Aug-2022 to 27-Aug-2022	**Sampling Coordinates**	28°44'24" **N** 70°27'52" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Parameters	Units	Monitoring Duration	LDL	Average Obtained Concentration	PEQS	Remarks
Nitrogen Dioxide (NO_2) *	µg/m³	24Hours	1.00	27.88	80.0	Optimal
Nitrogen Oxide (NO)*	µg/m³	24Hours	1.00	13.10	40.0	Optimal
NO_x*	µg/m³	24Hours	1.00	40.93	120.0	Optimal
Sulphur Dioxide (SO_2) *	µg/m³	24Hours	1.00	34.97	120.0	Optimal
Carbon Monoxide (CO) *	mg/m³	24Hours	0.01	0.85	05.0	Optimal
Particulate Matter (PM_{10}) *	µg/m³	24Hours	1.00	108.25	150	Optimal
Particulate Matter ($PM_{2.5}$) *	µg/m³	24Hours	1.00	31.80	35	Optimal
Total Particulate Matter (TSP)	µg/m³	24Hours	1.00	210.72	500	Optimal
Ozone (O_3)	µg/m³	01 Hour	1.00	20.40	130	Optimal

*Parameters are approved from Punjab Environment Protection Agency.

Abbreviations:
LDL= Lower Detection Limit **PEQS=** Punjab Environmental Quality Standards **µg/m³** = Micro Gram per Meter Cube

Remarks:
Optimal = Compliance with Permissible Range **Marginal** = Close to Extreme Edge **High** = Exceeds from Permissible Range
Low = Less Than Permissible Range

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-03	**Sampling Point**	Ghazipur, Zahir Pir, Rahimyar Khan
Date of Monitoring	26-Aug-2022 to 27-Aug-2022	**Sampling Coordinates**	28°44'24" **N** 70°27'52" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Sr. No.	Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
1	13:00	35	SW	1.2	52	749.07
2	14:00	36	S	1.5	50	748.66
3	15:00	37	S	1.6	48	748.14
4	16:00	38	S	1.2	48	747.45
5	17:00	36	S	1.3	46	748.01
6	18:00	35	S	0.8	45	749.22
7	19:00	35	S	1.1	48	749.79
8	20:00	33	SW	1.3	50	750.40
9	21:00	31	SW	1.5	52	751.09
10	22:00	29	SW	1.1	69	751.56
11	23:00	29	W	1.8	72	750.82
12	00:00	29	W	1.9	70	750.39
13	01:00	28	W	2.1	73	749.68
14	02:00	27	W	2.2	76	748.87
15	03:00	26	W	2.0	80	748.40
16	04:00	26	W	2.3	80	747.42
17	05:00	27	W	2.5	78	747.95
18	06:00	27	SW	2.1	75	748.30
19	07:00	28	SW	1.8	74	748.65
20	08:00	29	SW	1.5	69	749.50
21	09:00	31	SW	1.4	65	750.89
22	10:00	32	SW	1.1	60	751.54
23	11:00	33	SW	0.8	58	750.41
24	12:00	34	SW	0.6	56	749.90

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Reviewed By (TM)

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Noise Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-03	**Sampling Point**	Ghazipur, Zahir Pir, Rahimyar Khan
Date of Monitoring	26-Aug-2022 to 27-Aug-2022	**Sampling Coordinates**	28°44'24" **N** 70°27'52" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Sr. No.	Time	Noise (Leq) dB(A)*		PEQS
1	13:00	46.81		
2	14:00	46.57		
3	15:00	48.12		
4	16:00	49.37		
5	17:00	48.81	Day Time	55
6	18:00	46.81		
7	19:00	44.26		
8	20:00	41.51		
9	21:00	37.86		
10	22:00	36.42		
11	23:00	36.40		
12	00:00	36.44		
13	01:00	35.74		
14	02:00	35.73	Night Time	45
15	03:00	37.33		
16	04:00	39.29		
17	05:00	41.30		
18	06:00	43.37		
19	07:00	45.54		
20	08:00	46.11		
21	09:00	47.32		
22	10:00	48.36	Day Time	55
23	11:00	48.75		
24	12:00	49.37		

*Parameters are approved with Punjab Environment Protection Agency.

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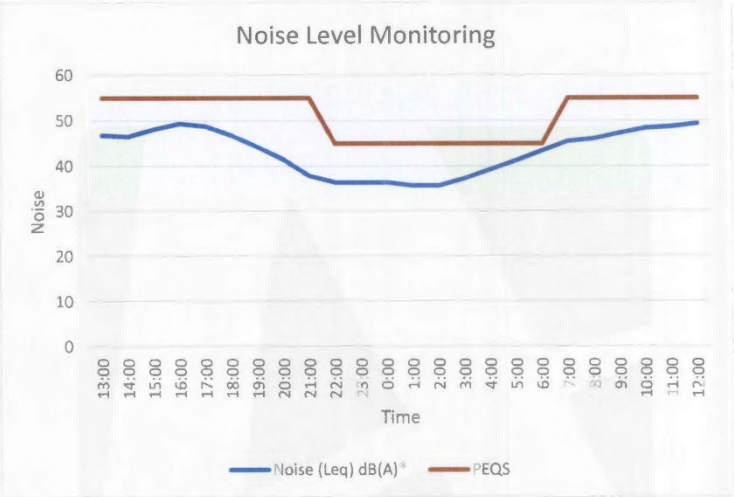

Graph-03; Noise Level Monitoring

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GROUND WATER ANALYSIS REPORT

Sample Detail

Reference No.	AES-ENV-HB-03/2022-GW-01	**Reporting Date**	07-09-2022
Nature of Sample	Ground Water	**Sampling Method Reference**	AES/LMS/QSP-014
Grab/Composite	Grab	**Sample Collected by/Sent By**	AES
Sampling Date	27-08-2022	**Sample Receiving Date**	02-09-2022
Analysis Completion Date	07-09-2022	**Lab Temp & Humidity**	24.6°C & 53%
Ambient Temperature & Humidity at the Time of Sampling			30°C & 63%
Sample ID	AES-ENV-GW-02/2022	**Sampling Location**	Ghazipur, Zahir Pir, Rahimyar Khan.
Project Name	Transmission Line Project Daharki-RYK-Bahawalpur.	**Validation Officer**	Mr. Fayyaz (Research Officer)

Ground Water Analysis Results

Parameter	Analysis Method	PEQS	LDL	Result	MU (CL95%)	Remarks
Lab Analysis						
Color*	SMWW 2120 C	≤ 15 TCU	1.0	0	N.A.	Optimal
Taste*	SMWW 2160 C	Non-Objectionable	-	Non-Objectionable	N.A.	Optimal
Odor*	SMWW 2150 B	Non-Objectionable	-	Non-Objectionable	N.A.	Optimal
Turbidity*	SMWW 2130 B	< 5 NTU	1.0	4.69	N.A.	Optimal
Total Hardness (as $CaCO_3$) **	SMWW 2340 C	< 500 mg/L	0.5	165	± 0.87	Optimal
Total Dissolved Solids (TDS)**	SMWW 2540 C	< 1000 mg/L	5.0	555	± 0.81	Optimal
pH**	SMWW 4500 H^+ B	6.5- 8.5	0.1	7.54	± 0.70	Optimal
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.001	0.006	N.A.	Optimal
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	0.0005	0.006	N.A.	Optimal
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.0005	<0.005	N.A.	Optimal
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.0035	0.02	N.A.	Optimal
Boron (B)	SMWW 3113 B	0.3 mg/l	0.02	0.02	N.A.	Optimal
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.00002	<0.006	N.A.	Optimal
Chloride (Cl^-) **	SMWW 4500 Cl^- B	< 250 mg/L	0.5	39.9	± 1.22	Optimal
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.0004	<0.004	N.A.	Optimal
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.0015	<0.164	N.A.	Optimal
Cyanide (CN^-)*	SMWW 4500 CN^- F	≤ 0.05 mg/L	0.1	0	N.A.	Optimal
Fluoride (F^-)**	SMWW 4500 F^- D	≤ 1.5 mg/L	0.1	0.35	± 0.71	Optimal
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.005	<0.005	N.A.	Optimal
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.015	<0.015	N.A.	Optimal
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	0.001	<0.001	N.A.	Optimal
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.06	<0.02	N.A.	Optimal
Nitrate (NO_3^-) *	SMWW 4500 NO_3^- B	≤ 50 mg/L	0.01	2.0	N.A.	Optimal

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GROUND WATER ANALYSIS REPORT

Sample Detail

Reference No.	AES-ENV-HB-03/2022-GW-01	**Reporting Date**	07-09-2022
Nature of Sample	Ground Water	**Sampling Method Reference**	AES/LMS/QSP-014
Grab/Composite	Grab	**Sample Collected by/Sent By**	AES
Sampling Date	27-08-2022	**Sample Receiving Date**	02-09-2022
Analysis Completion Date	07-09-2022	**Lab Temp & Humidity**	24.6°C & 53%
Ambient Temperature & Humidity at the Time of Sampling			30°C & 63%
Sample ID	AES-ENV-GW-02/2022	**Sampling Location**	Ghazipur, Zahir Pir, Rahimyar Khan.
Project Name	Transmission Line Project Daharki-RYK-Bahawalpur.	**Validation Officer**	Mr. Fayyaz (Research Officer)

Ground Water Analysis Results

Parameter	Analysis Method	PEQS	LDL	Result	MU (CL95%)	Remarks
Nitrite (NO_2^-) *	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.01	2.5	N.A.	Optimal
Selenium (Se)	SMWW 3114 B	0.01 mg/L	0.005	<0.01	N.A.	Optimal
Residual Chlorine (Cl_2) *	SMWW 4500 Cl^- B	0.5 mg/L	0.1	0	N.A.	Optimal
Phenolic Compounds (as Phenols) *	SMWW 5530 D	NGVS	0.01	0.032	N.A.	Optimal
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.15	0.054	N.A.	Optimal
Microbiological Analysis						
Total Coliforms*	SMWW 9222 B	0/ 100 mL CFU	-	0	N.A.	Optimal
Fecal Coliforms *	SMWW 9222 D	0/ 100 mL CFU	-	0	N.A.	Optimal

*Parameters are approved from Punjab Environment Protection Agency.
**Parameters are accredited from Pakistan National Accreditation Council.

Abbreviations:

PEQS = Punjab Environment Quality Standards
SMWW = Standard Methods for the examination of Water and Wastewater
TCU = True Color Unit
N.A. = Not Available
CFU = Colony forming Unit
NTU = Nephlometric Turbidity Unit
MU = Measurement Uncertainty
NGVS = No Guideline Value Set

Remarks:

Optimal = Compliance with Permissible Ronge
Marginal = Close to Extreme Edge
High = Exceeds from Permissible Range
Low = Less Than Permissible Range

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- This report shall not be reproduced in part/parties.
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- Values reflect the testing results; decision for usage of report totally depends on client.

Analyzed By 07-09-2022

Reviewed By (TM)

Approved By (QM) 07/09/22

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----------End of Report----------

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Location for Ambient Air Monitoring 04

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-04	**Sampling Point**	Liaquat Pur, Rahimyar Khan
Date of Monitoring	31-Aug-2022 to 01-Sep-2022	**Sampling Coordinates**	28°55'47" **N** 70°59'17" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Sr. No.	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1	12:00	0.88	14.63	25.28	39.86	32.52
2	13:00	0.94	14.57	25.89	40.41	33.17
3	14:00	0.98	13.65	26.52	40.12	33.80
4	15:00	0.97	13.25	27.04	40.24	34.62
5	16:00	1.06	14.79	28.45	43.19	34.32
6	17:00	1.02	15.98	30.55	46.47	39.26
7	18:00	1.02	14.31	27.18	41.44	36.56
8	19:00	0.94	14.34	26.52	40.81	36.05
9	20:00	0.94	12.38	27.90	40.23	37.55
10	21:00	0.91	11.95	26.41	38.31	36.52
11	22:00	0.88	11.32	24.14	35.41	38.46
12	23:00	0.84	11.65	23.26	34.86	33.18
13	00:00	0.79	11.51	22.41	33.88	34.74
14	01:00	0.79	10.98	22.26	33.20	35.95
15	02:00	0.76	10.12	22.58	32.66	32.35
16	03:00	0.71	10.49	22.99	33.43	30.42
17	04:00	0.75	12.34	24.64	36.93	31.98
18	05:00	0.77	11.76	26.85	38.56	34.47
19	06:00	0.87	12.03	27.85	39.83	36.38
20	07:00	0.84	14.20	30.36	44.50	38.63
21	08:00	0.76	13.71	27.37	41.03	39.84
22	09:00	0.85	15.21	27.98	43.13	38.65
23	10:00	0.86	13.40	26.34	39.69	40.96
24	11:00	0.99	14.55	29.85	44.34	40.21
Average Concentration		**0.88**	**13.05**	**26.28**	**39.27**	**35.86**

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-04	**Sampling Point**	Liaquat Pur, Rahimyar Khan
Date of Monitoring	31-Aug-2022 to 01-Sep-2022	**Sampling Coordinates**	28°55'47" **N** 70°59'17" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Parameters	Units	Monitoring Duration	LDL	Average Obtained Concentration	PEQS	Remarks
Nitrogen Dioxide (NO_2) *	µg/m³	24Hours	1.00	26.28	80.0	Optimal
Nitrogen Oxide (NO)*	µg/m³	24Hours	1.00	13.05	40.0	Optimal
NO_x*	µg/m³	24Hours	1.00	39.27	120.0	Optimal
Sulphur Dioxide (SO_2) *	µg/m³	24Hours	1.00	35.86	120.0	Optimal
Carbon Monoxide (CO) *	mg/m³	24Hours	0.01	0.88	05.0	Optimal
Particulate Matter (PM_{10}) *	µg/m³	24Hours	1.00	109.75	150	Optimal
Particulate Matter ($PM_{2.5}$) *	µg/m³	24Hours	1.00	32.38	35	Optimal
Total Particulate Matter (TSP)	µg/m³	24Hours	1.00	216.55	500	Optimal
Ozone (O_3)	µg/m³	01 Hour	1.00	14.98	130	Optimal

*Parameters are approved from Punjab Environment Protection Agency.

Abbreviations:
LDL= Lower Detection Limit **PEQS=** Punjab Environmental Quality Standards **µg/m³** = Micro Gram per Meter Cube

Remarks:
Optimal = Compliance with Permissible Range **Marginal** = Close to Extreme Edge **High** = Exceeds from Permissible Range
Low = Less Than Permissible Range

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-04	**Sampling Point**	Liaquat Pur, Rahimyar Khan
Date of Monitoring	31-Aug-2022 to 01-Sep-2022	**Sampling Coordinates**	28°55'47" **N** 70°59'17" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Sr. No.	Time	Ambient Temperature ^{0}C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
1	12:00	35	SW	0.4	53	746.61
2	13:00	36	SW	0.8	50	746.33
3	14:00	37	W	0.5	49	745.12
4	15:00	36	W	0.2	49	745.05
5	16:00	36	W	0.6	48	744.52
6	17:00	36	W	0.3	51	744.68
7	18:00	34	W	0.8	54	744.72
8	19:00	33	W	0.9	58	744.81
9	20:00	31	SW	1.1	61	744.82
10	21:00	30	SW	1.2	65	744.85
11	22:00	29	SW	1.4	66	744.81
12	23:00	29	SW	1.5	66	744.88
13	00:00	29	SW	1.6	67	744.92
14	01:00	29	SW	1.8	68	744.98
15	02:00	28	SW	1.9	70	744.90
16	03:00	28	SW	1.9	71	744.81
17	04:00	27	SW	2.0	72	744.80
18	05:00	28	SW	1.8	74	744.95
19	06:00	30	SW	1.4	78	745.12
20	07:00	30	SW	1.4	76	745.26
21	08:00	31	SW	1.0	75	746.01
22	09:00	31	SW	0.8	68	746.54
23	10:00	32	SW	0.9	63	746.95
24	11:00	33	SW	0.5	55	746.83

Monitored By

Reviewed By (TM)

Approved By (QM)

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Noise Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-04	**Sampling Point**	Liaquat Pur, Rahimyar Khan
Date of Monitoring	31-Aug-2022 to 01-Sep-2022	**Sampling Coordinates**	28°55'47" **N** 70°59'17" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Sr. No.	Time	Noise (Leq) dB(A)*		PEQS
1	12:00	47.85		
2	13:00	49.44		
3	14:00	50.89		
4	15:00	51.50		
5	16:00	50.15	Day Time	55
6	17:00	48.57		
7	18:00	47.50		
8	19:00	46.47		
9	20:00	44.95		
10	21:00	42.54		
11	22:00	40.69		
12	23:00	39.19		
13	00:00	36.98		
14	01:00	35.19		
15	02:00	34.65	Night Time	45
16	03:00	36.37		
17	04:00	37.83		
18	05:00	39.71		
19	06:00	41.87		
20	07:00	44.61		
21	08:00	46.99		
22	09:00	48.54	Day Time	55
23	10:00	49.49		
24	11:00	50.27		

*Parameters are approved with Punjab Environment Protection Agency.

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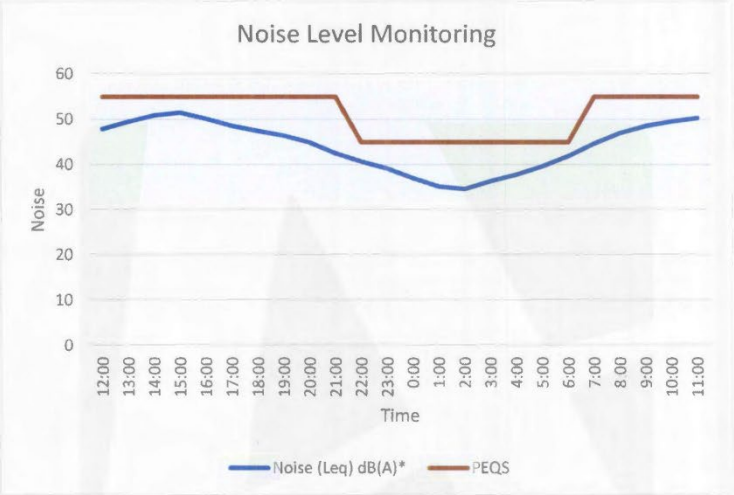

Graph-04; Noise Level Monitoring

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GROUND WATER ANALYSIS REPORT

Sample Detail

Reference No.	AES-ENV-HB-03/2022-GW-05	**Reporting Date**	07-09-2022
Nature of Sample	Ground Water	**Sampling Method Reference**	AES/LMS/QSP-014
Grab/Composite	Grab	**Sample Collected by/Sent By**	AES
Sampling Date	01-09-2022	**Sample Receiving Date**	02-09-2022
Analysis Completion Date	07-09-2022	**Lab Temp & Humidity**	24.6°C & 53%
Ambient Temperature & Humidity at the Time of Sampling			30°C & 63%
Sample ID	AES-ENV-GW-06/2022	**Sampling Location**	Liaquat Pur, Rahimyar Khan.
Project Name	Transmission Line Project Daharki-RYK-Bahawalpur.	**Validation Officer**	Mr. Fayyaz (Research Officer)

Ground Water Analysis Results

Parameter	Analysis Method	PEQS	LDL	Result	MU (CL95%)	Remarks
Lab Analysis						
Color*	SMWW 2120 C	≤ 15 TCU	1.0	0	N.A.	Optimal
Taste*	SMWW 2160 C	Non-Objectionable	-	**Salty**	N.A.	High
Odor*	SMWW 2150 B	Non-Objectionable	-	Non-Objectionable	N.A.	Optimal
Turbidity*	SMWW 2130 B	< 5 NTU	1.0	**27.1**	N.A.	High
Total Hardness (as $CaCO_3$) **	SMWW 2340 C	< 500 mg/L	0.5	**1548**	± 0.87	High
Total Dissolved Solids (TDS)**	SMWW 2540 C	< 1000 mg/L	5.0	**2040**	± 0.81	High
pH**	SMWW 4500 H^+ B	6.5- 8.5	0.1	7.12	± 0.70	Optimal
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.001	0.007	N.A.	Optimal
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	0.0005	0.007	N.A.	Optimal
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.0005	<0.005	N.A.	Optimal
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.0035	0.02	N.A.	Optimal
Boron (B)	SMWW 3113 B	0.3 mg/l	0.02	<0.02	N.A.	Optimal
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.00002	<0.006	N.A.	Optimal
Chloride (Cl^-) **	SMWW 4500 Cl^- B	< 250 mg/L	0.5	**286**	± 1.22	High
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.0004	<0.004	N.A.	Optimal
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.0015	<0.164	N.A.	Optimal
Cyanide (CN^-)*	SMWW 4500 CN^- F	≤ 0.05 mg/L	0.1	0	N.A.	Optimal
Fluoride (F^-)**	SMWW 4500 F^- D	≤ 1.5 mg/L	0.1	0.93	± 0.71	Optimal
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.005	<0.005	N.A.	Optimal
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.015	<0.015	N.A.	Optimal
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	0.001	<0.001	N.A.	Optimal
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.06	<0.02	N.A.	Optimal
Nitrate (NO_3^-) *	SMWW 4500 NO_3^- B	≤ 50 mg/L	0.01	0	N.A.	Optimal

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GROUND WATER ANALYSIS REPORT

Sample Detail

Reference No.	AES-ENV-HB-03/2022-GW-05	**Reporting Date**	07-09-2022
Nature of Sample	Ground Water	**Sampling Method Reference**	AES/LMS/QSP-014
Grab/Composite	Grab	**Sample Collected by/Sent By**	AES
Sampling Date	01-09-2022	**Sample Receiving Date**	02-09-2022
Analysis Completion Date	07-09-2022	**Lab Temp & Humidity**	24.6°C & 53%
Ambient Temperature & Humidity at the Time of Sampling			30°C & 63%
Sample ID	AES-ENV-GW-06/2022	**Sampling Location**	Liaquat Pur, Rahimyar Khan.
Project Name	Transmission Line Project Daharki-RYK-Bahawalpur.	**Validation Officer**	Mr. Fayyaz (Research Officer)

Ground Water Analysis Results

Parameter	Analysis Method	PEQS	LDL	Result	MU (CL95%)	Remarks
Nitrite (NO_2^-) *	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.01	0.37	N.A.	Optimal
Selenium (Se)	SMWW 3114 B	0.01 mg/L	0.005	<0.01	N.A.	Optimal
Residual Chlorine (Cl_2) *	SMWW 4500 Cl^- B	0.5 mg/L	0.1	0	N.A.	Optimal
Phenolic Compounds (as Phenols) *	SMWW 5530 D	NGVS	0.01	0	N.A.	Optimal
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.15	0.055	N.A.	Optimal
Microbiological Analysis						
Total Coliforms*	SMWW 9222 B	0/ 100 mL CFU	-	0	N.A.	Optimal
Fecal Coliforms *	SMWW 9222 D	0/ 100 mL CFU	-	0	N.A.	Optimal

*Parameters are approved from Punjab Environment Protection Agency.
**Parameters are accredited from Pakistan National Accreditation Council.

Abbreviations:

PEQS = Punjab Environment Quality Standards
SMWW = Standard Methods for the examination of Water and Wastewater
TCU = True Color Unit
N.A. = Not Available
CFU = Colony forming Unit
NTU = Nephlometric Turbidity Unit
MU = Measurement Uncertainty
NGVS = No Guideline Value Set

Remarks:

Optimal = Compliance with Permissible Range
Marginal = Close to Extreme Edge
High = Exceeds from Permissible Range
Low = Less Than Permissible Range

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- This report shall not be reproduced in part/parties.
- The provided results relate only to the sample provided/collected.
- Values reflect the test results, decision for usage of report totally depends on client.

Analyzed By 07-09-22

Reviewed By (TM) 07-09-22

Approved By (QM) 07-09-22

----------End of Report----------

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Location for Ambient Air Monitoring 05

SAMMA SATTA

Bahawalpur

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-05	**Sampling Point**	Samma Satta, Bahawalpur.
Date of Monitoring	30-Aug-2022 to 31-Aug-2022	**Sampling Coordinates**	29°16'27.786" **N** 71°34'3.594" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Sr. No.	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1	09:00	0.72	8.63	17.65	26.24	27.22
2	10:00	0.73	8.83	18.49	27.28	27.92
3	11:00	0.76	10.08	20.64	30.67	26.97
4	12:00	0.81	10.24	22.44	32.63	27.77
5	13:00	0.87	10.12	21.86	31.94	27.47
6	14:00	0.89	11.31	22.98	34.24	31.41
7	15:00	0.91	10.91	20.76	31.63	30.65
8	16:00	0.95	9.30	21.88	31.15	31.45
9	17:00	0.95	11.37	24.74	36.06	28.45
10	18:00	0.91	10.49	23.00	33.45	26.77
11	19:00	0.88	9.39	19.82	29.17	27.15
12	20:00	0.87	8.41	18.76	27.13	28.37
13	21:00	0.84	11.24	20.29	31.49	28.97
14	22:00	0.81	9.08	20.10	29.15	24.31
15	23:00	0.78	10.17	17.17	27.31	24.78
16	00:00	0.76	8.18	18.33	26.48	27.27
17	01:00	0.73	8.43	15.99	24.40	27.09
18	02:00	0.71	7.76	16.52	24.25	23.14
19	03:00	0.69	7.24	15.51	22.73	17.20
20	04:00	0.67	9.18	15.19	24.33	20.28
21	05:00	0.63	10.41	16.50	26.87	24.53
22	06:00	0.63	12.01	20.78	32.74	27.82
23	07:00	0.68	11.13	23.60	34.68	30.09
24	08:00	0.73	11.79	22.05	33.80	30.86
	Average Concentration	**0.79**	**9.82**	**19.79**	**29.58**	**27.00**

Monitored By

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-05	**Sampling Point**	Samma Satta, Bahawalpur.
Date of Monitoring	30-Aug-2022 to 31-Aug-2022	**Sampling Coordinates**	29°16'27.786" **N** 71°34'3.594" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Parameters	Units	Monitoring Duration	LDL	Average Obtained Concentration	PEQS	Remarks
Nitrogen Dioxide (NO_2) *	µg/m³	24Hours	1.00	19.79	80.0	Optimal
Nitrogen Oxide (NO)*	µg/m³	24Hours	1.00	9.82	40.0	Optimal
NO_x*	µg/m³	24Hours	1.00	29.58	120.0	Optimal
Sulphur Dioxide (SO_2) *	µg/m³	24Hours	1.00	27.00	120.0	Optimal
Carbon Monoxide (CO) *	mg/m³	24Hours	0.01	0.79	05.0	Optimal
Particulate Matter (PM_{10}) *	µg/m³	24Hours	1.00	98.24	150	Optimal
Particulate Matter ($PM_{2.5}$) *	µg/m³	24Hours	1.00	31.65	35	Optimal
Total Particulate Matter (TSP)	µg/m³	24Hours	1.00	208.65	500	Optimal
Ozone (O_3)	µg/m³	01 Hour	1.00	15.04	130	Optimal

*Parameters are approved from Punjab Environment Protection Agency.

Abbreviations:
LDL= Lower Detection Limit **PEQS=** Punjab Environmental Quality Standards **µg/m³** = Micro Gram per Meter Cube
Remarks:
Optimal = Compliance with Permissible Range **Marginal** = Close to Extreme Edge **High** = Exceeds from Permissible Range
Low = Less Than Permissible Range

Monitored By

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Ambient Air Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-05	**Sampling Point**	Samma Satta, Bahawalpur.
Date of Monitoring	30-Aug-2022 to 31-Aug-2022	**Sampling Coordinates**	29°16'27.786" **N** 71°34'3.594" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Sr. No.	Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
1	09:00	32	SW	1.2	65	753.70
2	10:00	33	SW	1.1	57	754.00
3	11:00	34	SW	1.3	51	754.46
4	12:00	35	SW	1.5	48	752.89
5	13:00	35	SW	1.4	46	762.15
6	14:00	36	SW	1.8	44	751.70
7	15:00	36	SW	1.6	44	749.44
8	16:00	36	W	1.9	44	748.86
9	17:00	35	W	2.0	46	749.40
10	18:00	35	W	2.0	50	750.88
11	19:00	33	W	2.1	57	751.65
12	20:00	32	W	1.8	61	751.82
13	21:00	32	W	2.0	64	753.49
14	22:00	31	W	2.2	65	753.89
15	23:00	30	SW	2.0	66	750.09
16	00:00	30	SW	1.8	67	750.82
17	01:00	30	SW	1.9	67	750.61
18	02:00	29	SW	2.0	68	749.72
19	03:00	29	SW	1.5	70	749.35
20	04:00	28	SW	1.4	73	748.50
21	05:00	27	SW	2.3	75	747.09
22	06:00	28	SW	1.5	77	750.63
23	07:00	29	SW	1.1	77	752.40
24	08:00	30	SW	0.8	72	752.85

Monitored By

Reviewed By (TM)

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Noise Monitoring Report

Monitoring Details

Reference Number	AES-ENV-HB-03/2022-AA-05	**Sampling Point**	Samma Satta, Bahawalpur.
Date of Monitoring	30-Aug-2022 to 31-Aug-2022	**Sampling Coordinates**	29°16'27.786" **N** 71°34'3.594" **E**
Validation Officer	Mr. Fayyaz (Research Officer)		

Sr. No.	Time	Noise (Leq) dB(A)*		PEQS
1	09:00	45.93		
2	10:00	50.26		
3	11:00	49.19		
4	12:00	50.36		
5	13:00	50.43		
6	14:00	50.92		
7	15:00	49.09	Day Time	55
8	16:00	47.31		
9	17:00	45.53		
10	18:00	43.54		
11	19:00	41.23		
12	20:00	39.30		
13	21:00	37.54		
14	22:00	35.67		
15	23:00	35.81		
16	00:00	34.55		
17	01:00	34.40		
18	02:00	35.42	Night Time	45
19	03:00	36.36		
20	04:00	37.51		
21	05:00	40.13		
22	06:00	42.35		
23	07:00	44.19		
24	08:00	46.56	Day Time	55

*Parameters are approved with Punjab Environment Protection Agency.

Monitored By | **Reviewed By (TM)** | **Approved By (QM)**

Asian Environmental Services (Pvt) Ltd LAHORE

Document No. AES/LMS/FRM-110, Date of Issue 01 April, 2022, Revision No. 01

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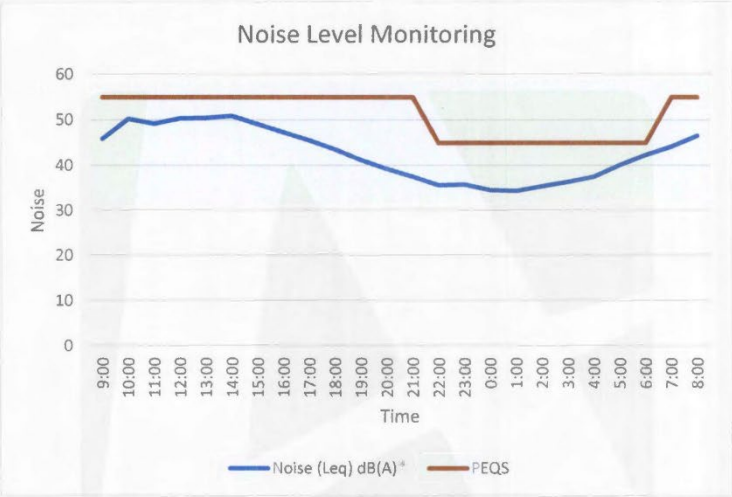

Graph-05; Noise Level Monitoring

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ASIAN ENVIRONMENTAL SERVICES PVT. (LTD)
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GROUND WATER ANALYSIS REPORT

Sample Detail

Reference No.	AES-ENV-HB-03/2022-GW-04	**Reporting Date**	07-09-2022
Nature of Sample	Ground Water	**Sampling Method Reference**	AES/LMS/QSP-014
Grab/Composite	Grab	**Sample Collected by/Sent By**	AES
Sampling Date	30-08-2022	**Sample Receiving Date**	02-09-2022
Analysis Completion Date	07-09-2022	**Lab Temp & Humidity**	24.6°C & 53%
Ambient Temperature & Humidity at the Time of Sampling			30°C & 63%
Sample ID	AES-ENV-GW-05/2022	**Sampling Location**	Samma Satta, Bahawalpur.
Project Name	Transmission Line Project Daharki-RYK-Bahawalpur.	**Validation Officer**	Mr. Fayyaz (Research Officer)

Ground Water Analysis Results

Parameter	Analysis Method	PEQS	LDL	Result	MU (CL95%)	Remarks
Lab Analysis						
Color*	SMWW 2120 C	≤ 15 TCU	1.0	0	N.A.	Optimal
Taste*	SMWW 2160 C	Non-Objectionable	-	Non-Objectionable	N.A.	Optimal
Odor*	SMWW 2150 B	Non-Objectionable	-	Non-Objectionable	N.A.	Optimal
Turbidity*	SMWW 2130 B	< 5 NTU	1.0	0	N.A.	Optimal
Total Hardness (as $CaCO_3$) **	SMWW 2340 C	< 500 mg/L	0.5	288	± 0.87	Optimal
Total Dissolved Solids (TDS)**	SMWW 2540 C	< 1000 mg/L	5.0	412	± 0.81	Optimal
pH**	SMWW 4500 H^+ B	6.5- 8.5	0.1	7.63	± 0.70	Optimal
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	0.001	<0.005	N.A.	Optimal
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	0.0005	<0.005	N.A.	Optimal
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	0.0005	<0.005	N.A.	Optimal
Barium (Ba)	SMWW 3113 B	0.7 mg/L	0.0035	0.02	N.A.	Optimal
Boron (B)	SMWW 3113 B	0.3 mg/l	0.02	<0.02	N.A.	Optimal
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	0.00002	<0.006	N.A.	Optimal
Chloride (Cl^-) **	SMWW 4500 Cl^- B	< 250 mg/L	0.5	46	± 1.22	Optimal
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	0.0004	<0.004	N.A.	Optimal
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.0015	<0.164	N.A.	Optimal
Cyanide (CN^-)*	SMWW 4500 CN^- F	≤ 0.05 mg/L	0.1	0	N.A.	Optimal
Fluoride (F^-)**	SMWW 4500 F^- D	≤ 1.5 mg/L	0.1	0.94	± 0.71	Optimal
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	0.005	<0.005	N.A.	Optimal
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/l	0.015	<0.015	N.A.	Optimal
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	0.001	<0.001	N.A.	Optimal
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	0.06	<0.02	N.A.	Optimal
Nitrate (NO_3^-) *	SMWW 4500 NO_3^- B	≤ 50 mg/L	0.01	0	N.A.	Optimal

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GROUND WATER ANALYSIS REPORT

Sample Detail

Reference No.	AES-ENV-HB-03/2022-GW-04	**Reporting Date**	07-09-2022
Nature of Sample	Ground Water	**Sampling Method Reference**	AES/LMS/QSP-014
Grab/Composite	Grab	**Sample Collected by/Sent By**	AES
Sampling Date	30-08-2022	**Sample Receiving Date**	02-09-2022
Analysis Completion Date	07-09-2022	**Lab Temp & Humidity**	24.6°C & 53%
Ambient Temperature & Humidity at the Time of Sampling			30°C & 63%
Sample ID	AES-ENV-GW-05/2022	**Sampling Location**	Samma Satta, Bahawalpur.
Project Name	Transmission Line Project Daharki-RYK-Bahawalpur.	**Validation Officer**	Mr. Fayyaz (Research Officer)

Ground Water Analysis Results

Parameter	Analysis Method	PEQS	LDL	Result	MU (CL95%)	Remarks
Nitrite (NO_2^-) *	SMWW 4500 NO_2^- B	≤ 3.0 mg/L	0.01	0	N.A.	Optimal
Selenium (Se)	SMWW 3114 B	0.01 mg/L	0.005	<0.01	N.A.	Optimal
Residual Chlorine (Cl_2) *	SMWW 4500 Cl^- B	0.5 mg/L	0.1	0	N.A.	Optimal
Phenolic Compounds (as Phenols) *	SMWW 5530 D	NGVS	0.01	0	N.A.	Optimal
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.15	0.051	N.A.	Optimal
Microbiological Analysis						
Total Coliforms*	SMWW 9222 B	0/ 100 mL CFU	-	0	N.A.	Optimal
Fecal Coliforms *	SMWW 9222 D	0/ 100 mL CFU	-	0	N.A.	Optimal

*Parameters are approved from Punjab Environment Protection Agency.
**Parameters are accredited from Pakistan National Accreditation Council.

Abbreviations:

PEQS = Punjab Environment Quality Standards
SMWW = Standard Methods for the examination of Water and Wastewater
TCU = True Color Unit
N.A. = Not Available
CFU = Colony forming Unit
NTU = Nephlometric Turbidity Unit
MU = Measurement Uncertainty
NGVS = No Guideline Value Set

Remarks:

Optimal = Compliance with Permissible Range
Marginal = Close to Extreme Edge
High = Exceeds from Permissible Range
Low = Less Than Permissible Range

Report Disclaimer

- The remaining portion of the sample (s) will be disposed off after 15 days after the issuance date of report from the laboratory unless otherwise instructed (Condition Apply).
- This report shall not be reproduced in part/parties.
- The provided results relate only to the sample provided/collected.
- Values reflect the testing results, decision for usage of report totally depends on client.

Analyzed By | **Reviewed By (TM)** | **Approved By (QM)** 07-09-22

----------End of Report----------

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Annexure IV: Sensitive Receptors

Map ID	Category	Subcategory	Sensitivity	Orientation	Distance From ROW (m)	Latitude	Longitude
1	Road	Small Blacktop Road	Low	Crossing	0	29° 18' 20.227"	71° 35' 17.993"
2	Settlements	Medium Size	High	Right	70	29° 17' 55.729"	71° 35' 18.634"
3	Settlements	Medium Size	High	Both Side	60	29° 17' 31.024"	71° 35' 8.156"
4	Road	Small Blacktop Road	Low	Crossing	0	29° 16' 28.674"	71° 34' 2.433"
5	Road	Unsealed Road	Low	Crossing	0	29° 16' 16.568"	71° 33' 4.424"
6	Settlements	Small Size	Medium	Both Side	60	29° 16' 13.498"	71° 32' 48.310"
7	Settlements	Small Size	Medium	Both Side	70	29° 13' 39.319"	71° 31' 1.269"
8	Settlements	Small Size	Medium	Both Side	50	29° 13' 12.921"	71° 30' 31.635"
9	Settlements	Small Size	Medium	Both Side	70	29° 13' 7.535"	71° 30' 10.587"
10	Settlements	Small Size	Medium	Left	20	29° 12' 6.342"	71° 29' 4.805"
11	Road	Medium Blacktop Road	Medium	Crossing	0	29° 11' 20.032"	71° 27' 29.793"
12	Commercial	Poultry Farm	Low	Right	80	29° 11' 18.808"	71° 27' 27.469"
13	Commercial	Poultry Farm	Low	Left	90	29° 10' 43.825"	71° 26' 50.553"
14	Road	Small Blacktop Road	Low	Crossing	0	29° 10' 12.458"	71° 26' 11.065"
15	Waterbody	Canal	Medium	Crossing	0	29° 8' 33.906"	71° 24' 38.656"
16	Settlements	Small Size	Medium	Left	70	29° 8' 26.619"	71° 24' 33.862"
17	Waterbody	Canal	Medium	Crossing	0	29° 8' 23.421"	71° 24' 22.060"
18	Settlements	Small Size	Medium	Left	70	29° 7' 57.043"	71° 22' 42.383"
19	Settlements	Small Size	Medium	Right	20	29° 6' 57.101"	71° 20' 54.891"
20	Road	Small Blacktop Road	Low	Crossing	0	29° 6' 53.910"	71° 20' 49.789"
21	Commercial	Office	Low	Left	5	29° 5' 23.897"	71° 18' 52.896"
22	Road	Small Blacktop Road	Low	Crossing	0	29° 3' 59.385"	71° 17' 12.632"
23	Waterbody	Canal	Medium	Crossing	0	28° 59' 53.426"	71° 8' 21.658"
24	Waterbody	Canal	Medium	Crossing	0	28° 57' 9.302"	71° 3' 38.345"
25	Waterbody	Nullah	Medium	Crossing	0	28° 56' 41.584"	71° 2' 15.851"
26	Road	Small Blacktop Road	Low	Crossing	0	28° 55' 40.531"	71° 0' 11.592"
27	Settlements	Medium Size	High	Left	20	28° 54' 59.064"	70° 58' 44.994"
28	Road	Small Blacktop Road	Low	Crossing	0	28° 54' 45.223"	70° 58' 5.302"
29	Settlements	Small Size	Medium	Left	30	28° 54' 19.929"	70° 57' 13.216"

30	Settlements	Medium Size	High	Right	40	28° 54' 3.962"	70° 56' 45.305"
31	Road	Medium Blacktop Road	Medium	Crossing	0	28° 53' 56.002"	70° 55' 48.974"
32	Road	Railway Track	Low	Crossing	0	28° 53' 52.002"	70° 55' 19.738"
33	Road	Main Highway	High	Crossing	0	28° 53' 44.021"	70° 54' 21.896"
34	Settlements	Small Size	Medium	Right	20	28° 53' 30.712"	70° 53' 48.949"
35	Waterbody	Canal	Medium	Crossing	0	28° 52' 54.794"	70° 52' 57.326"
36	Road	Small Blacktop Road	Low	Crossing	0	28° 52' 46.453"	70° 52' 45.180"
37	Road	Small Blacktop Road	Low	Crossing	0	28° 51' 19.873"	70° 49' 22.262"
38	Road	Small Blacktop Road	Low	Crossing	0	28° 51' 11.282"	70° 48' 52.077"
39	Road	Medium Blacktop Road	Medium	Crossing	0	28° 50' 50.747"	70° 48' 1.540"
40	Waterbody	Canal	Medium	Crossing	0	28° 50' 9.582"	70° 45' 34.254"
41	Settlements	Small Size	Medium	Right	15	28° 48' 52.259"	70° 41' 46.435"
42	Road	Medium Blacktop Road	Medium	Crossing	0	28° 48' 40.687"	70° 41' 36.620"
43	Settlements	Small Size	Medium	Right	40	28° 48' 31.907"	70° 41' 29.470"
44	Waterbody	Canal	Medium	Crossing	0	28° 47' 56.973"	70° 40' 35.686"
45	Road	Small Blacktop Road	Low	Crossing	0	28° 47' 49.323"	70° 40' 18.636"
46	Settlements	Small Size	Medium	Left	5	28° 47' 44.901"	70° 40' 3.112"
47	Waterbody	Canal	Medium	Crossing	0	28° 47' 29.026"	70° 37' 11.446"
48	Settlements	Small Size	Medium	Right	50	28° 47' 24.343"	70° 36' 39.252"
49	Waterbody	Canal	Medium	Crossing	0	28° 47' 11.158"	70° 35' 24.815"
50	Road	Small Blacktop Road	Low	Crossing	0	28° 47' 3.758"	70° 34' 37.168"
51	Waterbody	Canal	Medium	Crossing	0	28° 47' 7.332"	70° 34' 3.663"
52	Waterbody	Canal	Medium	Crossing	0	28° 47' 11.233"	70° 33' 24.077"
53	Road	Medium Blacktop Road	Medium	Crossing	0	28° 47' 14.468"	70° 32' 34.339"
54	Waterbody	Canal	Medium	Crossing	0	28° 47' 5.230"	70° 32' 15.433"
55	Settlements	Small Size	Medium	Right	10	28° 46' 36.922"	70° 31' 44.891"
56	Waterbody	Canal	Medium	Crossing	0	28° 46' 5.697"	70° 31' 7.821"
57	Settlements	Medium Size	High	Left	20	28° 46' 4.540"	70° 31' 0.873"
58	Road	Main Highway	High	Crossing	0	28° 45' 48.074"	70° 29' 24.034"
59	Settlements	Small Size	Medium	Left	60	28° 45' 30.594"	70° 28' 51.599"
60	Settlements	Small Size	Medium	Both /side	70-80	28° 45' 12.635"	70° 28' 30.147"
61	Commercial	Poultry Farm	Low	Left	70	28° 45' 10.949"	70° 28' 23.856"
62	Road	Small Blacktop Road	Low	Crossing	0	28° 45' 8.221"	70° 28' 14.859"

Annexure V: Ecological Field Data

Table 1: Terrestrial Vegetation

Location ID	Habitat	Latitude	Longitude	*Suaeda fruticosa*		*Saccharum bengalense*		*Acasia nilotica*		*Albizia lebbeck*		*Crotalaria burhia*		*Aerva javanica*		*Citrullus colocynthis*		*Calotropis procera*		*Arundo donax*		*Eucalyptus globulus*		*Dalbergia sissoo*		*Datura innoxia*	
				Cover %	Count	Cover%	Count	Cover%	Count	Cover%	Count	Cover%	Count	Cover%	Count	Cover%	Count	Cover%	Count	Cover%	Count	Cover%	Count	Cover%	Count	Cover%	Count	Cover%	Count
SP-1	Sand Dunes	29.3172	71.588904	1.646	-		2		-	29.162	-	1.7969	-	1.8456	11	2.5	2		3		-		-		-		-
SP-2	Vegetation	29.314266	71.576252	6.7	8		-		-		-		14		-		-	10.599	2		-		9		-	3.9776	-
SP-3	Sand Dunes	29.256856	71.542193	3.0819	-		3		-		-	1.8	5	3.4	9	5.4	2		-		-	3.1239	-		-		4
SP-4	Sand Dunes	29.133697	71.358734		-	1.5619	-	1.6515	2	12.556	7		11	11.2	8	0.2925	-		-		1		-		-	2.0546	-
SP-5	Sand Dunes	29.006004	71.173641	8.7	8	11.1	2	200.9	4		-		-		-		-	0.7	3		-		-	3.1	1	2.3	6
SP-6	Vegetation	28.932842	71.043872		-		-	59.5	2		-		-		-		-		-		-		-	24.9	2		-
SP-7	Vegetation	28.955841	71.033861		5		-	49.8	1		-		-		-		-	0.6	2	0.5	6		-	11.1	2		-
SP-8	Agricultural Fields	28.744992	70.46635		-		-	229.9	4		-		15		-		-	2.7	1		-	88.5	1	85.4	2		-
SP-9	Agricultural Fields	28.762829	70.485177		-	6.7	1	133.7	4		-		-		-		-	19.4	13		-		-	157.4	4	5.3	6
SP-10	Agricultural Fields	28.839233	70.789962		-		-	186.9	3	48.7	3		-		-		-		-		-		-	106.4	2		-
SP-11	Agricultural Fields	28.793727	70.576757		-	78.1	10		-	67.7	1		-		-	0.3	-		-		2		-	0.3	2		-
Total				**20.1**	**21**	**97.4**	**18**	**862.3**	**20**	**158.2**	**11**	**3.6**	**45**	**16.5**	**28**	**8.5**	**4**	**33.9**	**24**	**0.5**	**9**	**91.6**	**10**	**388.5**	**15**	**13.7**	**16**

	Capparis decidua		*Eucalyptus camaldulensis*		*Ficus religiosa*		*Nerium oleander*		*Phoenix dactylifera*		*Salsola imbricata*		*Prosopis juliflora*		*Tamarix aphylla*		*Saccharum sp.*		*Salvadora oleoides*		*Saccharum spp.*		*Ziziphus sp.*		**Total Cover %**	**Total count**	**Species Count**
Cover %	Count	Cover %	Count	Cover %	Count	Cover %	Count	Cover %	Count	Cover %	Count	Cover %	Count	Cover %	Count	Cover %	Count	Cover %	Count	Cover %	Count	Cover %	Count			
49.8	1	-	-	-	-	-	-	-	-	1.1	3	-	-	-	-	-		-	-	-	-	2.0	1	**89.8**	**23**	**8**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	274.1	6	-	-	244.0	3	-	-	-	-	**539.3**	**42**	**5**

160.12	5	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	11.8	10	1.4342	-	**190.2**	**40**	**8**
25.7	6	-	-	-	-	-	-	-	-	2.8	9	1.1	1	-	13	7.7	-	-	-	-	-	-	-	**66.6**	**64**	**10**
-	-	-	-	-	-	-	-	-	-	-	-	93.6	8	-	-	-	6	-	-	-	-	-	-	**320.3**	**32**	**7**
-	-	382.7	6	49.8	1	-	-	9.3	1	-	-	32.5	12	-	-	-	-	-	-	-	-	-	-	**558.7**	**24**	**6**
-	-	289.0	7	-	-	-	-	-	-	-	-	11.3	9	-	-	-	-	-	-	-	-	-	-	**362.1**	**32**	**6**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**406.5**	**23**	**4**
10.1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**332.5**	**29**	**6**
-	-	-	-	-	-	37.4	1	-	-	-	-	-	-	46.5	1	-	-	-	-	-	-	-	-	**425.9**	**10**	**5**
32.3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27.6	2	**206.4**	**20**	**6**
278.0	**16**	**671.7**	**13**	**49.8**	**1**	**37.4**	**1**	**9.3**	**1**	**3.9**	**12**	**138.4**	**32**	**320.6**	**20**	**7.7**	-	**244.0**	**3**	**11.8**	**10**	**31.1**	**3**	**3,498.4**	**339**	**24**

Table 2: Mammals Data

Location ID	Habitat	Latitude	Longitude	*Golden Jackal*		*Red Fox*		*Small Indian Mongoose*		*Five Striped Palm Squirrel*		*Wild Boar*				***Sighting***		***Sign***	
				Canis aureus		*Vulpes*		*Herpestes javanicus*		*Funambulus pennantii*		*Sus scrofa*		*Rodent spp.*		***Total***	***Species Count***	***Total***	***Species Count***
				Sighting	Sign	Sighting	Sign	Sighting	Sign	Sighting	Sign	Sighting	Sign	Sighting	Sign				
SP-1	Sand Dunes	29.3172	71.588904				3			1						**1**	**1**	**3**	**1**
SP-2	Vegetation	29.314266	71.576252	1						7						**8**	**2**		
SP-3	Sand Dunes	29.256856	71.542193							2						**2**	**1**		
SP-4	Sand Dunes	29.133697	71.358734							2						**2**	**1**		
SP-5	Sand Dunes	29.006004	71.173641							1					9	**1**	**1**	**9**	**1**
SP-6	Vegetation	28.932842	71.043872							2						**2**	**1**		
SP-7	Vegetation	28.955841	71.033861	1				1		3		3				**8**	**4**		
SP-8	Agricultural Fields	28.744992	70.46635					1		1						**2**	**2**		
SP-9	Agricultural Fields	28.762829	70.485177							2						**2**	**1**		
SP-10	Agricultural Fields	28.839233	70.789962																
SP-11	Agricultural Fields	28.793727	70.576757							1						**1**	**1**		
Total				**2**	-	-	**3**	**2**	-	**22**	-	**3**	-	-	**9**	**29**	**4**	**12**	**2**

Table 3: Birds Data

S. NO	Species		IUCN Status	CITES Appendices	SP-1	SP-2	SP-3	SP-4	SP-5	SP-6	SP-7	SP-8	SP-9	SP-10	SP-11	Total
	Common Name	Sciencetific Name														
1	Jacobin Cuckoo	*Clamator jacobinus*	Least Concern			1							1			**2**
2	Oriental Honey Buzzard	*Pernis ptilorhynchus*	Least Concern	II											1	**1**
3	Rosy Starling	*Pastor roseus*	Least Concern												2	**2**
4	Black Kite	*Milvus migrans*	Least Concern	II	12	4	3						1			**20**
5	Barn Swallow	*Hirundo rustica*	Least Concern			10	2		4			12				**28**
6	Wire-tailed Swallow	*Hirundo smithii*	Least Concern										20	10	10	**40**
7	Ashy-crowned Sparrow-lark	*Eremopterix griseus*	Least Concern					3								**3**
8	Crested Lark	*Galerida cristata*	Least Concern					8	6							**14**
9	Little Green Bee Eater	*Merops orientalis*	Least Concern		14	16	7	5	6	3	9		3	10	6	**79**
10	Blue-cheeked Bee-eater	*Merops superciliosus*	Least Concern							4						**4**
11	Clamorous Reed Warbler	*Acrocephalus stentoreus*	Least Concern			3										**3**
12	Jungle Babbler	*Turdoides striata*	Least Concern						6				4		7	**17**
13	Common Babbler	*Argya caudata*	Least Concern				2								2	**4**
14	Common Myna	*Acridotheres tristis*	Least Concern		6	6					6	5	6	10	4	**43**
15	Bank Myna	*Acridotheres ginginianus*	Least Concern										10			**10**
16	Indian Silverbill	*Euodice malabarica*	Least Concern		2											**2**
17	Indian Roller	*Coracias benghalensis*	Least Concern			1		4	5	2				7	4	**23**
18	Indian Robin	*Copsychus fulicatus*	Least Concern						2	4						**6**
19	Asian Koel	*Eudynamys scolopaceus*	Least Concern												2	**2**
20	Black Drongo	*Dicrurus macrocercus*	Least Concern											3	4	**7**

21	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern			3			2							**5**
22	Purple Sunbird	*Cinnyris asiaticus*	Least Concern						2	2	2			1		**7**
23	Greater Coucal	*Centropus sinensis*	Least Concern						2	1					1	**4**
24	House Sparrow	*Passer domesticus*	Least Concern							3		6		10	6	**25**
25	House Crow	*Corvus splendens*	Least Concern		10	10	9	3	10	6	10	8	10	10	6	**92**
26	White cheeked Bulbul	*Pycnonotus leucotis*	Least Concern			2				2	3					**7**
27	Pied Kingfisher	*Ceryle rudis*	Least Concern			2										**2**
28	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern						1	2				6	4	**13**
29	Red-vented Bulbul	*Pycnonotus cafer*	Least Concern			3										**3**
30	Eurasian Hoopoe	*Upupa epops*	Least Concern						1							**1**
31	Graceful Prinia	*Prinia gracilis*	Least Concern									2	6		7	**15**
32	River Tern	*Sterna aurantia*	Vulnerable												2	**2**
33	Striated Prinia	*Prinia crinigera*	Least Concern			3					3					**6**
34	Long-legged Buzzard	*Buteo rufinus*	Least Concern	II					1							**1**
35	Black-winged Stilt	*Himantopus himantopus*	Least Concern											16		**16**
36	Little egret	*Egretta garzetta*	Least Concern						3				20	16		**39**
37	Laughing dove	*Spilopelia senegalensis*	Least Concern			2			2	1	2					**7**
38	Eurasian Collared Dove	*Streptopelia decaocto*	Least Concern							3	2					**5**
39	Southern Grey shrike	*Lanius meridionalis*	Least Concern						3							**3**
40	Long-tailed Shrike	*Lanius schach*	Least Concern											2	1	**3**
41	Red-wattled lapwing	*Vanellus indicus*	Least Concern			20	10		24	6	10			12		**82**
42	Variable wheatear	*Oenanthe picata*	Least Concern					1								**1**
43	Common Moorhen	*Gallinula chloropus*	Least Concern											1		**1**

44	White-breated Moorhen	*Amaurornis phoenicurus*	Least Concern											1		**1**
45	Common Greenshank	*Tringa nebularia*	Least Concern								4			14		**18**
46	Baya Weaver	*Ploceus philippinus*	Least Concern									10	3	10	10	**33**
47	Black-breasted Weaver	*Ploceus benghalensis*	Least Concern												8	**8**
48	Indian Pond Heron	*Ardeola grayii*	Least Concern											10	2	**12**
49	Pied Bushchat	*Saxicola caprata*	Least Concern									1		3		**4**
50	Tailorbird	*Orthotomus sutorius*	Least Concern												2	**2**
51	Cattle Egret	*Bubulcus ibis*	Least Concern						3				26	6		**35**
Total							**44**	**86**	**33**	**24**	**83**	**39**	**51**	**44**	**110**	**158**
Total Species							**5**	**15**	**6**	**6**	**18**	**13**	**10**	**7**	**12**	**20**

Table 4:: Herpetofauna Data

Location ID	Habitat	Latitude	Longitude	Indian Fringe-fingered lizard *Acanthodactylus cantoris*	Indian Spiny-tailed Lizard *Uromastyx hardwickii*	Punjab Snake-eyed Lacerta *Ophisops jerdonii*	Sand Boa *Eryx johnii*	Asian Garden Lizard *Calotes versicolor*	Skittering Frog *Euphlyctis cyanophlyctis*	Indian Flapshell Turtle *Lissemys punctata*	***Total***	***Species Count***
SP-1	Sand Dunes	29.3172	71.588904	2	2		3				7	3
SP-2	Vegetation	29.314266	71.576252	1							1	1
SP-3	Sand Dunes	29.256856	71.542193	2			2				4	2
SP-4	Sand Dunes	29.133697	71.358734				1				1	1
SP-5	Sand Dunes	29.006004	71.173641						40		40	1
SP-6	Vegetation	28.932842	71.043872									
SP-7	Vegetation	28.955841	71.033861									
SP-8	Agricultural Fields	28.744992	70.46635			1		1	30		32	3
SP-9	Agricultural Fields	28.762829	70.485177							1	1	1
SP-10	Agricultural Fields	28.839233	70.789962			1					1	1
SP-11	Agricultural Fields	28.793727	70.576757						3		3	1
Total				**5**	**2**	**2**	**6**	**1**	**73**	**1**	**90**	**7**

Annexure VI: IBAT Findings Report

RYK to Bahawalpur (150 km)

IBAT

Integrated Biodiversity Assessment Tool

PROXIMITY REPORT

RYK-BHAWALPUR

Country: Pakistan

Location: [29, 71.1]

Date of analysis: 23 June 2022 (GMT)

Buffers applied: 5 km

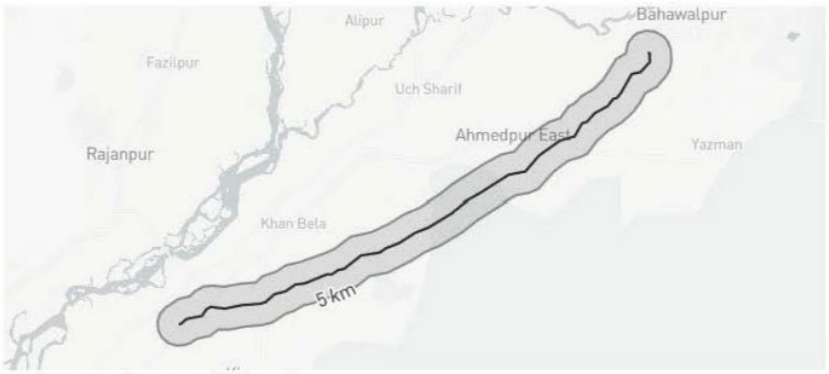
IUCN Red List Biomes: Freshwater, Terrestrial

Generated by: Abdul Basit Khan

Organisation: ADB

Overlaps with:

Protected Areas	2
Key Biodiversity Areas	0
IUCN Red List	35



Displaying project location and buffers: 5 km

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RYK-BHAWALPUR | Page 1 of 7

About this report

This report presents the results of [29327-31988] proximity analysis to identify the biodiversity features and species which are located within the following buffers: 5 km.

This report is one part of a package generated by IBAT on 23 June 2022 (GMT) that includes full list of all species, protected areas, Key Biodiversity Areas in CSV format, maps showing the area of interest in relation to these features, and a 'How to read IBAT reports' document.

WARNING: IBAT aims to provide the most up-to-date and accurate information available at the time of analysis. There i however a possibility of incomplete, incorrect or out-of-date information. All findings in this report must be supported by further desktop review, consultation with experts and/or on-the-ground field assessment. Please consult IBAT for any additional disclaimers or recommendations applicable to the information used to generate this report.

Please note, sensitive species data are currently not included in IBAT reports in line with the Sensitive Data Access Restrictions Policy for the IUCN Red List. This relates to sensitive Threatened species and KBAs triggered by sensitive species.

Data used to generate this report

- UNEP-WCMC and IUCN, 2022. Protected Planet: The World Database on Protected Areas (WDPA)[On-line], Cambridge, UK: UNEP-WCMC and IUCN. Available at: www.protectedplanet.net - June 2022.
- BirdLife International (on behalf of the KBA Partnership), 2022. Key Biodiversity Areas - April 2022.
- IUCN, 2021. IUCN Red List of Threatened Species - December 2021.
- IUCN. The IUCN Red List of Threatened Species. Version 2019-3. (2019). https://www.iucnredlist.org
- IUCN. Threats Classification Scheme (Version 3.2). (2019)
- Strassburg, B.B.N., Iribarrem, A., Beyer, H.L. et al. Global priority areas for ecosystem restoration. Nature 586, 724–729 (2020). https://doi.org/10.1038/s41586-020-2784-9

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Protected Areas

The following protected areas are found within 5 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

Area name	Within buffer of
Abbasia	5 km
Bahwaalpur Plantation	5 km

Key Biodiversity Areas

The following key biodiversity areas are found within 5 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

No KBAs within buffer distance

IUCN Red List of Threatened Species

The following threatened species are potentially found within 50km of the area of interest.

For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Vanellus gregarius	Sociable Lapwing	AVES	CR	Decreasing	Terrestrial
Gyps bengalensis	White-rumped Vulture	AVES	CR	Decreasing	Terrestrial
Geoclemys hamiltonii	Spotted Pond Turtle	REPTILIA	EN	Decreasing	Terrestrial, Freshwater
Hardella thurjii	Crowned River Turtle	REPTILIA	EN	Decreasing	Terrestrial, Freshwater

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RYK-BHAWALPUR | Page 3 of 7

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Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Nilssonia gangetica	Indian Softshell Turtle	REPTILIA	EN	Decreasing	Terrestrial, Freshwater
Nilssonia hurum	Indian Peacock Softshell Turtle	REPTILIA	EN	Decreasing	Terrestrial, Freshwater
Platanista gangetica	South Asian River Dolphin	MAMMALIA	EN	Unknown	Freshwater
Axis porcinus	Hog Deer	MAMMALIA	EN	Decreasing	Terrestrial, Freshwater
Oxyura leucocephala	White-headed Duck	AVES	EN	Decreasing	Terrestrial, Freshwater
Rynchops albicollis	Indian Skimmer	AVES	EN	Decreasing	Terrestrial, Freshwater
Sterna acuticauda	Black-bellied Tern	AVES	EN	Decreasing	Terrestrial, Freshwater
Haliaeetus leucoryphus	Pallas's Fish-eagle	AVES	EN	Decreasing	Terrestrial, Freshwater
Neophron percnopterus	Egyptian Vulture	AVES	EN	Decreasing	Terrestrial, Freshwater
Falco cherrug	Saker Falcon	AVES	EN	Decreasing	Terrestrial, Marine, Freshwater
Leptoptilos dubius	Greater Adjutant	AVES	EN	Decreasing	Terrestrial, Freshwater
Glyptothorax punjabensis		ACTINOPTERYGII	EN	Decreasing	Freshwater
Varanus flavescens	Yellow Monitor	REPTILIA	EN	Decreasing	Terrestrial

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RYK-BHAWALPUR | Page 4 of 7

IBAT

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Aquila nipalensis	Steppe Eagle	AVES	EN	Decreasing	Terrestrial
Crocodylus palustris	Mugger	REPTILIA	VU	Stable	Terrestrial, Freshwater
Pangshura tecta	Indian Roofed Turtle	REPTILIA	VU	Decreasing	Terrestrial, Freshwater
Wallago attu		ACTINOPTERYGII	VU	Decreasing	Freshwater
Bagarius yarrelli		ACTINOPTERYGII	VU	Decreasing	Freshwater
Marmaronetta angustirostris	Marbled Teal	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater
Aythya ferina	Common Pochard	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater
Columba eversmanni	Yellow-eyed Pigeon	AVES	VU	Decreasing	Terrestrial, Freshwater
Sterna aurantia	River Tern	AVES	VU	Decreasing	Terrestrial, Marine, Freshwater
Clanga clanga	Greater Spotted Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Aquila rapax	Tawny Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Aquila heliaca	Eastern Imperial Eagle	AVES	VU	Decreasing	Terrestrial, Freshwater
Chrysomma altirostre	Jerdons Babbler	AVES	VU	Decreasing	Terrestrial, Freshwater

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RYK-BHAWALPUR | Page 5 of 7

IBAT

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Lissemys punctata	Indian Flapshell Turtle	REPTILIA	VU	Decreasing	Terrestrial, Freshwater
Panthera pardus	Leopard	MAMMALIA	VU	Decreasing	Terrestrial
Saara hardwickii	Indian Spiny-tailed Lizard	REPTILIA	VU	Decreasing	Terrestrial
Saxicola macrorhynchus	White-browed Bushchat	AVES	VU	Decreasing	Terrestrial
Chlamydotis macqueenii	Asian Houbara	AVES	VU	Decreasing	Terrestrial

IBAT

Recommended citation

IBAT Proximity Report. Generated under licence 29327-31988 from the Integrated Biodiversity Assessment Tool on 23 June 2022 (GMT). www.ibat-alliance.org

How to use this report

This report provides an indication of the potential biodiversity-related features - protected areas, key biodiversity areas and species - close to the specified location. It provides an early indication of potential biodiversity concerns, and can provide valuable guidance in making decisions. For example, this information can be helpful when assessing the potential environmental risk and impact of a site, categorising investments/projects, preparing the terms of reference for an impact assessment, focusing attention on key species of conservation concern and sites of known conservation value, and reviewing the results of an impact assessment.

The report does not provide details of potential indirect, downstream or cumulative impacts. Furthermore, the report should be regarded as a "first-step", providing a set of conservation values sourced from global data sets, and is not a substitute for further investigation and due diligence, especially concerning national and/or local conservation priorities.

Annexure VII: Consultation Material

August 2022

Background Information Document
For IEE Update of
220 kV Rahim Yar Khan-Bahawalpur Transmission Line (150 km)

Introduction

The Government of Pakistan (GoP) signed a loan agreement with the Asian Development Bank (ADB) for financial support for the construction of the Power Enhancement Projects in Pakistan.

The overall objective of the project is to increase the power transmission capacity, efficiency, and coverage in Pakistan. It is also meant to increase the confidence of commercial financiers in financing long-term transmission and distribution assets in Pakistan. The specific objectives are:

- Improvement in transmission infrastructure and management.
- Improvement in Energy Market Transparency and efficiency

220 kV Rahim Yar Khan-Bahawalpur Transmission Line

The scope of work of this sub-project consists of the following sub-components:

- In/Out of D/C T/L Rahim Yar Khan- Bahawalpur (150 km)

The sub-project is located in the district of Rahim yar Khan and Bahawalpur, in Punjab province. The main objective of the sub-project is to enhance the transmission capacity of the NTDC system to meet the growing power demand. The location of the transmission line is provided in **Exhibit 1**.

The layout plan of the substation, which involves various installations of equipment, control room and ancillary facilities is standardized by NTDC. NTDC has developed design parameters for the planning and design of transmission systems in Pakistan. The design parameters are based on standard NTDC's existing specifications and practices for the existing as well as proposed Grid stations and transmission lines.

Study Scope

This IIE is required to prepare to meet the requirements of ADB's SPS 2009 for project and loan approval, IEE study is required to be conducted as the project was categorized as 'B' during a Rapid Environmental Assessment by NTDC.

NTDC will develop an EIA later for meeting local regulations and obtaining approval from Punjab EPA

Approach to IEE

The Project IEE will ensure, the proposed Project is in compliance with the environmental and social safeguards laid out by ADB and international best practices.

The major components of the IEE include:

- comprehensive baseline studies to characterize the existing socioeconomic and biophysical environment.
- a public consultation process to ensure that project stakeholders are informed of the project development plan and have an opportunity to influence it;
- a comprehensive analysis of the environmental and social impacts of the project, both negative and positive; and,
- the development of impact mitigation plans and an environmental management plan.

A brief overview of the conceptual components of an IEE process that meets ADB Environment and Social Safeguards, and international standards is given in **Exhibit 2**.

A preliminary list of the potential environmental and social impacts of the Project that will be investigated during the IEE is provided below.

- Damage to vegetation and wildlife in the area.
- Effluent from the Project impacts the biodiversity and ecological functions.
- Construction-related impacts such as noise and dust.
- Dust, noise, vibration, road congestion, and safety hazard from truck traffic carrying construction materials; and,
- Social and ecological impacts of construction-related activities.

Exhibit 1: Project Location

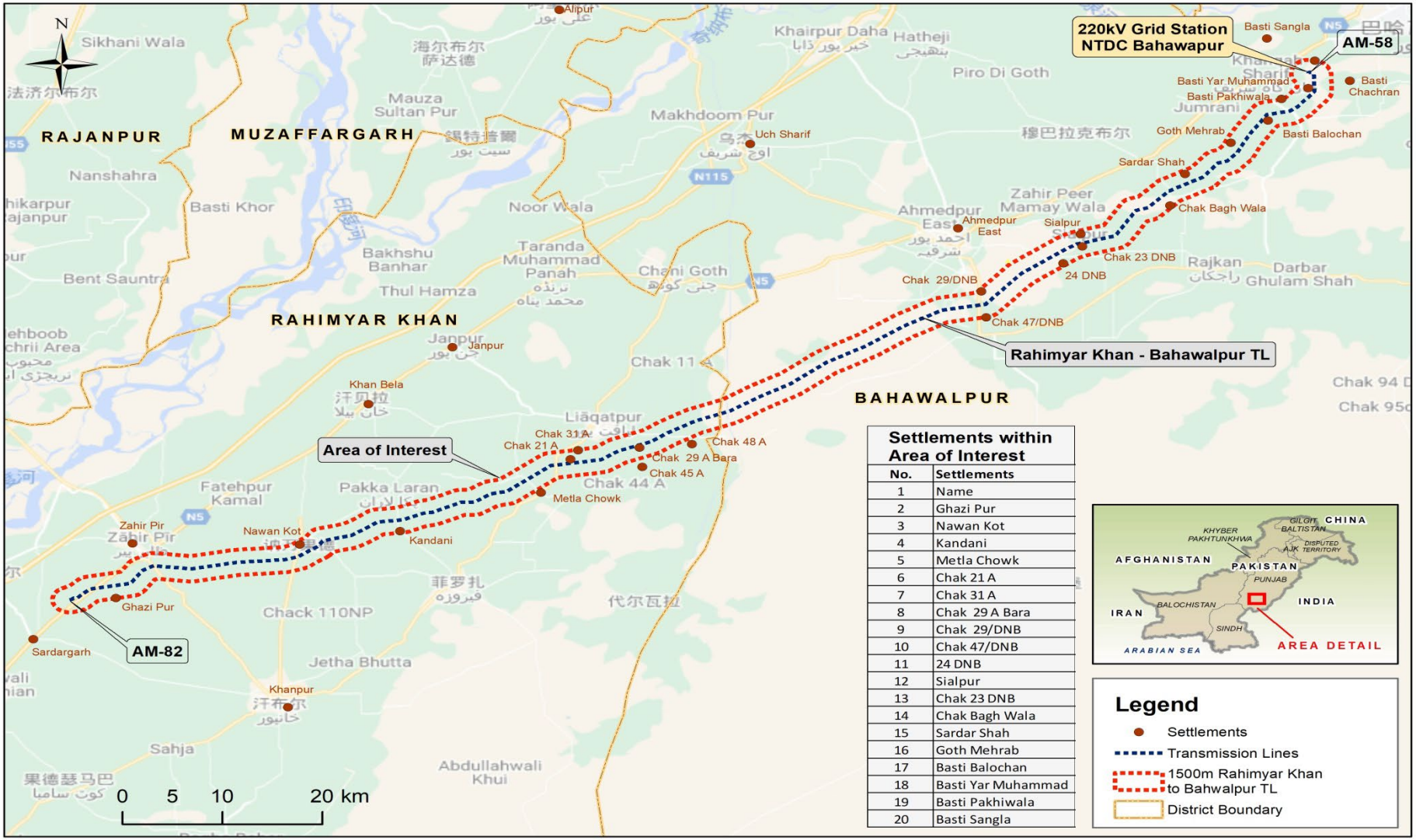


Exhibit 2: Conceptual Components of an IEE Process

Component	*Main purpose*	*Activities related to Stakeholder Consultations*
Scoping	• Identify the issues on which the IEE should focus. • Identify project alternatives that should be evaluated during the IEE.	• Identify institutional and community stakeholders • Engage stakeholders and record issues raised • Provide feedback to the IEE team to incorporate stakeholders' concerns in baseline investigations and impact assessment
Baseline investigations	• Collect background information on the environmental and social setting of the project.	• Incorporate additional issues raised during the baseline survey
Impact assessment, studies	• Define the potential impacts of the project • Undertake specialist investigations to predict changes to the environment due to the project • Determine the significance of the potential impacts • Identify measures for the management of the impacts • Determine the residual impacts of the project after incorporation of the management measures. • Evaluate the overall acceptability of the project (from environmental and social perspectives).	• Assess issues raised by stakeholders
Mitigation Measures and management plan	• The environmental mitigation and monitoring plan will describe the measures proposed to ensure the implementation of the mitigation measures identified during the impact assessment. It will include, for example, specific designs and plans, training requirements, resource requirements, monitoring details (sampling locations, methodology, and frequency), review and reporting requirements and budget.	• Assess the acceptability and practicability of the proposed mitigation measures
IEE Report Preparation	• After the studies, the IEE team will pull together a detailed assessment of impacts and mitigation measures. This may involve liaison with various specialists to ensure the correct interpretation of information and compilation of the IEE report.	• Compilation of draft report
IEE submittal to ADB for decision making	• Submittal and review of the IEE report by ADBs and other interested stakeholders. The reviewers will inform about their decision on the acceptability of the Project from environmental and social perspectives and the conditions of approval for the development	• respond to the issues and questions raised by ADB and the proponent for finalizing the report.

For more information on the IEE contact

For Project Proponents:
Muhammad Irfan
Deputy Manager, ESIC, NTDC
Egerton Rd, Garhi Shahu, Lahore
Tel: +92 333 574 02306

Annexure VIII: Consultation Logs

Record of the Consultation Meeting

Stakeholder/s	Forest Department, Bahawalpur	
Consultation	Stakeholder consultation for 220 kV Rahim Yar Khan to Bahawalpur	
Date	September 13, 2022	
Time	9:30 Am	
Meeting venue	Office of the Forest Department	
Attended by and contact details	Gohar Mushtaque Khalid	0301 7785452
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu/English	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	
Picture		

No.	Issues, Concerns and Suggestions
1	Discussed the payment mechanism against tree cutting involving both public and private stakeholders
2	Dust and noise should be minimum near the residential areas
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Fair & timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
6	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.
7	Employment should be given to local community

Record of the Consultation Meeting

Stakeholder/s	Agriculture Department, Bahawalpur
Consultation	Stakeholder consultation for 220 kV Rahim Yar Khan to Bahawalpur
Date	September 13, 2022
Time	11:00 Am
Meeting venue	Office of the Agriculture Department

Attended by and contact details	Mr Tarique Javeed	0300 5849828
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu/English	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	
Picture		

No.	Issues, Concerns and Suggestions
1	The contractor should promote local employment for skilled as well as non-skilled tasks and Tree cutting should be avoided as much as possible
2	Exposure of noise and dust pollution will cause disturbance and health & safety issues to the local residents and other stakeholders throughout the construction stage due to the movement of construction machinery and transportation of construction materials. The effects of noise and dust pollution on the local residents should be minimized by making necessary arrangements. Dust pollution should be controlled by water sprinkling on regular basis
	A comprehensive tree plantation plan should be formulated (if tree cutting is unavoidable

Record of the Consultation Meeting

Stakeholder/s	Wildlife Department Bahawalpur	
Consultation	Stakeholder consultation for 220 kV Rahim Yar Khan to Bahawalpur	
Date	September 13, 2022	
Time	1:00 pm	
Meeting venue	Office of the Wildlife Department Bahawalpur	
Attended by and contact details	Haroon Tufeel	**0313 4432900**
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu/English	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	
Picture		

No.	Issues, Concerns and Suggestions
1	Discussed the payment mechanism against tree cutting involving both public and private stakeholders

2	Dust and noise should be minimum near the residential areas
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Fair & timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
6	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.
7	Employment should be given to local community

Record of the Consultation Meeting

Stakeholder/s	District Councial Member	
Consultation	Stakeholder consultation for 220 kV Rahim Yar Khan to Bahawalpur	
Date	September 07, 2022	
Time	04:00 pm	
Meeting venue	Office of the Councial	
Attended by and contact details	Mr Khalid Majeed	**0332-6270261**
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu/English	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	
Picture		

No.	Issues, Concerns and Suggestions
1	The contractor should promote local employment for skilled as well as non-skilled tasks.
2	Most of the people in the region are farmers, the contractor should train them for non-skilled jobs and hire them
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Fair & timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
6	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.
7	Employment should be given to local community

Record of the Consultation Meeting

Stakeholder/s	Sugar Mill	
Consultation	Stakeholder consultation for 220 kV Rahim Yar Khan to Bahawalpur	
Date	September 07, 2022	
Time	10:00 Am	
Meeting venue	Office of the Sugar Mill field office RYK	
Attended by and contact details	MR Qurban ali soomro Sayed Saeed Ahmed Ashrif Sugar mill	**03330235974**
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu/English	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	
Picture		

No.	Issues, Concerns and Suggestions
1	Discussed the payment mechanism against tree cutting involving both public and private stakeholders
2	Dust and noise should be minimum near the residential areas
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Fair & timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
6	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.
7	Employment should be given to local community

Record of the Consultation Meeting

Stakeholder/s	Environment Department, Rahim Yar Khan	
Consultation	Stakeholder consultation for 220 kV Rahim Yar Khan to Bahawalpur	
Date	September 08, 2022	
Time	10:00 Am	
Meeting venue	Office of the Environment Department at District Ghotki	
	Amir Arshad	**03006827162**

Attended by and contact details		NA
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu/English	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	
Picture		

No.	Issues, Concerns and Suggestions
1	The construction waste should not be left unattended. There should be wastewater and solid waste management plan for domestic and hazardous waste disposal.
2	The project is a good step for the development of the area.
3	Government institutions need to be contacted for stakeholder consultations such as Agriculture, Wildlife, Board of Revenue, and Irrigation Department.
4	Soil analysis must be carried out before the sub-project execution.
5	Residential areas in the Right of Way (RoW) should be identified and the EIA report should incorporate relevant impacts and mitigation measures
6	A detailed health and safety plan may be develop and implement to mitigate the construction and operation risks of the proposed project on the local residents and surrounding communities.

Record of the Consultation Meeting

Stakeholder/s	Agriculture Department, Rahim Yar Khan	
Consultation	Stakeholder consultation for 220 kV Rahim Yar Khan to Bahawalpur	
Date	September 08, 2022	
Time	10:30 Am	
Meeting venue	Office of the Agriculture Department at District Ghotki	
Attended by and contact details	Iqrar Hassan	03006753454
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu/English	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	

Picture	

No.	Issues, Concerns and Suggestions
1	Earthing wires of the towers can be dangerous for domestic animals and farmers during rainy seasons as some cases have been reported of getting electrocuted from the earthing wires. EMF from high voltage wires may affect pollination, which in turn causes low crop and fruit yields.
2	Major crops and orchards in the surrounding of the proposed transmission line are mostly Banana, Mango, Sugarcane, Cotton, and vegetables.
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Fair & timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
	A detailed health and safety plan may be develop and implement to mitigate the construction and operation risks of the proposed project on the local residents and surrounding communities.

Record of the Consultation Meeting

Stakeholder/s	Wildlife Department, Rahim Yar Khan	
Consultation	Stakeholder consultation for 220 kV Rahim Yar Khan to Bahawalpur	
Date	September 09, 2022	
Time	10:00 Am	
Meeting venue	Office of the Wildlife Department at District Ghotki	
Attended by and contact details	MR Muhammad salah	**03006741522**
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu/English	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	

Picture	

No.	Issues, Concerns and Suggestions
1	Discussed the payment mechanism against tree cutting involving both public and private stakeholders
2	Dust and noise should be minimum near the residential areas
3	Agricultural land should not be polluted which affects soil productivity and crop yield.

4	Fair & timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
6	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.
7	Employment should be given to local community

Record of the Consultation Meeting

Stakeholder/s	Forest Department, Rahim Yar Khan	
Consultation	Stakeholder consultation for 220 kV Rahim Yar Khan to Bahawalpur	
Date	September 09, 2022	
Time	11:30 Am	
Meeting venue	Office of the Wildlife Department at District Ghotki	
Attended by and contact details	Muhammad yasir	**03006741522**
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu/English	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	
Picture		

No.	**Issues, Concerns and Suggestions**
1	Discussed the payment mechanism against tree cutting involving both public and private stakeholders
2	The Chief conservator very graciously offered technical support needed for the tree plantation campaign in order to offset the negative impacts of the sub-project
3	Engage landowners prior tree cutting
	Labor should bound to work and stay in the designated area or camp sites.
4	Note down Girth and species carefully while estimation of compensation amount
5	Appropriate mitigation measures should be adopted to minimize the harmful effects on the existing plantation

Record of the Consultation Meeting

Stakeholder/s	Community/ Village Zahir Pir

Consultation	Community Consultation	
Date	September 10, 2022	
Time	09:00 am	
Meeting venue	Village Zahir Pir	
Attended by and contact details	Fida Hussain	03032 2091195
	Kalimullah Khan	NA
	Muhammad Anas	0333 6497735
	Haji Khan	NA
	Javed Hussain Hotel owner	NA
	Muhammad Bilal	NA
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu	
Preamble	The team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinions expressed by the department.	
Picture		

No.	Issues, Concerns and Suggestions
1	Employment should be given to the local community Minimum wastage of crops & orchids, avoid construction during the peak cropping season
2	Dust and noise should be minimum near the residential areas
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
6	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.

Record of the Consultation Meeting

Stakeholder/s	Community/ Village Nawan Kot
Consultation	Community Consultation
Date	September 10, 2022
Time	11:00 am
Meeting venue	Village Nawan Kot

Attended by and contact details	Islam Din	0304 937027
	Ahmed Nawaz	0336 0366813
	Faisal Ahmed	NA
	Naveed Ahmed	NA
	Nasir Hussain	0300 8483423
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu	
Preamble	The team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinions expressed by the department.	
Picture		

No.	Issues, Concerns and Suggestions
1	Employment should be given to local community Minimum wastage of crops & orchids, avoid construction during the peak cropping season
2	Dust and noise should be minimum near the residential areas
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
6	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.

Record of the Consultation Meeting

Stakeholder/s	Community/ Village Chowk Metla	
Consultation	Community Consultation	
Date	September 10, 2022	
Time	01:30 pm	
Meeting venue	Village Chowk Metla	
Attended by and contact details	Muhammad Insha	0300 6962480
	Suhail Ahmed	NA
	Muhammad Aijaz	0305 3646434
	Muzafar Hussain	NA

	Mujeeb u Rahaman	NA
	Talha	NA
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu	
Preamble	The team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinions expressed by the department.	
Picture		

No.	Issues, Concerns and Suggestions
1	Employment should be given to local community Minimum wastage of crops & orchids, avoid construction during the peak cropping season
2	Dust and noise should be minimum near the residential areas
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
6	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.

Record of the Consultation Meeting

Stakeholder/s	Community/ Village Chack 48 Bara	
Consultation	Community Consultation	
Date	September 10, 2022	
Time	04:00 pm	
Meeting venue	Village Chack 48 Bara	
Attended by and contact details	Nasir Hussain	0301 6381622
	Abdul Rasheed	NA
	Mazahar Ali	NA
	Muhammad Aslam	NA
	Sadam khan	NA
	Asif Ali	0307 3757505

Conducted by	Jan Muhammad
Recorded by	Jan Muhammad
Reviewed by	
Language	Urdu
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.
Picture	

No.	Issues, Concerns and Suggestions
1	Employment should be given to local community Minimum wastage of crops & orchids, avoid construction during the peak cropping season
2	Dust and noise should be minimum near the residential areas
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas
	.

Record of the Consultation Meeting

Stakeholder/s	Community/ Village Chack 29DNB	
Consultation	Community Consultation	
Date	September 11, 2022	
Time	09:30 am	
Meeting venue	Village Chack 29DNB	
Attended by and contact details	Muhammad Ali	0305 3617433
	Zaheer Ahmed	NA
	Aamir Shaikh	NA
	Umeer Bhatti	0307 3797501
	Muzamil hussain	NA
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu	

Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.
Picture	

No.	Issues, Concerns and Suggestions
1	Employment should be given to local community Minimum wastage of crops & orchids, avoid construction during the peak cropping season
2	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
6	Dust and noise should be minimum near the residential areas

Record of the Consultation Meeting

Stakeholder/s	Community/ Village Chack 23 DNB	
Consultation	Community Consultation	
Date	September 11, 2022	
Time	11:40 am	
Meeting venue	Village Chack 23 DNB	
Attended by and contact details	Mujeeb u Rahman	0345 3150510
	Mujahid Kaleem	NA
	Iqrar Hassan	NA
	Ahmed Ali Shah	03008615130
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	
Picture		

No.	Issues, Concerns and Suggestions

1	Dust and noise should be minimum near the residential areas Minimum wastage of crops & orchids, avoid construction during the peak cropping season
2	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
6	Employment should be given to local community

Record of the Consultation Meeting

Stakeholder/s	Community/ Village Chack Bagh wala	
Consultation	Community Consultation	
Date	September 11, 2022	
Time	03:00 pm	
Meeting venue	Village Chack Bagh wala	
Attended by and contact details	Faisal Ahemd	0307 8112286
	Hasnain Munawar	NA
	Muneer Ahmed	0306 738109
	Usman Ahmed	0305 8722867
	Ahemd	NA
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	
Picture		

No.	**Issues, Concerns and Suggestions**
1	Employment should be given to local community Minimum wastage of crops & orchids, avoid construction during the peak cropping season

2	Dust and noise should be minimum near the residential areas
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.
6	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.

Record of the Consultation Meeting

Stakeholder/s	Community/ Village Basti Balochan	
Consultation	Community Consultation	
Date	September 11, 2022	
Time	05:00 pm	
Meeting venue	Village Basti Balochan	
Attended by and contact details	Asghar Ali	0307 7980150
	M Ramzan	0304 9194812
	Mushtaq Ahmed	NA
	M Saifullah	NA
	Sajad Ahmed	0300 9195911
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Sindhi	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	
Picture		

No.	**Issues, Concerns and Suggestions**
1	Employment should be given to local community Minimum wastage of crops & orchids, avoid construction during the peak cropping season
2	Dust and noise should be minimum near the residential areas
3	Agricultural land should not be polluted which affects soil productivity and crop yield.

4	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.

Record of the Consultation Meeting

Stakeholder/s	Community/ Basti Yar Muhammad	
Consultation	Community Consultation	
Date	September 12, 2022	
Time	10:00 am	
Meeting venue	Village Basti Yar Muhammad	
Attended by and contact details	Muzamill Hussain	03009 650206
	Shahid Hameed	NA
	Muhammad Faraz	NA
	Ahsan Ahmed	0301 3250497
	Ali Nawaz	0311 4707278
	Muhammad Yasir	NA
Conducted by	Jan Muhammad	
Recorded by	Jan Muhammad	
Reviewed by		
Language	Urdu	
Preamble	Team briefed the objective of the consultation and shared information on the proposed Project its activities and location followed by the recording of opinion expressed by the department.	
Picture		

No.	Issues, Concerns and Suggestions
1	Employment should be given to local community Minimum wastage of crops & orchids, avoid construction during the peak cropping season
2	Dust and noise should be minimum near the residential areas
3	Agricultural land should not be polluted which affects soil productivity and crop yield.
4	Timely compensation of crops
5	The project should offer jobs to the affected persons and compensation should be according to shares in crops.

6	Company workers should take care of our culture during the installation of T/L During the construction phase, labor and general workers should be inducted from the adjoining villages/areas.

Annexure IX: Dust Management Plan

Every effort to minimize dust pollution on the site must be undertaken. The contractor must implement the following measures with regards to the management of dust on site:

The most important dust control measure is achieved by maintaining as much of the vegetative cover as possible (the method of securing panels with minimal excavations supports this measure).

The recommendations made with regard to the demarcation of no-go areas are important in this regard.

- Construction vehicles must adhere to speed limits and minimization of haul roads must be implemented
- During dry, dusty periods haul roads should be kept dampened to prevent excess dust. No potable water may be used for damping haul roads
- All vehicles used to deliver or remove loose material (sand, soil, gravel etc.) to and from the site must be covered with a 60% shade cloth to avoid dust blowing from the vehicle
- As an alternative, products such as Road Environment Dust Suppressants (REDS) would be recommended to minimize the use of water to control dust pollution. This is to be determined by the contractor during construction as required, and
- Exposed stockpile materials must be adequately protected against the wind (covered) and should be sited in consideration of the prevailing wind conditions.

Apart from those measures detailed above, the following additional measures must be implemented:

- Dust nuisances shall comply with the applicable standards according to the Occupational Health and Safety plan. The contractor shall be solely responsible for the control of dust arising from the contractor's operations and for any costs against the Employer for damages resulting from dust
- The contractor shall take all reasonable measures to minimize the generation of dust as a result of construction activities to the satisfaction of the Client)
- Removal of vegetation shall be avoided until such time as soil stripping is required and similarly exposed surfaces shall be re-vegetated or stabilized as soon as is practically possible
- Excavation, handling, and transport of erodible materials shall be avoided under high wind conditions or when a visible dust plume is present
- During high wind conditions the site manager, with input from the contractor, must evaluate the situation and make recommendations as to whether dust damping measures are adequate, or whether work should cease altogether until the wind speed drops to an acceptable level
- Where possible, soil stockpiles shall be located in sheltered areas where they are not exposed to the erosive effects of the wind. Where erosion of stockpiles

becomes a problem, erosion control measures shall be implemented at the discretion of the site manager

- Vehicle speeds shall not exceed 40km/h along dust roads or 20km/h when traversing unconsolidated and non-vegetated areas
- Appropriate dust suppression measures shall be used when dust generation is unavoidable, e.g. dampening with water or use of REDS, particularly during prolonged periods of dry weather in summer. Such measures shall also include the use of temporary stabilizing measures (e.g. chemical soil binders, straw, brush packs, clipping etc.)
- Straw stabilization shall be applied at a rate of one bale per 10m² and harrowed into the top 100mm of top material for all completed earthworks (i.e. all those areas that are not hard surfaced as part of the Solar Facility). This is only relevant to areas disturbed through the construction activities (such as cable trenches) and not areas where vegetation remains intact, and
- Should water be used for dust suppression on gravel roads, it must be of quality compliant with the General Special Effluent Standards (31/03/2009): Temperature: max.25ºC, pH: between 5.5 & 7.5 and conductivity: not be increased more than 15% above the intake water & not exceed 250 milliSiemens per meter (determined at 25ºC). The water used for dust suppression must be sourced from a licensed resource.

Annexure X: Construction Noise and Vibration Management Plan

Objective

This management plan defines the measures to control and limit noise emissions and vibration levels, at residential properties and other sensitive receptors in the vicinity of the Project.

General Requirements

Best Practicable Means (BPM) of noise control will be applied during construction works to minimize noise (including vibration) at neighboring residential properties and other sensitive receptors arising from construction activities

The general principles of noise management are given below:

Control at source:

- Equipment – noise emissions limits for equipment brought to the site.
- Equipment – method of directly controlling noise e.g. by retrofitting controls to plant and machinery.
- Equipment - indirect method of controlling noise e.g. acoustic screens.
- Equipment - indirect method of controlling noise e.g. benefits and practicality of using alternative construction methodology to achieve the objective e.g. vibratory piling techniques or hydro-demolition as opposed to more conventional but noisier techniques; selection of quieter tools/machines; application of quieter processes.

Control across the site by:

- Administrative and legislative control,
- Control of working hours,
- Control of delivery areas and times,
- Careful choice of compound location,
- Physically screening site,
- Control of noise via Contract specification of limits,
- Noise Monitoring, to check compliance with noise level limits, cessation of works until an alternative method is found.
- Many of the activities which generate noise can be mitigated to some degree by careful operation of machinery and the use of tools. This may best be addressed by toolbox talks and site inductions.

The maintenance of good community relations is vital. Experience shows that construction noise has the potential to cause disturbance but can be tolerated if prior warning and explanation have been given to residents. In particular advice regarding the nature of construction works, the duration of the works and mitigation measures to be implemented can help to reduce people's reaction to noise.

Contractors will consult local residents/communities regarding works and give them details of a responsible appointed person on site who will be able to deal with queries.

Construction working hours should be carefully managed. All works should take place between normal working hours 07:30 and 18:30, Monday to Friday with the exception of restricted works.

Noise and Vibration Control Measures

In addition to the specific requirements of the Local Authority, the Contractor will be required to adopt the following more specific measures:

Control measures

Without prejudice to the other requirements of this section, the Contractor shall comply with the recommendations set out in BS5228:2009 and in particular with the following requirements:

- Vehicles and the mechanical plant will be maintained in a good and effective working order and operated in a manner to minimize noise emissions. The contractor will ensure that all plant complies with the relevant statutory requirements;
- HGV and site vehicles will be equipped with broadband, non-tonal reversing alarms;
- Compressor, generator and engine compartment doors will be kept closed and plant turned off when not in use;
- All pneumatic tools will be fitted with silencers/mufflers;
- Care would be taken when unloading vehicles to avoid unnecessary noise;
- The use of particularly noisy plant will be limited, i.e. avoiding the use of particularly noisy plants early in the morning;
- Restrict the number of plant items in use at any one time;
- Plant maintenance operations will be undertaken at distance from noise-sensitive receptors;
- Reduce the speed of vehicle movements;
- Ensure that operations are designed to be undertaken with any directional noise emissions pointing away from noise-sensitive receptors;
- When replacing an older plant, ensure that the quietest plant available is considered;
- Drop heights will be minimized when loading vehicles with rubble;
- Vehicles should be prohibited from waiting within the site with their engines running or located in waiting for areas away from sensitive receptors;
- Local hoarding, screens or barriers should be erected to shield particularly noisy activities;

Piling will be carried out with the method that minimizes both noise and the transmission of vibration to sensitive receptors

Vibration Mitigation

Vibration levels due to percussive piling are predicted to be approximately 1.0 mm/s Peak Particle Velocity (PPV) at the nearest residential properties on Wyberton Low Road which falls at the threshold of effects significant adverse effects due to vibration. Comparatively, piles installed using a vibratory piling rig are predicted to result in vibration levels exceeding 1.5mm/s PPV at the same location.

Press piling shall therefore be adopted by the contractor to minimize vibration levels during Piling along the right bank in conjunction with pre-auguring and jetting depending on ground conditions. Vibration levels at properties due to press piling including pre-auguring are predicted to be less than 0.2mm/s at 23m. Vibration levels due to the use of vibratory rollers at 10 m from the works are predicted to be approximately 1.5 mm/s PPV.

Noise and vibration monitoring

A regular program of noise and vibration monitoring shall be implemented as a minimum following Appendix C of this document.

The Contractor will submit the proposed method, the frequency and the location of the monitoring site to the Planning Authority for agreement before commencing works. Proposed monitoring requirements and locations are detailed in Appendix C. Noise baseline levels will be agreed upon prior to commencement of construction.

Reference:

https://proaccionaau.blob.core.windows.net/media/4gbpg4vk/ctp-noise-and-vibration-management-plan.pdf.

Annexure XI: Chance Finds Procedure

CHANCE FIND PROCEDURES

The proposed project may involve deep excavation. Therefore the possibility of chance find is not ignorable. In case of any chance find, the contractor will immediately report through Supervision Consultant to Directorate General (DG) of Archeological Department, Punjab to take further suitable action to preserve those antiques or sensitive remains. Representative of the DG will visit the site and observed the significance of the antique, artifact and Cultural (religious) properties and significance of the project. The report will be prepared by representative and will be given to the DG. The documentation will be completed and if required suitable action will be taken to preserve those antiques and sensitive remains.

In case any artifact, antiques and sensitive remains are discovered, chance find procedures should be adopted by contractor(s) as follows:

- Stop the construction activities in the areas of chance find;
- Delineate the discovered site or area;
- Consult with the local community and provincial Archeological Department;
- The suggestion of the local communities and the concerned authorities will be suitably incorporated during taking the preventive measures to conserve the antique, artifact and cultural (religious) properties;
- Secure the site to prevent any damage or loss of removable objects. In case of removable antiquities or sensitive remain, a night guard should be arranged until the responsible local authorities take over; and
- After stopping work, the contractor(s) must immediately report the discovery to the Resident Engineer.

Annexure XII: Traffic Management Plan

The Construction Contractor will develop a traffic management plan covering the following headings.:

Table of Contents

Annexure XIII: Waste Management Plan

CONSTRUCTION WASTE MANAGEMENT PLAN

Construction waste material consists mainly of concrete, masonry, limestone, sandstone, metal, and wood, depending on the construction type. In building waste, a larger percentage of paper, plastic, etc. is expected due to packaging materials and the wood retired from formwork and scaffolding. This is in addition to significant amounts of concrete, masonry and metal materials.

1.0 Origins and Causes of Construction Waste

Origins of waste	Causes of waste
Contractual	▪ Errors in contract documents ▪ Contract documents incomplete at commencement of construction
Design	▪ Design changes ▪ Design and detailing complexity ▪ Design and construction detail errors ▪ Unclear/unsuitable specification ▪ Poor coordination and communication (late information, last minute client requirements, slow drawing revision and distribution)
Procurement	▪ Ordering errors (i.e., ordering items not in compliance with specification) ▪ Over allowances (i.e., difficulties to order small quantities) ▪ Supplier errors
Transportation	▪ Damage during transportation ▪ Difficulties for delivery vehicles accessing construction sites ▪ Insufficient protection during unloading ▪ Inefficient methods of unloading
On-site Management and Planning	▪ Lack of on-site waste management plans ▪ Improper planning for required quantities ▪ Delays in passing information on types and sizes of materials and components to be used ▪ Lack of on-site material control ▪ Lack of supervision
Material storage	▪ Inappropriate site storage space leading to damage or deterioration

Origins of waste	Causes of waste
	▪ Improper storing methods ▪ Materials stored far away from point of application
Material handling	▪ Materials supplied in loose form ▪ On-site transportation methods from storage to the point of application ▪ Inadequate material handling
Site operation	▪ Accidents due to negligence ▪ Unused materials and products ▪ Equipment malfunction ▪ Poor craftsmanship ▪ Use of wrong materials resulting in their disposal ▪ Time pressure ▪ Poor work ethics
Residual	▪ Waste from application processes (i.e., over preparation of mortar) ▪ Off-cuts from cutting materials to length ▪ Waste from cutting uneconomical shapes ▪ Packaging
Other	▪ Weather ▪ Vandalism ▪ Theft

2.0 Construction Waste Management Plan

1) Waste Management Goals

To establish that this project shall generate at least 50% less waste into landfills and the processes shall be employed to ensure that this goal is met. These shall include prevention of damage to materials to be incorporated into the work due to mishandling, improper storage, contamination, inadequate protection or other factors as well as minimizing poor quantity estimation, as well as through building design.

2) Responsibility

- The Project Director shall be responsible for the implementation of the administrative portions of this program, including the notification of subcontractor management, the training of the site supervisor and the onsite posting of this plan.
- The site supervisor will be responsible for the implementation of the onsite portions of this program including the training of subcontractor personnel.

3) Waste Prevention Planning

- In addition to other requirements specified herein it is a requirement for the work of this project that the contractor comply with the applicable city waste disposal requirements.
- Of the inevitable waste that is generated, the waste materials designated in this specification shall be salvaged for reuse and or recycling where practical and possible.
- Project Construction Documents: The General Contractor will contractually require all subcontractors to comply with these recycling guidelines. A copy of this "Construction Waste Management Plan" will accompany all subcontractor agreements and require subcontractor participation.
- The "Construction Waste Management Plan" shall be implemented and executed as follows and as on the chart:
  - Salvageable materials will be diverted from disposal where feasible.
  - There will be a designated area on the construction site reserved for materials that can be recycled.
  - Areas shall be marked to designate what recycle materials are to be stored there.
  - Hazardous waste will be managed by a licensed hazardous waste vendor.

4) Communication & Education Plan

- This Construction Waste Management Plan will be posted onsite.
- Each subcontractor will be made aware of the intent of this project with respect to reduction of waste and recycling.
- Onsite recycling containers and/or areas will be plainly marked.
- The subcontractor will be expected to make sure all their crews comply with the Waste Management Plan.
- All recycling containers/areas will be clearly marked.
- Lists of acceptable/unacceptable materials will be posted at the site.
- All subcontractors will be informed in writing of the importance of non-contamination with other materials or trash.

5) Motivation Plan

The General Contractor will conduct a pre-award meeting for subcontractors. Subcontractors under consideration will be required to attend the meeting to review project goals and requirements with the project team. Attendance will be a prerequisite for award of subcontracts. This document will be an attachment to every subcontract. Copies of the attachment will be posted prominently at the job site.

6) Expected Project Waste, Disposal, and Handling

The following chart identifies waste materials expected on this project, their expected disposal methods and handling procedures. New items may be added as needed.

Material	Quantity	Disposal Method	Handling Procedure
Land clearing debris		Keep separate for reuse and or wood sale. Separate topsoil and rock for future landscaping use.	Keep separated in designated areas onsite.
Clean dimensional wood and palette wood		Keep separate for reuse by on-site construction or by site employees for either heating stoves or reuse in home projects. May be offered to public.	Keep separated in designated areas onsite.
Plywood, OSB, particle board		Reuse onsite when possible, landfill or recycle off site.	Keep separated in designated areas onsite. Place in "Trash" container.
Painted or treated wood		Reuse, off site recycle, landfill.	Keep separated in designated areas onsite. Place in "Trash" container.
Concrete		Recycle when possible.	
Concrete Masonry Units		Keep separate for re-use by on-site construction or by site employees.	Keep separated in designated areas onsite.
Metals		Recycle off site when possible. Separate copper wire when possible.	Keep separated in designated areas onsite. Place in "Metals" container.
Paint		Reuse onsite.	Keep separated in designated areas onsite
Insulation		Reuse, landfill.	
Flooring		Reuse, landfill.	
Carpet and pad		Reuse or recycle with carpet manufacturer	
Glass		Glass Bottles: recycle locally.	Keep separated in designated areas onsite.

Material	Quantity	Disposal Method	Handling Procedure
Plastics		Plastic Bottles: recycle locally; be aware of plastics that are acceptable to recycle facility.	Keep separated in designated areas onsite.
Beverage		Recycle locally	Keep separated in designated areas onsite.
Cardboard		Recycle locally	Keep separated in designated areas onsite.
Paper and newsprint		Recycle locally	Keep separated in designated areas onsite.

7) Waste Disposal Company

To be determined

a) Contact:

8) Recycle Hauler

To be determined

b) Contact:

c) Some or all recycle may be hauled by the builder.

9) Possible recycle locations and acceptable materials

i) Coordinate with companies which are registered with local Municipality that accept materials for recycle; and

ii) Using the above as a resource, a list will be kept indicating local opportunities for recycle of expected materials. New locations should be added as needed.

Annexure XIV: COVID-19 Management Plan

COVID-19 Health and Safety Management Plan

Project Name _____

Table of Contents

1. Introduction

1.1 Coronaviruses (CoV), COVID-19, and How It Spread?

1. A large family of viruses that cause a variety of illnesses including the common cold, Middle East Respiratory Syndrome (MERS-CoV), and Severe Acute Respiratory Syndrome (SARS-CoV).[1]

2. In late 2019, a new coronavirus – not seen previously in humans – was identified as the cause of human illness in China and given the name 2019-nCoV. By late January 2020, the outbreak declared a public health emergency of international concern by the World Health Organization (WHO).[2]

3. The Coronavirus Disease of 2019 is called COVID-19.[3]

4. The CoV spread by human-to-human transmission via respiratory droplets. The median incubation period from exposure to symptoms onset is 4–5 days.[4]

1.2 Purpose, Scope, and Applicability of COVID-19 H&S Plan

5. The purpose of COVID-19 Health and Safety Plan (COVID-19 H&S Plan) is to guide contractors and their staff and implement procedures to slow and stop transmission, prevent outbreaks and delay spread; to minimize the impact of epidemic diseases on health systems and project operations. This SOP has been tailored considering the recent coronavirus (COVID-19) outbreak.

6. The COVID-19 H&S Plan is a guidelines document providing standard operating procedures(SOP) for undertaking construction activities at the active and plan subprojects under Second Power Transmission Enhancement Investment Program.

7. The COVID-19 H&S Plan must be adhered to by all contractors, subcontractors, and its employees, its visitors, and any person that interacts with employees.

8. This Plan applies to all epidemic diseases. The World Health Organization has now confirmed the coronavirus as a pandemic; however, this SOP will be applicable for

[1] https://relief.unboundmedicine.com/relief/view/Coronavirus-Guidelines/2355000/all/Coronavirus_Disease_2019__COVID-19_#1
[2] Ibid
[3] Ibid
[4] Ibid

all epidemic outbreaks due to its greater scope and applicability in the prevention of disease transmission.

1.3 Frequency

9. The SOP in this plan must always be followed until an outbreak is no longer considered a public health emergency by WHO.

1.4 Distribution and Actions

10. The COVID-19 H&S Plan will be made part of the respective health and safety plans (HSP) and emergency response plans (ERP) of the contractors and subcontractors.

11. The HSP and ERP are standard elements of the environmental management plan (EMP), and now these need to be updated addressing COVID-19 health risks.

12. Broadly, the steps in this process include:

- The contractor's HSP and ERP should be aligned with this COVID-19 H&S Plan.
- The contractors' HSP and ERP should be reviewed by the PMU.
- The recommendation of the review (i.e. approval of the updated HSP and ERP or additional strengthening required etc.) will be forwarded to PMU for clearance.
- The PMU will then advise the Construction Contractors and also ADB Project Officer to be informed.

2. Workplace Risk Assessment

13. The risk of work-related exposure to COVID-19 depends on the probability of coming into close (less than 1 metre) or frequent contact with people who may be infected with COVID-19 and through contact with contaminated surfaces and objects.

14. The following risk levels may be useful in carrying out a workplace risk assessment for exposure to COVID-19 and planning for preventive measures in non-healthcare workplaces.

15. Low exposure risk – jobs or work tasks without frequent, close contact with the general public and other co-workers, visitors, clients or customers, or contractors, and that do not require contact with people known to be or suspected of being infected with COVID-19. Workers in this category have minimal occupational contact with the public and other co-workers.

16. Medium exposure risk – jobs or work tasks with close, frequent contact with the general public, or other co-workers, visitors, clients or customers, or contractors, but that do not require contact with people known to be or suspected of being infected with COVID-19. In areas where COVID-19 cases continue to be reported, this risk level may be applicable to workers who have work-related frequent and close contact with the general public, visitors, or customers in high-population-density work environments (e.g. food markets, bus stations, public transport, and other work activities where physical distancing of at least 1 metre may be difficult to observe), or work tasks that require close and frequent contact between co-workers. In areas without community transmission of COVID-19, this scenario may include frequent contact with persons returning from areas with community transmission.

17. High exposure risk – jobs or work tasks with high potential for close contact with people who are known or suspected of having COVID-19, as well as contact with objects and surfaces possibly contaminated with the virus. Examples of such exposure scenarios outside of health facilities include the transportation of persons known or suspected to have COVID-19 in enclosed vehicles without separation between the driver and the passenger, providing domestic services or home care for people with COVID-19, and contact with dead bodies of persons who were known or suspected of having COVID-19 at the time of their death.

18. In the same work setting there may be jobs with different levels of risk, and different jobs or work tasks may have similar levels of exposure. Therefore, the risk assessment should be carried out for each specific work setting and each job or group of jobs. For each risk assessment, it is prudent to consider the environment, the task, the threat, if any (e.g. for frontline staff), and resources available, such as personal protective equipment.

19. Some workers may be at higher risk of developing severe COVID-19 illness because of age or pre-existing medical conditions; this should be considered in the risk assessment for individuals. Essential public services, such as security and police, food retail, accommodation, public transport, deliveries, water and sanitation, and frontline workers may be at an increased risk of exposure to occupational hazards for health and safety.

20. Employers, managers and EHS staff, in consultation with workers, should carry out and regularly update the risk assessment for work-related exposure to COVID-19, preferably with support of occupational health services.

3. Procedures and Guidelines – Managing Risk

21. Health measures can slow the transmission and spread of infectious diseases. These measures can take the form of personal protective equipment, social distancing, and travel-related interventions.

22. The following areas should be given consideration:

- Communication and Awareness
- Personal Hygiene and Respiratory Etiquette
- Personal Protective Equipment (PPE)
- Access and Movement to/from Construction Site
- Compartmentalization
- Site Operation
- Meeting and Traveling
- Environmental Cleaning
- Working Remotely

3.1 Communication and Awareness

23. Clear signage is posted at entry points on the construction site and outline the commitment of the contractor to maintain health and safety measures during the COVID-19 crisis.

24. A display board at entry points of construction site showing daily statistics of COVID-19 in the locality, province, and in Pakistan using government official updates from appropriate jurisdictions' public health authorities.

25. Worksite policies as they relate to the COVID-19 crisis are communicated to workers and made available on site.

26. A clear signboard to show: All workers exercise the following recommended practices for reducing the risk of transmission:

- Avoid touching eyes, nose and mouth with unwashed hands;

- When coughing or sneezing:
  - Cough or sneeze into a tissue or the bend of your arm, not your hand;
  - Dispose of any tissues you have used as soon as possible in a lined wastebasket and wash your hands afterward;
  - Use face mask all time
  - Clean and disinfect frequently touched objects and surfaces, including all reusable personal protective equipment (PPE).
- Do not share personal items or supplies such as phones, pens, notebooks, tools, PPE, etc.;
- Use and remove PPE with care, being mindful of which surfaces may be contaminated. Individuals must clean their hands after handling any used PPE;
- Avoid common physical greetings, such as handshakes;
- Maintain a minimum physical distance of two meters from others; and
- Wash hands often with soap and water for at least 20 seconds after using the washroom, before handling food, after blowing the nose, coughing, or sneezing, and before smoking. If hands are not visibly soiled, and soap and water are unavailable, alcohol-based hand sanitizer can be used.

27. Additional sanitary measures are implemented on-site: handwashing stations with a posted hand washing protocol, hand sanitizer stations, provision of disinfectant wiping products. These types of facilities are made available at site entries, exits, washrooms, eating areas, offices, and any other areas with commonly touched surfaces.

28. The EHS team can develop informative handouts about COVID-19 Risk Management and distribute it among the employees and visitors (**Form A**).

Uniform signage for workers to provide clear messaging

3.2 Personal Hygiene and Respiratory Etiquette

29. Every employee must follow a certain standard of self-hygiene and precaution, especially when in company premises or busy areas.

30. It is the responsibility of the Employee to inform EHS Manager in case they have come in contact with a person traveling from an infected area.

31. Every employee must use hand sanitizer whenever entering office premises. These and tissue boxes can be found in numerous locations

32. Employees must use the hand sanitizer before using the biometric device.

33. Frequent and thorough hand washing is recommended and better illustrated in **Form B**.

3.3 Personal Protective Equipment

34. Face masks are required for all staff and those in their vicinity. Please see Govt of Pakistan's Guidelines for Mandatory use of facemask, document 17-06, 13-June-2020 on how to use mask properly.

35. https://covid.gov.pk/new_guidelines/14June2020_20200613_Guidelines_for_Mandatory_use_of_face_mask_(urdu)_1704.pdf

36. Providing disposable gloves for service staff is mandatory at all construction sites, camps and field offices.

37. The persons who showing any symptoms include soreness of the throat, sneezing, runny nose, coughing, body aches, frequent headaches, and fever should not be allowed to go to work or public places such as kitchen, dining area, mosque, etc.

3.4 Access and Movement to/from Construction Site

38. Wherever possible, workers travel to site using individual modes of transportation (e.g., personal vehicle or bicycle). Additional parking arrangements are made as required.

39. Entry and exiting of the worksite is monitored and controlled to ensure that the minimum physical distancing is not broken when shifts begin and end.

40. All non-essential individuals are not permitted access to the site.

3.5 Compartmentalization

41. The construction site is to be segregated to the extent possible in zones or other methods to keep different crews/trades physically separated at all time. This promotes physical distancing and supports the containment of propagation should it arise.

42. Eating is restricted to clearly identified dedicated eating areas with handwashing stations, cleaning and disinfectant materials, and adequate space to maintain minimum physical distancing.

43. Upper limits are put on the number of people allowed in each zone and in facilities like washrooms, trailers, and eating areas at once to allow for the recommended minimum physical distancing.

44. One-way staircases are established wherever practical to minimize worker contact.

45. Freight elevators are operated/occupied by only one individual at a time or where feasible, by respecting the minimum physical distancing guidelines.

46. At residential camp sites, accomodation for workers should be provided as per the guidelines in Workers Accomodation Plan (**Form C**).

3.6 Site Operation

47. The number of in-person meetings is minimized. If required, meetings should involve only necessary individuals and include six people or fewer. Minimum physical distancing is maintained, and meetings are held in open spaces when possible.

48. The worksite is rearranged to reduce high-traffic areas and allow for the minimum physical distancing.

49. Site teams are encouraged to put forward split/alternating shifts to avoid extensive intermingling. Voluntary shift offset and implementing time gaps between shifts are highly encouraged.

50. Alternate arrangements are made as necessary to ensure workers avoid breaking the minimum physical distance with others for prolonged periods. When this is not feasible, plans are made to minimize the duration of the task. For any work that ultimately must be done in close-proximity, a procedure is formalized outlining the required PPE and all steps to be taken to minimize risk.

51. Where work is done in crews, the work is planned to minimize or eliminate the crossover of workers between crews.

52. Project teams stagger break and lunch schedules to minimize the number of people in close proximity to one another. Enclosed lunchrooms are only made available during inclement weather.

53. Work schedules are adjusted to provide time for proper cleaning and disinfecting as required.

54. Delivery zones are clearly identified and limited to receivers and deliverers only.

55. When possible, nothing is passed between the deliverer and the receiver (e.g. shipment documents and pens for signatures). Deliveries are unloaded solely by receivers using proper PPE, while deliverers remain in their vehicles.

56. When working in spaces currently occupied (e.g. private residences), the minimum physical distancing with any occupants is strictly enforced. Where possible, workers and occupants are segregated in different rooms.

57. Non-emergency work should not be done in any occupied spaces where an occupant is suspected to have contracted COVID-19 or is under self-isolation (per the directions of the applicable authorities). Emergency work can be carried out provided workers are equipped with nitrile gloves, Tyvek suits or coveralls, and facial/ respiratory protection.

58. Hands and tools are thoroughly cleaned before entering the workplace and after leaving, and any surfaces or equipment in the occupied space are disinfected before work is done on them.

3.7 Meetings and Travelling

59. Any unnecessary meetings and traveling should be avoided. Using alternatives such as online meetings is recommended and employees should refrain from interacting with people who have been recently traveling to vulnerable areas.

60. Similarly, the travel of staff for meetings to vulnerable areas should be postponed.

61. All workers and employees are advised to maintain a minimum 1.5-meter distance from one another.

62. Workers and employees should also refrain from shaking hands or hugging anyone.

63. Dining breaks shall be rescheduled at different times, in smaller groups to avoid crowding in the dining areas.

64. It is encouraged that you keep your own mug/glass with you throughout the day and use only that.

65. See **Section 7** for more details on traveling protocols.

Social distancing during meetings outdoors

- Only absolutely necessary participants should physically attend meetings and should maintain social distancing guidelines (2m, or 1m with risk mitigation where 2m is not viable, is acceptable).
- Avoiding transmission during meetings, for example, avoid sharing pens, documents and or other objects.
- Providing hand sanitiser in meeting rooms.
- Holding meetings outdoors or in well-ventilated rooms whenever possible.
- For areas where regular meetings take place, use floor signage to help people maintain social distancing.

3.8 Equipment Cleaning and Sanitizing

66. The concern will be provided rubbing alcohol, or a suitable disinfectant as well as sterile gloves to wipe down equipment and commonly touched surfaces and objects every morning.

67. All door handles, railings, ladders, switches, controls, eating surfaces, shared tools and equipment, taps, toilets, and personal workstation areas are wiped down at least twice a day with a disinfectant, such as disinfectant wipes. Individuals are responsible for cleaning and disinfecting their workstations.

68. The implementation of cleaning procedures, safety prevention measures must be conducted twice a day to prevent any contamination. This will but is not limited to the following areas:

- Commonly touched surfaces such as vehicle'steering, vehicles' gear, and door handles, tools, chairs, tables, etc.
- , Workstations including keyboards, mice, telephones, desk surfaces
- Biometric devices
- Metal surfaces including door handles, knobs in and outside the office (includes main/rear exit)
- Kitchen surfaces
- Kitchen cutlery and utensils (before washing)
- Washrooms including the soap dispenser, hand dryer dyer, and other commonly touched surfaces
- Staplers, hole punchers, remotes, headphones, and other shared equipment.

69. Additional sanitary measures are implemented on-site: handwashing stations with a posted hand washing protocol, hand sanitizer stations, provision of disinfectant wiping products. These types of facilities are made available at site entries, exits, washrooms, eating areas, offices, and any other areas with commonly touched surfaces.

3.9 Working Remotely

70. Where practical, all office employees supporting a project work remotely.

71. Meetings are held through teleconferencing or videoconferencing.

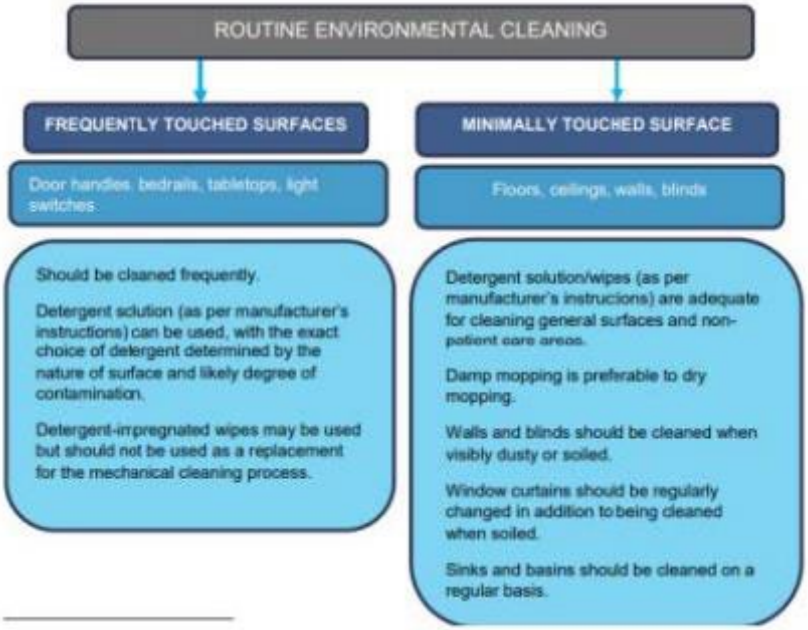
3.10 Cleaning Protocol

3.10.1 Cleaning/disinfection

72. Housekeeping staff undertaking the cleaning with detergent and disinfectant.

73. Perform hand hygiene then put on a plastic glove before and cleaning disinfection task

74. Dispose of used gloves in designated place/bin only.



3.10.2 On Entering the Room

75. Keep the door closed when using detergent and disinfection products, you may open a window if required.

76. All other personal items such as papers, pens, picture frames, etc. should be kept in drawers.

3.10.3 Cleaning of Communal Areas and Staff Workspaces

77. Wipe the surfaces with either a combined detergent disinfectant solution at a dilution of 1000 parts per million (ppm or 1 m/l) which is equal to one-quarter teaspoon of chlorine per 4 glasses of water.

78. Commercially available chlorine or alcohol-based disinfectant spray can be used as an alternative. This applies to benchtops and chairs.

79. For equipment, disinfect with commercial alcohol-based cleaners safe for computer surfaces.

80. Use disposable cloths, paper rolls, or disposable mop heads to clean and disinfect all hard surfaces, floors, chairs, door handles, or reusable non-invasive care equipment or sanitary fittings in the room, following one of the 2 options below:

- Use a combined detergent disinfectant solution at a dilution of 1m/l as described above or a commercial disinfectant spray.
- Follow the manufacturer's instructions for dilution, application, and contact times for all detergents and disinfectants.

6.6.4 Cleaning and disinfection of reusable equipment

81. Clean and disinfect any reusable non-invasive care equipment, such as Punch machines, staplers, pens, etc., that are in the room before their removal. Clean all reusable equipment systematically.

4. Detection and Response Measures

4.1 Screening at the Entry of Construction Site

82. Before entering the site, individuals must confirm that:

- They are not currently exhibiting flu-like symptoms such as fever, tiredness, coughing, or congestion;
- They have not returned from outside of Pakistan within the past 14 days;
- To the best of their knowledge, they have not been in contact with someone with a confirmed or probable case of COVID-19; and
- They have not been working on a site that was shut down due to the virus.

Responses are to be kept private and treated as sensitive medical information.

83. Individuals who are at increased risk of serious illness (due to age, pregnancy or other medical condition) are not to be permitted on site.

84. Workers who are not authorized to access the site are to be safely transported directly back home, or to a preferred location of self-isolation. When unable to do so themselves, a vehicle and driver will be arranged for them.

85. When transporting a potentially ill individual, both driver and passenger are to be given masks and nitrile gloves. The passenger is to sit in the backseat, and the driver is to open and close the doors for them.

4.2 Response Measures

86. Possible Case of COVID-19

- Individuals who have been potentially exposed to the virus, or who are exhibiting flu-like symptoms such as fever, tiredness, coughing, or congestion are instructed to:
  - Not come to work;
  - Contact their supervisor and/or human resources department;
  - Stay at home and self-isolate; and
  - Contact local health authorities for further direction.
- Such individuals are required to follow the directions of the local health

authority and may not return to work until given approval by the proper health authorities.

- Individuals who begin to display flu-like symptoms on site are instructed to avoid touching anything, take extra care to contain coughs and sneezes, and return home immediately to undergo self-isolation as directed by the local health authority..
- All areas on-site potentially infected by a confirmed or probable case are barricaded to keep individuals two meters away until the area is properly cleaned and disinfected.

4.3 Health Monitoring

87. An infrared thermometer should be made available, and temperatures of all people entering the offices, work areas, premises will be checked and recorded in a log every day (**Form D**).

88. A separate log will be kept for staff and visitors (**Form E**).

89. Employees should proactively communicate any concerns or symptoms they may be experiencing and not rely on the company to identify and prevent the transmission of infectious diseases.

5. Responsibilities

5.1 Contractors and Subcontractors Management

90. Make sure resources including financial resources required for the implementation of the plan available

91. Must also ensure adequate stock of hand sanitizers and face masks are present for all offices, camps, and construction sites.

5.2 EHS Team/ Site Managers

92. Responsible for ensuring housekeeping inspections are completed following this SOP.

93. This includes making sure the inspection checklist is completed daily (**Form F**).

94. The team is also responsible for supervising housekeeping staff and making sure all equipment and areas are routinely disinfected.

95. Every construction project shall make proper arrangements for uninterrupted building services including but not restricted to, electricity, fuel, water supply, water disposal and sanitation, communication links, washrooms with hand hygiene and shower facility and with proper and adequate supply of soaps and disinfectants.

96. Workers should not use biometric attendance machines or crowd during attendance, entry or exit to the premises of the construction site.

97. Ensure the availability of the thermal gun at the entry and exit of the construction site and no worker should be allowed without getting his/her temperature checked.

98. Site manager must maintain a register of all contact details with NID number and addresses of all present at the site in case a follow up or tracing and tracking of contacts is required at a later stage.

99. Develop the employee roaster to decrease the number of people on the site very day.

100. Split the shifts of the workers in morning and evening with limit of each shift to 8 working hours.

101. Every worker must change into standard working attire at the time of commencement of duty and change back to their regular dress after taking shower when their duty hours end.

102. Non-essential work trainings must be postponed avoiding gathering of people.

103. Ensure the physical distance by creating more than one route of entry and exit to the site.

104. Instruct the workers to inform the EHS manager (or authorities) if,

105. They develop any symptoms of cough, flu or fever.

106. They have been exposed to someone suspected or confirmed with COVID 19.

107. They have met someone who has a travel history of COVID 19 endemic country.

108. They have travelled in last couple of days or plan to travel soon

109. Do not allow any worker at the construction site who has the symptoms.

110. The lunch breaks and stretch breaks of the workers must be staggered to avoid the clustering of workers. Workers must not sit at less than 2 meters distance while having meals and while any other activity requiring interpersonal communications.

111. In the wake of current restrictions on transportations site mangers will ensure safe transport arrangements for worker which should not be crowded and should have social distancing in place during the entire process from pickups till drops at destination.

112. A list of COVID-19 medical facilties should be kept update along the contact information in **Form G**.

113. For more details please visit Govt of Pakistan's Guidelines for Health & Safety of Building & Construction Workers during COVID-19 Outbreak, Document 11-01, 11-April-2020.
https://covid.gov.pk/new_guidelines/01June2020_20200411_Guidelines_for_the_health_&_safety_of_building_&_construction_workers_1101.pdf.

5.3 Employees

114. To follow the procedures and preventative guidelines in this SOP and to maintain a certain level of precaution.

115. Employees must monitor their health, wear face masks if showing signs of a compromised immune system.

116. Disinfect equipment underuse and living areas routinely.

117. Report any symptoms immediately to EHS Team.

5.4 Corrective Actions and Response Strategy

118. If the EHS team determines that the cleaning does not pass the examination, the cleaning procedure and inspections are repeated.

119. Upon daily temperature recordings (**Form D and Form E**), the following response strategy will be implemented (With consideration of a ~0.5 Degree Celsius uncertainty of measurements):

120. Employees who have symptoms of acute respiratory illness are recommended to stay room/ home and not come to work until they are free of fever. The signs of a fever, and any other symptoms for at least 24 hours, without the use of fever-reducing or other symptom-altering medicines (e.g. cough suppressants).

121. Employees should notify their supervisor and stay home if they are sick.

122. Ensure that contractor and subcontractor sick leave policies are flexible and consistent with public health guidance and that employees are aware of these policies.

123. Do not require a healthcare provider's note for employees who are sick with acute respiratory illness to validate their illness or to return to work, as healthcare provider offices and medical facilities may be extremely busy and not able to provide such documentation in a timely way.

124. Contractors and subcontractors should maintain flexible policies that permit employees to stay home to care for a sick family member.

125. The contractor and subcontractor should be aware that more employees may need to stay at home to care for sick children or other sick family members than is usual.

126. Work from home for 2-3 days, and address fever and any other symptoms till status is more evident or symptoms subside.

127. Consult with and update the EHS team regarding your bill of health. Take medical leave; get examined by a doctor and tested for the virus.

6. SOP Auditing and Training

128. Contractors are to conduct periodic audits (frequency to be determined based on a project scale and scope) to verify that the appropriate measures have been implemented and are maintained.

129. EHS Team should arrange frequent awareness training sessions for employees and maintain a record.

130. Competence evaluations and repetition of training will be conducted as necessary to ensure the protection and continuance of this SOP.

7. Key Rules during Travel and Stop Overs

131. Avoid travelling if you have cough, fever/ flu like symptoms.

132. Persons having co morbidities (Diabetes, Heart conditions, Asthma), and persons older than 50 years of age should not travel unless very necessary.

133. Be sure to cover the mouth and nose with a mask (N-95) if not readily available, use a face mask.

134. Wash your hands often with soap and water for at least 20 seconds especially after you have been in a public place, or after blowing your nose, coughing, or sneezing.

135. Make sure distance of 2 meters between individuals.

136. Avoid mass gatherings

137. Avoid handshakes.

138. Avoid touching surfaces that may be frequently touched by other passengers, e.g. handles, seatback latches, seat belt buckles. Once touched, use a sanitizer to clean your hands as above.

139. Try using online check-in before moving.

140. Avoid touching surface, cards, machines; once touched, use a hand sanitizer to clean your hands.

141. Safety protocols should be followed at luggage check-in to ensure the safety of staff and passengers.

142. Avoid hugs and greeting styles which make you unnecessary close to each other.

143. Keep an alcohol-based hand rub in the car all time. Regularly and thoroughly clean your hands with an alcohol-based hand rub or wash them with soap and water.

144. Avoid touching surfaces such as door handle, shelf, tools, equipment, etc. unnecessarily and use disinfectant before having any food and drinks.

145. Make sure you and the people around you, follow good respiratory hygiene. This means covering your mouth and nose with your bent elbow or tissue when you cough or sneeze. Then dispose of the used tissue immediately.

146. Try to dedicate separate pairs of clothes for fieldwork.

147. Choose a hotel room which is well ventilated and well cleaned.

148. Ask the hotel services to replace the covers and blankets on arrival.

149. Try to take your towels and wipes during field visits.

150. Disinfect the doorknobs and side tables after entering the room every time.

151. Take good care of hygiene in your room and surroundings.

152. Avoid allowing any hotel staff for any room services during the stay.

153. Keep minimum interaction with other guests or staff during the stay.

154. Regularly and thoroughly clean your hands with an alcohol-based hand rub or wash them with soap and water.

155. Regularly disinfect the area of stay and your frequently used stuff like keys, door handles, etc.

156. Avoid touching surfaces such as door handle, shelf, tools, equipment, etc. unnecessarily and use disinfectant before having any food and drinks.

157. Stay informed on the latest developments about COVID-19. Follow the advice given by your healthcare provider, your national and local public health authority, or your employer on how to protect yourself and others from COVID-19.

158. Ensuring availability of disposable cups, glasses, and plates for drinks and meals and their disposable after one-time-use.

159. More details, see Govt of Pakistan's Guidelines for Health Guidelines for Domestic Air Travel During COVID 19 Outbreak, document 29-03, 30-August-2020. https://covid.gov.pk/new_guidelines/31August2020_20200830_Guidelines_for_Domestic_Air_Travel_2903.pdf

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- Govt of Pakistan's Guidelines for Health & Safety of Building & Construction

Workers during COVID-19 Outbreak, Document 11-01, 11-April-2020. https://covid.gov.pk/new_guidelines/01June2020_20200411_Guidelines_for_the_health_&_safety_of_building_&_construction_workers_1101.pdf

Form A: Information to Include in Leaflet

1. **Wear Mask at Project Sites or busy areas.**

When working at the project site and moving outside, be sure to cover the mouth and nose with a mask.

2. **Avoid Shaking Hands.**

Try to avoid unnecessary handshakes especially with strangers.

3. **No Hugs.**

Avoid hugs and greeting styles that make you unnecessarily close to each other.

4. **Maintain Social Distancing (at least 2 meters/6 feet)**

Maintain at least a 2-meter distance between yourself and other personnel during unavoidable meetings and gatherings. Maintain 2 meters from anyone who is coughing or sneezing.

5. **Avoid Social Gathering.**

Avoid social gatherings of a small and large group for example meetings, family festivals, wedding ceremonies, political, religious and social gatherings, etc. Chances of spreading viruses in such gatherings are much higher.

6. **Wash Hands Frequently.**

Regularly and thoroughly clean your hands with an alcohol-based hand rub or wash them with soap and water thoroughly.

7. **Reduce outdoor/outgoing Activities.**

Reduce everyday routine activities with friends, also teach your family members and close friends these safety measures to take care of meeting outside people, especially if someone came from the virus affected city/area or country.

8. **Do Proper Disinfection.**

Regularly disinfect the area of your office and home as well as your frequently used stuff like keys, door handles, etc.

9. **Avoid Touching Stuff in Public Places Unnecessarily.**

Avoid touching surfaces such as door handle, shelf, tools, equipment etc. unnecessarily and use disinfectant before having any food and drinks.

10. **Practice Respiratory Hygiene.**

Make sure you and the people around you, follow good respiratory hygiene. This means covering your mouth and nose with your bent elbow or tissue when you cough or sneeze. Then dispose of the used tissue immediately.

11. **Seek Medical Care Early.**

Stay home if you feel unwell. If you have a fever, cough, and difficulty breathing, seek medical attention, and call in advance. Follow the directions of your local health authority.

12. Stay Informed.

Stay informed on the latest developments about COVID-19. Follow the advice given by your healthcare provider, your national and local public health authority, or your employer on how to protect yourself and others from COVID-19.

Form B: Hand-Washing Guide

Form C: Guidelines on Worker Accommodation

This document contains Worker Accommodation Plan (WAP) for the Project which covers guidelines, the standards and practices to be used in the design and management of workers accommodation by NTDC, its contractors and subcontractors.

The WAP shall largely be implemented by the Construction Contractor and sub-contractors

The scope and applicability of the WAP is limited to the design and management of the worker accommodations provided during the construction phase of the Project.

NTDC and its contractors shall ensure sufficient resources are allocated on an on-going basis to achieve the effective implementation of the worker accommodation plan.

Regulatory Requirements for WAP

Laws applicable to the WAP include the following:

- Constitution of Pakistan that provides for humane conditions of work (Article 37(e)).
- Factories Act 1934 requirements for occupational health and safety at the workplace:
- Building Code of Pakistan. The Building Code of Pakistan (2008) provides the requirements for safety to be included in the design of buildings in Pakistan. The Building Code of Pakistan – Fire Safety Provisions (2016) provide the requirements for fire prevention, life safety in relation to fire and fire protection of buildings and building-like structures.

Accommodation Planning and Arrangement

Worker accommodations will be located within the Project site and will be provided during the construction phase of the Project. The worker accommodations will encompass areas where it shall not interfere with the construction activities.

Alongside the construction planning, the Construction Contractor (CC) along with the Project Management Unit (PMU) of NTDC, shall conduct a space assessment of accommodations.

Average minimum space of usual standards ranges from 10 to 12.5 cubic meters (volume) or 4 to 5.5 square meters (surface) per person will be provided throughout the construction period. Minimum ceiling height of 2.1 meters shall be provided.

Other specifications including building construction standards and fire safety will be managed according to the Building Code of Pakistan.

Drinking water complying with the provincial Environmental Quality Standards shall be provided at the worker accommodations.

Sewage and waste disposal system will be provided residential facilities in accordance with the regulatory requirements. As septic tanks will be constructed for management of sewage from the residential area and grease traps will be constructed to manage sewage from kitchen/mess.

Health and hygiene facilities will be provided against cold, heat, damp, biological hazards (disease-carrying animals), noise, vibration, food security and fire.

Washing facilities are will be provided as required. For sanitation septic tanks will be constructed on the campsite as per guidelines.

Employees will be provided with first aid training to cope up with emergency situations at the camp, in addition to emergency response at the workplace. Basic health care facility at the Project site and ambulance services shall be available.

If required, the project site during construction shall be encompassed by walls to limit impact on communities and ensure camp security.

All workers will be provided with an employee identity card and no person will be allowed to enter in the worker accommodations area without identification, or prior approval through security for visitors and other employees.

Standby generators to be located away from the communities towards the backside of Project site and also away from Worker Accommodation.

Inspection

A standard checklist on the workers' accommodation should be developed by the CC on cleanliness of the rooms, kitchen, toilets, open areas and disposal sites. The checklist will be used for the daily compliance of the cleanliness condition.

Project Manager of the CC will conduct an ongoing assessment of the accommodation requirement and the residual requirements for upcoming staffing.

The responsible staff of HSE of the CC will prepare monthly inspection report based on the inspection checklists and keep records and submissions along with other submissions to NTDC.

Form D: Daily Temperature Checklist for Employees

HBP Employee Temperature (°C) Checklist																												
Month:										Inspected By:												Signature:						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Name																															

Form E: Daily Temperature Checklist for Visitors

Use this checklist on daily basis to determine the temperature in °C of any visitors and the corrective actions required.

Inspected by: **Date:** dd/mm/yy

No	Name	Time	Temperature Recorded °C	Follow-up Action
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				

Form F: Cleaning and Disinfecting Checklist

Month:								Inspected by:												Signature:									
S #	Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Sweep and wash all hard surface flooring																														
2	Spot clean all interior glass																														
3	Clean and sanitize open desk surfaces																														
4	Clean and sanitize keyboard, mouse, and telephone																														
5	Dust computer monitors																														
6	Spot clean walls																														
7	Clean and sanitize all touchpoints																														
8	Empty and reline waste receptacles																														
9	Spot clean receptacles inside and out																														
10	Recycle paper waste																														
11	Detail floor edges, corners, and under desk																														
12	Dust all vertical surfaces																														
13	Dust window coverings																														
14	Clean all walls and glass																														
15	Clean between walls and furniture																														
12	Signature/ Initial																														

Form G: Nearby Covid-19 Facilities

To be updated by Contractor's EHS Manager/ Site Managers.

Annexure XV: Occupational Health, Safety, and Environment (OHSE) Management Plan

The Construction Contractor will develop an OSHE plan covering the following headings.:

1. Introduction
1.1 Purpose of the Plan
1.2 Applicability
1.3 Leadership Commitment
1.4 Project HSSE Objectives and Targets
2. Project Description
2.1 Scope of Work
3. Key Personnel and Health and Safety Responsibilities
3.1 General
3.2 Specific Roles and Responsibilities
4. Risk and Hazard Analysis and Control Measures
5. HSSE Requirements
5.1 General HSSE Requirements
5.2 General Standard Operating Procedures
5.3 Forms and checklists
5.4 Toolbox Talk
5.5 Documentation
6. Personal Protective Equipment
7. HSSE Training
8. Internal and External Communication
8.1 Communication Procedures
9. Emergency Preparedness and Response
9.1 Field Team
9.2 Hospital/ Clinics
9.3 Emergency Contact
9.4 Emergency Response Equipment
9.5 Emergency Response Procedure

Annexure XVI: Emergency Response Plan

Emergency Response Plan

1. Introduction

Emergency management can be defined as the organization, coordination and implementation of a range of measures to prevent, mitigate, respond to, overcome and recover from the consequences of emergency events affecting the community, its assets and the environment.

2. Purpose of Plan

This plan intends to provide a framework for safety and security to infrastructure, people and vehicles. It assigns responsibility to organizations and individuals for carrying out specific actions at projected times and places in an emergency situation that exceeds the capability or routine responsibility of any one agency.

The emergency response plan provides guidance to:

- Prevent any potential sources causing hazard to the resources during all stages of the project;
- Coordinate between various organizations to take actions in case of emergencies;
- Protect people and property in emergencies and disasters;
- Develop procedures to respond to the emergencies efficiently;
- Identify and ensure availability of personnel, equipment, facilities, supplies, and other resources for use in order to provide timely and efficient response and recovery operations; and
- Confirm that measures taken in an incident are adequate to recover the affected resources or further improvements are needed.

3. Planning

i. Emergency Response Team

A group/team shall be dedicated to identify and control potential emergencies during the construction and operation of the project. The roles and responsibilities of the group members shall be clearly defined.

The primary responsibilities of the group are described below:

- Identify the potential hazard or risk sources that can lead to emergency situations; Ensure availability of adequate resources, procedures and communication system to deal with the identified emergency situations;
- Ensure awareness and training of the staff to facilitate implementation of the emergency response plan;
- Maintaining the records of any previous incidents; and
- Post-event analysis to bridge the gaps of the existing risk prevention procedures.
- The emergency response team shall include but not limited to the following;
  1. Team Leader
  2. Safety Engineer
  3. Reporting officer/Inspector

Team Leader

- Approve/ modify devised measures to prevent or mitigate the risks associated with the identified risk sources
- Arrange resources for dealing with potential emergencies including, financial, equipments and personnel required to deal with emergencies.
- Assure that the Emergency Response plan is adequate, effective and can be implemented practically.

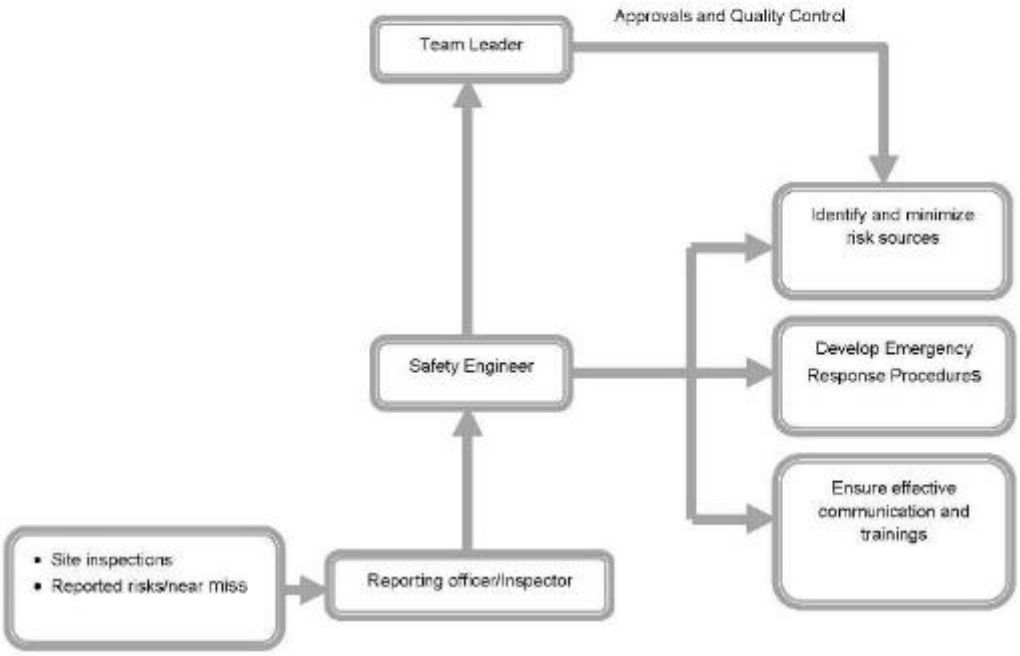
Safety Engineer

- Analyze the Identified risk sources and devise measures to prevent or mitigate the risks in close consultation with the Team Leader;
- Develop and implement the Emergency Response Procedures, in case of the possible emergencies arise;
- Ensure effective internal and external communication; and
- Provide regular trainings and arrange drills to make people aware of dealing with emergencies.

Reporting officer/Inspector

- Regular inspections of the site, to identify potential risks associated with equipments, materials and work practices;
- Anybody from the site can notify the reporting officer about potential risk and/or near misses on the site;
- Record any identified risks and mitigation measures to control the identified risk; and
- Notify the issue and control measures taken thereby to the safety engineer.

The designation, roles and responsibilities of each member shall be clearly defined and communicated to the employees. An outline of the framework of responsibilities is presented in the following organizational chart:



ii. Hazard Identification

A comprehensive identification and evaluation of the hazards/risks likely to cause an emergency shall be done by Emergency Response Team (ERT). Major potential emergencies identified in road projects are as follows:

- Structural failure
- Disruption of Utility (Power, Water, Telecommunications, Gas, etc)
- Accidents
- Vehicle accident
- Fog
- Smoke
- Power/equipment failure or Vandalism
- Fire
- Earthquake
- Terrorism including bombing
- Disease Outbreak

iii. Prevention and Mitigation

The ERT shall work to eliminate or reduce the impact of identified emergencies and increasing the resilience of an affected community to recover from the consequences of such events. These activities include:

- Design considerations to control flooding, earthquakes and adequate lightening for fog etc.;
- Regular inspection and maintenance of construction machinery and the structural integrity;
- Review of work schedules based on weather updates; and
- Security controls based on political situations.

4. Emergency Preparedness

The ERT shall be prepared with all necessary resources and the personnel's shall be trained regularly

i. Resources

Finance and administration

The financial resources shall be reserved for dealing with any emergencies arising on site during construction and operation. Responsibilities of the person managing the resources in case of emergencies shall be clearly defined and the required resources shall be adequate and updated regularly.

Equipment

All the necessary equipment needed in an event of emergencies shall be made available, as a minimum, the equipment needed include;

- Personal Protective Equipment
- Alarms/ Warnings
- Fire extinguishers
- Crowd control, flashlights, signs, barricades
- First Aid Facility
- Detection instruments, e.g; personal alarm kits; smoke detection instruments
- Tools to fix minor vandalism

Communication

All external and internal communication systems shall be made available. Local emergency numbers shall be clearly posted and communicated to the personnel involved in construction and during operation.

The local emergency numbers are given below, which shall be regularly updated.

Emergency Numbers

	Services
1	Edhi Ambulance
2	Emergency Police
3	Bomb Disposal

4 Rescue
5 Fire Brigade Center
6 Hospital Civil(casualties)

Trainings

Personnel shall be made aware of the importance of safety, potential emergencies and how to respond in case of emergencies. One day training and mock exercise shall be done to prepare, the personnel to deal with emergencies.

5. Emergency Response

Response includes actions taken to reduce the impacts of an emergency event, and to limit the threat to life, property and the environment.
The emergencies can be dealt with:

- On-Site Management of the situation
- Off-site coordination to arrange necessary resources to support the on-site management
- Providing advice and reports of the situation to stakeholders

i. Emergency Response Procedure:

Any person can report about an emergency, an on-site worker, an outside agency, or the public. Circumstances change during the course of an emergency in different events, thus, the procedure will vary as per the specific situation on ground. However, a basic action plan to be followed in an emergency is discussed below. This order of response is applicable to almost any emergency and should be followed in sequence.

Assess the situation:

The most important thing to do in case of emergency is to stay calm and avoid panic. Assess the situation, the cause and most immediate requirement to control, limit and/or manage the immediate, ongoing, or further damage.

Immediate control:

The most senior person on the scene should take control and contact, or delegate someone to contact emergency services as posted and communicated by ERT and inform the reporting officer of ERT and explain the situation. The area of emergency shall be restricted by barricades, tapes and adequate signage, if and as required.

Protection from further losses:

1. Once the site is restricted, to provide protection and reduce further losses, the source causing the emergency shall be controlled including equipments, materials, environment and accident scene from continuing damage or further hazards to the area and people. e.g: suppress fire, prevent objects from falling, shut down equipment or utilities, and take other necessary measures as required depending upon the type of emergency
2. Provide first aid if required or in doing so.
3. Designate people to emergency duties. e.g: assign personnel to guide emergency services on arrival.
4. Headcount People/personnel to identify any missing persons.
5. People/ personnel shall be directed to safe location.
6. Arrange diversions for the traffic to reduce disturbance to the flow of traffic, if and as far as possible.
7. Preserve the accident scene until experts mark it safe; only disturb what is essential to maintain life or relieve human suffering and prevent immediate or further losses.

ii. Communication:

Emergency service providers:
The emergency service providers' needs to be kept informed of the situation. On site, personnel from the emergency services shall be guided towards the emergency scene, brief about the event, ongoing and potential hazards and cause(s), if known.

Emergency Response Team and Management:
Members of ERT shall be immediately informed and the management shall also be kept informed.

Public:
Timely notifications to public shall be disseminated through electronic and print media depending upon the requirement and urgency of the emergency so that they can adopt alternate routes and avoid the hazards associated with the emergency encountered.

Utilities:
In case of disruption of utilities, the utility control authorities shall be immediately contacted to control the situation.

6. **Recovery:**

Emergency affected individuals, communities and infrastructure shall be restored in terms of emotional, economic, and physical well-being including the following as a minimum:

- A detailed analysis and assessment of causes of emergency , extent of damage and gaps if any, in managing the emergency;
- Recovery/replacement of the assets and infrastructure;
- Reinstatement of disrupted services;
- Road and bridge repairs;
- Updation of safety arrangements and Emergency response procedures to ensure better safety and security in any other arising emergencies.

Annexure XVII: Tree Plantation Plan

The Tree Plantation Plan

The Construction Contractor will develop a Tree Plantation Plan in consultation with the district office of the Forest and Wildlife Department of Sindh. A total of _____ trees will be planted in lieu of the expected _____affected trees.

The Plan should cover the following:

1. The tree plantation sites, were chosen in consultation with local Forest Offices.
2. The size of the tree and specie, as directed by the local Forest Offices.

Trees Recommended

The recommended trees from Forest Department should be mentioned in the following details.

#	Local Name	Scientific Name	Recommended Number and Size	Per Unit Cost	Total Cost (PKR)
1					
2					
3					

Project Implementation Period

The Construction of the Transmission Line Project Will be Completed in _____Years.

Tree Plantation Plan

1. **First Year**

Total _____ number of Trees will be planted in first year of project implementation.

2. **First Year**

Total _____ number of Trees will be planted in second year of implementation.

3. **First Year**

Total _____ number of Trees will be planted in second year of implementation.

4. **Rehabilitation Year**

Total _____ number of Trees will be planted during demobilization and rehabilitation period of the project implementation.

Measures for Maintenance of the Planted Trees

Finally, the Construction Contractor has to list the measures taken for the maintenance of the planted trees including regular watering and protection from animals, and removal by locals.

The Construction Contractor will develop a Tree Plantation Plan in consultation with the district office of the Forest and Wildlife Department of Sindh. A total of _____ trees will be planted in lieu of the expected _____affected trees.

The Plan should cover the following:

1. The tree plantation sites, were chosen in consultation with local Forest Offices.
2. The size of the tree and specie, as directed by the local Forest Offices.

Trees Recommended

The recommended trees from Forest Department should be mentioned in the following details.

#	Local Name	Scientific Name	Recommended Number and Size	Per Unit Cost	Total Cost (PKR)
1					
2					
3					

Project Implementation Period

The Construction of the Transmission Line Project Will be Completed in _____Years.

Tree Plantation Plan

1. **First Year**

Total _____ number of Trees will be planted in first year of project implementation.

2. **First Year**

Total _____ number of Trees will be planted in second year of implementation.

3. **First Year**

Total _____ number of Trees will be planted in second year of implementation.

4. **Rehabilitation Year**

Total _____ number of Trees will be planted during demobilization and rehabilitation period of the project implementation.

Measures for Maintenance of the Planted Trees

Finally, the Construction Contractor has to list the measures taken for the maintenance of the planted trees including regular watering and protection from animals, and removal by locals.

Annexure XVIII: Resource Conservation Plan

RESOURCE CONSERVATION PLAN

1. INTRODUCTION

The most of the resources in this world are finite and non-renewable in nature. We are completely dependent on these resources to fulfill all our daily requirements. Therefore, sustainable development calls for the need to conserve resources in a way that meet our needs of present generation as well as future generation, especially the non-renewable resources.

2. OBJECTIVE OF THE PLAN

The Resource Conservation Plan is intended to make an effort towards achieving sustainable development. The objective of the resource conservation plan is to:

- Minimize the use of natural resources; and
- Mitigate and prevent pollution contaminating the natural resources.

3. PLANNING

Careful estimations of quantities of material, fuel, water and energy required directly or indirectly shall be done to avoid excessive or unnecessary wastage of these materials. In addition to this, pollution prevention strategies shall also be devised to prevent contamination of resources.

- The estimations include the following:
  - Estimation of construction material required for the project;
  - Estimation of fuel consumption for construction machinery, construction vehicles and generators;
  - Estimations of the energy requirements during all the stages of the project; and
  - Estimations of water consumption for construction activities and construction camp sites.
- Strategies shall be planned to reduce loads on the identified resources to be consumed;
- Best management practices shall be devised to control or reduce pollution resulting from the activities during different stages of the project; and
- An inspector shall be assigned responsibility to oversee the ongoing activities to check the compliance of the planned strategies.

4. EXECUTION OF THE PLAN

The planned strategies shall be implemented to conserve the natural resources including but not limited to the following:

Material

- Material supplied shall be in conformance with the estimated quantities and excess material shall be returned to the supplier;
- Material wastage shall be avoided by using best management practices;
- Waste produced during the project execution shall be disposed off safely to the designated disposal sites through approved contractors; and
- Reuse of the materials shall be appreciated.

Energy

- Reduce trips and optimize routes to and from the construction site for all kinds of activities;
- Regular maintenance of equipment and vehicles to avoid leaks and sustain efficient fuel consumption;
- Switch off idle equipment and vehicles to avoid wastage of fuel;
- Minimize warm up time, unnecessary acceleration and deceleration of the construction equipment and vehicles;
- Avoid unnecessary burning of fuel for cooking in construction camps;

- Avoid unnecessary use of heating and cooling systems during extreme weathers events;
- Construction shall start in early hours of the day to avoid heat in summers and utilization of day light; and
- Alternate energy sources shall be considered for electricity generations during construction and operation to conserve fossil fuel as it is non-renewable resource.

Water

- Avoid using potable water for sprinkling, curing and washing of equipment and vehicles. Surface water or treated effluent can be used instead;
- Wastage of water should be controlled through providing proper valves and through controlling pressure of the water;
- Unnecessary equipment washings should be avoided;
- Awareness amongst workers shall be raised to conserve water and immediately report for any leaks detected; and
- Ensure protection of canal water from contamination resulting from construction activities.

Pollution

- Emissions shall be reduced and controlled as far as possible and direct discharges to air shall be avoided by strictly adhering to the mitigation measures outlined in EIA report;
- Waste water shall not be discharged directly and must be managed as per the recommendations presented in EIA; and
- Construction and demolition waste, and municipal solid waste shall not be dumped and burnt openly, and shall be handled according to the preventative measure given in EIA study.

5. CHECKING AND CORRECTIVE ACTIONS

C & W shall bind the construction contractor through contract agreement to comply with the strategies outlined in the Resource Conservation Plan. The Environmental Committee shall also appoint an Inspector who shall monitor the daily onsite activities and shall report any issues and concerns raised in relation to Resource Conservation Plan. The inspector shall recommend adequate corrective actions to mitigate the issues raised.

Annexure XIX: Site Specific EMP

The Construction Contractor will develop a SSEMP covering following headings.:

TABLE OF CONTENTS

Annexure XX: Worker Accommodation Plan

The Worker Accommodation Plan (WAP) for the Project covers guidelines, standards and practices to be used in the design and management of workers' accommodation by Proponent, its contractors and subcontractors. The WAP shall largely be implemented by the CC. The scope and applicability of the WAP are limited to the design and management of the worker accommodations provided during the construction phase of the Project. Proponent and its contractors will ensure sufficient resources are allocated on an ongoing basis to achieve the effective implementation of the worker accommodation plan.

Accommodation Planning and Arrangement

Worker accommodations will be located within the Project site and will be provided during the construction phase of the Project. The worker accommodations will encompass areas where it shall not interfere with the construction activities. Alongside the construction planning, the CC along with the Project Management Unit (PMU) of Proponent, shall conduct a space assessment of accommodations.

- The average minimum space of usual standards ranges from 10 to 12.5 cubic meters (volume) or 4 to 5.5 square meters (surface) per person will be provided throughout the construction period. A minimum ceiling height of 2.1 meters shall be provided.
- Other specifications including building construction standards and fire safety will be managed according to the Building Code of Pakistan.
- Drinking water complying with the provincial Environmental Quality Standards shall be provided at the worker accommodations.
- The sewage and waste disposal system will be provided in residential facilities following the regulatory requirements. As septic tanks will be constructed for the management of sewage from the residential area and grease traps will be constructed to manage sewage from the kitchen/mess.
- Health and hygiene facilities will be provided against cold, heat, dampness, biological hazards (disease-carrying animals), noise, vibration, food security, and fire.
- Washing facilities are will be provided as required. For sanitation, septic tanks will be constructed on the campsite as per guidelines.
- Employees will be provided with first aid training to cope with emergencies at the camp, in addition to emergency response at the workplace. Basic health care facilities at the Project site and ambulance services will be available.
- If required, the project site during construction may be encompassed by walls to limit the impact on communities and ensure camp security.
- All workers will be provided with an employee identity card and no person will be allowed to enter the worker accommodations area without identification, or prior approval through security for visitors and other employees.
- Standby generators to be located away from the communities towards the backside of the Project site and away from Worker Accommodation.

Inspection

A standard checklist on the workers' accommodation should be developed by the CC on the cleanliness of the rooms, kitchen, toilets, open areas and disposal sites. The checklist will be used for the daily compliance of the cleanliness condition.

The project manager of the CC will conduct an ongoing assessment of the accommodation requirement and the residual requirements for upcoming staffing.

The responsible staff of HSE of the CC will prepare monthly inspection reports based on the inspection checklists and keep records and submissions along with other submissions to Proponent.

Annexure XXI: Fire Management and Protection Plan

- Step 1: Designate a Responsible Person:
- Step 2: Action on Discovering Fire
- Step 3: Designate Exit Routes:
- Step 4: Designate the Assembly Area:
- Step 5: Designate Additional Duties:
- Reporting emergencies:
- Accounting for staff:
- First Aid:
- Step 6: Training:
- Step 7: Periodic review:
- How and When to Use a Fire Extinguisher?

Annexure XXII: Calibration Certificate of Noise and Air Quality Measuring Instruments

CERTIFICATE OF CALIBRATION

ISSUED BY ASIAN CALIBRATION LAB

Document No. ACS/LMS/FRM-110 **Date of Issue.** 01-04-2019 **Revision No.**00

Certificate No. AES/021/025/01

ASIAN CALIBRATION SERVICES (Pvt) Ltd.
www.asiancalibration.com

Client	Asian Environment Services	**Job No.**	ACS-025-AES/21
Location	Asian Calibration Lab	**Data Sheet No.**	AES/026-01
Equipment Detail	Noise Level Meter	**Inspection Date**	Nov 22, 2021
Model/type	WS2310CA	**Due Date (Where Required)**	Nov 21, 2022
Manufacturer	mi.sol	**Laboratory Temperature**	26 ± 3°C
Serial No.	112828	**Laboratory Humidity**	40% ± 20% RH
Code	ACS-WS-01	**Calibrated By**	Engr. Bilal Khalid

Inspection Checks & Results:

Range: 10 – 99 % **Resolution:** 1 **Source:** Humidity

Set value Ref. Std. Unit: %	Measured Value (IUT)* Unit: %	Deviation/Error Unit: %
20	21	1
30	30	0
40	40	0
50	51	1
60	61	1

Range: 0 – 50 mps **Resolution:** 0.1 **Source:** Speed

Set value Ref. Std. Unit: mps	Measured Value (IUT)* Unit: mps	Deviation/Error Unit: mps
0.4	0.3	-0.1
1.3	1.2	-0.1
2.2	2.1	-0.1
4.1	4.0	-0.1
8.7	8.7	0
19.5	19.2	-0.3
27.8	27.3	-0.5
36.3	35.5	-0.8
45.7	45.9	-0.2

Calibrated by. (DM) | Reviewed by. (TM) | Approved by. (QM)

Head Office:
Basement, C-3, Jhelum Block, Green Forts-II, Lahore - Pakistan
Phones: +92 42 35450914-15, Fax: +92 42 35450916,
Email: info@asiancalibration.com

ISO 17025 | ACS REGISTRARS ISO 9001

CERTIFICATE OF CALIBRATION

ISSUED BY ASIAN CALIBRATION LAB

Document No. ACS/LMS/FRM-110 Date of Issue. 01-04-2019 Revision No.00
Certificate No. AES/021/025/01

ASIAN CALIBRATION SERVICES (Pvt) Ltd.
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Wind Direction speed (wind tunnel speed at 20mps)

True Direction	Indicated (°)
N	359
E	088
S	176
W	268

Range: 35 – 1300 hPa Resolution: 0.1 Source: Pressure

Set value Ref. Std. Unit: hPa	Measured Value (IUT)* Unit: hPa	Deviation/Error Unit: hPa
1100	1100.4	0.4
1000	1000.4	0.4
950	950.4	0.4
800	800.4	0.4
300	300.3	0.3
200	200.2	0.2
100	100.1	0.1
50	50.1	0.1

Range: 0 – 60 °C Resolution: 0.1 Source: Temperature

Set value Ref. Std. Unit: °C	Measured Value (IUT)* Unit: °C	Deviation/Error Unit: °C
3.3	3.4	0.1
14.3	14.4	0.1
25.4	25.4	0
35.2	35.3	0.1
45.0	45.2	0.2
55.0	55.1	0.1

Calibrated by. (DM)

Reviewed by. (TM)

Approved by. (QM)

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Certificate No. AES/021/025/01

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Instrument Under Test

- Instrument was new and good in condition.
- Adjustment is carried out and measurement in this certificate are as obtained figures.
- The above instrument has been calibrated against the standards maintained in the instrument's division of ACS lab.
- Observed correction for anemometer are indicated above (acceptable limits of tolerance ± 0.1 mps upto 5.5 mps and ±2% beyond.

Reference / Calibration Standard

The weather station has been calibrated against thermocouple calibrator make GE Druck DPI821, Digital pressure indicator Sr no 51501374 of Druck Uk make, Digital thermometer & Digital Hygrometer make Extech /445814. which are traceable to certificates No. APCIC/PL (361)/ILO#938/29.05.19, APCIC/TL (907)/ILO#938/29.05.19, APCIC/TL (064)/ILO#764/24.12.19 and APCIC/TL (066)/ILO#764/24.12.19of PCSIR Laboratory Pakistan.

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Certificate No. AES/020/027/12

Client	Asian Enviro Services.	**Job No.**	ACS-027-AES/20
Location	Asian Enviro Services Lab	**Data Sheet No.**	AES/027-12
Equipment Detail	Air Quality monitor	**Calibration Date**	Oct 2, 2021
Model/type	AF22E/ Sulfur Dioxide Analyzer	**Due Date (Where Required)**	Oct 1, 2022
Manufacturer	Environment SA	**Laboratory Temperature**	26 ± 3°C
Serial No.	313AS	**Laboratory Humidity**	40% ± 20% RH
Code	ACS-AES-12	**Calibrated By**	Engr. Bilal Khalid

Calibration Results:

Range: 0-20.002 ppm **Resolution:** 0.001

Calibration Point (%FS)	Set value Ref. Std. Unit: ppm	Measured Value (IUT)* Unit: ppm	Deviation/Error Unit: ppm
0.0	0.000	0.000	0.00
20.0	5.418	5.418	0.00
40.0	8.837	8.838	0.01
60.0	15.255	15.251	-0.01
80.0	20.673	20.673	-0.12

Instrument Under Test

- Instrument was used and good in condition.
- Adjustment is carried out and measurement in this certificate are as obtained figures.

Reference / Calibration Standard

The air quality monitor O342e e has been calibrated against reference standard id ID#ACS-INST-12 which is traceable to certificates No. APCIC/TL (20)/ILO#98/47.10.20 of PCSIR Laboratory Pakistan.

Note(s):

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Certificate No. AES/020/027/06

Client	Asian Enviro Services.	**Job No.**	ACS-027-AES/20
Location	Asian Enviro Services Lab	**Data Sheet No.**	AES/027-06
Equipment Detail	Air Quality monitor	**Calibration Date**	Oct 2, 2021
Model/type	CO12e	**Due Date (Where Required)**	Oct 1, 2022
Manufacturer	Environment SA	**Laboratory Temperature**	26 ± 3°C
Serial No.	269SA	**Laboratory Humidity**	40% ± 20% RH
Code	ACS-AES-06	**Calibrated By**	Engr. Bilal Khalid

Calibration Results:

Range: 0-42.092 ppm **Resolution:** 0.0001

Calibration Point (%FS)	Set value Ref. Std. Unit: ppm	Measured Value (IUT)* Unit: ppm	Deviation/Error Unit: ppm
0.0	0.000	0.000	0.00
20.0	8.418	8.547	0.19
40.0	16.837	16.847	0.11
60.0	25.255	25.257	-0.02
80.0	33.673	33.651	-0.12
100.0	420.092	42.095	0.01

Instrument Under Test

- Instrument was used and good in condition.
- Adjustment is carried out and measurement in this certificate are as obtained figures.

Reference / Calibration Standard

The air quality monitor C342e e has been calibrated against reference standard id ID#ACS-INST-44 which is traceable to certificates No. APCIC/ML (44)/ILO#98/47.10.20 of PCSIR Laboratory Pakistan.

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Client	Asian Enviro Services.	**Job No.**	ACS-027-AES/20
Location	Asian Enviro Services Lab	**Data Sheet No.**	AES/027-05
Equipment Detail	Air Quality monitor	**Calibration Date**	Oct 2, 2021
Model/type	AC32e	**Due Date (Where Required)**	Oct 1, 2022
Manufacturer	Environment SA	**Laboratory Temperature**	26 ± 3°C
Serial No.	389SA	**Laboratory Humidity**	40% ± 20% RH
Code	ACS-AES-05	**Calibrated By**	Engr. Bilal Khalid

Calibration Results:

Range: 0-0.3895 ppm **Resolution:** 0.0001

Calibration Point (%FS)	Set value Ref. Std. Unit: ppm	Measured Value (IUT)* Unit: ppm	Deviation/Error Unit: ppm
0.0	0.0000	0.0000	0.18
20.0	0.0779	0.0799	0.24
40.0	0.1558	0.1560	0.19
60.0	0.2337	0.2387	0.18
100.0	0.3895	0.3848	-0.02

Instrument Under Test

- Instrument was used and good in condition.
- Adjustment is carried out and measurement in this certificate are as obtained figures.

Reference / Calibration Standard

The air quality monitor AC32 e has been calibrated against reference standard id ID#ACS-INST-17 which is traceable to certificates No. APCIC/TL (78)/ILO#32/13.10.20 of PCSIR Laboratory Pakistan.

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Client	Asian Enviro Services.	**Job No.**	ACS-027-AES/20
Location	Asian Enviro Services Lab	**Data Sheet No.**	AES/027-04
Equipment Detail	Air Quality monitor	**Calibration Date**	Oct 2, 2021
Model/type	Mp101M	**Due Date (Where Required)**	Oct 1, 2022
Manufacturer	Environment SA	**Laboratory Temperature**	26 ± 3°C
Serial No. `	362SA	**Laboratory Humidity**	40% ± 20% RH
Code	ACS-AES-04	**Calibrated By**	Engr. Bilal Khalid

Calibration Results:

Range: 10000 µg/m³ **Resolution:** 0.0001 **Source:** PM 10, PM 2.5

Calibration Point (%FS)	Set value Ref. Std. Unit: µg/m³	Measured Value (IUT)* Unit: µg/m³	Deviation/Error Unit: µg/m³
0.0 from HEPA filter	0.0000	-0.0001	-0.03

Instrument Under Test

- Instrument was used and good in condition.
- Adjustment is carried out and measurement in this certificate are as obtained figures.

Reference / Calibration Standard

The air quality monitor Mp101M has been calibrated against reference standard id ID#ACS-INST-021 which is traceable to certificates No. APCIC/DL (62N)/ILO#64/24.12.19 of PCSIR Laboratory Pakistan.

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Certificate No. AES/021/027/07

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Client	Asian Enviro Services.	**Job No.**	ACS-027-AES/21
Location	Asian Enviro Services Lab	**Data Sheet No.**	AES/027-07
Equipment Detail	Stack Emission Analyser	**Calibration Date**	Sep 2, 2021
Model/type	340	**Due Date (Where Required)**	Sep 1, 2022
Manufacturer	Testo	**Laboratory Temperature**	26 ± 3°C
Serial No.	6164345	**Laboratory Humidity**	40% ± 20% RH
Code	ACS-AES-07	**Calibrated By**	Engr. Bilal Khalid

Calibration Results:

Range: 100 °C **Resolution:** 0.1 **Source** Ambient Air Temperature

Set value Ref. Std. Unit: °C	Measured Value (IUT)* Unit: °C	Deviation/Error Unit: °C
100.0	100.0	±0.0

Range: 100 °C **Resolution:** 0.1 **Source** Flue Gas Temperature

Set value Ref. Std. Unit: °C	Measured Value (IUT)* Unit: °C	Deviation/Error Unit: °C
100.0	100.0	±0.0

Range: 8 hPa **Resolution:** 0.1 **Source** Pressure

Set value Ref. Std. Unit: hPa	Measured Value (IUT)* Unit: hPa	Deviation/Error Unit: hPa
8.00	7.98	-0.02

Range: 0 - 5% **Resolution:** 0.01 **Source** O2

Set value Ref. Std. Unit: %	Measured Value (IUT)* Unit: %	Deviation/Error Unit: %
0.0	0.00	0
2.51	2.55	+0.04
5.01	5.02	+0.01

Calibrated by. (DM)

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Calibration Results:

Range: 100-700 ppm **Resolution:** 1 **Source** CO

Set value Ref. Std. Unit: ppm	Measured Value (IUT)* Unit: ppm	Deviation/Error Unit: ppm
100	102	+2
401	399	-2
701	702	+1

Range: 100-1000 ppm **Resolution:** 1 **Source** SO2

Set value Ref. Std. Unit: ppm	Measured Value (IUT)* Unit: ppm	Deviation/Error Unit: ppm
100	96	-4
1000	979	-21

Instrument Under Test

- Instrument was used and good in condition.
- Adjustment is carried out and measurement in this certificate are as obtained figures.

Reference / Calibration Standard

The stack emission analyser has been calibrated against reference standard id ID#ACS-INST-39 which is traceable to certificates No. APCIC/ML (40)/ILO#98/47.10.20 of PCSIR Laboratory Pakistan.

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Client	Asian Enviro Services.	**Job No.**	ACS-027-AES/20
Location	Asian Enviro Services Lab	**Data Sheet No.**	AES/027-04
Equipment Detail	Air Quality monitor	**Calibration Date**	Oct 4, 2021
Model/type	Mp101M	**Due Date (Where Required)**	Oct 3, 2022
Manufacturer	Environment SA	**Laboratory Temperature**	26 ± 3°C
Serial No.	362SA	**Laboratory Humidity**	40% ± 20% RH
Code	ACS-AES-04	**Calibrated By**	Engr. Bilal Khalid

Calibration Results:

Range: 10000 µg/m³ **Resolution:** 0.0001 **Source:** PM 10, PM 2.5

Calibration Point (%FS)	Set value Ref. Std. Unit: µg/m³	Measured Value (IUT)* Unit: µg/m³	Deviation/Error Unit: µg/m³
0.0 from HEPA filter	0.0000	-0.0001	-0.03

Instrument Under Test

- Instrument was used and good in condition.
- Adjustment is carried out and measurement in this certificate are as obtained figures.

Reference / Calibration Standard

The air quality monitor Mp101M has been calibrated against reference standard id ID#ACS-INST-021 which is traceable to certificates No. APCIC/DL (62N)/ILO#64/24.12.19 of PCSIR Laboratory Pakistan.

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Client	Asian Enviro Services.	**Job No.**	ACS-027-AES/21
Location	Asian Enviro Services Lab	**Data Sheet No.**	AES/028-07
Equipment Detail	SO2 Gas Detector	**Calibration Date**	Nov 22, 2021
Model/type	QC-904	**Due Date (Where Required)**	Nov 21, 2022
Manufacturer	Oceanus	**Laboratory Temperature**	26 ± 3°C
Serial No.	190805002001	**Laboratory Humidity**	40% ± 20% RH
Code	ACS-AES-07	**Calibrated By**	Engr. Bilal Khalid

Calibration Results:

Range: 0-20 ppm **Resolution:** 0.1

Calibration Point (ppm)	Set value Ref. Std. Unit: ppm	Measured Value (IUT)* Unit: ppm	Deviation/Error Unit: ppm
0.0	0.0	0.0	0.0
2.0	2.0	1.9	0.1

Instrument Under Test

- Instrument was used and good in condition.
- Adjustment is carried out and measurement in this certificate are as obtained figures.

Reference / Calibration Standard

The Indoor Air Monitor (SO2 Gas Detector) has been calibrated against reference standard id ID#ACS-INST-44 which is traceable to certificates No. APCIC/ML (44)/ILO#98/47.10.20 of PCSIR Laboratory Pakistan.

Note(s):

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Client	Asian Environment Services	**Job No.**	ACS-025-AES/21
Location	Asian Calibration Lab	**Data Sheet No.**	AES/026-01
Equipment Detail	Noise Level Meter	**Inspection Date**	Nov 22, 2021
Model/type	BSWA 308	**Due Date (Where Required)**	Nov 21, 2022
Manufacturer	BSWA TECH	**Laboratory Temperature**	26 ± 3°C
Serial No.`	580036	**Laboratory Humidity**	40% ± 20% RH
Code	ACS-NM-01	**Calibrated By**	Engr. Bilal Khalid

Inspection Checks & Results:

Range: 93.8 dB **Resolution:** 0.1 **Source:** Sound

Set value Ref. Std. Unit: dB	Measured Value (IUT)* Unit: dB	Deviation/Error Unit: dB
93.8	93.8	0.0
93.8	93.8	0.0
93.8	93.8	0.0

Level Linearity

Range: 20 – 134 dB **Resolution:** 0.1 **Source:** Electrical

Set value Ref. Std. Unit: dB	Measured Value (IUT)* Unit: dB	Deviation/Error Unit: dB
20	20.2	0.2
21	21.1	0.1
22	22.2	0.2
23	23.2	0.2
24	24.1	0.1
25	25.1	0.1
30	30.2	0.2
40	40.0	0.0
50	50.0	0.0

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Range: 20 – 134 dB **Resolution:** 0.1 **Source:** Electrical

Set value Ref. Std. Unit: dB	Measured Value (IUT)* Unit: dB	Deviation/Error Unit: dB
60	60.0	0.0
70	70.0	0.0
80	80.0	0.0
89	89.0	0.0
90	90.0	0.0
91	91.0	0.0
92	92.0	0.0
93	93.0	0.0
94	94.0	0.0
95	95.0	0.0
96	96.0	0.0
97	97.0	0.0
98	98.0	0.0
99	99.0	0.0
100	100.0	0.0
110	110.0	0.0
120	120.0	0.0
130	130.0	0.0
131	131.0	0.0
132	132.0	0.0
133	133.0	0.0
134	134.0	0.0

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- Instrument was new and good in condition.
- Adjustment is carried out and measurement in this certificate are as obtained figures.
- The above instrument has been calibrated against the standards maintained in the instrument's division of ACS lab.

Reference / Calibration Standard

The Noise Level Meter has been calibrated against Noise calibrator make BSWA BK4231 which is traceable to certificates No. APCIC/PL (361)/ILO#938, of PCSIR Laboratory Pakistan.

Note(s):

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Client	Asian Enviro Services.	**Job No.**	ACS-027-AES/21
Location	ACS Lab	**Data Sheet No.**	AES/030-09
Equipment Detail	LUX meter	**Calibration Date**	Nov 22, 2021
Model/type	LM-200LED	**Due Date (Where Required)**	Nov 21, 2022
Manufacturer	AMPROBE	**Site Temperature**	23.8 °C ± 3°C
Serial No.	18050461	**Site Humidity**	50% ± 20% RH
Code	ACS-AES-09	**Calibrated By**	Engr. Abdur Rehman

Calibration Results:

Range: 540 - 2586 LUX **Resolution:** 50.0 **Source:** LUX

Set value Ref. Std. Unit: LUX	Measured Value (IUT)* Unit: LUX	Deviation/Error Unit: LUX
540	542	2.0
845	850	5.0
1241	1250	9.0
2037	2050	13.0
2586	2600	14.0

Instrument Under Test

- Instrument was used and good in condition.
- Adjustment are carried out and measurement in this certificate are as obtained figures.

Reference / Calibration Standard

The LUX Meter has been calibrated against Master LUX Meter which is traceable to the certificate no. ACS/LMS/FRM-LUX.M-01 of ACS.

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Client	Asian Enviro Services.	**Job No.**	ACS-027-AES/21
Location	Asian Enviro Services Lab	**Data Sheet No.**	AES/029-08
Equipment Detail	NO2 Gas Detector	**Calibration Date**	Nov 22, 2021
Model/type	QC-904	**Due Date (Where Required)**	Nov 21, 2022
Manufacturer	Oceanus	**Laboratory Temperature**	26 ± 3°C
Serial No. `	190805002002	**Laboratory Humidity**	40% ± 20% RH
Code	ACS-AES-08	**Calibrated By**	Engr. Bilal Khalid

Calibration Results:

Range: 0-20 ppm **Resolution:** 0.1

Calibration Point (ppm)	Set value Ref. Std. Unit: ppm	Measured Value (IUT)* Unit: ppm	Deviation/Error Unit: ppm
0.0	0.0	0.0	0.0
1.3	1.3	1.3	0.0

Instrument Under Test

- Instrument was used and good in condition.
- Adjustment is carried out and measurement in this certificate are as obtained figures.

Reference / Calibration Standard

The Indoor Air Monitor (NO2 Gas Detector) has been calibrated against reference standard id ID#ACS-INST-45 which is traceable to certificates No. APCIC/ML (45)/ILO#98/47.10.20 of PCSIR Laboratory Pakistan.

Note(s):

- This certificate provides traceability of measurements to recognised international/national standard and to units of measurements realizes to recognised international/national standard laboratories.
- This certificate may not be reproduced, except in full, without prior written approval of the laboratory.

Calibrated by. (DM)	Reviewed by. (TM)	Approved by. (QM)

----------End of Certificate----------

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