# Initial Environmental Examination

June 2017

## Islamic Republic of Pakistan: Proposed Multitranche Financing Facility II (MFF II) Second Power Transmission Enhancement Investment Program (Tranche 2)

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

# Sub-project 3: Supervisory Control & Data Acquisition (SCADA) Phase 3 & Revenue Metering System (RMS)

# TA 8818 (PAK)

# Initial Environmental Examination

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Prepared by National Transmission and Despatch Company Limited (NTDCL) for the Asian Development Bank (ADB)

# Table of Content

# ANNEXURES

# List of Figures



# List of Tables

**CURRENCY EQUIVALENTS**

As of 20th June 2017 Currency Unit – Pak Rupees (Pak Rs.)
Pak Rs 1.00 = $ 0.009 US$1.00 = Pak Rs. 105.8

**CONVERSIONS**

1 meter = 3.28 feet

1 hectare = 2.47 acre

# Acronyms

| | |
|---|---|
| **ADB** | Asian Development Bank |
| **SPS** | Safeguard Policy Statement |
| **EPA** | Environmental Protection Agency |
| **EIA** | Environment Impact Assessment |
| **EMP** | Environmental Management Plan |
| **EA** | Executing Agency |
| **IA** | Implementing Agency |
| **GoP** | Government of Pakistan |
| **IEE** | Initial Environmental Examination |
| **LARP** | Land Acquisition and Resettlement Plan |
| **Leq** | Equivalent sound pressure level |
| **NEQS** | National Environmental Quality Standards |
| **NGO** | Non Governmental Organization |
| **EMC** | Environmental Management Consultant |
| **PCP** | Public Communication Policy |
| **SSEMP** | Site Specific Environmental Management Plan |
| **REA** | Rapid Environmental Assessment |
| **AC** | Alternating Current |
| **AGC** | Automatic Generation Control |
| **AMR** | Automatic Meter Reading |
| **BoQ** | Bill of Quantities |
| **BUCC** | Back-Up Control Center |
| **CCVT** | Coupling Capacitor Voltage Transformer |
| **CDP** | Common Delivery Point |
| **CE** | Chief Engineer |
| **CPPA-G** | Central Power Purchase Authority (Guarantee) |
| **CT** | Current Transformer |
| **DC** | Direct Current |

| | |
|---|---|
| **DISCO** | Distribution Company |
| **DPLC** | Digital Power Line Carrier |
| **E&M** | Earth and Magneto |
| **EHV** | Extra High Voltage |
| **EMS** | Energy Management System |
| **EPC** | Engineer Procure and Construct |
| **HF** | High Frequency |
| **HMI** | Human Machine Interface |
| **GS** | Generation Scheduling |
| **GSM** | Global System for Mobile Communication |
| **GSO** | Grid System Operations |
| **IPP** | Independent Power Producer |
| **kV** | kilo-Volts |
| **LAN** | Local Area Network |
| **LDI** | Load Data Improvement System |
| **LDSUP** | Load Despatch System Upgrade Project (SCADA Phase 2) |
| **LF** | Load Forecast |
| **LFS** | Load Flow Study |
| **LMU** | Line Matching Unit |
| **MDF** | Main Distribution Frame |
| **MDM** | Meter Data Management |
| **MOS** | Meter Operating System |
| **MM** | Meter Management |
| **MW** | Mega Watts |
| **MoWP** | Ministry of Water and Power |
| **NAS** | Network Application Server |
| **NEPRA** | National Electric Power Regulatory Authority |
| **NMS** | Network Management System |
| **NPCC** | National Power Control Center |
| **NTDCL** | National Transmission and Despatch Company Limited |
| **ODF** | Optical Distribution Frame |
| **OE** | Owner's Engineer |
| **OLTC** | On-Load Tap Changer |
| **OPGW** | Optical Ground Wire |
| **PABX** | Private Automatic Branch Exchange |
| **PC-1** | Planning Commission Form 1 |
| **PDH** | Plesiochronous Digital Hierarchy |
| **PDS** | Primary Data Server |
| **PLC** | Power Line Carrier |
| **POC** | Point of Contact |

| | |
|---|---|
| **PT** | Potential Transformer |
| **RMR** | Remote Meter Reading |
| **RMS** | Revenue Metering System |
| **RRT** | Reliability Run Test |
| **RTU** | Remote Terminal Unit |
| **SCADA** | Supervisory Control and Data Acquisition |
| **SDH** | Synchronous Digital Hierarchy |
| **SFS** | System for Settlement |
| **SMS** | Secured Metering System |
| **STM** | Synchronous Transport Module |
| **TOC** | Take Over Certificate |
| **TP** | Tele-Protection |
| **UC** | Unit Commitment |
| **VSAT** | Very Small Aperture Terminal |
| **WAPDA** | Water and Power Development Authority |

## EXECUTIVE SUMMARY

1. The purpose of this Initial Environmental Examination report (IEE) is to provide an assessment of the environmental concerns that need to be taken into account with regards to the the Supervisory Control & Data Acquisition (SCADA) - Phase 3 & revenue metering system (RMS) project under the TA – 8818 of the Asian Development Bank (ADB).

2. Over the years, Pakistan's electric grid has expanded rapidly and become more diverse, making it challenging to run it reliably. SCADA systems are the need of any modern power system to give the operator control and visibility of the electric network.

3. The project aims to install both hardware and software to provide the NTDCL with a fully functional SCADA system for operations and monitoring of the complete electric grid and use the SCADA communication system to get energy data from all metering points on the system to the CPPA-G.

4. The proposed project will be implemented across four provinces of the country i.e. Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa (KPK). The SCADA and RMS related software and hardware installations will be conducted within the existing boundaries of the grid stations. However, 1754 km of fiber optic expansion sites will be installed next to the existing transmission lines.

5. Since it was not possible to visit each project site considering the relatively benign nature of the activities and the geographical spread across the country, thus secondary data was used as far as possible. However, some primary data was collected and public consultations with key stakeholders in a few of the selected project areas were conducted. This has been adopted as the most suitable approach since the scope of work will remain the same, irrespective of location.

6. Considering the limited scope and nature of the activities to be conducted and the geographical spread of the work sites, a generalized approach has been adopted that focuses on identifying potential impacts irrespective of any specific location. In addition, the EMP that has been developed provides necessary mitigation measures covering the proposed scope of work and will be used by all Contractors at their respective locations to prevent any significant impacts from taking place as a result of the planned project activities.

7. In consideration of the project scope, the likely impacts of the project activities during design and construction of the proposed project have been assessed and any necessary mitigation measures have been suggested. The proposed project was screened to determine the environmental category based on the ADB's Rapid Environmental Assessment (REA) Checklist and was assessed to be Category 'B' in accordance with ADB's Safeguard Policy Statement.

8. In certain selected project locations, the information disclosure to the public and consultation sessions was held with the local communities since they are the

primary stakeholders that are likely to be affected by the implementation of the proposed project. The consultation process was carried out as per the guidelines of ADB and EPA.

9. In order to ensure the effective implementation and management of mitigation measures, an Environmental Management Plan (EMP) has been prepared which is in line with ADB guidelines and is provided as Chapter 6 of the IEE report.

10. Also, mitigation will be assured by a program of environmental monitoring conducted during construction to ensure that all measures in the EMP are implemented and to determine whether the environment is protected as intended. This will include observations on-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported.

11. Therefore, the proposed project is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design and construction can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures. Based on the findings of this IEE, the classification of the Project as Category ‘B’ is confirmed. It is concluded that the proposed project should proceed, with appropriate mitigation measures and monitoring programs identified in the IEE.

# 1 Introduction

## 1.1 Overview

12. This document is the Initial Environmental Examination (IEE) for the Supervisory Control & Data Acquisition (SCADA) - Phase 3 & revenue metering system (RMS) project under the TA – 8818 of the Asian Development Bank (ADB).

13. The National Transmission and Despatch Company Limited (NTDCL) is the grid operator of Pakistan and the Central Power Purchase Authority - Guarantee (CPPA-G) is the billing and settlement entity. NTDCL currently owns all 500 and 220 kV transmission lines, grid stations and the central dispatch control center of Pakistan. Over the years, Pakistan's electric grid has expanded rapidly and become more diverse, making it very challenging to run it reliably. SCADA systems are the need of any modern power system to give the operator control and visibility of the electric network.

14. NTDCL has been using SCADA technology since 1992, which was upgraded very recently by the Japanese International Cooperation Agency (JICA) under the Load Despatch System Upgrade Project (LDSUP or SCADA Phase 2). This system is currently in place with many key components not working and the contract still open. Issues range from poor communication, non-functional protection equipment, and missing sites that were added after the initiation of the project.

15. The Asian Development Bank (ADB) is supporting the NTDCL in achieving a fully functional SCADA system for operations and monitoring of the complete electric grid and use the SCADA communication system to obtain energy data from all metering points on the system to the CPPA-G. This activity will involve installation of both hardware and software components across the country in the four provinces of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa (KPK).

16. This SCADA – Phase 3 and revenue metering system (RMS) sub-project is one of four sub-projects under Tranche 2 with a total cost of 230 million USD. The details of all four sub-projects under Tranche 2 are provided as **Table 1.1** below.

17. This Initial Environmental Examination (IEE) report presents the screening of potential environmental impacts of the proposed project and contains the mitigation measures in order to eliminate or reduce the negative impacts to an acceptable level, describes the institutional requirements and provides an environmental management plan.

## 1.2 Environmental Category of the Project

18. According to ADB's Safeguard Policy Statement (SPS) 2009, a Rapid Environmental Assessment (REA) Checklist was prepared for the proposed project (Annexure-I). The Pakistan Environmental Protection Agency's "Guidelines for the Preparation and Review of Environmental Reports (2000)" were also consulted.

Based on limited scope of the project activities and the nature of environmental impacts, which are site-specific, the project has been classified as Category 'B' and an IEE has been conducted.

### 1.3 Scope of IEE Study and Personnel

The following methodology was employed for this IEE study:

19. The proposed project will be implemented across four provinces of the country i.e. Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa (KPK). The SCADA and RMS related software and hardware installation will be conducted within the existing boundaries of the grid stations. However, 1754 km of fiber optic expansion sites will be installed next to the existing transmission lines.

20. Since it was not possible to visit each project site considering the relatively benign nature of the activities and the geographical spread across the country, thus secondary data was used as far as possible. However, some primary data was collected and public consultations with key stakeholders in a few of the selected project areas were conducted. This has been adopted as the most suitable approach since the scope of work will remain the same, irrespective of location.

21. Considering the limited scope and nature of the activities to be conducted and the geographical spread of the work sites, a generalized approach has been adopted that focuses on identifying potential impacts irrespective of any specific location. In addition, the EMP that has been developed provides necessary mitigation measures covering the proposed scope of work and will be used by all Contractors at their wherever felt necessary respective locations to prevent any significant impacts from taking place as a result of the planned project activities.

22. During the project implementation, at project sites where the equipment will be installed or retrofitted within the existing premises of the sub-stations, the study area to prevent impacts and ensure implementation of the EMP will be the immediate environs of the sub-stations. In the case of the installation of the fiber optic expansion sites onto the existing transmission lines, a corridor of impact of 20 meters on either side of the transmission line ROW shall be assumed.

23. A detailed environmental management and monitoring plan has been developed to ensure compliance to the proposed measures during the construction activity at the different project sites.

### 1.4 Structure of Report

24. Considering the scattered scope of the proposed activities over four provinces of Pakistan, this report provides a general overview of the environmental attributes in each province based on available secondary data.

25. This IEE also proposes various environmental management measures. Details of all background environmental quality, environmental impact/pollutant generating

activities, pollution sources, pollution control equipment, predicted environmental quality and related aspects have been provided in this report. References are presented as footnotes throughout the text. Following this introduction, the report follows ADB guidelines and includes:

- *Policy and Legal Framework*
- *Description of the Project*
- *Description of Environmental and Social Conditions*
- *Analysis of Alternatives*
- *Assessment of Environmental Impacts and Mitigation Measures*
- *Institutional Requirements Environmental Management Plan*
- *Public Consultation*
- *Grievance Redressal Mechanism*
- *Findings, Recommendations and Conclusions*

**Table 1.1: Sub-projects for proposed Tranche 2**

| **Subproject 1: 220 kV Mirpur Khas Substation with associated Transmission Lines** |
|---|
| • 2x220/132kV 250MVA transformers with allied equipment at Mirpur Khas S/S<br>• Extension of two line bays at 220 kV Hala Road S/S<br>• In/Out of D/C T/L Hala Road - Jamshoro at Mirpur Khas (70km)<br>• D/C T/L T.M.Khan - Hala Road (10 km) |
| **Subproject 2: D.I. Khan-Zhob 220 kV Transmission Line with Zhob Substation** |
| • New 220kV S/S with 2x160MVA transformers at Zhob S/S<br>• Extension of two line bays at 220 kV D.I Khan S/S<br>• 220 kV D/C T/L from D.I. Khan to Zhob (220 km) |
| **Subproject 3: SCADA Phase 3 and RMS Project for NTDC, SFS Project for CPPA-G** |
| **NTDC's component**:<br><br>• A renovated dispatch center with updated hardware/software<br>• Extended fiber optic backbone and backup microwave system<br>• Addition of backup control center at Jamshoro Regional Control Center<br>• Connecting all CDPs to the SCADA System<br>• Remote Terminal Unit interfacing with SCADA System<br><br>**CPPA-G's component**:<br><br>• Installation of SFS data servers; hardware and software at Islamabad (main center) and Lahore (backup center)<br>• Communication links for internal networks<br>• Data storage and backups in Islamabad and Lahore |
| **Subproject 4: Construction of New 220 kV Guddu-Shikarpur-Uch-Sibbi Transmission Line** |
| • Guddu- Shikarpur (150 km)<br>• Shikarpur - Uch plant (100 km)<br>• Uch Plant - Sibbi S/S (110 km) |

# 2 Policy and Legal Framework in Pakistan

## 2.1 General

26. This section provides an overview of the policy framework and national legislation that applies to the proposed activities to be conducted under the SCADA Phase 3 and RMS project. The project is expected to comply with all national legislation relating to environment in Pakistan, and to obtain all the regulatory clearances required.

27. Since the proposed project activities will be conducted in four provinces of Pakistan, namely Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa (KPK), thus all relevant national and provincial regulations and acts will be applicable based on the province in which the project implementation activity will be carried out. In addition, based on past practices, if the provincial EPAs so desire, they shall provide written consent to allow the Federal EPA to take the lead in reviewing of the IEE report and issuing the NoC on behalf of all provinces where the project activities are to be conducted.

## 2.2 National Policy and Legal Framework

28. The Pakistan National Conservation Strategy (NCS) that was approved by the federal cabinet in March 1992 is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992). The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas that are relevant in the context of the proposed sub-projects are pollution prevention and abatement and increasing energy efficiency while conserving biodiversity.

29. Prior to the adoption of the 18th Constitutional Amendment, the Pakistan Environmental Protection Act (PEPA) 1997 was the governing law for environmental conservation in the country. Under PEPA 1997, the Pakistan Environmental Protection Council (PEPC) and Pak EPA were primarily responsible for administering PEPA 1997. Post the adoption of the 18th Constitutional Amendment in 2011, the subject of environment was devolved and the provinces have been empowered for environmental protection and conservation. Subsequently, the following provincial acts are responsible for ensuring the implementation of the necessary environmental safeguards in their respective provinces:

- Punjab Environmental Protection (Amendment) Act 2012
- Sindh Environmental Protection Act, 2014
- Khyber Pakhtunkhwa Environmental Protection Act, 2014

- Balochistan Environmental Act, 2012

## 2.3 Regulations for Environmental Assessment, Pakistan EPA

30. Under Section 12 (and subsequent amendment) of the PEPA (1997), a project falling under any category specified in Schedule I of the IEE/EIA Regulations (SRO 339 (I0/2000), requires the proponent of the project to file an IEE with the concerned provincial EPA. Projects falling under any category specified in Schedule II require the proponent to file an EIA with the provincial agency, which is responsible for its review and accordance of approval or request any additional information deemed necessary.

## 2.4 Regulatory Clearances, Provincial EPAs

31. In accordance with provincial regulatory requirements, an IEE/EIA satisfying the requirements of the respective provincial Environmental Protection Acts mentioned above is to be submitted to the respective EPAs (or to Federal EPA to take the lead, if all provincial EPAs issue their consent) for review and approval, and subsequent issuance of NOC before the commencement of construction.

## 2.5 Guidelines for Environmental Assessment, Pakistan EPA

32. The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. The guidelines that are relevant to the proposed project are listed below:

- Guidelines for the Preparation and Review of Environmental Reports, Pakistan, EPA1997;
- Guidelines for Public Consultations; Pakistan EPA May 1997;

## 2.6 National Environmental Quality Standards (NEQS) 2000

33. The National Environmental Quality Standards (NEQS), 2000, specify the following standards:

- Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea (three separate sets of numbers);
- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources;
- Maximum allowable concentration of pollutants (two parameters) in gaseous emissions from vehicle exhaust and noise emission from vehicles;
- Maximum allowable noise levels from vehicles;

34. These standards apply to the gaseous emissions and liquid effluents discharged by construction machinery.

## 2.7 ADB Policies

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

35. The Asian Development Bank's Safeguard Policy Statement (SPS) 2009 requires that environmental considerations be incorporated into ADB's funded project to ensure that the project will have minimal environmental impacts and be environmentally sound. Occupational health & safety of the local population should also be addressed as well as the project workers as stated in SPS. A Grievance Redress Mechanism (GRM) to receive application and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance is also established and provided in Chapter 9 of this report.

36. All loans and investments are subject to categorization to determine environmental assessment requirements. Categorization is to be undertaken using Rapid Environmental Assessment (REA) checklists, consisting of questions relating to (i) the sensitivity and vulnerability of environmental resources in project area, and (ii) the potential for the project to cause significant adverse environmental impacts. Projects are classified into one of the following environmental categories:

Category A: A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA) is required.

Category B: A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) is required.

Category C: A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

Category FI: A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary (FI).

37. As a result of the completion of the REA checklist, the proposed sub-project has been classified as Category ''B'' and thus a detailed and comprehensive IEE study has been prepared including the EMP.

### 2.7.2 ADB's Public Communication Policy 2011

38. The PCP aims to enhance stakeholders' trust in and ability to engage with ADB, and thereby increase the development impact of ADB operations. The policy promotes transparency, accountability, and participatory development. It establishes the disclosure requirements for documents ADB produces or requires to be produced.

### 2.7.3 ADB's Accountability Mechanism Policy 2012

39. The objectives of the Accountability Mechanism is providing an independent and effective forum for people adversely affected by ADB-assisted projects to voice their concerns and seek solutions to their problems, and to request compliance review of the alleged noncompliance by ADB with its operational policies and procedures that may have caused, or is likely to cause, them direct and material harm. The Accountability Mechanism a "last resort" mechanism.

## 2.8 Other Environment Related Legislations

40. The **Table 2.1** provides a summary of all legislations, guidelines, conventions and corporate requirements.

**Table 2.1: Environmental Guidelines and Legislations**

| Legislation/Guideline | Description |
|---|---|
| **National Environmental Policy (2005) (NEP)** | NEP is the primary policy of Government of Pakistan addressing environmental issues. The broad Goal of NEP is, "to protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development". The NEP identifies a set of sectoral and cross-sectoral guidelines to achieve its goal of sustainable development. It also suggests various policy instruments to overcome the environmental problems throughout the country. |
| **The Forest Act (1927)** | The Act empowers the provincial forest departments to declare any forest area as reserved or protected. It empowers the provincial forest departments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce, quarrying and felling, lopping and topping of trees, branches in reserved and protected forests. No protected forest is situated in the sub-project area. |
| **Punjab Wildlife Protection Ordinance, 1972** | It empowers the government to declare certain areas reserved for the protection of wildlife and control activities within in these areas. It also provides protection to endangered species of wildlife. As no activities are planned in these areas, no provision of this law is applicable to the proposed project. |
| **Khyber Pakhtunkhwa Wildlife and Biodiversity Act, 2015** | It empowers the government to declare certain areas reserved for the protection of wildlife and control activities within in these areas. It also provides protection to endangered species of wildlife. As no activities are planned in these areas, no provision of this law is applicable to the proposed project. |
| **The KPK Antiquities Act (2016)** | It ensures the protection, preservation, development and maintenance of antiquities in the province of KPK. The Act defines "antiquities" as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the GoKPK to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, GoKPK, any archaeological discovery made during the course of the project. |

| Legislation/Guideline | Description |
|---|---|
| **Punjab Antiquities (Amendment) Act (2012)** | It ensures the protection of cultural resources and antiquities throughout the province of Punjab. |
| **The Antiquities Act (1975)** | It 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. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the GOP to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, GOP, any archaeological discovery made during the course of the project. |
| **Sindh Wildlife & Protected Areas Act (2010)** | It ensures the protection, preservation, conservation, sustainable use and management of biodiversity, especially wildlife, and establishment and management of protected areas in the province of Sindh. |
| **Balochistan Wildlife (Protection, Preservation, Conservation and Management) Act, 2014** | It ensures the protection, preservation, conservation, sustainable use and management to wildlife, and establishment and management of protected areas in the province of Balochistan. |
| **Balochistan Antiquities Act, 2014** | It is an Act that aims to provide for preservation and protection of antiquities in the province of Balochistan. |
| **Pakistan Penal Code (1860)** | It authorizes fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs so as to make them less fit for ordinary use. |
| **NATIONAL ENVIRONMENTAL AND CONSERVATION STRATEGIES** | |
| **National Conservation Strategy** | Before the approval of NEP, the National Conservation Strategy (NCS) was considered as the Government's primary policy document on national environmental issues. At the moment, this strategy just exists as a national conservation program. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage and recommends immediate attention to these core areas. |
| **Biodiversity Action Plan** | The plan recognizes IEE/EIA as an effective tool for identifying and assessing the effects of a proposed operation on biodiversity. |
| **INTERNATIONAL CONVENTIONS** | |
| **The Convention on Conservation of Migratory Species of Wild Animals (1981.21)** | The Convention requires countries to take action to avoid endangering migratory species. The term "migratory species" refers to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or cooperate with other countries in matters of research on migratory species. There are no endangered species of plant life or animal life in the vicinity of the proposed sub-project. |
| **Convention on International Trade in** | The convention requires Pakistan to impose strict regulation (including penalization, confiscation of the specimen) regarding trade of all species threatened with extinction or that may become so, in |

| Legislation/Guideline | Description |
|---|---|
| **Endangered Species of Wild Fauna and Flora (1973)** | order not to endanger their survival further. |
| **International Union for Conservation of Nature and Natural Resources Red List (2000)** | Lists wildlife species experiencing various levels of threats internationally. Some of the species indicated in the IUCN red list are also present in the wetlands of Pakistan. |
| **Kyoto Protocol/Paris Agreement** | SF6 gas is listed in the Kyoto Protocol as one of the six greenhouse gases subject to monitoring. SF6 has to be used in closed systems in order to avoid emissions. 194 member states agreed to extend the Kyoto protocol until 2020 with the aim of reducing the emission of greenhouse gases.<br>The Paris Convention agreed to reduce climate-damaging greenhouses gases under the United Nations Framework Convention on Climate Change (UNFCCC) as of 2020. 195 member states negotiated and adopted this agreement on the twenty-first session of the Conference of the Parties under the framework convention on climate change in Paris on 12 December 2015. |
| **IEC 62271-4 directive** | This directive stipulates SF6 gas recovery down to a final vacuum of < 20 mbar. The IEC requirements are exceeded by far when using DILO devices as DILO service carts enable a final vacuum of < 1 mbar depending on the type of device. |
| **IEC 60480 guideline** | This guideline stipulates the limit values for the re-use of SF6 gas in medium and high voltage switchgear. |
| **EMF Exposure limits by IFC for 'general public' and 'occupational exposure'** | These exposure limits have been provided for monitoring of EMF limits in order to prevent any adverse health effects in the general public as well as amongst workers. |

## 2.9 Comparison of International and Local Environmental Legislations

41. The ADB SPS requires application of pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards. The SPS states that when host country regulations differ from these standards, the EA will achieve whichever is more stringent.

42. A comparison of applicable local and international guidelines for ambient air quality has been provided in **Table 2.5** below. In the case of most pollutants, the NEQS standards for ambient air quality are more stringent in comparison to USEPA and WHO/IFC standards. The applicable and most stringent parameters for each respective pollutant are highlighted in green.

43. Similar to the standards for air quality, the comparison of noise standards provided in **Table 2.6** clearly shows that NEQS standards for noise are more stringent in comparison to the WHO/IFC standards. The only exception is the daytime noise level standard for Industrial areas where the World Bank/IFC standard is more stringent (70 dB(A)) in comparison to NEQS (75 dB(A)) and so for this

particular parameter, the WHO/IFC standard will be used. Apart from this one exception, the NEQS standards have been used for this project.

44. As far as regulations regarding other environmental parameters are concerned such as acceptable effluent disposal parameters, the local regulations i.e. NEQS take precedence over any other international regulations such as WHO/IFC since these specific IFC standards only cover a limited number of parameters relating to effluent disposal etc and the NEQS are generally more stringent.

## 2.10 Implications of national policies and regulations on proposed project

45. The Pak-EPA formulated regulations in 2000 for 'Review of IEE and EIA' which categorise development projects under three schedules - Schedules I, II and III. Projects are classified on the basis of expected degree and magnitude of environmental impacts and the level of environmental assessment required is determined from the schedule under which the project is categorised.

46. The projects listed in Schedule-I include those where the range of environmental issues is comparatively narrow and the issues can be understood and managed through less extensive analysis. Schedule-I projects require an IEE to be conducted, rather than a full-fledged EIA, provided that the project is not located in an environmentally sensitive area.

47. The proposed sub-project has been categorized as Schedule-I and thus an IEE study has been conducted.

48. This IEE study will be submitted to the relevant provincial EPAs for review and any comments in order to receive the respective NOC from each province where the scope of work is to be conducted. Each provincial EPA will respond within 10 working days from receipt of the IEE report and confirm the completeness of the report for detailed review or request additional information to be provided in order for the review to take place.

49. Each provincial EPA will make every effort to review the IEE report within 45 days of the issuance of completeness of the report. Upon completion of the review, an NOC will be issued, with conditions from the EPA if felt necessary.

## 2.11 Implications of ADB's safeguard policies on proposed project

50. The objectives of ADB's safeguards are to:

- avoid adverse impacts of projects on the environment and affected people, where possible;
- minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- help borrowers/clients to strengthen their safeguard systems.

51. ADB's SPS sets out the policy objectives, scope and triggers, and principles for three key safeguard areas:

- environmental safeguards,
- involuntary resettlement safeguards, and
- Indigenous Peoples safeguards.

52. The objective of the environmental safeguards is to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. ADB's policy principles are summarized in **Table 2.2** below.

**Table 2.2: ADB Policy Principles**

| | Policy principle | Summary |
|---|---|---|
| 1 | Screening and categorization | Screening process initiated early to determine the appropriate extent and type of environmental assessment. |
| 2 | Environmental assessment | Conduct an environmental assessment to identify potential impacts and risks in the context of the project's area of influence. |
| 3 | Alternatives | Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts, including no project alternative. |
| 4 | Impact minigation | Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts. Prepare an environmental management plan (EMP). |
| 5 | Public consultations | Carry out meaningful consultation with affected people and facilitate their informed participation. Involve stakeholders early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation. Establish a grievance redress mechanism. |
| 6 | Disclosure of environmental | Disclose a draft environmental assessment in a timely manner, in an accessible place and in a form and language(s) understandable to stakeholders. |

| | | |
|---|---|---|
| | assessment | Disclose the final environmental assessment to stakeholders. |
| 7 | Environmental management plan | Implement the EMP and monitor its effectiveness. Document monitoring results, and disclose monitoring reports. |
| 8 | Biodiversity | Do not implement project activities in areas of critical habitats. |
| 9 | Pollution prevention | Apply pollution prevention and control technologies and practices consistent with international good practices. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges. Avoid the use of hazardous materials subject to international bans or phaseouts. |
| 10 | Occupational health and safety<br><br>Community safety. | Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities |
| 11 | Physical cultural resources | Conserve physical cultural resources and avoid destroying or damaging them. Provide for the use of “chance find” procedures. |

## 2.12 EMF Exposure Guidelines

53. Although there is public and scientific concern over the potential health effects associated with exposure to EMF (not only high voltage power lines and substations, but also from everyday household uses of electricity), there is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines and equipment.

54. However, while the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern. Table 2.3 lists exposure limits for general public exposure to electric and magnetic fields published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) while Table 2.4 provides the exposure limits for occupational exposure.

55. It is important to mention that no national guidelines on EMF exposure exist at present.

**Table 2.3: ICNIRP exposure limits for general public exposure to electric and magnetic fields**

| Frequency | Electric Field (V/m) | Magnetic Field (uT) |
|---|---|---|
| 50 Hz | 5000 | 100 |
| 60 Hz | 4150 | 83 |

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

**Table 2.4: ICNIRP exposure limits for occupational exposure to electric and magnetic fields**

| Frequency | Electric Field (V/m) | Magnetic Field (uT) |
|---|---|---|
| 50 Hz | 10,000 | 500 |
| 60 Hz | 8300 | 415 |

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

**Table 2.5: Comparison of International and local Air Quality Standards***

| Pollutants | USEPA | | WHO/IFC | | Pak. NEQS | |
|---|---|---|---|---|---|---|
| | Avg. Time | Standard | Avg. Time | Standard | Avg. Time | Standard |
| $SO_2$ | 3 hrs<br>1 hr | 0.5 ppm<br>75 ppb | 24 hr<br>10 min | 20 ug/$m^3$<br>500 ug/$m^3$ | Annual Mean<br>24 hrs | 80 ug/$m^3$<br>120 ug/$m^3$ |
| CO | 8 hrs<br>1 hr | 9 ppm (11 mg/$m^3$)<br>35 ppm (43 mg/$m^3$) | - | - | 8 hrs<br>1 hr | 5 mg/$m^3$<br>10 mg/$m^3$ |
| $NO_2$ | Annual Mean<br>1 hr | 100 ug/$m^3$ (53 ppb)<br>100 ppb | 1 yr<br>1 hr | 40 ug/$m^3$<br>200 ug/$m^3$ | Annual Mean<br>24 hrs | 40 ug/$m^3$<br>80 ug/$m^3$ |
| $O_3$ | 8 hrs | 0.07ppm (148 ug/$m^3$) | 8 hrs | 100 ug/$m^3$ | 1 hr | 130 ug/$m^3$ |
| TSP | - | - | - | - | Annual Mean<br>24 hrs | 360 ug/$m^3$<br>500 ug/$m^3$ |
| $PM_{10}$ | 24 hrs | 150 ug/$m^3$ | 1 yr | 20 ug/$m^3$ | Annual Mean | 120 ug/$m^3$ |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 24 hr | 50 ug/$m^3$ | 24 hrs | 150 ug/$m^3$ |
| $PM_{2.5}$ | Annual Mean<br>24 hrs | 15 ug/$m^3$<br>35 ug/$m^3$ | 1 yr<br>24 hr | 10 ug/$m^3$<br>25 ug/$m^3$ | Annual Average<br>24 hrs<br>1 hr | 15 ug/$m^3$<br>35 ug/$m^3$<br>15 ug/$m^3$ |

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

**Table 2.6: Comparison of International and Local Noise Standards**

| Category of Area/Zone | Limit in dB(A) Leq | | | |
|---|---|---|---|---|
| | NEQS | | WHO/IFC | |
| | Day Time | Night Time | Day Time | Night Time |
| Residential area (A) | 55 | 45 | 55 | 45 |
| Commercial area (B) | 65 | 55 | 70 | 70 |
| Industrial area (C) | 75 | 65 | 70 | 70 |
| Silence zone (D) | 50 | 45 | 55 | 45 |

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

# 3 Description of the Project

## 3.1 Type of Project

1. The proposed project is the SCADA Phase 3 & RMS consisting of installation of multiple hardware and software components at different sites located in various provinces across Pakistan.

2. A detailed environmental assessment has been carried out in accordance with *ADB SPS 2009* and GoP's environmental assessment regulations and guidelines.

## 3.2 Project Background

3. Pakistan's national grid has had a SCADA system since 1991. A brief history of SCADA systems in Pakistan is provided below.

### 3.2.1 First SCADA Introduced (ABB)

4. In 1958, Pakistan's National Grid was established with the establishment of Water and Power Development Authority (WAPDA). It was relatively small and was operated at the grid stations and hydel power plants. With excess hydel energy, it was an easy task. As demand grew, the safe and reliable operation of the grid became more difficult. In 1985, WAPDA established the National Power Control Center (NPCC) (which is currently under the National Transmission and Despatch Company Limited (NTDCL)) to control the 500 and 220kV transmission network throughout Pakistan.

5. In 1991, ABB completed installation of the first SCADA system installed at the dispatch headquarters at NPCC in Islamabad. This SCADA system is referred to commonly as SCADA Phase 1. This system used analog power line carriers (PLCs) and microwave links to connect Remote Terminal Units (RTUs) installed at electric grid and generation stations to Islamabad. As the electric network grew, the SCADA system did not keep pace in expansion. As the system was getting more complex, control of it was degrading. The National Electric Power Regulatory Authority (NEPRA) introduced the NEPRA Grid Codes in 2005 and with these regulations came a regulatory need to upgrade the SCADA system. The existing technology with the ABB equipment was outdated and used a closed protocol, which drove the need for a new SCADA system.

### 3.2.2 First SCADA Upgradation (JICA)

6. In 2005, JICA agreed to provide financial assistance to Government of Pakistan to upgrade the SCADA system to newer technologies. The JICA funded project is commonly referred to as Load Dispatch System Upgrade Project (LDSUP) or as SCADA Phase 2. The project was aimed at modernization and upgradation of the Load Despatch Center in Islamabad, as well as the existing and new field locations since the completion of SCADA Phase 1 by ABB.

7. The plan for this upgrade was to install new RTUs in grid stations and additional “field wiring” where applicable. The communication network was set to have a new fiber optic backbone from Sheikh Muhammadi 500kV grid station to Guddu 500kV grid station along the 500kV electric network. Where required, new digital power line carrier (DPLC), upgraded from the analog power line carriers (PLCs) in service. In the original scope, both fiber optic and DPLC links would contain data, voice, and tele-protection.

8. Two things regarding the tele-protection; first, on transmission lines that had DPLC and fiber optic links, the tele-protection would utilize DPLC links as primary communication links and the fiber optics would be used (and commissioned) as backup for the tele-protection system. Second, not all electric power lines utilized tele-protection. Therefore, tele-protection was only to be facilitated for power line links where it existed under the analog power line carrier network.

### 3.3 Objective of Project

9. The project aims to install both hardware and software to provide the NTDCL with a fully functional SCADA system for operations and monitoring of the complete electric grid and use the SCADA communication system to get energy data from all metering points on the system to the CPPA-G.

### 3.4 Major Components of a SCADA system

10. In a SCADA system, different parts come together to give visibility, command and control over a power system. SCADA systems are a combination of hardware and software mainly comprising telecommunication equipment, computer systems, servers and application software. The sections below briefly describe the role of the major components that will be a part of the SCADA Phase 3 and RMS Project.

#### 3.4.1 Hardware

**Sensors & End Devices**

11. Sensors are the primary source of data in SCADA systems. They detect and transmit readings of parameters needed to Remote Terminal Units (RTU) installed at site.

**Remote Terminal Units (RTU)**

12. The remote terminal unit is an electronic device containing a local database that acts as the physical connection between equipment and devices installed in the field and the SCADA system. The devices provide signals to RTUs required by dispatchers at the control center. There are also control points that respond to commands, such as open or close, that can be sent from a SCADA master terminal, connected to the PDS, to the field devices through the RTUs. The RTU converts the data (indication, status, alarm, or measurement) from these devices to a digital form recognizable by the SCADA system protocol. RTUs may also be used to control outputs depending on signals from sensors for process automation.

13. RTUs play a very critical role in a SCADA system and they require a constant source of power. Therefore, apart from a normal AC source of power, they are also backed up by DC systems to ensure reliability.

14. As part of the JICA LDSUP (SCADA Phase 2) project, Alstom installed 49 new RTUs and 45 DC power supply systems.

**Primary Data Server (PDS)**

15. The PDS or Input-Output (I/O) Server is the main SCADA server which polls data from all field RTUs using different transmission media. All the data is then distributed to the operators and sent to the historian (database server) for record-keeping and future reference.

**Operator Stations**

16. These stations mainly comprise displays and computer systems, which show the data being received by the PDS. Operators then supervise this data and take appropriate actions based on the data being received. The operators can make changes to the system and shut down or start transmission lines, generators, transformers etc.

**Historian**

17. This is a server with large storage capacity, which logs, stores and maintain data being sent by the PDS. The data includes sensor readings, alarms, signals and event logs. In smaller systems, operator stations and historian can be the same device.

**Tele-protection**

18. Protection systems must meet sensitivity, time response, selectivity and reliability specifications to satisfy fault-clearing requirements of a power system. Protection schemes, for high-voltage transmission lines, rarely meet all these requirements without using telecommunications. The protection system architecture mainly consists of protection relays, tele-protection equipment and a telecommunication system. The tele-protection equipment is the interface between protection relays and the telecommunication system and plays an important role in quickly identifying and isolating the fault on transmission lines. SCADA telecommunication media are used to provide tele-protection services and they must have a deterministic signal transmission delay and constant bandwidth.

### 3.4.2 Software Applications

**Load Forecasting (LF)**

19. The software automatically calculates the expected load for future days. This is done mainly by evaluating past loading data, recent load trends and weather conditions. An accurate load forecast is critical to the operation and planning of a utility. It helps the utility in making decisions on generating and purchasing power, infrastructure development and load switching.

**Unit Commitment (UC)**

20. The coordinating of different types of generation keeping in mind operational and device constraints. This software helps in determining the generation units to be on

or off, their timing, type of fuel, the optimum generation from each generator, fuel mixture (where applicable) and reserve margins to have the most efficient and reliable power solution.

**Generation Scheduling**

21. This software evaluates the load forecast for the next day, and then schedules the time and output power for each generator of the system in coordination with the unit commitment software. Its primary purpose is to ensure that the required amount of generation and reserves are available to ensure reliability of the grid system.

**Automatic Generation Control (AGC)**

22. This application changes the generation output of different units on the power system for a quick response to load changes in real-time. The main aim is the keep the frequency stable always, which in Pakistan is 50Hz. If the frequency is above the required 50Hz, there is less load compared to generation on the system. Hence, it reduces generation to bring the frequency down and vice versa. In case the power grid is tied to other power utilities with scheduled power interchanges, it also keeps the power exchange at scheduled levels.

**Load Flow Study (LFS)**

23. This software is essential in simulating different conditions of the power system and seeing the results to determine if the system will remain under the required limits or stability and operation in case of any faults or additions on the system. They are also used to optimize loading, develop practical voltage profiles, identify power flows on the system, develop equipment specification guidelines and identify transformer tap settings. It also helps operators learn to handle different operational scenarios by simulating them and making them understand the system better.

### 3.4.3 Communications Media

24. Communications is the backbone of any SCADA system. There are many communication media available to choose from and in Pakistan. There are five main types of media being used: OPGW, DPLC, VSAT, GSM and Microwave. The appropriate media is chosen depending on the size, location and data requirements for a site that is to be connected to SCADA. Their brief descriptions are provided below.

**Optical Ground Wire (OPGW)**

25. An optical ground wire is an optical fiber composite over-head ground wire. These wires have two main functions: grounding and communications. The wire has a tubular structure with one or more optical fiber wires in or near the middle surrounded by steel and aluminum wires. It is placed at the top of electrical transmission line towers. The conductive part of OPGW (which is steel and aluminum) connects the adjacent towers to earth ground and shields the tower from lightning strikes. The optical fiber can be used for communications. Synchronous Data Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) are the primary telecommunication technology when it comes to transporting large quantities of data over fiber optic. PDH is an old technology and due to its technical superiority, the newer SDH is

taking over on fiber optic communication. Fiber Optic network is used for data, voice, and where applicable (on the same link) a backup for the tele-protection on the link.

**Digital Power Line Carrier (DPLC)**

26. Power lines also have the capability to communicate data to the SCADA system. This is achieved by superimposing data signals over the power signal being sent from a site at a higher frequency and pulling the data out at the receiving end by using a frequency filter. This saves both cost and time as only terminal receiving and sending equipment is required as the transmission media is the existing power line. NTDCL initially used analog PLC in its old SCADA system, which was replaced by DPLC in the LDSUP (SCADA Phase 2) contract, which has the advantage of transmitting much more data over the same power lines. DPLC is used for data, voice and tele-protection.

**Very Small Aperture Terminal (VSAT)**

27. Very Small Aperture Terminal (VSAT) is a satellite based communication system. The system employed in Pakistan's electric grid consists of point to multi-point two-way links. VSAT technology was employed between the original ABB SCADA installation and the LDSUP (SCADA Phase 2). With the addition of IPPs to the Pakistani grid, it became necessary to be able to communicate with these new power plants. While expensive, VSAT was the simplest technology to deploy to capture the data. The LDSUP (SCADA Phase 2) contract included integration of the IPPs on VSAT to report in the SCADA system. To date, only 1 out of 14 sites has been connected.

28. The challenge with VSAT in an electric grid is the lag time involved with transmission of data from earth to a satellite back to earth. Latency issues create poor performance of the electric grid. There is also the issue of heavy rain and signal blockage. Heavy rain is prevalent in Pakistan during the monsoon season.

**Private Automatic Branch Exchange (PABX)**

29. PABX is an automatic telephonic switching system, which is implemented within an organization and for its internal communications only. The advantage of this system is that it is not affected by network congestion issues, if properly configured and the dedicated phone lines give the most reliable access to users. In power system operations, having fast and dedicated telephonic communication is highly desirable. It can be implemented on fiber optic, DPLC and microwave.

**Microwave**

30. Previously Analog Microwave was used by the NTDCL. Analog microwave is a wireless data communication technology most-widely used in cellular telecommunication networks. It was used as the backup to the main telecom network for SCADA system but now, due to poor maintenance and outdated equipment it has been taken out of service. SCADA Phase 3 and RMS project has a component to convert this network to a Digital Microwave network and re-instate as the backup to the fiber optic backbone.

## 3.5 Justification and need for project

31. Over the years, Pakistan's electric grid has expanded rapidly and become more diverse, making it challenging to run it reliably. SCADA systems are the need of any modern power system to give the operator control and visibility of the electric network.

32. The proposed SCADA Phase 3 and RMS project is designed to fix both revenue meter data issues of CPPA-G and real-time data requirements of the NPCC. The intent of the project is to have revenue quality data from the CDP sites communicate to the CPPA-G for billing purposed and real-time data for the NPCC to observe loads at each DISCO to ensure the load allocations are followed.

## 3.6 Location and Scale of Project

33. The proposed project will be spread across the country in the provinces of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa (KPK). The different sites where the proposed scope of works are to be conducted are provided in **Tables 3.1** to **3.4** below with the breakdown as follows:

    **RTU Stations: 116 sites**

    **Fiber Optic Expansion Sites: 22 (Total length: 1754 km)**

    **Digital Microwave Sites: 59**

    **Private Automatic Branch Exchange (PABX): 24 sites**

34. The scope of works for this project consists of both hardware and software components. While from an environmental perspective, the software component is completely benign, however the hardware component of the project will involve retrofitting of additional electrical components onto existing power infrastructure. Even from the hardware perspective, a considerable proportion of the works will be conducted within the boundaries of the existing sub-stations while the fiber optic expansion activity will be conducted at the existing transmission lines, spread over 1754 kilometers.

## 3.7 Details of Project Scope

The project scope consists of two components, which are outlined below:

**NTDC's component**

- A renovated dispatch center with updated hardware/software
- Extended fiber optic backbone and backup microwave system
- Addition of backup control center at Jamshoro Regional Control Center
- Connecting all CDPs to the SCADA System
- Remote Terminal Unit interfacing with SCADA System

**CPPA-G's component**

- Installation of SFS data servers; hardware and software at Islamabad (main center) and Lahore (backup center)
- Communication links for internal networks
- Data storage and backups in Islamabad and Lahore

The specific activities to be conducted as a part of this activity are categorized and discussed below:

**NTDC's component**

### 3.7.1 Installation of Remote Terminal Units (RTU)

35. The Project will include the installation of 116 RTUs at different sites. These sites include generation plants, grid stations and BPCs that were not connected under the LDSUP (SCADA Phase 2) and some sites that are planned to be added by the expected end of project (early 2020). These RTUs will be connected using fiber optic or Digital Power Line Carrier (DPLC). Some of these sites are CDPs and will required the connection of SMS meters at site to be connected to the telecommunication network. The list of these sites is provided as **Table 3.1** below and the proposed NTDCL data route plan is shown as **Figures 3.1** to **3.9**.

### 3.7.2 Installation of Fiber Optic

36. The main activities will include installing 1754 km of OPGW, installation of terminal equipment for OPGW and DPLC, and installation of a backup digital microwave communication system. The details of the fiber optic expansion are provided as **Table 3.2** below and the fiber optic network plan is shown as **Figure 3.11**.

### 3.7.3 Installation of Digital Power Line Carrier (DPLC)

37. The SCADA Phase 3 project has mainly made use of fiber optic as the main telecommunication media, but wherever feasible, DPLC is planned to be deployed. DPLC communication will require installation of new equipment which will include wave traps, coupling capacitor voltage transformer (CCVT), Line Matching Units (LMU) and high frequency (HF) cable.

38. For each outdoor/PLC link there will 4 wave traps, 4 CCVTs, 4 LMUs and 1000m HF cable required. For P2P links 2 wave traps, 2 CCVTs, 2LMUs and 1000m HF cable will be required. The P2P links are to be installed at sites which are connected to the grid via a T-off arrangement due to which less equipment is required. Indoor equipment for DPLC will mainly include the DPLC multiplexer.

### 3.7.4 Installation/Up gradation of Digital Microwave

39. The digital microwave system will act as the backup to the main fiber optic backbone network. This activity will include installation, testing, configuring and commissioning of 59 stations. The stations will consist of new base stations and repeater stations and revamping (upgrade) of old base and repeater stations. There will also be 24 PABXs installed to act as a backup system in case the main fiber optic backup is down. The details of the digital microwave stations are provided in **Table 3.3** below and the proposed digital microwave network is shown as **Figure 3.10**.

### 3.7.5 Private Automatic Branch Exchange (PABX)

40. SCADA Phase 3 will also include making functional for NTDCL its own internal telephone system known as a Private Automatic Branch Exchange (PABX). Although this was a part of LDSUP (SCADA Phase 2), most PABX links are down, unreliable, congested or have a lot of noise on them. SCADA Phase 3 project will feature the installation of PABX on 24 digital microwave stations. This will act as the backup to the main PABX installed on the fiber optic. The sites for installation are given in the **Table 3.4** below.

### 3.7.6 CPD/SMS Meter Communication

41. All sites that are a CDP and have a SMS meter installed at site will need to be connected to the NTDC telecommunication network for transmitting real-time revenue meter data to NPCC. SMS meters are equipped with a communication module, which has an Ethernet output port. This communication module will be connected to the multiplexer installed in the telecom room at the site. To accomplish this an Ethernet to fiber optic converter will be used on both the meter and multiplexer end.

### 3.7.7 Installation of Accessories and Miscellaneous Items

42. Telecommunication networks are complex and a number of accessories and supporting systems go hand-to-hand with them to make them work. The following items will also be installed at sites for telecommunication:

    **Routers:** These will be installed at sites where data from two or more nodes are coming in or going out from.

    **DC Systems:** They will be installed which has equipment that runs on DC only e.g. multiplexers, exchanges, RTUs etc. DC systems consist of battery banks, chargers and DC distribution box.

    **NMS:** This is a critical modern tool that provides a real-time representation of the telecom network with details about the status, health and problems at any node in the network. Currently, the NTDCL has only one NMS installed at NPCC, Islamabad. As part of SCADA Phase 3, a NMS will be deployed at Dadu. This will allow the NTDCL telecom staff in the south to monitor, configure and troubleshoot the network locally, saving critical time and resources.

**Signal and Tele-protection cabling:** Additional cabling will be bought for connecting signals or connecting protection equipment to RTUs at sites.

**Tools and test equipment:** NTDCL's telecom department will be responsible for the operation and maintenance of the telecommunication network. For this purpose, telecom staff will require tools and test equipment. The telecom department is divided in to three circles, which are then further divided in divisions and sub-divisions. Equipment that is required more frequently will be given to each telecom division, while that which is needed seldom will be kept at the circle level. A total of 10 OTDRs, 5 splicing machines, 10 power meters, 10 talk sets, 5 level meters, and 10 data testers will be acquired.

### 3.7.8 Development of a Backup Control Center

43. The intent of this component is to ensure continued reliable operations of the NTDCL Network if the NPCC control center becomes inoperable. This requires the establishment of a Backup Control Center located geographically separate from the main control center.

44. The physical location should be such that it can be accessed in a few hours from NPCC Islamabad with relative ease. The most reasonable location, keeping in view the requirements, would be Jamshoro. This location is near a main transportation corridor as well as it is on the fiber optic communications backbone network.

45. The Scope of work for NTDCL Backup Control Center will include:

- Civil works for center
- Hardware/software installation
- Training for support staff
- Communication links pointing to B/U Control Center

**<u>CPPA-G's Component</u>**

### 3.7.9 Installation of SFS data servers (hardware and software) at Islamabad and Lahore

46. CPPA-G will install the RMS and SFS system at Islamabad (main center) and Lahore (backup center). This will be done to ensure data security and is a standard practice. The servers installed at both locations will have a main and redundant server. Redundant servers replicate all the data being received by the main constantly, and have a seamless transfer in case the main fails. In the RMS, if the main server fails, the redundant will take over. In case both servers at the main location are down, the backup location will take over and have a redundant on standby.

47. The revenue meter data for the System for Settlement can also be collected from the Revenue Meter System (RMS) database by the CPPA-G at their primary and backup locations. The main location will connect via a microwave link. The backup location, once determined, will connect with the most cost effective media available.

48. The data from the RMS data server in the NPCC is polled from the main and backup locations of CPPA-G System for Settlement (SFS) data server. From the SFS server, billing and settlement can be accomplished. There will also be dual back up data storage for data retention.

### 3.7.10 Communication links for internal networks

49. The complete communication path from the meters to CPPA-G will be the responsibility and jurisdiction of NTDCL. NTDCL will operate, maintain and modify the communication links as needed. CPPA-G will be responsible for the main and backup servers, computer systems, and any other associated hardware and software for the RMS and SFS.

50. The revenue meter data for the System for Settlement will be collected from the Revenue Meter System (RMS) database by the CPPA-G at their primary and backup locations. The main location will connect via a microwave link. The backup location, once determined, will connect with the most cost effective media available.

51. All SMS meters measuring CDP data have a 'data concentrator and communication' equipment installed with it. This communication equipment can assign IPs to the data being stored in the data concentrator unit. This data is currently being polled by servers using GSM that lacks the network reliability required. For the RMS and SFS project, GSM will only be used for 25 CDPs (each under 5MW) the communication to which using any other media is not technically and/or financially feasible.

### 3.7.11 Data storage and backups in Islamabad and Lahore

52. The data from the RMS data server in the NPCC is polled from the main and backup locations of CPPA-G System for Settlement (SFS) data server. From the SFS server billing and settlement can be accomplished. There will also be dual back up data storage for data retention.

## 3.8 Project Alternatives

53. The proposed SCADA and RMS project is urgently needed considering the existing energy shortfall in the country and the need to curb both transmission losses as well as energy theft. This project is designed to fix both the revenue meter data issues of CPPA-G and real-time data requirements of the NPCC.

### 3.8.1 No Project Alternative

54. If the proposed project is not implemented, it shall cause the existing issues with regards to grid performance and revenue collection to persist and further worsen with time. In addition, considering the increasing power plants coming online in the near future and the increasing need for managing and monitoring the grid effectively and efficiently, the proposed project is urgently needed and its absence will create considerable operational grid issues and revenue loss.

55. Thus, considering the rationale presented above, the ‘no project alternative’ is not a viable option and the project must be implemented at the earliest to manage the issues presently being faced by the power sector in the country.

### 3.8.2 Siting Alternative

56. The scope of works for the proposed project consists of retrofitting of the existing electrical equipment at the different locations where the electrical hardware alreay exists. In addition, the retrofitting works are to be conducted only at those specific locations where necessary upgrades and installation of new equipment is necessary.

57. Thus, the selected sites for the proposed works have been identified based on a detailed technical assessment and it is not possible to consider any alternative sites for these works.

### 3.8.3 Technological Alternative

58. The proposed works will involve installation of the latest hardware and software in order to resolve the existing and any future issues relating to grid operation and control and revenue collection. Since the SCADA hardware and software is very specific and is based on globally accepted technology with standard equipment specifications and brands used throughout the world, thus no other technology option is available for the proposed project.

## 3.9 Implementation Arrangement

### 3.9.1 Implementation Management and Execution

59. Physical implementation of the proposed project will be undertaken through a Contractor selected by the NTDCL. The Contractor shall conduct the construction activity on the basis of the detailed designs provided to him.

60. The Contractor will take broad responsibility for all elements of the construction and procurement and shall be responsible for ensuring compliance of the activities being conducted with the applicable environmental and social safeguards.

### 3.9.2 Project Construction Schedule

61. The project construction phase is expected to last for a total of 18 months with the activity expected to commence in the second quarter of 2017.

## 3.10 Construction Camps and Work Force

62. The proposed activity consists of technical expertise for which specifically trained technical staff will be engaged for conducting the different works. This staff will be provided accommodation by NTDCL either at the guest accommodation at site or at guesthouses near the respective project sites. Thus no construction camps will need to be developed. This will be possible since the staff to be engaged will be limited in

number. Also, any waste generated shall be disposed off in accordance with applicable NEQS guidelines.

### 3.11 Machinery Requirement

63. Considering the nature and scope of works for the proposed project, no heavy machinery will be engaged for the works since no extensive earth works such as piling, earth works etc will be required. The Contractor shall ensure that any equipment that is used during the project implementation as part of his contractual obligation fulfills all regulatory requirements according to applicable NEQS and IFC guidelines and Environmental Management Plan (EMP).

**Table 3.1: List of RTU Stations**

| S/No. | Location Name | S/No. | Location Name |
|---|---|---|---|
| **1** | Bahria Town-220 | **42** | Fauji Kabirwala |
| **2** | Bandala New-220 | **43** | FFC Wind |
| **3** | Chishtian-220 | **44** | Foundation Daharki |
| **4** | Dharki-220 | **45** | FWEL-I Wind |
| **5** | Gharo-220 | **46** | FWEL-II Wind |
| **6** | Ghazi Rd-220 | **47** | Golan gol |
| **7** | Jhampir-220 | **48** | Gomal zem |
| **8** | Kassowal-220 | **49** | Grange Power Ltd |
| **9** | Khuzdar-220 | **50** | Guddu-747 |
| **10** | Lal Sohanra-220 | **51** | Gul Ahmed Wind (GAWPL) |
| **11** | Loralai-220 | **52** | Habibullah Coastal |
| **12** | New Shalamar-220 | **53** | Hamza Sugar Mill |
| **13** | Okara New-220 | **54** | Haveli B.Shah |
| **14** | Rohri-220 | **55** | HAWA Energy Pvt. Ltd |
| **15** | T.T Singh-220 | **56** | HUBCO |
| **16** | WAPDA Town-220 | **57** | Hubco Narrowal |
| **17** | Mardan-220 | **58** | Hydrochina Dawood Power Pvt. Ltd |
| **18** | DG Khan-500 | **59** | Jabban Power |

| | | | |
|---|---|---|---|
| **19** | Lahore C/S (HVDC) | **60** | Jagran |
| **20** | Lahore North-500 | **61** | Japan Power |
| **21** | Lahore South-500 | **62** | JDW Unit-II |
| **22** | Matiari C/S (HVDC) | **63** | JDW Unit-III |
| **23** | AES Lalpir | **64** | Jaranwala Rd |
| **24** | PAKGEN TPS | **65** | Jinnah Hydro |
| **25** | Allai Khwar | **66** | KAPCO |
| **26** | Appollo Solar | **67** | Khan Khwar |
| **27** | Atlas Power | **68** | Kohinoor Energy |
| **28** | Attock Gen | **69** | Layyah Sugar Mills |
| **29** | Balloki | **70** | Liberty |
| **30** | Best Green | **71** | Liberty Tech |
| **31** | Bhikki | **72** | Malakand-III |
| **32** | Chashnup-III/IV | **73** | Marala HPP 7.64MW |
| **33** | Chashma C-1/C-2 | **74** | Master Wind Energy |
| **34** | Chashnupp | **75** | Metro Wind Energy |
| **35** | Chiniot Sugar Mill | **76** | Nandipur Power House |
| **36** | Cresent Solar | **77** | NBT Wind Power Project |
| **37** | D.M Jamali-220 | **78** | Nishat Chunian, |
| **38** | Davis | **79** | Nishat Power |
| **39** | Dubair Khwar | **80** | Orient |
| **40** | Engro | **81** | Pakpattan HPP 2.82 MW |
| **41** | Fatima Energy (FEL) | **82** | Patrind HPP 147MW |
| **S/No.** | **Location Name** | | |
| **83** | Pehoor Hydro | | |
| **84** | Quaid e Azam Solar | | |

| | |
|---|---|
| **85** | Rahim Yar Khan Mills |
| **86** | Ranolia Hydel Project |
| **87** | Rousch |
| **88** | SABA TPS |
| **89** | Sachal Wind Energy |
| **90** | Sahiwal Coal |
| **91** | Saif Power |
| **92** | Saphire TPS |
| **93** | Sapphire Wind Power Project |
| **94** | SEPCOL |
| **95** | Shikarpur 500KV |
| **96** | SSJD Bioenergy Ltd |
| **97** | Sunec Energy Ltd |
| **98** | Tapal Wind Energy |
| **99** | Tenega Generasi Limited (TGL) |
| **100** | TGF Wind |
| **101** | UCH-I |
| **102** | UCH-II |
| **103** | United Wind Power Private Limited |
| **104** | Yunus Wind Energy |
| **105** | Zonergy Future Solar 1 |
| **106** | Zonergy Future Solar 2 |
| **107** | Zonergy Future Solar 3 |
| **108** | Zonergy Future Solar 4 |
| **109** | Zonergy Future Solar 5 |
| **110** | Zonergy Future Solar 6 |

| | |
|---|---|
| **111** | ZORLU Wind |
| **112** | ZHOB 220 |
| **113** | DI Khan 220 |
| **114** | Noshera 220 |
| **115** | Lalian 220 |
| **116** | Chakdra 220 |

**Table 3.2: Proposed Fiber Optic Expansion Sites**

| Sr. No. | Circuit | Distance (km) |
|---|---|---|
| 1 | Bund Road 220kV GS – Kala Shah Kaku 220kV GS | 30 |
| 2 | Bund Road 220kV GS – Lahore 500kV GS | 30 |
| 3 | Bund Road 220kV GS – NKLP 220kV GS | 20 |
| 4 | Shikarpur 500Kv GS – Dadu 500kV GS | 192 |
| 5 | Dadu 500 kV GS – Jamshoro 500kV GS | 155 |
| 6 | Guddu 500kV GS – Shikarpur 500kV GS | 130 |
| 7 | Shikarpur 500 kV GS – Uch-II | 112 |
| 8 | DG Khan 132kV GS – Muzaffargarh 220kV GS | 70 |
| 9 | Tarbela 220kV GS – Mardan | 67 |
| 10 | Mangla 220kV – KSK 220kV GS | 74 |
| 11 | Mangla 220kV GS – Ghakkar 220kV GS | 45 |
| 12 | 220kV Yousufwala – Okara 220kV GS | 38 |
| 13 | Okara 220 kV GS – Sarfaraznagar 220kV GS | 80 |
| 14 | Kala Shah Kaku 220kV GS – Ghazi Road 220kV GS | 44 |
| 15 | New Multan 500kV GS – Vehari 220kV GS | 85 |
| 16 | Vehari 220 kV GS – Kassowal 220kV GS | 75 |
| 17 | Kassowal 220kV GS – Yousufwala 220kV GS | 110 |

| | | |
|---|---|---|
| 18 | Gatti 500kV GS – Bandala 220kV GS | 31 |
| 19 | Bandala 220kV GS – Kala Shah Kaku 220kV GS | 102 |
| 20 | New Multan 500 kV GS – T.T Singh 220kV GS | 83 |
| 21 | T.T Singh 220kV GS – Samundri Road 220kV GS | 53 |
| 22 | Quetta Industrial 220kV GS – Sibbi 220kV GS | 128 |
| | **Total Length** | **1754** |

**Table 3.3: Digital Microwave Sites**

| **NTDC MICROWAVE** | | |
|---|---|---|
| **S.#** | **Site Name** | **Type of Station** |
| 1 | Jhampir 220kV GS | Base Station (New) |
| 2 | Lakhra | Repeater Station (Upgrade) |
| 3 | Sehwan | Repeater Station (Upgrade) |
| 4 | Khairpur Nathansha | Repeater Station (Upgrade) |
| 5 | Kambar | Repeater Station (Upgrade) |
| 6 | Kandhkot | Repeater Station (Upgrade) |
| 7 | Guddu | Base Station (Upgrade) |
| 8 | Mithankot | Repeater Station (Upgrade) |
| 9 | Fazilpur | Repeater Station (Upgrade) |
| 10 | Kot Chutta | Repeater Station (Upgrade) |
| 11 | Gujrat South | Repeater Station (Upgrade) |
| 12 | New Sandnai | Repeater Station (Upgrade) |
| 13 | TT Singh | Repeater Station (Upgrade) |
| 14 | New Lahore | Repeater Station (Upgrade) |
| 15 | Shahkot | Repeater Station (Upgrade) |

| | | |
|---|---|---|
| 16 | Eminabad | Repeater Station (Upgrade) |
| 17 | Gujrat | Repeater Station (Upgrade) |
| 18 | Mangla | Base Station (Upgrade) |
| 19 | Rawalpindi-Rawat | Base Station (Upgrade) |
| 20 | ISPR | Base Station (New) |
| 21 | Ghazi Barotha | Base Station (New) |
| 22 | Shahi Bagh | Base Station (New) |
| 23 | Kolu Kohar | Repeater Station (New) |
| 24 | Jamshoro | Base Station (Upgrade) |
| 25 | Amri | Repeater Station (Upgrade) |
| 26 | Warah | Repeater Station (Upgrade) |
| 27 | Rato Dero | Repeater Station (Upgrade) |
| 28 | Karampur | Repeater Station (Upgrade) |
| 29 | Kashmore | Repeater Station (Upgrade) |
| 30 | Rojhan | Repeater Station (Upgrade) |
| 31 | Rajanpur | Repeater Station (Upgrade) |
| 32 | Jampur | Repeater Station (Upgrade) |
| 33 | DG Khan | Base Station (New) |
| 34 | Multan-Ismailabad | Base Station (Upgrade) |
| 35 | Kabirwala | Repeater Station (Upgrade) |
| 36 | Pir Mahal | Repeater Station (Upgrade) |
| 37 | Gojra | Repeater Station (Upgrade) |
| 38 | Gatti | Base Station (Upgrade) |
| 39 | Warburton | Repeater Station (Upgrade) |
| 40 | Ghakkar | Repeater Station (Upgrade) |
| 41 | Kharian | Repeater Station (Upgrade) |

| | | |
|---|---|---|
| 42 | Hill Top | Repeater Station (Upgrade) |
| 43 | NPCC (Islamabad) | Base Station (Upgrade) |
| 44 | Nowshehra | Repeater Station (New) |
| 45 | Dadu | Base Station (Upgrade) |
| 46 | Kala Shah Kaku | Base Station (Upgrade) |
| 47 | Burhan | Base Station (New) |
| 48 | Shikarpur | Base Station (Upgrade) |
| 49 | New Multan | Base Station (Upgrade) |
| 50 | Attaabad | Base Station (Upgrade) |
| 51 | NKI | Terminal Station (New) |
| 52 | Moro | Base Station (New) |
| 53 | WAPDA House | Base Station (Upgrade) |
| 54 | Tarbela | Base Station (New) |
| 55 | Shikarpur 500kV GS | Base Station (New) |
| 56 | Muzaffargarh | Base Station (Upgrade) |
| 57 | Sheikhupura | Base Station (Upgrade) |
| 58 | Sheikh Muhammadi | Terminal Station (New) |
| 59 | CPPA (G) Head Quarter | Base Station (New) |

**Table 3.4: Private Automatic Branch Exchange (PABX) Microwave Sites**

| **NTDC MICROWAVE** | | |
|---|---|---|
| **S.#** | **Site Name** | **Type of Station** |
| 1 | Jhampir 220kV GS | Base Station (New) |
| 2 | Guddu | Base Station (Upgrade) |
| 3 | Mangla | Base Station (Upgrade) |
| 4 | Rawalpindi-Rawat | Base Station (Upgrade) |

| | | |
|---|---|---|
| 5 | ISPR | Base Station (New) |
| 6 | Ghazi Barotha | Base Station (New) |
| 7 | Shahi Bagh | Base Station (New) |
| 8 | Jamshoro | Base Station (Upgrade) |
| 9 | DG Khan | Base Station (New) |
| 10 | Gatti | Base Station (Upgrade) |
| 11 | Islamabad-NPCC | Base Station (Upgrade) |
| 12 | Dadu | Base Station (Upgrade) |
| 13 | Kala Shah Kaku | Base Station (Upgrade) |
| 14 | Burhan | Base Station (New) |
| 15 | New Multan | Base Station (Upgrade) |
| 16 | NKI | Terminal Station (New) |
| 17 | Moro | Base Station (New) |
| 18 | WAPDA House | Base Station (Upgrade) |
| 19 | Tarbela | Base Station (New) |
| 20 | Shikarpur 500kV | Base Station (New) |
| 21 | Muzaffargarh | Base Station (Upgrade) |
| 22 | Sheikhupura | Base Station (Upgrade) |
| 23 | Sheikh Muhammadi | Terminal Station (New) |
| 24 | CPPA-G Head Quarter | Base Station (New) |

**Figure 3.1: Proposed NTDCL Data Route Plan – PESCO Region**

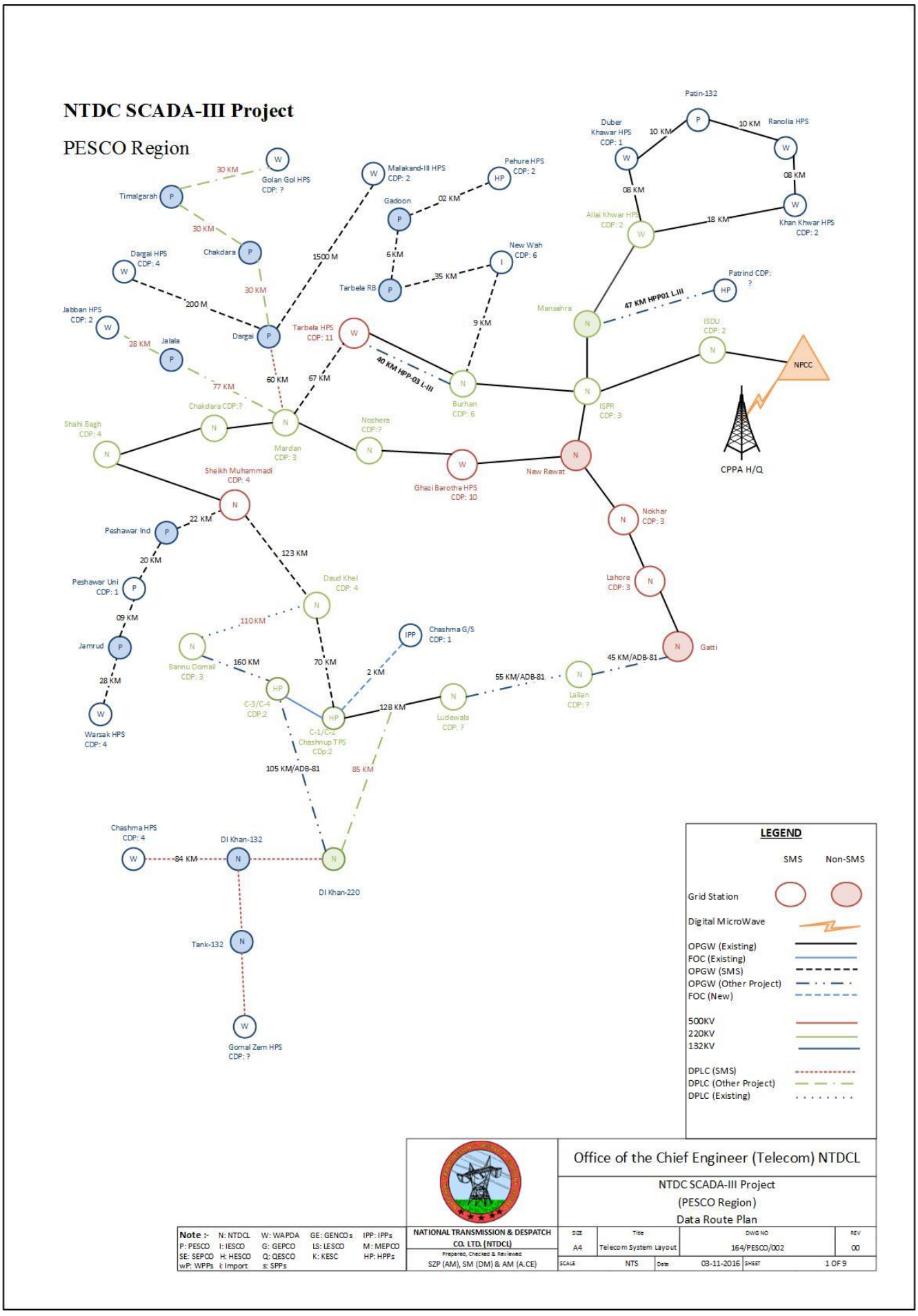


**Figure 3.2: Proposed NTDCL Data Route Plan – IESCO Region**

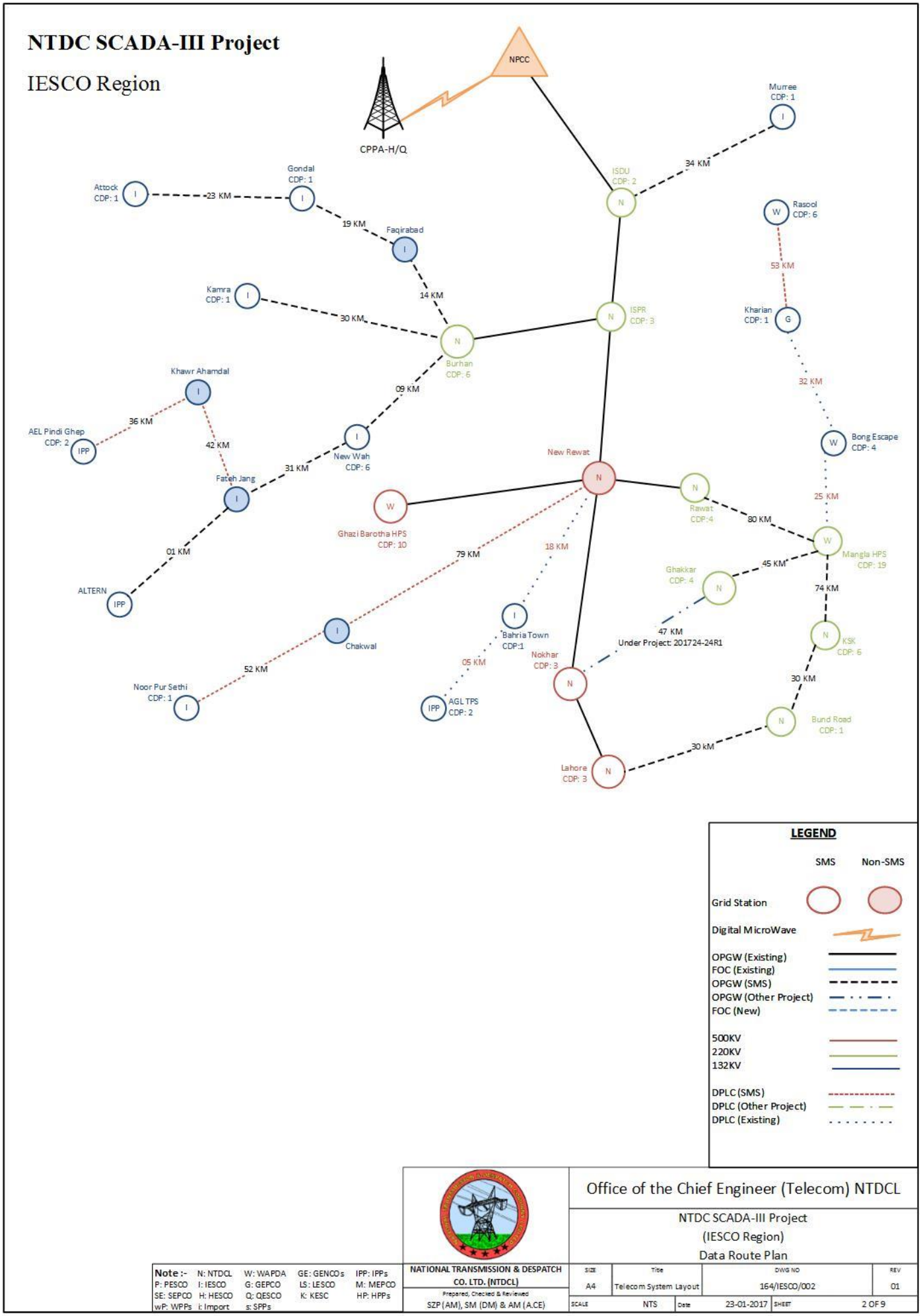


**Figure 3.3: Proposed NTDCL Data Route Plan – GEPCO Region**

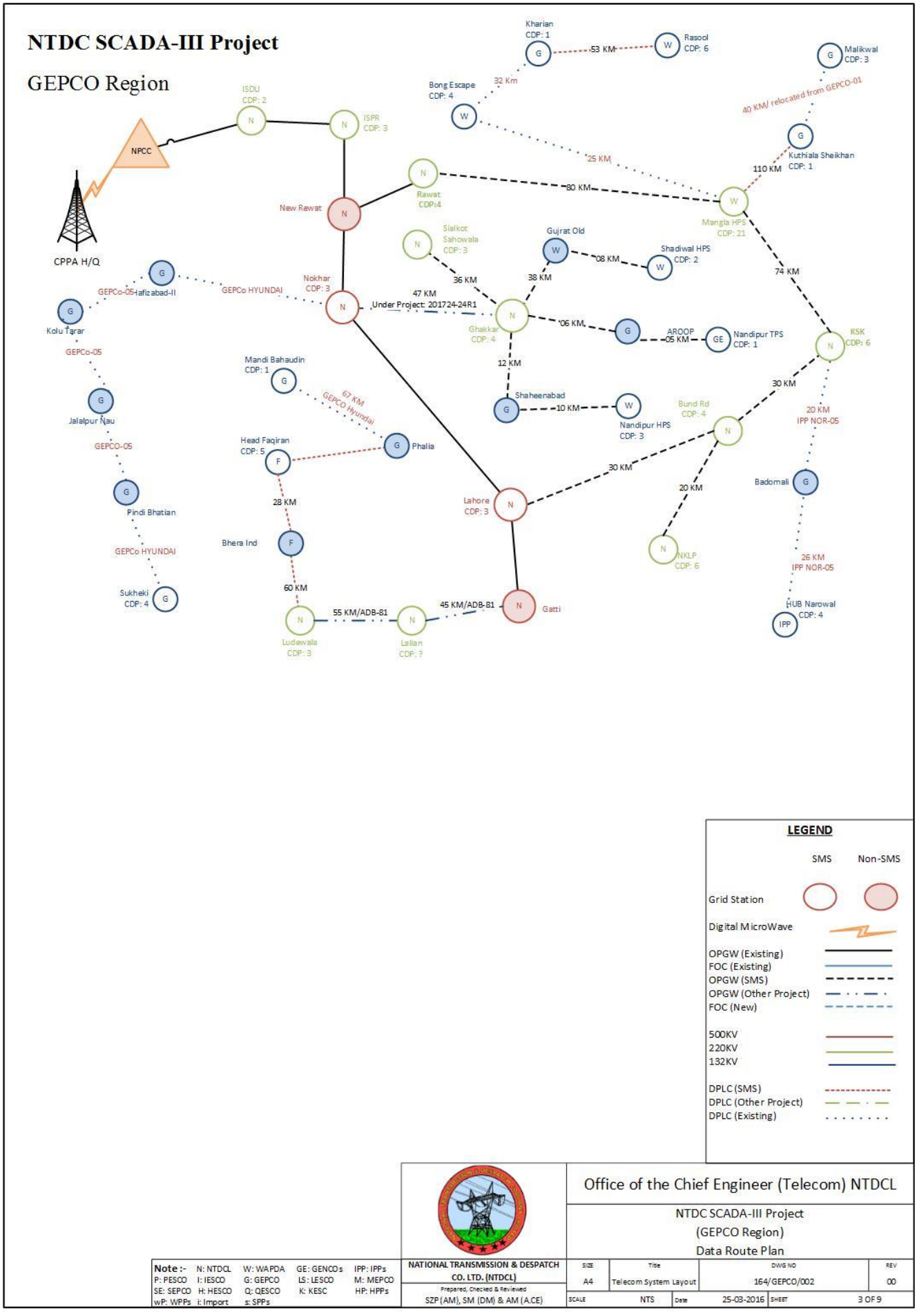


**Figure 3.4: Proposed NTDCL Data Route Plan – LESCO Region**

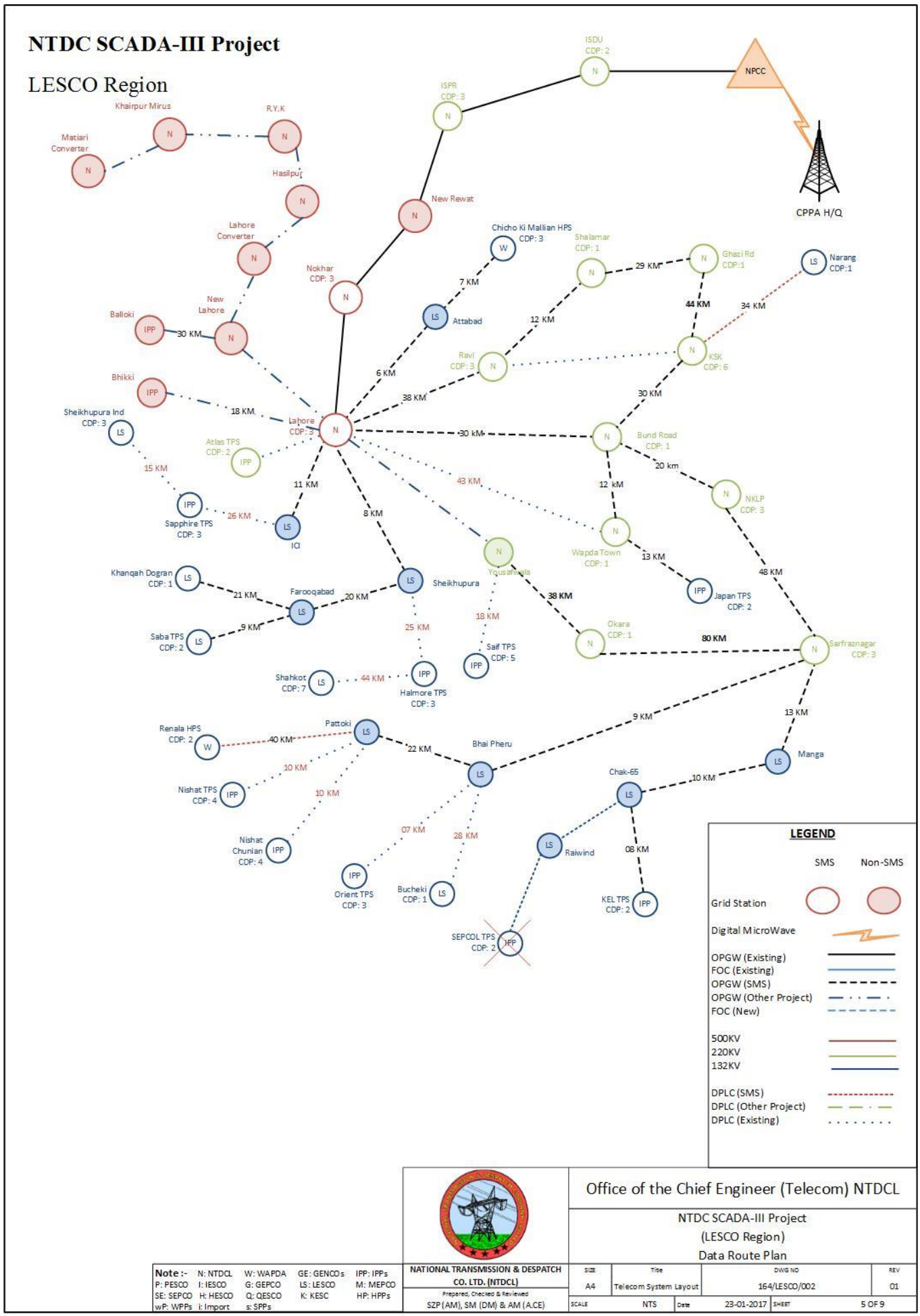


**Figure 3.5: Proposed NTDCL Data Route Plan – FESCO Region**

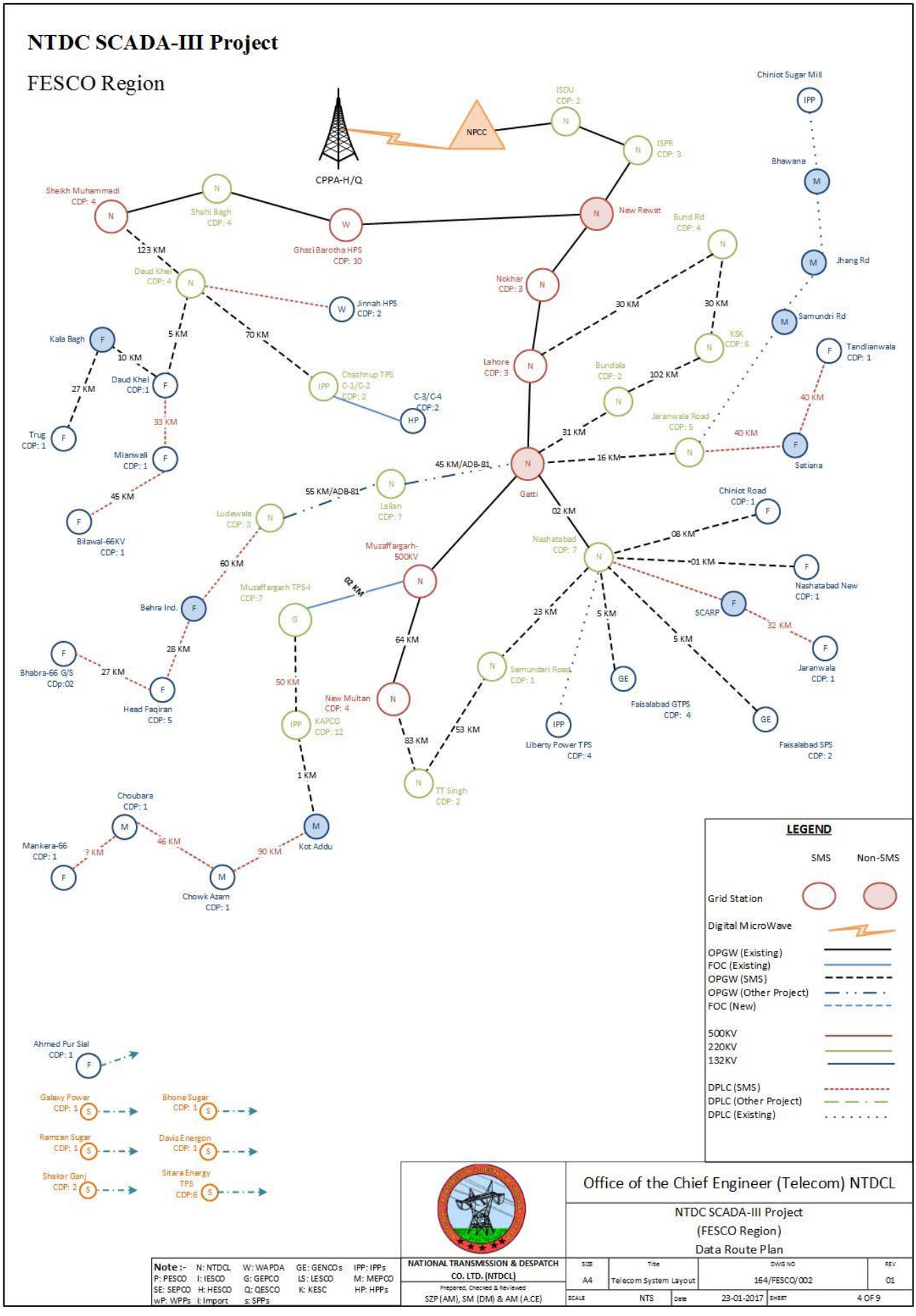


**Figure 3.6: Proposed NTDCL Data Route Plan – MEPCO Region**

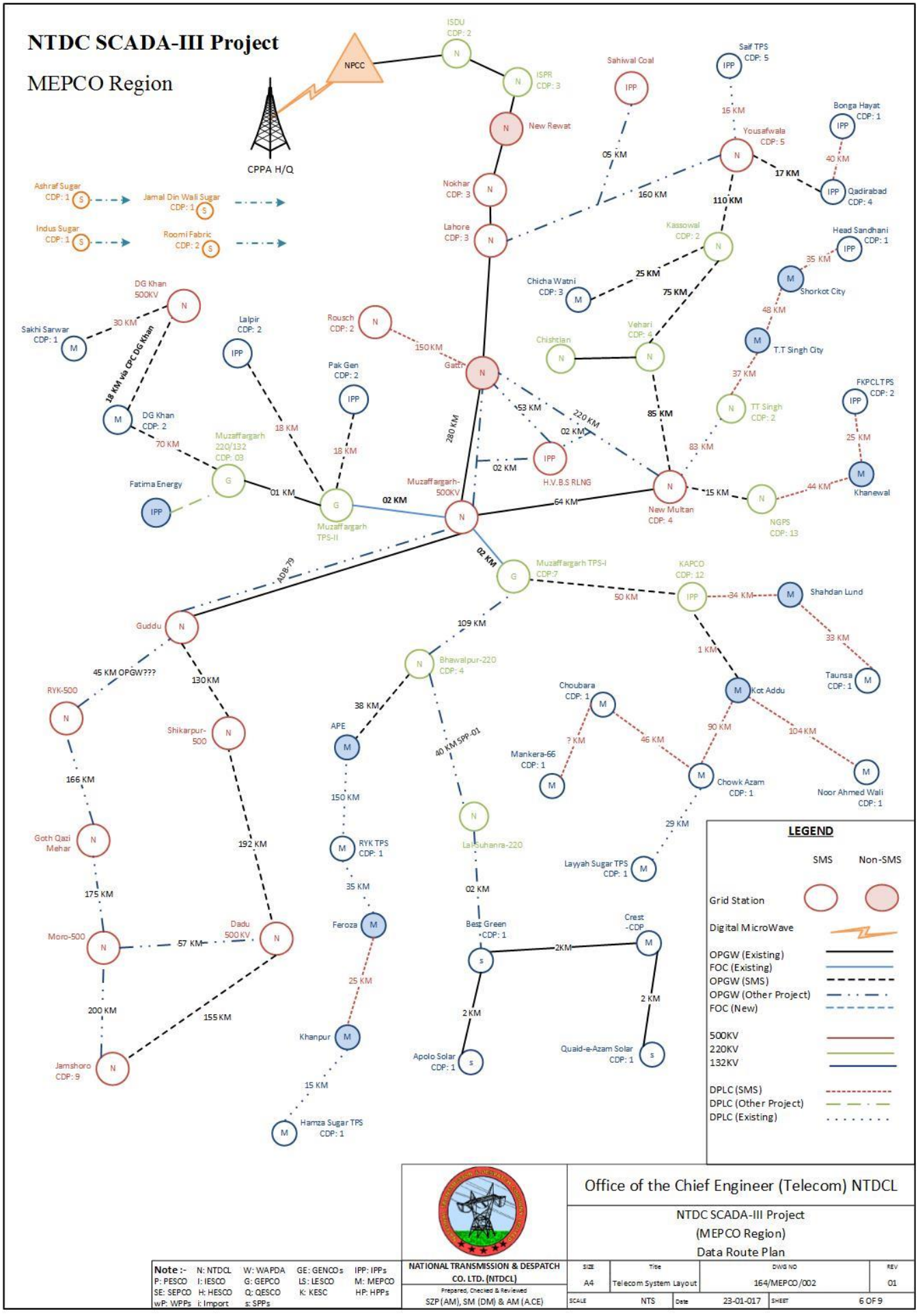


**Figure 3.7: Proposed NTDCL Data Route Plan – SEPCO Region**

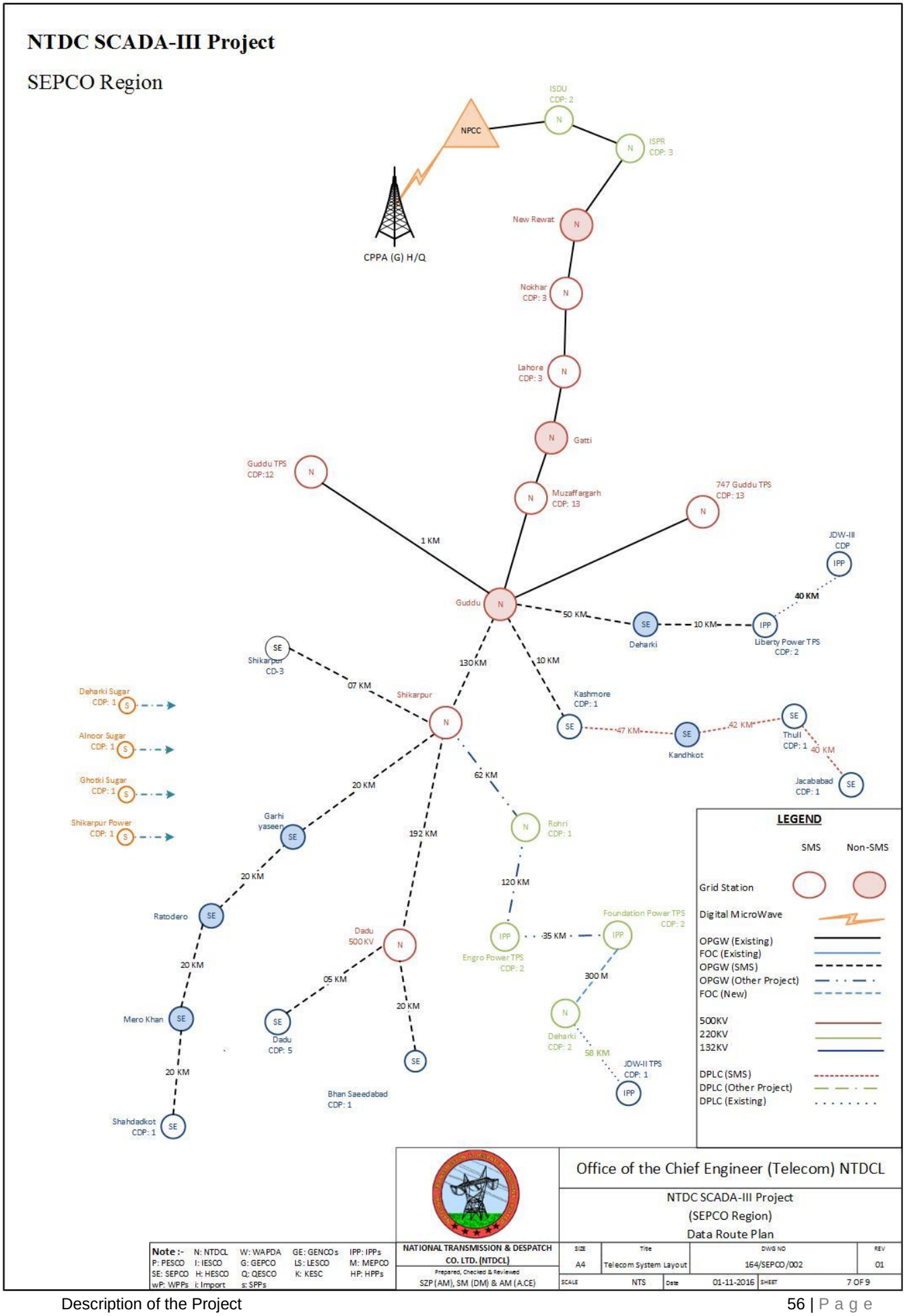


**Figure 3.8: Proposed NTDCL Data Route Plan – HESCO Region**

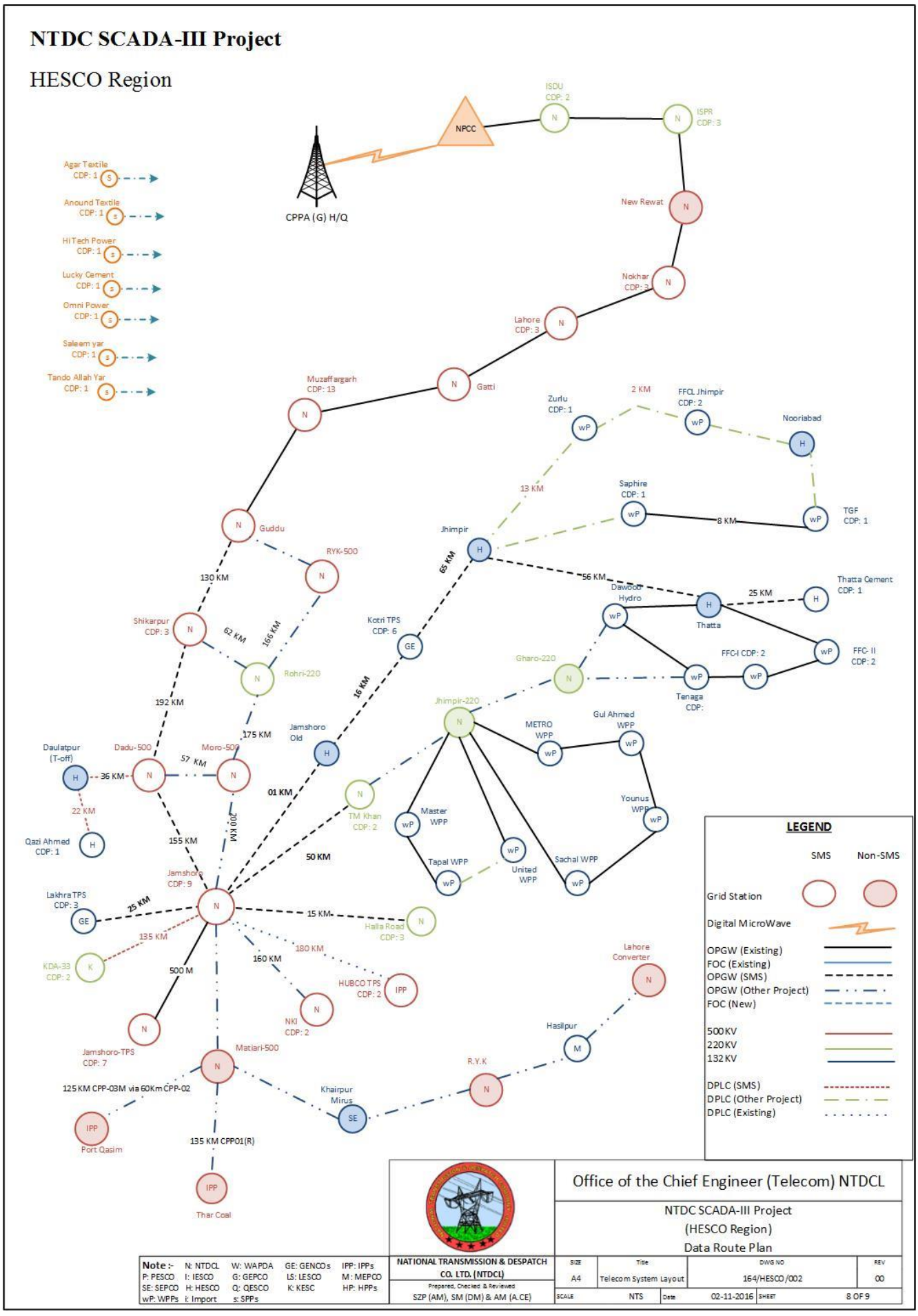


**Figure 3.9: Proposed NTDCL Data Route Plan – QESCO Region**

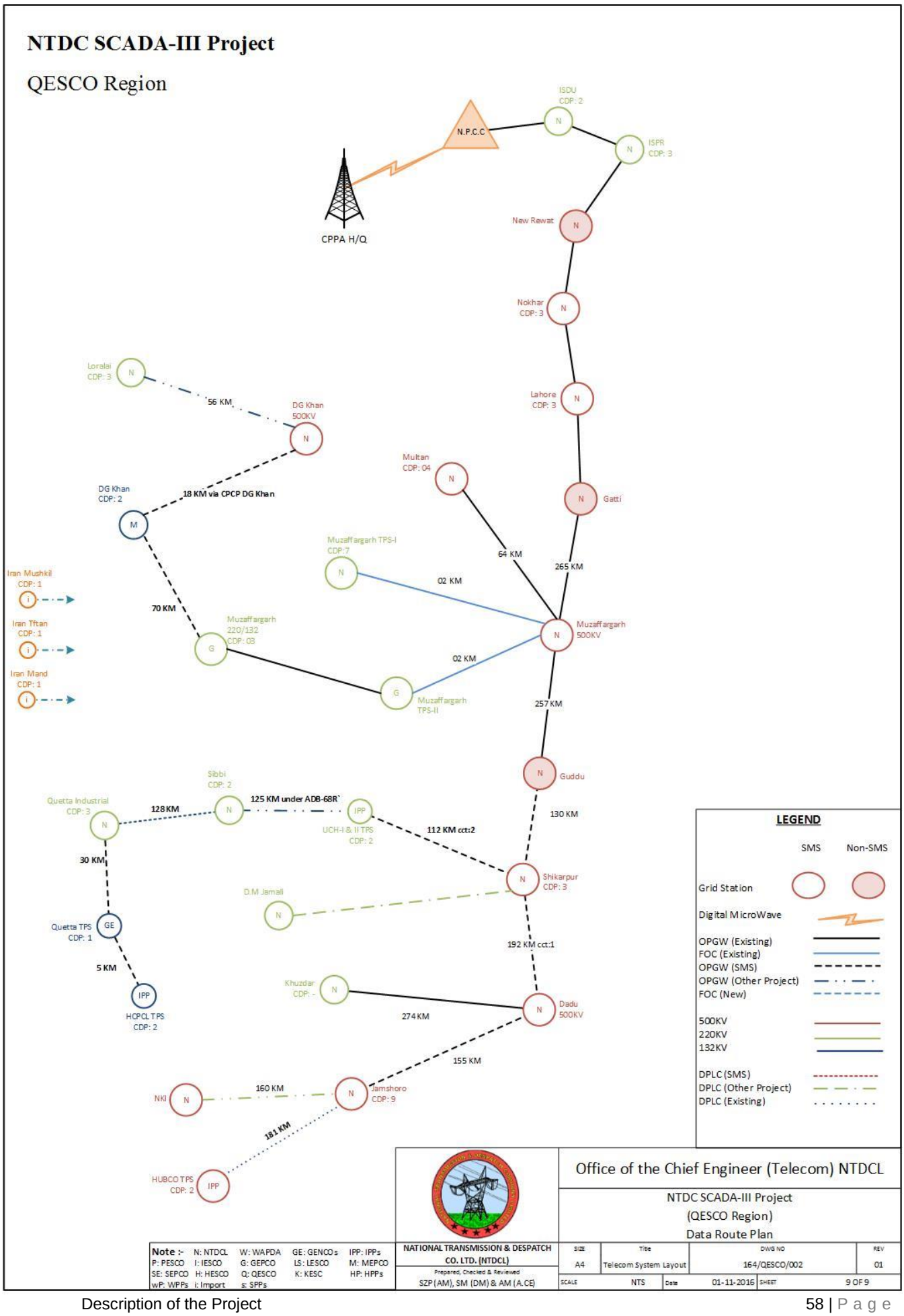


**Figure 3.10: Proposed NTDCL Digital Microwave Network**

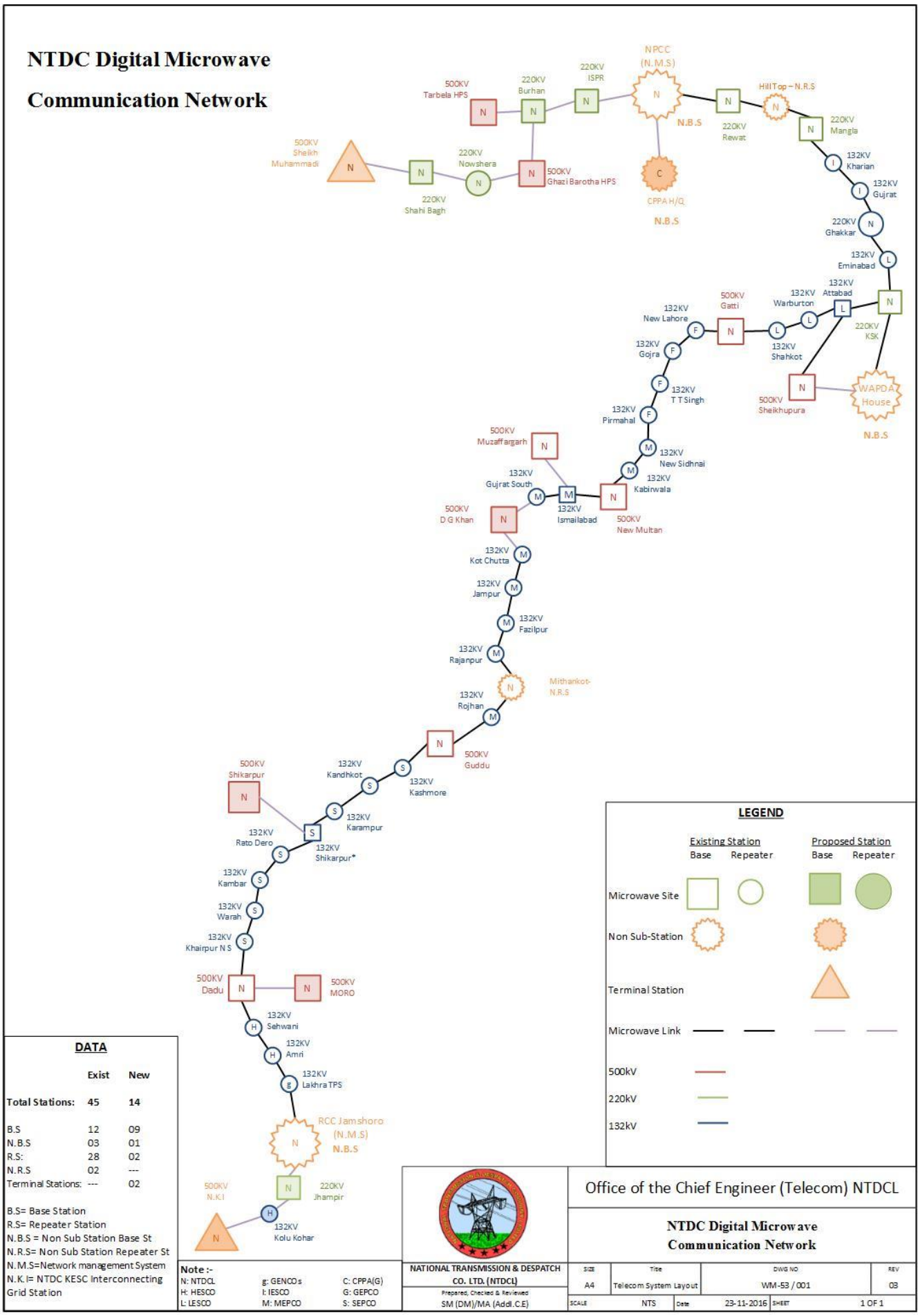
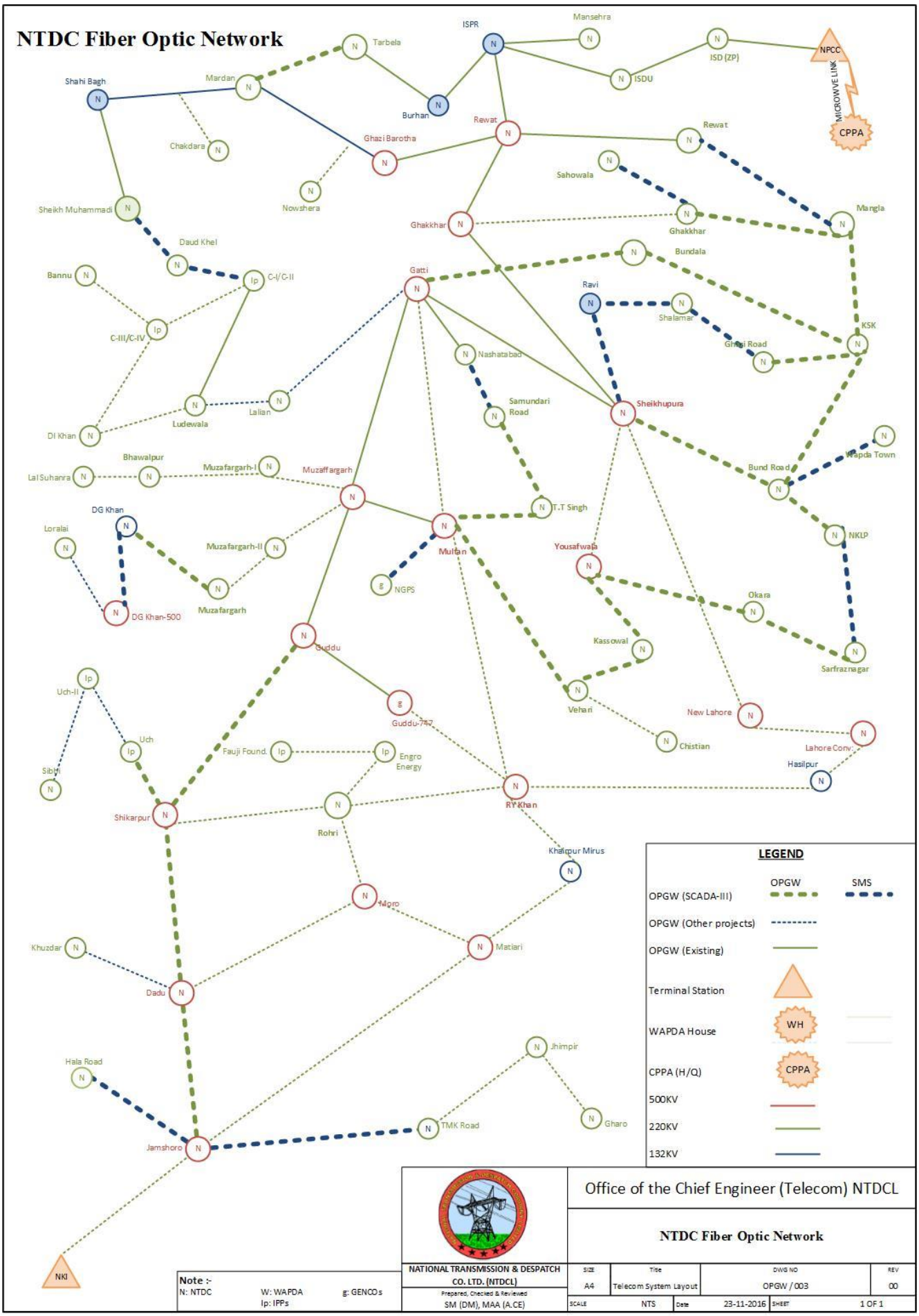


**Figure 3.11: NTDCL Fiber Optic Network Plan**



# 4 Description of Environment

## 4.1 General

64. The proposed project is located across four provinces of Pakistan, namely Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa (KPK). A general overview of the different environments including physical, ecological, cultural and socio-economic in each of the provinces where the project activities will be conducted is provided in the sub-sections below.

## 4.2 Physical Resources

### 4.2.1 Topography, Geology and Soils

**Punjab**

65. Punjab's landscape consists mostly consists of fertile alluvial plains of the Indus River and its four major tributaries in Pakistan, the Jhelum, Chenab, Ravi, and Sutlej rivers which traverse Punjab north to south - the fifth of the "five waters" of Punjab, the Beas River, lies exclusively in the Indian state of Punjab. The landscape is amongst the most heavily irrigated on earth and canals can be found throughout the province.

66. Punjab also includes several mountainous regions, including the Sulaiman Mountains in the southwest part of the province, the Margalla Hills in the north near Islamabad, and the Salt Range which divides the most northerly portion of Punjab, the Pothohar Plateau, from the rest of the province. Sparse deserts can be found in southern Punjab near the border with Rajasthan and near the Sulaiman Range. Punjab also contains part of the Thal and Cholistan deserts. In the north, Punjab's elevation reaches 2,291 metres (7,516 ft) near the hill station of Murree, which is surrounded by lush and dense forest.[1]

**Sindh**

67. Sindh is in the western corner of South Asia, bordering the Iranian plateau in the west. Geographically it is the third largest province of Pakistan, stretching about 579 kilometres (360 mi) from north to south and 442 kilometres (275 mi) (extreme) or 281 kilometres (175 mi) (average) from east to west, with an area of 140,915 square kilometres (54,408 sq mi) of Pakistani territory. Sindh is bounded by the Thar Desert to the east, the Kirthar Mountains to the west and the Arabian Sea in the south. In the centre is a fertile plain around the Indus River.[2]

**Balochistan**

68. Balochistan is an extensive plateau of rough terrain divided into basins by ranges of sufficient heights and ruggedness. Broadly, Balochistan geographic area can be

[1] https://en.wikipedia.org/wiki/Punjab,_Pakistan

[2] https://en.wikipedia.org/wiki/Sindh#Geography_and_nature

divided in to four distinct zones: Upper high lands, lower high lands, plains, and deserts. The upper highlands, known locally as Khorasan, rise as high as 3,700 meters, with valley floors about 1,500 meters above sea levels.

69. The highlands include Makran, Kharan and Chaghi ranges in the West and Sulaiman, Pab, Kirther in the east. The Upper High Lands fall mainly in districts Zhob, Killa Saifullah, Pishin, Quetta, Ziarat and Kalat. It comprises a number of ranges such as Sulaiman, TobakKakari, Murdar, Zarghoon, Takatu, and Chiltan ranges.

70. The Lower Highlands have an altitude ranging from 1970 to 3940 ft (600 to 1200 M). They are located in the south-eastern Balochistan, except eastern part of Kachi, the southern end of Dera Bugti and Nasirabad districts. Some are extension of lower high lands that exist at boundaries of Gwadar, Turbat, Panjgur, Kharan and Chaghi districts.

71. Balochistan has relatively small area of plains as compared to its total land area. They include the Kachi plain, situated to the south of Sibi and extending into Nasirabad Division, the southern part of Dera Bugti district, and narrow plain area along the Mekran coast stretching from Kachi to the Iranian border. The plains of Kachi, Las Bela and that of river Dasht cover sizable area. Mountains dominate the terrain, and valley floors, and piedmont plain make up only 15% of the landscape.

72. The western part of the province, mostly in Kharan and Chaghi districts, consists of vast plains covered with black gravel surface and broad expanses of sand dunes.

73. The coastal-line is about 760 Kilometers long, with a number of peninsulas and promontories. The coastal area is not effectively connected with the interior; the steep hills rise abruptly beyond the narrow costal plain. Ports, such as Somiani, Pasni and Gwadar are unsheltered. Federal and provincial governments have comprehensive development plans that feature a deep sea port at Gwadar and a coastal highway.

**KPK**

74. The mountainous terrain is broken by small basins or valleys, dotted with settlements and agricultural fields. The area can be divided into the northern, central and southern regions which happen to coincide with administrative boundaries. The northern zone consists of the Bajaur and Mohmand agencies. The hills in this region form a transition zone between the Hindukush mountains, and the Piedmont and lowland basins. Here, the Jandool river and its tributaries join the Panjkora river. Towards the south, the Kabul river collects the outflow from local rivers including the Bira Darya and khwars (seasonal watercourses) such as the Gandab, Sallala and Shalman.

75. The central region covers the Khyber, Kurram and Orakzai agencies, and the FRs of Kohat and Peshawar. Here, the Safed Koh mountains rise from the Terimangal pass and stretch eastward, reaching an elevation of 3,600 meters. The Sikaram, at 4,760

meters, is the tallest peak in this range. The Kurram river flows north-west to south-east, entering North Waziristan below the town of Thal in the Hangu district of the KPK, and eventually joining the Indus river. In Orakzai Agency, the Khanki and Mastura streams flow to the east to meet the Bara river. The towns of Bara and Khajuri form a plains area from where the Bara river and its tributaries join the Kabul river near Peshawar. To the north of the Kabul river stand the Mullagori and Shilman hills. The fertile Bara, Khanki, Kurram and Mastura valleys contain the most extensively cultivated land in FATA.

76. The southern region comprises the North Waziristan and South Waziristan agencies, and the FRs of Bannu, Dera Ismail Khan, Lakki Marwat and Tank. To the south of the Safed Koh are the Sulaiman mountains and the Waziristan hills. The hills rise to an altitude of between 1,500 and 3,000 meters, and are mostly barren. Takht-i-Sulaiman, located in FR Dera Ismail Khan, is the highest peak in the Sulaiman range, at 3,487 meters. Overall drainage in this region is toward the east. The Gomal river flows in the south, while the Kurram river passes though the north. The Jandola, Kaitu and Tochi are smaller rivers in this area. The rod kohi system (flood irrigation, or torrent-spate irrigation) is commonly practiced mainly in the FR areas. The Gomal and Tochi mountain passes in the south connect Pakistan to Afghanistan.

77. An interesting mix of sedimentary, igneous and metamorphic rock is found in the area. The most common sedimentary formations consist of sandstone, limestone, shale and conglomerates, occurring in the south-west. Partly metamorphosed andesite, granite and gabbro make up the bulk of igneous masses. Metamorphic rocks in the area include schist, slate and marble.

78. The soil is derived mainly from the local weathering of bedrock, deposited by streams and rivers, though loses also occurs to some extent. Landforms in the area are varied and include piedmont, plains, valleys, gravel fans, rough broken land and gullied land. Level areas are loamy, while lowlands are slightly to strongly calcareous. The content of organic matter and available phosphorus is very low.

### 4.2.2 Climate

**Punjab**

79. Most areas in Punjab experience extreme weather with foggy winters, often accompanied by rain. By mid-February the temperature begins to rise; springtime weather continues until mid-April, when the summer heat sets in.

80. Recently the province experienced one of the coldest winters in the last 70 years. Punjab's region temperature ranges from −2° to 45 °C, but can reach 50 °C (122 °F) in summer and can touch down to −10 °C in winter. Climatically, Punjab has three major seasons:

    - Hot weather (April to June) when temperature rises as high as 110 °F.

- Rainy season (July to September). Average rainfall annual ranges between 96 cm sub-mountain region and 46 cm in the plains.

- Cooler/ Foggy / mild weather (October to March). Temperature goes down as low as 40 °F.

81. Weather extremes are notable from the hot and barren south to the cool hills of the north. The foothills of the Himalayas are found in the extreme north as well, and feature a much cooler and wetter climate, with snowfall common at higher altitudes.[3]

**Sindh**

82. The province of Sindh is situated in a subtropical region; it is hot in the summer and cold in winter. Temperatures frequently rise above 46 °C (115 °F) between May and August, and the minimum average temperature of 2 °C (36 °F) occurs during December and January.[4]

83. Sindh is divided into three climatic regions: Siro (the upper region, centred on Jacobabad), Wicholo (the middle region, centred on Hyderabad), and Lar (the lower region, centred on Karachi).

84. In the winters, frost is common. Central Sindh's temperatures are generally lower than those of upper Sindh but higher than those of lower Sindh. Dry hot days and cool nights are typical during the summer. Central Sindh's maximum temperature typically reaches 43–44 °C (109–111 °F). Lower Sindh has a damper and humid maritime climate affected by the southwestern winds in summer and northeastern winds in winter, with lower rainfall than Central Sindh. Lower Sindh's maximum temperature reaches about 35–38 °C (95–100 °F).

**Balochistan**

85. The climate of the upper highlands is characterised by very cold winters and hot summers. In the lower highlands, winters vary from extremely cold in northern districts Ziarat, Quetta, Kalat, Muslim Baagh and Khanozai to milder conditions closer to the Makran coast. Winters are mild on the plains, with temperature never falling below freezing point. Summers are hot and dry, especially in the arid zones of Chagai and Kharan districts. The plains are also very hot in summer, with temperatures reaching 50 °C (122 °F). The record highest temperature, 53 °C (127 °F), was recorded in Sibi on 26 May 2010, exceeding the previous record, 52 °C (126 °F). Other hot areas include Turbat, and Dalbandin. The desert climate is characterised by hot and very arid conditions. Occasionally strong windstorms make these areas very inhospitable.[5]

**KPK**

[3] https://en.wikipedia.org/wiki/Punjab,_Pakistan#Climate

[4] https://en.wikipedia.org/wiki/Climate_of_Sindh

[5] https://en.wikipedia.org/wiki/Balochistan,_Pakistan

86. The mountain ranges experience cold winters and cool summers, and temperatures rise markedly toward the south. Precipitation over the province is variable but averages roughly 16 inches (400 mm) annually, with much of this occurring during the period from January to April.

87. The mountain slopes in the north support stands of evergreen oak and pine. There are also extensive mountain grasslands. The hills to the south are sparsely covered with bushes, acacia, and grasses.

### 4.2.3 Seismology

88. The proposed project locations are spread all over Pakistan and lie in the respective province wise zones as shown in the seismic zone map of Pakistan in **Figure 4.1** below.

### 4.2.4 Water Resources

**Surface Water (Rivers and Tributaries)**

**Punjab**

89. The Punjab province of Pakistan is blessed with five major rivers and their numerous local tributaries. All of these five rivers originate from the snow capped peaks of the Himalayan mountains.

90. After traveling hundreds of miles through the high mountain valleys, these rivers ultimately enter into the plains and plateaus of Punjab via the Frontier province of Pakistan, the State of Kashmir, and India.

91. The Indus (Sindh) is the northern and the upper most of the five rivers. The other four rivers named Jhelum, Chenab, Ravi and Sutlej follow the sequence. Waters of these rivers are managed through a vast system of large earthen dams and reservoirs, barrages and headworks, and, irrigation and link canals. Each river is linked to the next lower river through canals originating or ending at these waterworks and thus developing a grid of rivers and their link canals in the process.[6]

92. First major storage of Indus waters takes place at Tarbela Reservoir located just north of the boundary between Punjab and the Frontier Province. From this point on all the way down to the small town of Miran, with the exception of Kalabagh and Isa Khel areas, the River Indus roughly forms the boundary between Punjab and the Frontier Province. Within this course of the river numerous tributaries descending from the eastern slopes of the adjacent mountain ranges join the Indus. Most notable are the Kabul River that joins at Jahangira and Kurram River that joins at Kondal or Isa Khel. Both of these two relatively smaller rivers originate in Afghanistan and enter Pakistan via Frontier Province.

[6] http://pakistaniat.com/2006/10/30/punjab-link-canal-irrigation/

93. Similarly, the waters of the next lower river, Jhelum, are stored at the Mangla Reservoir located at the boundary between Punjab and Pakistan controlled part of Kashmir known as Azad Kashmir. In fact River Jhelum as a north-south axis starting from Muzzafarabad, the capital of Azad Kashmir, to the city of Jhelum in Punjab forms the western boundary of the disputed state of Kashmir with Pakistan. From the city of Jhelum to the city of Khushab, the river flows westward just below the famous Salt Range.

**Sindh**

94. The Sindh province boasts of three sources of water to irrigate its agricultural sector; the canal irrigation system itself irrigates 89%, whereas the under table water utilized through tube wells and rainy water irrigates only 8% and 3% respectively of the cropped area. It is very important to mention here that the canal system of the Indus is a major source of water for agricultural and economic prosperity of Sindh. Tube well water is applied in many areas during cropping season particularly when access to canal water is not possible, and rainy water is the only source of irrigation in arid regions of Sindh.

95. The canal network of Sindh consists of three barrages i.e. Sukkur Barrage, Kotri Barrage and Guddu Barrage. The Sukkur Barrage has seven canals, Kotri Barrage four canals and Guddu Barrage has three canals. The water of these barrages below the canal level is delivered through branch canals and minors, eventually the water flows onwards through 42,000 watercourses to the farms/fields. The average length of each watercourse stands at 4 kilometers and the total length of irrigation system in the province stands at 160,000 kilometers. The Sukkur barrage irrigates 26.1 millions acres more than that of other two barrages. Perennial canals irrigate 77% of the total canal irrigated area of the province.

**Balochistan**

96. Out of a total of three main hydrologic units in Pakistan, two are located in Balochistan. These hydrologic units are: Indus River basin, Kharan desert basin and Mekran coastal basin. The province is blessed with extensive groundwater resource.

97. Kharan desert basin covers the northwestern part of Balochistan between Siahan range and Raskoh belt and constitutes a closed drainage system. Undulated deserts characterize most of the area. The Mashkhel and Kharan rivers are principal sources of water of the basin. The water discharges into Hamun-e-Mashkhel after passing through the Kharan desert.

98. Mekran coastal basin comprises of the central and coastal Mekran ranges and the Pab hills and the sub-mountainous areas in the southwest. The Hub, Porali, Hingol and Dasht are the principal rivers of the basin with erratic discharges. Hingol is the biggest seasonal river of Balochistan with a catchment area of more than 2,500 miles, starting from central Balochistan to Ormara. Makran coastal zone and several other basins contain highly brackish groundwater. In the absence of alternative sources of water, the local communities are compelled to use brackish groundwater.

Balochistan can be divided into three hydrological regions: the Nari Basin, the Kharan closed Basin and the Mekran Coast. There are about 73 small or large rivers and streams constituting the three hydrological basins. Only about 30% of this potential of rivers and streams is utilized through different schemes. A thorough and comprehensive investigation of all the basins in Balochistan is highly needed.

**KPK**

99. The major rivers that criss-cross the province are the Kabul, Swat, Chitral, Kunhar, Siran, Panjkora, Bara, Kurram, Dor, Haroo, Gomal and Zhob. The Kabul River is considered to be rough boundary between the mountainous areas and the Trans-Indus plains.

100. Kabul River or Kabal River is a river that rises in the Sanglakh Range of Afghanistan, separated from the watershed of the Helmand by the Unai Pass. It is the main river in the eastern part of Afghanistan. It flows 700 km before joining the Indus River near Attock. It passes through the cities of Kabul, Chaharbagh, Jalalabad, and (flowing into Pakistan some 30 km north of the Khyber Pass) Nowshera. The major tributaries of the Kabul River are the Logar, Panjshir, Kunar and Alingar rivers.

101. The Kabul River itself is little more than a trickle for most of the year, but swells in summer due to melting snows. Its largest tributary is the Kunar, which starts out as the Mastuj River, flowing from the Chiantar glacier in Chitral, Pakistan and once it flows south into Afghanistan it is met by the Bashgal River flowing from Nurestan. The Kunar meets the Kabul near Jalalabad. In spite of the Kunar carrying more water than the Kabul, the river continues as the Kabul River after this confluence, mainly for the political and historical significance of the name.

102. This river is attested in the Rig Veda, the earliest scripture of Hinduism, under the name Kubhā (many of the rivers of Afghanistan are mentioned in the Rig Veda). The Sanskrit word later changed to Kābul.

103. Bara River is a river in Khyber Agency and Khyber Pakhtunkhwa, Pakistan. The Bara River originates in the Tirah Valley of Bara Tehsil, Khyber Agency. It joins the Kabul River Canal which originates from the Warsak Dam, and enters Peshawar. Then it flows in the North-easterly direction to the Nowshera District, eventually joining the Kabul River near Camp Koruna, Akbarpura. Due to its higher elevation, very limited areas flow through gravity into Bara river.

104. Gomal River is a river in Afghanistan and Pakistan, with its headwaters in the south-east of Ghazni. The headwater springs of the Gomal's main leg come together close to the fort of Babakarkol in Katawaz, a district inhabited primarily by Kharoti and Suleiman Khel Pashtuns.

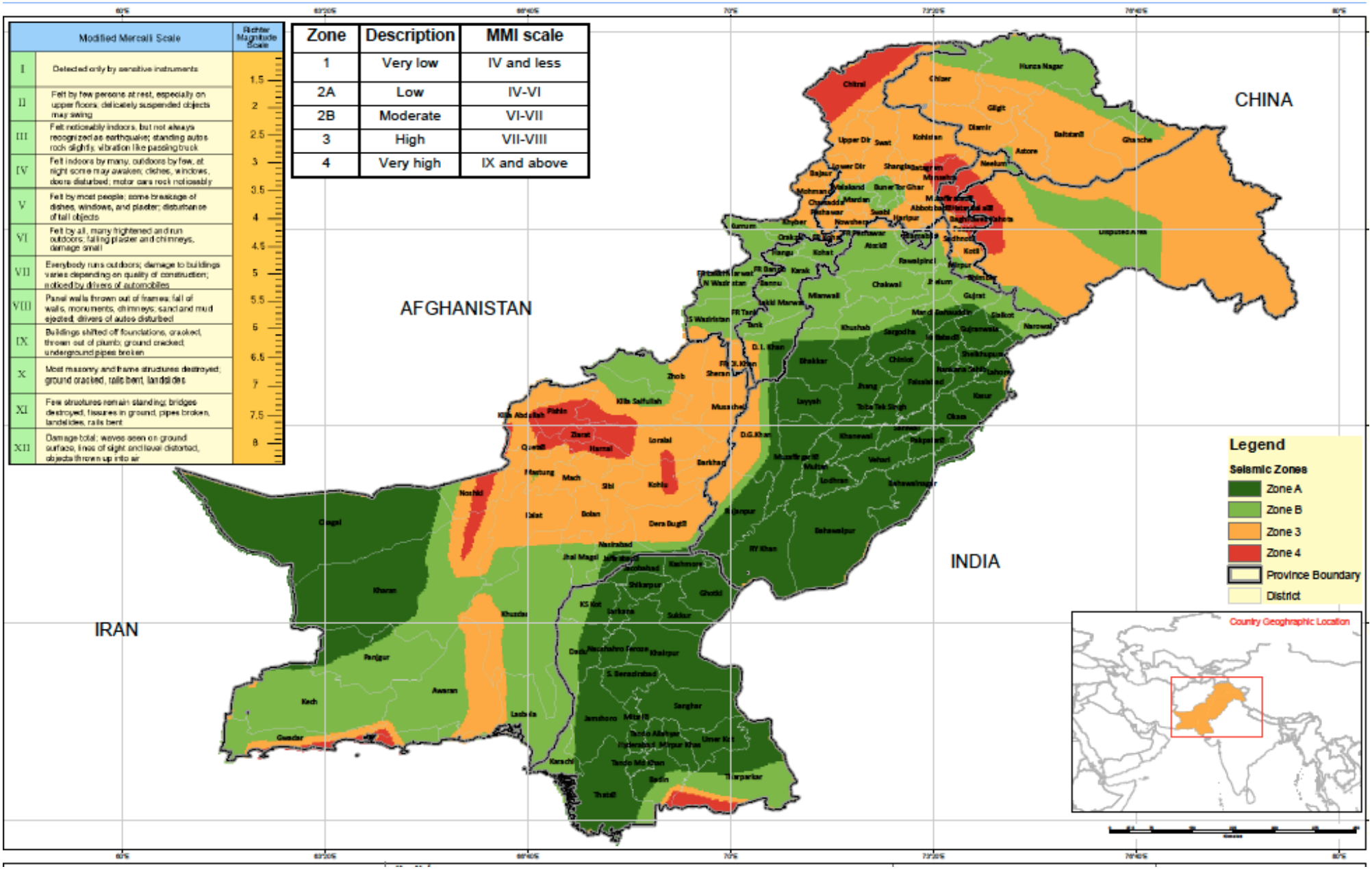
The Gomal's chief tributary is the Zhob River. Within Pakistan, Gomal river surrounds South Waziristan agency, forms the boundary between the North-West Frontier Province and Balochistan. The river passes then through the Damaan plain in

Kulachi Tehsil and later on through Dera Ismail Khan Tehsil and then finally falls in river Indus.

105. Kunhar River is located in KPK and a main source of the river is Lulusar Lake, nearly 48km from Naran Valley. Glaciers of Malka Parbat and Makra Peak and the waters of Saiful Muluk Lake feed the river. The Kunhar flows through the entire Kaghan Valley through Jalkhand, Naran, Kaghan, Jared, Paras and Balakot, and joins the Jhelum River.

106. Swat River flows from Hindu Kush Mountains through Kalam valley and merges into Kabul River in Peshawar valley Sarhad, Pakistan. This river irrigates vast area of Swat District and contributes to fishing industry of the region. Swat River joins the Kabul river near Charsadda, Peshawar valley. There are two main hydro-electric power projects on canals from the swat river which generates electricity for local usage.

**Figure 4.1: Seismic Zones of Pakistan**



### 4.2.5 Air Quality

107. The proposed project sites where the project implementation activities will be conducted consist of both urban and rural areas. As a result, a considerable variation in air quality can be expected with the rural environments generally possessing much higher air quality in comparison to urban cities where due to high traffic volumes, vehicular pollutant emissions are much higher.

108. Air quality in most of the project areas located in rural areas appears good based on observations during the study period. Emissions should be controlled at source under the EMP. Domestic sources of air pollution, such as emissions from wood and kerosene burning stoves as well as small diesel standby generators in some households, are minor.

109. The project implementation is not expected to result in any negative impact on the air quality apart from the pollutant emissions resulting from the vehicular movement for transportation of hardware electrical components and use of generators in case of power outtages, whenever felt necessary.

110. The other major source of air pollution is dust arising from construction and other ground or soil disturbance, during dry weather, and from movement of vehicles on poorly surfaced or damaged access roads.

### 4.2.6 Noise

111. Since the project sites and optic fiber corridor consists of both rural and urban areas, thus a considerable variation in ambient noise levels can be expected with the rural environments generally possessing lower noise levels due to less movement of vehicles, smaller community sizes and greater scatter in the settlements compared to urban areas.

112. Irrespective of rural or urban settings, it has been observed that there are the occasional calls to prayer from the PA systems at the local mosques but there are no significant disturbances to the typical setting since these last for only a few minutes and only occur five times a day.

## 4.3 Ecological Resources

### 4.3.1 Protected Areas/National Sanctuaries

113. In Pakistan, there are several areas of land devoted to the preservation of biodiversity through the dedication of national parks and wildlife sanctuaries. There is no wetland, protected area or national sanctuary near the area of proposed project work areas.

## 4.4 Economic Development

### 4.4.1 Agriculture, Horticulture and Industries

114. Cropping Pattern: The main crops in the project areas during winter are wheat, gram, barley, pulses, sesamum, linseed, barseem and green fodder. In summer, rice is the chief canal irrigated crop and is grown on 93% of the cultivated area, and the other crops during summer are cotton, maize, sawanki, sugarcane, Bajra and tobacco.

115. Horticulture: The main fruits grown in the project areas are jamun (Syzygium cumini), falsa (Grewia asiatica), banana, orange (type of Citrus fruit), kinno (type of Citrus fruit), fruiter (type of Citrus fruit), sweet lemon, plum, mulberry, mango, guava and pomegranate. The principal vegetables grown are onions, potatoes, ginger, egg-plant, arum, ladyfinger, spinach, mint, tomato, turnip, cloguxtida, carrot, cauliflower, bittergourd, garlic, pea, reddish, cucumber, etc.

116. Industry: There are large industrial units of chemicals, food products, textiles and engineering. The engineering industry includes manufacturing of air conditioners, electric transformers, electric motors, electric washing machines, fans, etc. other industries are sugar manufacturing, paper and paperboard, tannery, steel re-rolling, pipes electric wires/ropes, edible oils and ghee, synthetic fibers, turbines and steel containers, small industrial units include lighting and scientific equipment, utensils, hosiery and non-metallic work.

117. Major Industries: There are large industrial units of chemicals, food products, textiles and engineering. The engineering industry includes manufacturing of air conditioners, electric transformers, electric motors, electric washing machines, fans, etc. Other industries are sugar manufacturing, paper and paperboard, tannery, steel re-rolling, pipes electric wires/ropes, edible oils and ghee, synthetic fibers, turbines and steel containers, small industrial units include lighting and scientific equipment, utensils, hosiery and non-metallic work.

### 4.4.2 Community Dynamics

118. The inhabitants in the project areas fall into socioeconomic strata varying from poor to rich. The inhabitants in the rural areas generally were observed to have access to clean drinking water from hand pumps and motor operated pumps with the health and sanitation facilities mostly found to be inadequate. In the rural part of the project areas, most of the areas are dotted with agricultural fields which support both crop and livestock production, including cattle, goats and sheep. The majority of farmers within the rural project areas appear to prefer horticulture to traditional agronomic crops.

### 4.4.3 Religion

119. The project areas consist primarily of Muslim communities with a few minorities residing in peace and harmony. Issues relating to terrorist attacks have taken place in the past in certain locations along the project corridor, particularly in the troubled Balochistan and KPK provinces.

### 4.4.4 Languages

120. The mother tongue in the project areas varied based on the specific province in which the project site is located. Punjabi along with Urdu is spoken in Punjab, Balochi is spoken in Balochistan, Sindhi in Sindh and Pashto in KPK. Majority of the communities possess basic English skills.

### 4.4.5 Education

121. In the urban areas, the literacy rates are quite high with men and women both receiving higher education in all the major cities. In comparison, in the rual project areas, the literacy rates for males and females are below 40%, which is surprising considering the presence of educational institutions. There has been an increase in literacy in rural communities in general compared to the earlier generations whose literacy rate was considerably lower.

### 4.4.6 Archaeological and Cultural Heritage

122. No archaeological or cultural heritage sites have been reported during the technical surveys. However, if at any stage any archaeological or physical heritage is discovered, it shall be managed as per established protocol from the department of Museum and Archaeology, GoP. 'Chance find' procedures **(Annexure IV)** will be implemented if the need arises.

### 4.4.7 Health Care

123. All major cities and urban areas where the project sites are located contain hospitals and clinics. Within each major city, there are a large number of both private and public hospitals offering all necessary treatment. In the rural areas, there are clinics and/or Basic Health Units (BHUs), which offer emergency treatment or treat minor illnesses such as common cold, flu etc.

### 4.4.8 Energy Supplies

124. Almost all villages in the project areas are connected to the WAPDA grid. Unfortunately, Sui gas connections are very rare while the remaining communities are forced to use LPG cylinders or firewood. Some poor communities also use cow dung for cooking purposes.

### 4.4.9 Communication

125. Majority of the community members in the project areas possess cellular phones. PTCL line is present in the project areas but is not used commonly except in Public Call offices (PCOs). Some youth is IT literate and use desktop computers and have access to the internet. Postal service is available in all rural parts of the project areas. On special occasions, messages are also conveyed through word of mouth or on mosque loud speakers. In the rural parts of the project areas, less than 10% of the community members have televisions at home while over 60 percent of the communities use radios to stay updated.

## 4.5 Climate Vulnerability of Sub-Project

126. The activities to be conducted for development of the project or its subsequent operation are not expected to result in any increase in vulnerability to climate related impacts such as floods, cyclone winds etc. This is largely due to the nature of the project, which does not involve contribution to global warming or climate change in any way.

# 5 Potential Environmental Impacts and Mitigation Measures

127. This chapter presents the potential environmental impacts related to construction and operation phases of the proposed project. Following is a description of the environmental impacts and the proposed mitigation measures to minimize the negative impacts, if any.

## 5.1 Project Location Impact Assessment and Mitigation

128. The location and scale of the works are very important in predicting the environmental impacts. This process of impact prediction is the core of the IEE process. It is critical that the recommendations and mitigation measures are carried out according to the conditions on the ground in the affected areas in the spirit of the environmental assessment process.

In this section, the potential environmental impacts are reviewed. If impacts are predicted to be significant enough to exceed accepted environmental standards, mitigation is proposed in order to reduce residual impact to acceptable levels and achieve the expected outcomes of the project being implemented. Therefore, it is essential that a proper analysis is carried out during the project planning period. In this regard, the impact prediction plays a vital role as these predictions are used for developing mitigation measures and any alternative options, if appropriate. Once the detailed designs are completed, the impacts and mitigation measures will need to be further reviewed to take account of how the contracts are set up and in the light of any fine tuning of the project.

129. The environmental management plan (**Table 6.1**) has been compiled based on the available information and shall be reviewed in due course at project inception and through construction in order to receive feed back and provide updated mitigation requirements for any significant unpredicted impacts. The analysis primarily focuses on the key environmental issues likely to arise from the project implementation, to prescribe mitigation measures to be integrated in the project design, to design monitoring and evaluation schedules to be implemented during project construction and to estimate costs required for implementing project mitigation measures.

The EMP must be reviewed when the project reaches the inception stage by the project management team and be approved before any construction activity is initiated, to take account of any subsequent changes and fine tuning of the proposals.

## 5.2 General Approach to Mitigation

130. During the preparation of the construction phase for the project, the future contractors must be notified and prepared to co-operate with the executing agency, supervising consultants and local population in the mitigation of impacts.

Furthermore, the contractor must be primed through bidding stages and the contract documentation to implement the EMP in full and be ready to engage trained environmental management staff to audit the effectiveness and review mitigation measures as the project proceeds. These requirements must be included in contractual clauses.

## 5.3 Environmental Considerations during Procurement/Pre-Construction Phase

### *5.3.1 Lack of environmental capacity*

**Impacts**

131. Based on past project experiences, it is clear that the NTDC officials who will be charged with overseeing the construction and the Contractor staff that shall conduct the work tasks are generally unfamiliar with the environmental impacts associated with the proposed scope of works and the EMP implementation. As a result, the likelihood of the mitigative and monitoring measures being implemented is low.

**Mitigation measures**

132. During the pre-construction period and once the contractors have been selected, the Environment and Social Impact Cell (ESIC) of NTDC will conduct a one day workshop to inform NTDC project focal staff and contractors on environmental safeguards, the implementation of the project EMPs and credible environmental reporting. The workshop will be based on the presentation of examples and provision of templates for contractors and agency officials/inspectors to use.

133. The contractor will be required to define an Occupational and Environmental Health and Safety procedure for all work, including use of Personal Safety Equipment. These procedures should be developed and approved by the ESIC-NTDC before the contractor begins civil work.

### *5.3.2 Lack of integration of IEE/EMP requirements into Construction bid documents*

**Impacts**

134. The bidding documents should reflect the requirement to select a qualified and experienced contractor from the perspective of ensuring implementation of required safeguards during project development. Bidding documents have greater emphasis on the methodology on the protection with regards to environmental and social worksite management. The bidder's environmental, social and safety methodology shows material deviation, reservation or omission towards environmental, social and safety specification.

**Mitigation measures**

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

### 5.3.3 Waste Disposal

**Impacts**

136. Considering the scope of Works, it is expected that some waste will be generated during the development of foundations for installation of electrical hardware equipment. In addition, some excess soil along with oily waste and scrap metal might also be produced which will need to be disposed in accordance with local regulations.

**Mitigation measures**

137. Suitable locations will be identified for disposal of the waste produced such as unsuitable soils, oily waste and scrap metal.

138. NTDC shall ensure that any waste generated in the construction phase is disposed in line with provincial EPA and local authority requirements. With the proper implementation of appropriate waste disposal protocols, there will be no residual risk due to improper waste disposal.

### *5.3.4 Electronic Hardware Transport Routes*

**Impacts**

139. Hauling of heavy electrical equipment on large transport trucks has significant impacts on the community, public safety, traffic congestion, air quality and lifespan of the town roadways.

**Mitigation measures**

140. The vehicles hauling the electrical hardwave equipment and materials such as microwave dishes, optical fiber cables etc. along urban and rural roads in localities with roadside residences will be limited.

141. Contractor will establish a route plan to minimize this disruption and will approve this plan from NTDC.

142. The speed of trucks transporting the heavy electronic hardware in congested localities will be limited to 20 km/hr.

### *5.3.5 Cultural Heritage or Religious Sites*

**Impacts**

143. Since the project sites are spread in four provinces across the country, thus the possibility of the works being conducted in areas of cultural heritage or in the vicinity of religious sites does exist.

144. Considering the scope of works which are to be conducted within the premises of existing grid stations and also along a 1754 km long corridor of existing transmission towers, the possibility of impacts on any cultural or religious sites is extremely remote.

145. In case, during any excavation works to be conducted at the existing grid stations for creation of foundations, if any archaeological find is discovered, the 'Chance Find' protocol provided in **Annexure IV** will be followed.

**Mitigation measures**

No mitigation measures required.

### 5.3.6 EMF Reduction

**Impact analysis**

146. The optic fiber lines will be installed on the existing transmission line towers and the optic fiber cables might result in EMF. Although the health effects of chronic exposure to EMFs from AC transmission lines remain scientifically uncertain, many utilities and regulatory authorities employ EMF reduction practices as a precautionary measure, usually within the limit of a few percent of overall project cost. Utilities seek to keep annual average magnetic field intensities at the edge of the right-of-way below about 10 mG (milli-Gauss).

**Mitigation measures**

The following mitigation measures shall be implemented as far as possible:

147. Raising conductor height above the ground, typically by increasing tower height.

148. Reducing conductor spacing.

149. Arranging phases so that fields tend to cancel.

150. Increasing transmission voltage (since magnetic field intensities are a function of current, and increased voltage, all things being equal, will result in reduced current).

151. Reducing loads (and therefore, currents).

### *5.3.7 Land Acquisition and Resettlement Impacts*

**Impacts**

152. All project works will be conducted within the premises of existing grid stations and also along a 1754 km long corridor of existing transmission towers. Thus, since only existing premises and transmission towers will be utilized for the project activities, thus no land acquisition or resettlement impacts are expected.

**Mitigation measures**

153. No mitigation measures required.

## 5.4 Potential Environmental Impacts during Construction

### Physical Resources

### *5.4.1 Air Quality*

**Impacts**

154. Air quality will be affected by the fugitive dust and emissions from the construction machinery, and vehicular traffic during the construction phase.

155. The critical sources of air pollution during the construction phase are as follows:

- Earth haulage trucks that generate dust, particularly during transportation, loading and unloading processes.
- Noxious gases emission by Construction equipment and vehicles.

**Mitigation measures**

156. The following mitigation measures are proposed:

- Concrete batching plants will be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce the level of dust emissions.
- The NEQS applicable to gaseous emissions generated by the construction vehicles, equipment and machinery will be enforced during the construction works.
- Contractor should make sure that all equipment and vehicles are tested for emissions. Regular maintenance of equipment and vehicles will also control the incomplete combustion.
- Where necessary, dust emissions will be reduced by a regular sprinkling of water for keeping the dust settled, at least twice a day.
- Haul-trucks carrying sand, aggregate and other materials will be kept covered with tarpaulin to help contain construction materials being transported.
- Ensure proper tuning of the construction vehicles.
- The need for large stockpiles should be minimized by careful planning of the supply of materials from controlled sources.

- The stack height of generators will be at least 3 meters above the ground.

### *5.4.2 Noise*

**Impacts**

157. It is anticipated that powered mechanical equipment and some hand tool methods will be used to construct the project works. Powered mechanical equipment can generate significant noise and vibration. The cumulative effects from several machines can be significant.

158. Since the works that are expected to generate noise will be conducted within the existing sub-station premises, thus no significant impacts are anticipated. The other part of the scope of work consisting of installation of optic fibre between existing transmission towers will not generate significant noise levels.

159. Although the possibility of any significant impacts resulting from the project activtiies is remote, however the measures provided below shall be implemented at all sites to ensure no significant noise impacts take place.

**Mitgation measures**

160. The following mitigation measures will be implemented:

- Equipment noise will be reduced at source by proper design, maintenance and repair of construction machinery and equipment. Noise from vehicles and power generators will be minimized by use of proper silencers and mufflers.
- Excessive noise emitting equipment will not be allowed to operate and will be replaced.
- Blowing of horns will be prohibited.
- As a rule, the operation of heavy equipment shall be conducted in daylight hours.
- Hammer- type percussive pile-driving operations shall not be allowed at night time.
- Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise.
- Well-maintained haulage trucks will be used with speed controls.

### *5.4.3 Soil Contamination*

**Impacts**

161. Land may get contaminated from the spillage of chemicals like fuels, solvents, oils, paints and other construction chemicals and concrete. This normally happens when these materials are transported in open or loosely capped containers.

**Mtigation measures**

162. The possible contamination of soil by oils and chemicals, workshop areas, and equipment washing-yards may limit the future use of land for vegetation purposes.

163. It will be ensured that spill prevention trays are provided and used during refueling. Also, on-site maintenance of construction vehicles and equipment will be avoided as far as possible. In case on-site maintenance is unavoidable, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil.

164. Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities.

165. Fuels, lubricants and chemicals will be stored in covered bounded areas, underlain with impervious lining. Appropriate arrangements, including shovels, plastic bags and absorbent materials will be available near fuel and oil storage areas.

166. Solid waste generated at the work sites will be properly segregated, treated and safely disposed of only in the demarcated waste disposal sites. Also, it shall be ensured that fuel, oil and chemicals are stored in a bunded area of 110% volume.

### 5.4.4 Construction waste disposal

**Impacts**

167. The waste generated during the construction works at site must be properly disposed in accordance with local applicable NEQS guidelines and environmental best practices.

**Mitigation measures**

168. Potential safe disposal sites close to the project sites shall be identified by the Contractor and approved by NTDC.

169. Piling up of any loose material shall be done in segregated areas to arrest washing out of soil. Debris shall not be left where it may be carried by water to downstream flood plains etc. Waste shall be disposed off in a suitably licensed landfill.

170. Used oil and lubricants shall be recovered and reused or removed from the site in full compliance with the national and local regulations.

171. Oily wastes shall not be burned. Disposal location to be agreed with local authorities/EPA.

172. Machinery shall be properly maintained to minimize oil spill during the construction.

173. Solid waste shall be disposed at an approved solid waste facility, open burning is illegal and contrary to good environmental practice.

### 5.4.5 Disposal of Electronic waste due to hardware upgrade

**Impacts**

174. A total of upto 3 tons of electronic waste and scrap material could be generated during the hardware upgradation of the existing equipment. This would consist of replacement of radios installed at the field sites, with 90 pounds of waste generated from each site with a total of 40 sites where this replacement of radios would be conducted. The servers at the NPCC would also be replaced and would result in approximately 400 pounds of electronic waste.

175. No regulations exist in the country relating to disposal of electronic waste. The present practice consists of electronic waste/scrap being mostly purchased by scrap dealers who in turn sell the metal parts separately to different entities based on the demand for specific components or metal parts. In addition, at times certain small businesses and companies dealing with electronic parts bid for and procure large lots of electronic scrap being auctioned off and use the parts in their own manufacturing.

176. Based on international best practices, the measures provided below can be taken to minimize the possibility of any significant impacts resulting from disposal of electronic waste/scrap material.

**Mitigation measures**

177. It shall be ensured that all electronic waste is collected and segregated to ensure any non-metal parts such as plastic, rubber, wooden parts are removed and disposed off in accordance with international best practices to ensure no negative impact takes place on the immediate environment and its receptors.

178. It shall be ensured that if the scrap is to be sold to a third party, only an entity possessing a comprehensive EMS with a clear procedure for disposal of metal scrap/waste is considered.

179. Any metal waste containing asbestos shall be segregated and it shall be ensured that such waste is disposed off in accordance with international guidelines for handling asbestos. Scrap shall only be sold to a pre-selected third party in accordance with national guidelines and international best practices.

180. As far as possible, the waste/scrap generated shall be reused through retrofitting or refurbishment to minimize the total volume of waste generated. International guidelines from the World Bank Group for handling asbestos shall be followed.[7]

[7] https://siteresources.worldbank.org/EXTPOPS/Resources/AsbestosGuidanceNoteFinal.pdf

181. In case scrap is to be stored prior to assessing most suitable disposal options, it shall be ensured that a dedicated yard is selected which is properly covered to protect the scrap from exposure to the elements and possible rusting of the scrap.

**Ecological Resources**

### *5.4.6 Vegetation and Wildlife Loss*

**Impacts**

182. The construction of the project facilities will require minimal vegetation removal, if any. Thus, no significant residual impact on the natural vegetation of the project areas is anticipated.

183. The impact of project activities on the wildlife in the area will be insignificant, as part of the activities will be conducted within the premises of the sub-stations while the optic fiber cables will be installed on the existing transmission towers.

**Mitigation measures**

184. It will be ensured that willful killing, trapping and trade of faunal species will be strictly prohibited. Also, while stringing the fiber optic cables on the transmission lines, there will be no need to cut any vegetation that has grown up beneath the transmission line.

185. Burning of vegetation or wood as fuel will be prohibited.

**Socioeconomic environment**

### *5.4.7 Impact of Construction Activity on Living Environment*

**Impacts**

186. The proposed project does not involve involuntary resettlement nor will it affect the livelihood of villagers.

187. Intrusion on Indigenous People (IPs) and Ethnic Minority (EM): No IPs or EM are found within the respective project areas.

188. Even though the construction activity will be short lived, certain minor and temporary impacts might take place on the living environment in the project area. Necessary mitigation measures are proposed below to ensure no long-term impacts take place as a result of the construction activity of the proposed project.

**Mitigation Measures**

189. The following mitigation measures will be implemented to minimize disturbance as far as possible:

- Consultation with the local community to inform them of the nature, duration and likely effects of the construction work, and the mitigation measures in place;
- Proper planning of work programme so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times;
- Avoiding noise-generating activities at night;
- Implementing the measures to reduce dust;
- Utilizing modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions, and ensuring that these are maintained to manufacturers' specifications at all times.

### *5.4.8 Community Health and Safety*

**Impacts**

190. The proposed project will involve the use of considerable heavy machinery during the works and also for transportation of the electronic equipment. The risk to the commuters during transportation of the equipment to the respective sites will be significant and thus a number of precautionary measures will be necessary to minimize the risk of a possible accident.

**Mitigation Measures**

The following mitigation measures will be implemented:

191. Work areas outside the project site, especially where machinery is involved, will be roped off and will be constantly monitored to ensure that local residents, particularly children stay away. Also, no machinery will be left unattended, particularly in running condition.

192. Local communities in the villages along the transmission line corridor, where the optical fiber has to be installed, will be briefed on traffic safety, especially women who are the main care providers to children.

193. Speed limit of 20 km/hr will be maintained by all project related vehicles and nighttime driving of project vehicles will be limited where possible.

194. Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances (if any) and other construction materials during transport.

### *5.4.9 Social Impacts*

**Impacts**

195. The construction activity can lead to different social impacts that must be managed through the mitigation measures provided below.

**Mitigation Measures**

196. The following mitigation measures shall be implemented:

- Claims/complaints of the people on construction nuisance/damages close to project sites to be considered and responded to promptly by the Contractor.
- Contractor shall organize temporary means of access and make alternative arrangements to avoid local community impacts and to avoid such short-term negative impacts.

## 5.5 Potential Impacts Associated with Project Operation

### 5.5.1 Aircraft safety and radar interference

**Impact analysis**

197. The proposed optic fiber to be installed on the existing transmission lines can pose a potential threat to low flying aircraft and also cause radar interference to the communication systems of the aircraft.

198. No airports are located in close proximity to any of the proposed optic fiber corridors. In addition, no smaller air fields are located near the optic fiber line route and since the optic fiber will be laid onto existing transmission towers, no threat is posed to aircraft from the proposed project.

199. Keeping in view the minimal height of the transmission towers in comparison to the minimal altitude of aircraft along with the fact that there are no airports or small airfields in close proximity to the TL route, no significant impact is expected on aircraft safety and the possibility of radar interference is also highly remote.

**Mitigation measures**

No measures required.

### 5.5.2 Impacts on Ecological Resources

**Impact analysis**

200. No tree cutting is to take place during the operation stage. On the other hand, tree plantation, on the ratio of 5:1 will improve the ecological habitat and environmental conditions of the project areas and thus enable the scared away avifauna to return to this area. New plantations will not only compensate for any potential loss of trees, but will also add to the aesthetics of the area. There will be healthy and positive impacts on flora and fauna during the operation stage.

**Mitigation measures**

No measures required.

### 5.5.3 Crops and vegetation

**Impact analysis**

201. In order to ensure tree clearance under transmission lines is controlled to prevent damage to TLs (on which the optic fiber is to be installed) from tree growth.

**Mitigation measures**

202. Track growth of large trees under the conductors.

### 5.5.4 Social safety impacts

**Impact analysis**

203. To ensure no encroachments/construction under the transmission line and prevent violation of clearance spaces.

**Mitigation measures**

204. Necessary signboards with limits of height clearances to be placed properly.

205. Identify and prevent any illegal encroachments under the transmission lines.

### 5.5.5 Enhancement

**Impact analysis**

206. Environmental enhancements are not a major consideration for this project. However, it is noted that it is common practice at many such sites to create some local hard and soft landscaping and successful planting of fruit trees and shrubs has been accomplished in many sites. This practice should be encouraged as far as practicable.

**Mitigation measures**

No measures required.

### 5.5.6 Occupational Health and Safety

**Impact analysis**

207. The high voltage transmission lines on which the optic fiber will be installed in the respective project areas and at times in close proximity to certain communities pose a real threat if any kids or community members do not realize the danger and choose to climb the towers.

208. The staff of NTDC that will be required to climb the towers for maintenance of the optic fiber lines are at considerable threat of falling from the towers or being electrocuted if they are not wearing the proper equipment or following the established protocol.

**Mitigation measures**

209. It shall be ensured that a public awareness campaign is developed and implemented to educate the local communities regarding the dangers posed by exposure to the high voltage contained in live transmission lines which will be installed next to the optic fiber lines.

210. All NTDC staff conducting maintenance of the transmission lines shall ensure that they wear protective equipment such as goggles, rubber boots, protective jacket and also carefully follow all standard protocols to ensure their safety while working on the towers.

211. All NTDC staff shall also use protective harnesses to ensure they are protected from falling from the towers.

212. All NTDC staff shall avoid working on the towers in bad weather conditions, particularly during rain and high winds.

## 5.6 Cumulative impacts

213. Cumulative impacts would mainly be from other projects, particularly other transmission line projects being constructed concurrently with the construction stage of this sub-project.

214. There is no other transmission line project or any other infrastructure projects being planned in the project area alone the transmission line alignment. Thus, no cumulative impacts are expected.

# 6 Environmental Management Plan & Institutional Requirements

## 6.1 Introduction

215. The Environmental Management Plan (EMP) is developed to eliminate and/or mitigate the impacts envisaged at the design, construction and operation stages.

216. The detailed EMP provided in this document as **Table 6.1** ensures that this project has no detrimental effect on the surrounding environment. The Plan shall act as a guideline for incorporating environmental measures to be carried out by the contractors engaged by NTDC for the proposed project. It shall also be used for other parties concerned for mitigating possible impacts associated with the project and will form part of the Contract documents to be considered alongside the specifications. This Plan shall act as the Environmental Monitoring Plan during the construction phase of the project and will allow for prompt implementation of effective corrective measures.

## 6.2 Environmental Management Plan (EMP)

217. The EMP attached with this report ensures the following:

- Delivery of the prescribed environmental outcomes during all phases of this project;
- Formulating a system for compliance with applicable legislative requirements and obligations and commitments for this project;
- Ensure that project design process incorporates best practice environmental design and sustainability principles to minimize potential impacts of construction on the environment and community.
- Ensure that the construction work procedures minimize potential impacts on the environment and community.
- Develop, implement and monitor measures that minimize pollution and optimize resource use.

## 6.3 Objectives of EMP

218. The EMP provides a delivery mechanism to address potential impacts of the project activities, to enhance project benefits and to outline standardized good practice to be adopted for all project works. The EMP has been prepared with the objectives of:

- Defining the roles and responsibilities of the project proponent for the implementation of EMP and identifying areas where these roles and

responsibilities can be shared with other parties involved in the execution and monitoring of the project;

- Outlining mitigation measures required for avoiding or minimizing potential negative impacts assessed by environmental study;
- Developing a monitoring mechanism and identifying requisite monitoring parameters to confirm effectiveness of the mitigation measures recommended in the study;
- Defining the requirements for communication, documentation, training, monitoring, management and implementation of the mitigation measures.

## 6.4 Environmental Management/Monitoring and Reporting

219. The proposed Project will be administrated by NTDC during the implementation stage as described in detail below, and the existing institutional setup of NTDC for implementation of the project is illustrated in **Figure 6.1**. The existing organizational setup of NTDC for all the stages of the project (design, construction and operation) is fully integrated with handling of environment and social issues.

220. The NTDC federal headquarter is based in Lahore, and is responsible for managing the project at the policy level. At the highest level, the Chief Engineer (EHV-I) will be responsible for day-to-day project management at project implementation stage. He will report directly to the General Manager (GSC), who will have ultimate responsibility for planning and managing implementation of the projects.

221. The Chief Engineer (EHV-I) will be assisted by Project Director, who will have overall responsibility for ensuring the project compliance with the EMP. The Project Director (PD) will be supported by two Executive Engineers i.e. Survey and Soil Investigations (SI) and Transmission Line Construction (TLC) who, will further be assisted by the concerned Sub-Divisional Officers and their teams.

222. After completion of the Project, the Project will be handed over to the GSO Division of NTDC, which is working under the Chief Engineer (GSO). He reports to the General Manager (GSO) for operation and maintenance of grid stations and transmission lines.

223. The Chief Engineer GSO will be supported by the Superintending Engineer for the proposed Project, who will also be assisted by Executive Engineer, Sub-Divisional Officer and his field team.

224. To ensure the community participation and to provide the environmentally and socially viable conditions, the ESIC of NTDC will extend its services and support the field teams. The Organogram of ESIC for the implementation of EMP is depicted in **Figure 6.2**.

225. The specific roles and responsibilities for environmental management are provided in **Table 6.3** below.

**Figure 6.1: NTDC's Institutional Setup for Project Implementation**

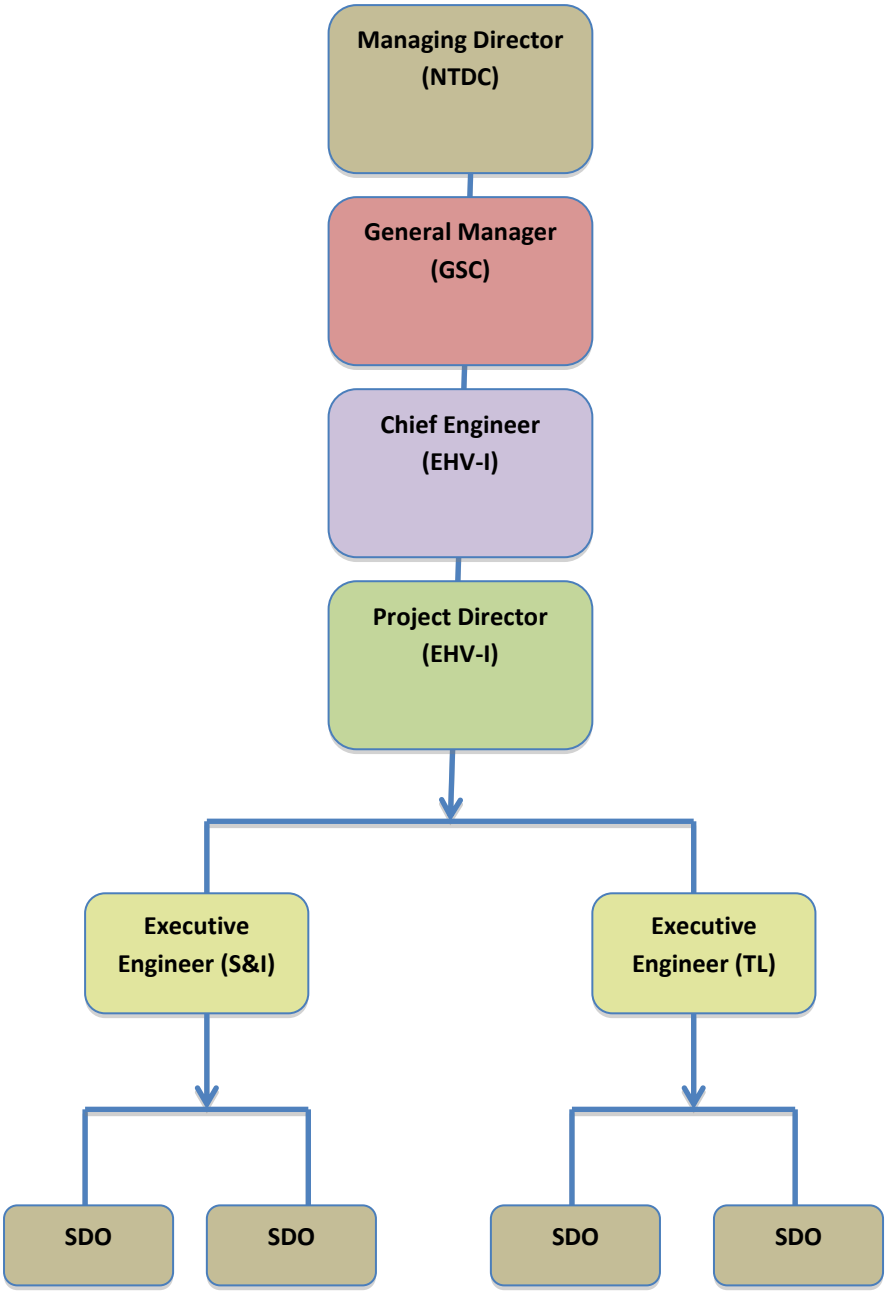
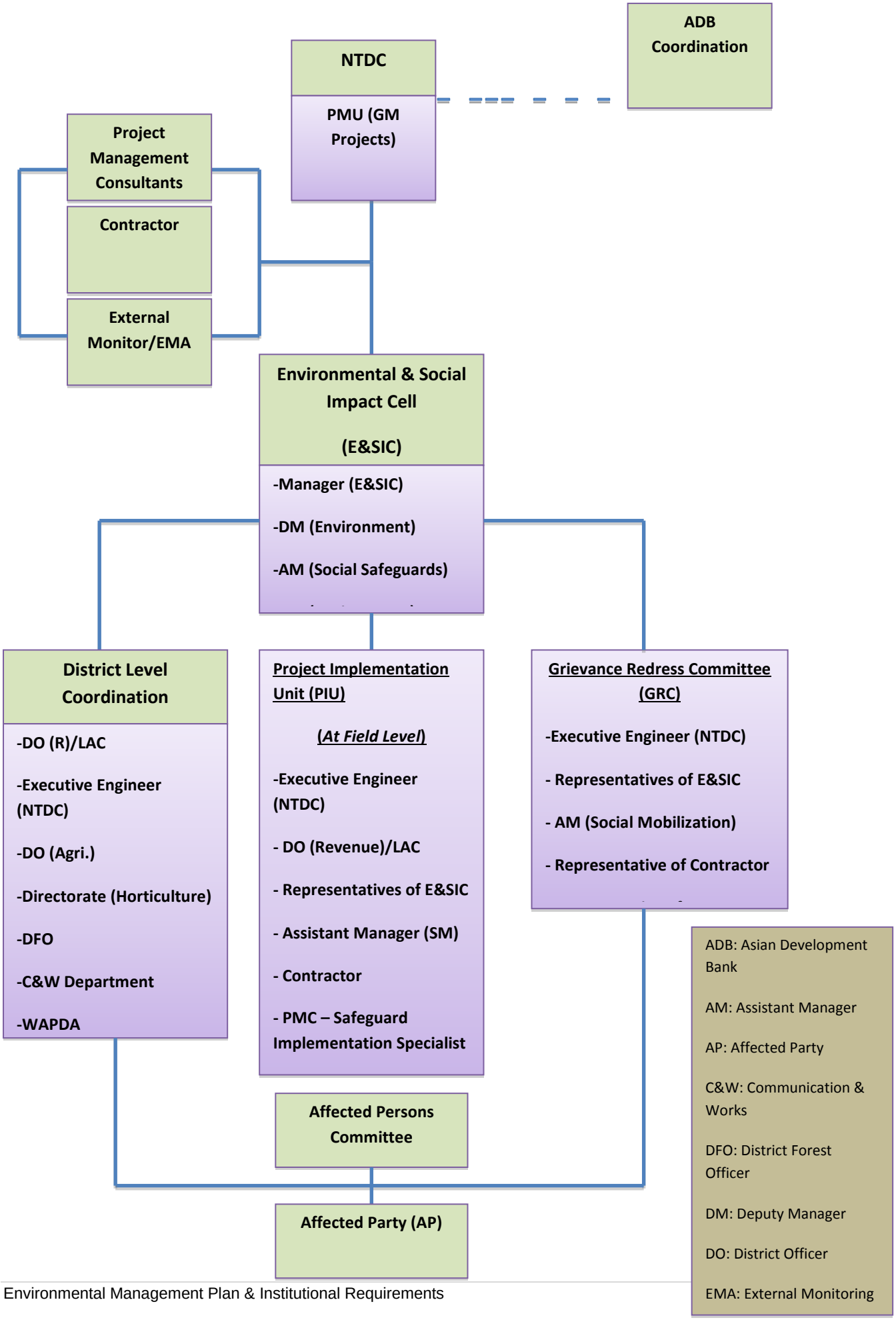


**Figure 6.2: Organogram of NTDC Environment and Social Impact Cell**



226. The EMP was prepared taking into account the capacity of the NTDC to conduct environmental assessments of this project. But it is envisaged that the NTDC's ESIC will conduct monitoring of the project to check the compliance of EMP provisions and will obtain environmental approval from the respective EPAs.

The ESIC is composed of one Manager, one Deputy Manager, and two Assistant Managers (refer to **Figure 6.2**). Most of the environmental work is delegated to consultants. Specific areas for immediate attention are in EMP auditing, environmentally responsible procurement, air, water and noise pollution management, social and ecological impact mitigation. It is recommended that an environmental specialist should be made part of team of supervisory consultants for effective monitoring of EMP provisions.

227. The duties of the ESIC include but are not limited to the following:

- Provide review and technical support to PMU, including review of papers, feasibility studies, appraisal reports and other relevant documents from the perspective of environment and land acquisition and resettlement management, on assignment basis.
- Supervise and scrutinize the consultants hiring process for environmental and social documents preparation.
- Oversight of construction contractors for monitoring and implementing mitigation measures.
- Preparing and implementing environment policy guidelines and environmental good practices.
- Liaising with the PIUs and seeking their help to solve the environment related issues of project implementation.
- Providing awareness-training workshop on environmental and social issues related to power transmission and distribution to PIU staff.
- Preparation of bi-annual progress reports on environmental and social safeguards for submission to ADB.
- Conduct seminars / local training workshops on environment safeguards matters with the help of NGOs / PIU / IFIs, etc. and
- Prepare EIAs/IEEs of new projects.
- Seek environmental approvals (NOCs) from respective EPA
- Appoint environmental supervisory consultant during the construction phase of the project to ensure implementation of the EMP.

### 6.4.1 Environmental and Social Monitoring by ESIC

228. The general monitoring responsibilities of the NTDC's ESIC will consist of:

- Check that the Contractor backfills, compacts, and leaves the ground in the original condition after excavation of any pits.
- Keep checks and controls so that the pollution of land and water resources due to the spills of lubricants, fuel, chemicals, and other wastes does not take place.
- All the existing tracks, roads, water courses are left in the original shape after completion of the construction activities.
- Monitor that the Contractor uses such working methodology so as not to cause disturbance to the communities by fugitive dust, noise, fumes, etc.
- Monitor that the Contractor adjusts his working hours during the stringing activities in such a manner that it causes least inconvenience to the local population.
- To ensure that the Contractor keeps first aid kits, medicines, safety gadgets at site for taking care of possible mishaps to the workers or other persons.
- To keep the working site tidy so as to avoid unhealthy impacts on the work force.

## 6.5 Institutional Arrangements

229. The environmental management plan will require involvement of the following organizations for its implementation:

- ESIC - NTDC as environmental monitor of the execution of the EMP.
- Project Contractors as executors of the EMP;

### 6.5.1 Role of ESIC - NTDC

230. The ESIC will work on behalf of the NTDC and through their environmental specialist, will be responsible for ensuring the implementation of the EMP. The ESIC will also ensure the overall environmental performance during construction operations and will be responsible for ensuring implementation of the EMP by the project Contractors.

231. Provide technical support for compliance and monitoring of EMP;

### 6.5.2 Role of Project Contractor

232. The project contractor will be responsible for following items:

- Implementation of, or adherence to, all provisions of the IEE and EMP;
- Contractor's environmental performance will rest with the person holding the highest management position within the contractor's organization. Reporting to their management, the contractor's site managers will be responsible for the effective implementation of the EMP.
- The Contractor will be required to have qualified Environmental Specialists in their team to ensure all mitigation measures are implemented during the different

development phases of the project.

## 6.6 Monitoring Parameters

233. A monitoring plan for the construction phase of the project, indicating environmental parameters, frequency and applicable standards is provided below as **Table 6.3** below.

234. During the procurement/pre-construction period, the monitoring activities will focus on (i) checking the contractor's bidding documents, particularly to ensure that all necessary environmental requirements have been included; and (ii) checking that the contract documents' references to environmental mitigation measures requirements have been incorporated as part of contractor's assignment and making sure that any advance works are carried out in good time.

235. During the construction period, the monitoring activities will focus on ensuring that any required environmental mitigation measures are implemented to address possible impacts.

236. In general, the construction impacts will be manageable and no insurmountable impacts are predicted, provided that the EMP is implemented to its full extent as required in the Contract documents.

237. The effective implementation of the EMP will be audited as part of the loan conditions and the executing agency must be prepared for this. In this regard, the ESIC - NTDC will guide the design engineers and Contractors on the environmental aspects.

## 6.7 Environmental Training

### 6.7.1 Capacity Building and Training

238. Capacity building and training programs are necessary for the project staff in order to control the negative impacts resulting from the project construction and during its operation phase. They will also require trainings on monitoring and inspecting of such a project for environmental impacts and for implementation of mitigation measures.

239. The details of this capacity building and training program are presented in the **Table 6.7** below.

## Table 6.1: Environmental Management Plan

| Project Activities | Section | Impact | Mitigation Measures Recommended | Responsibility | | Timing |
|---|---|---|---|---|---|---|
| | | | | Execution | Monitoring | |
| **Procurement/Pre-construction Considerations** | 1.1 | Lack of Environmental Capacity | • ESIC working with NTDC will conduct one day workshop to develop capacities on environmental safeguards.<br>• Contractor will be provided guidance for developing and defining an Occupational and Environmental Health and Safety procedure for all work, including use of PPEs. | ESIC | NTDC | BC: during detailed designing of the project |
| | 1.2 | Lack of Integration of IEE/EMP requirements into bidding documents | The ESIC - NTDC will check the design and bid documents to ensure they are responsive to key environmental, social and safety considerations. | ESIC | NTDC | BC |
| | 1.3 | Waste Disposal | • Suitable locations will be identified for disposal of the waste produced such as unsuitable soils, oily waste and scrap metal.<br>• NTDC shall ensure that any waste generated in the construction phase is disposed in line with provincial EPA and local authority requirements. With the proper implementation of appropriate waste disposal protocols, there will be no residual risk due to improper waste disposal. | ESIC | NTDC | BC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 1.4 | Electronic Hardware Transport Routes | • The vehicles hauling the electrical hardwave equipment and materials such as microwave dishes, optical fiber cables etc. along urban and rural roads in localities with roadside residences will be limited.<br>• Contractor will establish a route plan to minimize this disruption and will approve this plan from NTDC.<br>• The speed of trucks transporting the heavy electronic hardware in congested localities will be limited to 20 km/hr. | ESIC | NTDC | BC & DC |
| | 1.5 | EMF Reduction | • Raising conductor height above the ground, typically by increasing tower height.<br>• Reducing conductor spacing.<br>• Arranging phases so that fields tend to cancel.<br>• 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>• Increasing right-of-way widths or buffer zone widths, to move people further from transmission lines. | ESIC | NTDC | BC |
| **Construction Phase** | 2.1 | Air Quality | • Concrete batching plants will be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce the level of dust emissions. | Contractor | ESIC, NTDC | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Construction Phase (Continued)** | | | • The NEQS applicable to gaseous emissions generated by the construction vehicles, equipment and machinery will be enforced during the construction works.<br>• Contractor should make sure that all equipment and vehicles are tested for emissions. Regular maintenance of equipment and vehicles will also control the incomplete combustion.<br>• Where necessary, dust emissions will be reduced by a regular sprinkling of water for keeping the dust settled, at least twice a day.<br>• Haul-trucks carrying sand, aggregate and other materials will be kept covered with tarpaulin to help contain construction materials being transported.<br>• Ensure proper tuning of the construction vehicles.<br>• The need for large stockpiles should be minimized by careful planning of the supply of materials from controlled sources.<br>• The stack height of generators will be at least 3 meters above the ground. | | | |
| | 2.2 | Noise | • Equipment noise will be reduced at source by proper design, maintenance and repair of construction machinery and equipment. Noise from vehicles and power generators will be minimized by use of proper silencers and mufflers.<br>• Excessive noise emitting equipment will not be allowed to operate and will be | Contractor | ESIC, NTDC | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Construction Phase (Continued…)** | | | replaced.<br>• Blowing of horns will be prohibited.<br>• As a rule, the operation of heavy equipment shall be conducted in daylight hours.<br>• Hammer- type percussive pile-driving operations shall not be allowed at night time.<br>• Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise.<br>• Well-maintained haulage trucks will be used with speed controls. | | | |
| | 2.3 | Soil Contamination | • The possible contamination of soil by oils and chemicals, workshop areas, and equipment washing-yards may limit the future use of land for vegetation purposes.<br>• It will be ensured that spill prevention trays are provided and used during refueling. Also, on-site maintenance of construction vehicles and equipment will be avoided as far as possible. In case on-site maintenance is unavoidable, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil.<br>• Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities.<br>• Fuels, lubricants and chemicals will be stored in covered bounded areas, | Contractor | ESIC, NTDC | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | underlain with impervious lining. Appropriate arrangements, including shovels, plastic bags and absorbent materials will be available near fuel and oil storage areas.<br>• Solid waste generated at the work sites will be properly segregated, treated and safely disposed of only in the demarcated waste disposal sites. | | | |
| | 2.4 | Construction waste disposal | • Potential safe disposal sites close to the project sites shall be identified by the Contractor and approved by NTDC.<br>• Piling up of any loose material shall be done in segregated areas to arrest washing out of soil. Debris shall not be left where it may be carried by water to downstream flood plains etc.<br>• Used oil and lubricants shall be recovered and reused or removed from the site in full compliance with the national and local regulations.<br>• Oily wastes shall not be burned. Disposal location to be agreed with local authorities/EPA.<br>• Machinery shall be properly maintained to minimize oil spill during the construction.<br>• Solid waste shall be disposed at an approved solid waste facility, open burning is illegal and contrary to good environmental practice. | Contractor | ESIC, NTDC | DC |
| | 2.5 | Disposal of Electronic Waste due to hardware upgrade | • It shall be ensured that all electronic waste is collected and segregated to ensure any non-metal parts such as | Contractor | ESIC, NTDC | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | plastic, rubber, wooden parts are removed and disposed off in accordance with international best practices to ensure no negative impact takes place on the immediate environment and its receptors.<br>• It shall be ensured that if the scrap is to be sold to a third party, only an entity possessing a comprehensive EMS with a clear procedure for disposal of metal scrap/waste is considered.<br>• Any metal waste containing asbestos shall be segregated and it shall be ensured that such waste is disposed off in accordance with international guidelines for handling asbestos.<br>• As far as possible, the waste/scrap generated shall be reused through retrofitting or refurbishment to minimize the total volume of waste generated.<br>• In case scrap is to be stored prior to assessing most suitable disposal options, it shall be ensured that a dedicated yard is selected which is properly covered to protect the scrap from exposure to the elements and possible rusting of the scrap. | | | |
| | 2.6 | Vegetation and Wildlife Loss | • It will be ensured that willful killing, trapping and trade of faunal species will be strictly prohibited.<br>• Burning of vegetation or wood as fuel will be prohibited. | Contractor | ESIC, NTDC | DC |
| | 2.7 | Impact on living environment | • Consultation with the local community to inform them of the nature, duration and | Contractor | ESIC, NTDC | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | likely effects of the construction work, and the mitigation measures in place;<br>• Proper planning of work programme so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times;<br>• Avoiding noise-generating activities at night;<br>• Implementing the measures to reduce dust;<br>• Utilizing modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions, and ensuring that these are maintained to manufacturers' specifications at all times. | | | |
| | 2.8 | Community Health and Safety | • Work areas outside the project site, especially where machinery is involved, will be roped off and will be constantly monitored to ensure that local residents, particularly children stay away. Also, no machinery will be left unattended, particularly in running condition.<br>• Local communities in the villages along the transmission line corridor, where the optical fiber has to be installed, will be briefed on traffic safety, especially women who are the main care providers to children.<br>• Speed limit of 20 km/hr will be maintained by all project related vehicles and nighttime driving of project vehicles will be limited where possible.<br>• Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances (if any) and | Contractor | ESIC, NTDC | DC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | other construction materials during transport. | | | |
| | 2.9 | Social impacts | • Claims/complaints of the people on construction nuisance/damages close to project sites to be considered and responded to promptly by the Contractor.<br>• Contractor shall organize temporary means of access and make alternative arrangements to avoid local community impacts and to avoid such short-term negative impacts. | Contractor | ESIC, NTDC | DC |
| **Operation Phase** | 3.1 | Crop and vegetation | • Tree planting shall be conducted at suitable locations in project area, as near as possible from locations where any trees might be uprooted, if necessary.Required measures for vegetation management shall be taken such as minimizing use of chemicals, avoiding invasive plant species, risk of forest fires etc.<br>• Track growth of large trees under the conductors. | Contractor | ESIC, NTDC | DO |
| | 3.2 | Social Safety impacts | • Necessary signboards with limits of height clearances to be placed properly.<br>• Identify and prevent any illegal encroachments under the transmission lines. | Contractor | ESIC, NTDC | DO |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 3.3 | Occupational Health and Safety | • It shall be ensured that a public awareness campaign is developed and implemented to educate the local communities regarding the dangers posed by exposure to the high voltage contained in live transmission lines which will be installed next to the optic fiber lines.<br>• All NTDC staff conducting maintenance of the transmission lines shall ensure that they wear protective equipment such as goggles, rubber boots, protective jacket and also carefully follow all standard protocols to ensure their safety while working on the towers.<br>• All NTDC staff shall also use protective harnesses to ensure they are protected from falling from the towers.<br>• All NTDC staff shall avoid working on the towers in bad weather conditions, particularly during rain and high winds. | Contractor | ESIC, NTDC | DO |

**BC** : Before Construction

**DC** : During Construction

**DO** During Operation

**Table 6.2: Pre-Construction Environmental Monitoring Plan for Baseline Development**

| Parameter to be measured | Objective of Monitoring | Parameters to be Monitored | Measurements | Location | Frequency | Responsibility |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| **Ambient Air Quality** | To establish baseline air quality levels | CO,$NO_x$ & $PM_{10}$ (particulate matter smaller than 10 microns) concentration at receptor level | 1-hr concentration levels | At any three random project sites | Once | ESIC |
| **Ambient Noise** | To establish baseline noise levels | Ambient noise level near receptors at project site | 1-hr concentration levels | At any three random project sites | Once | ESIC |
| **Safety of Workers and Community members** | To minimize risk of hazards and accidents by ensuring only trained and certified personnel with experience of high voltage and working at height are employed to undertake this work. | Review and verify profiles of workers to be engaged for project and ensure they possess relevant credentials and experience | Verification of relevant skills and experience | At time of hiring of staff | Once | ESIC & Contractor |

**Table 6.3: Construction Phase Monitoring Requirements**

| Project Activity and Potential Impact | Objective of Monitoring | Parameters to be Monitored | Measurements | Location | Frequency | Responsibility |
|---|---|---|---|---|---|---|
| **Noise**<br>Disturbance due to noise from construction activity | To determine the effectiveness of noise abatement measures on sound pressure levels | Ambient noise level at different locations along project corridor<br>Performance standard: Most stringent noise standards at nearest receptor to works. | 1-hr concentration levels | At any three random project sites | Once every three months on a typical working day | Contractor's Environmental officer, ESIC |

| Project Activity and Potential Impact | Objective of Monitoring | Parameters to be Monitored | Measurements | Location | Frequency | Responsibility |
|---|---|---|---|---|---|---|
| **Air Quality**<br>Dust emissions from construction vehicles and equipment | To determine the effectiveness of dust control program on dust at receptor level | CO,$NO_x$ & $PM_{10}$ (particulate matter smaller than 10 microns) concentration at receptor level | 1-hr concentration levels | At any three random project sites | Once every three months on a typical working day | Contractor's Environmental officer, ESIC |
| | | Visible dust | Visual observation of size of dust clouds, their dispersion and the direction of dispersion | Construction sites | Once daily during peak construction period | Contractor's Environmental officer, ESIC |
| **Safety precautions for Community members and Safety workers** | To prevent accidents for workers and general public | Number of near miss, minor, major and fatal events and accidents taking place<br>Performance standard: zero near miss, minor, major and fatal accidents | ▪ Visual inspections and documenting of all such minor and major incidents. | Construction sites along corridor. | Once Daily | Contractor's Environmental officer, ESIC |
| **Soil Contamination** | To prevent contamination of soil from oil and toxic chemical spills and leakages | Incidents of oil and toxic chemical spills | Visual inspections | At construction sites and at vehicle and machinery refuelling & maintenance areas | Once a month | Contractor's Environmental officer, ESIC |
| **Solid Waste & Effluent disposal**<br>Insufficient procedures for waste collection, storage, transportation and disposal | To check the availability of waste management system and implementation | Inspection of solid and liquid effluent generation, collection, segregation, storage, recycling and disposal will be undertaken at all work sites | Visual inspections | At work sites along project corridor | Once daily. | Contractor's Environmental officer, ESIC |

| Project Activity and Potential Impact | Objective of Monitoring | Parameters to be Monitored | Measurements | Location | Frequency | Responsibility |
|---|---|---|---|---|---|---|
| **Monitoring of EMF levels post optic fiber installation** | To ensure EMF levels do not increase due to installation of the optic fiber and cause health effects for community members and workers | EMF levels<br><br>Performance standard: No over exposure to EMF by community members or workers | Measurement of EMF | Along entire transmission line | Once every three months on a typical working day | Contractor's Environmental officer, ESIC |

## 6.8 Environmental Management Costs

240. The **Table 6.4** below provides cost estimates for 'Pre-Construction phase' monitoring while **Table 6.5** provides cost estimates for 'Construction phase' monitoring of key environmental parameters.

241. The costs associated with implementation of the EMP and the necessary mitigation measures are provided as **Table 6.6** below. The **Table 6.7** below provides the 'Capacity development and training programme' for project contractors for the proposed project.

**Table 6.4: Annual Cost Estimates for 'Pre-Construction Phase' Environmental Monitoring[8]**

| Monitoring Component | Parameters | Quantity | Amount PKR | Details |
|---|---|---|---|---|
| **Air Quality** | CO, NOx, $PM_{10}$ | 3 (Once only at 3 locations) | 30,000 | 3 readings @ PKR 10,000 per sample |
| **Noise Levels** | dB(A) | 3 (Once only at 3 locations) | 30,000 | 3 readings @ PKR 10,000 per reading |
| **Contingencies** | | | 3,000 | 5% of monitoring cost |
| **Total (PKR)** | | | **63,000** | |

**Table 6.5: Annual Cost Estimates for 'Construction Phase' Environmental Monitoring[9]**

| Monitoring Component | Parameters | Quantity | Amount PKR | Details |
|---|---|---|---|---|
| **Air Quality** | CO, NOx, $PM_{10}$ | 6 (Quarterly basis at 3 locations) | 60,000 | 6 readings @ PKR 10,000 per sample |
| **Noise Levels** | dB(A) | 6 (Quarterly basis at 3 locations) | 60,000 | 6 readings @ PKR 10,000 per reading |
| **Contingencies** | | | 6,000 | 5% of monitoring cost |
| **Total (PKR)** | | | **126,000** | |

[8] For air quality monitoring: 'Passive samplers' such as test tubes can be used or 'Active samplers' with sorbent turbes can also be used.

For noise monitoring: sampling equipment with duration greater than 1 hour can be used.

**Table 6.6: Estimated Costs for EMP Implementation**

| Item | Sub-Item | Estimated Total Cost (PKR) |
|---|---|---|
| **Staff, audit and monitoring cost[1]** | 1 person for 12 months (@ 20,000 per month) | **240,000** |
| **Monitoring Activities** | Provided separately in Tables 7.4 and 7.5. | - |
| **Mitigation Measures** | As prescribed under EMP and EIA. | **600,000** |
| **(i) Water sprinkling** | To suppress dust emissions | 300,000 |
| **(ii) Solid waste collection & disposal** | From construction sites (based on initial estimates) | 300,000 |
| **Contingencies** | 5% of EMP implementation cost | 30,000 |
| **Total Estimated Cost (PKR)** | | **870,000** |

**1: To cover staff cost and expenses of Environmental Specialist for Contractor**

**Table 6.7: Capacity Development and Training Programme for Project Contractor(s)**

| Provided by | Organized by | Contents | Target Audience | Venue | Duration |
|---|---|---|---|---|---|
| **Pre-construction Phase**<br>ESIC - NTDC offering specialized services in environmental management and monitoring | Project Director | Short seminars and courses on:<br>Environmental Management Plan and Environmental Monitoring Plan | Contractor staff & NTDC Project field staff | NTDC Office, Lahore | One day long training seminar |
| **Construction Phase**<br>ESIC -NTDC offering specialized services in social management and monitoring | Project Director | Short seminar on Environmental risks associated with construction phase.<br>Development of Environmental Performance Indicators<br>Occupational Health and Safety (OHS) issues | Contractor staff & NTDC Project field staff | NTDC Office, Lahore | One day long training seminar |

# 7 Public Consultation and Information Disclosure

## 7.1 Introduction

242. The public consultation process with various stakeholders has been approached so as to involve public and other relevant stakeholders from the earliest stages. Public consultation has taken place and viewpoints of the stakeholders have been taken into account as well as their concerns and suggestions regarding likely impacts of the project during the construction phase. The main objectives of the public consultation were as follows:

- To share the information about the proposed project, its components and activities with affected people;
- To obtain cooperation and participation of the general public in Project planning and implementation processes;
- To establish accessible and effective grievance redress procedures; and
- Create a sense of ownership among the stakeholders regarding the respective sub-projects.

243. The environmental assessment process under the Pakistan Environmental Protection Act 1997, requires the disclosure to the public after the statutory IEE / EIA has been accepted by the relevant EPA, to be in strict adherence to the rules. In this IEE, the consultation process was performed to satisfy the ADB requirements as stipulated in the Safeguard Policy Statement (SPS) 2009.

## 7.2 Identification of Main Stakeholders

244. The primary stakeholders identified are as follows:

- Landowners near the sub-station sites and near the optic fiber corridor.
- People that might be indirectly affected by the project.
- People who shall benefit from project activities in the form of employment or business opportunities.
- Government departments directly or indirectly involved with the project.
- Knowledgeable residents of the project areas keen to contribute to the consultation process.

## 7.3 Approach for Public Consultation

245. The approach adopted towards public participation was to disseminate information, soliciting inputs and obtaining consensus on issues and proposing mitigation measures. This approach was put into practice through consultation and public meetings with local communities residing in proximity to the project areas, meetings with influential people of the area, roadside consultations with pedestrians etc.

## 7.4 Meetings with Stakeholders

246. During discussions with the local communities residing in the project areas, they expressed positive sentiments for the project along with mentioning the hope that the project activities would play an important part in reduction of the constant power outtages, which they suffer on a daily basis.

247. The consultations with the key stakeholders (conducted from 15th to 23rd March'17) such as the local communities near the different project sites and along the optic fiber project corridor resulted in the following comments being obtained:

- Employment as laborer during civil works of sub-station and for installation of optic fiber
- Information should be provided prior to commencement of work
- Avoid tree cutting
- Contractor must work efficiently and complete work as per agreed timelines to minimize any potential inconvenience to residents of project areas
- Contractor must use necessary safety precautions in order to protect themselves and the residents in the project areas since the scope of work involves high voltage electrical equipment.
- Work on transmission towers must not be conducted on rainy days to minimize risk of hazards and accidents.
- The optic fiber must be properly installed to ensure during high winds, it will not get loose and cause any incidents such as electrocutions.
- Contractor must install high quality equipment to ensure repeated nuisance resulting from repair and maintenance does not take place.
- Work must be conducted during day time as far as possible.
- Speed of heavy trucks that will transport the heavy electronic hardware must not be allowed to exceed 20 km/hr and drivers of these trucks must be instructed to follow strict rules while driving.
- Any toxic waste produced from the work sites must be disposed off properly.

## 7.5 Stakeholders Comments & Concerns

248. Any concerns expressed above will be addressed through the proper implementation of the EMP. The list of persons consulted during the consultation process, conducted is provided as **Annexure III**.

# 8 Grievance Redress Mechanism

## 8.1 General

249. In order to receive and facilitate the resolution of affected peoples' (AP) concerns, complaints and grievances about the Project's environmental performance, a Grievance Redress Mechanism (GRM) will be established for this project. The GRM will address the APs' concerns and complaints proactively and promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the APs at no costs and without retribution. The mechanism will not impede access to the country's judicial or administrative remedies.

## 8.2 Redress Committee, Focal Points, Complaints Reporting, Recording and Monitoring

250. Field level grievances will be addressed through a local Grievance Redress Committee (GRC) to be formally constituted by the EA/IA. GRCs will be instituted by ESIC - NTDC.

251. The GRC will include the Environment Specialist in addition to a specially recruited grievance officer and a local notable.

252. The GRCs will be formally notified and established along the project corridor, and will function as open forums for hearing complaints and exploring quick resolutions to resolving conflicts.

253. Each GRC will record its deliberations and inform the concerned parties of a resolution within 2 weeks of its findings and recommendations. Communities will be informed about the GRC through the ESU outreach program.

254. Additionally, Environmental Tribunals exist at the provincial level and can be approached for the resolution of conflicts and grievances that cannot be resolved by the GRC. Grievance may also be addressed to ADB's Office of Special Projects Facilitator.

255. A pre-mobilization public consultation meeting will be convened by ESIC - NTDC and attended by GFP, Contractor and other interested parties (e.g. district level representatives, NGOs). The objectives of the meeting will be as follows:

- Introduction of key personnel of each stakeholder including roles and responsibilities,
- Presentation of project information of immediate concern to the communities by the contractor (timing and location of specific construction activities, design issues, access constraints etc.) This will include a brief summary of the EMP - its purpose and implementation arrangements;

- Establishment and clarification of the GRM to be implemented during project implementation including proactive public relations activities proposed by the project team and contractor to ensure that communities are continually advised of project progress and associated constraints throughout project implementation;

- Elicit and address the immediate concerns of the community based on information provided above.

256. Following the pre-mobilization public consultation meeting, environmental complaints associated with the construction activity will be routinely handled through the GRM as explained and shown in **Figure 8.1** below:

- Individuals will lodge their environmental complaint/grievance with their respective community's nominated GFP.

- The GFP will bring the individual's complaint to the attention of the Contractor.

- The Contractor will record the complaint in the onsite Environmental Complaints Register (ECR) in the presence of the GFP.

- The GFP will discuss the complaint with the Contractor and have it resolved;

- If the Contractor does not resolve the complaint within one week, then the GFP will bring the complaint to the attention of the ESIC's Environmental Specialist. The ESIC's Environment Specialist will then be responsible for coordinating with the Contractor in solving the issue.

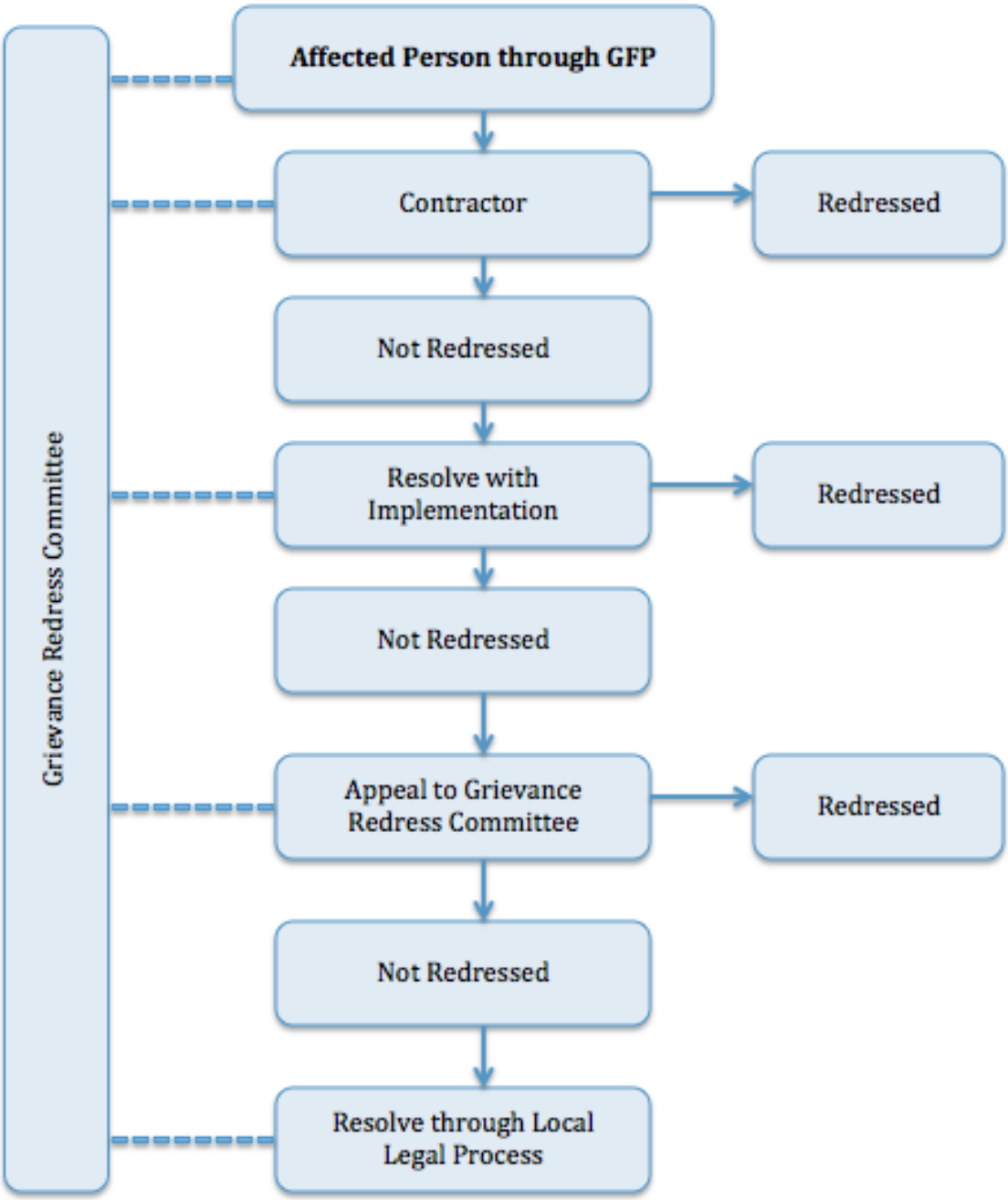
- If the Complaint is not resolved within two weeks, the GFP will present the complaint to the Grievance Redress Committee (GRC).

- The GRC will have to resolve the complaint within a period of two weeks and the resolved complaint will have to be communicated back to the community. The Contractor will then record the complaint as resolved and closed in the Environmental Complaints Register.

- Should the complaint not be resolved through the GRC, the issue will be adjudicated through local legal processes.

- In parallel to the ECR placed with the Contractor, each GFP will maintain a record of the complaints received and will follow up on their rapid resolution.

**Figure 8.1: Grievance Redress Mechanism**



# 9 Conclusions and Recommendations

257. The 'SCADA Phase 3 and revenue metering system' project is extremely important since it aims to install both hardware and software to provide the NTDCL with a fully functional SCADA system for operations and monitoring of the complete electric grid and use the SCADA communication system to get energy data from all metering points on the system to the CPPA-G.

258. Primary and secondary data has been used to assess the environmental impacts of the project. This IEE report highlights any potential environmental impacts associated with the project and recommends mitigation measures, wherever felt necessary. Any environmental impacts associated with this project needs to be properly mitigated, wherever required, through the existing institutional arrangements described in this report.

259. The majority of the environmental impacts, however minimal and temporary in nature, are associated with the construction phase of the project. The implementation of mitigation measures during this period will be the responsibility of the Contractor. Therefore, the required environmental mitigation measures will have to be clearly defined in the bidding and Contract documents, and appropriately qualified environmental staff retained by the Consultant to supervise the implementation process.

260. This IEE concludes that no significant negative environmental impacts are likely to occur due to construction and operation of the proposed project, provided mitigation measures are implemented and the proposed monitoring program is adequately carried out. The EMP includes measures to minimize project impacts due to noise and air pollution, waste generation etc.

261. This project has been assigned environmental category 'B' in accordance with the ADB's Safeguard Policy Statement (SPS) 2009 and Schedule II as per PEPA, IEE and EIA Gazette Notification, 2000. Thus, this IEE report with the associated EMP is regarded as sufficient environmental assessment of this project and a full EIA is not required.

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# ANNEXURE-I

## Rapid Environmental Assessment Checklist

# Rapid Environmental Assessment (REA) Checklist

**Instructions:**

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to Environment and Safeguards Division (RSES) for endorsement by Director, RSES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

**Country/Project Title:** Installation of SCADA Phase 3 and Revenue Metering System at different sites across Pakistan

**Sector Division:** Power Transmission

| Screening Questions | Yes | No | Remarks |
|---|---|---|---|
| **A. Project Siting**<br>Is the Project area adjacent to or within any of the following environmentally sensitive areas? | | | |
| ▪ Cultural heritage site | | X | Not Applicable |
| ▪ Protected Area | | X | Not Applicable |
| ▪ Wetland | | X | Not Applicable |
| ▪ Mangrove | | X | Not Applicable |
| ▪ Estuarine | | X | Not Applicable |
| ▪ Buffer zone of protected area | | X | Not Applicable |
| ▪ Special area for protecting biodiversity | | X | Not Applicable |

| Screening Questions | Yes | No | Remarks |
|---|---|---|---|
| **B. Potential Environmental Impacts**<br>Will the Project cause… | | | |
| ▪ encroachment on historical/cultural areas, disfiguration of landscape and increased waste generation? | | X | The project sites are located within the existing sub-station/grid station boundaries and the Scope of work will be limited and thus no significant impacts are expected. |
| ▪ encroachment on precious ecosystem (e.g. sensitive or protected areas)? | | X | Not Applicable |
| ▪ alteration of surface water hydrology of waterways crossed by roads and resulting in increased sediment in streams affected by increased soil erosion at the construction site? | | X | All activities will be conducted within existing sub-station/grid station boundaries and thus no alteration of surface water hydrology is expected to take place. |
| ▪ damage to sensitive coastal/marine habitats by construction of submarine cables? | | X | The Scope of work for this project will not result in any such impacts. |
| ▪ deterioration of surface water quality due to silt runoff, sanitary wastes from worker-based camps and chemicals used in construction? | | X | The scope of work is highly technical and NTDC's trained staff will be engaged for conducting the works. The need for a labor camp is not expected since these technical staff will be provided accommodation available for technical staff. No chemicals are expected to be used while conducting the scope of work. Any waste generated shall be disposed off in accordance with applicable NEQS guidelines. |
| ▪ increased local air pollution due to rock crushing, cutting and filling? | | X | The Scope of work for this project will not result in any such impacts. |
| ▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation? | X | | Certain risks are expected during the project construction phase since high voltage electrical equipment will need to be installed. In addition, the operation of microwave dishes does emit high levels of radiation, which can have significant health impacts during long-term exposure. |

| Screening Questions | Yes | No | Remarks |
|---|---|---|---|
| ▪ chemical pollution resulting from chemical clearing of vegetation for construction site? | | X | The project sites are located within walls of existing sub-stations/grid stations and no notable vegetation is present that will require removal. Also, as a general policy, NTDC does not use chemicals for clearing of vegetation. |
| ▪ noise and vibration due to blasting and other civil works? | | X | Blasting is not involved. Noise levels generated due to any civil work conducted is expected to be within allowable NEQS guidelines. |
| ▪ dislocation or involuntary resettlement of people? | | X | All activities will be conducted within the existing sub-station/grid station boundaries. |
| ▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups? | | X | The Scope of work for this project will not result in any such impacts. |
| ▪ social conflicts relating to inconveniences in living conditions where construction interferes with pre-existing roads? | | X | The Scope of work for this project will not result in any such impacts. |
| ▪ hazardous driving conditions where construction interferes with pre-existing roads? | X | | A part of the Scope of Work entails installation of additional transmission lines between existing towers at specific locations for the SCADA system. During this activity, if the transmission line is passing over specific roads, traffic could be impacted. |
| ▪ creation of temporary breeding habitats for vectors of disease such as mosquitoes and rodents? | | X | The Scope of work for this project will not result in any such impacts. |

| Screening Questions | Yes | No | Remarks |
|---|---|---|---|
| ▪ dislocation and compulsory resettlement of people living in right-of-way of the power transmission lines? | X | | Temporary dislocation might take place. A part of the Scope of work entails the addition of additional transmission lines between existing towers at specific locations for the SCADA system. However, this will be a short-term activity, limited in scope. As a result, even if any households are residing in different proximity to the work site, only temporary dislocation for their safety during the duration of the works will be required. |
| ▪ environmental disturbances associated with the maintenance of lines (e.g. routine control of vegetative height under the lines)? | | X | Not Applicable |
| ▪ facilitation of access to protected areas in case corridors traverse protected areas? | | X | Not Applicable |
| ▪ disturbances (e.g. noise and chemical pollutants) if herbicides are used to control vegetative height? | | X | Not Applicable |
| ▪ large population influx during project construction and operation that cause increased burden on social infrastructure and services (such as water supply and sanitation systems)? | | X | The scope of work will be limited with technical staff mostly engaged and thus no large population influx is expected. |
| ▪ social conflicts if workers from other regions or countries are hired? | | X | Technical staff will mostly be engaged and thus no potential conflicts are expected. |
| ▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations? | | X | Only technical staff will be engaged for this activity that will be provided proper accommodation since they will be limited in number. Any waste generated shall be disposed off in accordance with applicable NEQS guidelines. |
| ▪ risks to community safety associated with maintenance of lines and related facilities? | X | | The installation of an additional transmission line between existing towers at specific locations can cause an occupational health and safety risk considering the high voltage of the equipment being installed. |

| Screening Questions | Yes | No | Remarks |
|---|---|---|---|
| ▪ community health hazards due to electromagnetic fields, land subsidence, lowered groundwater table, and salinization? | X | | As a part of the scope of work, the installation of additional transmission towers along with microwave equipment will result in increased electromagnetic fields. The radiations emitted can have serious health effects in the long term if prolonged exposure takes place. |
| ▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation? | X | | No explosives will be involved in the proposed Scope of Work. Also, any fuel or chemicals used shall be disposed off in accordance with NEQS Guidelines.<br><br>However, the heavy equipment will be transported to the different sites across the country on large transport trucks, which can lead to possible congestion and safety risks if proper driving protocols are not followed, particularly in congested areas where communities are residing and kids might be playing outdoors. |
| ▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., high voltage wires, and transmission towers and lines ) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning? | X | | One aspect of the scope of work (installation of microwave equipment on sub-stations/grid stations) will be conducted within the existing boundaries of the sub stations and thus no hazard is expected to the neighboring communities.<br><br>However, the installation of the additional transmission lines between existing towers at certain locations can pose a community safety risk due to the high voltage of these lines. |

# ANNEXURE-II

## NEQS Guidelines

**National Environmental Quality Standards for Ambient Air**

| Pollutants | Time-weighted average | Concentration in Ambient Air | | Method of measurement |
|---|---|---|---|---|
| | | Effective from 1st January 2009 | Effective from 1st January 2012 | |
| Sulphur Dioxide ($SO_2$) | Annual Average* | 80 µg/m$^3$ | 80 µg/m$^3$ | -Ultraviolet Fluorescence method |
| | 24 hours** | 120 µg/m$^3$ | 120 µg/m$^3$ | |
| Oxides of Nitrogen as (NO) | Annual Average* | 40 µg/m$^3$ | 40 µg/m$^3$ | - Gas Phase Chemiluminescence |
| | 24 hours** | 40 µg/m$^3$ | 40 µg/m$^3$ | |
| Oxides of Nitrogen as ($NO_2$) | Annual Average* | 40 µg/m$^3$ | 40 µg/m$^3$ | - Gas Phase Chemiluminescence |
| | 24 hours** | 80 µg/m$^3$ | 80 µg/m$^3$ | |
| $O_3$ | 1 hour | 180 µg/m$^3$ | 130µg/m$^3$ | -Non dispersive UV absorption method |
| Suspended Particulate Matter (SPM) | Annual Average* | 400µg/m$^3$ | 360µg/m$^3$ | - High Volume Sampling, (Average flow rate not less than 1.1 m3/minute). |
| | 24 hours** | 550µg/m$^3$ | 500µg/m$^3$ | |
| Respirable Particulate Matter. $PM_{10}$ | Annual Average* | 200µg/m$^3$ | 120µg/m$^3$ | -β Ray absorption method |
| | 24 hours** | 250µg/m$^3$ | 150µg/m$^3$ | |
| Respirable Particulate Matter. $PM_{2.5}$ | Annual Average* | 25µg/m$^3$ | 15µg/m$^3$ | -β Ray absorption method |
| | 24 hours** | 40µg/m$^3$ | 35µg/m$^3$ | |
| | 1 hour | 25µg/m$^3$ | 15µg/m$^3$ | |
| Lead (Pb) | Annual Average* | 1.5µg/m$^3$ | 1 µg/m$^3$ | - ASS Method after sampling using EPM 2000 or equivalent Filter paper |
| | 24 hours** | 2 µg/m$^3$ | 1.5µg/m$^3$ | |
| Carbon Monoxide (CO) | 8 hours** | 5 mg/m$^3$ | 5 mg/m$^3$ | - Non Dispersive Infra Red (NDIR) method |
| | 1 hour | 10 mg/m$^3$ | 10 mg/m$^3$ | |
| *Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval. | | | | |
| ** 24 hourly /8 hourly values should be met 98% of the in a year. 2% of the time, it may exceed but not on two consecutive days. | | | | |

## National Environmental Quality Standards for Noise[1]

| S/No. | Category of Area/Zone | Limit in dB(A) Leq | |
|---|---|---|---|
| | | Day Time | Night Time |
| 1 | Residential area (A) | 55 | 45 |
| 2 | Commercial area (B) | 65 | 55 |
| 3 | Industrial area (C) | 75 | 65 |
| 4 | Silence zone (D) | 50 | 45 |

**1**:Effective from 1st July, 2012.

Note: 1. Day time hours: 6 am to 10 pm

2. Night time hours: 10 pm to 6 am

3. Silence zone: Zones that are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts.

4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

# ANNEXURE-III

## List of Public Consultations

| **Public Consultations for SCADA Phase 3 & RMS Project (15th March'17 to 23rd March'17)** | | | | |
|---|---|---|---|---|
| **S/No.** | **Participant Name** | **Occupation** | **Location Name** | **Date of Consultation** |
| 1 | Muhammad Bashir | Student | Mardan | 15-03-17 |
| 2 | Muhammad Adil | Labor | Mardan | 15-03-17 |
| 3 | Ali Raza | Mobile Vendor | Mardan | 15-03-17 |
| 4 | Muhammad Hamaad | Student | Mardan | 15-03-17 |
| 5 | Fazal Elahi | Shopkeeper | Lahore | 16-03-17 |
| 6 | Taj Din | Labor | Lahore | 16-03-17 |
| 7 | Khalid Iqbal | Milkman | Lahore | 16-03-17 |
| 8 | Qaiser Mustafa | Student | Lahore | 16-03-17 |
| 9 | Din Muhammad | Student | Lahore | 16-03-17 |
| 10 | Talib Hussain | Poultry business | Chiniot | 17-03-17 |
| 11 | Faqir Muhammad | Transporter | Chiniot | 17-03-17 |
| 12 | Noor Muhammad | Shopkeeper | Chiniot | 17-03-17 |
| 13 | Muhammad Shafi | Farmer | Chiniot | 17-03-17 |
| 14 | Abdul Maghees | Student | Balloki | 18-03-17 |
| 15 | Ali Anwar | Player | Balloki | 18-03-17 |
| 16 | Abdu Ghaffor | Labor | Balloki | 18-03-17 |
| 17 | Roshen Din | Shopkeeper | Balloki | 18-03-17 |
| 18 | Muhammad Iqbal | Milk Man | Sahiwal | 19-03-17 |
| 19 | Noman Bashir | Moble Vendor | Sahiwal | 19-03-17 |
| 20 | Muhammad Naveed | Teacher | Sahiwal | 19-03-17 |
| 21 | Hakim Ali | Patwari | Sahiwal | 19-03-17 |
| 22 | Muhammad Ali | Police | Sahiwal | 19-03-17 |
| 23 | Muhammad Farzand | Shopkeeper | Sahiwal | 19-03-17 |
| 24 | Muhammad Ramzan | Shopkeeper | Sahiwal | 19-03-17 |
| 25 | Muhammad Azmat | Student | Nowshera | 20-03-17 |
| 26 | Muhammad Boota | Student | Nowshera | 20-03-17 |
| 27 | Ahmad Ali | Security man | Nowshera | 20-03-17 |
| 28 | Muhammad Ishaq | Driver | Nowshera | 20-03-17 |
| 29 | Khurseed Ali | Driver | Nowshera | 20-03-17 |

| | | | | |
|---|---|---|---|---|
| 30 | Pervaiz Ashrafl | Farmer | Quetta | 21-03-17 |
| 31 | Waseem Iqbal | Driver | Quetta | 21-03-17 |
| 32 | Rashid Mehmood | Transporter | Quetta | 21-03-17 |
| 33 | Muhammad Bashir | Shopkeeper | Quetta | 21-03-17 |
| 34 | Muhammad Adil | Farmer | Gujrat | 22-03-17 |
| 35 | Ali Raza | Student | Gujrat | 22-03-17 |
| 36 | Muhammad Hamaad | Player | Gujrat | 22-03-17 |
| 37 | Fazal Elahi | Labor | Gujrat | 22-03-17 |
| 38 | Khadam Hussain | Shopkeeper | Rawat | 23-03-17 |
| 39 | Noor Muhammad | Milk Man | Rawat | 23-03-17 |
| 40 | Muhammad Shafi | Moble Vendor | Rawat | 23-03-17 |
| 41 | Abdul Maghees | Teacher | Rawat | 23-03-17 |
| 42 | Ali Anwar | Patwari | Rawat | 23-03-17 |
| 43 | Abdu Ghaffor | Farmer | Rawat | 23-03-17 |

# ANNEXURE IV

## Archaeological ‘Chance Find’ procedure

**Background**

The purpose of this document is to address the possibility of archaeological deposits becoming exposed during ground altering activities within the project area and to provide protocols to follow in the case of a chance archaeological find to ensure that archaeological sites are documented and protected as required.

The Antiquities Act, 1975 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. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the GOP to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, GOP, any archaeological discovery made during the course of the project.

**Potential Impacts to Archaeological Sites**

Developments that involve excavation, movement, or disturbance of soils have the potential to impact archaeological materials, if present. Activities such as road construction, land clearing, and excavation are all examples of activities that may adversely affect archaeological deposits.

**Archaeological 'Chance Find' Procedure**

If you believe that you may have encountered any archaeological materials, stop work in the area and follow the procedure below. The following 'chance-find' principles will be implemented by the contractor throughout the construction works to account for any undiscovered items identified during construction works:

(i) Workers will be trained in the location of heritage zones within the construction area and in the identification of potential items of heritage significance.

(ii) Should any potential items be located, the site supervisor will be immediately contacted and work will be temporarily stopped in that area.

(iii) If the site supervisor determines that the item is of potential significance, an officer from the department of Archaeology (DoA), Government of Punjab will be invited to inspect the site and work will be stopped until DoA has responded to this invitation.

(iv) Work will not re-commence in this location until agreement has been reached between DoA and C&W Punjab as to any required mitigation measures, which may include excavation and recovery of the item.

(v) A precautionary approach will be adopted in the application of these procedures.

**Detailed Procedural Steps**

- If the Director, department of Archaeology receives any information or otherwise has the knowledge of the discovery or existence of an antiquity of which there is no owner, he shall, after satisfying himself as to the correctness of the information or knowledge, take such steps with the approval of the Government, as he may consider necessary for the custody, preservation and protection of the antiquity.
- Whoever discovers, or finds accidentally, any movable antiquity shall inform forth with the Directorate within seven days of its being discovered or found.
- If, within seven days of his being informed, the Director decides to take over the antiquity for purposes of custody, preservation and protection, the person discovering or finding it shall hand it over to the Director or a person authorized by him in writing.
- Where the Director decides to take over an antiquity, he may pay to the person by whom it is handed over to him such cash reward as may be decided in consultation with the Advisory Committee.
- If any person, who discovers or finds any movable antiquity contravenes the provisions of the Act, he shall be punishable with imprisonment for a term which may extend to five (05) years, or with fine not less than fifteen hundred thousand rupees or with both and the Court convicting such person shall direct that the antiquity in respect of which such contravention has taken place shall stand forfeited to Government.
- The Director or any officer authorized by him with police assistance may, after giving reasonable notice, enter into, inspect and examine any premises, place or area which or the sub-soil of which he may have reason to believe to be, or to contain an antiquity and may cause any site, building, object or any antiquity or the remains of any antiquity in such premises, place or area to be photographed, copied or reproduced by any process suitable for the purpose.
- The owner or occupier of the premises, place or area shall afford all reasonable opportunity and assistance to the Director.
- No photograph, copy of reproduction taken or made shall be sold or offered for sale except by or with the consent of the owner of the object of which the photograph, copy or the reproduction has been taken or made.
- Where substantial damage is caused to any property as a result of the inspection, the Director shall pay to the owner thereof reasonable compensation for the damage in consultation with the Advisory Committee.
- If the Director after conducting an inquiry, has reasonable grounds to believe that any land contains any antiquity, he may approach the Government to direct the Revenue Department to acquire such land or any part thereof and the Revenue Department shall

thereupon acquire such land or part under the Land Acquisition Act, 1894 (I of 1894), as for a public purpose.