National Grid Company of Pakistan Limited (NGC)

*(Formerly NTDC)*

# Environmental Impact Assessment
# 500/220/132 kV Chakwal Grid Station

National Grid Company of Pakistan Limited (NGC)

*(Formerly NTDC)*

**Environmental & Social Impact Cell**

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# Executive Summary

National Grid Company of Pakistan Limited (NGC) formerly known as National Transmission and Despatch Company (NTDC), as part of Pakistan's energy sector reform program supported by the KfW Development Bank, World Bank and other development partners, plans to implement the National Transmission Modernization Phase-I Project (NTMP-I). This project aims to enhance the reliability and efficiency of the national transmission network.

In this context, KFW intends to finance the construction of the 500/220/132 kV Chakwal Substation in Punjab Province, Pakistan. The substation is designed to evacuate power to Islamabad Electric Supply Company (IESCO). To assess and manage potential environmental and social impacts of the project, NGC has commissioned an Environmental Impact Assessment (EIA). The proposed substation will occupy approximately 751 kanals of agricultural land. This EIA evaluates the environmental impacts associated with the grid station and recommends appropriate mitigation and management measures.

Typical facilities to be built at the grid station will include:

- Grid station facilities such as transformers, circuit breakers, feeder bays, bus bars, etc.;
- Control and administrative buildings;
- Infrastructure facilities such as fencing/boundary wall, internal roads and drains;
- Residential colony consisting of three houses for 1 deputy Manager Category B and 2 Assistant Managers Category C and Flat Building having 22 Nos. residential flats for Employees Category D, E and F. Total houses will be 25 nos and land under these houses about 1ha;
- Water supply and sanitation facilities.

**Location of the Project**

The substation will be located in the District of Chakwal of Punjab Province, Pakistan. NGC has selected the substation site some 10 km outside of the city of Chakwal on a plot used for agricultural farming. See Exhibit I: Project Location.

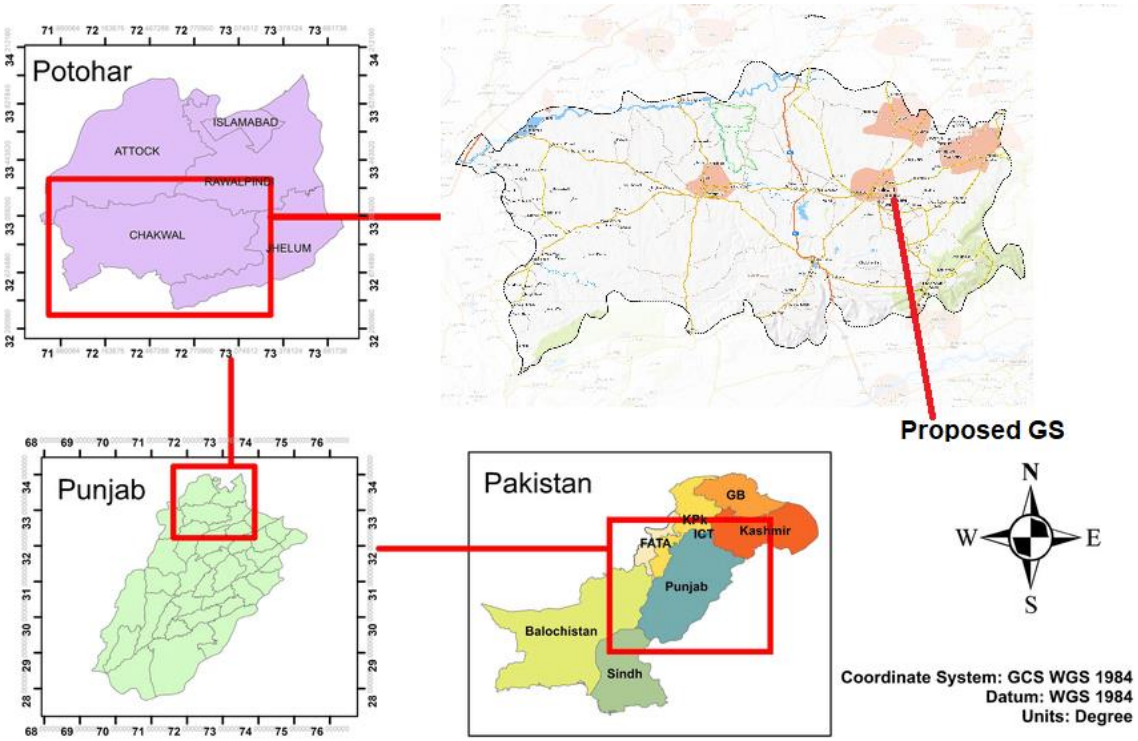


**Exhibit I: Project Location**

**Name of Proponent**

**National Grid Company (NGC), formerly NTDC** – Responsible authority for the 500/220/132 kV Chakwal Grid Station Project, overseeing project implementation, environmental and social compliance, and stakeholder engagement.

**Name of the Organization Preparing the Report:**

The Environmental Impact Assessment (EIA) was prepared jointly by **WSP Italia** and **CleanTech Solutions**, bringing together a multidisciplinary team of experts in environmental management, social development, and livelihood restoration

**WSP Italia in association with CleanTech Solutions** – Multidisciplinary consultancy firms responsible for preparing the Environmental Impact Assessment (EIA) for the 500/220/132 kV Chakwal Grid Station Project.

**The Major Impacts**

The major impacts are listed below. A detailed assessment of design, construction and operations phases is provided in **Section 6**.

**Design Phase Impacts**

In the design phase of the 500 kV Grid Station Chakwal, NGC has incorporated key environmental and social considerations to minimize potential site-specific impacts:

- **Land Use Conversion**: The project will require conversion of approximately 38 hectares of agricultural land for the construction of the grid station, leading to permanent loss of productive land.
- **Visual Impact**: The presence of large-scale grid station structures, including transformers, switchgear, and steel gantries, will alter the existing rural landscape and may cause visual intrusion for nearby communities.
- **Electromagnetic Field (EMF) Exposure**: Operation of high-voltage equipment within the grid station will generate EMF, potentially affecting areas immediately surrounding the station perimeter.
- **Noise Generation**: Installation and operation of transformers and other high-voltage equipment will result in noise emissions during both construction and operation phases.
- **Biodiversity Disturbance**: The conversion of agricultural land and installation of tall structures may disturb local fauna, especially avian species that could interact with station structures.
- **Soil Disturbance and Compaction**: Site levelling, excavation, and foundation works during the design and pre-construction stages will disturb topsoil and compact the land, affecting its natural drainage and fertility.

**Construction Phase Impacts**

**Physical Environment**

- The vegetation cover in the substation area will be removed for setting up the temporary camps, material storage areas and for the development of the temporary tracks. This may affect the existing vegetation to some extent in the substation area, which will be acquired and cleared before start of the construction activities.
- Lands may be contaminated from the spillage of chemicals like fuels, solvents, oils, paints and other construction chemicals and concrete.
- Soil erosion may occur in the workshop areas as a result of improper runoff drawn from the equipment washing-yards, sewage effluents and improper management of construction activities.
- Air quality will be affected by the dust and emissions from the construction machinery and by vehicular traffic during the construction phase. These air emissions may contain particulate matter (PM), Smoke, Dust, CO, $SO_x$, NO, $NO_2$.
- During construction, air and noise emissions from the construction activities will cause nuisances to the residents of the nearby villages.
- Failure of stockpile areas resulting in increased erosion and sediment flash.
- Generation of waste (hazardous and non-hazardous)
- Contamination of surface and groundwater due to improper handling of materials, leakage of oil and fuels and discharge from construction activities; and;
- Pressure on local water resources due to its use in construction activities.
- 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,

**Socioeconomic Impacts**

- Increased employment opportunities and local economy
- Disturbance of privacy due to the influx of workers
- Risks related to community safety
- Risks related to sanitation, solid waste disposal, and communicable diseases.
- Temporary loss of livelihood and acquisition of land.

**Operation Phase Impacts**

The operation of the facility is not likely to;

- Cause any appreciable increase in the noise level due to electrical equipment
- Be a source of atmospheric pollution during the operation of the Project.
- Generate liquid or solid waste.
- Increased opportunities for employment and the local economy
- Disturbance of privacy due to the influx of workers, risks related to community safety
- Possible adverse effects on bats due to design of structures and night-time radiological testing
- No additional land acquisition will be required during operations
- No additional water resources will be required during the operational phase but the water sources developed during the construction phase must be maintained.

**Recommendations for Mitigation Measures**

The mitigation measures for major impacts are listed below. The detailed proposed mitigation measures during the design, construction and operations phases are provided in Section 6 of the Main Report.

**Design Phase Impacts**

In the design phase of the 500 kV Grid Station Chakwal, NGC has incorporated key environmental and social considerations to minimize potential site-specific impacts:

- **Site Selection**: The substation site has been selected on agricultural land with minimal ecological sensitivity, ensuring that no critical habitats, forests, or protected areas are affected.
- **Grid Station Layout and Space Optimization**: The grid station will be designed to efficiently use the allocated 38 hectares of land, minimizing the physical footprint and optimizing the internal layout to reduce land disturbance and soil compaction.
- **Electromagnetic Field (EMF) Management**: State-of-the-art equipment and design measures will be applied within the substation to limit EMF levels, ensuring they remain within international safety standards for operational staff and nearby communities.

- **Aesthetic Integration**: Design elements such as the use of oxidized steel structures and painted equipment will be considered to reduce visual intrusion and help the facility blend better with the surrounding landscape.
- **Wildlife Safety Add-ons**: Although bird collision risks are generally lower for grid station, bird diverters and perch deterrents will be installed where necessary to reduce any potential bird interaction within the grid station area.

These considerations aim to ensure that the 500 kV Chakwal Grid Station is designed in an environmentally responsible and socially acceptable manner, aligning with the objectives of the NTMP-I Project**,** with financing support from KfW.

**Construction Phase Impacts**

**Physical Environment**

- No specific measures are required; however, use of good engineering practices such as use of equipment to cause minimum noise and damage to the vegetation will minimize the impact.
- Temporary drains and embankments should be made to channel the runoff appropriately.
- Storage areas for fuel and hazardous materials shall be roofed and have a concrete floor with a bund for secondary containment and collection of spills
- All storage areas and major construction sites shall have spill kits, sand, dust, and other appropriate absorbent materials.
- Good engineering practices should be used to minimize the impact of dust emissions.
- Concrete batching plants should be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce the level of dust emissions.
- Enforcement of NEQS.
- Water will be sprinkled through a dedicated water-bowser from the project water source identified in the Project Description section, around the construction site and along the routes used for construction activities to prevent the generation of dust.
- Haul-trucks carrying sand, aggregate and other materials should be kept covered with tarpaulin to help contain construction materials being transported between the sites within the body of each carrier;
- NGC should set up a system to monitor the air quality along the project corridor in accordance with accepted international standards. The system should have protocols for sampling and analysis, assessment of air quality at sensitive locations, reporting, and information sharing;
- Proper tuning and maintenance of the construction vehicles should be ensured;
- Construction materials should be stored within the boundary wall of the site so that no disturbance is made to surrounding areas;
- The contractor should also be required to provide a traffic management plan before commencement of work at site.

- The Contractor should be required to implement the mitigation measures provided in relevant ECP's to address noise quality impacts
- Construction activities near settlements should be limited to daytime only (8 am to 6 pm);
- High noise producing equipment should be provided with mufflers or acoustic enclosures.
- 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.
- Dust emissions at the camp and construction sites are to be minimized by implementing good housekeeping and sound management practices.
- The construction material will be stored in the boundary wall and no disturbance to surrounding areas is expected. The contractor will, however, be required to provide a traffic management plan before the commencement of work at the site.
- The need for large stockpiles should be minimized by careful planning of the supply of materials from controlled sources.
- Noise will be controlled by monitoring at a distance of 100m from the boundary wall of any residential unit and while following the NEQS of 55 dB (A).
- Construction should not be allowed during night-time (9 PM to 6 AM).
- Where vibration could become a major consideration (within say 100m of schools, religious premises, hospitals or residences) a building condition survey should take place before construction.
- Noise barriers should be installed for the workers working more than 8 hr/day during construction activities.
- Ensure that the workers are wearing necessary personal protection equipment (PPE) 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.
- Use muffled breakers and silenced diesel generators and compressors to reduce construction noise.
- 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 its 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 water bodies.
- Spill clean-up kits (shovels, plastic bags, and absorbent materials) will be available near fuel and oil storage areas.
- Clean-up kits will be carried in all fuel trucks.
- Fuelling 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.
- 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
- All types of solid and liquid wastes will be handled as per procedures discussed in

**Environmental Management Plan**.

- The source of water for construction from authorized abstraction sources will be agreed upon between the local communities, local government, and the contractor.
- Water conservation techniques will be developed and implemented by the contractor.
- Access of the community to water sources shall be kept clear so that the community's ability to meet its water requirements is not compromised.
- Care will be exercised while moving heavy machinery to avoid damage or blockage of natural waterways and channels.
- Efforts will be made to minimize the use of heavy trucks by preferring transport of equipment and supplies by 4x4 pickups, wherever possible, and
- A speed limit of not more than 30 km/h shall be imposed on unpaved roads and link roads for reducing traffic accident risks and dust generation.
- Ensure safe storage and handling of fuels, oils, and other hazardous substances according to standard safety practices
- 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.
- Solid residue from the septic tanks will be transported to a nearby municipal sewage disposal site.

**Socioeconomic Impacts**

- A total of 38 hectares of land for the construction of the grid station has been acquired by NGC in accordance with the Land Acquisition Act of 1894. However, to align with KfW's sustainability standards (as required by the donor), a standalone Livelihood Restoration Plan (LRP) has also been developed. The LRP is designed to go beyond the legal framework of land acquisition by supporting the socio-economic well-being of the affected population. It includes:

    - Livelihood restoration assistance and vulnerability allowances for those impacted by the project.

    - Capacity-building initiatives and skill development training to enhance local employability.

    - Implementation of a Local Employment Plan (LEP) to prioritize hiring from within the local community during construction and operation phases.
    - Execution of a Local Procurement Plan (LPP) to promote the use of locally sourced materials and services, thereby supporting small businesses and the local economy.

- These measures aim to ensure that the project not only minimizes adverse impacts but also contributes positively to the sustainable development of the host communities.
- Temporary project facilities including contractor's camps will be located within the Grid Sttion site at a minimum distance of 500 m from existing settlements / built-up areas.
- Prior to the commencement of the construction activities, the contractor should submit a site specific construction environmental management plan, in accordance with environmental management plan of this EIA, to the Engineer-in-Charge and the concerned EPA (if required) for its scrutiny and approval.
- Contractor and NGC 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 considered to be '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 must be ensured that construction activities do not disturb or disrupt agricultural activities in the surrounding areas.
- Local communities should be consulted before the start of work.
- Require non-locals employed by the Project to adhere to a social 'code of conduct' in terms of relations with local communities.
- Provide employees and visitors with cultural awareness training.
- 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

**Operation Phase Impacts**

- Proper landscaping and vegetation with planting of trees and green establishment of green belts and green areas around the station should be carried out by the contractor.
- Facilities for recycling (dehydrating) oil from breakers should be provided with dedicated drainage and run-off.
- Contaminated residues and waste oil residues should be delivered to licensed disposal companies.
- Oily residues and fuel and any contaminated soil residues should be captured at source and refuelling and maintenance should take place in dedicated areas away from surface water resources.
- Cause any appreciable increase in the noise level
- There is no source of atmospheric pollution during the operation of the Project.
- No liquid or solid waste generation is anticipated.
- Due to sufficient distance between the two opposite-phased conductors; no danger to the birds is envisaged.
- Community safety risks during operations of the TL can be reduced through the implementation of NGC's operation and maintenance procedures wherein all associated TLs are shut down before conducting maintenance work. This risk is further reduced by adherence to the standard Occupational Health and Safety Guidelines.
- Where gas insulated switchgear (GIS) containing SF6 is planned as part of the technical setup, solutions with alternative insulation mediums should be evaluated and applied if possible.
- Appropriate design features should be applied so that the national standards on occupational noise and noise in residential areas are complied with within the substation at offices, control rooms, relay rooms, employee colonies and at the periphery of the station;
- Equipment that generates low sound levels,
- Equipment layout to minimize the acoustic noise
- Acoustic barriers (walls or enclosures) wherever necessary to maintain noise levels that comply with national standards for noise
- No additional water resources will be required during the operational phase but the water sources developed during the construction phase must be maintained.

**Proposed Monitoring**

The key environmental and social issues that have been discussed in Chapter 5 of the Main Report, are as under:

- Impacts on crops and trees
- Contamination of air, water and soil during the construction activities
- Borrowing of aggregate materials

- Soil erosion and soil contamination
- Impact of noise generated by vehicles, machinery and equipment during the construction activities
- Impact on community and workforce safety as a result of accident hazards during the construction and operation of the project

An environmental monitoring plan (EMP) establishes the linkages between the environmental and social impacts, mitigation strategy and the agencies responsible for execution. Thus, the EMP in **Section 7** covers:

- 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 .

**Recommendations**

1. **Implementation of EMP:**
   Enforce all site-specific mitigation measures during design, construction, and operation phases, including:
   - Dust suppression measures.
   - Noise control through well-maintained machinery.
   - Waste management plans for construction debris and hazardous waste.
   - Health and safety plans for workers and local communities.
2. **Monitoring and Reporting:**
   - Regular environmental and social monitoring as per EMP.
   - Quarterly environmental performance reporting to relevant authorities.
3. **Stakeholder Engagement:**
   - Continue meaningful engagement with local communities, ensuring transparency and timely grievance redress.
   - Special focus on women and vulnerable groups in ongoing consultations.
4. **Capacity Building:**
   - Conduct environmental and social training for project staff, contractors, and sub-contractors.
5. **Emergency Preparedness:**
   - Develop and implement emergency response plans for accidental spills, fires, or other emergencies.

**Conclusion**

The proposed 500 kV Chakwal GS is environmentally and socially acceptable, provided that the mitigation measures, monitoring programs, and stakeholder engagement processes are strictly implemented.

# 1 Introduction

The Chakwal Substation Project is being executed by the National Grid Company of Pakistan Limited (NGC), which is responsible for the design and construction of the required improvements of grid stations in Pakistan.

This Environmental Impact Assessment (EIA) report has been commissioned by NGC and presents the assessment of potential environmental impacts of the proposed project. It also presents prosed mitigation measures in order to eliminate or reduce the negative/adverse impacts to an acceptable level, describes the institutional requirements and provides an environmental and social management monitoring plan.

## 1.1 Objectives of the Report

NGC, in support of the energy sector reform, assisted by World Bank and other funding agencies and institutions, intends to implement the National Transmission Modernization Phase-I Project (NTMP-I), which aims to improve reliability and efficiency of the national transmission system in Pakistan. In this context, KfW intends to assist NGC with the funding of the 500/220/132 kV Chakwal Substation.

The project will consist of the construction and operation of a new substation and requires "Preparation of Environmental Impact Assessment (EIA) including ESMMP and Resettlement Framework". This EIA Report is prepared to determine and assess the environmental and social impacts of the planned project and to propose appropriate mitigation and follow-up measures.

## 1.2 Purpose of Report

The specific objectives of the EIA are:

- To assess the existing environmental and socio-economic conditions of the project area.
- To identify likely impacts of the proposed project on the natural, human and social environment of the area and to predict and evaluate these impacts and to determine the significance of these impacts in the light of the technical and regulatory concerns.
- To propose appropriate mitigation measures to be incorporated in the design of the project to eliminate or minimize the adverse impacts.

## 1.3 Details of Project and Proponent

The National Grid Company of Pakistan Limited (NGC), assisted by the World Bank and other donor countries and institutions such as KfW, intends to implement the National Transmission Modernization Phase-I Project (NTMP-I), which aims to improve reliability and efficiency of the national transmission system in Pakistan. The proposed 500/220/132 kV grid substation Chakwal will be implemented within the larger framework of the NTMP-I. The proposed

Project is intended to increase the availability, reliability and efficiency of power transmission in the Chakwal District.

The NGC is the project proponent for the Chakwal substation project for which the Government of Pakistan (GoP) has applied for financing under the Financial Cooperation agreement between Pakistan and Germany.

This EIA study was commissioned by the Environment and Social Impact Cell (ESIC) of NGC comprising team of experts of various sectors including environment, social, health and safety etc.

### 1.4 Details of Consultant

The Environmental Impact Assessment (EIA) was undertaken jointly by WSP Italia (International Environmental & Social Consultancy) and CleanTech Solutions (Pakistan E&S Consultancy). The multidisciplinary team comprised experienced professionals with expertise in environmental management, social development, and livelihood restoration. The team included:

i. Ms. Eva Decampo – Project Manager and E&S expert for permitting processes, responsible for overall coordination, quality assurance, and timely delivery of the EIA.
ii. Ms. Heidi Hjorth– Social and Livelihood Development Expert, leading the assessment of social impacts, livelihood risks, and community development needs.
iii. Ms. Mehwish Rehman – Environmental Expert, responsible for evaluating environmental impacts, proposing mitigation measures, and ensuring compliance with national and international environmental standards.
iv. Mr. Khurram Riaz – Sociologist, contributing to social baseline data collection, stakeholder engagement, and socio-economic analysis.
v. Ms. Najma Iftikhar – Environmentalist, assisting in environmental surveys, data analysis, and preparation of mitigation plans.
vi. Mr. Hasnain Javid – Environmentalist, supporting environmental data collection, impact assessment, departmental consultations, and reporting.
vii. Mr. M. Bilal Ikhlaq – Field Survey, Document Preparation and Formatting.

This team brought together a blend of technical expertise and field experience to ensure that the EIA comprehensively addressed environmental, social, and livelihood considerations in line with relevant regulatory frameworks and international best practices.

### 1.5 Brief description of nature, size, and location of Project

The main project components include 500/220/132 kV Chakwal Substation with 2 x 450 MVA, 500/220 kV and 4x160 MVA, 220/132 kV transformers along with associated equipment and accessories; setting up in the usual equipment configuration as implemented for all other 500 kV Substations under NGC.

All the above facilities will be designed, manufactured, tested, supplied, installed and commissioned by a contractor. During this design, the contractor should ensure that the electromagnetic fields, acoustic noise and radio interference levels generated from the equipment in the substation will comply with the applicable national and international standards at the offices and residential buildings and at the periphery of the station.

## 1.6 Screening

The Punjab Environmental Protection Act 1997 (PEPA 1997) is the basic legislative tool empowering the government to frame regulations for the protection of the environment in Punjab province. Punjab Environmental Protection Agency (Punjab EPA) is responsible to implement the provisions of the applicable law Punjab Act 1997 in Punjab. The Punjab Act 1997 applies to a broad range of issues and extends to air, water, industrial liquid effluent, marine, and noise pollution, as well as to the handling of hazardous wastes. The IEE-EIA Regulations 2014 of the Punjab province provides the necessary details on the preparation, submission, and review of the EIA. The categorization of projects for EIA is one of the main components of the IEE-EIA Regulations 2014. An EIA is required to prepare and submit it to Punjab EPA for seeking environmental approval or no objection certificate (NOC).

### 1.6.1 EIA Requirements

The Punjab Environmental Protection Act of 2012 and the Pakistan Environmental Protection Agency Regulations 2000 are the main pieces of national legislation that are relevant for this project. In accordance with these, the development of a project will require an Environmental Impact Assessment (EIA) for obtaining clearance from the provincial Environmental Protection Agency before implementation can start.

## 1.7 Approach to the EIA

The EIA was performed in five main phases described below.

#### 1.7.1.1 Phase 1 – Scoping

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 the physical, ecological and socioeconomic environment was compiled.
- *Legislative Review*: Information on relevant legislation, regulations, guidelines, and standards was compiled.
- *Spatial and Temporal Boundaries of Environmental Assessment*: the boundary considered for the environmental assessment include the Chakwal Grid Station. However, there are some areas where construction related activities may extend further; for instance, for the establishment of construction camps.
- *Evaluation of Project Activities*: Based on available information on Project activities including land requirements according to Project options, construction, operations, and maintenance.

- *Important issues and concerns raised during consultation*: The major issues which might be raised during consultation are the loss of livelihood and loss of forest which will require prior attention and proper mitigation as per planning.
- *Identification of Potential Impact/Significant impacts and factors to be determined:* The information collected in the above steps was reviewed, and potential environmental and socioeconomic issues were identified in the area of influence (AoI).

#### 1.7.1.2 Phase 2 – Baseline Studies

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

#### 1.7.1.3 Phase 3 – Stakeholder Consultation

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.

#### 1.7.1.4 Phase 4 – Impact Assessment and Mitigation Measures

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 issues studied included potential Project impact 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

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.

#### 1.7.1.5 Phase 5 – Documentation

This EIA report was produced at the end of the study. It was prepared according to the relevant environmental legislation. This report includes the findings of the assessment, identifies the Project impacts, and suggests mitigation measures to be implemented during the execution and operations.

### 1.8 Project Benefits

The benefits associated with the proposed Project mainly include:

- Improvement in power supply position at/around 220 kV Chakwal Grid Station.
- Increase in system capacity to meet future load demands of the area.
- Improvement in voltage profile of the existing 132 kV grid station in Chakwal.
- Reduction in transmission system losses.

- The proposed project will provide the resynchronization of the NGC network during collapse due to severe bad weather conditions.
- The 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.

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.

Envisaged social benefits of the Project are:

- Provision of a more reliable supply of electricity to the consumers.
- Fulfilment 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.

### 1.9 Organization of the Report

- **Section 1** (*Introduction*) provides an introduction to the Project and outlines the objectives of the EIA.
- **Section 2** (*Legal and Policy* Framework) presents the legislative requirements that need to be followed while conducting an EIA.
- **Section 3 (***Project Description*) contains information about the key features of the proposed Project and describes the proposed Project activities. The section also discusses the alternatives of the proposed Project that were considered.
- **Section 4** (*Description of the Environment*) documents in detail the existing physical, ecological and socioeconomic conditions around the Project site.

- **Section 5** (*Stakeholder Consultation*) presents the objectives and outcomes of the public consultation that were conducted during the EIA.
- **Section 6** (*Screening of Project Potential Impacts and Mitigation Measures*) presents an assessment of the Project's impact on the physical, biological, and socioeconomic environment, as well as recommended mitigation measures.
- **Section 7** (*Environmental* Management *Plan*) facilitates the implementation and monitoring of the mitigation measures identified in the environmental impact assessment.
- **Section 8** *(Conclusion)* summarizes the findings and recommendations of this EIA study and concludes the report

# 2 Legal and Policy Framework

## 2.1 Historical and Constitutional Context

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 (PEPA) 1997 was enacted to replace the 1930 Ordinance. PEPA 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 2000 which provided the necessary details on the preparation, submission, and review of initial environmental examinations (IEE) and environmental impact assessments (EIA).

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.

The PEPA 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 PEPA 1997 continued to be the legal instrument for environmental protection in the provinces till the enactment of the provincial law.

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

## 2.2 Punjab Environmental Protection Act 2012

The Punjab Environmental Protection Act of 2012 is the provincial version of the Pakistan Environmental Protection Act, 1997 (PEPA) relevant to the Project. Responsibility for administration and implementation of the PEPA was transferred from the Ministry of Environment to the provincial governments by an amendment to the PEPA in 2012. The provincial versions continue to remain materially the same as the PEPA except when it comes to the designation of the responsible governmental bodies.

The following key features of the provincial Acts have a direct bearing on the Project:

- Section 11 (Prohibition of Certain Discharges or Emissions) states that “Subject to the provisions of this Act and the rules and regulations made thereunder, no person shall discharge or emit, or allow the 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 Environmental Quality Standards”.
- Section 13-I (Initial Environmental Examination and Environmental Impact Assessment) requires that “No proponent of a project shall commence construction or operation unless he has filed with the Federal Agency an IEE or, where the project is likely to cause an adverse environmental effect, an EIA, and has obtained from the Federal Agency approval in respect thereof.”
- Section 13-2b (Review of IEE and EIA): “The Environmental Protection Agency shall review the EIA report and accord its approval subject to such conditions as it may deem fit to impose, or require that the EIA be re-submitted after such modifications as may be stipulated or rejected, the project as being contrary to environmental objectives”.
- Section 15 (Handling of Hazardous Substances) requires that “Subject to the provisions of this Act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle, or import any hazardous substance except (a) under a license issued by the EPA and in such manner as may be prescribed; or (b) in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement, or other Instrument to which Pakistan is a party.” Enforcement of this clause requires the EPA to issue regulations regarding licensing procedures and to define ‘hazardous substance.’
- Section 16 (Regulation of Motor Vehicles): “Subject to provision of this clause of the Act and the rules and regulations made there under, no person shall operate a motor vehicle from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the EQS, or where the applicable standards established under clause (g) of subsection (1) of Section-6 of the Act”.

- Section 18 (Penalties): “Whoever contravenes or fails to comply with the provisions of section 11, 12, 13, or section 16 or any order issued thereunder shall be punishable with fine which may extend to one million rupees, and in the case of a continuing contravention or failure, with an additional fine which may extend to one hundred thousand rupees for every day during which such contravention or failure continues: Provided that if contravention of the provisions of section 11 also constitutes contravention of the provisions of section 15, such contravention shall be punishable under sub-section (2) only”.
- Section 19 (Offences by Bodies Corporate): “Where any contravention of this Act has been committed by a body corporate, and it is proved that such offence has been committed with the consent or connivance or, is attributed to any negligence on the part of, any director, partner, manager, secretary or other officer of the body corporate, such director, partner, manager, secretary or other officer of the body corporate, shall be deemed guilty of such contravention along with the body corporate and shall be punished accordingly”.

## 2.3 Pakistan Environmental Protection Agency (Review of IEE & EIA) Regulations, 2000

The IEE/EIA Regulations of 2000 establish the framework for the preparation, submission, and review of the IEE and the EIA. The regulations categories development projects for IEE and EIA into two schedules (Schedules I and II). Schedule I include projects where the range of environmental issues is comparatively narrow and the issues can be understood and managed through less extensive analysis. Schedule II covers major projects that have the potential to affect a large number of people in addition to generating potentially significant adverse environmental impacts. Preparation of a complete EIA is required for Schedule II projects. NGC has determined that the proposed Project will fall under Schedule II requiring EIA.

National guidelines for undertaking EIA in accordance with the IEE/EIA Regulations 2000 include the Policy and Procedures for Filing, Review and Approval of Environmental Assessments, 1997 (the FRAEA Guidelines) and Guidelines for the Preparation and Review of Environmental Reports, 1997 (the PRER Guidelines).

## 2.4 Environmental Regulatory Authorities

Since the project area falls in Punjab Province, the Punjab Environmental Protection Agency (EPA) is the relevant environmental regulatory authority. The provincial EPAs are responsible for environmental regulation and implementing GoP environmental policies in their respective provinces. As part of their roles, provincial EPAs are responsible for reviewing EIA documentation for compliance with provincial EIA requirements and procedures and, using their district based staff, monitoring the implementation of EMPs. The Statutory functions of the provincial EPAs are to:

- Administering and implementing the Environmental Protection Act, its rules and regulations;

- Reviewing IEE/EIA, preparation of procedures and guidelines;
- Prepare, revise and enforce Environmental Quality Standards (EQS) for industries, municipalities, vehicular emissions;
- Establishing and maintaining laboratories, certification of laboratories for conducting tests and analyses;
- Assisting local Councils, Authorities and/or Government Agencies in execution of projects;
- Establishing a system of surveys, monitoring, examination and inspection to combat pollution;
- Conducting training for government staff and industrial company staff;
- Provide information and education to the public on environmental issues;
- Publishing annual "State of the Environment" reports;
- Undertaking surveys and qualitative and quantitative analysis of data on air, soil and water quality, and industrial, municipal and traffic emissions;

## 2.5 Land Acquisition Act of 1894

The Land Acquisition Act of 1894 provides for the acquisition of private properties for public purposes including development projects in Pakistan. It comprises 55 sections dealing with area notifications, survey, acquisition, compensation, apportionment awards, disputes resolutions, penalties and exemptions. Necessary land for the project (substation area) must be acquired in accordance with this Act.

## 2.6 Telegraph Act of 1885

The Telegraph Act of 1885 was enacted to define the authority and responsibility of the Telegraph Authority. The law covers, among other activities, installation and maintenance of telegraph lines and posts (poles). The Act defines the mechanism to determine and make payments of compensation associated with the installation of these lines and posts. Under this Act, the land required for the poles is not acquired (or purchased) from the owner, nor the title of the land transferred. Although compensation is paid to the owner for any structure, crop or tree that exists on the land; the cost of the land itself is not paid to the owner

## 2.7 International Treaties signed by Pakistan

Pakistan is a signatory to a number of international environment-related treaties, conventions, declarations and protocols. The following are the relevant international treaties and conventions to which Pakistan is a party:

- Convention on the Conservation of Migratory Species of Wild Animals;
- Convention on Wetlands of International Importance;
- Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal;
- Convention concerning the Protection of World Culture and Natural Heritage;
- Convention on International Trade in Endangered Species;

- International Plant Protection Convention;
- International Covenant on Economic, Social and Cultural Rights;
- International Labour Organization's (ILO) Core Labour Standards on:
  - Freedom of association (convention 87)
  - Elimination of forced and compulsory labour (conventions 29 and 105)
  - Elimination of discrimination in respect of employment and occupation (conventions 100 and 111)
  - Abolition of child labour (conventions 138 and 182)
- Kyoto Protocol to the Convention United Nations Framework on Climate Change
- Stockholm Convention on Persistent Organic Pollutants
- United Nations Convention on Biological Diversity
- United Nations Convention on the Rights of the Child
- United Nations Framework Convention on Climate Change.

## 2.8 Electric Magnetic Field Exposure Guidelines

**Table 2-1 and 2-2** lists exposure limits for public exposure to electric and magnetic fields published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP)1 and the exposure limits for occupational exposure.

**Table 2-1 ICNIRP Exposure Limits for General Public Exposure to EMF**

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

**Table 2-2 ICNIRP Limits for Occupational Exposure to EMF**

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

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

## 2.9 IEEE Guide for the Design, Construction, and Operation of Electric Power Substations for Community Acceptance and Environmental Compatibility

1127-2013 - IEEE Guide for the Design, Construction, and Operation of Electric Power Substations for Community Acceptance and Environmental Compatibility published and copyrighted by Institute of Electrical and Electronics Engineers (IEEE) provides guidance on community acceptance and environmental compatibility for new substations or substation expansions.

The guide identifies significant community acceptance and environmental compatibility items to be considered during the planning and design phases, the construction period, and the operation of electric supply substations, and documents ways to address these concerns to obtain community acceptance and environmental compatibility.

Community considerations and Public involvement are dealt with specifically and represent best practice. The Guide also specifies Best Practices under the various phases of the project cycle as follows:

**Design:** Best Practices for treatment of aesthetics, noise, electric and magnetic fields and environmental considerations;

**Construction:** Best Practices for site preparation, noise abatement, physical site security, traffic control, site housekeeping, hazardous materials, oil containment and community involvement;

**Operation and Maintenance:** Best Practices for site housekeeping, noise abatement, physical site security, fire protection and hazardous materials.

All the impacts and measures described in the IEEE Guide for the Design, Construction, and Operation of Electric Power Substations for Community Acceptance and Environmental Compatibility have been considered and the mitigation and management plan developed accordingly.

## 2.10 NGC Safety Considerations

NGC Design Directorate has issued safety considerations which must be borne in mind during selection of route for ESSs. The main points of the guidelines are:

- Operation in environmentally sensitive areas with special respect for fragile ecosystems and their inherent biodiversity are to be avoided to the extent possible;
- ROW is selected after due consideration for location of telecommunication lines and railway circuits to avoid electrical interference due to mutual induction;
- Residential structures are kept a minimum of 12 m out from the plumb line of the outer conductor in the ROW. However, in the absence of an alternative alignment, an exception can be made for farm buildings and single floor factory buildings, provided neither is used for purposes of residence;
- Innovative technologies and latest equipment must be adopted or used to abate pollution in construction activities and operations;

- Routes of T/Ls are avoided to the maximum extent through areas of cultural or historical importance and religious places;
- Tube wells and open wells using a surface pump are not permitted under high voltage conductors as piping and cranes used to recondition such wells could make contact with high voltage conductors;
- Existing orchards can remain within the ROW although Towers are kept out of orchards wherever possible. Orchards are to be over-sailed by a clearance of six (6) m above the height of a mature orchard whereas all other trees are to be removed;
- Brick kilns should be kept at least 40 m outside the centreline of the ROW;
- Alternative route alignments should be used if any school, rural dispensary, mosque or local shrine (ziarat) falls within 200 m of the centreline of a planned route;
- Existing open wells and hand pumps can remain under high voltage conductors, provided open wells are capped;
- Selection of sites for Tower foundation and Tower erection is made consciously on stable surfaces and by rejecting sites susceptible to erosion, slips and landslides;
- Alignment of the T/L is made by NGC after discussions with key persons of the area and by avoiding properties and infrastructure to the extent feasible;
- Spacing between Towers/poles may not be uniform and ranges could vary for physical and other considerations, such as crossing of main roads, residential areas, streams and canals and trees and for avoiding graveyards and big ditches in between Towers/poles;
- No residential or other public buildings such as factories, schools, hospitals and mosques, except for graves/graveyards, are permitted within the RoW. However, farm buildings which are used for residential purposes may remain under extra high voltage lines, provided a vertical clearance of at least eight (8) m is maintained. The height of towers can be increased to accommodate such buildings.

This section provides a summary of the national and international legislation and guidelines that are relevant to the assessment of the Project's environmental components. The review of the legal and institutional framework and relevant laws help identify the policy directives and required procedures to investigate social responsibility, environmental accountability, and financial soundness of the Project.

## 2.11 Institutional Framework

Under the PEPA Act 1997, Punjab EPA is an autonomous agency for administrative purposes and performs the following functions:

- Implements the provisions of PEPA 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

## 2.12 Requirements for Environmental Impact Assessment

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

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[2] 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…'

The Punjab IEE-EIA Regulations are still to be formulated and so PEPA IEE-EIA Regulations 2000 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 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

2 The term 'Agency' refers to the Punjab Environmental Protection Agency.

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.

The Project[3] requires filing an EIA with Punjab EPA for NOC. The applicable law binds the Agency (Punjab EPA) to inform the proponent (NGC 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 Act4, to the extent to which it does not contravene the provisions of the Act and 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.

## 2.13 Punjab Environmental Quality Standards

Punjab EPA notified seven sets of Punjab Environmental Quality Standards (PEQS) on August 12, 2016.[5] All projects in operation on the date of notification or all projects that will come into force after the date are required to comply with these standards.

The applicability of the PEQS to the Project is described in Table 2-3.

**Table 2-3 PEQS Applicable to the Project**

| Standard | Applicability During Construction | Applicability During Operation |
|---|---|---|
| Gaseous emission | Emissions from power generators | Not applicable |
| PEQS for noise | All noise sources | Substation operations |
| 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 the Project vehicles) | Fugitive emissions from the substation and TL operational activities such as vehicular movement. |
| PEQS for municipal and liquid industrial effluents | Effluent from the construction activities (camp sanitary waste, surface run-off, and other waste) | Sanitary waste |

3 Each subproject under Tranche 4 Readiness will require an independent EIA to be submitted to provincial EPAs.

4 https://environment.gov.pk/SiteImage/Misc/files/Regulations/IEE%20EIA%20Regulation%202000.pdf paragraph 16.

5 http://epd.punjab.gov.pk/rules_regulations. Retrieved on August 22, 2017

| Standard | Applicability During Construction | Applicability During Operation |
|---|---|---|
| PEQS for drinking water | Water supplied to the construction staff | Water supplied to operation staff |
| 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 |

## 2.14 Other Environmental Laws

Several other laws in the statute books of Pakistan have a bearing on the environmental performance of the Project. These are listed in **Table .**

**Table 2-4 Laws Relevant to the Project**

| Law | Description | Applicability to the Project |
|---|---|---|
| The Punjab Water Act 2019 | The act authorizes comprehensively manage and regulate water resources in Punjab in the interest of conservation and sustainability | Water extraction/ contamination and waste during construction and operations. |
| 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 canal bank are maintained by the Forest Department and coordination with them will be required if the trees are to be removed. |

| 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 does not apply 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 concerning fire and fire protection of buildings and building-like structures. | Applicable on 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 cultural-historical site was found on the RoW of the Project. |

# 3 Consideration of Alternatives

This Chapter deals with an analytical overview of the different alternatives available to the current project proposal. The various alternatives, which have been considered during the conduct of the study are as under;

- Alternatives of Location
- Alternative Construction Logistics
- Alternative Labour Options
- The no project option

## 3.1 No Project Alternative

Under the "no project" alternative, the proposed Chakwal substation would not be constructed and operated, and hence, the identified environmental and social impacts would not occur. However, choosing the no project alternative does not necessarily correspond to maintaining baseline conditions or status quo, as changes may result from other actions.

The justification of the project is the increased demand for electricity supply caused by increase in population and living standards. Furthermore, increased economic, industrial and agriculture development requires a sustainable and strong electricity supply system.

In order to achieve desired economic growth and poverty reduction, it is necessary to ensure a reliable power supply to an increasing number of industrial, agricultural, commercial, and domestic consumers. To cope with this growth in demand, additional capacity is required to be added to the system on a regular basis which, in a grid-based system, translates into the need for and justification of the project.

Around the world, alternatives to such a grid-based economy are beginning to emerge and, in some countries, off-grid system are advancing in popularity for a number of reasons. In Africa for example, off-grid solutions at community scale are often a solution for villages which would otherwise have to wait years for grid connection.

Off-grid power supply can be stand-alone power systems or micro-grids typically to provide a smaller community with electricity. Off-grid electrification is an approach to access electricity used in countries and areas with little access to electricity, due to scattered or distant population. In developed countries off-grid homes aim to achieve autonomy from utilities and external sources of energy.

Such off-grid alternatives are, however, not suitable in the current project context due to the large scale of the electricity power supply. Overall, given that most of the adverse environmental and social impacts can be successfully mitigated, the no project alternative

is not considered to be a preferred option when taking all technical, economic, social and environmental aspects into account.

### 3.2 Alternative Construction Methods

The feasibility of the substation is 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 pre-fabricated units' in-situ. Thus, the impacts of construction activities are very manageable from an environmental viewpoint.

## 3.3 Location Alternate

During the site selection process, three potential alternative locations were initially considered for the grid station, with all options evaluated against environmental sensitivity, social acceptability, technical feasibility, and land availability.

- Alternative 1 was rejected due to high social sensitivity and community opposition, despite being technically feasible.
- Alternative 3 was also ruled out as it posed challenges related to land use conflicts and required significant infrastructure adjustments.
- Alternative 2 was selected as the preferred and final site, as it was found to be technically feasible, socially acceptable, and environmentally favourable as shown in the Figure 3-1.

The Table 3-1 below presents a comparative analysis of the three potential site alternatives considered for the proposed 500/220/132 kV Chakwal Grid Station. Each alternative has been evaluated against key parameters including technical feasibility, land type and condition, vegetation and trees impacted, environmental sensitivity, community acceptance, and the rationale for selection or rejection.

Alternative 2 has been selected as the preferred site because it is technically feasible, socially acceptable, and environmentally favorable. Alternatives 1 and 3 were rejected due to higher social sensitivity, potential conflicts with productive agricultural land, and environmental or infrastructure challenges.

This comparison provides a transparent and systematic basis for site selection, ensuring that social, environmental, and technical factors are all taken into account in the decision-making process.

**Table 3-1 Comparison of Project Alternatives**

| Parameter | Alternative 1 | Alternative 2 (Selected) | Alternative 3 |
|---|---|---|---|
| Technical Feasibility | Technically feasible | Technically feasible | Technically feasible with |

| | | | |
|---|---|---|---|
| | | | modifications |
| Houses Affected | None | None | None |
| Land Type / Condition | Developed agricultural land (irrigated, fertile) | Rain-fed, degraded agricultural land (less fertile, limited cultivation) | Developed agricultural land (irrigated, productive) |
| Trees / Vegetation Impact | High – mature trees and hedgerows | Minimal – sparse vegetation | Moderate – scattered trees |
| Environmental Sensitivity | High – potential soil disturbance, irrigation-dependent land, limited resilience | Low – degraded land, lower erosion risk, fewer environmental constraints | Medium – potential conflict with irrigation channels and existing infrastructure |
| Community Acceptance | Opposed by community | Accepted by community | Mixed reactions |
| Reason for Selection / Rejection | Rejected due to high social sensitivity and strong community opposition; would affect productive farmland and established vegetation | Selected as preferred site; technically feasible, socially acceptable, environmentally favourable; minimal ecological and land-use conflicts | Rejected due to land use |

The selected site (Alt 2), 751 kanal is situated on mostly degraded agriculture land, this private land which was previously owned by 100 household is acquired by NGC, back in 2023. with no significant environmental sensitivities, ecological habitats, or protected areas in proximity. There is no presence of critical habitats, endangered flora or fauna, or sensitive receptors, minimizing the environmental footprint of the project.

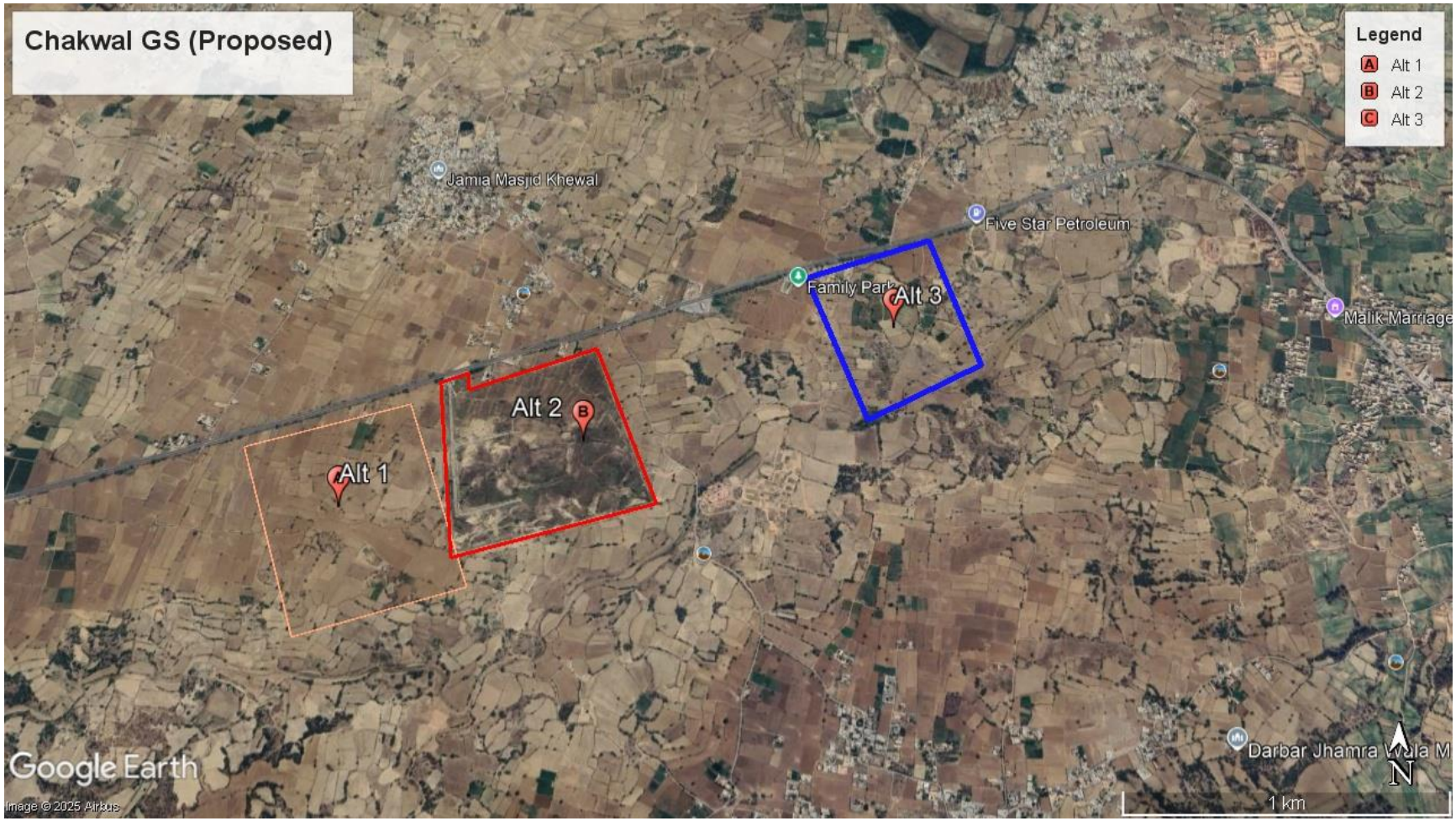


**Figure 3-1 Location of Project Alternates**

### 3.4 Other Temporary and Permanent Facilities

## 3.5 Rationale for Staff Colony Location

The staff colony for the Chakwal Grid Station will be accommodated on the already acquired land of 751 kanals, which is part of the project site. Given that this land is already under the ownership of the proponent, there is no requirement for additional land acquisition, and no suitable alternative locations are available within close proximity to the grid station.

Using the already acquired land for staff accommodation ensures:

- Operational efficiency: Staff housing is located near the grid station, allowing timely response to operational and maintenance requirements.
- Minimal social impact: As the land is already acquired, no additional displacement or disruption to the local community will occur.
- Environmental suitability: The selected area is relatively flat and degraded, with minimal vegetation, making it suitable for construction with limited ecological impact.

Based on these considerations, no alternative site was proposed for the staff colony, and the existing project land has been confirmed as the most feasible and sustainable option.

### 3.5.1 Contractors' Camp Alternatives

Construction logistics provide alternatives for siting of contractor facilities including labour camp site, machinery yard and material stores.

Based on the impact assessment socio-economic analysis and other security and logistical benefits of containing the camp facilities inside a concentrated and protected area, the option of establishing contractor facilities within the project boundary is strongly recommended. It will reduce the environmental impacts due to project implementation while minimizing extra camping costs on the contractor.

In terms of the Chakwal project this means inside the substation area for the contactor's camp for mast construction sites and material and waste depots.

### 3.5.2 Alternative Labour Options

Three labour options may be considered:

a. Hire all labour from local people;

b. Hire all labour from external sources outside the community;

c. A combination of the above depending on available Skills.

Although the first option is desirable with respect to maximising the benefits reaped from the project by the local community, it is usually not possible to rely entirely on local labour for all required trades and skills since these are often simply not available in the area.

Moreover, reliance only on local labour can create seasonal or overall labour shortages and thus failure in achieving targets on time.

Considering the second option, if the entire labour is brought from outside, this will be highly undesirable and socially unacceptable for the local community.

Consequently, option c. of hiring mixture of local and outside labour is recommended since this option presents the best combination of local manpower and outside skills. This option also presents an opportunity of transfer of skills and technical knowledge from outside technicians to local work.

### 3.5.3 Environmental Design Alternatives

Environmental design options were also evaluated to reduce impacts during construction and operation:

- Layout optimization: Minimized land disturbance by placing structures on degraded or low-value land.
- Vegetation conservation: Retained trees where possible and planned compensatory plantation in cleared areas.
- Drainage and runoff management: Designed stormwater systems to reduce soil erosion and protect nearby watercourses.
- Access road alignment: Avoided environmentally sensitive areas and limited cut-and-fill operations.

### 3.5.4 Economic Design Considerations

In addition to careful site selection, a number of economic measures and design strategies were considered to ensure that the Chakwal Grid Station is both cost-effective and sustainable over the long term. These measures aim to optimize construction and operational costs, reduce the need for compensation or restoration, and minimize economic disruption to local communities.

#### 3.5.4.1 Efficient Layout Planning

The project layout was designed to minimize the total area of land required for the grid station, access roads, and ancillary facilities.

Key infrastructure, such as substations, transmission corridors, and drainage channels, was optimally located to reduce excavation, earthworks, and material transportation costs.

Consolidating functional components in a compact layout lowers construction duration and labor requirements, thereby improving cost efficiency.

#### 3.5.4.2 Minimizing Land Disturbance

Construction activities were planned to limit disturbance to surrounding land, thereby reducing the need for costly site restoration or rehabilitation. Sensitive areas, productive plots, and remaining vegetation were avoided wherever possible, preventing unnecessary

land degradation. By confining construction to degraded or low-value areas, the project reduces potential financial liabilities associated with land compensation and legal claims.

#### 3.5.4.3 Use of Degraded or Low-Value Land

Priority was given to rain-fed, degraded agricultural land (Alternative 2) for the grid station to minimize economic losses. Avoiding high-value irrigated land ensures that local agricultural productivity is preserved, and farmers' livelihoods are not negatively affected. Utilizing already low-value land reduces the overall cost of land acquisition, compensation, and mitigation, while still meeting technical and operational requirements.

#### 3.5.4.4 Infrastructure Optimization

Road access, drainage, and other supporting infrastructure were designed to minimize construction and maintenance costs. Where feasible, existing pathways and minor structures were used or upgraded instead of constructing entirely new facilities, further enhancing economic efficiency.

#### 3.5.4.5 Long-Term Operational Cost Savings

Placement of facilities on stable, low-risk land reduces maintenance costs associated with erosion, flooding, or land subsidence. Efficient site layout reduces transmission line losses and improves operational efficiency, translating into lower long-term costs for energy delivery.

# 4 Description of the Project

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.

## 4.1 Project Background and Justification

Pakistan has long faced significant power shortages. Despite notable improvements, the performance of the power sector remains below expectations, with several issues still unresolved. In 2023, the total installed electricity generation capacity reached 46,605 MW, while the electricity transmission network had the capacity to handle more than 53,000 MVA. However, during peak demand periods, the country continues to experience shortfalls. For instance, in June and July 2025, various regions across the country experienced recurring power outages. Peak electricity demand during this period reached approximately 30,000 MW, resulting in a shortfall of around 5,000 to 6,000 MW.

To address these challenges, the Government has developed a comprehensive action plan to implement the 2013 National Power Policy. This plan integrates the necessary policies, strategies, and actions required to strengthen the power sector, improve generation capacity, enhance transmission and distribution efficiency, and reduce energy shortfalls nationwide.

The NGC in support of the energy sector reform, assisted by the World Bank and other donor countries and institutions, intends to implement the National Transmission Modernization Phase-I Project (NTMP-I), which is to improve reliability and efficiency of the national transmission system in Pakistan. The proposed 500/220/132 kV Grid substation Chakwal and associated 500 kV Transmission Line feeders will be implemented within the larger frameworks of the NTMP-I. The proposed Project is intended to increase the availability, reliability and efficiency of power transmission in the Chakwal District. The project is expected to consist of the construction and operation of a new Substation.

### 4.1.1 Objective of the Project

The primary objective of the 500/220/132 kV Chakwal Grid Station Project is to strengthen Pakistan's national electricity transmission network and support the growing demand for reliable power supply. The project aims to address current energy shortfalls, improve system stability, and enhance the efficiency of electricity distribution in the region.

Key objectives include:

#### 4.1.1.1 Enhancing Transmission Capacity

Establish a high-capacity grid station capable of transmitting electricity efficiently across the network.

Reduce transmission bottlenecks and energy losses in the northern and central regions of Pakistan.

#### 4.1.1.2 Improving System Reliability and Stability

Ensure continuous and reliable electricity supply to industrial, commercial, and residential users.

Reduce the risk of blackouts and system overloads during peak demand periods.

#### 4.1.1.3 Supporting Economic Growth

Facilitate industrial development and economic activity by providing reliable and sustainable power supply.

Enable the integration of renewable energy sources into the national grid.

#### 4.1.1.4 Reducing Environmental and Social Impacts

Optimize site selection and design to minimize land acquisition, displacement, and environmental disturbance.

Implement best practices for environmental management and mitigation throughout construction and operation.

#### 4.1.1.5 Facilitating Long-Term Power Sector Development

Align with the National Power Policy 2013 and the government's strategic action plan for the electricity sector.

Strengthen the resilience and sustainability of Pakistan's national grid to meet future energy demands.

## 4.2 Project Proponent

The NGC is the executing agency of the Project for which the Government of Pakistan (GoP) has applied for financial support within the Financial Cooperation between Pakistan and Germany.

## 4.3 Project Location

The substation will be located on a 751-kanal land parcel situated along the Jhelum-Chakwal Road, approximately 10 km outside the city of Chakwal in the Punjab Province of Pakistan. The land currently supports agricultural farming, primarily rain-fed and degraded agricultural land, which minimizes impacts on productive farmland and reduces potential social and economic displacement as shown in **Figure 4-1.**

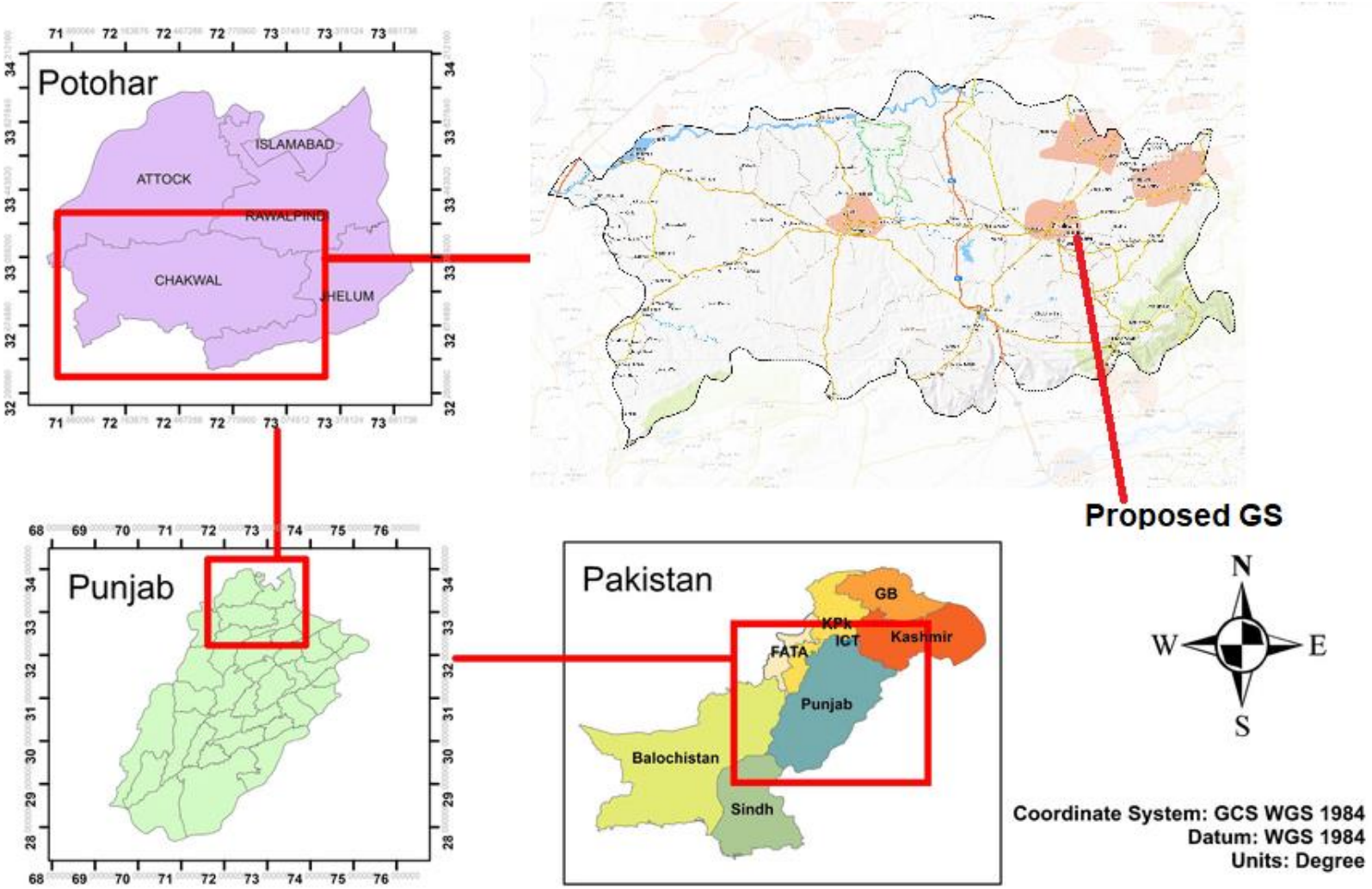


**Figure 4-1 Location of Proposed Project**

## 4.4 Vegetation Features of the Site

The proposed 500/220/132 kV Chakwal Grid Station will be constructed on a 751-kanal plot along the Jhelum-Chakwal Road, approximately 10 km from the city of Chakwal. The site primarily consists of rain-fed, degraded agricultural land, with limited natural vegetation due to previous farming activities and seasonal land use.

The site exhibits sparse ground cover, mainly composed of grasses, shrubs, and small herbaceous plants typical of degraded agricultural fields. No dense forests or high-value tree stands are present within the project footprint. Scattered trees are present along field boundaries and minor drainage channels, including species such as Acacia, Eucalyptus, and a few native fruit trees. Tree density is low, and the majority of the vegetation is non-forested.

Surrounding areas outside the immediate site consist of agricultural fields, both rain-fed and irrigated, and small patches of natural scrubland supporting small shrubs, grasses, and isolated mature trees. No protected or ecologically sensitive vegetation has been recorded within or immediately adjacent to the site.

No tree cutting is required within the project site. To enhance the green cover, an additional green belt will be formed, including tree plantation along internal roads, within the substation site, and in the staff colony area. These measures will contribute to environmental enhancement, improve aesthetics, and provide shade and microclimate benefits to the site.

## 4.5 Project Components

Main Project Components or the direct concerned project components are:

500/220/132 kV Chakwal Substation with 2x450 MVA, 500/220 kV and 4x160 MVA, 220/132 kV transformers along with associated equipment and accessories; setting up in the usual equipment configuration as implemented for all other 500 kV Substations under NGC.

Looping in and out of one of the single circuit 500 kV transmission lines on three bundled Drake conductor 500kV of the existing Ghazi Barotha – Gatti circuit passing close to the envisaged 500 kV Chakwal Substation; the line is situated within the boundary of the proposed substation.

Looping in and out of one of the single circuit 500 kV transmission lines on quad bundled Drake conductor 500 kV of the existing Rewat - Gakkhar circuits at 500 kV Chakwal Substation (about 30 km). The Looping in and out of the transmission line is envisaged to be undertaken with a Double Circuit transmission line with one system the line-in circuit and the second system the line-out system; refer to the picture in the Annexe showing the illustration of the proposed D/C tower type. However this EIA does not cover impact assessment of this 30km transmission line a separate IA will be prepared by NGC to address environmental,


**Figure 4-2 The Proposed Chakwal Grid Station Site**

ecological and scio-economic impacts of this 30 km long transmission line and will submit to EPA and Donor before construction.

All the above facilities will be designed, manufactured, tested, supplied, installed and commissioned by the contractor. During this design, the contractor should ensure that the electromagnetic fields, acoustic noise and radio interference levels generated from the equipment in the substation will comply with the applicable national and international standards at the offices and residential buildings and at the periphery of the station.

A schematic drawing showing the proposed facilities in the substation site are shown in **Figure 4-3**. The key components in this station are; (i) Grid station facilities, (ii) office buildings, (iii) a residential colony and (iv) all other necessary general facilities. These key components are further described in the following sections.


**Figure 4-3 Proposed Facilities in the Chakwal Substation**

### 4.5.1 Description of the Substation Equipment

A typical layout of the 500 kV substation is shown in **Figure 4-3**. Typical components of the substation and their functions are given in Table 4-1.**Table** 4-1

**Table 4-1 Typical Grid Station Components and their Functions**

| Equipment | Functions |
|---|---|
| Transformers | To step-down or step-up voltage and transfer power from one current to another. The windings of such large transformers are immersed in transformer oil, which is a highly refined mineral oil that is stable at high temperatures and has excellent electrical insulating properties. Its functions are to insulate, suppress corona and arcing, and to serve as a coolant for transformers. |
| Circuit Breakers | Automatic switching during normal or abnormal conditions. |
| Feeder Bay | Steel work housing for circuits. |
| Reactors | Equipment for the efficient operation of long transmission power lines as they compensate the voltage on power lines to avoid uncontrolled voltage rise, especially on lightly loaded lines. |
| Isolators | Equipment for de-energizing a circuit for maintenance and repair purposes. |
| Bus bars | Incoming and outgoing circuits of the same voltage tie into a common node called a bus bar, which consists of a number of tubular conductors made of aluminum. |
| Loop-in lines | Incoming power lines (connected to bus bars). |
| Loop- out lines | Outgoing power lines (connected to bus bars). |
| Telecommunication mast | Equipment used for remote communication with the sub-station. |

### 4.5.2 Control Building

One or more control buildings are required for the substation to house valves, protective relays, control devices, battery banks for primary control power, and remote monitoring equipment. The size of the building depends on design of the station. Typically, the control building will be constructed of concrete block, pre-engineered metal sheathed, or composite surfaced materials. Special control buildings may be developed within the substation developments to house other control and protection equipment.

### 4.5.3 Other General Facilities in the Substation

Details of general facilities to be built in the substation are given in **Table 4-2.**

**Table 4-2 Typical General Facilities in the Substation**

| Facilities | Functions |
|---|---|
| Residential Colony | An employee Residential Colony will be built on one side of the substation consisting of three houses for 1 deputy Manager Category B and 2 Assistant Managers Category C and Flat Building having 22 Nos. residential flats for Employees category D, E and F. Total houses will be 25 Nos and land under these houses 2 to 2.5 acres.<br><br>WHO endorsed standards on EMF (http://www.who.int/peh-emf/standards/en/ - developed by International Commission on Non-Ionizing Radiation Protection, ICNIRP) will be complied through design considerations by providing adequate distance from the substation equipment and residential colony. Exposure to noise from the substation equipment will also be evaluated, to comply with national standards, to provide adequate distance from the substation and residential colony. |
| Water supply and sanitation | Safe drinking water supply (through groundwater wells) and sewerage facilities (with septic tanks) will be established to provide water and sanitation facilities to the colony and offices. Water storage tanks will also be constructed for the firefighting and cooling system. |
| Internal roads and storm water drainage | Internal roads and storm water drainage facilities will be established in the substation site, including in residential colony. The storm water drainage facilities will be connected to the natural stream located on western side of the station site through a sedimentation pond. |
| Fencing and landscaping | Security fencing (a fencing wall) will be constructed around the entire perimeter of the station to protect sensitive equipment and prevent accidental contact with energized conductors by third parties. A three-meter buffer zone with plantation will be developed with native plantation around the fence and landscaping will be carried out wherever allowed. |
| Security facilities | Several aspects will be considered for providing fool-proof security for the station. These include firing position/bunkers at the main entrance, sentry posts, concrete barriers to restrict entry at main entrance, security towers, etc. |

## 4.6 Construction Activities

The process for constructing the substation will follow standard NGC practice for substation construction. The key activities in the construction process include the following:

Construction will commence with the clearing of vegetation and the levelling and terracing of the ground surface in those areas where heavy electrical transformers and other switchgear will stand. Once levelled and terraced, the concrete works and construction of foundations for the supporting steelwork, transformers and other switchgear will commence. This will also include the construction of storm water drainage pipes, slabs, bund walls, a control room, small buildings and storage areas that are needed.

All open areas between the transformer plinths and other switchgear foundations will be covered with about a 100 mm layer of 25 – 38 mm crushed stone.

The steelwork will then be erected. The transformers, circuit breakers, reactors and other high voltage equipment will be delivered to site, erected and then commissioned.

### 4.6.1 Construction Machinery, Materials and Other Supplies

The major civil works in the substation area and transmission line towers will include construction of foundations and buildings. The raw material required for these constructions are aggregates, sand, cement and steel. The exact quantities of these materials required for construction will only be known at the time of design. However, all these material are foreseen procured from the market and no quarry site is expected to be developed under this subproject.

Steelwork sections for the towers will be delivered by access road or by head loads when there are no access roads. It is normal practice to use cranes to erect steelwork, subject to good access being available.

No new access roads are expected to be developed for erection of steel work.

## 4.7 Waste Generation

Waste generation from the construction works is estimated to be about 122 kg/day (considering an average per capita waste generation in Pakistan, which ranges from 0.286 to 0.612 kg/capita/day).

These wastes will be disposed at the local municipal waste disposal sites. Since the project site is located close to Chakwal city, the municipal waste disposal sites are already available.

No new waste disposal sites are foreseen developed for the subproject.

## 4.8 Manpower/Workforce Requirements

During construction when the civil works are being carried out (foundations, buildings, etc.), there would be approximately 150 to 200 people present on the site at any one time.

Depending on the level and nature of construction activity taking place, there will be varying numbers of people housed on site within a construction camp.

This will be constructed within the proposed substation facility.

## 4.9 Operation, Maintenance and Decommissioning

The substation of NGC are designed and constructed for operation, supervision and control by the staff around the clock, unlike the grid system of many developed countries where the substations are remotely operated, supervised and controlled at central control centres.

The operation staff at control rooms of substation comprises shift engineers, operators, attendants, etc. and perform duty in three shifts i.e. morning shift, evening shift and night shift. The operation staff supervises and controls the substation in accordance with the provisions made in the design and construction of the equipment and in compliance of the instructions of the system operator.

The transmission line facilities will be operated and maintained by NGC in accordance with its general system maintenance procedures. This involves an inspection regime which requires access to the towers from time to time and visual inspection of the line corridor. Where defects or repairs are noted, maintenance crews will be mobilized to undertake the corrective works. Land users and title holders are required to keep tree heights within the 2.5 m limits and this requirement is enforced by the NGC inspection teams.

NGC do not envision decommissioning of its grid or substations at any point. Should this be required in the future, removal and disposal of equipment will be done in accordance with legislative requirements at that time. In such case it should be possible to restore the land to its pre-construction state by the employment of reasonable means of deconstruction and removal of steelworks, building and roads etc.

## 4.10 Project Implementation Schedule

Development of Chakwal is expected to take about 3 years:

During the first year, the designs will be completed and all civil works will be completed by end of the second year. Manufacturing of equipment and shipment will be carried out during the second and third years. All the erection and installation will be completed in the third year including the testing of facilities and commissioning as shown in **Figure 4-4.**

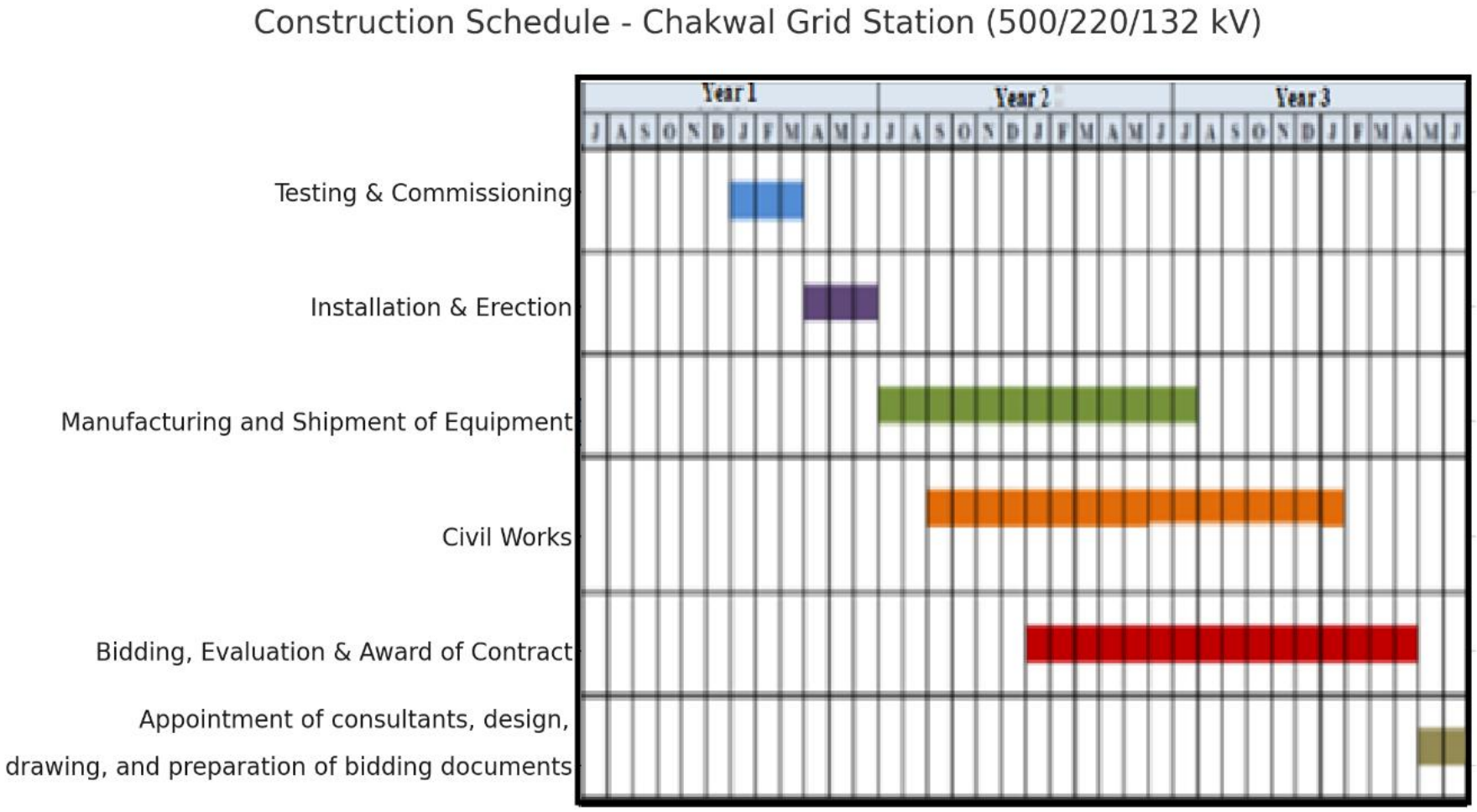


**Figure 4-4 Construction Schedule of 500 kV Chakwal GS**

## 4.11 Impact Assessment Methodology

### 4.11.1 Area of Influence

The proposed Chakwal project will be connected to the national grid and thus will have an influence area covering the entire country. However, for the purpose of assessment of environmental impacts, the influence area or the study area of the Chakwal project is defined as areas that are likely to be directly or indirectly affected by the proposed construction activities, including but not limited to: direct footprint of the substation site and right of way of proposed transmission line, temporary construction areas and worker camp sites, access roads to the project facilities for transport of material and equipment, etc.; areas that will be affected by the emissions from construction traffic; and also adjoining areas of the substation site that will be affected by operational activities.

### 4.11.2 Area of Influence for EIA

The area of influence (AOI) for Chakwal project covers the Chakwal- Jhelum Road connecting the national highway 5 (N5 or Grand Trunk Road) with the Chakwal City, substation and the villages along this route. This route will be extensively used for transport of equipment and material required for construction and operation of the substation. All local roads and tracks to be used for the construction of transmission line including the Chakwal-Jhelum Road have also been included in the project influence area.

In addition to the above-mentioned sites, the water bodies/wetlands within a distance of 5 km from the substation is included in the AOI.

The influence area further divided into direct and indirect impact zones.

#### 4.11.2.1 Direct Impact Zone

The Direct Impact Zone (DIZ) is defined as all areas which are directly affected by the project works, for instance the line corridor, areas close to access roads, camps, etc. The direct impact zone includes:

The entire area acquired for construction of the proposed substation at Chakwal, which will be acquired permanently;

The area for establishment of Contractor's facilities such as labour camp, storage of construction material, and haulage routes etc. that may involve clearance of vegetation and subsequent habitat loss;

The area within 60 m wide Right of Way (RoW) where project activities such as foundation excavation for tower installation and stringing of conductors are carried out. This area will also be kept permanently clear of any vegetation above 5 feet height during the operation phase of the project which may result in repeated disturbance of the habitat.

#### 4.11.2.2 Indirect Impact Zone

The Indirect Impact Zone (INDIZ) covers a larger area not directly affected, but where indirect impacts of the project may extend. It includes:

- A buffer zone of 1 km radius around the substation;
- Nearby forest and game reserves as well as area of cultural sensitivity;
- The nearby water bodies that attract the migratory birds.

#### 4.11.2.3 Impact Magnitude

The potential implications of the project have been categorized as major, moderate, minor or minimal based on a consideration of the parameters such as:

- duration of the effect;
- spatial extent of the impact;
- reversibility;
- likelihood; and
- Legal standards and established professional criteria.

### 4.12 Other Government Department Approvals

No designated forest area falls on the RoW. The approvals required will be sorted before the start of construction from other line departments where required.

# 5 Description of the Environment

This section describes the existing physical, ecological and socioeconomic conditions in the Project area. Beginning with a discussion of the Area of Influence (AoI) selected for describing the environment and followed by the description of the physical, ecological and socioeconomic environment. The information presented in this section was collected from the field surveys and the available literature.

## 5.1 Project Area of Influence

The Area of Influence (AOI) of the project is defined as the Direct and the Indirect Impact Zones which represent the study area. These are the areas that are likely to be directly or indirectly affected by the proposed construction activities, including but not limited to:

- Direct footprint of the substation site and right-of-way (RoW)
- Temporary construction areas and workers camp sites,
- Access roads to the project facilities for transport of material and equipment;
- Areas that will be affected by the emissions from construction traffic; and
- Adjoining areas of the substation site that will be affected by operational activities.

## 5.2 Baseline Physical Environment

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

### 5.2.1 Topography and Geography

Chakwal District is a district with mainly hilly terrain lying at the beginning of the Potwar plateau and the Salt Range. It is covered with scrub forest in the south-west and levelled plains interspersed with dry rocky patches in the north-east. It was raised to the administrative status of a district in 1985. Before that it was a Tehsil of Jhelum District.

Chakwal town is situated in the plateau range of northern Punjab which ranges in elevation between 400 to 700 metres above mean sea level. It is linked to Motorway (M-2) at a distance of 17 km via the Balkasar interchange. The town is connected with the N-5 National Highway by the Chakwal - Sohawa Road and the Chakwal - Mandra Road. It lies 119 km from the town of Jhelum, 100 km from Rawalpindi and 297 km from Lahore. It was previously connected by rail to other parts of the country through the Mandra junction but this track has been decommissioned and removed.

The Potwar Plateau and the Salt Range region are located to the south of the mountainous north of the country and lie between the Indus River in the west and the Jhelum River in the east. Its northern boundary is formed by the Kala Chitta Ranges and the Margalla Hills and

of 450 – 900 m and extends for about 72 km. The main Potwar Plateau extends north of the Salt Range and is an undulating area with altitudes ranging from 300 to 600 m.

**Figure 5-1 Site proposed for the substation construction.**

### 5.2.2 Geology and Soils

- **Geology**

The dominant physiographic feature in the AOI is the highly dissected Potwar Plateau. The southern part of the AOI contains part of the Jhelum and Indus Plains, which extend for hundreds of kilometres south and east of the Salt Range. In the Chakwal area, these plains are covered by alluvium from the Jhelum and Indus Rivers. The Salt Range and its associated piedmont, plateaus and hills lie north and east of these alluvial deposits. East of the Salt Range are the Bunha Basin and Plain, which drain into the Jhelum Plain.

- **Seismology and Earthquake Risks**

The structural features of the Potwar Plateau region are dominated by a large south eastward-convex deformation lobe. This lobe includes abundant thin-skinned thrust faults, some strike-slip and normal faults, and many folds. The Potwar Plateau region is an area of active oil and

gas exploration and production. Recent studies (Butler and others, 1987[6]; Leathers, 1987[7]; Raza and others, 1989[8]; Hylland, 1990[9]; McDougall and Hussain, 1991[10]) have combined seismic-reflection profiles, petroleum exploration well logs, Bouguer gravity anomaly maps, and surface geology to construct regional structural cross sections that detail the thrust-related tectonics of the area. The area consists of several structural-tectonic subdivisions is shown in Figure 5-2. This includes the Salt Range along the southern part of the area, the Kohat Plateau along the western part of the area, the Potwar Plateau in the central part of the area, and the Northern Folded Zone and the Kala Chitta Fold Belt along the northern part of the area.

Earthquake seismicity provides evidence of low-magnitude ongoing activity along the Salt Range. **Figure 5-3** shows that the project lies in an area of minor to moderate activity/damage potential. Pakistan Building Codes[11] (and relevant International Standards), specify design and construction requirements for earthquake induced loadings.

According to "Building Code of Pakistan with Seismic Provisions – 2007", the grid station falls in Zone 2B (seismic factor 0.20). The grid station must be designed in compliance with this code.

6 Butler, W.H., Harwood, G.M., and Knipe, R.J., 1987, Salt control on thrust geometry, structural style and gravitational collapse along the Himalayan Mountain front in the Salt Range of northern Pakistan, in Leche, I., and O'Brien, J.J., eds., Dynamic geology of salt and related structures: San Diego, Calif., Academic Press, p. 339–418

7 Leathers, M.R., 1987, Balanced structural cross section of the Salt Range and western Potwar Plateau, Pakistan—Deformation near the strike-slip terminus of an overthrust sheet: Corvallis, Oregon State University, M.S. thesis, 228 p

8 Raza, H.A., Ahmed, Riaz, Alam, Shaji, and Ali, S.M., 1989, Petroleum zones of Pakistan: Pakistan Journal of Hydrocarbon Research, v. 1, no. 2, p. 21–56

9 Hylland, M.D., 1990, Geology of the southern Gandghar Range and Kherimar Hills, northern Pakistan: Corvallis, Oregon State University, M.S. thesis, 77 p

10 McDougall, J.W., and Hussain, Ahmad, 1991, Fold and thrust propagation in the western Himalya based on a balanced cross section of the Surghar Range and Kohat Plateau, Pakistan: American Association of Petroleum Geologists Bulletin, v. 75, no. 3, p. 463–478

11 Available at:
http://www.ndma.gov.pk/Publications/Building%20code%20of%20Pakistan%20with%20seismic%20provision.pdf

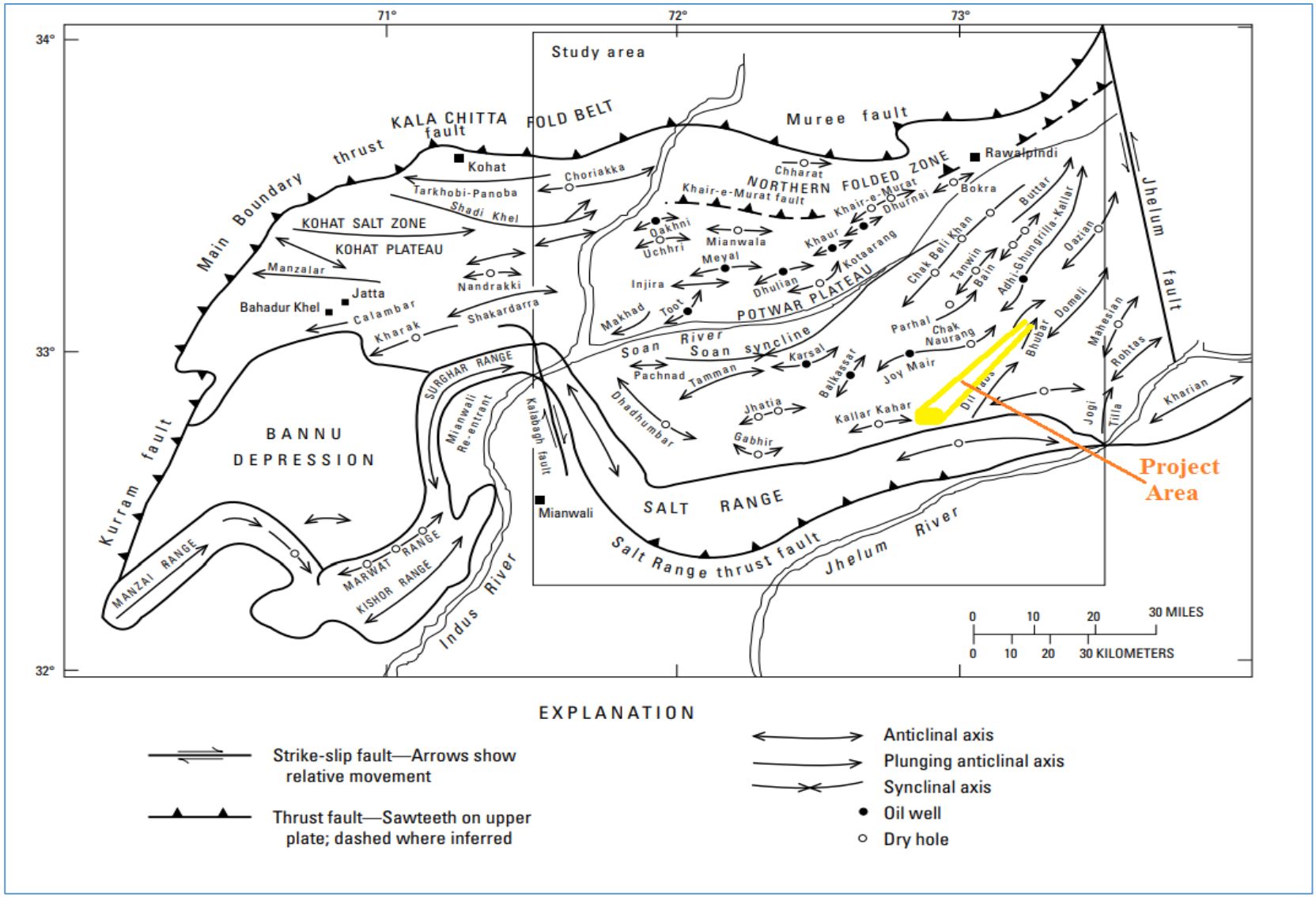


**Figure 5-2 Structural map of the Potwar Plateaus showing project area**

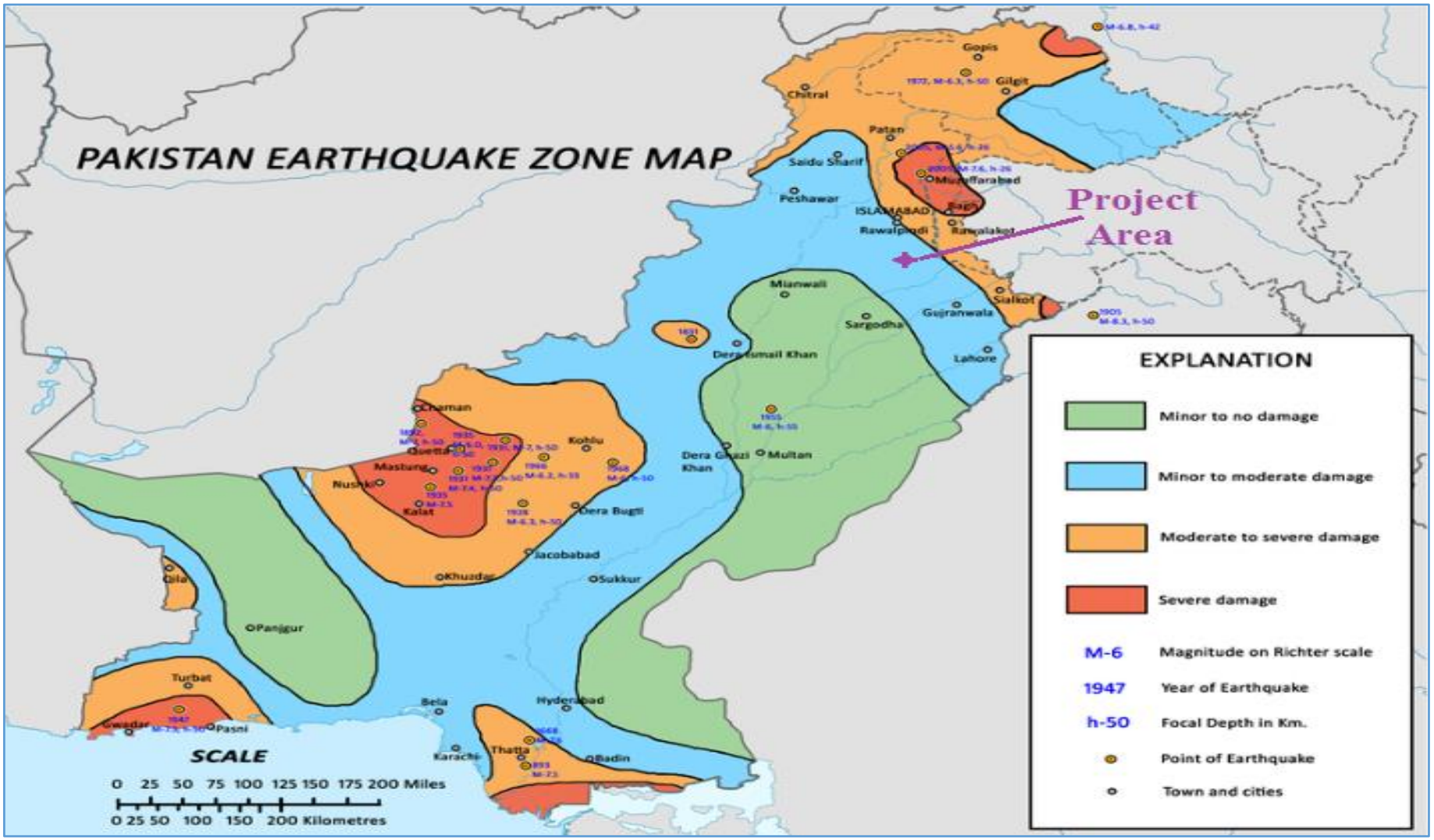


**Figure 5-3 Seismic Activity in the project area**

#### 5.2.2.1 Soils

The sub soil consists of cohesive clay mixed with gravels and broken rock fragments. No alluvial deposits seem to occur except for some small strips created by natural hill torrents. No major aquifers occur in the subsoil except for some confined layers bearing water in small quantities, recharged by precipitation. Such water dries out under continuous pumping. The water table depth in the city varies from 20 to 30 metres due to undulating topography.

### 5.2.3 Climate

**Temperature**

The climate of the project area is generally hot and dry in the summer (April to October) and cold in the winter (November to March). Climate data for the project area is available for Chakwal. Long term data available on the Internet at Climate-Data.org has been collected for the current studies.

Mean monthly minimum temperatures at Chakwal vary from 3.3°C in January to 25.4°C in June. The mean monthly minimum temperature at Chakwal remains above 20°C from May to September. The mean monthly minimum temperature is shown graphically in **Figure 5-4**.

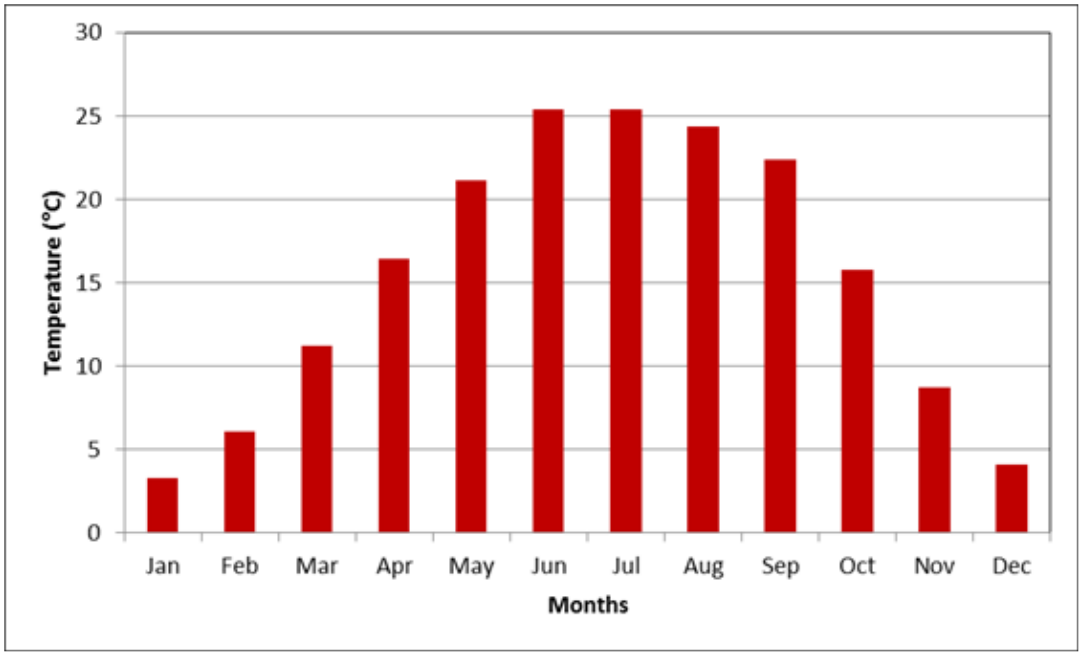


**Figure 5-4 Mean monthly minimum temperatures - Chakwal**

The mean monthly maximum temperature at Chakwal varies from 17.8 °C in January to 39.7 °C in June. Mean monthly maximum temperature remains above 30°C from April to October. The mean monthly maximum temperatures are shown graphically in **Figure 5-5**.

January is the coldest month at the project area and observed the minimum temperatures in this month while the highest temperatures are experienced in the month of June.

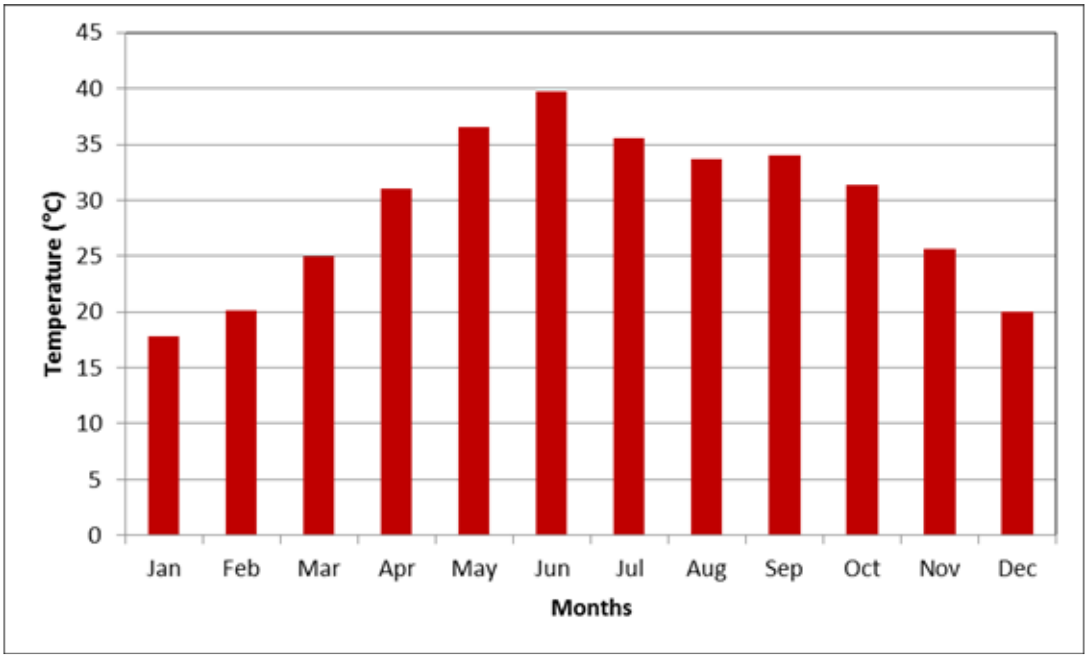


**Figure 5-5 Mean Monthly Maximum Temperatures - Chakwal**

**Rainfall**

Rainfall data of Chakwal has been used to calculate average rainfall in the area. Mean monthly rainfall vary from 7 mm (minimum) in November to a maximum of 133 mm in August. From November to May, during the winter period, the rainfall is mainly brought by the western disturbances. The rainfall during this period is 179 mm. During the summer period from June to October the rainfall is induced by the monsoon and average rainfall is 340 mm. The mean annual rainfall at Chakwal is 519 mm. Mean monthly rainfall shown in **Figure 5-6.**

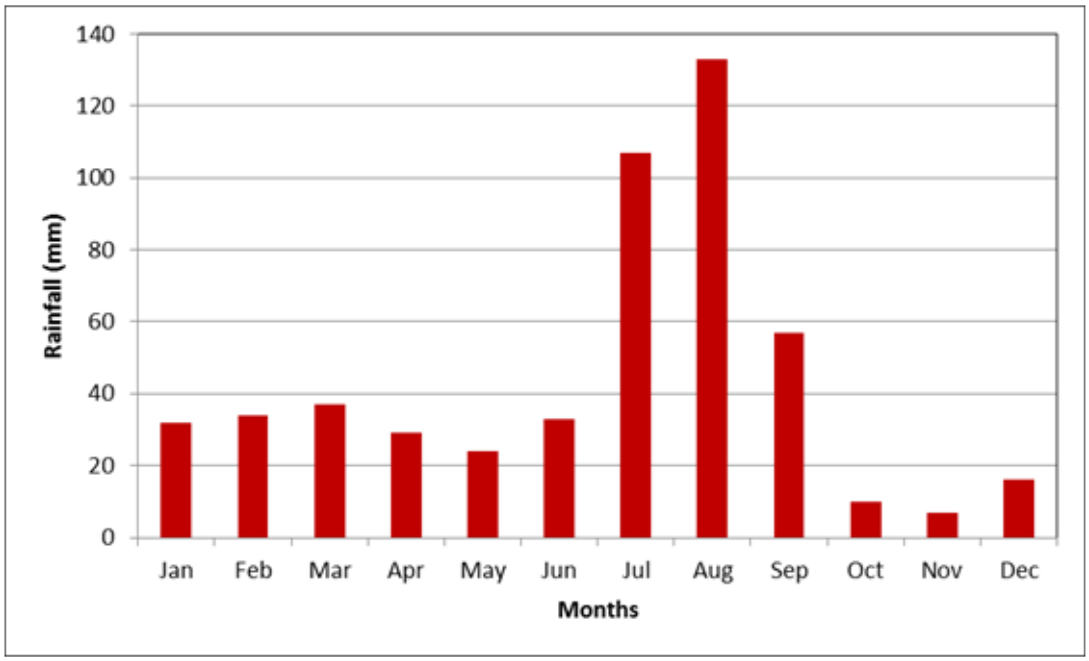


**Figure 5-6 Mean monthly rainfall - Chakwal**

**Wind Speed**

The average wind speed and wind gusts is given in Figure below:

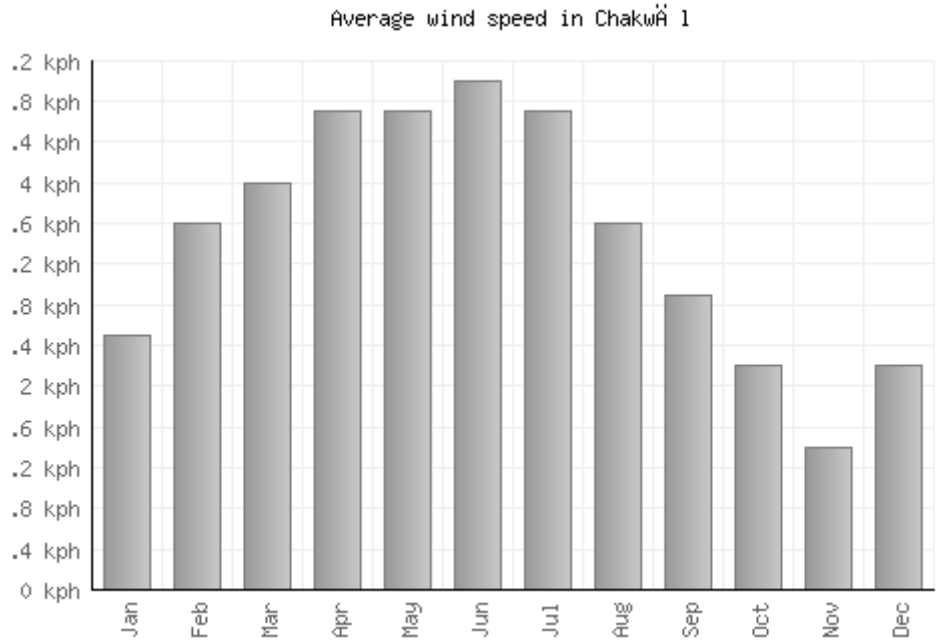


**Figure 5-7 Average wind speed in Project Area**

### 5.2.4 Air Quality

The ambient air quality monitoring conducted at the proposed 500 kV Chakwal Grid Station (Alt 2) site and its surroundings for 24 hours duration revealed that all key parameters, including PM10, PM2.5, $SO_2$, $NO_2$, CO, $O_3$, and VOCs, were well within the permissible limits of Pakistan's National Environmental Quality Standards (NEQS) and WHO guidelines as shown in **Table 5-1** and **Table 5-2.** The site exhibited clean air quality with low dust levels and negligible concentrations of gaseous pollutants, reflecting the rural, barren, and sparsely populated nature of the area, with no significant sources of industrial or vehicular emissions nearby. The baseline air quality is classified as 'Good,' and no sensitive ecological or human receptors were identified in the vicinity, ensuring that the project will not face any pre-existing air quality concerns. However, it is recommended that standard dust suppression and machinery maintenance measures be adopted during the construction phase to prevent localized temporary air quality deterioration.

Detailed results on hourly air quality are given in Appendix 6.

**Table 5-1 Ambient air quality monitoring near substation area**

| Parameters | Unit | PEQS* | Avg. Results |
|---|---|---|---|
| Nitrogen Oxide (NO) | µg/m³ | 40 | 22.38 |
| Nitrogen Dioxide (NO2) | µg/m³ | 80 | 57.92 |
| Carbon Monoxide (CO) | mg/m³ | 5 | 1.42 |
| Sulphur Dioxide (SO2) | µg/m³ | 120 | 20.28 |
| Particulate Matter (PM10) | µg/m³ | 150 | 141.40 |
| Ozone (O3) | µg/m³ | 130 | 16.71 |
| Particulate Matter (PM2.5) | µg/m³ | 35 | 33.13 |

**Table 5-2 Chakwal Road near Grid Station boundary**

| Parameters | Units | PEQS | Average Results |
|---|---|---|---|
| Nitrogen Dioxide ($NO_2$) | µg/m³ | 80.0 | 16.43 |
| Nitrogen Oxide (NO) | µg/m³ | 40.0 | 12.05 |
| $NO_x$ | µg/m³ | 120.0 | 28.48 |
| Sulphur Dioxide ($SO_2$) | µg/m³ | 120.0 | 30.73 |
| Carbon Monoxide (CO) | mg/m³ | 5.0 | 0.92 |
| Particulate Matter ($PM_{10}$) | µg/m³ | 150.0 | 80 |
| Particulate Matter ($PM_{2.5}$) | µg/m³ | 35.0 | 23 |
| Total Suspended Particulates (TSP) | µg/m³ | 500.0 | 118 |

Based on the ambient air quality monitoring conducted at the proposed 500 kV Chakwal Grid Station site (GPS Coordinates: 32.892850° N, 72.963134° E), the results indicate that the overall air quality is within the permissible limits set by the Punjab Environmental Quality Standards (PEQS). Key parameters such as Nitrogen Oxide (NO) at 22.38 µg/m³ and Nitrogen Dioxide ($NO_2$) at 57.92 µg/m³ were recorded well below their respective PEQS limits of 40 µg/m³ and 80 µg/m³, while Carbon Monoxide (CO) was observed at 1.42 mg/m³, significantly lower than the PEQS limit of 5 mg/m³. Similarly, Sulphur Dioxide ($SO_2$) levels stood at 20.28 µg/m³ against a permissible limit of 120 µg/m³. Particulate Matter (PM10) and PM2.5 were recorded at 141.40 µg/m³ and 33.13 µg/m³ respectively, remaining within PEQS thresholds, though PM10 was noted close to its limit, which is typical for semi-arid rural areas with loose soil. Ozone ($O_3$) levels were also within safe limits at 16.71 µg/m³ against a standard of 130 µg/m³. Overall, the data confirms that the air quality at the proposed site is clean, with no significant pollution sources nearby, and suitable for the development of the proposed grid station, provided standard mitigation measures are implemented during construction to control dust emissions.

Here is the bar chart comparing the ambient air quality parameters measured at the Chakwal Grid Station site with the PEQS limits. This visual presentation clearly shows that all monitored parameters are within their respective permissible limits, confirming clean air quality at the site.

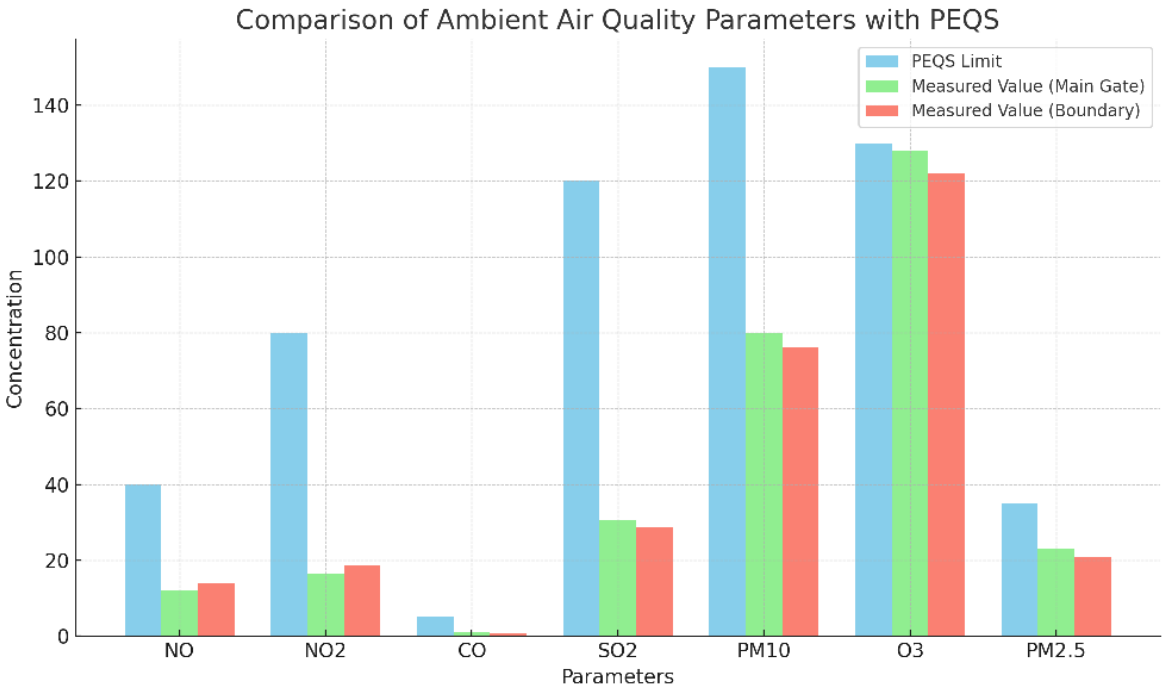


**Figure 5-8 Comparison of Ambient Air Quality with PEQS**

## 5.3 Water Resources

The principal river in the Potwar area is the Indus, which flows south through the western part of the plateau. The Kabul River flows east out of Afghanistan and joins the Indus near Attock City in the north-western part of the plateau. The major drainage pattern in the central part of the Potwar Plateau is toward the west via the Soan River, which joins the Indus River northeast of the town of Kalabagh. The Jhelum River joins the Indus River in the south

### 5.3.1 Water Quality

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### 5.3.2 Surface Water

No source of potable water supply is available in Chakwal town itself and water has to be imported from distant sources. The existing water supply system is based on two sources described as under:

**Khokhar Zer Dam**: A dam constructed for irrigation purposes, named after a nearby village Khokhar Zer, is situated at a distance of 15 km south of Chakwal town. The catchment area of this reservoir has cohesive red soils which are carried by rainwater into the reservoir and cause turbidity in the reservoir. The turbidity of water in summer is very high but reduces during dry spells.

**Mial Spring**: A spring located in the foothills on the Chakwal-Choa Saiden Shah Road emerged during the course of coal mining in the early 1980's and this was used as a water source for the town of Chakwal. It is located at a distance of 27 km from Chakwal on the south at a higher elevation and a 10-inch and 12-inch gravity main conveys water from this spring to the Tatral Road Water Works in Chakwal. The water is clear and does not need treatment. It is supplied to the town without treatment from the Tatral Road Water Works. The total quantity emerging from the spring is approximately two cusecs (approximately 57 l/s) out of which some water is used by local farmers for irrigation whereas 1.63[12] cusec (approximately 46 l/s) is provided to Chakwal City.

### 5.3.3 Groundwater

No aquifers occur in the subsoil except for some confined layers bearing water in small quantities, recharged by precipitation. Such water dries out with continuous pumping. The water table depth in the town varies from 20 to 30 metres due to undulating topography.

Most of the available water in the sub soil is saline with Total Dissolved Solids (TDS) value ranging from 800-2000 parts per million. Some Small quantities with better quality ground water are found in certain areas, though the volumes are limited and can be depleted by hand pumps.

The depth of hand pumps installed in Chakwal town varies from 30 to 60 metres Harnessing of such water sources is difficult and expensive. Some 20-25 dug open wells have been constructed in depressions in the outskirts of the town with depths of 9 to 10 metres. In Chakwal town the depth of such wells is 30-45 metres and the construction costs exceeds Rs. 400 000.

Small quantities of water is available in these wells after precipitation but it depletes during dry spells. Hence the wells cannot be considered as a reliable source of water. Furthermore, the quality of water in these wells and hand pumps is not good and varies widely from place to place. A sample of groundwater was collected from the one of the tube wells for analysis by an EPA certified Laboratory. The water quality report from this sample is given in Appendix 3. While results are shown in **Table 5-3** and **Table 5-4.**

**Table 5-3 Ground Water Analysis**

| Parameter | Analysis Method | PEQS | Result | MU (CL95%) | Remarks |
|---|---|---|---|---|---|
| Color* | SMWW 2120 C | ≤ 15 TCU | 0 | N.A. | Optimal |
| Taste* | SMWW 2150 B | Non-Objectionable | Non-Objectionable | N.A. | Optimal |
| Odor* | SMWW 2150 B | Non-Objectionable | Non-Objectionable | N.A. | Optimal |
| Turbidity* | SMWW 2130 B | ≤ 5 NTU | 0.42 | ±0.04 | Optimal |
| Total | SMWW 2340 C | < 500 mg/L | 140.8 | ±14.21 | Optimal |

12 Punjab Municipal Development Fund Company, Town Municipal Administrarion, Chakwal.

| | | | | | |
|---|---|---|---|---|---|
| Hardness (as $CaCO_3$) | | | | | |
| Total Dissolved Solids (TDS)** | SMWW 2540 C | < 1000 mg/L | 262.4 | ±18.4 | Optimal |
| Aluminum (Al) | SMWW 3111 B | 0.2 mg/L | <0.005 | N.A. | Optimal |
| Antimony (Sb) | SMWW 3111 B | 0.005 mg/L | <0.005 | N.A. | Optimal |
| Arsenic (As) | SMWW 3111 B | 0.05 mg/L | <0.005 | N.A. | Optimal |
| Barium (Ba) | SMWW 3111 B | 0.7 mg/L | <0.005 | N.A. | Optimal |
| Boron (B) | SMWW 3111 B | 0.3 mg/L | <0.05 | N.A. | Optimal |
| Cadmium (Cd) | SMWW 3111 B | 0.01 mg/L | <0.003 | N.A. | Optimal |
| Chloride ($Cl^-$) | SMWW 4500 Cl B | 250 mg/L | 24.64 | ±0.5 | Optimal |
| Chromium ($Cr^{+6}$) | SMWW 3111 B | 0.05 mg/L | <0.005 | N.A. | Optimal |
| Copper (Cu) | SMWW 3111 B | 1.0 mg/L | <0.005 | N.A. | Optimal |
| Cyanide ($CN^-$) | SMWW 4500 CN C | 0.05 mg/L | <0.005 | N.A. | Optimal |
| Fluoride ($F^-$) | SMWW 4500 F C | 1.5 mg/L | 0.41 | ±0.04 | Optimal |
| Iron (Fe) | SMWW 3111 B | 0.3 mg/L | <0.01 | N.A. | Optimal |
| Manganese (Mn) | SMWW 3111 B | 0.5 mg/L | <0.005 | N.A. | Optimal |
| Mercury (Hg) | SMWW 3111 B | 0.001 mg/L | <0.0005 | N.A. | Optimal |
| Nitrate ($NO_3^-$) | SMWW 4500 NO3 B | 45 mg/L | 2.04 | ±0.1 | Optimal |
| Nitrite ($NO_2^-$) | SMWW 4500 NO2 B | 3 mg/L | <0.004 | N.A. | Optimal |
| Selenium (Se) | SMWW 3111 B | 0.01 mg/L | <0.005 | N.A. | Optimal |
| Residual Chlorine ($Cl_2$)** | SMWW 4500 Cl G | 0.2 mg/L | 0 | N.A. | Optimal |
| Phenolic Compounds (as Phenol) | SMWW 5530 D | NGVS g/m³ | 0 | N.A. | Optimal |
| Zinc (Zn) | SMWW 3111 B | 5.0 mg/L | 0.031 | N.A. | Optimal |

**Table 5-4 Ground Water Analysis**

| Parameter | Analysis Method | PEQS | Result | MU (CL95%) | Remarks |
|---|---|---|---|---|---|
| Laboratory Analysis | | | | | |
| Color* | SMWW 2120 C | ≤ 15 TCU | 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 | 0 | N.A. | Optimal |
| Total Hardness (as $CaCO_3$) ** | SMWW 2340 C | < 500 mg/L | 148 | ± 5.1421 | Optimal |

| | | | | | |
|---|---|---|---|---|---|
| Total Dissolved Solids (TDS)** | SMWW 2540 C | < 1000 mg/L | 668 | ± 8.0226 | Optimal |
| pH** | SMWW 4500 $H^+$ B | 6.5- 8.5 | 8.25 | ± 0.04 | Optimal |
| Aluminum (Al) | SMWW 3111 B | ≤ 0.2 mg/L | <0.005 | N.A. | Optimal |
| Antimony (Sb) | SMWW 3114 B | ≤ 0.005 mg/L | <0.005 | N.A. | Optimal |
| Arsenic (As) | SMWW 3114 B | ≤ 0.05 mg/L | <0.005 | N.A. | Optimal |
| Barium (Ba) | SMWW 3113 B | 0.7 mg/L | <0.0035 | N.A. | Optimal |
| Boron (B) | SMWW 3113 B | 0.3 mg/L | <0.02 | N.A. | Optimal |
| Cadmium (Cd) | SMWW 3113 B | 0.01 mg/L | <0.006 | N.A. | Optimal |
| Chloride ($Cl^-$) ** | SMWW 4500 $Cl^-$ B | < 250 mg/L | 65 | ± 1.73 | Optimal |
| Chromium (Cr) | SMWW 3113 B | ≤ 0.05 mg/L | <0.004 | N.A. | Optimal |
| Copper (Cu) | SMWW 3111 B | 2.0 mg/L | 0.164 | N.A. | Optimal |
| Cyanide ($CN^-$)* | SMWW 4500 $CN^-$ F | ≤ 0.05 mg/L | 0 | N.A. | Optimal |
| Fluoride ($F^-$)** | SMWW 4500 $F^-$ C | ≤ 1.5 mg/L | 0.7 | ± 0.0505 | Optimal |
| Lead (Pb) | SMWW 3114 B | ≤ 0.05 mg/L | <0.005 | N.A. | Optimal |
| Manganese (Mn) | SMWW 3113 B | ≤ 0.5 mg/L | <0.015 | N.A. | Optimal |
| Mercury (Hg) | SMWW 3114 B | ≤ 0.001 mg/L | <0.001 | N.A. | Optimal |
| Nickel (Ni) | SMWW 3113 B | ≤0.02 mg/L | <0.02 | N.A. | Optimal |
| Nitrate ($NO_3^-$) ** | SMWW 4500 $NO_3^-$ D | ≤ 50 mg/L | 2.73 | ± 0.048 | Optimal |
| Nitrite ($NO_2^-$) * | SMWW 4500 $NO_2^-$ B | ≤ 3.0 mg/L | 0 | N.A. | Optimal |
| Selenium (Se) | SMWW 3114 B | 0.01 mg/L | <0.01 | N.A. | Optimal |
| Residual Chlorine ($Cl_2$) * | SMWW 4500 $Cl^-$ B | 0.5 mg/L | 0 | N.A. | Optimal |
| Phenolic Compounds (as Phenols) * | SMWW 5530 D | NGVS mg/L | 0 | N.A. | - |
| Zinc (Zn) | SMWW 3113 B | 5.0 mg/L | 0.031 | N.A. | Optimal |
| Microbiological Analysis | | | | | |
| Total Coliforms* | SMWW 9222 B | 0 CFU/ 100 mL | 0 | N.A. | Optimal |
| Fecal Coliforms * | SMWW 9222 D | 0 CFU/ 100 mL | 0 | N.A. | Optimal |

The laboratory analysis of drinking water samples collected from the Chakwal Grid Station site confirms that the water quality is within the permissible limits set by the Punjab Environmental Quality Standards (PEQS). All key parameters, including physical characteristics (color, taste, odor, turbidity), chemical indicators (TDS, total hardness, chloride, fluoride, nitrate, nitrite), and heavy metals (arsenic, cadmium, lead, mercury, etc.), were found well below the PEQS

thresholds, indicating the water is safe and suitable for consumption. The absence of objectionable taste and odor, coupled with low turbidity and optimal levels of essential and toxic metals, reflects the water quality as optimal and non-polluted. No biological contaminants or residual chlorine were detected, further confirming that the groundwater at the project site is clean and does not pose any health risk to the local community or construction workers.

### 5.3.4 Noise

Noise quality sampling was also carried at the different locations to assess noise levels near road and residential areas. The measurements were done in day time and the results are given in Appendix 3.

## 5.4 Baseline Ecological Environment

The ecology baseline has been prepared to provide an overview of the ecological conditions in the AoI and its surroundings. It includes information collected from a literature review and IEE study13 undertaken for the Project.

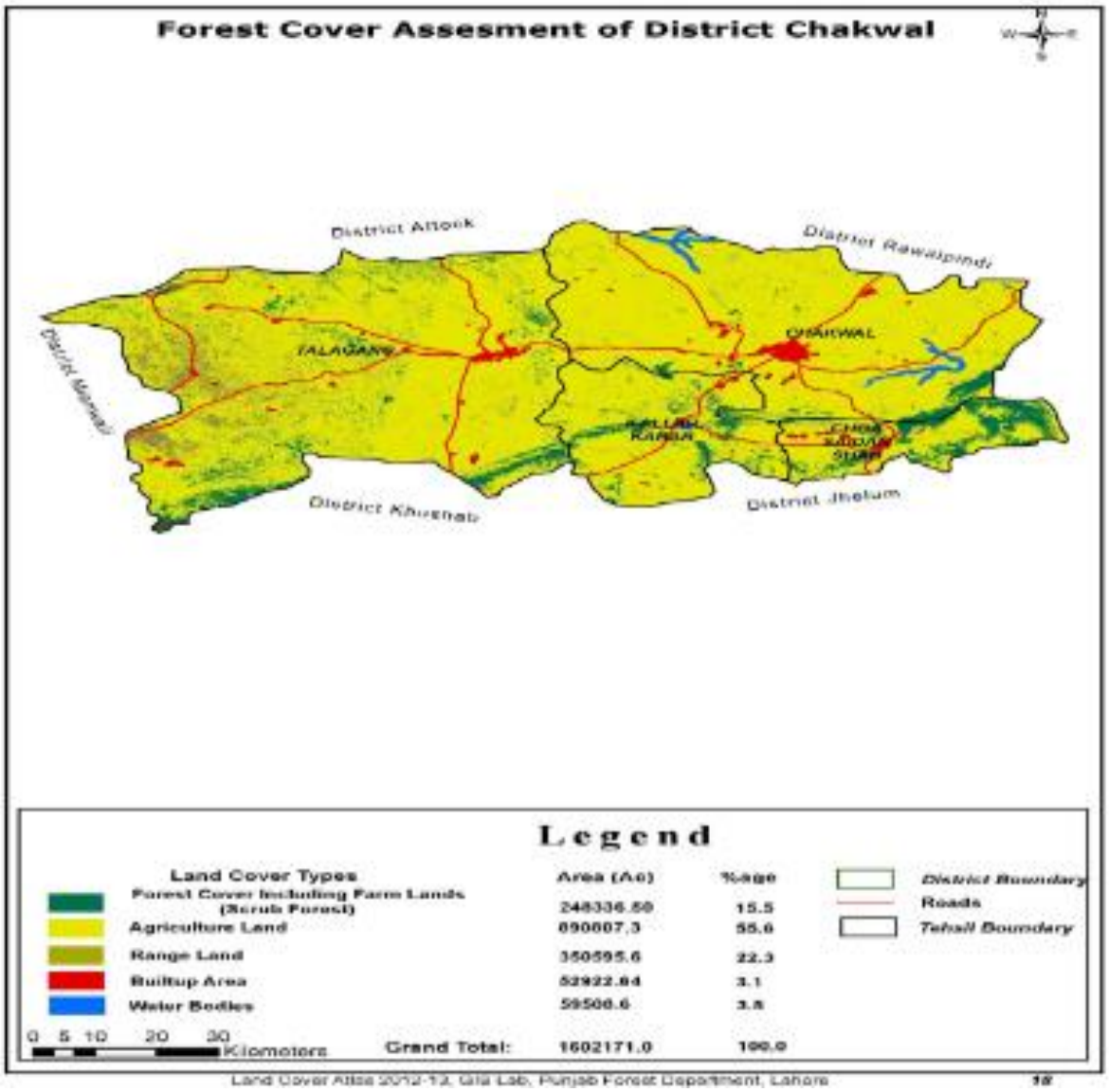
Sources of information for preparation of this baseline included published literature, reports, scientific journals as well as information obtained from national and globally recognized sources such as the International Union for Conservation of Nature (IUCN), the Convention on International Trade in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

In addition, a field survey was also carried out during Aug 2024, to collect field data and information about the terrestrial ecological resources in and around the Project area.

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.

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.

**Figure 5-9 Forest cover map – Chakw*al***




## 5.5 Terrestrial Vegetation

Chakwal district lies in the subtropical, semi-arid zone and is characterised by dry deciduous scrubland, consisting of plant varieties typical of these kinds of forests. The Punjab Forest Department, Chakwal District has carried out a cover assessment survey which concluded that it has 248,336 acres of forest (scrub) cover, 350,595 acres of rangeland, 890,807 acres of agriculture land and 54,508 acres of water bodies. Most of the scrub forests in the project area have either been cleared for farming or are heavily degraded due to deforestation, overgrazing and faulty agricultural practices. Another leading cause of loss of biodiversity is fragmentation of habitat due to expanding human settlements and infrastructure development. Natural forests still surviving are generally overexploited due to the heavy dependence of local communities on fuel wood but are fast degrading due to increasing this type of anthropogenic pressure.

Illegal hunting, unsustainable harvesting of Non-Timber Forest Products (NTFPs), and killing of predators are some of the additional threats to the biodiversity.

The pastures in the project area are in small patches and are used for cattle grazing by the local communities. Grazing is not regulated by law. Although there is no data on the condition of these pastures, there is common belief that the pastures are overgrazed and that the condition of the ecosystems is deteriorating.

### 5.5.1 Floristic composition of substation site

Most of the land proposed for substation is under cultivation. However, there are patches of natural vegetation established on the borders of the agriculture fields and on elevated an dissected pieces of land where cultivation is not possible.

The floristic composition of substation site is as follows:

### 5.5.2 Trees

Tree species present in the project area include Acacia modesta (Phulai), Acacia nilotica (Kikar), Albizzia lebbeck (Sars), Bomax ceiba (Sumbul), Broussonetia papyrifera (Jangli toot) Dalbergia sissoo (Sheeshum), Ficus palmate (Phagwara), Melia azedarach (Bakain), (Beri), Prosopis juliflora (Pahari Kikar), Tamarix aphylla (Farash), and Ziziphus spp.

**Figure 5-10 Typical trees and shrubs in the AOI**

*Melia azedarach*

Acacia modesta

*Ziziphus sp.*

*Dalbergia sisso* and *Ficus sp.*

### 5.5.3 Shrubs

Tree species present in the project area include Abutilon indicum, Achyranthes aspera (Poth Kanta), Calotropis procera (Ak), Canabis sativa (Bhang), Capparis aphylla (Karir), Datura alba (Datura), Propsopis glandulosa (Mesquite) Withania somnifera (Aksin), Xanthium strumarium (Mohabit Booti), and Ziziphus nummularia (malah).

### 5.5.4 Herbs

Species of herbs occurring in the project area include Asphodelus tenuifolius (Piazi), Boerhavia diffusa (Itsit), Convolvulus arvensis (Harn Khuri), Solanum nigrum (Makoo), Solanum xanthocarpium (Kandiari), Parthenium hysterophorus (Gajar Ghans), Peganum harmala ((Harmal), and Tribulus terrestris (Bakhra).

### 5.5.5 Grasses:

Grass species occurring in the project area include Cenchrus ciliarus, Cynodon dactylon, Desmostachya bipinnata, Eleusine compressa, Eulaliopsis binate, Heteropogon contortus, Lasiurus sindicus, and Saccharum munja.

The overall floristic composition (observed as well as reported[14], [15], [16]) within the RoW is as follows:

**Table 5-5 The conservation status of plant species occurring in the project area.**

| Sr. No. | Name of Species | Conservation Status |
|---|---|---|
| **Trees** | | |
| i. | Acacia modesta | Not assessed |
| ii. | Acacia nilotica | Least Concern |
| iii. | Albizzia lebbeck | Not assessed |
| iv. | Bomax ceiba | Not assessed |
| v. | Broussonetia papyrifera | Not assessed |
| vi. | Dalbergia sissoo | Not assessed |

14 Qureshi R., Abdul W., Muhammad A., and Talat U. (2009): Medico-Ethnobotanical Inventory of Tehsil Chakwal, Pakistan. Pak. J. Bot., 41(2): 529-538, 2009.

15 Ahmad H., Sarwat N. Mirza., Irshad A. K., and Muhammad A. N. 2009: Determination of Relative Species Composition and Seasonal Plant Communities of Nurpur Reserved Forest in Scrub Rangelands of District Chakwal. Pak. J. Agri. Sci., Vol. 46(1), 2009. Pp.34-39

16 Khan. D., Abid S., Junaid A., Imtiaz Q., Fazal Y., Saleem ud Din., and Muhammad T. 2016: Assessment of Riparian Vegetation in Dhrabi Watershed and Chakwal Region in Pakistan. Pakistan J. Agric. Res. Vol. 29 No.3, 2016. pp. 260-267

| Sr. No. | Name of Species | Conservation Status |
|---|---|---|
| vii. | Ficus palmate | Not assessed |
| viii. | Gymnosporia royleana | Not assessed |
| ix. | Melia azedarach | Least Concern |
| x. | Prosopis juliflora | Not assessed |
| xi. | Tamarix aphylla | Not assessed |
| xii. | Ziziphus spp. | Not assessed |
| xiii. | Withania somnifera | Not assessed |
| xiv. | Xanthium strumarium | Not assessed |
| xv. | Ziziphus nummularis | Not assessed |
| **Shrubs** | | |
| i. | Abutilon indicum | Not assessed |
| ii. | Achyranthes aspera | Not assessed |
| iii. | Asparagus adscendens | Not assessed |
| iv. | Atriplex sp. | Not assessed |
| v. | Calotropis procera | Not assessed |
| vi. | Canabis sativa | Not assessed |
| vii. | Capparis decidua | Not assessed |
| viii. | Datura alba | Not assessed |
| ix. | Grewia tenax | Not assessed |
| x. | Lantana camara | Not assessed |
| xi. | Otostegia limbata | Not assessed |
| xii. | Parthenium hysterophorus | Not assessed |
| xiii. | Periploca aphylla | Not assessed |
| xiv. | Propsopis glandulosa | Not assessed |
| xv. | Taverniera cuneifolia | Not assessed |
| **Herbs** | | |
| i. | Asphodelus tenuifolius | Not assessed |
| ii. | Ajuga integrifolia | Not assessed |
| iii. | Amaranthus ovalifolius | Not assessed |
| iv. | Amaranthus virdis | Not assessed |
| v. | Boerhavia diffusa | Not assessed |
| vi. | Chenopodium album | Not assessed |
| vii. | Commelina benghalensis | Least Concerned |
| viii. | Convolvulus arvensis | Not assessed |

| Sr. No. | Name of Species | Conservation Status |
|---|---|---|
| ix. | Coronopus didymus | Not assessed |
| x. | Dicliptera roxburghiana | Not assessed |
| xi. | Fagonia Cretica | Not assessed |
| xii. | Fumaria indica | Not assessed |
| xiii. | Ipomoea pentaphylla | Not assessed |
| xiv. | Malva parviflora | Not assessed |
| xv. | Malvastrum coromendelianum | Not assessed |
| xvi. | Oxalis corniculata | Not assessed |
| xvii. | Saussuria candicous | Not assessed |
| xviii. | Sisymbrium irio | Not assessed |
| xix. | Solanum nigrum | Not assessed |
| xx. | Sonchus arvensis | Not assessed |
| xxi. | Parthenium hysterophorus | Not assessed |
| xxii. | Peganum harmala | Not assessed |
| xxiii. | Tribulus terrestris | Not assessed |
| xxiv. | Withania somnifera | Not assessed |
| **Grasses** | | |
| i. | Cenchrus pennisetiformis | Least Concern |
| ii. | Cynodon dactylon | Not assessed |
| iii. | Cymbopogon jwarancusa | Not assessed |
| iv. | Desmostachya bipinnata | Least Concern |
| v. | Eleusine compressa | Least Concern |
| vi. | Eragrostis tremula | Not assessed |
| vii. | Eulaliopis binate | Not assessed |
| viii. | Heteropogon contortus | Not assessed |
| ix. | Lasiurus sindicus | Not assessed |
| x. | Saccharum munja | Not assessed |

### 5.5.6 Mammals

Dry deciduous scrub in the Chakwal District is an ideal habitat for the Punjab Urail (*Ovis vignei*) which is a species of wild sheep protected under Punjab wildlife laws. On the IUCN Red List of Species it is categorised as Vulnerable (VU) The Chakwal district also has another species i.e. Indian Pangolin *(Manis Crassicaudata)* which due to a low remaining population caused

by massive illegal hunting and trade now it is classified as an Endangered (EN) species[17]. This species was not recorded during the field survey but its presence in the project area cannot be completely ruled out. The Pangolin, the "scaly anteater", has a distinguishing characteristic of unique body scales (Aktin, 2004) and the same character is reflected by the name of its order Pholidota, meaning "the scaled animal". The Indian Pangolin (*Manis crassicaudata*) is the only member of Pholidota found in Pakistan. It occurs in and around Sialkot, Jhelum and Gujrat districts in the north west of the Punjab and extends across the Salt Range into Kohat District, and also from Attock district up to Mardan and Peshawar in the Khyber Pakhtoonkhawah (KPK) province. It is also reported from Dadu and Lerkana districts of Sindh, and Mekran and Lasbela districts of Baluchistan (Roberts, 1997).

The Indian pangolin (also called thick tailed Pangolin) is a nocturnal, burrow-dwelling occurs in open land, grasslands and degraded habitat in the project area. The population is expected to decline with more than 50% over the next couple of decades [18] due to illegal hunting/poaching.

According to information obtained from local informants during the fieldwork people in the project area are involved in trafficking as well as hunting of this species. Some hunters admitted that they smoke out set Pangolins from their burrows and said that they had been involved in Pangolin trade since 2009. The people providing this information claimed to be professional hunters and were not only the illegal trade of Pangolins but also caught and traded species such as Black scorpion and geckos. They claimed to catch Pangolins using traps or by using dogs. They then either remove the Pangolin's scales using boiling water, starve it to death or sell the live animal to dealers. Some villagers had killed Pangolins assuming them to be a threat to humans.[19]

During a detailed survey of the land proposed for construction of the substation, no Pangolin burrows were observed.

There are large numbers of rodent (Rodentia) species in agricultural lands. The common species reported/observed from the area are: Indian porcupine, Palm squirrel, Indian field mouse and the lesser bandicoot rat.

Reptiles and amphibians are the least studied wildlife groups in Pakistan. Rais et al., (2015) recorded 33 species of amphibians and reptiles belonging to 15 families from six different areas of Chakwal Tehsil in Chakwal Distric.t They also reported the threats to the hereto fauna of Chakwal which included hard substrate, water availability, agriculture activities, road

17 https:\www.iucnredlist.org. Retrieval Nov. 23, 2018

18 IUCN-Species Survival Commission. Global Pangolin Conservation Status. https://www.fws.gov/international/pdf/pangolin-conservation-status-challender.pdf. Retrieval 1-2-2019.

19 WWF. 2018. NATURA Volume 42 Issue 2, 2018.

network, traffic, road mortality, and habitat conversion. The natural areas are intersected by road networks that make reptiles and amphibians vulnerable for being killed on roads. Changes in land-use practices such as habitat conversion for residential development, housing schemes, and road development also cause reductions in the populations of amphibians and reptiles.

**Figure 5-11 Observed wildlife in the AOI**

Indian Porcupine Quill (In-direct evidence)

Indian Grey Mongoose (*Herpestes edwardsi*)

### 5.5.7 Birds

#### 5.5.7.1 Detailed Methodology

The bird surveys were undertaken to identify flight patterns of migratory species within the study area. The surveys were carried out in the early morning and late evening when birds are most likely to be moving across the study area. Observation periods varied in duration from two to three hours. A three-hour nocturnal survey was also undertaken. Bird flight lines were analysed to determine collision risk for each species. The surveys also included an assessment of land use and its suitability for supporting birds.

The survey comprised both point count (most of the sites) and line transect (at some sites) methodologies for the recording bird species. The call recognition or call count method was used for some species. Most of the birds were identified without using binoculars. Some birds were identified after keenly observing with binoculars and consulting a hand book for bird identification (Grimmett et al., 2008). For birds which could not be identified in the field, basic information about colour, size and habitat were recorded and photographs taken to facilitate their identification after consulting reference books (Grimmett et al. 2006; Mirza, 2012; Roberts 1991 and 1992).

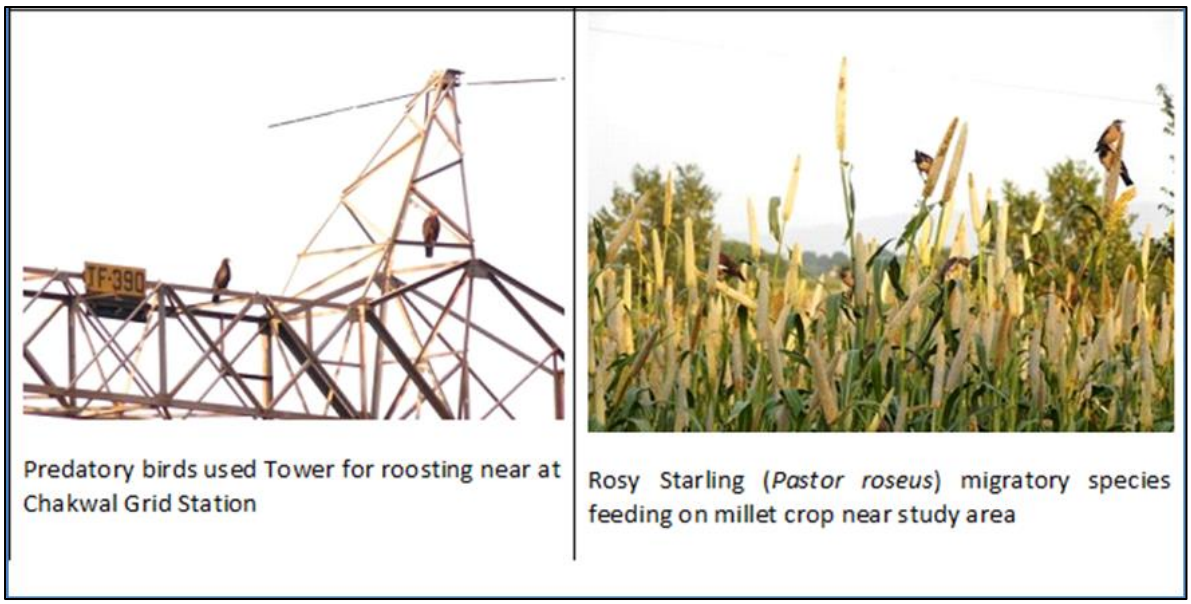
#### 5.5.7.2 Baseline

There are 21 small dams in the Chakwal District under the control of the Punjab Irrigation Department where the Punjab Fisheries Department have fishing rights. Among these small dams, a small lake formed by Ghazial Maswal Dam is located near Angle Markers AM03 &

AM04. The dam attracts some of the left-over migratory birds from the Indus Flyway which passes 131 km north-west of the Ghazial Maswal Dam.

An attractive place for birds is Kallar Kahar Lake which is approximately 50 km away from the project area. This is declared as a Game Reserve by the Wildlife Department under the Punjab wildlife (Protection, Preservation, Conservation and Management) Act, 1974. Additionally there are three lakes at a distance from the project area i.e. Jhallar[20] (93 km), Khabeki[21] (80 km) and Uchalli[22] Lake (17 km). Migratory birds visit the Uchalli wetlands complex which is Ramsar site. The three wetlands are important wintering sites for the rare/vulnerable white-headed duck, ferruginous duck, greylag goose and flamingos[23].

**Figure 5-12 Typical birdlife in the Chakwal area**




Predatory birds used Tower for roosting near at Chakwal Grid Station

Rosy Starling (*Pastor roseus*) migratory species feeding on millet crop near study area

20 Notified as a Wildlife Sanctuary vide section 16 of Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974, vide Notification No. SOFT(EXT)XII-2/93, dated 10-12-2004, w.e.f. 02-02-2003

21 Notified as a Wildlife Sanctuary vide section 16 of Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974, vide Notification No. SOFT(EXT)XII-1/89, dated 03-09-2004, w.e.f. 25-12-2002

22 Notified as a Game Reserve vide section 18 of Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974, vide Notification No. SOFT(EXT)XII-8/86, dated 09-07-1995, w.e.f. 09-07-1996

23 WWF 2011: Management Plan Uchhali Wetlands Complex- A part of Salt Range Wetlands Complex.

A checklist of bird species recorded in the project area was made covering the Area of Influence of the Sub-Station. The checklist is reproduced in

. A total of 48 Species were recorded.

**Table 5-6 Checklist of Recorded Bird Species**

| Sr. # | Common Names | Biological Names | Category | IUCN Status |
|---|---|---|---|---|
| ORDER GALLIFORMES | | | | |
| Family Phasianidae | | | | |
| 1 | Common Quail | Coturnix coturnix | Passage Migrant | Least Concern |
| 2 | Grey Francolin | Francolinus pondicerianus | Resident | Least Concern |
| 3 | Black Francolin | Francolinus francolinus | Resident | Least Concern |
| Family Rallidae | | | | |
| 3 | Common Moorhen | Gallinula chloropus | Resident | Least Concern |
| 4 | White Breasted Water hen | Amaurornis phoenicurus | Resident | Least Concern |
| OREDR PICIFORMES | | | | |
| Family Picidae | | | | |
| 5 | Golden backed woodpecker | Dinopium benghalense | Resident | Least Concern |
| Family Megalamidae | | | | |
| 6 | Coppersmith Barbet | Psilopogon haemacephalus | Resident | Least Concern |
| ORDER CORACIIFORMES | | | | |
| Family Upupidae | | | | |
| 7 | Common Hoopoe | Upupa epops | Winter Visitor | Least Concern |
| Family Coraciidae | | | | |
| 8 | Indian Roller | Coracias benghalensis | Resident | Least Concern |
| Family Halcyonidae | | | | |
| 9 | White-throated Kingfisher | Halcyon smyrnensis | Resident | Least Concern |
| Family Meropidae | | | | |
| 10 | Green Bee-eater | Merops orientalis | Summer Breeder | Least Concern |
| ORDER CUCULIFORMES | | | | |
| Family Cuculidae | | | | |

| | | | | |
|---|---|---|---|---|
| 11 | Asian Koel | Eudynamys scolopacea | Summer Breeder | Least Concern |
| 12 | Greater Coucal | Centropus sinensis | Resident | Least Concern |
| ORDER PSITTACIFORMES | | | | |
| Family Psittaculidae | | | | |
| 13 | Rose-ringed Parakeet | Psittacula krameri | Resident | Least Concern |
| ORDER APODIFORMES | | | | |
| Family Apodidae | | | | |
| 14 | House Swift | Apus affinis | Summer Breeder | Least Concern |
| ORDER STRIGIFORMES | | | | |
| Family Strigidae | | | | |
| 15 | Spotted Owlet | Athene brama | Resident | Least Concern |
| ORDER COLUMBIFORMES | | | | |
| Family Columbidae | | | | |
| 16 | Rock Pigeon | Columba livia | Resident | Least Concern |
| 17 | Eurasian Collared Dove | Streptopelia decaocto | Summer Breeder | Least Concern |
| ORDER CHARADRIIFORMES | | | | |
| Family Charadriidae | | | | |
| 18 | Red-wattled Lapwing | Vanellus indicus | Resident | Least Concern |
| ORDER ACCIPITRIFORMES | | | | |
| Family Accipitridae | | | | |
| 19 | Eurasian Sparrow Hawk | Accipiter nisus | Winter Visitor | Least Concern |
| 20 | Shikra | Accipiter badius | Resident | Least Concern |
| 21 | Black Shoulrded Kite | Elanus caeruleus | Resident | Least Concern |
| 22 | Black Kite | Milvus migrans | Resident | Least Concern |
| ORDER FALCONIFORMES | | | | |
| Family Falconidae | | | | |
| 23 | Common Kesterel | Falco tinnunculus | Winter Visitor | Least Concern |
| ORDER CICONIIFORMES | | | | |
| Family Ardeidae | | | | |
| 24 | Cattle Egret | Bubulcus ibis | Resident | Least Concern |
| 25 | Indian Pond Heron | Ardeola grayii | Resident | Least Concern |
| ORDER PASSERIFORMES | | | | |

| | | | | |
|---|---|---|---|---|
| Family Laniidae | | | | |
| 26 | Bay-backed Shrike | Lanius vittatus | Resident | Least Concern |
| 27 | Rufous-backed Shrike | Lanius schach | Resident | Least Concern |
| Family Corvidae | | | | |
| 28 | Indian Tree pie | Dendrocitta vagabunda | Resident | Least Concern |
| 29 | House Crow | Corvus splendens | Resident | Least Concern |
| Family Dicruridae | | | | |
| 30 | Black Drongo | Dicrurus macrocercus | Summer Breeder | Least Concern |
| Family Muscicapidae | | | | |
| 31 | Indian Robin | Saxicoloides fulicata | Resident | Least Concern |
| 32 | Pied Bushchat | Saxicola caprata | Resident | Least Concern |
| 33 | Brown Rock Chat | Cercomela fusca | Resident | Least Concern |
| Family Sturnidae | | | | |
| 34 | Common Myna | Acridotheres tristis | Resident | Least Concern |
| 35 | Bank Myna | Acridotheres ginginianus | Resident | Least Concern |
| 36 | Rosy starling | Sturnus roseus | Passage Migrant | Least Concern |
| Family Pycnonotidae | | | | |
| 37 | Red-vented Bulbul | Pycnonotus cafer | Resident | Least Concern |
| Family Timaliidae | | | | |
| 38 | Common Babbler | Turdoides caudatus | Resident | Least Concern |
| 39 | Jungle Babbler | Turdoides striatus | Resident | Least Concern |
| Family Alaudidae | | | | |
| 40 | Crested Lark | Galerida cristata | Resident | Least Concern |
| Family Motacillidae | | | | |
| 41 | Grey Wagtail | Motacilla cinerea | Winter Visitor | Least Concern |
| 42 | White Wagtail | Motacilla alba | Winter Visitor | Least Concern |
| 43 | Yellow Wagtail | Moticilla Flava | Winter Visitor | Least Concern |
| Family Cisticolidae | | | | |
| 44 | Common Tailorbird | Orthotomus sutorius | Resident | Least Concern |
| Family Passeridae | | | | |
| 45 | House Sparrow | Passer domesticus | Resident | Least Concern |
| Family Ploceidae | | | | |

| | | | | |
|---|---|---|---|---|
| 46 | Baya Weaver | Ploceus philippinus | Resident | Least Concern |
| Family Estrildidae | | | | |
| 47 | Indian Silverbill | Lonchura malabarica | Resident | Least Concern |
| 48 | Spotted Munia | Lonchura punctulata | Resident | Least Concern |

#### 5.5.7.3 Impacts

There are no threatened species or species of concern in the Area of Influence of the project and no impacts are expected.

### 5.5.8 Herpetofauna

#### 5.5.8.1 Literature Review

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.

These are represented by five species of amphibians, five species of freshwater turtles, nine species of lizards, and 13 species of snakes.24

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.

Of the documented herpetofauna species from the wider area of the project, the Bengal Monitor Lizard Varanus bengalensis is included in CITES Appendices I,25 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.[26]

#### 5.5.8.2 Survey Results

A total of 11 locations were sampled for herpeto fauna. A total of seven herpetofauna species were observed in the terrestrial study area. The most abundant herpetofauna species observed in the Project area was the Skittering Frog. A total of 73 individuals of Skittering Frog were observed at different sampling locations. The second abundant and widely distributed species in the study area were Boa and Indian Fringe-fingered lizard.

24 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).

25 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.

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

**Table 5-7 Herpetofauna Signs and Sightings in the Study** Area

| 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** |

**Table 5-8 Herpetofauna Species Observed in Terrestrial Project Area**

August 2024 Survey

Traces of Sand Boa (August 2024)

Indian Flap-shell Turtle (August 2024)

Skittering Frog (August 2024)

Asian Garden Lizard (August 2024)

### 5.5.8.3 Conservation and Protection Status

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.

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

## 5.5.9 Flora

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.

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.

The sampling locations for terrestrial vegetation are shown in **Table 5-9**

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

**Table 5-9 Flora in AoI**

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

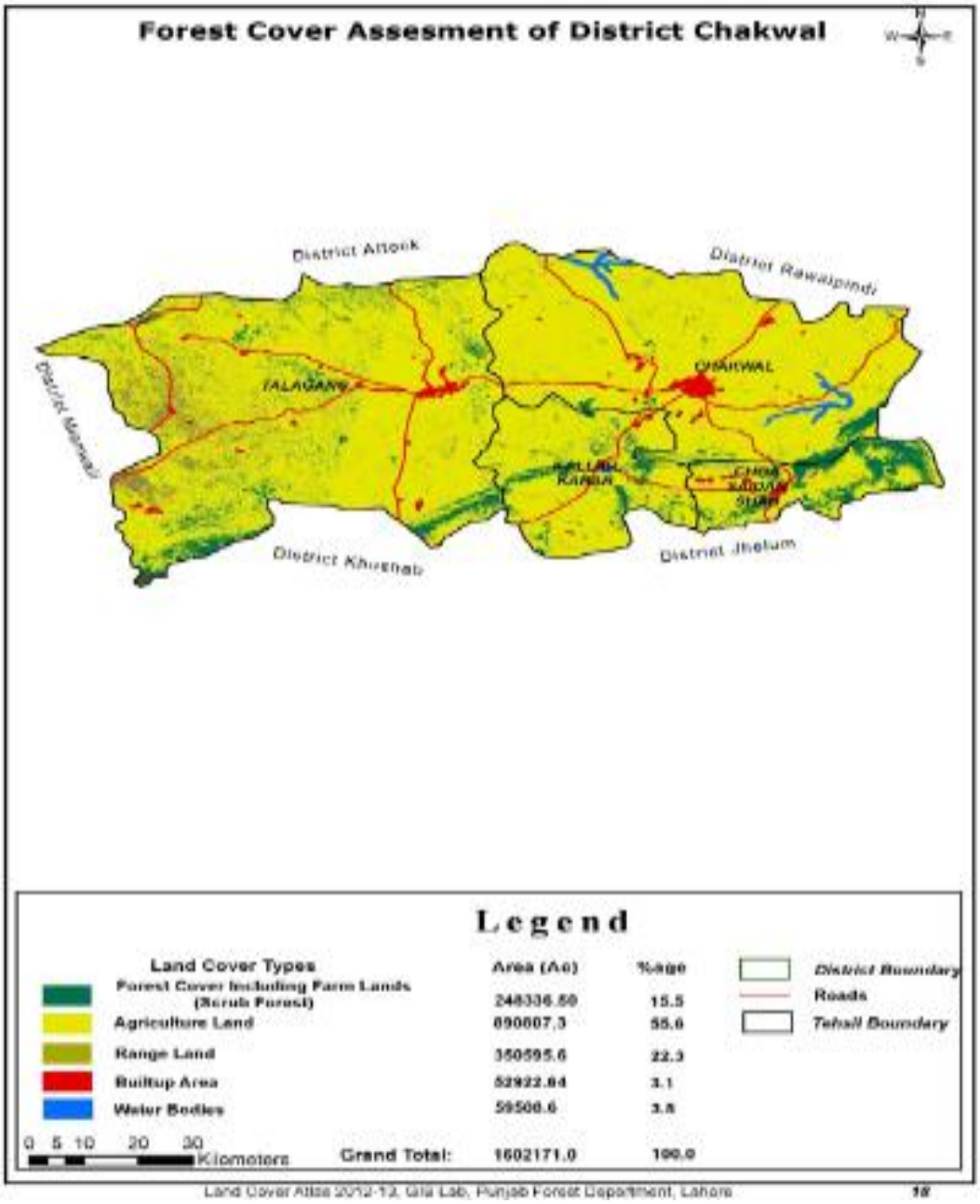
Crops include wheat, maize, sugarcane and tobacco in Rabi season and rice and pulses in Kharif season. The flora plays a significant role in the local economy by way of timber and fuelwood production, protection from wind and water erosion, as a habitat of birds and animals providing environmental balance, cultural identification and rehabilitation of soils affected by waterlogging and salinity.

Trees will be enumerated species wise and compensatory plantations will be arranged along roads and paths through forestry. To replace the removed trees, sufficient areas will be identified to allow the plantation of trees at a rate of 10:1. Moreover, owners of the affected trees will be paid compensation for their loss.

### 5.5.10 Vegetation Features of the Site

Chakwal district lies in the subtropical, semi-arid zone and is characterised by dry deciduous scrubland, consisting of plant varieties typical of these kinds of forests. The Punjab Forest Department, Chakwal District has carried out a cover assessment survey which concluded that it has 248,336 acres of forest (scrub) cover, 350,595 acres of rangeland, 890,807 acres of agriculture land and 54,508 acres of water bodies. Most of the scrub forests in the project area have either been cleared for farming or are heavily degraded due to deforestation, overgrazing and faulty agricultural practices. Another leading cause of loss of biodiversity is fragmentation of habitat due to expanding human settlements and infrastructure development. Natural forests still surviving are generally overexploited due to the heavy dependence of local communities on fuel wood but are fast degrading due to increasing this type of anthropogenic pressure.

**Figure 5-13 Forest cover map - Chakwal**




Illegal hunting, unsustainable harvesting of Non-Timber Forest Products (NTFPs), and killing of predators are some of the additional threats to the biodiversity.

The pastures in the project area are in small patches and are used for cattle grazing by the local communities. Grazing is not regulated by law. Although there is no data on the condition of these pastures, there is common belief that the pastures are overgrazed and that the condition of the ecosystems is deteriorating.

### 5.5.11 Floristic composition of substation site

Most of the land proposed for substation is under cultivation. However, there are patches of natural vegetation established on the borders of the agriculture fields and on elevated an dissected pieces of land where cultivation is not possible.

The floristic composition of substation site is as follows:

***Trees:***

Tree species present in the project area include *Acacia modesta* (Phulai), *Acacia nilotica* (Kikar), *Albizzia lebbeck* (Sars), *Bomax ceiba* (Sumbul), *Broussonetia papyrifera* (Jangli toot) *Dalbergia sissoo* (Sheeshum), *Ficus palmate* (Phagwara), *Melia azedarach* (Bakain), (Beri), *Prosopis juliflora* (Pahari Kikar), *Tamarix aphylla* (Farash), and *Ziziphus spp.*

**Figure 5-14 Typical trees and shrubs in the AOI**

*Melia azedarach*

Acacia modesta

*Ziziphus sp.*

*Dalbergia sisso* and *Ficus sp.*

**Shrubs**:

Tree species present in the project area include Abutilon indicum, Achyranthes aspera (Poth Kanta), Calotropis procera (Ak), Canabis sativa (Bhang), Capparis aphylla (Karir), Datura alba (Datura), Propsopis glandulosa (Mesquite) Withania somnifera (Aksin), Xanthium strumarium (Mohabit Booti), and Ziziphus nummularia (Malah).

**Herbs:**

Species of herbs occurring in the project area include Asphodelus tenuifolius (Piazi), Boerhavia diffusa (Itsit), Convolvulus arvensis (Harn Khuri), Solanum nigrum (Makoo), Solanum xanthocarpium (Kandiari), Parthenium hysterophorus (Gajar Ghans), Peganum harmala (Harmal), and Tribulus terrestris (Bakhra).

**Grasses**:

Grass species occurring in the project area include Cenchrus ciliarus, Cynodon dactylon, Desmostachya bipinnata, Eleusine compressa, Eulaliopsis binate, Heteropogon contortus, Lasiurus sindicus, and Saccharum munja.

The land selected for establishment of the substation has to be cleared from vegetation and levelled for construction of grid and associated structures, therefore all trees growing at site were counted.

**Floristic Composition of Right of Way**

Due to human activities such as land clearance for agriculture, plant harvesting for fuel and timber, livestock grazing and fire induction in pastures, the biodiversity of the area is low. Species were observed growing in different plant associations/communities within the RoW. The species variation of plants from site to site is mainly due to the soil type, composition of soil, elevation, moisture content of soil, nature of disturbance like grazing pressure, human interference, distance of study site from population area etc. Acacia modesta and Olea cuspidate are dominant

trees. The overall floristic composition (observed as well as reported[27], [28], [29]) within the RoW of is as follows:

**Trees:**

The tree species include Acacia modesta (Phulai), Acacia nilotica (Kikar), Albizzia lebbeck (Sars), Bomax ceiba (Sumbul), Broussonetia papyrifera (Jangli toot) Dalbergia sissoo (Sheeshum), Ficus palmate (Phagwara), Gymnosporia royleana, Melia azedarach (Bakain), Prosopis juliflora (Pahari Kikar), Tamarix aphylla (Farash), and Ziziphus spp.

**Shrubs:**

Shrubs include Abutilon indicum, Achyranthes aspera (Poth Kanta), Asparagus adscendens, Calotropis procera (Ak), Canabis sativa (Bhang), Capparis aphylla (Karir), Datura alba (Datura), Grewia tenax, Lantana camara, Otostegia limbata, Periploca aphylla, Propsopis glandulosa (Mesquite), Taverniera cuneifolia, Withania somnifera (Aksin), Xanthium strumarium (Mohabit Booti), and Ziziphus nummularis (Malah)

***Herbs**:*

Herbs include Asphodelus tenuifolius (Piazi), Ajuga bracteosa, Amaranthus ovalifolius (Choleri) (Kauri Booti), Amaranthus virdis (Cholai), Boerhavia diffusa (Itsit), Chenopodium album (Bathu), Commelina benghalensis (Kana Keeri), Convolvulus arvensis (Harn Khuri), Coronopus didymus, Dicliptera roxburghiana, Fagonia cretica, Fumaria indica (Shahatra), Ipomoea pentaphylla (Kaan Kati), Malva parviflora (Sonchal), Malvastrum coromendelianum (Damhni plant), Oxalis corniculata (Khati Booti), Saussuria candicous, Sisymbrium irio (Khoob Kalan), Solanum nigrum (Makoo), Sonchus arvensis (Dodh Bhatal), Solanum xanthocarpium (Kandiari), Parthenium hysterophorus (Gajar Ghans), Peganum harmala (Harmal), and Tribulus terrestris (Bakhra), Withania somnifera (Asgand).

**Grasses:**

27 Qureshi R., Abdul W., Muhammad A., and Talat U. (2009): Medico-Ethnobotanical Inventory of Tehsil Chakwal, Pakistan. Pak. J. Bot., 41(2): 529-538, 2009.

28 Ahmad H., Sarwat N. Mirza., Irshad A. K., and Muhammad A. N. 2009: Determination of Relative Species Composition and Seasonal Plant Communities of Nurpur Reserved Forest in Scrub Rangelands of District Chakwal. Pak. J. Agri. Sci., Vol. 46(1), 2009. Pp.34-39

29 Khan. D., Abid S., Junaid A., Imtiaz Q., Fazal Y., Saleem ud Din., and Muhammad T. 2016: Assessment of Riparian Vegetation in Dhrabi Watershed and Chakwal Region in Pakistan. Pakistan J. Agric. Res. Vol. 29 No.3, 2016. pp. 260-267

Grasses include Cenchrus ciliarus, Cenchrus pennisetiformis, Cynodon dactylon, Cymbopogon jwarancusa, Desmostachya bipinnata, Eleusine compressa, Eragrostis tremula, Eulaliopsis binate, Heteropogon contortus, Lasiurus sindicus, and Saccharum munja.

**Table 5-10 The conservation status of plant species occurring in the project area.**

| Sr. No. | Name of Species | Conservation Status |
|---|---|---|
| **Trees** | | |
| i. | Acacia modesta | Not assessed |
| ii. | Acacia nilotica | Least Concern |
| iii. | Albizzia lebbeck | Not assessed |
| iv. | Bomax ceiba | Not assessed |
| v. | Broussonetia papyrifera | Not assessed |
| vi. | Dalbergia sissoo | Not assessed |
| vii. | Ficus palmate | Not assessed |
| viii. | Gymnosporia royleana | Not assessed |
| ix. | Melia azedarach | Least Concern |
| x. | Prosopis juliflora | Not assessed |
| xi. | Tamarix aphylla | Not assessed |
| xii. | Ziziphus spp. | Not assessed |
| xiii. | Withania somnifera | Not assessed |
| xiv. | Xanthium strumarium | Not assessed |
| xv. | Ziziphus nummularis | Not assessed |
| **Shrubs** | | |
| i. | Abutilon indicum | Not assessed |
| ii. | Achyranthes aspera | Not assessed |
| iii. | Asparagus adscendens | Not assessed |
| iv. | Atriplex sp. | Not assessed |
| v. | Calotropis procera | Not assessed |
| vi. | Canabis sativa | Not assessed |
| vii. | Capparis decidua | Not assessed |
| viii. | Datura alba | Not assessed |
| ix. | Grewia tenax | Not assessed |
| x. | Lantana camara | Not assessed |

| Sr. No. | Name of Species | Conservation Status |
|---|---|---|
| xi. | Otostegia limbata | Not assessed |
| xii. | Parthenium hysterophorus | Not assessed |
| xiii. | Periploca aphylla | Not assessed |
| xiv. | Propsopis glandulosa | Not assessed |
| xv. | Taverniera cuneifolia | Not assessed |
| **Herbs** | | |
| i. | Asphodelus tenuifolius | Not assessed |
| ii. | Ajuga integrifolia | Not assessed |
| iii. | Amaranthus ovalifolius | Not assessed |
| iv. | Amaranthus virdis | Not assessed |
| v. | Boerhavia diffusa | Not assessed |
| vi. | Chenopodium album | Not assessed |
| vii. | Commelina benghalensis | Least Concerned |
| viii. | Convolvulus arvensis | Not assessed |
| ix. | Coronopus didymus | Not assessed |
| x. | Dicliptera roxburghiana | Not assessed |
| xi. | Fagonia Cretica | Not assessed |
| xii. | Fumaria indica | Not assessed |
| xiii. | Ipomoea pentaphylla | Not assessed |
| xiv. | Malva parviflora | Not assessed |
| xv. | Malvastrum coromendelianum | Not assessed |
| xvi. | Oxalis corniculata | Not assessed |
| xvii. | Saussuria candicous | Not assessed |
| xviii. | Sisymbrium irio | Not assessed |
| xix. | Solanum nigrum | Not assessed |
| xx. | Sonchus arvensis | Not assessed |
| xxi. | Parthenium hysterophorus | Not assessed |
| xxii. | Peganum harmala | Not assessed |
| xxiii. | Tribulus terrestris | Not assessed |
| xxiv. | Withania somnifera | Not assessed |
| **Grasses** | | |
| i. | Cenchrus pennisetiformis | Least Concern |

| Sr. No. | Name of Species | Conservation Status |
|---|---|---|
| ii. | Cynodon dactylon | Not assessed |
| iii. | Cymbopogon jwarancusa | Not assessed |
| iv. | Desmostachya bipinnata | Least Concern |
| v. | Eleusine compressa | Least Concern |
| vi. | Eragrostis tremula | Not assessed |
| vii. | Eulaliopis binate | Not assessed |
| viii. | Heteropogon contortus | Not assessed |
| ix. | Lasiurus sindicus | Not assessed |
| x. | Saccharum munja | Not assessed |

### 5.5.12 Fauna

The immediate and surrounding area of the project has been under human interference for a long time and, therefore, a large number of wildlife species have already shifted to other sites where they could find protection. The species left behind are those which have either adjusted to the present state of habitat or have adapted so they keep migrating between alternate habitats to strike their best balance with physical, biological or human factors of the environment. No threatened species were observed to be present in the project area.

The detailed list of local fauna[30] is presented in **Table 5-11:**

**Table 5-11 Fauna in AoI**

| Common Name | Scientific Name | Common Name | Scientific Name |
|---|---|---|---|
| **Mammals** | | | |
| Jungle Cat | Felis chaus | Hare/Siah | Lepus nigricolus |
| Bat/Changadar | Pipistralius terwis | Wild boar/Soor/Khinzeer | Sus scrofa |
| Gheese/House Shrew | Suncus marinus | Jackal/Gidder | Canis auries |
| Black Rat | Ratus ratus | Hedge Hog | Hemiechinus Sp. |
| House Rat | Mus musculus | Porcupine/She | Hystrise indirca |
| Mole Rat | Bandicota bengalensis | Squirrel/Gulehri | Fumbulus penanti |
| Birds (Seed Eating Birds) | | | |
| Dove/Common Dove | Streptophelia senegalusis | Indian Sand Martins | Riparia paludicola |

30 http://uu.urbanunit.gov.pk/Documents/Publications/0/115.pdf

| Common Name | Scientific Name | Common Name | Scientific Name |
|---|---|---|---|
| Dove/Common Dove | Streptophelia tranquefabria | Indian River Tern | Sterna auranlia |
| Larks | Mirfa erythroptra | Black Partridge | Francolinus |
| Stark/Bagla | Bagla | Common Babler/Bagla/Chakkira | Turdoides candatus |
| Weaver Bird | Ploceus phillipinus | Grey Partridge | Pyeronotus xythopygos |
| Dove (Ring-necked) | Streptopelia dacaocto | Woody-Wood Pecker (Chakki Ra) | Chakki Ra |
| **Resident Birds of Prey** | | | |
| Brahminy Kite | Haliaster Indus | Black Kite | Milvus rigrans |
| White-breasted King Fisher | Heleyon sinyrnensis | | |
| **Common Terrestrial Birds** | | | |
| **Grey Partridge** | Pyeronotus xynthopygos | **House Sparrow** | Passer spp |
| Jungle Pigeon | Teron walia | Russian Sparrow | Hirundo rustica |
| Sun Bird | Necterine spp | Crow | Corcias abyssinicus |
| Owl | Bubo Africans | Parakeets/Tota | Psittaciformes |
| Shrikes | Passeriformes | Rollers | Passeriformes |
| Tree-pies | Passeriformes | Neel Kanth | Gracius garrulous |
| Fly Catchers | Passeriformes | Common Babler | Turdiodes cardatus |
| Mynas | Passeriformes | Munias | Passeriformes |
| Bee-eaters | Passeriformes | Koel | Koel |
| Minivits | Passeriformes | Parrot | Psittacula krameri |
| Quail (Batera) | Pycnonotus cafer | Black Rock Pigeon | Columbia livia |
| **Reptiles** | | | |
| Chequered Keel back Snake | Natrix piscator | Common Field Lizard | Uromastrix hardwickir |
| Dark-bellied marsh Snake | Xenochrophis cerasogaster | Common House Lizard | Geko geko |
| Indian Monitor Lizard | Veranus bengalensis | Frogs | Rara Tigrina |
| Chequered Keel back Snake | Natrix piscator | Common Field Lizard | Uromastrix hardwickir |

### 5.5.13 Protected Areas/ National Sanctuaries

There is no protected area in the vicinity of the project area.

### 5.5.14 Wetlands and Aquatic Biology

The nearest wetland is the Jhelum River which is at a distance of 17 km from the TL, and potential impacts from the Project activities are unlikely.

### 5.5.15 Game Reserves & Wildlife Sanctuaries

No game reserves and wildlife sanctuaries exist in the vicinity of the project area even up to a 5 km distance.

### 5.5.16 Important Bird Areas

No Important bird areas are located in proximity to the project sites.

## 5.6 Baseline Socioeconomic Environment

This section summarizes the results and the collected socio-economic information derived from primary data (socio-economic survey) and secondary data such as the Agriculture Department statistics (type of crops being grown, income and yield level), Population Census Reports (2017 and 2023) of Chakwal District. In addition, information was collected through focus group discussions with selected households, individual interviews with key informants

Meetings were held with stakeholders including the affected community and officials of Revenue, Agriculture, Forest and Social welfare Departments. The census survey of the PAPs were carried out during the months of March and April 2025.

### 5.6.1 Administrative Setting

The Chakwal District is managed by the Deputy Commissioner who also fills the position of District Magistrate as well as District Collector. The District Magistrate is mainly responsible for law and order and is assisted by an Additional District Magistrate.

In addition to being the district headquarters, Chakwal town is also the administrative centre of Chakwal Tehsil (a subdivision of the district). The Chakwal District is divided into five Tehsils, namely, Kalarkahar, Chohsaidan Shah, Talagang, Lawa and Chakwal as shown in **Table 5-12**. The town of Chakwal itself is divided into five Union Councils and the whole of Chakwal District is divided into 68 union councils. There is one district council, two municipal committees, Chakwal and Talagang, and two town committees, Choa Saidan Shah and Kallar Kahar.

**Table 5-12 Tehsil wise list of institutions**

| Sr. No. | Name of tehsil | No. of union councils | No. of villages | No. of public schools | No. of police stations | No. of post offices |
|---|---|---|---|---|---|---|
| 1 | Chakwal | 30 | 207 | 523 | 7 | 48 |

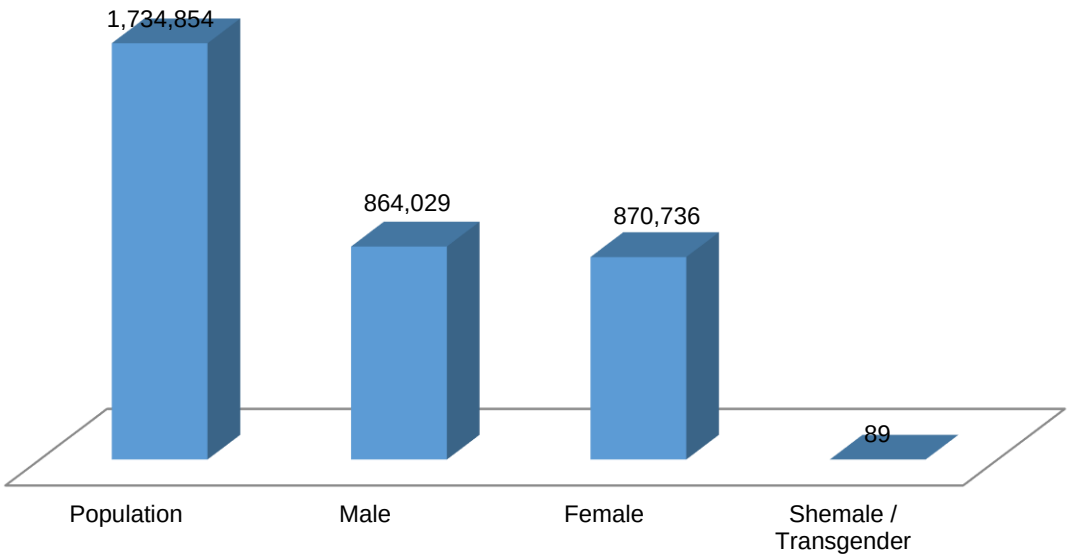
| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | Kallar Kahar | 8 | 72 | 148 | 2 | 15 |
| 3 | Choa Saidan Shah | 7 | 47 | 96 | 2 | 14 |
| 4 | Talagang | 17 | 76 | 318 | 3 | 30 |
| 5 | Lawa | 6 | 18 | 119 | 1 | 11 |
| | **Total** | **68** | **420** | **1204** | **15** | **118** |

Under the Punjab Local Government Act (PLGA) 2013, the Tehsil Municipal Administration has been converted into a Municipal Committee, which consists of a Chairman, Vice Chairman, Chief Officer, four Municipal Officers, some other officials of the Local Council Service and officials of the offices delegated to the Municipal Committee.

Union Councils (UC) is the lowest tier of the local government and fifth tier of government in Pakistan; in rural areas, UCs are often known as Village Councils (VC). The territory administered by a village council usually comprises a large village and surrounding areas, often including nearby small villages. A village council is an elected local government body headed by a mayor and a deputy mayor. Tehsil Council (TC) is the next tier of local government and normally comprises four to five UCs or VCs.

### 5.6.2 Demographics

#### 5.6.2.1 Population



According to 2023 census, the total population of Chakwal District is 1,734,854 with 864,029 males and 870,736 females as shown in **Table 5-13**. The average annual population growth rate is 2.51 from 2017 to 2023.

**Table 5-13 Population of Chakwal District according to the 2023 census**

| Sr. No. | Description | Rural | Urban | Total |
|---|---|---|---|---|
| 1 | Male | 645,153 | 218,876 | 864,029 |
| 2 | Female | 654,788 | 215,948 | 870,736 |
| 3 | Transgender | 15 | 74 | 89 |
| 4 | Household | 203,133 | 67,938 | 271,071 |
| Total | | 1,299,956 | 434,805 | 1,734,854 |

The age and gender distribution of the surveyed families is presented in the **Table 5-14** below.

**Table 5-14 Gender and age distribution of surveyed families**

| Sr. No | Age Group (Years) | Male | | Female | | Total | |
|---|---|---|---|---|---|---|---|
| | | No. | Percentage | No. | Percentage | No. | Percentage |
| 1 | 0-4 | 61 | 11.0 | 67 | 13.0 | 128 | 12.0 |
| 2 | 5-9 | 67 | 12.1 | 61 | 11.8 | 128 | 12.0 |
| 3 | 10-19 | 110 | 19.9 | 104 | 20.2 | 214 | 20.0 |
| 4 | 20-39 | 145 | 26.2 | 133 | 25.8 | 278 | 26.0 |
| 5 | 40-49 | 106 | 19.2 | 87 | 16.9 | 193 | 18 |
| 6 | 50-59 | 38 | 6.9 | 45 | 8.7 | 83 | 7.8 |
| 7 | 60 and above | 26 | 4.7 | 19 | 3.7 | 45 | 4.2 |
| | Total | 553 | 100.00 | 516 | 100 | 1069 | 100 |

The sex ratio is an important demographic indicator, which is defined as the “number of males per hundred females”. The sex ratio for the district computed in 2017 is 94 males per 100 females. The sex ratio based on the household survey was 107 males per 100 females.

In rural areas of Pakistan, sons are preferred because (i) they have a higher wage-earning capacity, (ii) they continue the family line; and (iii) they are generally recipients of inheritance. Girls are often considered an economic burden because of the dowry system and after marriage they typically become members of the husband's family, ceasing to have responsibility for their parents in illness and old age.

#### 5.6.2.2 Religion

The project area consists primarily of Muslim communities with a few minorities residing in peace and harmony. The area has no record of communal riots or the presence of any terrorist activity within the immediate area.[31]

#### 5.6.2.3 Languages

The educational level of the respondents is shown in **Table 5-15**. The majority (i.e. 44.3%) are illiterate while 20.7% have primary education.

**Table 5-15 Educational Level of the Respondents in the AOI**

| Sr. No. | Education of the Respondent | Percentage |
|---|---|---|
| 1 | Primary | 20.7 |
| 2 | Middle | 12.1 |
| 3 | Matric | 11.4 |
| 4 | Intermediate | 7.9 |
| 5 | Illiterate | 44.3 |
| 6 | Graduation | 3.6 |
| Total | | 100 |

The survey results show that female literacy rate is lower compared to literacy rate for males. There are a number of reasons for this situation as listed below:

- A family having many children will prefer to educate the boys of the family;
- Females are expected to stay at home after marriage whereas males have to earn for livelihood, so education is considered important only for males and not for females;
- The number of schools and colleges for females are few. Girls have often to travel a long distance to reach the schools or colleges.

Punjabi and Potohari are the predominant languages spoken in the study area while Urdu is also a common language.

### 5.6.3 Castes and Ethnic Groups

The population of the villages in the study area is predominantly Muslim. The core unit of social organization is the caste system (“biraderi” in local language) in which groups are either defined on the basis of specific occupation or lineage. Occupationally defined caste groups are considered as lower status in the social hierarchy. For instance occupationally defined biraderi/caste groups are Mochi (cobbler), Machi (fisherman), Nai (barber), Gujjar (dairy and

31 LARP, 500/220/132 kV Chakwal Grid Station Punjab Province Pakistan

livestock farmers), Julahay (weavers) while lineage based biraderi/caste groups are e.g., Khokar, Malik, Rajput, Bhatti, Jutt, Kullah, Mian, Khurral, Syed, and Cheema.

The information collection in the project area identified a number of caste groups the main ones being: Syed, Rahmani, Muslim Sheikh and Bhatti are the dominant castes of the study area.

According to the World Bank definition there is only one community that is considered as indigenous in Pakistan, namely the Kalash community who are living in Chitral District in Khyber Pakhtunkhwa Province.

### 5.6.4 Local Culture

Most of the population in the project area live in extended families comprising grandparents, uncles, aunts and cousins. In the extended family system all of the important household decisions are taken by the eldest male members of the family.

Landlords (locally named as Chaudry/Mian) as well as the head/or elder of the respective caste generally make decisions related to the social issues at village level as well as the social development works in their areas. Prior to any social programme start-up, it is essential to involve these groups right from start in planning design and implementation of any activity.

People mostly wear the traditional Shalwar Kamez while Men from well off families often wear a ‘koti’/ coat over Shalwar Kameez. Women might wear a ‘Burqa’ a large black over flowing garment over their clothes to cover themselves. Sandals and Chapals/ flip flops are worn mostly.

### 5.6.5 Conflict Resolution

The methods for decision-making about social conflict resolution in the project area include the “Panchayat” (an assembly of wise and respected elders), formal legal courts, “Jirga” (traditional assembly of leaders that make decisions by consensus) and caste group assemblies.

People in the project area prefer the “Panchayat” compared to legal courts because this method is more effective. The Panchayat provides timely justice while other methods are complex and require time as well as money.

The people have a tradition to help each other in the hour of need. Common conflicts arise from time to time which are solved by the community at the local level. Generally, in case of a conflict between two individuals, only the families or closest friends take sides so there are small chances that a personal conflict will transform into a major dispute.

### 5.6.6 Quality of Life Values

During the field survey, the availability of the social amenities/ basic infrastructure near the - Project area was asked from the sample DPs as well as physically observed at the site.

It was noted that as a whole, facilities such as roads, electricity, primary and middle schools, water supply, health facilities, filling stations, and drinking water were available in the vicinity of the project site (i.e. within 4 sq. km). However, water filtration plants, telecommunication, sewerage and sui-gas facilities were limited.

### 5.6.7 Health

Health facilities are generally inadequate in the project area. People tend to get treatment from traditional healers due to the lack of suitable and sufficient health facilities. Bad sanitary conditions, insufficient medical facilities and meagre parental care, all contribute to the prevalence of ill health and high rate of mortality in the area.

There are health facilities in few villages in the project area of the AOI but they are not in good condition. In some villages, dispensaries or Basic Health Units (BHUs) are to some extent working.

In Chakwal town only one government level hospital is functioning but it was found to be in poor condition. Due to lack of staff and inadequate space, it is overloaded and unable to provide good services.

Because of this people have to travel long distances to Islamabad and Rawalpindi to get good health services. The situation is worst for women in need of maternity facilities. According to the information obtained in the survey, people have to move to Rawalpindi due to lack of proper maternity facilities in the local hospital. There are private clinics in the project area but these are run by dispensers with limited services. The availability of dispensaries/BHU in the project area is given in **Table 5-16** and **Table 5-16**.

**Table 5-16 Other facilities in the project area**

| Village | Dispensary/BHU | Post Office |
|---|---|---|
| Khaiwal | 1 Private | - |
| Rabaal | - | - |
| Mohra Alia | - | - |
| Phapeel Natho | 2 Private | - |
| Parri Derwezaa | 1 Govt. | - |
| Jheak Adda (Bus Stop) | - | Yes |
| Daiwal | - | - |
| Sadyali | - | - |
| Jandala Raika | 1 Private | - |
| Bangwala | - | - |
| Tasa Mohra | 1 Private | Yes |

| Village | Dispensary/BHU | Post Office |
|---|---|---|
| Mulhal Mughlan | 1 Private | - |
| Saba Mohra Rajgaan | - | - |
| Photaki | - | - |
| Maswal | 2 Private | - |
| Ghazial Chakwal | 1 Govt. | - |
| Nachindi | - | Yes |
| Khokhar Rajgan | - | - |
| Dhoke Malikaan | - | - |
| Duman | 1 Private | - |
| Khanpur | - | - |
| Chak Baqir Shah | 1 Private | Yes |
| Sarkal Myer | 1 Private | - |
| Sehgalabad (Khothian) | - | - |

### 5.6.8 Education

**Table 5-17** lists the educational facilities in the project area. Primary schools for boys and girls are found in several villages but there are only a few higher secondary level education facilities.

Chakwal District has a total of 1,199 government schools out of which 52 percent (627 schools) are for girl students. The district has an enrolment of 181,574 in public sector schools.

At present there are five degree colleges, 2 intermediate colleges, 10 higher secondary schools, 131 high schools, 937 primary schools and 208 Maktab schools in the district. Collages and other education institutions also include:

- Government Post Graduate College (Chakwal)
- Government College for Women (Chakwal)
- Cadet College Kallar Kahar
- Misali Pre Cadet College
- Govt College of Technology Chakwal
- Gomal University DESC Chakwal (1751) Girls College Road Chakwal
- Fauji Foundation Higher Secondary School Chakwal

**Table 5-17 Schools in the Project Area**

| Sr. No. | Name of Village/ Chak | Govt. Primary School | Govt. Middle School | Govt. High School | Private School | Govt. College | Vocational Training Centre | Religious School (Deeni Madrassa) |
|---|---|---|---|---|---|---|---|---|
| 1 | Khaiwal | Primary school for boys and girls | Boys and girls | Boys and Girls | Private school and colleges boys and girls | - | - | Boys |
| 2 | Rabaal | - | - | - | Private school and colleges boys and girls | - | - | - |
| 3 | Mohra Alia | Primary school for boys and girls | - | - | Private school and colleges boys and girls | Boys | Girls | - |
| 4 | Phapeel Natho | Primary school for boys and girls | Boys and Girls | Primary school for boys and girls | Boys and Girls | - | - | - |
| 5 | Parri Derwezaa | Boys and primary girls school | Girls | - | - | - | - | - |
| 6 | Jheak Adda (Bus Stop) | Boys and girls primary school | - | - | - | - | - | Boys |
| 7 | Daiwal | - | - | - | - | - | - | - |
| 8 | Sadyali | Boys and girls primary school | - | - | - | - | - | Boys |

| Sr. No. | Name of Village/ Chak | Govt. Primary School | Govt. Middle School | Govt. High School | Private School | Govt. College | Vocational Training Centre | Religious School (Deeni Madrassa) |
|---|---|---|---|---|---|---|---|---|
| 9 | Jandala Raika | Boys and girls primary school | - | - | - | - | - | Boys |
| 10 | Bangwala | Boys and girls primary school | - | - | - | - | - | - |
| 11 | Tasa Mohra | Boys and girls primary school | - | - | - | - | - | - |
| 12 | Mulhal Mughlan | - | - | - | - | - | - | - |
| 13 | Saba Mohra Rajgaan | - | - | - | - | - | - | - |
| 14 | Photaki | - | - | - | - | - | - | - |
| 15 | Maswal | - | - | - | Boys and Girls | - | - | Boys and Girls |
| 16 | Ghazial Chakwal | - | - | - | Boys and Girls | - | - | Boys and Girls |
| 17 | Nachindi | Boys and Girls | Boys and Girls | Boys and Girls | Boys and Girls | - | - | Boys and Girls |
| 18 | Khokhar Rajgan | Boys and Girls | - | - | - | - | - | - |
| 19 | Dhoke Malikaan | - | - | - | Boys and Girls | - | - | Boys and Girls |
| 20 | Duman | - | - | - | Boys and Girls | - | - | Boys and Girls |
| 21 | Khanpur | Boys and Girls | Boys and Girls | Boys and Girls | Boys and Girls | - | - | Boys and Girls |

| Sr. No. | Name of Village/ Chak | Govt. Primary School | Govt. Middle School | Govt. High School | Private School | Govt. College | Vocational Training Centre | Religious School (Deeni Madrassa) |
|---|---|---|---|---|---|---|---|---|
| 22 | Chak Baqir Shah | - | - | - | Boys and Girls | - | - | Boys and Girls |
| 23 | Sarkal Myer | - | - | - | Boys and Girls | - | - | Boys and Girls |
| 24 | Sehgalabad (Khothian) | Boys and Girls | Boys and Girls | Boys and Girls | Boys and Girls | - | - | Boys and Girls |

There are a few institutions (private sector) that provide education at matric or secondary level in the project area. However, there are no government schools for higher education institution so most students have to move to Chakwal for higher level education. Some also prefer to go to Rawalpindi for higher education as it is regarded as a first-class place of learning in Pakistan.

### 5.6.9 Housing

Housing characteristics is one important indicator for the assessment of the living standard of the individual households. Most of the houses are owned by one influential resident of house who is male but some joint ownership also exists.

Approximately 76.4% houses belonging to the surveyed families are pucca (made from brick, stone, and mortar) and 23.6% are semi-pucca (made of clay, inferior bricks and plastered with mortar). Types of housing structures in are given in **Table 5-18**.

**Table 5-18 Housing Conditions in the Project Area**

| No. | Type of House | Number | Percentage |
|---|---|---|---|
| 1 | Semi Pucca[32] | 33 | 23.6 |
| 2 | Pucca[33] | 107 | 76.4 |
| | Total | 140 | 100 |

32 Constructed using a combination of pucca (strong, high-quality) and kutcha (inferior) materials.

33 Pucca housing refers to dwellings that are designed to be solid and permanent, built of substantial material such as stone, brick, cement, concrete, or timber.

The majority of the respondents have 1-2 rooms in their houses while a few of them have three or more rooms. Most of the surveyed families (99%) have flush type of latrines while only 1% is using open types such as pit latrines and open fields.

The electricity supply is available to almost all the villages and settlements along the line route.

### 5.6.10 Sui Gas (Natural Gas)

Natural gas (or Sui Gas) is available to 75% of the household in the project area. 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 that it is cheap and easily available in rural areas as compared to other methods.

### 5.6.11 Telecommunication

The town of Chakwal is connected to the rest of Pakistan by the main highway which links to the M2 motorway. The nearest international airport is Islamabad International Airport, which is 90 km from Chakwal.

The effective capacity of the road system is reduced by poor traffic management, compounded by a lack of discipline and poor compliance with traffic regulations on the part of drivers, and the mix of motorized and non-motorized traffic on all roads in the town. The transport infrastructure and public transport has not kept up with the demand from the rapid expansion of urban areas.

### 5.6.12 Post Offices and Banks

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

### 5.6.13 Water Supply

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.

**Figure 5-15** Water Sources in Project Area

### 5.6.14 Sources of Income and Livelihood

The income level distribution of the surveyed affected household are shown in the table below. The largest group are those who have an income between 18,000 and 22,000 PKR per month (29.3) while the group that earn less than 18 000 PKR are of a similar size (26.4%). Only 3.6% of the families earn more than 60,000 per month

### 5.6.15 Livelihoods

The main source of income and livelihood in the project area is agriculture and income from casual labour as a secondary source of income. Livestock is also kept to fulfil the nutrition requirements of the family, especially the children and women.

As mentioned above the dominant source of income of the surveyed families is agriculture which 56% depends solely. The second major source of income identified in the study area was labour while only few people were found to work in other occupations. Details occupational distribution of the respondents are given in **Figure 5-16**.

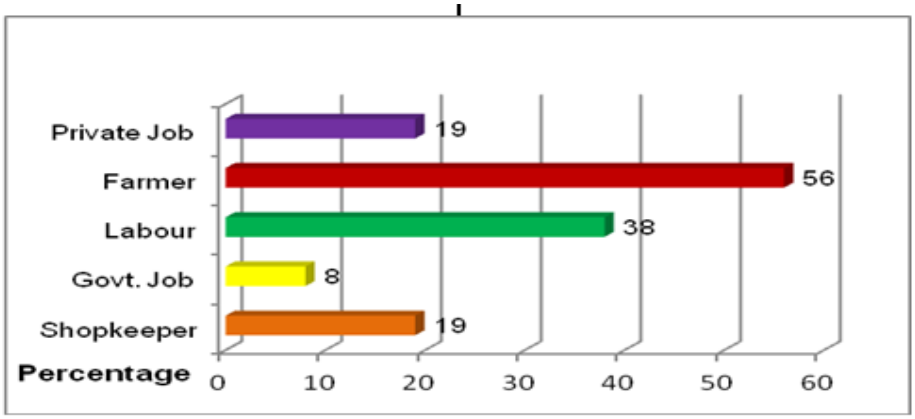



**Figure 5-16 Occupations and Employment**

### 5.6.16 Agricultural Crops

In the proposed substation area people practise rainfed while few people also use groundwater for irrigation.

Farmers use traditional methods for farming (i.e. ploughing, tilling etc.) coupled with use of tractors and modern machinery for cultivation and harvesting. Main crops of the Rabi season are wheat, peas and mustard while Kharif crops consist of maize and fodder crops. Rabi crops (also called winter/spring crops) are planted in the period from October to December and harvested in March -April. The Kharif crops (also known as summer/autumn crops) have generally longer growth periods with planting from February (for wheat) to July (for maize) and harvesting during winter season. There are no fruit orchards in in the substation area.

Because crops are mainly rain fed area the yield in the area are moderate. According to local farmers the yield per kanal (510 $m^2$) of wheat is 30 to 35kg. Information on yields of various crops in the project area is shown in the **Table 5-19**.

**Table 5-19 Agricultural crop yields**

| Sr. No. | Crop | Yield per Kanal |
|---|---|---|
| 1 | Wheat | 30-35 Kg |
| 2 | Maize | 40-50 kg |
| 3 | Potatoes | 70 Kg |
| 4 | Peas | 30-40 Kg |
| 5 | Rice | 35-40 Kg |

*Source: Socio-economic survey, October, 2024*

The major agricultural machinery being used includes tractors, and threshers. There has been a consistent increase in the number of privately owned agricultural machines. Scythes and sickles are also being used for cutting of barseem (clover) and other fodder crops. Tractors are available

for rent at a cost of 3,000 to 5,500 PKR per hectares for soil preparation and other jobs. Most cow dung is used as the fuel for cooking. Fertilizers such as urea and ammonium phosphate are used by farmers to increase the crop productivity.

### 5.6.17 Archaeological or Historical SIte s

In the Chakwal District there are many archaeological or historical sites such as Malot Fort, Katas Fort, Kallar Kahar Museum, Takht. E. Babri at Kallar Kahar, Sakhi Saidan,and Shah Shirazi Shrine etc. The distances to these cultural heritage sites are however so large that they in no way can be affected by the Project. During the field work no additional and unregistered cultural heritage site were identified in the AOI.

### 5.6.18 Tourism Potential and Recreation Areas

There are several tourism sites and recreation areas including historical, archaeological sites in Chakwal District. However, all are far away from the Area of Influence of the Project. In the Area of Influence of the Project itself there are no areas that are considered as important tourism sites.

## 5.7 Lab Reports of Environmental Analysis

All laboratory tests for water, noise and ambient air were conducted by AES (Asian Environmental Services Pvt. Ltd.) which is certified laboratory form Punjab Environmental Protection Agency. The sampling results and their discussion is provided in respective sections: **Section 5.2.4** to **Section 5.2.9**; whereas, the complete laboratory reports of environmental analysis are provided in **Appendix 3**.

## 5.8 Suitability of the Site

Based on the above assessment of the physical environment, ecology, and socioeconomic environment, it can be concluded that the Project is not located in an environmentally sensitive, prohibited, incompatible with surroundings, or an unsuitable area.

# 6 Potential Impacts and Mitigation Measures

Potential environmental and social issues in construction and operation of the proposed subproject have been estimated based the field visits, baseline environmental and social conditions, stakeholder consultations and proposed development activities. Environmental issues associated with the project location are minimal since the project area is located in an already modified habitat with agricultural, residential and industrial development. Most of the environmental issues will arise from the construction activities. General mitigation measures and best management practices to address these constructions related impacts are given in Annex 1 Environmental Code of Practices (ECPs) which are prepared based on World Bank General EHS guidelines and experiences from other projects in Pakistan. By inclusion by these ECPs in general specifications of contractors bidding documents and ensuring their implementation, most of the construction related impacts can be mitigated. General environmental issues associated with operation of the equipment and lines such as EMFs, noise, pollution from oil spills and waste water can be mitigated through adequate engineering designs.

## 6.1 Impact Assessment Methodology

The significance of potential impacts was assessed using the criteria and methodology given below.

### 6.1.1 Impact Magnitude

The potential implications of the project have been categorized as major, moderate, minor or minimal based on consideration of the parameters such as i) duration of the effect; ii) spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria.

The magnitude of potential impacts of the Project has been identified according to the categories outlined in **Table 6-1.**

**Table 6-1 Parameters for Determining Magnitude**

| Parameter | Major | Moderate | Minor | Minimal |
|---|---|---|---|---|
| Duration of potential impact | Long term (beyond the project period) | Medium Term Lifespan of the project (within the project period) | Limited to construction period | Temporary with no detectable potential impact |

| Parameter | Major | Moderate | Minor | Minimal |
|---|---|---|---|---|
| Spatial extent of the potential impact | Widespread far beyond project boundaries | Beyond next project components, site boundaries or local area | Within project boundary | Specific location within project component or site boundaries with no detectable potential impact |
| Reversibility of potential impacts | Potential impact is effectively permanent, requiring considerable intervention to return to baseline | Benchmarkneeds a year or so with some responsesto come back to baseline | Baseline returns naturally or with limited response within a few months | Baseline remains constant |
| Legal standards and established professional criteria | Breaches national standards and or international guidelines/obligations | Complies with limits given in national standards but violates international lender guidelines in one or more parameters | Meets minimum national standard limits or international guidelines | Not applicable |
| Likelihood of potential impacts occurring | Occurs under typical operating or construction conditions (Certain) | Happens under worst case (negative consequences) or best case (positive impact) working conditions (Likely) | Occurs under abnormal, exceptional or emergency conditions (occasional) | Unlikely to happen |

### 6.1.2 Sensitivity of Receptor

The sensitivity of a receptor has been determined based on a review of the population (including proximity/numbers/vulnerability) and the presence of features on the site or the surrounding area. Each detailed assessment has defined sensitivity about the topic. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in **Table 6-2.**

**Table 6-2 Criteria for Determining Sensitivity**

| Sensitivity Determination | Definition |
|---|---|
| Very High | Vulnerable receptor with little or no ability to absorb proposed changes or minimal opportunities for mitigation. |
| High | Vulnerable receptor with little or no ability to absorb proposed changes or limited opportunities for mitigation. |

| Sensitivity Determination | Definition |
|---|---|
| Medium | Vulnerable receptor with some ability to absorb proposed changes or moderate opportunities for mitigation |
| Low | Vulnerable receptor with good ability to absorb proposed changes or/and excellent opportunities for mitigation |

### 6.1.3 Assigning Significance

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the impact significance matrix shown in **Table 6-3.**

**Table 6-3 Significance of Impact Criteria.**

| Magnitude of Impact | Sensitivity of Receptors | | | |
|---|---|---|---|---|
| | Very High | High | Medium | Low |
| Major | Critical | Major | Moderate | Minimal |
| Moderate | Major | Moderate | Moderate | Minimal |
| Minor | Moderate | Moderate | Minor | Minimal |
| Minimal | Minor | Minimal | Minimal | Minimal |

### 6.1.4 Checklists

- Checklists were used to systematically identify potential impacts across all project activities.
- Each checklist entry considers the activity, the receptor, and potential consequences.
- This ensures a thorough initial screening and reduces the likelihood of overlooking important impacts.

### 6.1.5 Matrices

Matrices cross-reference project activities with receptors, magnitude, and sensitivity, enabling prioritization of impacts and transparent documentation of significance.

### 6.1.6 Supplementary Tools

**Networks:** Illustrate cause–effect relationships between project activities and environmental/social receptors.

**Overlays:** Spatially combine the project footprint with environmental and social constraints to identify potential conflicts.

**GIS/Computer Expert Systems:** Support spatial mapping and analysis of baseline conditions, sensitive receptors, and project components to enhance impact prediction accuracy.

## 6.2 Summary of Assessed Impacts

The project's potential impacts and their significance have been assessed using the methodology described in the above section. A summary of these impacts and their significance along with the mitigation measures are presented in **Table 6-4.**

**Table 6-4 Potential impacts, their significance and Mitigation measures**

| Potential impacts | Sensitivity | Magnitude | Significance before Mitigation | Mitigation and Enhancement Measure | Residual Significance |
|---|---|---|---|---|---|
| **Environmental Considerations during Project Design** | | | | | |
| Audible noise will be generated by most of converter equipment during operation | High | Major | Major | Contractor will design (i) equipment that generate low sound levels, (ii) equipment layout to minimize the acoustic noise and (iii) acoustic barriers (walls or enclosures) wherever necessary to maintain noise levels that comply with national standards at offices, and residential colony and at periphery of the station. | Minimal |
| Exposure to Electro Magnetic Fields (EMF) and radio interferences from the converter and grid station equipment and the power lines (EMFs will affect the health and radio interferences will affect the telecommunications). | High | Moderate | Major | WHO endorsed standards on EMF and noise levels will be complied through design considerations. These include adequate spacing between the equipment and fencing/boundary wall or right of way. International standards on radio interferences will also be complied with. | Minimal |

| Potential impacts | Sensitivity | Magnitude | Significance before Mitigation | Mitigation and Enhancement Measure | Residual Significance |
|---|---|---|---|---|---|
| Safe drinking and sanitation facilities to the offices and colony, firefighting and cooling, and storm water design drainage facilities in the converter and grid stations. Improper design of these facilities pose risk to workers' health and safety. | High | Major | Major | Contractor will design (i) water supply facilities including facilities for firefighting and cooling, (ii) sanitation facilities with septic tanks, and (iii) storm water management facilities with sedimentation ponds and connecting them to local streams. | Minimal |
| Oil spills and leaks from the transformers and reactors (these spills have potential to contaminate soil and water resources) | High | Major | Major | Contractor will design oil containment and recuperation systems around all transformers and oil-filled reactors | Minimal |
| **Environmental Impacts during Construction Stage** | | | | | |
| Risk of soil and water pollution from construction activities | Medium | Moderate | Moderate | Implementation of soil and pollution control measures as specified in ECPs. | Minimal |

| Potential impacts | Sensitivity | Magnitude | Significance before Mitigation | Mitigation and Enhancement Measure | Residual Significance |
|---|---|---|---|---|---|
| Dust and noise from construction activities | Medium | Moderate | Moderate | Maintenance of construction equipment and vehicles; and implementation of ECPs | Minimal |
| Waste generation and disposal (materials and solid waste) | Medium | Moderate | Moderate | Proper collection and disposal of waste in the local municipal waste disposal facilities | Minimal |
| Procurement of quarry material | Medium | Minimal | Minimal | Procurement from existing government approved quarry sites | Minimal |
| **Social Impacts during construction stage** | | | | | |
| Community health and safety from construction traffic and activities | Medium | Moderate | Moderate | Traffic, noise and dust control measures in accordance with ECPs. | Minimal |
| Workers health and safety (risk associated with working at height and electrical equipment; and inadequate facilities in construction camps) | Medium | Moderate | Moderate | Occupational health and safety measures; and adequate facilities in the construction camps in accordance with ECPs. | Minimal |
| Employment opportunities for local communities | Medium | Moderate | Moderate (positive) | Preference to the local communities; in the construction works | |

| Potential impacts | Sensitivity | Magnitude | Significance before Mitigation | Mitigation and Enhancement Measure | Residual Significance |
|---|---|---|---|---|---|
| Security concerns for the foreign workers | Very High | Moderate | Major | NGC will deploy Police/ Rangers and its own security staff for security of foreigners | Minimal |
| **Environmental impacts during operation and maintenance stage** | | | | | |
| Improved power supply in area and nearby load centers in the country during summer months of May to September. | Very high | Major | Critical (positive) | Adequate maintenance of the facilities in accordance with the standard operating practices of NGC | |
| Risk of bird collision and electrocution from the transmission line | High | Minor | Moderate | Insulation of exposed parts of the tower structure | **Minimal** |
| Generation of wastes from the offices and colonies | Medium | Moderate | Moderate | Material management through a central local of NGC in Lahore. Solid waste disposal in the local available municipal waste disposal sites. | Minimal |
| Impact on soil and groundwater quality | High | Major | Major | Regular maintenance of oil containment facilities and monitoring; and also storm water drainage facilities. | Minimal |
| **Social Impacts during operation and maintenance stage** | | | | | |
| Workers health and safety | High | Major | Major | Implementation of Standard operating procedures (SOPs) of NGC | Minimal |

| Potential impacts | Sensitivity | Magnitude | Significance before Mitigation | Mitigation and Enhancement Measure | Residual Significance |
|---|---|---|---|---|---|
| Community health and safety | High | Minor | Moderate | Maintenance of water supply, sanitation and drainage facilities in the residential colony.<br>Safety barriers and signage to avoid electrocution. | Minimal |

## 6.3 Environmental Considerations during Project Design

### 6.3.1 Audible Noise Generated from the Equipment

Much of the equipment in the converter and grid stations generates acoustic noise during their operation and typical noise levels generated by the equipment are given in **Table 6-5**. The impact of these noise levels on the nearby village are minimal since the nearest residences are located about 800 m away from the converter and grid stations site. However, the impact of noise levels on the employees working in the offices close to these facilities will be major.

**Table 6-5 Noise levels from the converter and grid stations equipment**

| Equipment | Noise level, dB (A) |
|---|---|
| AC harmonic filter capacitors | 80 |
| Converter transformer | 105 |
| Valve cooling (air blast coolers) | 100 |
| Transformer cooling | 105 |
| AC harmonic filter reactor | 100 |
| DC smoothing reactor | 110 |

**Mitigation**

The national standards on noise levels are given in **Table 6-6**. The standards on the residential areas zone should be complied at the offices, control rooms, relay rooms, employee colonies and at the periphery of the station through appropriate design features. Contractor will design (i) equipment that generate low sound levels, (ii) equipment layout to minimize the acoustic noise and (iii) acoustic barriers (walls or enclosures) wherever necessary to maintain noise levels that comply with national standards at offices, and residential colony and at periphery of the station. The contractor shall perform noise measurements during commissioning that the standards are complied with. Further, the proposed 3 m of buffer zone around the fencing of the station with plantation will also help minimizing the noise levels generated from the station.

**Table 6-6 Standards for Noise**

| Sr. No. | Category of Area / Zone | Daytime (6:00 a.m. to 10:00 p.m.) | Night-time 1(0:00 p.m. to 6:00 a.m.) |
|---|---|---|---|
| 1 | Residential Area (A) | 55 | 45 |
| 2 | Commercial Area (B) | 65 | 55 |
| 3 | Industrial Area (C) | 75 | 65 |

### 6.3.2 Exposure to EMF and Radio Interferences

Grid station equipment generate electrical and magnetic fields (EMF) which are considered to be health hazards although it was not scientifically proven. The exposure limits for EMF fields developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) - a non-governmental organization formally recognized by WHO34, are given in **Table 6-7.**

**Table 6-7 Standards for EMF Exposure**

| | Electric Field (kV/m) | Magnetic Field (μT) |
|---|---|---|
| Public Exposure | 5 | 200 |
| Occupational Exposure | 10 | 1000 |

The radio interference level from the electromagnetic or electrostatic radiation generated by the station will affect the telecommunications. The radio interference levels shall not exceed[35] 100 microvolt/m at the offices and residential areas under fair weather conditions.

**Mitigation**

Exposure to EMF and noise levels will be assessed during the design stage, and the residential colonies will be located at a sufficient distance away from the grid station facilities to ensure compliance with the internationally recognized standards. Hence no additional mitigation measures are proposed. The electric and magnetic fields will be regularly monitored during O&M phase to ensure compliance with the ICNIRP standards and if required additional mitigation measures will be proposed during O&M phase. The radio interference levels will also be complied through appropriate design features.

### 6.3.3 Safe Drinking Water, Sanitation and Drainage Facilities

Municipal water supply, sewerage and storm water drainage facilities do not exist in the project area. Hence all these facilities should be newly developed for the subproject. Groundwater is being extensively used in the project area for drinking and irrigation purposes, and the groundwater yields are generally high due to presence of alluvial aquifers and recharge from Kabul River. Improper design of these facilities pose risk to workers' health and safety.

**Mitigation**

Safe drinking facilities will be established to the offices and colony and also for the requirements of firefighting and cooling in the subproject. Exiting tube wells will be developed for these water supply facilities or new water wells will be drilled if required.

34 EMF Fields, WHO Webpage http://www.who.int/peh-emf/standards/en/

35 IEEE (Institute of Electrical and Electronics Engineers) Standard 430-1986

The wells that will be developed for water supply will be located minimum 500m away from any agricultural wells located outside the boundary to avoid any hydraulic interferences with those wells. These facilities will be established by the contractor in the initial stages of construction to supply for their offices and camps. The contractor will also design adequate sanitation facilities with the septic tanks for offices, residential colonies and also for construction camps. The contractor will also design storm water drainage facilities in and around the grid and converter stations for collection and disposal of rainwater. The storm water drainage facilities will include a sedimentation pond for collection of water and then discharge of sediment free water to the natural stream located on the western side of the converter and grid stations site.

### 6.3.4 Risk of Oil Spills and Leaks from Transformers and Reactors

Fuels, oils and lubricants will be used in transformers and reactors. There will be risk of leakages from these equipment and spillages during storage and handling. These leaks and spills will contaminate soil and water resources in the subproject area.

**Mitigation**

Contractor will design oil containment and recuperation systems around all transformers and oil-filled reactors. The storage facilities for oils will design in the bunded areas and will be covered on the top to avoid direct expose to sunlight and rain.

## 6.4 Environmental Impacts from Construction

### 6.4.1 Physical Impacts

#### 6.4.1.1 Risk of Soil and Water Pollution from Construction Works

The soil and groundwater resources will be at risk of pollution from the construction activities. Earth works for site preparation and foundation during rainy periods may carry the sediment load to the nearby streams. Waste water discharges from the construction activities and construction camps will impact the water quality in the streams. Other potential sources of soil and water pollution are improper storage and handling of materials, including hazardous materials, discharges from the construction sites and material storages, lack of proper drainage facilities, spillage of fuels, erosion from material stock piles, etc.

**Mitigation**

Storm water drainage from the construction areas will be collected to the sedimentation ponds for settling of sediments and the sediment free water will be discharged to the natural stream located on the western boundary. The Contractor will strictly adhere to the mitigation measures. According to these ECPs, the contractor will also be required to take appropriate measures to avoid and contain any spillage and pollution of the soil and water resources.

#### 6.4.1.2 Dust and Noise from Construction Activities

During construction, air and noise emissions from the construction activities will cause temporary nuisances to the residents of the nearby villages. The nearest residences are located about 800 from the boundary of the converter and grid stations site and hence these impacts are expected to be minimal. The expected noise levels from the construction activities are estimated and presented in **Table 6-8**. In general, the noise levels are within the standards at a distance of 800m (the nearest receptors) from the construction activities. However, the construction of transmission line may cause some temporary disturbances since at some locations residences are located about 200 m away from the line.

**Table 6-8 Estimated Noise Levels during Construction**

| Stage of work | Description of works | Key activities | Activity LAeq,10m dB | Predicted noise at 800 m, dB |
|---|---|---|---|---|
| Site preparation | Earth works | Earthmoving | 90 | 47 |
| | Site compounds and set-up | Excavation works | 90 | 37 |
| | | Transport and handling of soil/ materials | 70 | 30 |
| | | Storage of soil/ materials | 88 | 48 |
| | | Preparation of materials (cutting, grinding) | 86 | 46 |
| Construction of foundations and buildings | Ground preparation | Earthworks | 90 | 51 |
| | Building/equipment foundation construction | Transport and handling of soil / materials | 70 | 30 |
| | Internal roads | Concrete batching | 95 | 42 |

**Mitigation**

Contractor will be required to implement the mitigation measures provided in ECPs to address air and noise quality impacts (see ECPs 10 and 11 in Annex 1 on air and noise quality management). Machinery and vehicles causing excess pollution would be banned from the construction sites. Construction equipment and vehicles will be well maintained, so that emissions are minimal and comply with emission standards of NEQS. Dust generation from construction sites would be restricted as much as possible, and water

sprinkling would be carried out through the construction period. Construction activities near the settlements will be limited to day time only (8 am to 6 pm). High noise producing equipment will be provided with mufflers or acoustic enclosures.

#### 6.4.1.3 Waste generation and disposal

Construction works will generate large quantities of excess materials from construction sites (concrete, discarded material) and wastes from workers' camp and construction yards, including garbage, recyclable waste, food waste, and other debris. According to estimates of EPA Punjab, the solid waste generation in Pakistan ranges between 0.283 to 0.612 kg/capita/day. Considering the higher side, the average solid waste generated from the 200 construction workers would be 122 kg/day. No cut and fill activities are expected at the grid station site since it is a gentle rolling terrain.Hence No spoils (excess earth material) are exp47/58*ected to be generate from the construction activities. Improper management of wastes, especially fuels and lubricants, may harm the environment and health of construction workers.

**Mitigation**

Management of wastes, including solid and hazardous wastes, are given in ECPs (See ECP1 on Waste Management and ECP 2 on Fuels and Hazardous Substances Management in Annex 1 for detailed mitigation measures). Before commencing the construction activities, the contractor will be required to prepare Waste Management Plan in accordance with the ECPs and submit it to the PMU for their review and approval. Since its proximity to Chakwal, the waste disposal facilities available in these cities will be used for disposal of various wastes. No site specific disposal facilities will be developed for the project. Siting of any fuel and hazardous material storage sites, including refueling facilities, batching plants and construction yards will be located within the proposed converter and grid stations site, and 100 m away from stream/watercourse.

#### 6.4.1.4 Procurement of Quarry Material

Quarry material will be required for construction of foundation, concrete structures and covering open areas between transformer plinths in the grid station, and also for internal road works. The number of aggregates required for construction will be estimated during the design phase. Sourcing of material from the quarry areas will have significant impacts on the local air quality and noise levels due to blasting and crushing activities. The topography and natural topography at the quarry sites will be affected by the quarrying. The transport of material from quarry sites to the construction areas will have impact on the local roads.

**Mitigation**

No quarry sites will be developed for this project. The contractor will procure material from the market and approved quarry sites. Existing and government approved quarry sites are

located within the district. Material for this subproject will be sourced from the existing quarry sites and no new quarry areas will be developed.

### 6.4.2 Ecological Impacts

#### 6.4.2.1 Potential impact on threatened species:

No threatened plant or animal species were recorded during the field surveys. Clearance of vegetation and excavation of soil layers for construction of the substation is therefore not expected to have any impact on the threatened population in the area.

#### 6.4.2.2 Vegetation clearing:

All the vegetation including 40-45 mature trees of different species growing on land proposed for construction of the Chakwal substation will be cleared.

**Mitigation:**

- As a compensation, 10 plants of indigenous tree species for each cut/uprooted tree should be planted.
- No burning of grasslands or clearance of grasses within the RoW.
- Avoid unnecessary cutting/uprooting of plants.

#### 6.4.2.3 Hunting by workforce:

Some herbivores like hares, rabbits and birds such as quail and teeter etc. would be prone to poaching/hunting by the contractor's personnel. This would be a low adverse impact and after proper mitigation, the impact should be zero.

**Mitigation:**

- Enforce a complete ban on poaching/hunting of animals and birds

#### 6.4.2.4 Potential impacts on reptiles and amphibians (herpetofauna):

The construction activities would potentially affect movement of reptiles and amphibians. Most of the species hide in holes. Disturbance during construction by excavation of soil may destroy the habitats of these species. In addition, the moving construction and transport vehicles may kill crawling species such as snakes, lizards and geckos.

**Mitigation:**

- Site inspection for burrows prior to excavation of pits for erection of pylons.
- Restriction on speed limit in areas of connected habitats.

### 6.4.3 Socioeconomic Environment

#### 6.4.3.1 Land Acquisition

**Permanent land acquisition:** A total of approximately 758 kanals of land has been acquired in compliance with the provisions of the Land Acquisition Act and formally transferred to the National Grid Company (NGC) for project implementation.

**Temporary land acquisition***:* All the contractor's facilities, i.e. workers' camps, offices, workshops and storage areas will be within the substation boundary.

**Operation Phase:** No additional land acquisition will be required during operations, if there will be any future expansions, an updated Land Acquisition Plan should be developed accordingly with other relevant documents.

**Mitigation:**

No further mitigation should be required.

#### 6.4.3.2 Local Communities and Population

About 50-60 external workers are expected to be employed during the construction phase. These will be resident in the project area for at least 6 months. In addition to the workforce, construction activities usually attract job seekers and camp followers' Local communities will be affected during the construction phase as follows:

- The presence of external workers hired by the contractor may cause frictions and conflicts with the local population regarding the cultural issues due to unawareness of the local customs and norms.
- During the construction phase, the general mobility of the local population and their livestock in and around the AOI will be affected temporarily.
- Nearby community have to face the noise and dust problems during the construction activities, which may have adverse impact on the health of the locals. However, these impacts are of temporary nature;

**Mitigation:**

- Workers should be housed within the camps/office within the substation boundary.
- Movement of the contractor's staff, workers and visitors through the nearby residential areas should limited and controlled by the contractor.
- Good relations with the local communities will be promoted by encouraging the contractor to provide opportunities for skilled and unskilled employment to the local population, as well as on-job training for workers.
- During the construction phase, mobility of the workers in the nearby areas should be strictly restricted by the contractor to avoid any inconvenience to the local communities. The contractor should select specific timings for stringing so as to cause least disturbance to the local population considering their peak movement hours.
- The Contractor will warn the workers not to indulge in any theft activities and if anyone gets involved in such activities, he will have to pay heavy penalty and would be handed over to the police. Similarly, at the time of employing, the Contractor has to take care that the workers should be of good repute. The

contractor camp should be fenced properly and main gate will be locked at night with a security guard at guard to avoid any theft incidence.

- The contractor should as far as possible provide business opportunities to local businesses and providers by purchasing supplies locally.

#### 6.4.3.3 Social Services

**Pressure on health services:** With the introduction of an estimated 50-60 workers and the associated population influx, the health service delivery system may be challenged, thereby worsening it's the service delivery for the local resident population. This will mainly affect the resources of the lower-level health centres and dispensaries whose central role lies with prevention and first line treatment.

**Mitigation:**

- The contractor should be required to provide basic health checks and services to all of his workers.
- Support to local authorities in providing basic social services to improve capacities and quality should be considered by NGC as the project developer.
- The contractors should be required to provide for their own workforce with regard to water and sanitation, and accommodation.

#### 6.4.3.4 Loss of Livelihoods

Due to the proposed substation about 70 households will lose all of their agricultural land while another 30 households will lose 40-50% of their land. All households will therefore lose their permanent source of income fully of partly.

**Mitigation:**

The main mitigation measure for permanent loss of land is to pay compensation according to market rates that will allow the affected households to by replacement land or establish an alternative livelihood.

In addition to compensation livelihood restoration support must be offered and provided to all affected households so that they can establish sustainable incomes after the project. A livelihood restoration plan must therefore be implemented for all the 100 households that will lose their agricultural land due to the construction of the substation. The livelihood restoration plan is a stand-alone document. Special measures are put in place to secure vulnerable household a sustainable livelihood for the future.

Regarding temporary loss of land compensation for the loss of their standing agricultural crops in accordance with the prevailing market rates will be paid.

#### 6.4.3.5 Religious, Cultural Heritage and Historical Sites

There are no registered religious, cultural and historical heritage sites in the proposed AOI of the project. However, any chance finds during construction should be registered.

**Mitigation**

- A chance find procedure should be used by the contractor.

#### 6.4.3.6 Community Health and Safety

The local communities will be exposed to increased safety risks during the construction phase because of the increased traffic and population influx which might lead to an increase in crime rates and thefts in the area. Increased use of trucks and other construction vehicles on the local roads may expose the elderly people, women and children to dangerous situations, which may lead to traffic accidents. Other hazards for the local population include electrocution risks from direct contact with high-voltage electricity.

**Mitigation:**

- The contractor should engage security service providers to safeguard project property and control access to the project sites by non-employees.
- The contractor should prepare and implement a traffic management plan with the aim at ensuring access to residential areas and construction areas, and preventing unsafe situations.
- The construction areas should be secured with appropriate barriers and signs to prevent the local communities from entering into the construction areas. Education/public outreach activities should be carried out to prevent public contact with potentially dangerous equipment.

#### 6.4.3.7 Occupational Health and Safety

During the construction phase workers will be exposed to occupational health and safety risks such as traffic accidents, working at height and accidents in connection with handling machines and tools.

**Mitigation:**

- Occupational health and safety procedures should be enforced at site and the contractor required to prepare, obtain approval of, and implement an occupational health and safety (OHS) plan, Environment, Health, and Safety (EHS) Guidelines.
- Appropriate personal protection equipment (PPE), such as safety shoes, helmets, ear mufflers, safety glasses, etc. will be given to the construction workers by the contractor and necessary training will be provided in occupational health and safety.
- Only trained workers should be used to deal with the live power lines or deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines.

- Adequate safe drinking water and sanitation facilities should be provided in the construction camps and work sites.
- The contractor should develop adequate facilities for the construction workers, including prayer and entertainment facilities, so that there will be minimum interaction between them and the local communities.
- Use of fall protection and fall arrest equipment (harnesses) or must be used when working at height.
- Appropriate medical services and a facility with the capacity to treat emergency cases and trauma patients should be established at the site.

## 6.5 Environmental Impacts from O&M

### 6.5.1 Generation of Waste

Various types of wastes will be generated during regular operations of the grid stations. These include materials related to the electric equipment which are broken or not useful, scrap material and used oils. Solid wastes will also be generated from the officers and employee colonies.

**Mitigation**

The material waste generated from the various grid stations of NGC will be managed by a central warehouse of NGC at Lahore, where it will be reused or recycled. Solid waste will be regularly collected from the offices and colony and will be disposed in the municipal waste disposal sites available near project site

### 6.5.2 Impact on soil and groundwater quality

Fuels, oils and lubricants will be used in transformers and reactors. There will be potential leakages from the transformers and spillages will also occur during storage and handling. Improper management storm water drainage and septic tank facilities may also affect the soil and groundwater quality.

**Mitigation**

Storm water drains and septic tanks will be regularly maintained to avoid any contamination of soil and water resources. Transformers and storage facilities for fuels will be regularly monitored for leakages. If any leakages noticed, these will be contained with absorbent material and immediate cleanup will be taken up. The contaminated soils will be disposed as a hazardous material. Experienced workers will only be involved in handling of the fuels. Absorbent and containment material will be used around the oil storage facilities.

### 6.5.3 Occupational Health and Safety

During the operation phase maintenance crew is likely to be exposed to a number of occupational health and safety risks such as:

- Physical hazards from use of heavy equipment and cranes and falling objects;
- Exposure to electrical hazards from the use of tools and machinery;
- Risk of electrocution from contact with live power lines;
- Fall accidents in connection with working at height;
- Exposure to hazardous chemicals.

**Mitigation:**

- Use of fall protection and fall arrest equipment (harnesses) or must be used when working at height;
- Use of appropriate personal protection equipment (PPE), such as safety shoes, helmets, ear mufflers, safety glasses by maintenance workers;

## 6.5.4 Potential Environmental Enhancement Measures

In addition to mitigation of adverse impacts, the project presents opportunities for positive environmental enhancement that can improve the surrounding environment and contribute to sustainable development. Potential measures include:

#### 6.5.4.1 Green Belt Development

Planting native trees and shrubs around the grid station and along access roads to improve air quality, provide habitat, and enhance aesthetics.

#### 6.5.4.2 Habitat Restoration

Rehabilitating areas disturbed during construction by re-vegetation and soil stabilization to promote biodiversity.

#### 6.5.4.3 Energy Efficiency Measures

Incorporating energy-efficient lighting and equipment in the grid station to reduce overall energy consumption and associated emissions.

#### 6.5.4.4 Water Management and Conservation

Rainwater harvesting and proper drainage design to reduce water runoff and recharge local groundwater.

#### 6.5.4.5 Pollution Reduction Initiatives

Use of dust suppression during construction and proper management of construction waste to prevent soil and water contamination.

#### 6.5.4.6 Community Environmental Awareness

Conducting workshops and awareness campaigns for local communities on tree plantation, waste management, and sustainable resource use.

#### 6.5.4.7 Monitoring and Reporting

Establishing regular environmental monitoring beyond compliance requirements to track air quality, noise, and biodiversity indicators, and identify opportunities for improvement.

These enhancement measures complement mitigation strategies and demonstrate the project's commitment to environmental stewardship and sustainable development.

# 7 Environmental Management Plan

This Chapter provides an overall approach for managing and monitoring environment-related issues and describes the institutional framework and resource allocations proposed by NGC to implement the Environmental Management Plan (EMP) for the 500/220/132 Kv Chakwal Grid Station. 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.

## 7.1 Description of Proposed Mitigation Actions

The key environmental and social issues, which have already been discussed in **Chapter 6** are as under:

- Contamination of air, water, and soil during the construction activities
- Borrowing of aggregate materials
- Soil erosion and soil contamination
- Impact of noise generated by vehicles, machinery, and equipment during the construction activities
- Impact on community and workforce safety as a result of accident hazards during the construction and operation of the project
- Vegetation clearing for tower foundations and establishment of camp facilities

An environmental monitoring plan (EMP) establishes the linkages between the environmental and social impacts, mitigation strategy, and the agencies responsible for execution. Thus, the EMP Error! Reference source not found. covers

- A comprehensive listing of mitigation measures (actions).
- The institution(s)/ person(s) responsible for the 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 (DC) or During Restoration (DR).

The Affects Management Plan for the ongoing activities is presented below.

**Table 7-1 Environmental Management Plan**

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| **Design Phase** | | | | | | |
| Route Selection | Using corridor-sharing to minimize RoW requirements. Prefer to select a route with a minimum tree cutting requirement | NGC | – | – | | DP |
| Transmission Structure Design | | NGC | – | – | | DP |
| | | NGC | – | – | | DP |
| Tower Placement | Making minor adjustments in tower locations to avoid archeological sites or minimize effects on agricultural operations. | NGC | – | – | | DP |
| Add-ons | Adding flight diverters to conductors to minimize bird collisions with the | NGC | – | – | | DP |
| Impacts due to EMF | NGC's standard operating procedures (SOPs) of minimum vertical ground clearance for TL conductor of 7 meters will be ensured.<br>Raising the conductor height above the ground to 8 m, typically by increasing tower height, will be ideal.<br>Reducing conductor spacing.<br>Arranging phases so that fields tend to cancel. | NGC | | | | DP |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| | Increasing transmission voltage (since magnetic field intensities are a function of current, and increased voltage, all things being equal, will result in reduced current).<br>Reducing loads (and therefore, currents).<br>Identification of potential exposure levels in the work area including surveys of exposure levels and establishment of safety zones.<br>Safety signs and warning zone shall be highlighted to indicate EMF in the area<br>Limit access to properly trained workers and those equipped with appropriate PPE when entering safety zones. | | | | | |
| **Construction Phase** | | | | | | |
| General | Arranging training sessions, conducting environmental monitoring, maintaining health safety and environment (HSE) and training records, | Contractor | ESIC | Compliance | 0.2 | DC, DR |
| | A 'no-hunting' policy is to be strictly enforced. Wild animals are not to be harassed or trapped. Project personnel are to be prohibited from buying wild animals or birds. | Contractor | ESIC | Compliance | | DC, DR |
| | Field crew's general awareness of natural vegetation and wildlife is to be increased through training, toolbox talks, and notice board clippings. | Contractor | ESIC | Compliance | | DC, DR |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| | Ensure that no trash, wrappers, shopping bags, paper, cans, bottles, or any other kind of litter are thrown in the open | Contractor | ESIC | Compliance | | DC, DR |
| | Ensure the use of existing trails while walking | Contractor | ESIC | Compliance | | DC, DR |
| | Ensure that archaeological sites are not disturbed | Contractor | ESIC | Compliance | | DC, DR |
| | All sites of archaeological, historical, cultural, and religious significance are to be avoided. If any artifacts are discovered during the excavation, they must be delivered to the relevant authorities. | Contractor | ESIC | Compliance | | DC, DR |
| | Ensure that domestic animals are not fed | Contractor | ESIC | Compliance | | DC, DR |
| | Dust emissions at the construction sites are to be minimized by implementing good housekeeping and sound management practices. | Contractor | ESIC | Compliance | | DC, DR |
| | Fuelwood and shrubs are not to be used as fuel during construction. Traditional rights of the localities should not be deprived of. | Contractor | ESIC | Compliance | | DC, DR |
| | Noise from the campsites and construction sites is to be minimized using appropriate means (silencers, barriers, etc.) as required. | Contractor | ESIC | Compliance | | DC, DR |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| | Fire prevention measures are to be implemented if fire hazards exist. | Contractor | ESIC | Compliance | | DC, DR |
| | The construction crew's interaction with the local population is to be minimized. Liaison with the local community is to be maintained by the project proponent and the contractor. | Contractor | ESIC | Compliance | | DC, DR |
| | No interaction with the local womenfolk. | Contractor | ESIC | Compliance | | DC, DR |
| | Road and railway crossings are to be appropriately marked | Contractor | ESIC | Compliance | | DC |
| Backfilling, Restoration, and Rehabilitation | Using the photographs taken before site/camp establishment, ensure that the right of way (RoW), camping area, access tracks, and other construction sites are restored as far as possible after abandoning the worksite. | Contractor | ESIC | Compliance | 0.2 | DR |
| | Ensure that no refuse or waste is left behind. Pick up all pin flags, signs, and refuse. | Contractor | ESIC | Compliance | | DR |
| | Ensure that the natural drainage of the area is restored. | Contractor | ESIC | Compliance | | DR |
| | Install cross-drainage ditches on steep slopes to divert run-off into the adjacent vegetation. | Contractor | ESIC | Compliance | | DR |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| | Ensure that erosion control and revegetation measures using native species are taken where required. | Contractor | ESIC | Compliance | | DR |
| | Ensure that all pits, holes, and sumps are backfilled. An extra cap of soil should be put on top to account for compaction. | Contractor | ESIC | Compliance | | DR |
| | Remove all temporary stream/canal crossings. Stabilize banks at the crossings. | Contractor | ESIC | Compliance | | DR |
| | Remove contaminated soil for appropriate disposal (eg, incineration). | Contractor | ESIC | Compliance | | DR |
| | Implement active revegetation measures if natural growth is not considered sufficient. | Contractor | ESIC | Compliance | | DR |
| | Take appropriate action to discourage access by project staff/vehicles to the area after the completion of the construction. | Contractor | ESIC | Compliance | | DR |
| | Ensure that fences and gates are removed and restored. | Contractor | ESIC | Compliance | | DR |
| | Take photographs of the sites after restoration. | Contractor | ESIC | Compliance | | DR |
| | After the restoration of construction campsites and storage areas, after the construction period, preserved tops soil will be spread and covered with grass and shrubs. | Contractor | ESIC | Compliance | | DR |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| | The surplus excavated material will not be disposed-off at natural waterways even if it is dry and be disposed-off at designated sites appropriately. | Contractor | ESIC | Compliance | | DR |
| Handling of fuels, oils, and chemicals | Equipment will be maintained properly to minimize oil or fuel leakages from construction machinery. | Contractor | ESIC | Compliance | 0.2 | DC, DR |
| | Fuels, oils, and other hazardous substances are to be handled and stored according to standard safety practices. | Contractor | ESIC | Compliance | | DC, DR |
| | 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. | Contractor | ESIC | Compliance | | DC, DR |
| | Fuels, oils, and chemicals are to be stored in areas lined by an impervious base and containing dikes. | Contractor | ESIC | Compliance | | DC |
| | All storage fuel tanks will be marked by content 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. | Contractor | ESIC | Compliance | | DC |
| | Install grease traps/ spill prevention trays on the site, wherever needed, to prevent the flow of oily water. Chemicals should be placed at a designated location on the site according to MSDS. | Contractor | ESIC | Compliance | | DC |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| | A spill-cleaning kit (shovels, plastic bags, and absorbent materials) will be available near fuel and oil storage areas. | | | | | |
| | Fueling of construction vehicles and machinery will take place at designated places or over impermeable surfaces for fixed machinery. | Contractor | ESIC | Compliance | | DC |
| | Hazardous materials will be stored separately from nonhazardous waste in designated places having impervious linings. | Contractor | ESIC | Compliance | | DC |
| Vehicle Operation | Travel on existing roads, trails, or fence lines, wherever practical. | Contractor | ESIC | Compliance | 0.2 | DC, DR |
| | To the extent possible, only designated roads and trails are to be used for driving. | Contractor | ESIC | Compliance | | DC, DR |
| | Use a ‘no short-cuts’ policy. | Contractor | ESIC | Compliance | | DC, DR |
| | Minimize travel by good daily planning. | Contractor | ESIC | Compliance | | DC, DR |
| | Limit vehicle speed to avoid damage to topsoil and raising dust. Ensure that a speed limit of 60 km/hr (30 km/hr near the settlements) on dirt roads is adhered to. | Contractor | ESIC | Compliance | | DC, DR |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| | Dust emissions due to vehicular traffic are to be minimized by reduced speed. Water is to be sprinkled where necessary. | Contractor | ESIC | Compliance | | DC, DR |
| | Use vehicles that are properly tuned and which do not emit abnormal exhausts | Contractor | ESIC | Compliance | | DC, DR |
| | Use vehicles with proper exhaust mufflers (silencers) | Contractor | ESIC | Compliance | | DC, DR |
| | Ensure that vehicles are not washed or repaired in the field, as far as possible | Contractor | ESIC | Compliance | | DC, DR |
| | Plan efficient refueling of vehicles daily to minimize travel and chances of spills. | Contractor | ESIC | Compliance | | DC, DR |
| | Periodically check for leaks under all operating vehicles; contaminated soil should be removed for proper disposal. | Contractor | ESIC | Compliance | | DC, DR |
| | Keep a daily leak/spill record for each vehicle; repair at the earliest opportunity. | Contractor | ESIC | Compliance | | DC |
| | To prevent fires when driving over dry grasslands, clear the undercarriage of the brush. | Contractor | ESIC | Compliance | | DC |
| | Spark-arresting mufflers should be used in dry areas. | Contractor | ESIC | Compliance | | DC, DR |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| | Fire-fighting equipment should be available while operating in dry areas, and all vehicles should carry a suitable fire extinguisher. | Contractor | ESIC | Compliance | | DC, DR |
| | Do not throw litter or cigarettes out of vehicles. | Contractor | ESIC | Compliance | | DC, DR |
| | Take special care while driving where there is wildlife to avoid accidents. | Contractor | ESIC | Compliance | | DC, DR |
| | Do not sound the vehicle's horn near settlements, colonies of birds, or other wildlife. | Contractor | ESIC | Compliance | | DC, DR |
| | Ensure that canal crossing is done over designated bridges. For water channels where bridges are not present, culverts should be constructed | Contractor | ESIC | Compliance | | DC, DR |
| | Ensure that routes near or through the communities are avoided as far as possible. | Contractor | ESIC | Compliance | | DC, DR |
| | Maintenance of vehicles and other equipment is to be allowed only in designated areas underlain with concrete slabs and a system to catch runoff. Washing of vehicles to be limited. | Contractor | ESIC | Compliance | | DC |
| | Nighttime vehicular traffic is to be avoided as much as possible. | Contractor | ESIC | Compliance | | DC, DR |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| | Drivers are to be instructed to give way to locals while driving on access tracks. | Contractor | ESIC | Compliance | | DC, DR |
| | Drivers are to be instructed to keep a close watch for wild/domestic animals and children while driving. | Contractor | ESIC | Compliance | | DC, DR |
| | The use of canal flood protection bunds for the movement of heavy vehicles is minimized. Wooden/damaged bridges on canal/river/ other crossings are not to be used for the movement of heavy vehicles. | Contractor | ESIC | Compliance | | DC, DR |
| | Dry stream beds are not to be used as access routes | Contractor | ESIC | Compliance | | DC, DR |
| | Any damage to access tracks, metaled roads, watercourses or the canal/river protection bunds, etc., is to be appropriately repaired to bring these structures to their pre-construction condition. Any damage, which may cause hardship to the local community or wildlife, to be immediately repaired. | Contractor | ESIC | Compliance | | DC, DR |
| | Litter or cigarettes are not to be thrown outside the vehicles; all vehicles are to carry adequate means of storing such trash, which is to dispose of at the campsite or any other designated place for this purpose. | Contractor | ESIC | Compliance | | DC, DR |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| Sewage and other Waste | Sewage and waste disposal systems will be provided at residential facilities following the regulatory requirements. 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.<br>♦ The sewage system for camps will be properly designed (pit latrines or, as required, septic tanks) to receive all sanitary wastewater.<br>♦ The solid residue from the septic tanks will be transported to the nearby municipal sewage disposal site.<br>♦ 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. | Contractor | ESIC | Compliance | 0.5 | DC, DR |
| | Solid waste (including food waste) is not to be left un-disposed. Solid waste is to be segregated and disposed of as follows:<br>♦ Materials are suitable for recycling to be stored separately and sold to the approved recycling contractors. Use of three (3) bin systems where appropriate. | Contractor | ESIC | Compliance | | DC, DR |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| | ♦ Combustible waste to be burnt at a burn pit close to the camp.<br>♦ Medical waste is to be transported to a nearby facility for incineration.<br>♦ The solid residue from the septic tanks is to be transported to municipal sewage treatment facilities available nearby. | | | | | |
| Community Safety | Continuous liaison is to be maintained with the affected community and their concerns are addressed appropriately. | Contractor | ESIC | Compliance | | DC, DR |
| Occupational Health and Safety | Supply all protective gear (personal protective equipment, PPE) to all workers as per the job requirement. | Contractor | ESIC | Compliance | 0.5 | DC, DR |
| | Ensure strict adherence to occupational safety measures. | Contractor | ESIC | Compliance | | DC, DR |
| | The construction crew undergoes medical screening before being deployed in the field. | Contractor | ESIC | Compliance | | DC |
| **Operation Phase** | | | | | | |
| Local Employment | Mitigation measures discussed in the construction phase on local employment will be followed for the operation phase also. | NGC | – | – | | DO |
| Dust and air Emissions | Project vehicles will be regularly maintained and tuned for gaseous emissions. A speed limit discussed in the construction phase will be followed. | NGC | – | – | | DO |

| Potential Impact/Project Activity | Action | Responsibility | | Monitoring Requirement | Budget PKR (Million) | Timing |
|---|---|---|---|---|---|---|
| | | Execution of Mitigation | Monitoring of Mitigation | | | |
| Community Safety | Applicable mitigation measures discussed in the construction phase on Community Safety will also be followed for the operation phase | NGC | – | – | | DO |
| Occupational Health and Safety | Applicable mitigation measures discussed in the construction phase on Occupational Health and Safety will also be followed for the operation phase | NGC | – | – | | DO |
| Local Norms, Privacy and Women's Mobility | Applicable mitigation measures discussed in the construction phase on Local Norms, Privacy and Women's Mobility will also be followed for the operation phase | NGC | – | – | | DO |
| Traffic | Applicable mitigation measures discussed in the construction phase on Traffic will also be followed for the operation phase | NGC | – | – | | DO |
| EMF Impacts | A vertical clearance required as per international standards will be maintained for TL for minimizing EMF effects. | NGC | – | – | | DO |
| | No construction will be allowed within 100 m of the TL | NGC | – | – | | DO |

**Note:** DP = During Planning, DC = During Construction, DR = During Restoration, DO = During Operation

**Table 7-2 Effects Monitoring Plan**

| No | Monitoring Parameter | Monitoring Location | Frequency | Responsibility | Resource Requirement | Criteria for Triggering Action | Documentation |
|---|---|---|---|---|---|---|---|
| 1. | Water quality | At representative existing wells (if any) within 100 m of the campsite | Once during field activities | Contractor | 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 | ♦ Campsite<br>♦ Access road<br>♦ Communities within 100 m of RoW, campsite or access road | Once during field activities | Contractor | Resources for monitoring dust generation | To ensure compliance against PEQS for emissions | Records of measured values to be maintained |
| 3. | Noise | ♦ Campsite<br>♦ Access road<br>♦ Communities within 100 m of RoW, campsite or access road | At least once at each community falling within the specified distance (100 m) | Contractor | Noise meter | Exceeding WB 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 |

| No | Monitoring Parameter | Monitoring Location | Frequency | Responsibility | Resource Requirement | Criteria for Triggering Action | Documentation |
|---|---|---|---|---|---|---|---|
| | | | At least once at the camp boundary | | | | |
| 4. | Visual check for exhaust emissions from equipment and vehicles | ♦ Campsite<br>♦ Access road<br>♦ RoW<br>♦ Other construction sites | Once during field activities | Contractor | - | Personal judgment | Records of abnormal emissions. |
| 5. | Visual check for soil erosion | ♦ Campsite<br>♦ Access road<br>♦ RoW<br>♦ Other construction sites | After the restoration activity | Contractor | - | Visible signs of any soil erosion | Photographic record |
| 6. | Grievances of the local communities | ♦ Campsite<br>♦ Access road<br>♦ RoW<br>♦ Other construction sites | During field activities | Contractor | Monitoring register | Complaints | Complete grievance record to be maintained in the social complaint register. |

## 7.2 Waste Management Plan

This section provides the waste disposal plan that will be employed during the construction and operations of the proposed Project. The main types of waste that will be generated are non-hazardous and hazardous.

The solid and liquid waste to be generated from the project activities and camps is to be disposed of as per measures discussed in this chapter.

### 7.2.1 Non-hazardous Waste Management Plan

#### 7.2.1.1 Construction Phase

A Waste and Hazardous Waste Management Plan will be integrated into Construction Management Plan for the construction period. The Construction Contractor is responsible for preparing a Waste and Hazardous Waste Management Plan for the construction phase of the Project.

- Re–use opportunities for waste generated from the Project will be actively investigated. Used oil and other waste will be identified, and if any, it will be stored in a separate designated and contained facility.
- As a standard practice, all metal (such as iron and copper) or wooden parts generated as waste during the construction of the Project will be recycled or stored in a dedicated existing scrap yard for auction.
- Even after the implementation of the control measures, it is possible that some littering may take place. Periodic monitoring and cleanup will be undertaken to minimize the residual impact.

#### 7.2.1.2 Operation Phase

There will be not much waste generated during the operational phase of the project other than during maintenance activities at the substation and most of which will be considered hazardous waste.

Solid waste materials will be regularly collected from the site, sorted, and stored in demarcated spaces. The waste will be disposed of in a government-approved landfill.

### 7.2.2 Hazardous Wastes Management Plan

The oils, lubricants and coolant used in substation are all considered hazardous waste and must be disposed of appropriately.

A Hazardous Materials Management Plan will also include the following management and mitigation measures:

- Storage and handling of hazardous materials will be in accordance with international standards and appropriate to their hazard characteristics. Storage and liquid impoundment areas for fuels and hazardous process chemicals will be designed with secondary containment to prevent spills and contamination of soil and groundwater. The secondary containment will be impervious with a capacity of at least 110% of the largest single container.
- Labeling will be placed on all storage vessels as appropriate to national and international standards. The labeling will clearly identify the stored materials.
- Supporting information such as Material Safety Data Sheet (MSDS) will be available for all hazardous materials.
- A Hazardous Materials Register will be in place that covers:
    - Hazardous Material name
    - HAZCHEM/United Nations Code
    - Material Safety Data Sheet (MSDS)
    - Summary of maximum inventory
    - Storage requirements and precautions
    - Location, physical properties of the materials where they are used
    - Approved disposal methods

### 7.2.3 Management Level Mitigation Measures

In addition to the above-mentioned assessment and project design measures to minimize the waste, and handling options, the following general management-level mitigation measures will be taken:

#### 7.2.3.1 On-site handling

a. Recyclable material will be separated at the source. Separate bins will be placed at each site for the different types of materials—plastic, paper, metal, glass, wood, and cotton etc. The recyclable waste will be delivered to approve waste contractors.

b. All hazardous waste will be separated from other wastes.

c. Hazardous waste that cannot be disposed of through acceptable means will be stored in an on-site storage facility until an off-site hazardous waste disposal facility is available.

#### 7.2.3.2 Audits

a. On-site audits of waste management will be undertaken regularly.

b. Audits of the waste disposal contractors and waste disposal facilities will be undertaken regularly to check that procedure are being followed.

#### 7.2.3.3 Records

a. Records of all waste generated will be maintained. Quantities of waste disposed of, recycled, or reused will be logged on a Waste Tracking Register.

#### 7.2.3.4 Disposal

a. All non-hazardous waste material that cannot be recycled or reused will be transferred to approve landfill sites in Karachi.

a. Depending on the nature and quantity of the hazardous waste, it will either be disposed of by licensed hazardous waste contractors or will be incinerated at an incineration facility equipped to handle hazardous waste.

b. The possibility of returning the packaging to the manufacturers for reuse will be explored.

c. Recyclable waste will be disposed of via approved waste contractors.

d. Chemical containers (including partially full containers) will be returned to vendors.

#### 7.2.3.5 Other management measures

a. An emergency response plan will be developed for hazardous waste (and substances).

a. Training will be provided to personnel for identification, segregation, and management of waste.

b. All containers of hazardous waste will be appropriately labeled.

c. Equipment and material containing asbestos, poly-chlorinated biphenyls (PCBs), and ozone-depleting substances (ODSs) will not be used during Project operations.

d. The equipment used at substation does not contain any Persistent Organic Pollutants (POPs) such as polychlorinated biphenyls (PCB). The use of such chemicals has been discontinued in the early 1990s.

### 7.3 Spoil Management Plan

Spoil is defined as 'rock' or 'other than rock' resulting from construction excavation. This Plan addresses and details the following issues:

- Excavation, handling, haulage, disposal and reuse methodology, including on-site storage and stockpiling arrangements;
- Processes and procedures that will be used for the management of spoil;
- Measures that will be implemented to both reduce spoil quantities and maximize the beneficial reuse of spoil that will be generated during the performance of the works;
- Nominated quantities for reuse of spoil within the construction site, for beneficial reuse of spoil off-site and for spoil disposal; and

- Processes and procedures for the management of the environmental and social impacts of spoil transfer and reuse.
- The Spoil Management Plan (SMP) will be updated for each specific constriction work prior to the commencement of any excavation works and other works that may generate spoil. The updated SMP will incorporate detailed information on the handling of spoil generated during construction. It should be consistent with the Traffic Management Plan to allow for ready access to spoil and spoil disposal areas and to avoid disturbance to the non-Project related traffic.

### 7.3.1 Spoil Production

Spoil will be produced from construction activities during the construction of grid stations and towers.

### 7.3.2 Mitigation Hierarchy

Where feasible and reasonable, spoil should be managed according to the following hierarchy:

- Minimization of spoil generation through design and management
- Reuse of spoil within the Project
- Beneficial reuse of spoil outside the Project for environmental and community works
- Beneficial reuse of spoil outside the Project for site leveling, development or rehabilitation
- Disposal of spoil outside the Project for non-beneficial uses (landfilling)

### 7.3.3 On-site Management

On-site management includes management of stockpiling sites, spoil transport, spoil tracking and spoil testing for re-use.

#### 7.3.3.1 Stockpiles

On-site management of spoil material stockpiling sites involves planning for stockpiling including selection of stockpiling sites, their accessibility to the road network, management of stockpiles to minimize wind and water erosion, management of stockpiles to minimize dust from exposed surfaces and management of noise and dust during loading and unloading.

The stockpile sites need to:

- Have ready access to the road network
- Be located on leveled land where possible
- Not affect land use of adjacent properties
- Be located in areas so that the erosion control measures can be implemented
- Be located in areas so that flooding does not result in runoff
- Be located in areas such that they do not result in the disturbance of species of conservation importance
- Be positioned in areas where there are minimal visual, noise and vibration impacts anticipated on nearby residents
- Be located within the Project approved boundary

- Be located in areas such that they do not affect cultural heritage
- Ensure land care and avoid loss of habitat and spread of invasive plant species
- Avoid flooding of trees and waterlogging of soils
- Have contaminated materials stockpiled separately
- Have erosion and sedimentation controls in place
- Be subjected to regular inspection
- Stockpile must be located no less than 250 meters from the nearest residence
- Any long-term stored topsoil stockpiles are to be protected from water and wind erosion by stabilizing with hydro-seed or by covering with a geo-textile fabric until required.

#### 7.3.3.2 Spoil Transport

The following need to be considered for spoil transport:

- Spoil transport/haulage routes should be identified, assessed and if necessary, upgraded
- Haulage routes should be assessed and if necessary, upgraded
- The routes should be selected to minimize impacts on sensitive receptors including people, ecology and the landscape
- Transport should be undertaken with minimization of noise and dust

#### 7.3.3.3 Spoil Tracking

A spoil tracking system should be developed which should include fields such as:

- Date
- Docket Number
- Haulage Company (if other than EPC Contractor)
- Material Classification
- Quantity in Tonnes to be Transported
- Truck Identification Number
- Location of Spoil Generation Site
- Location of Spoil Receival Site

#### 7.3.3.4 Spoil Testing

It is necessary to determine if the waste material is hazardous or non-hazardous and whether or not it requires any special treatment before disposal or re-use. Spoil testing before re-use is important to answer questions such as the following:

- Are manufactured chemicals or process residues present?
- Are sulfidic ores or soil present?
- Are naturally occurring asbestos soils present?
- Is there any other waste present?

### 7.4 Traffic Management

The construction material will be transported to the project sites via the existing road network. There will be one site entrance/exit for the construction site which will be theExisting entrance.

The entrance of the camp will be controlled by a security gateman located within a security hut at the site entrance. During the hours of site operation, the site entrance gates will remain open and vehicle access to the site will be controlled via a manual barrier, set back from the road to prevent vehicles from parking on the access road.

The barrier will be controlled by a security gateman at all times and all drivers will have to register upon entering and leaving the site. Drivers will also be given verbal instruction as to the correct access to be taken onto the site (dependent on construction site activities).

Following measures will be taken on the site during the construction phase to avoid traffic congestion or any traffic accident, however, a detailed traffic management plan will be prepared by the contractor for the construction phase of the project:

- Efforts will be made to minimize the use of heavy trucks by preferring transport of equipment and supplies by 4x4 pickups, wherever possible, and
- A speed limit of not more than 30 km/h shall be imposed on unpaved roads and link roads for reducing traffic accident risks and dust generation.
- All the light vehicles cars, jeeps, etc, and heavy will be parked in a designated area.
- Speed breakers will be followed properly.
- Experienced license holders (drivers and operators) will be hired for transportation.
- All the heavy machinery will be checked properly and inspected regularly.
- Speed limit signboards will be installed at the project site.
- All the headlights, backlights, indicators, etc. of vehicles and machines will be checked and maintained regularly.
- All the warning lights, reverse back alarms will be maintained properly.

## 7.5 Plantation Plan

The construction of the 500/220/132 kV Chakwal Grid Station will involve potential removal of 49 trees, comprising Acacia modesta (Phulai), Dalbergia sissoo (Shisham), and Ziziphus spp. (Ber). These species are common in the project area and hold ecological, social, and economic value. However, it is important to note that not all trees will be cut. The contractor, at the time of construction, will carefully mark only those trees that are essential to remove for civil works or safety reasons. This process will be verified by the Implementation Consultant and NGC to avoid unnecessary tree loss. The remaining trees will be preserved and protected in place. The selective removal of trees will have minor to moderate localized impacts, including loss of shade, reduced carbon sequestration potential, and reduced biodiversity value. As the affected trees are not located within any protected forest or ecologically sensitive area, the overall impact is considered limited and reversible.

The details of trees are given below.

**Table 7-3 Trees to be Cut/Uprooted**

| Sr. No. | Name of Tree Species | No. of trees to be cut/uprooted | | |
|---|---|---|---|---|
| | | Young (Girth less than 24") | Mature (Girth more than 24") | Total |
| 1 | Acacia modesta | 250 | 69 | 319 |
| 2 | Dalbergia sissoo | 11 | 6 | 17 |
| 3 | Ziziphus spp. | 7 | - | 7 |

To offset this impact, a compensatory plantation program will be implemented at a minimum ratio of 1:10 (ten new trees for every tree removed). This will include plantation of indigenous and fast-growing species and the development of green belts within and around the grid station area, ensuring long-term environmental enhancement and improved landscape aesthetics.

However, it is recommended to plant 500 mature plants including trees, shrubs, and flowering plants, having 4-5 feet in height and 1.0 to 1.5 inches stem diameter at the Chakwal Grid Station Punjab Province Pakistan. The Contractor will ensure the provision of staff and budget for the implementation of the plantation plan.

The plantation of recommended indigenous species will be carried out at a distance of 8 feet having a distance of 8-10 feet among rows (in case of multiple rows).

The plantation plan consists of trees, shrubs, and flowering plants which are recommended for plantation.

***Trees (20 ft. and above)***

The trees comprising shady, flowering, fruit trees have been recommended for plantation at Chakwal Grid Station as shown in **Table 7-4**.

**Table 7-4 Recommended Trees**

| No | Botanical Name | Description |
|---|---|---|
| 1 | Pongamia glabra | A large flowering tree having good timber |
| 2 | Alstonia scholaris | An evergreen tropical tree in the family Apocynaceae. |
| 3 | Pilkan | A medicinal plant found in arid and semi-arid regions without a high nutritional value |
| 4 | Bauhenia varigated | A large flowering tree |
| 5 | Ficus relegiuosa | A tree with a large shade |
| 6 | Syzigium cumini | A fruiting plant that can easily be grown in a semi-arid climate |
| 7 | Delbergia sisso | A tree with a large shade |
| 8 | Malea azaderach | A tree with a large shade |

**Flowering Plants**

The flowering plants having positive psychological effects have been recommended at the substation as shown in **Table 7-5.**

**Table 7-5 Recommended Flowering Plants**

| No. | Scientific Name | Description |
|---|---|---|
| 1 | Meri gold | An evergreen flowering vine |
| 2 | Petunia | An evergreen flowering vine |
| 3 | Pansy | An evergreen flowering vine |
| 4 | Calendula | An evergreen flowering vine |
| 5 | Nausturcium | An evergreen flowering vine |
| 6 | Rose | Perennial flowering plant |

To offset the anticipated tree losses and enhance the environmental quality of the project area, a five-year plantation and landscaping plan has been developed. The plan emphasizes a mix of shade-providing, fruit-bearing, nitrogen-fixing, drought-resistant, and ornamental flowering species suitable for the semi-arid climate of the project area. Priority is given to native and locally adapted trees such as Pongamia glabra (Karanja), Ficus religiosa (Peepal), Syzygium cumini (Jamun), Alstonia scholaris (Devil Tree), and Bauhinia variegata (Kachnar), which provide multiple ecological and social benefits including shade, air purification, soil stabilization, and cultural value. In addition, flowering plants such as marigold, rose, bougainvillea, hibiscus, and chrysanthemum are included to improve the aesthetic appeal of the grid station and surrounding areas, while also supporting pollinators and community acceptance of the project. The plantation will be phased over five years, ensuring survival through regular monitoring, watering, mulching, pruning, pest management, and mortality replacement. The plan aims to establish a greenbelt and landscape buffer around the substation and approach roads, with an overall survival target of at least 80%, thereby contributing to long-term environmental enhancement and community well-being. See **Table 7-6** for details.

**Table 7-6 5-Year Plantation and Landscaping Plan**

| Year | Botanical Name | Common Name | No. of Plants to be Planted | Purpose / Benefit | Notes on Care & Monitoring |
|---|---|---|---|---|---|
| 1 | Pongamia glabra | Karanja | 50 | Shade, timber, nitrogen-fixing | Initial planting along boundary and approach road |
| | Alstonia scholaris | Devil Tree | 50 | Evergreen cover, air purification | Plant in rows near boundary fence |
| | Pilkan (Salvadora oleoides) | Pilkan | 30 | Drought resistant, medicinal | Suitable for dry patches |
| | Tagetes erecta | Marigold (Genda) | 200 | Seasonal color, pest repellent | Planted in beds near entrance and pathways |
| **Total Year 1** | | | 330 | | Site preparation, fencing, watering |
| 2 | Bauhinia variegata | Kachnar | 40 | Flowering, ornamental value | Inner plantation, adds landscape value |
| | Ficus religiosa | Peepal | 30 | Large shade, cultural value | Needs wider spacing, along open areas |
| | Rosa indica | Rose (Gulab) | 150 | Ornamental, fragrance, beautifies | Regular pruning and pest control |
| **Total Year 2** | | | 220 | | Mulching and irrigation during dry months |
| 3 | Syzygium cumini | Jamun | 50 | Fruit bearing, wildlife support | Plant near community access areas |
| | Pongamia glabra | Karanja | 30 | Timber, shade | Gap-filling plantation |
| | Bougainvillea glabra | Bougainvillea | 100 | Flowering creeper, fencing cover | Along boundary walls/fences |
| **Total Year 3** | | | 180 | | Survival check; replace 20% mortality |

| Year | Botanical Name | Common Name | No. of Plants to be Planted | Purpose / Benefit | Notes on Care & Monitoring |
|---|---|---|---|---|---|
| 4 | Alstonia scholaris | Devil Tree | 30 | Evergreen cover | Supplementary plantation |
| | Ficus religiosa | Peepal | 20 | Shade | Gap filling |
| | Bauhinia variegata | Kachnar | 30 | Ornamental | Enhancement plantation |
| | Hibiscus rosa-sinensis | China Rose (Gul-e-Khatmi) | 80 | Ornamental, perennial flowering | Hedge rows and landscaping |
| **Total Year 4** | | | 160 | | Regular monitoring, pruning |
| 5 | Syzygium cumini | Jamun | 40 | Fruit bearing | Enrichment |
| | Pilkan | Pilkan | 20 | Drought hardy | Last year reinforcement |
| | Pongamia glabra | Karanja | 30 | Timber/shade | Reinforcement |
| | Chrysanthemum indicum | Chrysanthemum | 120 | Seasonal, ornamental landscaping | Beds near office/greenbelt areas |
| **Total Year 5** | | | 210 | | Mortality replacement + maintenance |
| **Grand Total (5 Years)** | | | 1,100 Plants (Trees + Flowers) | | Overall survival target ≥ 80% |

## 7.6 Framework for Restoration and Rehabilitation Plan

This framework is intended to guide how NGC and contractor(s) will minimize a project's area of disturbance, create a stable landscape, and restore land and vegetation of disturbed areas. To help accomplish these goals, the NGC project contractor(s) will develop and implement a Site Restoration and Rehabilitation Plan that meets the requirements of this framework for each site where construction or other activities would result in adverse impacts on vegetation or landscape if no restoration activates were undertaken. Contractor(s) will be responsible for preparing a Plan and NGC will be responsible for reviewing and approving the Plan before it is implemented.

### 7.6.1 Approach and Activities

The key objective of the restoration and rehabilitation works is to restore disturbed land and vegetation, so they are at least equivalent to their pre-existing condition, with self-sustaining vegetation and minimal visual disturbance.

The Plan will be based in part on baseline conditions that existed prior to project disturbance, which would be described in the Environmental Impact Assessment (EIA) or other assessment documents. If this information is not available, those who prepare the Plan will need to develop an understanding of baseline conditions.

The Plan will include a comprehensive site layout and a detailed description of the location and area of disturbance. It will establish goals for ultimate land use and describe the details of how and when site restoration will be implemented and completed. Mitigation measures required by the EIA or other assessment documents will be the starting point, but additional measures will be adopted as needed to achieve the goals of the Plan.

For all project activities that involve land clearing, vegetation removal, or other major landscape disturbance, the Plan should introduce rehabilitation strategies including:

- Keeping the construction disturbance footprint as small as possible.
- Rehabilitating disturbed areas is not required for ongoing use in as timely a manner as possible (so-called "concurrent reclamation").
- Salvaging topsoil and subsoil for use in site rehabilitation and storing it so it maintains its value as a growth medium (e.g., limits to pile sizes, erosion controls).
- Covering disturbed areas, including road and earthworks batters, with subsoil and topsoil as needed, prior to seeding or planting grasses or other native species.
- Screening new visual objects with trees or other measures so they "blend" into the landscape.
- Using native (and local) species of grass and other plants for all reinstatement and landscaping work, with local seed sources used where practical. The plan should define the preferable and required plant species, based on flora baseline surveys, and identify appropriate sources, which may include seed collection in nearby areas to serve future rehabilitation.

- Monitoring rehabilitated areas regularly during and after construction until vegetation is self-sustaining for at least three years, with remediation works undertaken as required. This may call for watering in dry periods, protective sleeves for plants, or other measures to ensure vegetation survives until it can become self-sustaining.
- Maintaining site vegetation and landscaping works on project sites as long as the project remains.

The Plan must define rehabilitation completion criteria for determining whether and when a disturbed area is completely rehabilitated. The Plan should define realistic but achievable goals, including at least general guidelines on the desired percentage of ground cover, tree or shrub height, canopy cover, the complexity of different kinds of vegetation communities based on the land use prior to clearing, pre-existing health and integrity of the landscape, and land use requirements.

The Plan will require local consultations to ensure that local stakeholders' concerns and wishes are considered when developing and implementing rehabilitation and landscaping measures.

### 7.7 Environmental Management Team along with their Roles and Responsibilities

Institutions responsible for executing and monitoring the environmental aspects of this project are:

**NGC**: The top management of ESIC will be ultimately responsible to ensure that the EMP is implemented through a monitoring mechanism. For this purpose, ESIC will develop and maintain internal institutional capacity for environmental management.

**Contractors**: The NGC construction contractors (the 'Contractors') will be primarily responsible for the implementation of the EMP. Contractors will develop an internal monitoring and reporting mechanism for all activities undertaken. Contractors are also responsible for updating or making necessary changes to the EMP if and as required as a result of any changes in design or location, and ongoing reviews and requirements.

Specific roles and responsibilities for environmental monitoring are provided hereunder as shown in **Table 7-7**.

**Table 7-7 Roles and Responsibilities for Implementation of EMP**

| Aspect | NGC's ESIC Responsibilities | Contractor's Responsibilities | Relevant Documentation |
|---|---|---|---|
| Contracting | Ensure that the EMP implementation and internal monitoring and reporting requirements are included in the contract between NGC and the Contractors. | Understand the requirements and estimate the required resources. | The contract between NGC and Contractors |
| EMP Update | Review updated EMP if any changes to design happened | Update EMP if any changes to the design occur | Revised EMP |
| 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 and reporting to NGC. | Project EMP implementation and monitoring plans and budgets. |
| Environmental staff | Designate an HSE Manager for the Project | Appoint an officer dedicated to the environment (may be combined with health and safety, and for social issues). | Job descriptions. |
| Monitoring surveys and inspections | Undertake periodic inspections and carry out field measurements, where needed over and above those of the Contractor. Review Contractor monitoring. | Systematically observe and collect data on environmental performance, undertake inspections, and carry out surveys | Inspection and survey reports. |
| Environmental audit | Conduct periodic internal audits of the construction sites and commissioning third-party (external) audits | Conducting periodic internal audits. | Audit reports. |

| Aspect | NGC's ESIC Responsibilities | Contractor's Responsibilities | Relevant Documentation |
|---|---|---|---|
| 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 disseminate these to the management and appropriate staff members. | Periodic reports. |
| Corrective actions | Verify that the activities that are carried out comply with the 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 all incidents of environmental significance and related corrective measures. | Maintain monitoring data and record all incidents of environmental significance and related corrective measures. | Environmental databases. |

### 7.8 Schedule for implementation and Environmental Budget

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.

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 EIA and EMP are clearly understood and followed by all Project personnel in the course of the construction phase.

The Contractors will have primary responsibility for providing training to all construction personnel in line with the Training Plan shown in **Table 7-8**. The plan will be finalized before the commencement of the training.

**Table 7-8 Training Schedule**

| Target Audience | Trainers | Contents | Schedule |
|---|---|---|---|
| Contractor Supervisors/ Managers | NGC's ESIC Team | Induction training per 'Training Plan' | Before the start of construction activities |
| Selected management staff from the contractor | Contractor | Key findings of EIA<br>Mitigation measures<br>EMP | Before the start of construction activities |
| All site personnel | Contractor | Mitigation measures of EMP and EIA<br>Camp rules | Before and during construction activities |
| Construction crew | Contractor | EMP<br>Waste disposal procedures | Before and during construction activities |
| Drivers | Contractor | Road safety<br>Defensive driving<br>Road access restrictions<br>Vehicle movement restrictions<br>Waste disposal | Before and during the construction phase |
| Construction Staff | Contractor | Waste disposal<br>Vehicle movement restrictions | Before and during the construction phase |
| Camp staff | Contractor | Camp operation<br>Waste disposal<br>Natural resource conservation<br>Housekeeping<br>Camp Rules | Before and during the construction phase |

## 7.9 Environment Budget

An estimated cost for the implementation of mitigation measures prescribed in the Environmental Management Plan (EMP) has been provided in **Table 7-9.** 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.

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 NGC's ongoing environment management program.

**Table 7-9 Estimated Environmental and Social Management Costs**

| Cost Head | Details | Budget Required (PKR) |
|---|---|---|
| **Construction Phase** | | |
| Staffing | Environmental/ HSE Officer: 01 for 3 years (200,000x36),<br>HSE Inspector: 02 for 3 Year (100,000x2x36) | 14,400,000.0 |
| Monitoring and | Implementation of EMP (Third-Party Monitoring | 1,000,000.0 |

| | | |
|---|---|---|
| Mitigation Activities | for Air Quality, Noise and Water Quality- Quarterly) | |
| | Implementation of other EMP Measures during Construction such as Sewerage Treatment, Spill Management, etc. | 4,000,000.0 |
| | Plantation of trees | 500,000.0 |
| | PPEs (Hard Hat, Steel Toe Shoes, Coverall, Google, Gloves and Safety Harnes) | 2,000,000.0 |
| **Total: Twenty one million nine hundred thousand rupees only** | | **21,900,000.0** |

### 7.10 Proposed Monitoring Program to assess performance or output of EMP

A monthly report on the monitoring and compliance is to be provided to ESIC NGC by the Contractor based on the requirements set out in this section.

The monitoring report should be prepared by NGC through CC for submission to the local authorities or local offices of the Punjab EPA.

The EMP will be reviewed if the projects continue for more than a year, and updated annually, or more frequently based on the outcomes of reviews, monitoring by NGC, and inspections conducted by the Construction Supervision Consultants.

#### 7.10.1 Reporting and Feedback Mechanism

The Contractor will prepare a ‘Construction Management Plan’ (CMP) demonstrating the way they will comply with the requirements of mitigation measures proposed in the EMP of the EIA report. The CMP will form part of the contract documents and will be used as a monitoring tool for compliance. Violation of the compliance requirements will be treated as non–compliance leading to the corrections or otherwise imposing a penalty on the contractors

The contractor, through the environmental specialist on its team, will prepare periodic (not more than once every three months) status reports on the EMP implementation. Such reports will carry information on the main types of activities carried out within the reporting period, the status of any clearances/permits/licenses which are required for carrying out such activities, mitigation measures applied, and any environmental issues that emerged concerning suppliers, local authorities, and affected communities.

The Contractor’s reports will be based on reports prepared by various subcontractors and their monitoring and supervision. The contractor will assess how accurate is the information provided in the contractor’s reports, fill any gaps identified in them, and evaluate the adequacy of mitigation measures applied by the subcontractor. The contractor must highlight any cases of incompliance with EMPs, inform on any acute issues brought up by a contractor or revealed by the supervisor himself, and propose corrective actions.

After completion of the Contractor’s contract, NGC will oversee the operation and maintenance of the Project.

Feedback and adjustment will be carried out in two tiers. Upon request for EMP modification by the subcontractor, the Contractor and NGC will review the proposals in detail and consider their acceptance or rejection. Primarily, only those modifications will be considered, which do not contravene the conditions of the environmental approval from Punjab-EPA. NGC will consider the recommendations of the Contractor but it will be the final authority on approval of the change. It may decide to undertake studies before approval of the change.

### 7.10.2 Meetings

An effective mechanism to communicate and record environmental information during the Project is an essential requirement of an EMP.

Two kinds of environmental meetings will take place during the project:

- Kick-off meetings
- Fortnightly meetings

The purpose of the kick-off meeting will be to present the EMP to Project staff and discuss its implementation.

A fortnightly meeting will be held during the construction phase at the site. The purpose of this meeting will be to discuss environmental issues and their management. The proceedings of the meeting, the required action, and responsibilities will be recorded in the form of a brief report.

### 7.10.3 Change-Record Register

A change-record register will be maintained at the site, to document any changes in EMP and procedures related to changes in the project design, construction plan or external environmental changes affecting the EMP. These changes will be handled through the change management mechanism discussed later in this chapter.

## 7.11 Proposed EMP Reporting and Reviewing Procedures

The Plan must call for periodic inspection/monitoring of the construction footprint and project activities against the requirements of the Plan. For verification and monitoring, the Plan will need to specify:

- The locations and activities that will be monitored.
- The measurable/observable criteria by which implementation of rehabilitation and landscaping management will be judged successful, and when they will be considered complete.
- The timing and frequency of inspection and monitoring.
- The required qualifications of persons who will conduct the monitoring and inspection.
- Records that must be kept and the person responsible for keeping the records.

- Reports that will be prepared, to whom the reports are to be submitted for review and the length of time records will be kept.

The Plan must describe what actions will be taken, and by whom, if inspection/monitoring results show that satisfactory natural regeneration is not occurring, or the rehabilitation management practices do not meet applicable requirements, including the requirements of the Plan itself.

### 7.11.1 Implementation

The Plan must identify and describe the responsibilities of all parties, including the NGC and contractors. The Plan must also identify the roles and responsibilities of individual positions within the NGC and contractor. This should be shown in an organogram that includes as much detail as possible, down to the individual person/position.

Oversight activities of contractors and NGC will be laid out in detail in the Plan, including the frequency and scope of oversight activities. In all cases, NGC will remain ultimately responsible for the implementation of the EMP by the contractors.

### 7.11.2 Revision

The Plan will be reviewed by the contractor at least annually, and whenever there is a significant change in project or site conditions, when it is determined that any mitigation measure is or may be insufficient to achieve its purpose, and where non-compliance occurs with regard to the conditions of approval. It will be revised when necessary to update or improve rehabilitation and landscaping management, and when it is determined necessary to ensure compliance with applicable standards and good international industry practice.

## 7.12 Any Training needs required to ensure implementation of EMP and Monitoring Plans

The Plan must identify training requirements for staff and managers of the contractors, including who will be responsible for conducting the training and who must be trained in what skills. Training will focus on the assigned responsibilities of the trainees and will cover technical and administrative skills needed to perform assigned responsibilities, identification of response actions required in case of incidents, and topics related to occupational health and safety, including personal protective equipment required to conduct assigned activities.

## 7.13 Change Management

The Change Management System proposed for the project recognizes three orders of changes in the project design or project area:

**First-Order:** A first-order change leads to a significant departure from the project described in EIA and consequently requires a reassessment of its environmental impact. Examples of first-order changes include:

- Shifting the project area by more than 1 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.

A new environmental assessment will be conducted and a revised IEE/ EIA report submitted to the provincial EPAs for a first-order change in the project.

**Second-Order:** A second-order change entails project activities not significantly different from those described in the EIA.

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%.

**Third-Order:** A third-order change or uncertainty is of little consequence to the EIA findings. In case such a change is made, the only action necessary will be to update the EMP to reflect how the change has been dealt with.

Examples of third-order changes are:

- Shifting 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.

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.

## 7.14 Equipment Maintenance Details

### 7.14.1.1 Construction

Equipment during the construction phase includes dump trucks, loader trucks, excavators, cranes, front-end loaders, fuel tankers, water bowsers, cars etc. This equipment and other machinery will only be repaired at designated sites at the warehouse.

### 7.14.1.2 Operations

Limited vehicular movement by the maintenance team will be required on a need basis.

### 7.14.2 Confidentiality and Non-Retaliation

All complaints will be treated confidentially, and no retaliation shall be tolerated against any person who lodges a complaint. Anonymous grievances may also be accepted and investigated, depending on severity and feasibility.

### 7.14.3 Monitoring, Reporting and Record-keeping

All grievances and resolutions will be documented in the GRM Register maintained by NGC's Environment and Social Impact Cell.

A monthly summary of grievances, actions taken, and status will be submitted to the Punjab EPA and shared with KfW, if required.

A grievance log will be made publicly available (excluding confidential information) for transparency.

### 7.14.4 Special Provisions for Vulnerable Groups

Additional facilitation will be provided for women, elderly, differently-abled persons, and illiterate community members to access the GRM.

### 7.14.5 Awareness and Capacity Building

The GRM process will be explained during community meetings, and leaflets/posters will be distributed in local languages.

All contractor and NGC staff will be trained on the importance of GRM and how to respond professionally.

# 8 Grievance Redress Mechanism

## 8.1 Introduction

This chapter provides policy and procedure, hereinafter to be referred as “The Grievance Redress Mechanism (GRM)”, outlining a process for documenting, addressing, responding and employing methods to resolve project grievances (and complaints) that may be raised by affected persons or community members regarding major project specific activities such as, environmental and social performance, the engagement process, land acquisition and resettlement and/or unanticipated social impacts resulting from project activities that are performed and/or undertaken by project authority. The document describes the scope and procedural steps and specifies roles and responsibilities of the parties involved.

For the purpose of this GRM an ‘Affected Person (AP)’ means any person or entity that is adversely affected temporarily or permanently as a result of the project undertaken by the project authority or works carried out thereunder.

The term ‘Grievance/Compliant’ is confined to any formal communication made by an AP that expresses dissatisfaction and/or adversity about an action or lack of action, about the standard of service, works or policy, deficiency of service, works or policy of the project management and its implementation mechanism.

Moreover, the term ‘Implementation Period’ would mean the period starting from the date of the commencement of the project and ending on the date on which the project ends.

## 8.2 Principles

A GRM is proposed to address any complaints or grievances filed during the Implementation Period of the project undertaken by project authority. Members of the public and entities may perceive risks to themselves or their property or their legal rights or have concerns about the possible adverse environmental and social impact that a project may have. The primary principle is that any complaints or grievances should be addressed fairly, quickly, transparently and at reasonable costs, and without retribution to the AP.

All minor complaints regarding land or property disputes that can be resolved should be resolved immediately on the site at the village level. In case the concerned parties are unable to resolve the said dispute on the site the AP may make a Complaint to the Grievance Redressal Committee (GRC), the details of which are provided herein below. The focus of the GRM is to resolve issues in a customarily appropriate fashion and record details of the Complaint, the AP and the resolution.

## 8.3 Objectives

The objectives of the GRM are to:

- develop an organizational framework to address and resolve the grievances of AP(s) fairly, equitably and at reasonable costs;
- • provide enhanced level of satisfaction to the AP(s);
- • provide easy accessibility to the AP(s) for immediate grievance redressal;
- ensure that the targeted communities and individuals are treated fairly at all times;
- 
- identify systemic flaws in the operational functions of the project and suggest corrective measures; and
- ensure that the operation of the project is in line with its conception and transparently to achieve the goals for sustainability of the project.

## 8.4 Structure of Grievance Redress Mechanism

The project shall have multi-tier GRM with designated staff responsibilities at each level. These levels comprise the following:

### 8.4.1 Project Management Unit (PMU)/Project Implementation Unit (PIU) Level

The project authority shall constitute a Grievance Redressal Committee at PMU/PIU level (GRC-P) to resolve all Grievances and Complaints of the AP(s). The GRC-P shall comprise of the following members:

- Project Director (or his representative), NGC as Convener of GRC-P
- Deputy Manager (Social & Environment), NTDC as Secretary of GRC-P
- Representative of Land Acquisition Collectors (LAC) as Member
- Independent Consultant36 (a retired Land Acquisition Collector (LAC) (or equivalent who has knowledge of the land acquisition and process to resolve issues) as Member
- Representative from Consultant (male and female)37
- Notable personality from the area to be nominated in writing by the relevant District Administration in consultation with the community Note: Representative from any other Department may be called as and when required by the GRC-P.

PIU will install a complaint box in the office and dedicate a telephone number for registration of any Complaints. PIU will also designate a staff not below the rank of an Office Assistant who will also be the focal point, to record the Complaints and immediately report it in PIU and concerned officials.

36 PIU will hire this person as its consultant.

37 Once the consultant is hired. This representation can be from design, supervision, owner engineer or any other consultant depending upon the stage of project implementation.

The GRC-P, through the designated staff member, as mentioned above, will acknowledge the APs Complaint, scrutinize the record, explore the remedies available and request the AP to produce any record in favor of his claim. After thorough review and scrutiny of the available record on Complaint, visit the field and collect additional information, if required. Once the investigations are completed, the GRC-P shall provide with a decision within 21 days of receipt of the Complaint. If the AP is not satisfied, he/she will be allowed to elevate the Complaint to next level of GRM for resolution of his/her grievances within 07 days after communication of decision by the GRC-P.

### 8.4.2 NTDC Headquarter (HQ) Level

NTDC shall constitute a Grievance Redressal Committee at HQ level (GRC-HQ). The committee will have following composition:

- General Managers Projects Delivery North/South (as relevant) as Member, being the Convener of GRC-HQ
- Additional Director General ESIC as Member
- Gender Focal Point or NTDC female manager as Member
- Representative of the Land Directorate as Member
- Representative of the Legal Department as Member

This GRC-HQ, through its focal point, will acknowledge the APs Complaint, scrutinize the record of the GRC-P, investigate the remedies available and request the AP to produce any record in favor of his claim. After thorough review and scrutiny of the available record on Complaint, visit the field and collect additional information, if required. Once the investigations are completed, the GRC-HQ shall give decision within 21 days of receipt of the Complaint. If the AP is still dissatisfied with the decision, he can go to the court of law, if he/she so wishes. Gender representation will be ensured by inducting a female member in both GRCs. The mechanism will ensure the access of APs to a GRM that openly and transparently deals with the grievances and makes decision in consultation with all concerned that are consistent with Foreign Donor’s requirements and country safeguard system.

## 8.5 Grievance Redress Mechanism

The intention of GRM is to resolve a Complaint as quickly and at as low a level as possible to avoid a minor issue becoming a significant grievance. Irrespective of the stage of the process, AP has the option to pursue the grievance through the court as is his or her legal right in accordance with law. The details of the process are given below:

### 8.5.1 Grievance Redress Procedure

a. The Grievance or Complaint shall be made by filling in the Intake Form available at the designated office and on the website of the (project authority). The Intake Form can be directly submitted at the designated office, sent through email or be mailed to the address of the designated office. If the Complaint is verbal (through telephone or verbally at office), the office will arrange to convert verbal Complaint in written form (Please find enclosed the Intake Form);

b. A serial number will be assigned to it together with the date of receipt;

c. A written acknowledgement to the AP shall be sent promptly and in any case within not more than 3 working days. The acknowledgement shall contain:

i. The name and designation of the authorized representative (if the designated representative is in another office then the relevant address will also be included) who will deal with the grievance.

ii. Information that necessary actions will be taken within the specified working days from the date of receipt of the grievance by the authorized representative concerned.

d. If the office receiving the Grievance/Complaint is not the one designated to consider and dispose it, the receiving office shall forward it to the designated office, but after having complied with the requirements at (b to c) above;

e. The GRCs shall provide an opportunity of hearing to all the concerned parties and examine the relevant record before making the final decision;

f. The GRCs or its representative designated to consider the matter shall make every effort to ensure that grievances/ appeals are considered and disposed off preferably within the stipulated period; and

g. The complete records of all activities shall be kept and filed into the grievance database maintained by both the GRCs. The GRCs shall also be responsible to compile records of the GRM and make quarterly reports to the Foreign Donor or any other concerned authority.

### 8.5.2 Eligibility Criteria

The GRCs while considering the eligibility of the Grievance/Complaint shall take into account the following considerations:

• The severity of the Grievance;

• Potential impact on the AP;

• Potential impact on the project; and

• Public profile of the issue.

### 8.5.3 Follow up/Closeout

The Complaint shall be considered as disposed off and closed when:

- The designated GRC has decided/disposed-off the Grievance/Complaint in written form, stating therein the reasons for reaching the decision;
- Where the AP has indicated acceptance of the response of the GRC in writing;
- Where the AP has not responded to the GRC within one month of being intimated the final decision of the grievance officer on his Grievance/Complaint;
- Where the AP fails to attend the proceedings of the GRC within the stipulated period of the disposal of the Complaint; and
- Where the AP withdraws his/her Complaint.

## 8.6 Exclusions

The following allegations/Complaints shall not be construed or taken up for consideration and disposal as 'Grievances':

- Anonymous complaints or frivolous cases in respect of which inadequate supporting details are provided;
- Cases involving decisions/policy matters in which the AP has not been affected directly/indirectly;
- Cases where quasi-judicial procedures are prescribed for deciding matters or cases that are subjudice;
- A grievance which has already been disposed off by GRC;
- Complaints of corruption should be lodged and dealt with separately.

## 8.7 Information Dissemination and Community Outreach

GRM will also develop an information dissemination system to inform the APs about their rights under the statute LAA, 1894, World Bank's policy and approved RAP for the project. The APs will be informed about the GRM, its functioning and the complaint process.

## 8.8 Conclusion

This GRM is intended to be used for all World Bank, ADB and other Foreign Donor funded projects. It is intended that the GRM be reviewed if or when necessary to ensure that it can deal with a complex range of sub-projects in a manner that is appropriate and suits the social, cultural and legal situation in Pakistan.

# 9 Stakeholder Consultations

Stakeholder engagement (consultation) is an important feature of the environmental assessment, especially with the local population and key stakeholders (e.g., authorities, community leaders and organizations). Effective consultation can lead to acceptable decision-making regarding Project design and implementation and the stakeholders feel a sense of ownership. Stakeholder engagement was initiated at EIA level.

Stakeholders, especially the local population, involvement is an important feature of the environmental assessment and can lead to a better and more acceptable decision-making regarding the project design and implementation. Public involvement, undertaken in a positive manner and supported by a real desire to use the information gained to improve the Project design, will lead to better outcomes and lay the basis for on-going positive relationships between the stakeholders. Public involvement is necessary for smooth implementation of the project. The local community support is also required for the success of the Project.

Public consultation was carried out with relevant government departments, concerned individuals, institutions and PAPs in all accessible villages in the AOI during the month of September to November 2024 and April 2025. These consultations were conducted together with the baseline survey.

The feedback and issues raised during the consultation were recorded and documented.

The stakeholder consultations had the following main objectives:

- Sharing of information with government authorities, local communities and affected persons about the proposed Project and expected environmental and social impacts;
- Understanding the stakeholders concerns regarding various aspects of the Project, including the existing situation, grid station location, land acquisition, compensation and the potential impacts of the construction-related activities and operation of the Project;
- Recording the feedback of public in order to develop a mechanism to address their issues and other local level concerns and incorporation of the outcomes in final decision making; and
- Acquire latest data, information and other approved procedures relevant to the Project form the concerned government authorities.

Stakeholder Mapping Identification of stakeholder is an important step which ensures that all stakeholders are identified and classified as per their role about the Project. The Project identified primary as well as secondary stakeholders as defined below. As per definition, stakeholder is a person or an institution/organization that is affected or in any way can be determined to have an interest in the proposed Project.

Stakeholders can be divided into two main groups, Primary Stakeholders and Secondary Stakeholders. Primary stakeholders are those who are directly affected due to the loss of assets and conditions. The secondary stakeholders include government departments and agencies that has an interest in or in some way through planning and implementation will be involved in the Project. The secondary stakeholders with regard to the Project were identified to include:

- Environmental Protection Department (EPA);
- NGC
- Revenue Department;
- Forest Department Punjab;
- Agriculture Department, Chakwal;
- District and Local Governments;
- Social Welfare Department;
- The local business community.

The National Grid Company (NGC), formerly NTDC**,** is the responsible authority for the 500/220/132 kV Chakwal Grid Station Project. The EIA has been prepared in close coordination with NGC's Environmental and Social Impact Cell (ESIC), which is responsible for overseeing environmental and social compliance during project planning, construction, and operation. The list of Proponents/ESIC Environmental team is given below:

**Table 9-1 List of Proponents/ESIC Environmental team**

| Name | Project Position | Qualification and Experience |
|---|---|---|
| Muhammad Irfan | Manager Environment and Social Impact Cell, NGC | M. Phill Environmental Sciences,<br>Master of Public Administration (MPA)<br>Overall Environment Management Experience: Over 15 Years. |
| Muhammad Shahid Saleem | Deputy Manager Environment NGC | M. Phill Environmental Sciences,<br>Master of Public Administration (MPA)<br>Overall Environment Assessment Experience: Over 15 Years. |
| Fawad Ahmad | Assistant Manager Social, NGC | M. Phil M. Phill Environmental Sciences,<br>Master of Public Administration (MPA)<br>Overall Social Assessment Experience: Over 08 Years. |
| Ms. Arooj Bakhtawar | Assistant Manager Environment, NGC | M.Sc. Environmental Engineering<br>Overall Environment Management Experience: Over 05 Years. |

Details regarding roles and responsibilities of the concerned agencies and departments are given in **Table 9-2** below.

**Table 9-2 Role of Concerned Agencies/Departments**

| **Project Stakeholder** | **Name** | **Roles** |
|---|---|---|
| National Authorities | EPA | Recently due to the 18th amendment Pak EPA has delegated all his Powers to the provincial EPAs. Now the Provincial EPAs are the responsible for the protection of the environment as per Punjab Environmental Protection Act 1997 and all its provisions. |
| | NGC | NGC is the Project Proponent of the proposed Project. NGC operates and maintains nine 500 KV Grid Stations, 4,160 km of 500 KV TLs and 4,000 km of 220 KV TLs in Pakistan. NGC also perform the following task in the country;<br>o Central Power Purchasing Agency;<br>o System Operator;<br>o Transmission Network Operator; and<br>o Contract Registrar and Power Exchange Administrator. |
| Punjab Authorities | Environmental Protection Agency, Punjab | EPA, Punjab is the regulatory authorities and mainly responsible for the development and implementation of the environmental policies and strategies in order to integrate the environmental issues and |
| Project Stakeholder | Name | Roles |
| | | sustainable development approaches into the legal and regulatory frameworks as per Punjab Environmental Protection Act, 1997;<br>EPAs are responsible for the issuance of NOC of the Proposed Project;<br>EPA Punjab is responsible for the compliance of EMP and NOC provision during the construction and operation stages of the Project. |
| | Agriculture Department | Promoting high value crops, fruits and vegetables;<br>Promoting export of high value agricultural products;<br>Promoting efficient use of water and other inputs;<br>Development of arable waste lands<br>Ensuring fair returns for the growers in marketing of their produce. |

| | | |
|---|---|---|
| | Forest Department | Protection, improvement and maintenance of existing forests;<br>Increase forests by planting new trees;<br>Extension and advisory services to the general public about tree plantation; |

## 9.1 Consultation Outcomes

Consultations were carried in out in the villages falling within the area of the proposed grid station. In total 16 consultation meetings were held with directly and indirectly affected villages and communities. The majority of the people who participated in these consultations were village leaders and elders who according to local culture and custom are those who have decision power in the community.

The socio-economic survey was carried out in conjunction with the consultations which took place from the Aug 2024 to April 2025.

### 9.1.1 Consultation with Government Officials

The consultative meetings were held with officials of concerned government departments in Chakwal as a part of stakeholder consultation process for the Project. The following departments at province and district level in Chakwal were consulted:

- Environment Protection Agency (EPA), Chakwal;
- Agriculture Department, Chakwal;
- Additional Deputy Commissioner Revenue Dept., District Chakwal
- Asst. Commissioner, District Chakwal;
- Executive Director, Power Systems, GOPA - International Energy Consultants GmbH( Design Consultant;
- Deputy Director Social Welfare Department, Chakwal;
- Revenue Department, Chakwal;
- Forest Department, Chakwal;
- NGC Chakwal; and
- Social Welfare Department, Chakwal.

The **Table 9-3** below presents the issues and concerns raised by the different departments that were consulted with.

**Table 9-3 List of Consultations with the Stakeholders in Chakwal district**

| Sr. No. | Department | Concerns/Observations |
|---|---|---|
| 1 | **Agriculture Department**<br>**Designation:** Deputy | Mr. Muhammad Aslam Deputy Director told that there is no potentially major agriculture loss foreseen in proposed Chakwal grid station by the subject |

| Sr. No. | Department | Concerns/Observations |
|---|---|---|
| | Director, Chakwal<br>**Name:** Mr. M. Aslam<br>**Contact No.:** 03359933220 | Project is passing mostly through the barren area; However, the substation grid station area covering 751 kanals agriculture land will be lost;<br>He also explained that the barren land has potential for agriculture;<br>The govt. of Punjab is promoting agriculture in barren areas of Chakwal and providing subsidy for high efficiency irrigation techniques for the enhancement of agriculture in the area;<br>He recommended that small canal systems should be proposed for the development of agriculture in Chakwal through the development of small dam because drip irrigation is not applicable for large scale irrigation;<br>He recommended consulting the Lahore head office of agriculture department for further information regarding crop rates including in the Project area;<br>The government have developed several small dam in Chakwal such as the mosal dam, the khanpur dam etc. to irrigate the barren land and for the water supply to the local population. |
| 2 | **Revenue Department**:<br>**Designation**: Additional Deputy Commissioner Revenue Department, District Chakwal<br>**Name**: Mr. Tanver ur Rehman<br>**Contact No.:** 0543660102 03015916918 | The official stated that agriculture is a major livelihood in Punjab, so special attention must be given if there is change of land-use.<br>He also asked about the distance of the proposed TL from the nearest protected areas in Chakwal;<br>He also inquired about the monitoring mechanism that will be adopted at post level of the Project.<br>The Project is appreciable in view of the prevailing electricity shortage.<br>The Project is in national interest and should be executed in a way so that minimum loss of agriculture land is ensured. |
| 3 | **Forest Department**<br>**Designation:** Divisional Forest Officer<br>**Name:** Mr. Shekh Manzoor<br>**Contact No.:** 0543-660067 | The officer informed that the Forest Department has developed a table for the compensatory rates of plantation which are based on the market prices; and<br>He advised that cutting of trees should be avoided as far as possible and also shared the information about different species of trees present in the Project area. |
| 4 | **Social Welfare Department**<br>**Designation:** Deputy | The officer informed that that there are no National or International NGOs working in the Project area; However, there are a few local and non-registered |

| Sr. No. | Department | Concerns/Observations |
|---|---|---|
| | Director<br>**Name:** Raja Tanveer Safdar<br>**Contact No.:** 0543-553353 | NGOs working in all the district in areas such as health care, mother and child development etc.;<br>The officer suggested considering a social welfare program along with the Project especially in for improvement of the living condition for the local population. |
| 5 | **Government of Punjab**<br>**Designation:** Asst. Commissioner, District Chakwal<br><br>**Name:** Mr. Muzzafar Muhtar<br>**Contact No.:** 03347755055 | .<br>The Assistant Commissioner informed that initially the plans entailed acquisition of about 800 kanals land, which subsequently was reduced to app.751 kanals. The section-IV order for acquiring the land was issued for 800 kanals out of which 751 kanals has been acquired by NGC as per final design.<br>Proceedings of section 5, 6 and award under section 11 has been done as per Land Acquisition act 1894.<br><br>Negotiation regarding the compensation process has been completed with the families (PAPs) that are affected by the substation. |
| 6 | **Environmental Protection Department, Chakwal**<br>**Name:** Mr. Nazir Ahmed<br>**Contact No.:** 0307-6726874 | In case of affected agricultural land, payment of compensation for affected crops should be according to the prevailing rates;<br>Interest of local communities must be given priority in the form of development initiatives such as drainage canals, drinking water supply and other public amenities;<br>It was suggested that the public hearing should be held in Chakwal.<br>With the acquisition of land NGC requires to submit EIA report to EPA Punjab before construction. |
| 7 | **Revenue Department**<br>**Designation:** Tehseeldar, Chakwal<br>**Name:** Qaiser Mehmood<br>,<br>**Contact No:** 03225874544 | Mr. Qaisar expressed appreciation of the Project as it will help to overcome the electricity crisis of the area;<br>He added that the consultations should be conducted with the families that are affected by the Project till the project completion. |
| 9 | **NGC Chakwal**<br>**Name:** Anwer Hussain Shah<br>**Contact No.:** | Efforts should be made to keep the route away from the populated areas;<br>The officer advised that cutting of trees and bushes should be minimised. |
| 10 | Mr. Asghar Khan, CE, | Chakwal substation is restored to the original site. |

| Sr. No. | Department | Concerns/Observations |
|---|---|---|
| | NGC<br>Mr Adnan, Project Director, Chakwal Project | Section 9 and 10 of Land Acquisition are issued, copy of which will be provided to consultant, via an email.<br>The map of restored site for the substation is still unavailable, however, it will be shared with Consultants<br><br>Land has been acquired. Compensation with allowances has been paid to all PPAPs |
| 11 | **NGC**<br>**Name:** Mr. Ahsan Javed<br>**Contact No.:03188126765** | Crop compensation should also be paid along with land acquisition and NGC is estimating the compensation<br>Establishment of Site Office and GRM is also planned before construction. |

## 9.2 Environmental Practitioners and Experts

The findings of consultation with the environmental practitioners and experts are mentioned below in **Table 9-4**.

**Table 9-4 Consultation with Environmental Practitioners and Experts**

| No. | Name | Organization | Designation | Views |
|---|---|---|---|---|
| 1 | Muhammad Waqar Saleem | Earthcon Management & Development Solutions (EMDS) | Social and Environment Expert | Vulnerables should be kept on high priority. Practices to accommodate the affectees should be considered. |
| 2 | Aleem Butt | Asian Consulting Engineers Pvt. Ltd. | Environmental Expert | Plantation plan and rehabilitation plan should be completed as per policies and requirements. Mitigation measures should be added in the report. |
| 3 | Mr. Jenz Johons | Multitech Consult | E & S Expert | Gap in national legislation should be filled with help of international best practice |
| 4 | Mr. A. Kostas | Gopa Intech | E & S Expert | Design must be E & S responsive |

## 9.3 Affected and Wider Community

The affected community for the proposed 500/220/132 kV Chakwal Grid Station comprises individuals, households, and entities directly influenced by land acquisition, construction activities, or operational impacts of the project. This includes:

- Landowners and households from Rabbal and Khewal villages whose land is acquired for the grid station site and associated infrastructure (100 household).
- Residents in the immediate vicinity of the project area who may be exposed to temporary impacts such as noise, dust, and restricted access during construction.
- Local businesses and service providers in the two villages that may experience short-term economic opportunities due to project activities.

The wider community refers to stakeholders located beyond the immediate project footprint who may not experience direct land or asset loss but could be indirectly impacted or benefit from the project. This group includes:

- Communities along access roads leading to the grid station, particularly those in Rabbal and Khewal.
- Residents of surrounding villages and Chakwal city, who will benefit from improved electricity supply, reduced outages, and enhanced reliability of power infrastructure.
- Educational, health, and public institutions in the wider area that will gain from more stable power supply, enabling improved services.
- Local government departments and service agencies involved in project coordination, permitting, and monitoring.

The project's stakeholder engagement has been designed to address both affected and wider communities, ensuring inclusive participation, transparent communication, and equitable consideration of community concerns throughout the project life cycle.

### 9.3.1 Consultation Methodology

The stakeholder consultation process was undertaken in various stages. It began with the identification of the Project stakeholder groups and individuals, which required an understanding of the potential environmental and social impacts resulting from the Project activities as well as the existing environmental setting of the Project. This understanding was acquired through a detailed review of the available literature on the region and a review of similar projects undertaken elsewhere. The Project stakeholders were categorized into two main groups i.e. community stakeholders and institutional stakeholders.

Consultations were undertaken with the stakeholders in which the project information was communicated to the stakeholders and their feedback was documented for use in the EIA. The baseline survey for the EIA was planned for the collection of baseline data and stakeholder consultations.

### 9.3.2 Consultation Material

A Basic Information Document (BID) was prepared for communities in the AoI. BID was distributed to stakeholders during the consultation to inform the stakeholders about the project. The BID contained information about the Project and the EIA process.

A consultation form was used to record the issues, concerns and suggestions of the stakeholders.

### 9.3.3 Community Consultation Mechanism

The consultations carried out in the project area covered both directly and indirectly affected people. As local culture does not allow direct consultations with women, information regarding women's situation was collected through indirect methods. The consultations were carried out during October and November 2024 in all the villages affected by the Project.

It is recommended that stakeholder consultations are continued and conducted at the construction and operational stages of the Project. The institutional responsibilities for construction and post-construction stage consultations rests with NGC

The consultations meeting venues and number of participants are listed in the **Table 9-5** below.

**Table 9-5 List of Village Consultation**

| Type of Meeting / Consultation & Agenda | Date | Venue | Target Group | Number of Participants | Remarks |
|---|---|---|---|---|---|
| **Information Disclosure** | 25-08-2024 | Rabbal | Resource Persons of LARP studies, Teachers, Mosque/Imam Bargah Heads, village Nazim | 09 | Informal meetings to convey study requirements and clear confusions, pre-tasting of survey tools, arrangements for detailed survey and meetings |
| **Information Disclosure** | 25-08-2024 | Khewal | = | 11 | Informal meetings to convey study requirements and clear confusions, pre-tasting of survey tools, arrangements for detailed survey and meetings |
| **Socioeconomic Survey** | 14 to 18-09-2024 | | All PAPs | 100% PAPs contacted | Sample semi-structured questionnaire are attached as Annex-3 |
| **Consultative Meeting** | 20-09-2024 | Khewal | All PAPs (Anyone/stakeholder from general public could be attended) | 40 | Joint visit of ESIC, NGC & Multiconsult Local Team (Project Coordinator & Sociologist) |
| **Update of** | 27 & | Khewal | All PAPs | 100% | Verification of PAPs List |

| Type of Meeting / Consultation & Agenda | Date | Venue | Target Group | Number of Participants | Remarks |
|---|---|---|---|---|---|
| **Socioeconomic Survey** | 28-09-2024 | & Rabbal villages | | PAPs contacted | provided by LAC |
| **Meeting with Revenue Department** | 17-09-2024 | Chakwal | Assistant Commissioner & Revenue Officers | 05 | Details collected are represented in section 3.4 of this LRP |
| **Meeting with Agriculture Department** | 10-04-2025 | Chakwal | Deputy Director Agri & Team | 05 | Data & Statistics on agriculture, livestock and agriculture development plan, presented in LEP |
| **Meeting with Social Welfare Department** | 10-04-2025 | Chakwal | Director Social Welfare | 04 | Status of NGO working in area and other social parameters. Data regarding social welfare programs in project are to develop LRP interventions, especially for vulnerable groups |
| **Focus Group Discussion (FGD-I)** | 16-09-2024 | Khewal | Vulnerable Males | 18 | - |
| **FGD-II** | 16-09-202 | Khewal | Vulnerable Females/Widows | 11 | = |
| **FGD-III** | 17-09-2024 | Rabal | Vulnerable Males | 7 | = |
| **FGD-IV** | 17-09-2024 | Rabal | Vulnerable Females/Widows | 11 | = |
| **FGD-V** | 17-09-2024 | Rabal | Youth & PAPs interested in Jobs & Capacity Building | 18 | = |
| **Consultation with NGOs** | 19-09-2024 | Sehgal abad | Akhuwat, FPAP NRSP, VTI | various | - |
| **Meeting with Revenue Officer** | 20-09-2024 | Khewal | Revenue Officer/Patwari PAPs | 14 | Demarcation of individual Boundaries with help of Khasra No. identification of owners of new area |
| **FGD-VII** | 20-09-2024 | Rabal | = | 18 | = |
| **FGD-VIII** | 20-09-2024 | Rabal | Vulnerable Groups | 7 | Follow-up Consultation with Vulnerable Groups |

| Type of Meeting / Consultation & Agenda | Date | Venue | Target Group | Number of Participants | Remarks |
|---|---|---|---|---|---|
| **FGD-IX** | 20-09-2024 | Khewal | Youth & All PAPs interested in Capacity Building for Implementation Phase | 18 | = |
| **FGD-X** | 11-11-2024 | Khewal | Youth & All PAPs interested in Capacity Building for Implementation Phase | 22 | |
| **FGD-XI** | 11-11-2024 | Rabal | Youth & All PAPs interested in Capacity Building for Implementation Phase | 24 | |
| **FGD-XII** | 12-11-2024 | Khewal | Youth & All PAPs interested in Capacity Building for Implementation Phase | | 38 |
| **FGD-XIII** | 12-11-2024 | Rabal | Youth & All PAPs interested in Capacity Building for Implementation Phase | | 17 |

### 9.3.4 Consultation with People Affected by the Substation

Feedback received during public consultation includes both Project related concerns and other/general concerns. The questions and issues raised in connection with the consultations mainly concerned compensation for loss of land and crops, livelihoods, power supply and electrification as well as water supply, health facilities and sanitation facilities, road infrastructure, education and security.

The main issues raised during the consultation with people affected by the substation is summarized below:

- People owning land that will be affected by the prosed substation informed that this area has very fertile soils and therefore they would be rather unwilling to lose;
- The land owners suggested that local government should consider nearby land which is not so fertile;
- If the land to be acquired for the grid station has been finally identified and decided on compensation for this land should be according to existing market prices;
- The land being considered is located in an area with non-salty ground water and therefore the compensation should high;
- PAPs emphasised that the land at the substation location is valuable as it is conveniently located along the main road and provides them with a good source of income which also is also the major source of income for most;
- Regarding market prices of land in the area people maintained that it ranges from PKR 2.5 to 4.0 lacs per kanal, corresponding to PKR 2,00,000 to 3,200,000 per acre;
- They also expressed a grave concern about their livelihoods which because of the project will be lost permanently.
- PAPs expressed their demands for good and high enough compensation so that they can purchase replacement land easily.;
- Some of the PAPs indicated that replacement land in nearby areas instead of cash compensation would be acceptable to them;
- Concerns about political interference were expressed and it was emphasized that the cash compensation should be paid directly to the PAPs;
- It was emphasised that agricultural land was their sole source of income and that they did not possess any technical and vocational skills. Chances of non-agricultural based incomes were therefore small so that without land they would not be able to provide for themselves and their families.
- In terms of benefits the people affected by the substation expressed that would like to be provided with electricity at a subsidised rate; and
- It was also suggested by some people that their children, which have skills should be given employment on the Project during the construction stage.

### 9.3.5 Summary of Concerns Raised by Stakeholders

As mentioned above, there were many comments made by the PAPs about public services and amenities in the project area.

**Water Supply/Drinking Water/Irrigation Water**

Water scarcity is a big issue in most of the settlements as the accessible ground water is neither good for drinking nor for irrigation of crops. In some areas such as Nachindi, Pataki, Mulhal Mughlan, drinking water is salty PAPs therefore demanded that clean and safe drinking water should be provided through water a supply system providing potable water.

**Sewerage System**

There is no proper sewerage system in most of the villages in the project area which causes health problems. PAPs in the substation area therefore demanded that sewerage system should be installed to improve sanitation conditions in the villages.

**Health and Medical Facilities**

Water borne diseases are common in most of the villages along route alignment. Diseases such as jaundice, hepatitis, fever, tuberculosis and stomach disorders etc. are common in these areas. Hospitals are mostly far away while dispensaries in the project area are not fully equipped and staffed. People demanded that better health facilities should be provided. It was especially mentioned that reproductive health facilities are lacking in the area, compelling them to travel long distances to access such services.

**Public Infrastructures/ Roads**

The road infrastructure is poor in project area where most villages only have simple access tracks that tend to become impassable during the rainy season. Improvement of roads and tracks were therefore demanded.

**Education**

Schools are of a poor standard and are poorly equipped in the project area. During the consultations, it was therefore suggested that the project should provide support to upgrade education services for the PAPs.

### 9.3.6 Gender Related Issues

Gender related issues and concerns were discussed in focus group discussions (FGD) arranged alongside the consultation meetings. The main concerns raised by women included:

- Women are afraid that they will have to restrict their movements during the construction phase when outsiders will come into their area. The Project should therefore not be implemented during the harvesting season as women then are working in the fields;
- It was suggested that the Government should provide job opportunities for literate women within the education and health sectors. Women also demanded that during construction stage male household member should be provided with jobs on the project.
- Women complained of lack of alternate working opportunities outside of agriculture.

# 10 Conclusions & Recommendations

## 10.1 Conclusions:

Based on the preliminary plans, environmental and social field surveys, and impacts assessment of the proposed substation the major impacts are summarized as under:

- No protected forest area or wildlife sanctuary or any other environmentally sensitive site will be affected by the project;
- There are risks that a number of negative impacts can be caused by the project such as soil erosion, soil contamination, water contamination, air pollution and high noise levels However, most impacts will be of a temporary nature during the construction stage and can be controlled and mitigated by good construction practises;
- There will be social issues such as community health and safety and occupational health and safety that can and must be controlled and mitigated the contractor and NGC;
- No indigenous peoples have been identified in the Area of Influence of the project;
- The construction of the new substation will improve transmission of electricity and increase its supply in the national grid. This will help to reduce the load shedding and will reduce the load on the nearby grid thereby improving the overall electricity efficiency;
- Expansion of the industrial base is expected due to the increase in the availability of electricity in the national grid.

## 10.2 Recommendations

Comprehensive mitigation and monitoring measures have been proposed in this report to minimise the negative impacts and to enhance the positive impacts of the project. These should be implemented in accordance with the recommendations in the ESMMP in Volume IV of this report and monitored followed up by the project proponent, NGC, during construction and operation of the project.

Furthermore, a detailed Livelihood Restoration Plan should be elaborated for the PAPs, including the vulnerable groups who partly (25 households) or fully (97 households) will lose their livelihoods as a consequence of their agricultural land being compulsorily acquired for the substation construction. Such a Livelihood Restoration Plan (Volume III) is designed through a full LARP (Volume II) study.

## Appendix -1. Departments and Organizations Consulted

As part of the EIA process for the 500/220/132 kV Chakwal Grid Station, consultations were held with relevant government departments, non-government organizations, and community-based institutions to gather baseline information, identify potential concerns, and integrate stakeholder perspectives into project planning. The key entities consulted included:

1. **Forest Department** – For information on local vegetation, tree removal requirements, and compensatory plantation guidelines.
2. **Revenue Department** – To obtain land ownership records, cadastral maps, and details of land acquisition processes.
3. **Agriculture Department** – For data on cropping patterns, agricultural productivity, and potential impacts on farmland.
4. **Social Welfare Department** – To discuss community development needs, vulnerable group support, and social services in the area.
5. **Akhuwat Foundation** – For insights on local poverty alleviation initiatives and microfinance support to affected households.
6. **Family Planning Association of Pakistan (FPAP)** – To assess health and family welfare services available to communities.
7. **National Rural Support Programme (NRSP)** – For information on community mobilization, livelihood programs, and rural development activities.
8. **Vocational Training Institute (VTI) / Technical Education and Vocational Training Authority (TEVTA) Chakwal** – To explore opportunities for local skills development and employment in project-related activities.
9. **National Grid Company (NGC), formerly NTDC** – For project-specific technical details, operational requirements, and environmental safeguards relevant to grid station design and operation.

These consultations contributed to a comprehensive understanding of the environmental, social, and economic context of the project area and informed the formulation of mitigation measures and community benefit initiatives.

## Appendix -2. Terms of References

The Overall Responsibility of Environment and Social Impact Cell of NGC is comprised on following tasks.

- Meet the environmental and social safeguards requirements of International Financing Institutions (IFIs) like ADB, World Bank, JICA, AFD, KfW etc.
- To fulfill the requirements of local regulators like Environmental Protection Agencies (EPAs) of all the provinces including federal, AJK and GB.
- Conduct public hearings, address comments by EPAs and fulfill all pre-requisites until the NOC issuance.
- Monitor the EMP/SSEMP implementation progress onsite through field visits;
- Assess the progress as per the requirements given in EMP/SSEMP/Environmental Approval from EPA and address the gaps to ensure compliance;
- Submit environmental monitoring reports on the prescribed format to respective IFI as well as to EPAs;
- Update the safeguards documents if required.

## Appendix -3. Laboratory Provided Analysis Reports

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# ENVIRONMENTAL MONITORING & ANALYSIS REPORT

**NTDC Grid Station, Chakwal**

- Ambient Air Monitoring
- Noise Level Monitoring
- Ground Water Analysis

Page 1 of 2

Reference No: AES-ENV-NT-139/2024

Dated: 05 August, 2024

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# Ambient Air Monitoring Location-01

## NEAR MAIN GATE

## Chakwal Grid Station




Document No. AES/LMS/FRM-115, Date of Issue 07 July, 2022, Revision No. 00

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## Ambient Air Monitoring Report

**Monitoring Details**

| | | | |
|---|---|---|---|
| **Reference Number** | AES-ENV-NT-139/2024-AA-01 | **Monitoring Point** | Near Main Gate |
| **Date of Monitoring** | 19-07-2024 to 20-07-2024 | **Monitoring Coordinates** | 32°55'07" N 73°04'17" E |

| Sr. No. | Time | CO (mg/m³) | NO (µg/m³) | $NO_2$ (µg/m³) | $NO_x$ (µg/m³) | $SO_2$ (µg/m³) |
|---|---|---|---|---|---|---|
| 1 | 12:00 | 1.01 | 11.71 | 21.18 | 32.89 | 44.96 |
| 2 | 13:00 | 1.05 | 12.04 | 22.04 | 34.08 | 46.05 |
| 3 | 14:00 | 1.09 | 12.58 | 23.26 | 35.84 | 48.25 |
| 4 | 15:00 | 1.11 | 12.76 | 24.05 | 36.81 | 48.95 |
| 5 | 16:00 | 0.96 | 13.03 | 24.73 | 37.76 | 50.65 |
| 6 | 17:00 | 0.98 | 12.55 | 25.59 | 38.14 | 51.77 |
| 7 | 18:00 | 0.80 | 12.16 | 25.07 | 37.23 | 49.58 |
| 8 | 19:00 | 0.83 | 11.71 | 24.11 | 35.81 | 47.65 |
| 9 | 20:00 | 0.86 | 11.16 | 23.96 | 35.11 | 46.63 |
| 10 | 21:00 | 0.89 | 10.86 | 23.62 | 34.48 | 45.77 |
| 11 | 22:00 | 0.71 | 10.46 | 23.04 | 33.50 | 45.53 |
| 12 | 23:00 | 0.71 | 10.07 | 21.84 | 31.90 | 45.53 |
| 13 | 00:00 | 0.70 | 10.09 | 15.70 | 25.79 | 29.86 |
| 14 | 01:00 | 0.69 | 10.00 | 15.34 | 25.34 | 29.49 |
| 15 | 02:00 | 0.66 | 09.83 | 14.83 | 24.67 | 20.98 |
| 16 | 03:00 | 0.67 | 01.00 | 14.80 | 15.80 | 20.43 |
| 17 | 04:00 | 0.67 | 09.37 | 14.85 | 24.22 | 19.98 |
| 18 | 05:00 | 0.71 | 09.59 | 15.53 | 25.12 | 20.45 |
| 19 | 06:00 | 0.74 | 10.08 | 16.32 | 26.39 | 21.63 |
| 20 | 07:00 | 0.78 | 10.43 | 16.60 | 27.03 | 22.26 |
| 21 | 08:00 | 0.82 | 10.90 | 17.18 | 28.08 | 23.25 |
| 22 | 09:00 | 0.87 | 11.19 | 17.39 | 28.58 | 23.88 |
| 23 | 10:00 | 0.94 | 11.84 | 17.89 | 29.73 | 25.26 |
| 24 | 11:00 | 1.07 | 12.53 | 18.23 | 30.76 | 26.72 |
| | Average Concentration | **0.85** | **10.75** | **19.88** | **30.63** | **35.65** |

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Approved By (QM/Chief Chemist)

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## Ambient Air Monitoring Report

**Monitoring Details**

| | | | |
|---|---|---|---|
| **Reference Number** | AES-ENV-NT-139/2024-AA-01 | **Monitoring Point** | Near Main Gate |
| **Date of Monitoring** | 19-07-2024 to 20-07-2024 | **Monitoring Coordinates** | 32°55'07" N 73°04'17" E |

| Parameters | Units | Monitoring Duration | LDL | Average Obtained Concentration | PEQS | Remarks |
|---|---|---|---|---|---|---|
| Nitrogen Dioxide ($NO_2$) * | µg/m³ | 24Hours | 1.00 | 19.88 | 80.0 | Optimal |
| Nitrogen Oxide (NO)* | µg/m³ | 24Hours | 1.00 | 10.75 | 40.0 | Optimal |
| $NO_x$* | µg/m³ | 24Hours | 1.00 | 30.63 | - | - |
| Sulphur Dioxide ($SO_2$) * | µg/m³ | 24Hours | 1.00 | 35.65 | 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 | 78 | 150 | Optimal |
| Particulate Matter ($PM_{2.5}$) * | µg/m³ | 24Hours | 1.00 | 23 | 35 | Optimal |
| Total Particulate Matter (TSP) | µg/m³ | 24Hours | 1.00 | 115 | 500 | Optimal |

*Parameters are approved from Punjab Environmental Protection Agency.

**Abbreviations:**
LDL= Lower Detection Limit PEQS= Punjab Environmental Quality Standards µg/m³ = Micro Gram per Meter Cube
Mg/m³ = Mill 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-NT-139/2024-AA-01 | **Monitoring Point** | Near Main Gate |
| **Date of Monitoring** | 19-07-2024 to 20-07-2024 | **Monitoring Coordinates** | 32°55'07" N 73°04'17" E |

| Sr. No. | Time | Ambient Temperature °C | Wind Direction | Wind Velocity m/s | Humidity % | Pressure (mm of Hg) |
|---|---|---|---|---|---|---|
| 1 | 12:00 | 34 | SW | 6.7 | 47 | 751.60 |
| 2 | 13:00 | 34 | W | 8.4 | 47 | 752.40 |
| 3 | 14:00 | 35 | NW | 3.7 | 46 | 752.30 |
| 4 | 15:00 | 35 | NW | 5.8 | 46 | 752.40 |
| 5 | 16:00 | 34 | NW | 4.3 | 46 | 752.90 |
| 6 | 17:00 | 34 | NW | 4.7 | 46 | 753.50 |
| 7 | 18:00 | 33 | NW | 5.3 | 47 | 752.10 |
| 8 | 19:00 | 33 | NW | 4.6 | 49 | 752.70 |
| 9 | 20:00 | 33 | W | 4.7 | 51 | 751.30 |
| 10 | 21:00 | 32 | W | 4.9 | 52 | 751.80 |
| 11 | 22:00 | 32 | SW | 2.5 | 54 | 750.40 |
| 12 | 23:00 | 31 | SW | 2.4 | 55 | 750.20 |
| 13 | 00:00 | 30 | NE | 3.2 | 57 | 750.30 |
| 14 | 01:00 | 30 | NE | 3.3 | 58 | 749.80 |
| 15 | 02:00 | 29 | NE | 3.3 | 60 | 749.60 |
| 16 | 03:00 | 29 | E | 3.7 | 62 | 749.40 |
| 17 | 04:00 | 29 | E | 3.5 | 63 | 748.90 |
| 18 | 05:00 | 28 | SE | 3.2 | 65 | 748.80 |
| 19 | 06:00 | 28 | SE | 3.2 | 60 | 749.20 |
| 20 | 07:00 | 30 | SE | 4.6 | 53 | 749.70 |
| 21 | 08:00 | 31 | SE | 3.4 | 50 | 750.40 |
| 22 | 09:00 | 32 | SW | 3.9 | 50 | 750.70 |
| 23 | 10:00 | 33 | W | 4.4 | 49 | 751.30 |
| 24 | 11:00 | 35 | NW | 4.1 | 48 | 751.80 |

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## Noise Monitoring Report

| Monitoring Details | | | |
|---|---|---|---|
| Reference Number | AES-ENV-NT-139/2024-AA-01 | Monitoring Point | Near Main Gate |
| Date of Monitoring | 19-07-2024 to 20-07-2024 | Monitoring Coordinates | 32°55'07" N 73°04'17" E |

| Sr. No. | Time | Noise dB(A) | | PEQS |
|---|---|---|---|---|
| 1 | 12:00 | 60 | | |
| 2 | 13:00 | 60 | | |
| 3 | 14:00 | 61 | | |
| 4 | 15:00 | 61 | | |
| 5 | 16:00 | 59 | Day Time | 65 |
| 6 | 17:00 | 58 | | |
| 7 | 18:00 | 56 | | |
| 8 | 19:00 | 55 | | |
| 9 | 20:00 | 55 | | |
| 10 | 21:00 | 54 | | |
| 11 | 22:00 | 53 | | |
| 12 | 23:00 | 52 | | |
| 13 | 00:00 | 52 | | |
| 14 | 01:00 | 51 | | |
| 15 | 02:00 | 50 | Night Time | 55 |
| 16 | 03:00 | 49 | | |
| 17 | 04:00 | 48 | | |
| 18 | 05:00 | 47 | | |
| 19 | 06:00 | 48 | | |
| 20 | 07:00 | 49 | | |
| 21 | 08:00 | 51 | | |
| 22 | 09:00 | 52 | Day Time | 65 |
| 23 | 10:00 | 54 | | |
| 24 | 11:00 | 58 | | |

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## Ambient Air Monitoring Location-02

## CHAKWAL ROAD KHAIRPUR VILLAGE

Chakwal Grid Station




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## Ambient Air Monitoring Report

**Monitoring Details**

| | | | |
|---|---|---|---|
| Reference Number | AES-ENV-NT-139/2024-AA-02 | Monitoring Point | Chakwal Road Khairpur Village |
| Date of Monitoring | 20-07-2024 to 21-07-2024 | Monitoring Coordinates | 32°55'07" N 73°04'17" E |

| Sr. No. | Time | CO (mg/m³) | NO (µg/m³) | $NO_2$ (µg/m³) | $NO_x$ (µg/m³) | $SO_2$ (µg/m³) |
|---|---|---|---|---|---|---|
| 1 | 13:00 | 1.12 | 13.30 | 16.54 | 29.84 | 33.91 |
| 2 | 14:00 | 1.21 | 13.82 | 17.59 | 31.42 | 34.35 |
| 3 | 15:00 | 1.17 | 14.36 | 18.33 | 32.69 | 35.87 |
| 4 | 16:00 | 1.12 | 15.12 | 19.02 | 34.14 | 37.25 |
| 5 | 17:00 | 1.07 | 14.50 | 19.98 | 34.48 | 38.84 |
| 6 | 18:00 | 1.05 | 13.97 | 20.56 | 34.53 | 37.38 |
| 7 | 19:00 | 1.02 | 13.37 | 19.28 | 32.65 | 36.41 |
| 8 | 20:00 | 0.99 | 13.20 | 18.27 | 31.47 | 35.19 |
| 9 | 21:00 | 0.97 | 12.70 | 17.80 | 30.50 | 33.67 |
| 10 | 22:00 | 0.90 | 12.04 | 16.60 | 28.63 | 32.00 |
| 11 | 23:00 | 0.89 | 11.71 | 16.03 | 27.74 | 31.32 |
| 12 | 00:00 | 0.87 | 11.29 | 15.26 | 26.55 | 29.60 |
| 13 | 01:00 | 0.83 | 11.19 | 15.11 | 26.31 | 29.15 |
| 14 | 02:00 | 0.78 | 10.98 | 14.89 | 25.87 | 28.32 |
| 15 | 03:00 | 0.73 | 10.84 | 14.57 | 25.41 | 27.51 |
| 16 | 04:00 | 0.71 | 10.32 | 14.01 | 24.33 | 27.09 |
| 17 | 05:00 | 0.67 | 9.70 | 12.79 | 22.48 | 25.39 |
| 18 | 06:00 | 0.70 | 9.64 | 13.03 | 22.67 | 24.69 |
| 19 | 07:00 | 0.78 | 10.22 | 13.56 | 23.78 | 23.48 |
| 20 | 08:00 | 0.75 | 10.48 | 14.55 | 25.03 | 24.84 |
| 21 | 09:00 | 0.82 | 10.69 | 15.64 | 26.33 | 26.49 |
| 22 | 10:00 | 0.90 | 11.35 | 16.30 | 27.65 | 27.09 |
| 23 | 11:00 | 0.97 | 12.06 | 16.88 | 28.94 | 28.34 |
| 24 | 12:00 | 1.06 | 12.40 | 17.69 | 30.09 | 29.41 |
| | Average Concentration | **0.92** | **12.05** | **16.43** | **28.48** | **30.73** |

Monitored By

Reviewed By (TM)

Approved By (QM/Chief Chemist)

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## Ambient Air Monitoring Report

**Monitoring Details**

| | | | |
|---|---|---|---|
| **Reference Number** | AES-ENV-NT-139/2024-AA-02 | **Monitoring Point** | Chakwal Road Khairpur Village |
| **Date of Monitoring** | 20-07-2024 to 21-07-2024 | **Monitoring Coordinates** | 32°55'07" N 73°04'17" E |

| Parameters | Units | Monitoring Duration | LDL | Average Obtained Concentration | PEQS | Remarks |
|---|---|---|---|---|---|---|
| Nitrogen Dioxide ($NO_2$) * | µg/m³ | 24Hours | 1.00 | 16.43 | 80.0 | Optimal |
| Nitrogen Oxide (NO)* | µg/m³ | 24Hours | 1.00 | 12.05 | 40.0 | Optimal |
| $NO_x$* | µg/m³ | 24Hours | 1.00 | 28.48 | - | - |
| Sulphur Dioxide ($SO_2$) * | µg/m³ | 24Hours | 1.00 | 30.73 | 120.0 | Optimal |
| Carbon Monoxide (CO) * | mg/m³ | 24Hours | 0.01 | 0.92 | 05.0 | Optimal |
| Particulate Matter ($PM_{10}$) * | µg/m³ | 24Hours | 1.00 | 80 | 150 | Optimal |
| Particulate Matter ($PM_{2.5}$) * | µg/m³ | 24Hours | 1.00 | 23 | 35 | Optimal |
| Total Particulate Matter (TSP) | µg/m³ | 24Hours | 1.00 | 118 | 500 | Optimal |

*Parameters are approved from Punjab Environmental Protection Agency.

**Abbreviations:**
LDL= Lower Detection Limit
PEQS= Punjab Environmental Quality Standards
µg/m³ = Micro Gram per Meter Cube
Mg/m³ = Mili 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-NT-139/2024-AA-02 | **Monitoring Point** | Chakwal Road Khairpur Village |
| **Date of Monitoring** | 20-07-2024 to 21-07-2024 | **Monitoring Coordinates** | 32°55'07" **N** 73°04'17" **E** |

| Sr. No. | Time | Ambient Temperature °C | Wind Direction | Wind Velocity m/s | Humidity % | Pressure (mm of Hg) |
|---|---|---|---|---|---|---|
| 1 | 13:00 | 30 | NW | 0.7 | 68 | 751.87 |
| 2 | 14:00 | 28 | NW | 0.9 | 73 | 752.3 |
| 3 | 15:00 | 32 | NW | 2.3 | 65 | 752.40 |
| 4 | 16:00 | 36 | W | 3.6 | 51 | 752.50 |
| 5 | 17:00 | 38 | W | 4.2 | 40 | 752.20 |
| 6 | 18:00 | 37 | W | 4.7 | 41 | 751.80 |
| 7 | 19:00 | 37 | W | 4.9 | 43 | 750.70 |
| 8 | 20:00 | 36 | SW | 5.1 | 44 | 750.10 |
| 9 | 21:00 | 35 | SW | 4.3 | 46 | 749.50 |
| 10 | 22:00 | 34 | S | 3.1 | 48 | 749.10 |
| 11 | 23:00 | 34 | S | 2.6 | 49 | 749.80 |
| 12 | 00:00 | 33 | S | 2.6 | 51 | 749.90 |
| 13 | 01:00 | 32 | SE | 2.6 | 56 | 749.80 |
| 14 | 02:00 | 31 | SE | 3.7 | 58 | 749.30 |
| 15 | 03:00 | 31 | SE | 3.9 | 60 | 749.10 |
| 16 | 04:00 | 30 | E | 2.8 | 62 | 748.60 |
| 17 | 05:00 | 30 | NE | 2.3 | 63 | 748.80 |
| 18 | 06:00 | 32 | NE | 24 | 59 | 749.20 |
| 19 | 07:00 | 33 | NE | 2.7 | 56 | 749.70 |
| 20 | 08:00 | 35 | NE | 3.9 | 53 | 750.10 |
| 21 | 09:00 | 36 | NE | 2.1 | 49 | 750.30 |
| 22 | 10:00 | 37 | NW | 1.3 | 43 | 750.60 |
| 23 | 11:00 | 37 | NW | 0.3 | 45 | 751.20 |
| 24 | 12:00 | 38 | NW | 1.2 | 42 | 751.80 |

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## Noise Monitoring Report

**Monitoring Details**

| | | | |
|---|---|---|---|
| **Reference Number** | AES-ENV-NT-139/2024-AA-02 | **Monitoring Point** | Chakwal Road Khairpur Village |
| **Date of Monitoring** | 20-07-2024 to 21-07-2024 | **Monitoring Coordinates** | 32°55'07" **N** 73°04'17" **E** |

| Sr. No. | Time | Noise dB(A) | | PEQS |
|---|---|---|---|---|
| 1 | 13:00 | 58 | | |
| 2 | 14:00 | 59 | | |
| 3 | 15:00 | 60 | | |
| 4 | 16:00 | 62 | | |
| 5 | 17:00 | 63 | Day Time | 65 |
| 6 | 18:00 | 58 | | |
| 7 | 19:00 | 55 | | |
| 8 | 20:00 | 55 | | |
| 9 | 21:00 | 54 | | |
| 10 | 22:00 | 53 | | |
| 11 | 23:00 | 52 | | |
| 12 | 00:00 | 52 | | |
| 13 | 01:00 | 51 | | |
| 14 | 02:00 | 50 | Night Time | 55 |
| 15 | 03:00 | 50 | | |
| 16 | 04:00 | 49 | | |
| 17 | 05:00 | 48 | | |
| 18 | 06:00 | 47 | | |
| 19 | 07:00 | 49 | | |
| 20 | 08:00 | 51 | | |
| 21 | 09:00 | 54 | | |
| 22 | 10:00 | 57 | Day Time | 65 |
| 23 | 11:00 | 58 | | |
| 24 | 12:00 | 58 | | |

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# GROUND WATER ANALYSIS REPORT

## Sample Detail

| | | | |
|---|---|---|---|
| **Reference No.** | AES-ENV-NT-139/2024-GW-55 | **Reporting Date** | 05-08-2024 |
| **Nature of Sample** | Ground Water | **Sampling Method Reference** | AES/LMS/QSP-014 |
| **Grab/Composite** | Grab | **Sample Collected by** | AES |
| **Sampling Date** | 19-07-2024 | **Sample Receiving Date** | 31-07-2024 |
| **Analysis Completion Date** | 02-08-2024 | **Lab Temp & Humidity** | 24.9°C & 54% |
| **Ambient Temperature & Humidity at the Time of Sampling** | | | 38°C & 41% |
| **Sample ID** | AES-ENV-GW-55/2024 | **Sampling Location** | NTDC Grid station |
| **Clint Details** | NTDC Grid Station, Chakwal | | |

## Ground Water Analysis Results

| Parameter | Analysis Method | PEQS | Result | MU (CL95%) | Remarks |
|---|---|---|---|---|---|
| **Lab Analysis** | | | | | |
| Color* | SMWW 2120 C | ≤ 15 TCU | 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 | 0 | N.A. | Optimal |
| Total Hardness (as $CaCO_3$) ** | SMWW 2340 C | < 500 mg/L | 140 | ± 5.1421 | Optimal |
| Total Dissolved Solids (TDS)** | SMWW 2540 C | < 1000 mg/L | 670 | ± 8.0226 | Optimal |
| pH** | SMWW 4500 $H^+$ B | 6.5- 8.5 | 8.42 | ± 0.04 | Optimal |
| Aluminum (Al) | SMWW 3111 B | ≤ 0.2 mg/L | <0.005 | N.A. | Optimal |
| Antimony (Sb) | SMWW 3114 B | ≤ 0.005 mg/L | <0.005 | N.A. | Optimal |
| Arsenic (As) | SMWW 3114 B | ≤ 0.05 mg/L | <0.005 | N.A. | Optimal |
| Barium (Ba) | SMWW 3113 B | 0.7 mg/L | <0.0035 | N.A. | Optimal |
| Boron (B) | SMWW 3113 B | 0.3 mg/L | <0.02 | N.A. | Optimal |
| Cadmium (Cd) | SMWW 3113 B | 0.01 mg/L | <0.006 | N.A. | Optimal |
| Chloride ($Cl^-$) ** | SMWW 4500 $Cl^-$ B | < 250 mg/L | 95 | ± 1.73 | Optimal |
| Chromium (Cr) | SMWW 3113 B | ≤ 0.05 mg/L | <0.004 | N.A. | Optimal |
| Copper (Cu) | SMWW 3111 B | 2.0 mg/L | 0.164 | N.A. | Optimal |
| Cyanide ($CN^-$)* | SMWW 4500 $CN^-$ F | ≤ 0.05 mg/L | 0 | N.A. | Optimal |
| Fluoride ($F^-$)** | SMWW 4500 $F^-$ C | ≤ 1.5 mg/L | 0.74 | ± 0.0505 | Optimal |
| Lead (Pb) | SMWW 3114 B | ≤ 0.05 mg/L | <0.005 | N.A. | Optimal |
| Manganese (Mn) | SMWW 3113 B | ≤ 0.5 mg/L | <0.015 | N.A. | Optimal |
| Mercury (Hg) | SMWW 3114 B | ≤ 0.001 mg/L | <0.001 | N.A. | Optimal |
| Nickel (Ni) | SMWW 3113 B | ≤0.02 mg/L | <0.02 | N.A. | Optimal |
| Nitrate ($NO_3^-$) ** | SMWW 4500 $NO_3^-$ D | ≤ 50 mg/L | 3.19 | ± 0.132 | Optimal |
| Nitrite ($NO_2^-$) * | SMWW 4500 $NO_2^-$ B | ≤ 3.0 mg/L | 0 | N.A. | Optimal |
| Selenium (Se) | SMWW 3114 B | 0.01 mg/L | <0.01 | N.A. | Optimal |
| Residual Chlorine ($Cl_2$) * | SMWW 4500 $Cl^-$ B | 0.5 mg/L | 0 | N.A. | Optimal |
| Phenolic Compounds (as Phenols) * | SMWW 5530 D | NGVS mg/L | 0 | N.A. | - |
| Zinc (Zn) | SMWW 3113 B | 5.0 mg/L | 0.031 | N.A. | Optimal |

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ISO 9001:2015 ISO 14001:2015 ISO 45001:2018

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## GROUND WATER ANALYSIS REPORT

**Sample Detail**

| | | | |
|---|---|---|---|
| **Reference No.** | AES-ENV-NT-139/2024-GW-55 | **Reporting Date** | 05-08-2024 |
| **Nature of Sample** | Ground Water | **Sampling Method Reference** | AES/LMS/QSP-014 |
| **Grab/Composite** | Grab | **Sample Collected by** | AES |
| **Sampling Date** | 19-07-2024 | **Sample Receiving Date** | 31-07-2024 |
| **Analysis Completion Date** | 02-08-2024 | **Lab Temp & Humidity** | 24.9°C & 54% |
| **Ambient Temperature & Humidity at the Time of Sampling** | | | 38°C & 41% |
| **Sample ID** | AES-ENV-GW-55/2024 | **Sampling Location** | NTDC Grid station |
| **Clint Details** | NTDC Grid Station, Chakwal | | |

**Ground Water Analysis Results**

| Parameter | Analysis Method | PEQS | Result | MU (CL95%) | Remarks |
|---|---|---|---|---|---|
| **Microbiological Analysis** | | | | | |
| Total Coliforms* | SMWW 9222 B | 0 CFU/ 100 mL | 0 | N.A. | Optimal |
| Fecal Coliforms * | SMWW 9222 D | 0 CFU/ 100 mL | 0 | N.A. | Optimal |

*Parameters are approved from Punjab Environmental Protection Agency.
**Parameters are accredited from Pakistan National Accreditation Council.
The reported expanded uncertainty is based on combined standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

**Abbreviations:**

PEQS = Punjab Environmental 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 = Nephelometric 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 05/08/2024

Reviewed By (TM) 05/08/2024

Approved By (QM/Chief Chemist)

Asian Environmental Services (Pvt) Ltd. LAHORE

----------End of Report----------

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## GROUND WATER ANALYSIS REPORT

**Sample Detail**

| | | | |
|---|---|---|---|
| **Reference No.** | AES-ENV-NT-139/2024-GW-56 | **Reporting Date** | 05-08-2024 |
| **Nature of Sample** | Ground Water | **Sampling Method Reference** | AES/LMS/QSP-014 |
| **Grab/Composite** | Grab | **Sample Collected by** | AES |
| **Sampling Date** | 19-07-2024 | **Sample Receiving Date** | 31-07-2024 |
| **Analysis Completion Date** | 02-08-2024 | **Lab Temp & Humidity** | 24.9°C & 54% |
| **Ambient Temperature & Humidity at the Time of Sampling** | | | 38°C & 41% |
| **Sample ID** | AES-ENV-GW-56/2024 | **Sampling Location** | NTDC Grid station Khairpur Village |
| **Clint Details** | NTDC Grid Station, Chakwal | | |

**Ground Water Analysis Results**

| Parameter | Analysis Method | PEQS | Result | MU (CL95%) | Remarks |
|---|---|---|---|---|---|
| **Lab Analysis** | | | | | |
| Color* | SMWW 2120 C | ≤ 15 TCU | 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 | 0 | N.A. | Optimal |
| Total Hardness (as $CaCO_3$) ** | SMWW 2340 C | < 500 mg/L | 148 | ± 5.1421 | Optimal |
| Total Dissolved Solids (TDS)** | SMWW 2540 C | < 1000 mg/L | 668 | ± 8.0226 | Optimal |
| pH** | SMWW 4500 $H^+$ B | 6.5- 8.5 | 8.25 | ± 0.04 | Optimal |
| Aluminum (Al) | SMWW 3111 B | ≤ 0.2 mg/L | <0.005 | N.A. | Optimal |
| Antimony (Sb) | SMWW 3114 B | ≤ 0.005 mg/L | <0.005 | N.A. | Optimal |
| Arsenic (As) | SMWW 3114 B | ≤ 0.05 mg/L | <0.005 | N.A. | Optimal |
| Barium (Ba) | SMWW 3113 B | 0.7 mg/L | <0.0035 | N.A. | Optimal |
| Boron (B) | SMWW 3113 B | 0.3 mg/L | <0.02 | N.A. | Optimal |
| Cadmium (Cd) | SMWW 3113 B | 0.01 mg/L | <0.006 | N.A. | Optimal |
| Chloride ($Cl^-$) ** | SMWW 4500 $Cl^-$ B | < 250 mg/L | 65 | ± 1.73 | Optimal |
| Chromium (Cr) | SMWW 3113 B | ≤ 0.05 mg/L | <0.004 | N.A. | Optimal |
| Copper (Cu) | SMWW 3111 B | 2.0 mg/L | 0.164 | N.A. | Optimal |
| Cyanide ($CN^-$)* | SMWW 4500 $CN^-$ F | ≤ 0.05 mg/L | 0 | N.A. | Optimal |
| Fluoride ($F^-$)** | SMWW 4500 $F^-$ C | ≤ 1.5 mg/L | 0.70 | ± 0.0505 | Optimal |
| Lead (Pb) | SMWW 3114 B | ≤ 0.05 mg/L | <0.005 | N.A. | Optimal |
| Manganese (Mn) | SMWW 3113 B | ≤ 0.5 mg/L | <0.015 | N.A. | Optimal |
| Mercury (Hg) | SMWW 3114 B | ≤ 0.001 mg/L | <0.001 | N.A. | Optimal |
| Nickel (Ni) | SMWW 3113 B | ≤0.02 mg/L | <0.02 | N.A. | Optimal |
| Nitrate ($NO_3$) ** | SMWW 4500 $NO_3^-$ D | ≤ 50 mg/L | 2.73 | ± 0.048 | Optimal |
| Nitrite ($NO_2$) * | SMWW 4500 $NO_2^-$ B | ≤ 3.0 mg/L | 0 | N.A. | Optimal |
| Selenium (Se) | SMWW 3114 B | 0.01 mg/L | <0.01 | N.A. | Optimal |
| Residual Chlorine ($Cl_2$) * | SMWW 4500 $Cl^-$ B | 0.5 mg/L | 0 | N.A. | Optimal |
| Phenolic Compounds (as Phenols) * | SMWW 5530 D | NGVS mg/L | 0 | N.A. | - |

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# GROUND WATER ANALYSIS REPORT

## Sample Detail

| | | | |
|---|---|---|---|
| **Reference No.** | AES-ENV-NT-139/2024-GW-56 | **Reporting Date** | 05-08-2024 |
| **Nature of Sample** | Ground Water | **Sampling Method Reference** | AES/LMS/QSP-014 |
| **Grab/Composite** | Grab | **Sample Collected by** | AES |
| **Sampling Date** | 19-07-2024 | **Sample Receiving Date** | 31-07-2024 |
| **Analysis Completion Date** | 02-08-2024 | **Lab Temp & Humidity** | 24.9°C & 54% |
| **Ambient Temperature & Humidity at the Time of Sampling** | | | 38°C & 41% |
| **Sample ID** | AES-ENV-GW-56/2024 | **Sampling Location** | NTDC Grid station Khairpur Village |
| **Clint Details** | NTDC Grid Station, Chakwal | | |

## Ground Water Analysis Results

| Parameter | Analysis Method | PEQS | Result | MU (CL95%) | Remarks |
|---|---|---|---|---|---|
| Zinc (Zn) | SMWW 3113 B | 5.0 mg/L | 0.031 | N.A. | Optimal |
| **Microbiological Analysis** | | | | | |
| Total Coliforms* | SMWW 9222 B | 0 CFU/ 100 mL | 0 | N.A. | Optimal |
| Fecal Coliforms * | SMWW 9222 D | 0 CFU/ 100 mL | 0 | N.A. | Optimal |

*Parameters are approved from Punjab Environmental Protection Agency.
**Parameters are accredited from Pakistan National Accreditation Council.
The reported expanded uncertainty is based on combined standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

**Abbreviations:**

PEQS = Punjab Environmental Quality Standards
TCU = True Color Unit
NTU = Nephelometric Turbidity Unit
SMWW = Standard Methods for the examination of Water and Wastewater
N.A. = Not Available
MU = Measurement Uncertainty
CFU = Colony forming Unit
NGVS = No Guideline Value Set

**Remarks:**

Optimal = Compliance with Permissible Range
Low = Less Than Permissible Range
Marginal = Close to Extreme Edge
High = Exceeds from 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 05/08/2024

Asian Environmental Services (Pvt) Ltd ★ LAHORE

Reviewed By (TM) 05/08/2024

Approved By (QM/Chief Chemist) 5/8/2024

----------End of Report----------



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## Appendix -4. Sources of data and a full list of all reference material used

1. http://www.NGC.com.pk Accessed on September 2024
2. http://www.NGC.com.pk Accessed on September 2024
3. http://epd.punjab.gov.pk/rules_regulations Retrieved on August 22, 2024
4. http://environment.gov.pk/act-rules/IEE-EIA-REG.pdf
5. http://www.kicc.jp/auick/database/baseline/BS2004/BS2004-CHAP6.html Retrieved on October 3, 2017
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8. Salinity Management Alternatives for the Rechna Doab, Punjab, Pakistan Volume II (January 1997), International Irrigation Management Institute, Lahore.
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10. Giardini, D., Grünthal, G., Shedlock, K. M. and Zhang, P. The GSHAP Global Seismic Hazard Map. Annali di Geofisica 42 (6), 1225-1228, 1999.
11. Waqar A. Jehangir, etal, Net Gains from Conjunctive Use of Surface and Groundwater, International Water Management Institute.
12. Google definitions
13. Information and data provided by project proponents
14. Information gathered through discussions with the project related persons of the project contractor
15. Punjab Environment Quality Standards for Ambient Air November 2010
16. Punjab Environment Quality Standards Noise Levels November 2010
17. Punjab Environment Quality Standards for Drinking Water November 2010
18. Pakistan Environmental Protection Act, 1997;
19. The Punjab Environmental Protection (Amendment) Act 2012
20. Government of Pakistan, Pakistan Environmental Protection Agency, Policy and Procedures for Filing, Review and Approval of Environmental Assessment, 2000;
21. Google earth, maps.

## Appendix -5. Approvals from other concerned departments

No designated forest area falls on the RoW. The approvals required will be sorted before the start of construction from other line departments where required.

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## Appendix -6. Glossary

| Terms | Definition |
|---|---|
| Air pollution | Air is made up of several gases, mostly nitrogen and oxygen and, in smaller amounts, water vapor, carbon dioxide and argon and other trace gases. Air pollution occurs when harmful chemicals and particles are emitted into the air – due to human activity or natural forces – at a concentration that interferes with human health or welfare or that harms the environment in other ways. |
| Alluvial | The alluvium is loose, unconsolidated soil or sediment that has been eroded, reshaped by water in some form and redeposited in a non-marine setting. The alluvium is typically made up of a variety of materials, including fine particles of silt and clay and larger particles of sand and gravel. |
| Ambient air quality | Ambient air quality refers to the quality of outdoor air in our surrounding environment. It is typically measured near ground level, away from direct sources of pollution. |
| Archaeology | The study of human history and prehistory through the excavation of sites and the analysis of artifacts and other physical remains. |
| Biodiversity | The variety of plant and animal life in the world or a particular habitat, a high level of which is usually considered to be important and desirable. |
| Botanical | A substance obtained from a plant and used typically in medicinal or cosmetic products. |
| Carbon monoxide | A highly poisonous, odorless, tasteless and colorless gas that is formed when carbon material burns without enough oxygen. |
| Climate | The pattern of weather in a particular region over a set period, usually 30 years. |
| Conductor | Conductors are the materials or substances used in towers to allow electricity to flow. Conductors have this property of allowing the transition of heat or light from one source to another. |
| Conservation | Preserving or protecting animals and resources such as minerals, water and plants through planned action (such as breeding endangered species) or non-action (such as not letting taps run unnecessarily). |
| Conventional foundations | Large, round foundation slabs with a complex central anchoring system, as well as extensive steel reinforcement and high-quality concrete used in the foundations of towers |
| Cranes | A type of machine, generally equipped with a hoist rope, wire ropes or chains, and sheaves, that can be used both to lift and lower materials and to move them horizontally. It is mainly used for lifting heavy things and transporting them to other places. |
| Crow footing | The process of using design modifications and a combination of counterpoise earthing, vertically with the use of driven copper rod electrodes, and conductive concrete and copper-coated steel earth electrodes. |

| Terms | Definition |
|---|---|
| Derrick poles | A supported pole that uses a pulley or block and tackles on its upper end to lift loads. The lower end is braced or set in a shallow hole and positioned so the upper end lies above the object to be lifted. Also known as a Gin Pole |
| Ecology | The branch of biology that deals with the relations of organisms to one another and their physical surroundings. |
| Effluent | Liquid wastes such as sewage and liquid waste from industries. |
| EIA | An environmental impact assessment (EIA) is an analytical process that systematically examines the possible environmental consequences of the implementation of projects, programs and policies. |
| Electrodes | A conductor through which electricity enters or leaves an object, substance, or region. |
| EMP | An environmental management plan (EMP) is a site-specific plan developed to ensure that all necessary measures are identified and implemented to protect the environment and comply with environmental legislation. |
| Erection | The action of erecting a structure or object. |
| Fauna | The animals of a particular region, habitat, or geological period. |
| Flora | The plants of a particular region, habitat, or geological period. |
| Fluviatile | Of, found in, or produced by a river. |
| Galvanized | Galvanization or galvanizing is the process of applying a protective zinc coating to steel or iron, to prevent rusting. |
| Geomorphology | The study of the physical features of the surface of the earth and their relation to its geological structures. |
| Grand trunk sheet | Large sheets used for surveying and as markers for the ROW |
| Habitat | The area is occupied by a community or species (a group of animals or plants), such as a forest floor, desert or seashore. |
| Initial Environmental Examination | Initial environmental examinations describe the environmental condition of a project, including potential impact, formulation of mitigation measures, and preparation of institutional requirements and environmental monitoring. |
| Isokeraunic | The ground flash density, which is equal to 0.15 strikes per square kilometers per lightning day |
| Noise Pollution | Noise disturbs the environment and people's ability to enjoy it, for example continually sounding house alarms, loud music, air conditioning or other electrical units and aircraft or motor engines. |
| peak ground acceleration | Peak ground acceleration (PGA) 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 a particular earthquake. |

| Terms | Definition |
|---|---|
| PEQS | The Punjab Environmental Quality Standards (PEQS) are quality standards to regulate the air emissions and effluents of industry and other big polluters. |
| Physiographic | The subfield of geography that studies physical patterns and processes of the Earth. It aims to understand the forces that produce and change rocks, oceans, weather, and global flora and fauna patterns. |
| Pile Cap | A pile cap is a thick concrete mat that rests on concrete or timber piles that have been driven into the soft or unstable ground to provide a suitable stable foundation. |
| Pile foundations | Pile foundations are deep foundations. They are formed by long, slender, columnar elements typically made from steel or reinforced concrete, or sometimes timber. A foundation is described as 'piled' when its depth is more than three times its breadth |
| Pile pad | Pile Pad foundations are a form of spread foundation that have large depths and are formed by rectangular, square, or sometimes circular concrete 'pads' that support localized single-point loads such as structural columns |
| Precambrian | Relating to or denoting the earliest eon of the earth's history, preceding the Cambrian period and the Phanerozoic aeon. |
| Project footprint | the impact a project has on the environment and the well-being of our ecosystem as a whole. Project activities are measured in terms of the area of biologically productive land and water required to produce the goods consumed and to assimilate the wastes generated. |
| Right of Way (RoW) | A right-of-way is a right to make a way over a piece of land, usually to and from another piece of land. |
| Seismicity | The branch of science concerned with earthquakes and related phenomena. |
| Septic tanks | A tank, typically underground, in which sewage is collected and allowed to decompose through bacterial activity before draining using a soakaway. |
| Stakeholder Consultations | Stakeholder consultation involves the development of constructive, productive relationships over the long term. Stakeholder concerns and feedback is a valuable sources of information that can be used to improve project design and outcomes and help a corporation to identify and control external risks. |
| Stringing | A vehicle, to which the conductor is attached, is driven past each structure while pulling out the conductor. At each structure, the conductor is lifted and placed into a stringing sheave |
| Switching surge | Switching surges are the overcurrent/overvoltage spykes that are experienced in the highly inductive circuits at the time of sudden interruption I.e. switching period. As the magnetic field about the inductive conductor collapses, a brief very high voltage can be generated at that point. |

| Terms | Definition |
|---|---|
| Terrestrial | Relating to the planet Earth, or living or existing on the land rather than in the sea or air |
| Topography | The arrangement of the natural and artificial physical features of an area. |
| Topsoil | Surface soil usually includes the organic layer in which plants have most of their roots and which the farmer turns over in plowing. |
| torque | Torque is the twisting force that tends to cause rotation. The torque, specified about the axis of rotation, is equal to the magnitude of the component of the force vector lying in the plane perpendicular to the axis |
| Tranches | Tranche is a French word meaning "slice" or "portion." In the world of investing, it is used to describe a security that can be split up into smaller pieces and subsequently sold to investors. |
| Tripout | When the flow of electricity is cut off. the lightning trip-out rate depends on the tower-footing resistance and the length of an arcing horn gap. |
| Ultraviolet fluorescence principle | Fluorescence describes a phenomenon where a molecular system absorbs, then emits light. In absorption high energy (short wavelength) light excites the system, promoting electrons within the molecule to transition from the ground state to the excited state |

## Appendix -7. List of Abbreviations

| | |
|---|---|
| AC | Alternating Current |
| APs | Affected Persons |
| CITES | Convention on International Trade in Endangered Species |
| CPPA-G | Central Power Purchasing Agency Guarantee |
| dB A | A-weighted Decibels |
| DC | Double Circuit |
| DG | Director General |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Plan |
| EPA | Environment Protection Agency |
| EPD | Environment Protection Department |
| ESIC | Environment and Social Impact Cell |
| FMC | Facility Management Consultant |
| GIIP | Good International Industry Practice |
| GM | General Manager |
| GoP | Government of Pakistan |
| GS | Grid Station |
| HSE | Health, Safety and Environment |
| IEE | Initial Environmental Examination |
| IFC | International Finance Corporation |
| IUCN | International Union for Conservation of Nature |
| Km | Kilometer |
| kV | Kilovolts |
| LARU | Land Acquisition and Resettlement Unit |
| MEPCO | Multan Electric Power Supply Company |
| MFF | Multi Tranche Financing Facility |
| NEQS | National Environmental Quality Standards |
| NOC | No Objection Certificate |
| NGC | National Transmission and Despatch Company |
| OHS | Occupational Health and Safety |
| PAK | Pakistan |
| PEPA | Punjab Environmental Protection Act |
| PEQS | Punjab Environmental Quality Standards |
| PM | Particulate Matter |
| PMU | Project Management Unit |

| | |
|---|---|
| PPE | Personal Protective Equipment |
| PVC | Polymerizing Vinyl Chloride |
| RoW | Right of Way |
| RP | Resettlement Plan |
| SAEMR | Semi-annual Environmental Monitoring Review |
| SPS | Safeguard Policy Statement |
| SSEMP | Site-specific EMP |
| TL | Transmission Line |
| WAPDA | Water & Power Development Authority |
| WWF | World Wildlife Fund |
| **Units** | |
| µg/$m^3$ | Microgram per cubic meter |
| amsl | Above mean sea level |
| dB(A) | decibels (A-weighted) |
| km | Kilometer |
| $km^2$ | Square kilometer |
| kV | kilovolt |
| m | Meter |
| $m^3$/sec | Cubic meter per second |
| MW | Megawatt |
| **Currency** | |
| PKR | Pakistani Rupee |
| USD | United States Dollar |

## Appendix -8. List of names, qualifications and roles of team members carrying out the EIA study

The Environmental Impact Assessment (EIA) was undertaken jointly by **WSP Italia** and **CleanTech Solutions**. The multidisciplinary team comprised experienced professionals with expertise in environmental management, social development, and livelihood restoration. The team included:

- **Ms. Eva Decampo** – Project Manager, responsible for overall coordination, quality assurance, and timely delivery of the EIA.
- **Ms. Heidi** – Social and Livelihood Development Expert, leading the assessment of social impacts, livelihood risks, and community development needs.
- **Ms. Mehwish Rehman** – Environmental Expert, responsible for evaluating environmental impacts, proposing mitigation measures, and ensuring compliance with national and international environmental standards.
- **Ms. Najma Iftikhar** – Environmentalist, assisting in environmental surveys, data analysis, and preparation of mitigation plans.
- **Mr. Hasnain Javid** – Environmentalist, supporting environmental data collection, impact assessment, departmental consultations, and reporting.
- **Mr. M. Bilal Ikhlaq** – Field Survey, Document Preparation and Formatting.

This team brought together a blend of technical expertise and field experience to ensure that the EIA comprehensively addressed environmental, social, and livelihood considerations in line with relevant regulatory frameworks and international best practices.

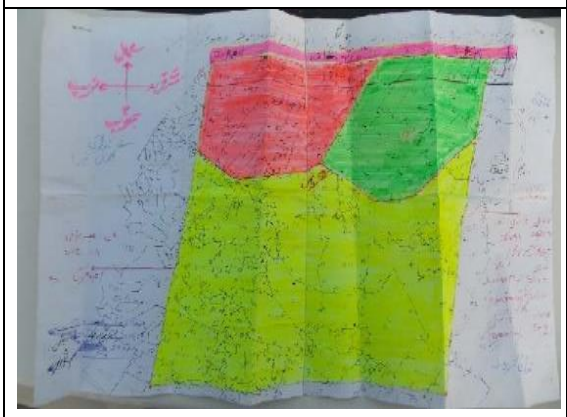
## Appendix -9. Photo log

| | |
|---|---|
|  |  |
| Institutional Consultation with the Social Welfare Department Chakwal | Institutional Consultation with Forest Department Chakwal |
|  |  |
| Institutional Consultation with Technical Education and Vocational Training Authority (TEVTA) for women Chakwal | Consultation with Vocational Training Institute Dhoke Feroz, Pindwal Road Chakwal |
|  |  |
| Institutional Consultation with Livestock Department Chakwal | Institutional Consultation with Agriculture Department Chakwal |

| | |
|---|---|
|  |  |
| Gathering data at site | Avifauna of the project area |
|  |  |
| At IESCO with Officials of existing Chakwal G/S | Environmental Testing at Site |
|  |  |
| Supervising Environmental Testing at Site | View of Proposed Substation Site |

Vegetation in Project area

Visit and Consultation at Existing IESCO Grid Station, Chakwal



Hand Made Map of Proposed Substation collected from Revenue Department, Chakwal

Meeting at Social welfare Department, Chakwa

Meeting at EPA Chakwal

Meeting In Agriculture Extension Department, Chakwal

| | |
|---|---|
|  |  |
| Environmental Monitoring | Environmental Monitoring |

## Public Consultations

| | |
|---|---|
|  |  |
|  |  |


ARMY

## Appendix -10. Validation Form of Environmental Monitoring Reports

ENVIRONMENTAL PROTECTION AGENCY
GOVERNMENT OF THE PUNJAB
*National Hockey Stadium, Gate No. 08*
*Gaddafi Stadium Complex, Lahore*

### Validation for Wastewater & Drinking Water

| | | |
|---|---|---|
| Facility /Project Name & Address Phone | 500 KVA Powerplant<br>Chakwal | Sampling Point<br>GW=2 |

Waste Water (WW) Treatment facility: Primary Secondary Tertiary NA

Drinking Water (W) Treatment Facility

Total WW collected Sample .....

Total Collected Drinking water samples GW=2

| | | | |
|---|---|---|---|
| Sample Tag for testing parameter is assigned on sample container | Yes | NO | NA |
| Sample is preserved properly for each testing parameter | Yes | NO | NA |
| Sample size is adequate for testing the target parameters | Yes | NO | NA |
| Wastewater Flow Measurement performed to ensure sample representativeness | Yes | NO | NA |

| No. of Waste Water outlets | Waste Water Flow $m^3$/hr from each outlet (Optional) | Water intake $m^3$/hr (Optional) | Water Mass balance complied during sampling (Optional) | Sample Type |
|---|---|---|---|---|
| | | | Yes No | Grab Composite |

| Parameter | Matrix GW | Matrix WW | Container | Sample Size | Preservation | Yes | NO | NA |
|---|---|---|---|---|---|---|---|---|
| Coliform, Total or Fecal | X | N | Sterile Container | 100 mL | Refrigerate 6 C | Y | | |
| Coliform, Total or Fecal, Chlorinated Water | X | Y | Sterile Container | 100 mL | 0.008% Thiosulphate & cooled 6 C | X | | |
| Color, Turbidity | ✓ | N | P,G | 500 mL | Cool 6 C | ✓ | | |
| Hardness, Total | ✓ | N | P,G | 500ml | HNO3 to pH<2 | ✓ | | |
| Nitrogen, Nitrate + Nitrite , Phenolic Compounds, Oil & Grease, COD, NH3 | ✓ | N | P,G | 2000 mL | H2SO4 to pH < 2, Cool 6C | ✓ | | |
| Metals, General | ✓ | N | P,G Rinsed 1.1 HNO3 | 500 mL | HNO3 to pH < 2 | ✓ | | |
| Cyanide, Total | ✓ | X | P,G | 500 mL | NaOH to pH > 12, Cool 6C | ✓ | | |
| Pesticides, General | ✓ | N | Glass | 1 Liter | Cool 6 C | ✓ | | |

Field Parameters*

| Field parameter | | pH meter, Model Make | Measurement Method | Calibrated in Field | Measured value |
|---|---|---|---|---|---|
| pH | ✓ | | Electrometric Thermometer | Yes NO | 1.5L + 250ml |
| Temp | ✓ | | | | |
| Cl | ✓ | | | | |

* Field testing parameters only be validated by RAs, ROs, DD (Labs)

Remarks for Sample Quality (if Any):-

Dated July - 2024

Lab Analyst Shoaib Ahmad

Signature
Name of EPA Officer with office Address
Inspectors /RAs / ROs or ADs /DDs

Signature
Name of Assistant / Deputy Analyst, Analyst
with Name of Private Lab along with Address

ENVIRONMENTAL PROTECTION AGENCY
GOVERNMENT OF THE PUNJAB
*National Hockey Stadium, Gate No. 08*
*Gaddafi Stadium Complex, Lahore*

## Validation for Stack & Ambient Monitoring / Sampling

| Emission Monitoring under CTM-34 or OTM-39 | | | | |
|---|---|---|---|---|
| Facility Name & Address Phone | 500 KVA Power Plant | No of Stacks /Sampling Point | AA=02 | |
| | Chakwal | | | |
| Industry Category | Power Plant | | | |
| Analyzer Model & Make | | Environmental SA | | |
| Average stack emission Values of CO, NOx (in mg/nM3) | | In compliance | | |
| Excess Air / Excess Oxygen (%age):- | | 6.4 % | | |
| Analyzer exposed for Ramp-Up phase to the sample gas for 5 minutes | | Yes | NO | NA |
| Analyzer flow rate and EC temperature monitored during calibration and testing | | Yes | No | NA |
| Test Data Phase of sample gas recorded with 15 second interval | | Yes | No | NA |
| All key requirements to ensure QA/QC complied for said EPA approved Method | | Yes | No | NA |
| **Particulate Matter (PM) Monitoring / Sampling under USEPA Method 5 / 17** | | | | |
| Model & Make of Iso-kinetic PM Assembly | | | | |
| The PM sampling train is complete as per Method 5 & 17 | | Yes | No | NA |
| Leak Test performed prior to sampling | | Yes | No | NA |
| Field data Sheet for PM Sampling filled during PM sampling | | Yes | No | NA |
| Data for determining of "K" factor & OGM "Y" Factor filled during sampling | | Yes | No | NA |
| All method key requirements during sampling were compiled to ensure QA/QC | | Yes | No | NA |
| Filter of Particulate matter is suitable for metal Testing | | Yes | No | NA |
| **SOx sampling as per Method 8 (Thorin Indicator Method)** | | | | |
| The right absorbent solution are available for SOx Sampling | | Yes | No | NA |
| The equipment is capable to maintain flow rate @ 2.0LPM or as per method 8 requirement | | Yes | No | NA |
| Sampling for SOx is performed as per method | | Yes | No | NA |
| **Ambient Air Quality Monitoring by Automatic Monitors for CO, O3, SO2, NOx, PM2.5 & PM10** | | | | |
| *In case of continuous monitoring at a site, One Point QC Check Single analyzer &* Zero/span check is performed every 14 days. | | Yes | No | NA |
| The CE of NOx analyzer is ensured to be maintained within 96% - 104.1% | | Yes | No | NA |
| Zero/span check is performed prior to starting ambient monitoring | | Yes | No | NA |
| All key requirements for Critical & Operational Criteria for ambient air monitoring by automatic monitors were complied during monitoring | | Yes | No | NA |
| The measuring techniques of monitors comply PEQS | | Yes | No | NA |
| **Ambient Air Sampling of SPM, PM10, Pb by High Volume Sampler** | | | | |
| In case of Sampling for SPM through samplers, the flow rate of sampler comply PEQS (1.1m3/min). | | Yes | No | NA |
| Calibration of Sampler performed prior to sampling | | Yes | No | NA |
| **Vehicular Emissions & Noise Measurement** | | | | |
| Sampling of Vehicle emissions and noise measurement have been performed as per method and SOPs | | Yes | No | NA |

**Remarks** (If Any):-

**Dated** July-2024

Deputy Analyst
Shoaib Ahmad

**Signature**
**Name of EPA Officer with office Address**
**RAs / ROs /DOLLabs)**

**Signature**
**Name of Assistant / Deputy Analyst, Analyst with Name of Private Lab along with Address**