Initial Environmental Examination

April 2018

PAK: Proposed Multitranche Financing Facility II (MFF II) Power Transmission Enhancement Investment Program Tranche 3

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

Power Transmission Enhancement Investment Programme II Tranche 3

Initial Environmental Examination

Sub-Project 5: Grid Connected Battery Energy Storage System Pilot Project

April 2018

Prepared by National Transmission & Despatch Company Limited (NTDC)
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CURRENCY EQUIVALENTS

As of 4th April 2018	Currency Unit – Pak Rupees (Pak Rs.)
Pak Rs 1.00 = $ 0.009	US$1.00 = Pak Rs. 112

CONVERSIONS

1 meter = 3.28 feet

1 hectare = 2.47 acre

LOCAL TERMINOLOGY

Kacha	Weak structure (composed of mud/clay)
Pakka	Robust/strong structure (composed of bricks/concrete)
Tehsil	Area of land with a city or town that serves as its administrative centre

Acronyms

ADB	Asian Development Bank
NTDC	National Transmission & Despatch Company Limited
SPS	Safeguard Policy Statement
ESIC	Environment and Social Impact Cell
MFF	Multi-Tranche Financing Facility
NCS	National Conservation Strategy
OPGW	Optical Ground Wire
HVDC	High Voltage Direct Current
PTEIP	Power Transmission Enhancement Investment Program
NEP	National Environmental Policy
ILO	International Labor Organization
EHV	Extra High Voltage
EPA	Environmental Protection Agency
USEPA	United States Environmental Protection Agency
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
EA	Executing Agency
PMU	Project Management Unit
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
WHO	World Health Organization

O&M	Operation & Maintenance
PC	Public consultation
SEPA	Sindh Environmental Protection Agency
PEPC	Pakistan Environmental Protection Council
PEPAct	Pakistan Environment Protection Act 1997
RP	Resettlement Plan
LPG	Liquefied Petroleum Gas
RoW	Right of Way
WAPDA	Water and Power Development Authority
IFC	International Finance Corporation
FI	Financial Intermediary
EMF	Electro-magnetic Field
CSC	Construction Supervision Consultant
ICNIRP	Non-Ionizing Radiation Protection
WB	World Bank
ANSI	American National Standards Institute
PCO	Public Call Office
G.T	Grand Trunk
OHL	Overhead Lines
SSEMP	Site Specific Environmental Management Plan
EC	Erosion Control
REA	Rapid Environmental Assessment

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EXECUTIVE SUMMARY

1. Under Tranche III of the MFF II, the sub-project 5 i.e. 'Grid Connected Battery Energy Storage System Pilot Project'' consists of the following activities:

   - Lithium-ion Battery Packs (5 MWh)
   - Balance of system including inverters (20MW)

   All project activities will be conducted within the boundaries of the existing Jhimphir-1 sub-station located in Jhimpir in Thatta district in Sindh province of Pakistan.

2. It is expected that a building shall also be constructed to house this electronic hardware consisting of the battery packs and inverters and thus civil works for development of this building which shall be of a limited scope will also be conducted under this proposed sub-project.

3. This sub-project will contribute to the improvement of the overall performance of the power distribution sector, improving distribution efficiency, broadly widening access to power to drive economic opportunities. The major beneficiaries of this sub-project will be the general public and the industry in the country and all other consumers that use power distribution services directly or indirectly.

4. Available secondary data and the feasibility study conducted for this sub-project was used to develop a clear picture of the environmental and social aspects of the sub-project development landscape for the purpose of this study.

5. Since the project scope is very limited and all project works will be conducted within the existing sub-station boundaries, thus any potential impacts shall be benign and of a temporary and limited nature.

6. During the construction phase, potential short-term impacts such as air quality, noise, construction waste disposal and worker safety etc. have been assessed and required mitigation measures have been provided.

7. During the operation phase of the sub-project, the disposal of the batteries in an environmentally sustainable manner in accordance with international best practices must be ensured.

8. An action plan with clear roles and responsibilities of stakeholders has been provided in the report. NTDC, Project Contractor and the Construction Supervision Consultant are the major stakeholders responsible for this plan. This action plan must be implemented prior to commencement of construction work.

9. 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.

10. Therefore, the proposed sub-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 sub-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.

11. As a result of this IEE study, it has been determined that no adverse or harmful impacts of any significance are expected. The sub-project falls under the Category ‘B’ of ADB's Guidelines and thus an IEE is sufficient.

1 Introduction

1.1 Overview

12. Under Tranche III of NTDC Power Transmission Enhancement Investment Program II (MFF II), this fifth sub-project i.e. 'Grid Connected Battery Energy Storage System Pilot Project' consists of the following activities:

    - Lithium-ion Battery Packs (5 MWh)
    - Balance of system including inverters (20MW)

13. The GoP has requested the Asian Development Bank (ADB) to provide finance for the proposed subproject, to help fulfill the overall objective of the MFF to encourage economic growth and improve transmission efficiency by creating a series of national improvements.

14. The project is part of the NTDC's overall power development program and is proposed to strengthen the transmission system to fulfill the need of secure, safe and reliable power supply and to meet not only the existing requirement but also the future demand of the country for sustained economic growth.

15. This Initial Environmental Examination (IEE) report presents the screening of potential environmental impacts for this sub-project 5 and contains the mitigation measures in order to eliminate or reduce the negative impacts to an acceptable level. This report also describes the institutional requirements and provides an environmental management plan for implementing the scope of work.

1.2 Environmental Category of the Project

16. According to ADB's Safeguard Policy Statement (SPS) 2009, a Rapid Environmental Assessment (REA) Checklist was prepared for the activities to be conducted under the sub-project 5 (Annexure-I). The Pakistan Environmental Protection Agency's "Guidelines for the Preparation and Review of Environmental Reports (2000)" were also consulted. Based on the initial findings, the proposed activities under sub-project 5 have been classified as Category 'B'. Thus an IEE has been conducted.

1.3 Scope of IEE Study and Personnel

The following methodology was employed for this study:

17. This IEE study has included field reconnaissance in the sub-project area during March 2018. The physical environment and any sensitive receivers within the project area of 2 sq. kilometers were recorded, including any irrigation facilities, water supply, habitable structures, schools, health facilities, hospitals, religious places and sites of heritage or archaeological importance and critical areas[5].

18. The study process began with scoping and field reconnaissance during which the REA was carried out to establish any potential impacts resulting from the

development of the proposed sub-project. The environmental impacts and concerns requiring further study in the environmental assessment were then identified. The methodology of the IEE study was then elaborated in order to address all interests. Subsequently, both primary and secondary baseline environmental data was collected and the intensity and likely location of impacts were identified with relation to the sensitive receivers; based on the construction activities to be carried out in the sub-project area. The significance of impacts from the works was assessed and, for those impacts requiring mitigation, measures were proposed to reduce impacts to within acceptable limits.

19. The significance of impacts from the proposed sub-project were then assessed and for those impacts requiring mitigation, suitable measures were proposed to reduce impacts to within acceptable limits as per local and international applicable regulations.

20. A detailed environmental management and monitoring plan was developed to ensure compliance to the proposed measures during the development of the sub-project.

1.4 Structure of Report

21. This report reviews information on existing environmental attributes of the areas around the study area. Geological, hydrological and ecological features, air quality, noise, water quality, soils, social and economic aspects and cultural resources are included. The report predicts the probable impacts on the environment due to the proposed sub-project.

22. This IEE report contains the following chapters:

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

2 Policy and Legal Framework in Pakistan

2.1 General

23. This section provides an overview of the policy framework and national legislation that applies to the scope of work to be conducted under the proposed sub-project 5. This sub-project is expected to comply with all national legislation relating to environment in Pakistan, and to obtain all the regulatory clearances required.

2.2 National Policy and Legal Framework

24. 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-project are pollution prevention and abatement and increasing energy efficiency while conserving biodiversity.

25. 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.

2.3 Regulations for Environmental Assessment, Pakistan EPA

26. 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, Sindh EPA

27. Post 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.

28. **Sindh Environmental Protection Act, 2014**: The SEPA, 2014 is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The act is applicable to a broad range of issues and extends to air, water, soil, marine, and noise pollution, as well as to the handling of hazardous wastes. The key features of the law that have a direct bearing on the proposed project relate to the requirement for an initial environmental examination (IEE) and EIA for development projects. Section 12(1) requires that: "No proponent of a project shall commence construction or operation unless he has filed with the Federal Agency an initial environmental examination or, where the project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the Federal Agency approval in respect thereof." The Pak-EPA has delegated the power of review and approval of environmental assessments to the provincial environmental protection agencies. As the proposed project will be located in Sindh, it falls under the jurisdiction of SEPA.

2.5 Guidelines for Environmental Assessment, Pakistan EPA

29. 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 sub-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

30. 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;

31. These standards apply to the gaseous emissions and liquid effluents discharged by batching plants, campsites and construction machinery. The standards for vehicles will apply only during the construction phase of the project. Standards for ambient air quality have also been prescribed.

2.7 ADB Policies

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

32. 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 8**.

33. 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).

34. As a result of the completion of the REA checklist, the scope of work to be conducted under the sub-project 5 has been classified as Category ''B'' and thus a detailed and comprehensive IEE study has been prepared, including an EMP for the sub-project development.

2.7.2 ADB's Public Communication Policy 2011

35. 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

36. 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

37. 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 forests are located in the project areas of sub-project 5.
Sindh Wildlife 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 sub-project 5.
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 sub-project.
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

Legislation/Guideline	Description
	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.
Environment and Conservation	There is a well-established framework for environmental management in Pakistan. The Ministry of Environment deals with environment and biological resources. Within the ministry, the NCS unit established in 1992 is responsible for overseeing the implementation of the strategy. Two organizations, the Pakistan Environmental Protection Council (PEPC) and the Pak EPA are primarily responsible for administering the provisions of the PEPA, 1997. The PEPC oversees the functioning of the Pak EPA. Its members include representatives of the government, industry, non-governmental organizations and the private sector. The Pak EPA is required to ensure compliance with the NEQS, establish monitoring and evaluation systems, and both identify the need to and institution of legislations whenever necessary. It is thus the primary implementing agency in the hierarchy. The Provincial Environmental Protection Agencies are formed by the respective provinces.
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 sub-project 5.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)	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 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	SF_6 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. 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.

Legislation/Guideline	Description
IEC 62271-4 directive	This directive stipulates SF_6 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 SF_6 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

38. 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.

39. 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.

40. 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 sub-project 1.

41. 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

42. 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.

43. 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.

44. The proposed sub-project 5 has been categorized as Schedule-I and thus an IEE study has been conducted.

45. This IEE study will be submitted to the Sindh EPA (SEPA) for review and comments. The SEPA 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.

46. The SEPA 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

47. 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.

48. 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.

49. 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 2.4** below.

2.12 EMF Exposure Guidelines

50. 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.

51. However, while the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern. **Table 2.2** 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 2.3** provides the exposure limits for occupational exposure.

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

Table 2.2: 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 2.3: 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 2.4: 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 mitigation	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 assessment	Disclose a draft environmental assessment in a timely manner, in an accessible place and in a form and language(s) understandable to stakeholders. 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 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.

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 1 hr	0.5 ppm 75 ppb	24 hr 10 min	20 ug/m^3 500 ug/m^3	Annual Mean 24 hrs	80 ug/m^3 120 ug/m^3
CO	8 hrs 1 hr	9 ppm (11 mg/m^3) 35 ppm (43 mg/m^3)	-	-	8 hrs 1 hr	5 mg/m^3 10 mg/m^3
NO_2	Annual Mean 1 hr	100 ug/m^3 (53 ppb) 100 ppb	1 yr 1 hr	40 ug/m^3 200 ug/m^3	Annual Mean 24 hrs	40 ug/m^3 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 24 hrs	360 ug/m^3 500 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 24 hrs	15 ug/m^3 35 ug/m^3	1 yr 24 hr	10 ug/m^3 25 ug/m^3	Annual Average 24 hrs 1 hr	15 ug/m^3 35 ug/m^3 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 General

53. This chapter provides an overview of the scope of work to be conducted under the sub-project 5 consisting of the proposed sub-project development, project components, design considerations, construction procedures, operation and maintenance activities. The safety parameters to be followed by NTDC (WAPDA) during construction and operation stages are also provided.

3.2 Scope of Work

54. The scope of work under this sub-project 5 will consist of the following activities:

- Litium-ion Battery Packs (5 MWh)
- Balance of system including inverters (20MW)

55. It is expected that a small building structure might be constructed to house these components in case the existing space at the Jhimpir I sub-station is found to be insufficient.

3.3 Categorization of Sub-Project

56. The **Figures 3.1** clearly show the proposed sub-project location and the proximity of this sub-project to any sensitive receptors in the project area. The existing land use of the sub-project consists of barren coastal landscape consisting of wind turbines with no settlements or any other sensitive receptors present in the sub-project area

57. Based on the implementation of the mitigation measures proposed in the EMP, no significant long term adverse impacts are expected either during the construction or operation phases of the scope of work to be conducted under this sub-project 5.

58. The aspects of the sub-project with potential for significant environmental impacts were assessed in detail and environmental assessment has focused on potential significant impacts from the construction aspects.

59. Based on the proposed scope of project works and assessment conducted of potential impacts during the different project phases, this sub-project is categorized as Category ‘B’.

3.4 Need for Sub-Project

60. Pakistan is a country with an economy of improving performance with a wide network of power distribution. However, the standards and conditions of the power distribution are inadequate to meet rapidly growing power demand. This situation limits reliable power distribution and therefore the contribution of the power sector to national development and economic growth. To cope with the constraints, the existing power distribution infrastructure has to be improved and upgraded. The overall contribution

of power infrastructure also requires institutional arrangements and capacity that support strategic management of the sector, and planning and management of investments.

61. This sub-project will contribute to the improvement of the overall performance of the power distribution sector, improving distribution efficiency, broadly widening access to power to drive economic opportunities. The beneficiaries of the sub-project will be people, companies, and government and non-government agencies in Pakistan that use power distribution services directly and indirectly. Communities indirectly served by the sub-project will benefit from improved, secure faster distribution services. Power users will benefit in terms of secure power and improved power safety and potentially increased productivity.

62. In order to achieve economic growth and poverty reduction, it is essential to ensure a reliable power supply to an increasing number of industrial, agricultural, commercial and domestic consumers. Average increase in power demand of country during next 10 years is about 4.96% per annum. To cope with this growth in demand, additional capacity will be required annually.

3.5 Cost of Sub-project

63. The estimated cost of this sub-project is 8 million USD.

3.6 Design Aspects

3.6.1 Battery Energy Storage System (BESS)

64. Battery energy storage is a versatile technology that offers advantages for both power and energy applications by selecting from a variety anode and cathode materials to meet the needs of the specific application. The choice of battery chemistry depends on the application (power or energy), the depth of discharge and the number of charge/discharge cycles per year. Short-duration discharge (such as for frequency regulation) can be from a few hundred milliseconds up to about 15 minutes, depending on the application. In general, frequent discharge of short duration storage implies hundreds of discharges over the course of a year.

65. As an energy source, a BESS has electrical characteristics that are quite different from a traditional, mechanical generator, which with a rotating mass that has a finite ramp rate. The absence of inertia allows the BESS to respond to load fluctuations orders of magnitude faster than any engine or combustion turbine in an electric power system. However, BESSs are limited in their available energy depending on their state of charge (SOC) at any given point in time. Practical size considerations and inherent characteristics of most battery chemistries generally limit the maximum energy storage times to between two and six hours for deep discharges.

66. Generally, an application that requires a shallow discharge or a series of shallow charge/discharge cycles over a sustained period can be successfully combined with a deep discharge application, as long as controls are in place to reserve the capacity

needed for the deep discharge as and when needed. This is the case for the frequency regulation application combined with the deep discharge required for spinning reserve application. In this case there is a control to ensure that the frequency regulation duty does not push the battery below a set SOC, such as the 70–75 % SOC level for lead-acid batteries. Thus, the remaining energy capacity of the battery is always available as spinning reserve, as required by any spinning reserve duty source.

3.6.2 Chemistry

67. An optimized battery solution for an application is developed by balancing the choice of cell chemistry and internal cell design with the battery design (e.g., how the cells are interconnected).

68. In the case of the high-temperature batteries, the intrinsic material characteristics such as the melting point of the sodium metal anode necessitate high temperature operation, which in turn imposes operational constraints on the batteries. Since the battery inefficiencies and the associated heating during charge and discharge provided some of the energy necessary for maintaining operational temperature, those applications that require continuous charging and discharging are best suited for these chemistries.

69. In the case of flow batteries, the active electrode materials are generally liquids, and these are held in separate storage reservoirs and pumped through the electrochemical cell during charge and discharge. Since the storage reservoirs can be resized independently from the electrodes and cell stack, the energy and power of these battery chemistries can be independently controlled, unlike virtually every other battery chemistry having fixed cell geometry with a single compartment for both the active materials and electrodes.

70. Another chemistry that is gathering momentum is Zinc-Air. The technology is well suited to energy applications such as storage of wind power during times of insufficient power evacuation capacity. Zinc-air pioneer, Fluidic Energy, claims that zinc-air battery life is independent of temperature (0-50 degrees centigrade), humidity, number of cycles (charging and discharging), or nature of discharge (i.e., battery continues to operate at high efficiency even when repeatedly fully discharged). While less suited to power applications, Fluidic-Energy offers zinc-air / lithium-ion hybrid solutions in such cases. Another advantage of zinc air batteries is that they do not contain toxic components and are 100% recyclable.

3.6.3 Power Electronics

71. Two power electronic-based control systems are used in the BESS – the power conversion system (PCS) and the battery management system (BMS).

72. The PCS provides bidirectional power transfer from the grid to the battery and vice versa. The power converter will act as an inverter to transmit power from DC to AC, and it acts as a rectifier to transmit power from AC to DC. Power conversion in the

PCS is accomplished using high-power switching circuits that can synthesize the sinusoidal currents or voltages at the fixed frequency needed on the AC side (e.g. 50 Hz.).

73. The BMS monitors the condition of the batteries, aids in balancing batteries during charge/discharge, and communicates critical information to the PCS. Monitoring is done using measurements of cell temperature, voltage, and current. The BMS can estimate the battery SOC or state-of-health (SOH) by using these measurements and information such as the battery age and the number of charge/discharge cycles. The BMS may also protect the battery by disconnecting it from the PCS in the event of an over voltage, under voltage, over temperature, or over current. The BMS may also include a thermal management or active cooling system, which will be essential for Jhimpir, where the temperature is quite often above 40 degrees Celsius.

3.6.4 State of Charge (SoC)

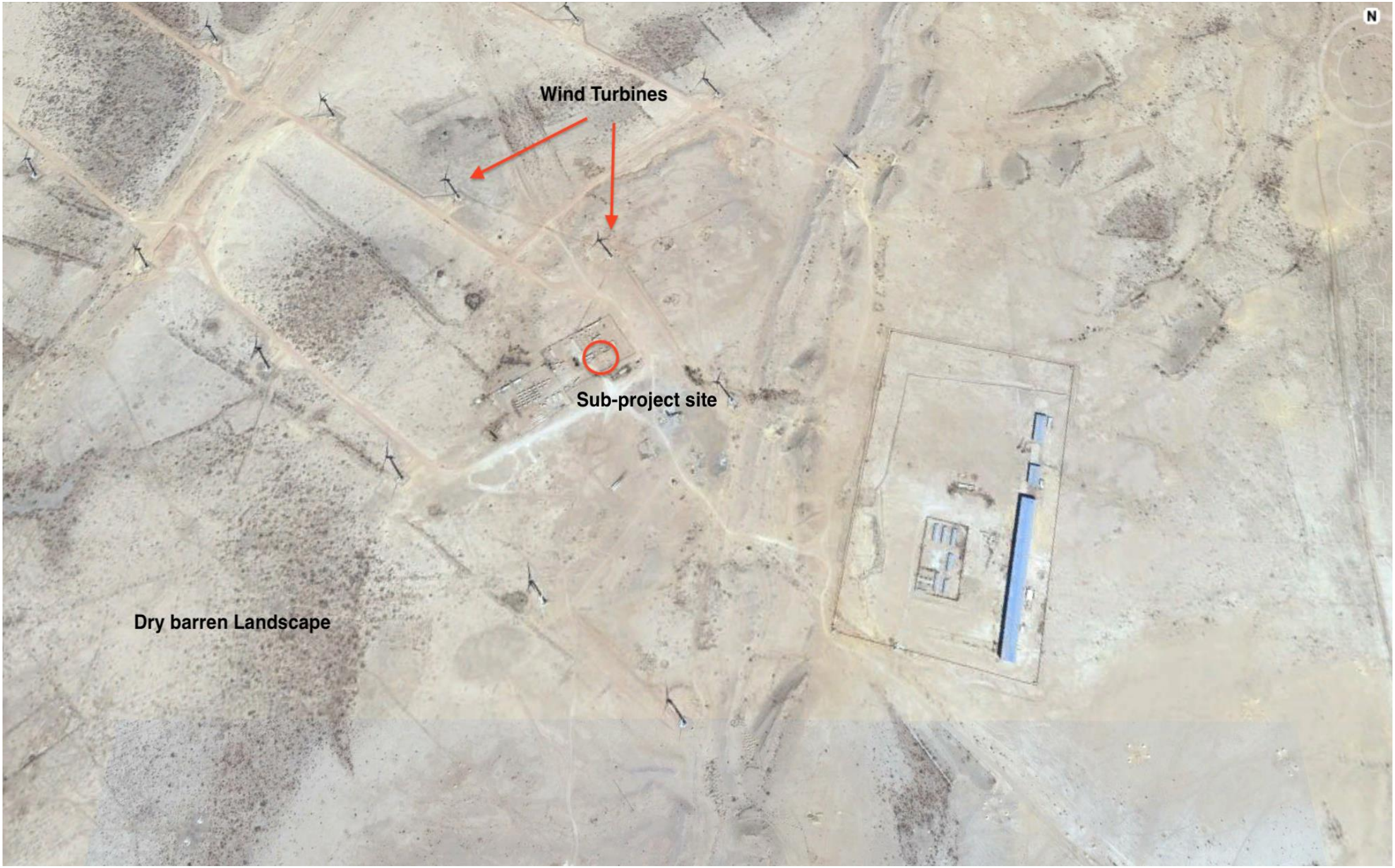
74. The battery SOC is not directly measurable. Instead, an estimate of SOC is calculated by continuously monitoring battery current, voltage, and other parameters, such as internal pressure or electrolyte acidity. It is assumed that the battery SOC is primarily a function of the charge/discharge schedule but it is also affected by time or battery temperature.

75. ABB's EssPro Grid is a battery energy storage system that can be used in projects ranging from hundreds of kilowatts to tens of megawatts. It can be used for a range of applications such as frequency regulation, spinning reserve, capacity firming, peak shaving, power quality, uninterruptable power supply, load levelling and voltage support.

3.6.5 Lithium Ion Batteries

76. There are numerous environmental issues to consider with lithium ion batteries. Lithium can pose significant disposal hazards. While many lithium compounds used in industrial processes are harmless, even a small amount of elemental lithium reacts violently, sparking flames in contact with water. This makes it critical to prevent leaching from landfills into groundwater. Flammable organic solvents in lithium batteries can be ignited by a spark, also making them potentially dangerous in landfills.

77. Most of the potential negative impacts to the environment can be avoided by following international best practices. It is assumed that the first operator of the Pilot BESS would be a foreign company experienced in large utility-scale battery operations. Therefore, it is expected that the foreign operator would provide its expertise in establishing standard operating procedures (SOPs) based on international best practices.


N
Wind Turbines
Sub-project site
Dry barren Landscape

3.7 Project Alternatives

78. This sub-project of Tranche 3 of MFF-II will contribute to the improvement of the overall performance of the power transmission sector, improving transmission efficiency, broadly widening access to power to drive economic opportunities. The beneficiaries of the subproject will be people, companies, and government and non-government agencies in Pakistan that use power transmission services. Power users will benefit in terms of secure power and improved power safety and potentially increased productivity.

3.7.1 No Project Alternative

79. Electricity demand has been increasing during the past several years and this trend is expected to continue as a result of the on-going economic uplift in the country. The key factors fueling the increasing power demand include increasing population, rapid urbanization, industrialization, improvement in per capita income and village electrification. In order to match the increasing trend in the power demand, regular investments in various segments of the power network generation, transmission and distribution is vitally important. Otherwise, the gap between the supply and demand will continue to increase.

80. In the absence of the sub-project, the potential for interruptions to power supply will increase and socio-economic development of the province could be affected in the short to medium term. In an un-enhanced state, the wear and tear on existing facilities will rise. In the short term, the power supply would improve and more reliable access to secure power would be available.

In consideration of all the rationale provided above, the 'No Project' option is not a preferred alternative.

3.7.2 Alternative sub-station locations for installation of battery bank

81. A number of alternative locations were assessed prior to finalizing the proposed sub-statioon site for installation of the battery bank. The major criteria while selecting the sub-station location for this sub-project was to ensure grid stability by installing the battery bank in a suitable location to ensure balance of systems.

82. Furthermore, the proposed location is ideal since the proposed works will be located within the existing Jhimpir-I sub-station, which is located in a wind corridor, and thus it is sparely populated and does not contain any sensitive receptors.

3.8 Proposed Schedule for Implementation

83. The Project Proponent (NTDC) plans to have this tranche-III sub-project completed by December 2019, after completing the necessary arrangements.

4 Description of Environment

4.1 General

84. The proposed sub-project 5 consists of development of a grid connected battery energy storage system pilot project in Sindh province of Pakistan. The detailed description of the sub-project area environment is provided below.

4.2 Physical Resources

4.2.1 Topography

85. Since the scope of work will be conducted in Thatta district, the physical resources are discussed below.

Thatta District

86. This district is located in the southern area, locally called Laar in the Sindh province of Pakistan. Its capital is Thatta and has a population of 979,817 according to statistics collected in 2017. It has four Talukas, which are Thatta, Mirpur Sakro, Keti Bander and Ghorabari.

87. The land form of the Jhimpir area is mainly flat and barren with little (in the form of grass, shrubs and scrubs) or no vegetation. The soil texture in this area is mostly rocky and gravely with the Kohistan hills which are an extension of the Kirthar range also present in the surroundings. Various water bodies including Kinjhar Lake (at a distance of more than 20km) and Haleji Dhand (at a distance of more than 32km) are also present in the project vicinity.

88. Various physiographic units covered in the wind corridor and proposed wind farm sites have been established using GIS technique. The procedure used to classify the Satellite imagery of the Gharo wind corridor is called “Unsupervised Classification” technique. Initially 75 classes were developed using this standard technique and thereafter these classes were reclassified to 7 final Physiographic classes.

4.2.2 Climate & Air Quality [1]

89. There is negligible variation of altitude above sea level in the area over which this sub-project is located. The climate in general is typical of that of Central Punjab. The climate in the project area is hot during the summers and moderately cold in the winters.

90. The mean maximum and minimum temperatures in summers are 43°C and 27°C, while in winters it is 32°C and 12°C respectively. The summer season starts from April and continues till October. May, June and July are the hottest months. The

[1] https://en.climate-data.org/location/3511/
https://www.meteoblue.com/en/weather/forecast/modelclimate/sheikhupura_pakistan_1165221

winter season on the other hand starts from November and continues till March. December, January and February are the coldest months as shown in **Figure 4.1** below.

91. The rainy season starts in July and ends in September. Annual rainfall is 25 mm. More rain occurs from July to September than any other months due to the monsoon season. Most of the winter rains are received in the months of September to December. Winter rainfalls are rare and scanty as shown in **Figure 4.2** below.

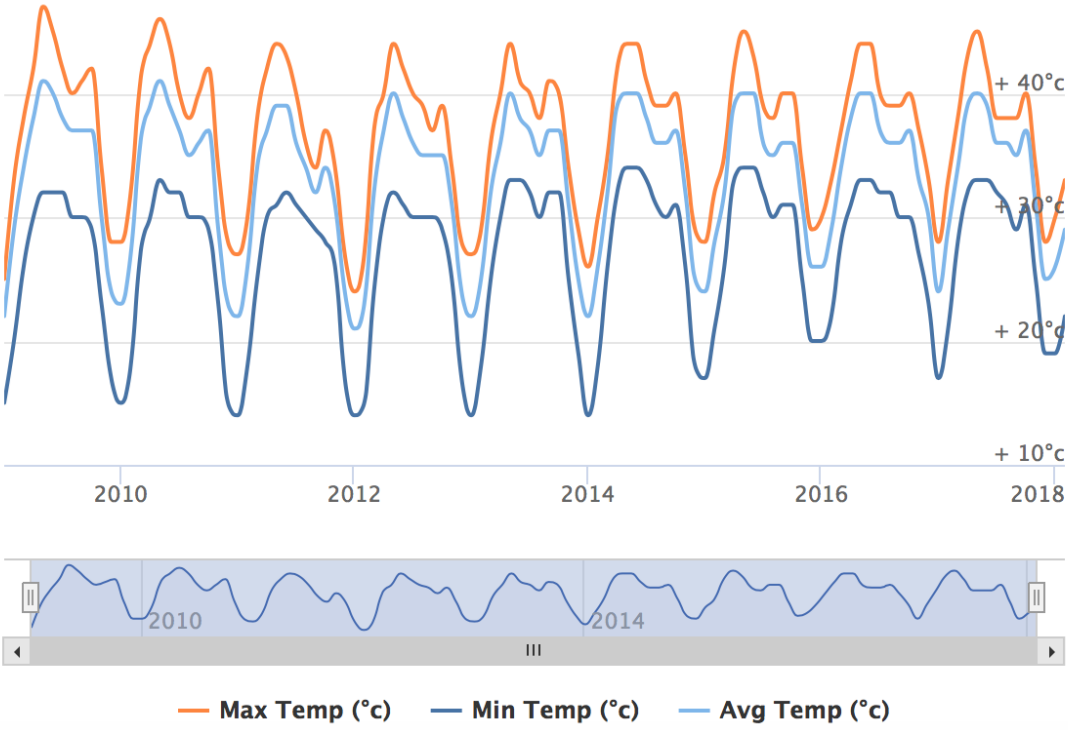
92. The relative humidity during the rainy season is as high as 45%. During the dry months, it falls below 18% as shown in **Figure 4.3** below.

93. The air quality in the sub-project corridor appears good based on observations during the study period. Emissions, if any, shall be controlled at source under the EMP. There will be a few items of powered mechanical equipment to be used in the proposed works that may give rise to limited quantities of dust and other emissions. However, these should be minor and easily dissipated.

94. The project area corridor is distant from major sources of air pollution such as industries or urban type traffic, domestic sources such as burning of wood and kerosene stoves etc. or fugitive sources such as burning of solid wastes. Air quality in the project corridor appeared good during the study period. It should be possible to control and manage emissions from project activities at source, under the EMP.

95. The activities to be conducted for development of the sub-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 sub-project, which does not involve contribution to global warming or climate change in any way.

Figure 4.1: Annual variation in Temperature in Sub-Project Area[2]



[2] http

Figure 4.2: Annual variation in Rainfall in Project Area[3]

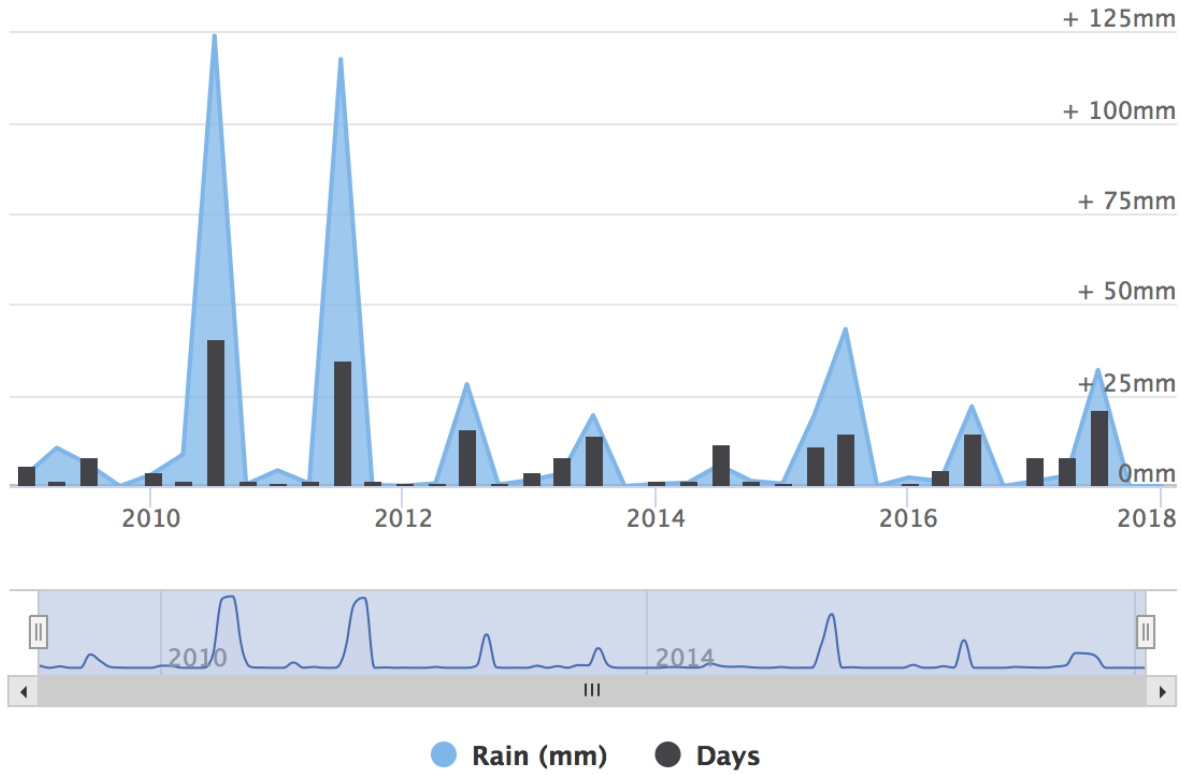
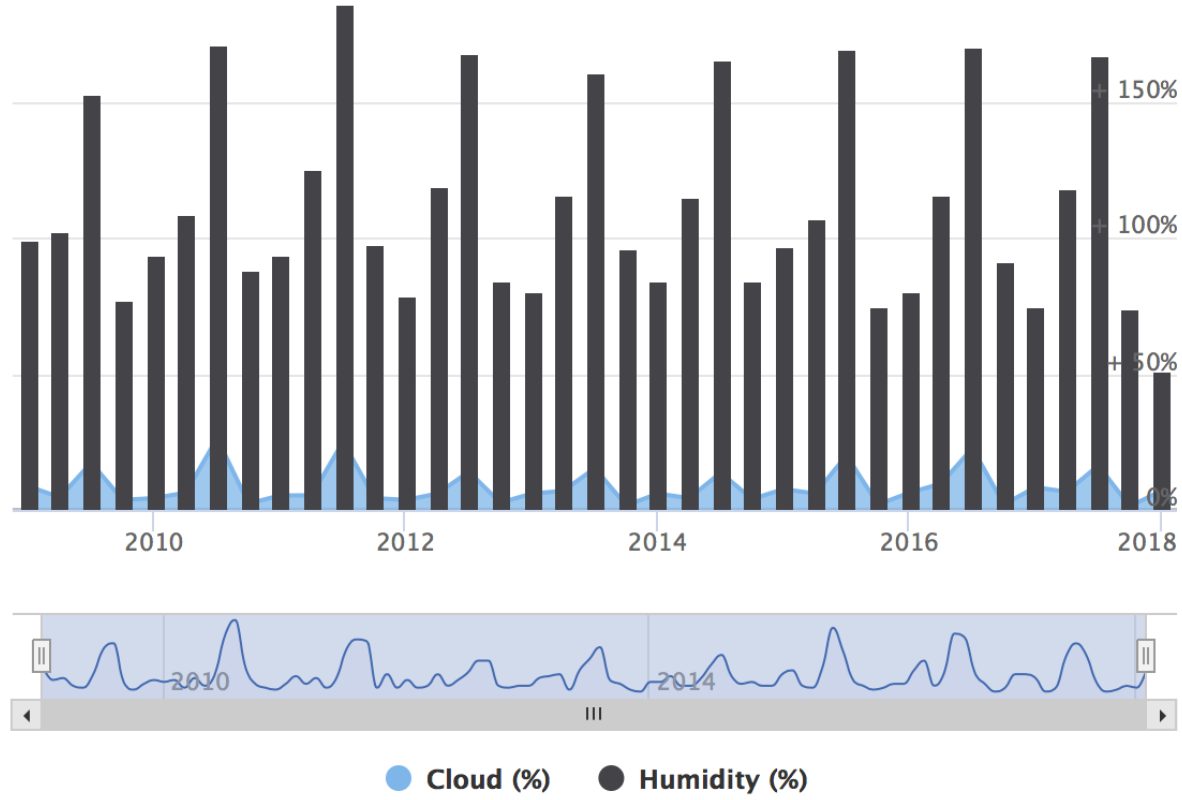


Figure 4.3: Annual variation in Humidity in Project Area[4]



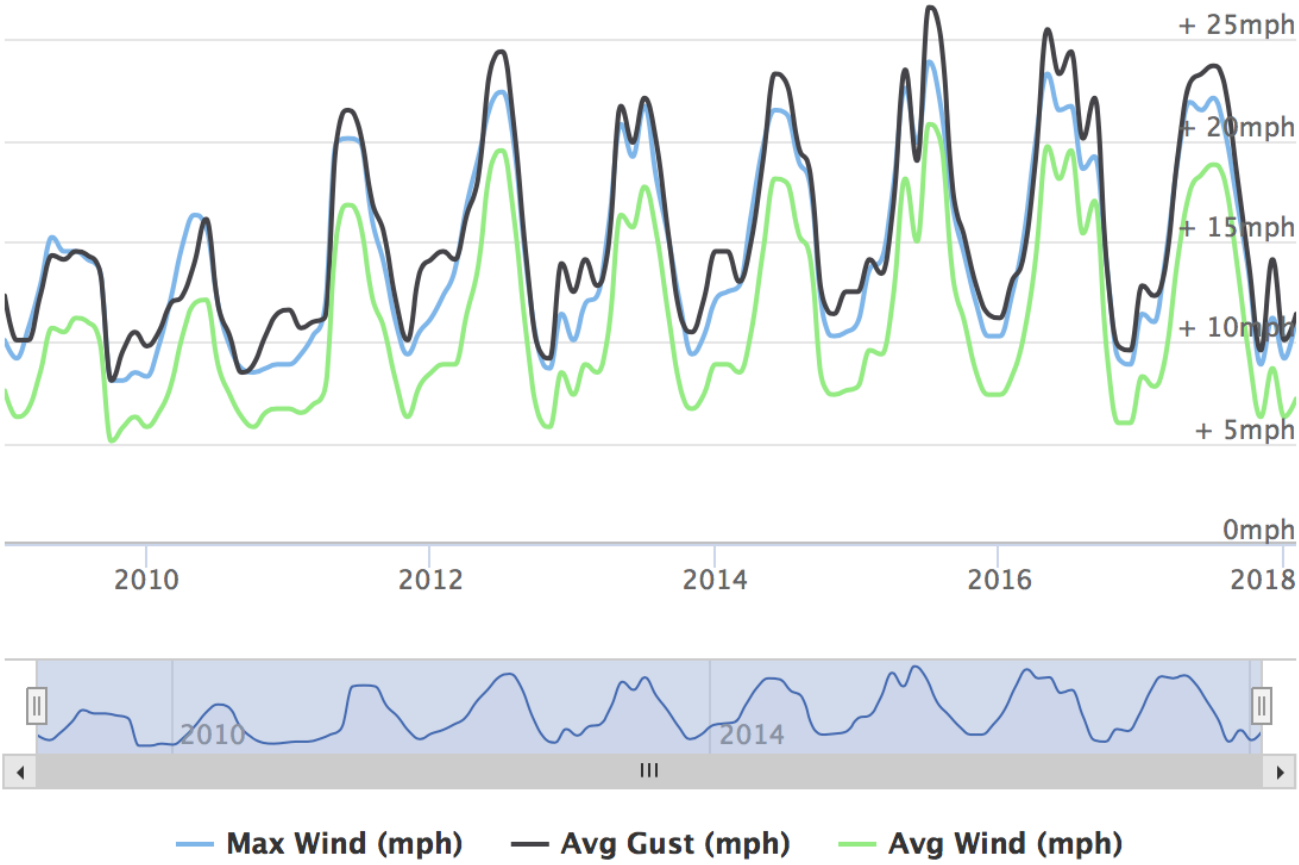
[3] https://www.worldweatheronline.com/lang/en-pk/sheikhupura-weather-averages/punjab/pk.aspx

[4] https://www.worldweatheronline.com/lang/en-pk/sheikhupura-weather-averages/punjab/pk.aspx

4.2.3 Wind velocity[5]

96. The average wind speed has been recorded to be around 18 mph during the month of July. In recent years, the maximum sustained wind speed has reached 27 mph. Prevalent wind velocity is 15 to 22 mph as shown in **Figure 4.4** below.

Figure 4.4: Annual variation in Wind Speeds in Project Area[6]



4.2.4 Geology[7]

97. The sub-project area is covered under the Eocene Sedimentary and unconsolidated Surfical Deposits of silt, sand and gravel geologic formations belonging to the Tertiary and Quaternary ages respectively. The area is also rich in coal deposits with the Meting Jhimpir coal field being explored currently for coal reservoirs.

98. Coal is associated with basal part of laterite where a sequence of lateritic clay and shale with beds of arenaceous sandstone of Laki Formation, named as Sonhari Member of Early Eocene age is found. Laki formation attains a thickness of 55m near

[5] https://www.worldweatheronline.com/lang/en-pk/jhimpir-weather-averages/sindh/pk.aspx
[6] https://www.worldweatheronline.com/lang/en-pk/jhimpir-weather-averages/sindh/pk.aspx
[7] Geologicla Survey of Pakistan, www.gsp.com.pk

Thatta However; the latter sequence of Laki Formation is mainly composed of nodular limestone with shale and sandstone.

99. The Sonhari coal is of poor quality lignite with high Sulphur. Sonhari member varies in thickness from 10m to 30m. The meting limestone and Shale member consists mainly of creamy white nodular limestone with subordinate sandstone in the upper part. The shale is grey, greenish yellow, weathering dark rusty brown ferruginous and gypsiferous. The limestone is thin bedded and arenaceous whereas the sandstone is commonly ferruginous.

100. The Prevailing geologic conditions in the region are the results of extensive in undation, deposition, coastal movements, and erosion over a long period of time in the geological ages. The geology of the region is closely related to the formation process of Himalayan Ranges Resulting in intense deformation with complex folding, high angel strike- slip fault and crust thickening expressed in a series of thrust faults.

101. The important tectonic changes which have had so much influence in the region are feebly visible particularly in the Indus plain, and it is only by considering the geology on a broader regional scale, as well as in site specific detailed, that the effect can be appreciated.

102. Most part of Sindh is covered either by recent alluvium or wind borne sand. The principal features of the geological significance are to be found in the hilly portion of the province, toward the west of Indus. Outline extension of this hilly track occurs east of the Indus as well near Sukkar, Hyderabad and Jerruck. The isolated hills of Nagarparker on the northern border of the Rann of Kutch belong to quite a different system both geographically and geologically.

103. The hilly region of western Sindh consists almost entirely of rocks belonging to the tertiary system of geological nomenclature. It is only along the Laki range and in its neighborhood that there is some exposure of rocks belonging to the next older system; the cretatious with the exceptions of some volcanic beds associated with these cretatious strata, all the rocks formation of western Sindh are the sedimentary origin. All of the more important hills messes consist of limestone. A great majority of this limestone deposit belongs to the nummultic period and are largely built up of the accumulated shells of foraminifera principally those belonging to the genus nummulties.

4.2.5 Soil Classification

104. The soils of inland Jhimpir wind farm site are also classified as mainly loamy saline and part gravely. The soil is similar in nature to the soil of Gharo area. However, the soils in some patches may be different with a slight salinity (between 4dSm1 to 8dSm1). This type of soil is usually neutral (with a pH of 6.6 to 7.3), and moderately calcareous (with $CaCO_3$ content in the range of 3% to 15%).

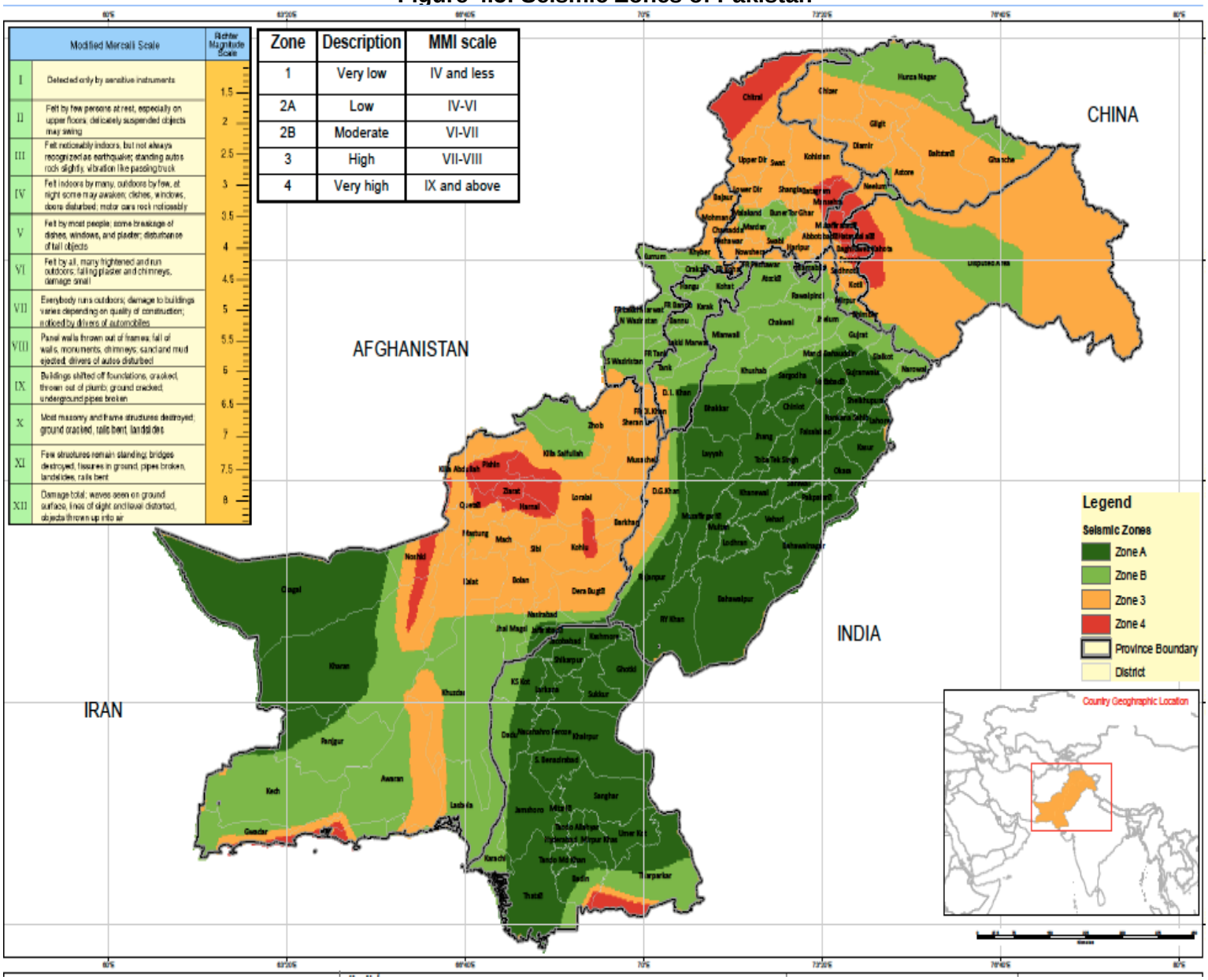
105. Properties of soil in some patches of the project area may be indifferent to the ones stated above with moderately alkaline (pH of 7.9 to 8.4), strongly calcareous

(with a CaCO3 content of greater than 15%) with little or no salinity (between 0dSm1 to 4dSm1).

4.2.6 Seismology

106. The seismic zone map of Pakistan is shown in **Figure 4.5** below. As can be observed, the project location lies in the dark green colored 'Zone 2A' which depicts low risk.

Figure 4.5: Seismic Zones of Pakistan



4.2.7 Land Capability

107. The land area covered by the wind farm site of Jhimpir consists of complex of agriculturally unproductive (rock) land and some poor grazing (gravely land) (Class VIII, VII). This area constitutes about 38.3% of the total wind farm area and is also incapable of agriculture as the soil underneath mainly consists of rock and gravel.

108. The remaining portion (about 61.7%) of the land is a complex of poor Torrent watered crop land and poor (loamy) grazing land. Some part of this land is capable of agriculture being fed by torrent water whereas the remaining portion comprises of grazing area (capable of growing grass and shrubs).

4.2.8 Land Use

109. The sub-project area consists of areas that have variable land use. The rocky and gravely soil formation devoid the major land area for any agricultural use. However, the land area is also influenced by perennial grazing consisting of short grasses shrubs and scrubs. A few patches of cultivated land also exist in the vicinity and surroundings of the wind farm sites, which come under the torrent water restricted cropping. This area is dependent on residual moisture from torrent overflows. The major crops in this area include gram, oilseeds, barley and pulses.

4.2.9 Water Resources

Surface Water Hydrology

110. The only perennial water channel in the area is the Kalri Baghar (KB) Upper Feeder which feeds Kinjhar Lake with Indus water from Kotri Barrage. The KB Feeder is about 20km away from the Jhimpir wind farm site and lies on its eastern side. The KB feeder is about 61km long and its design discharge is about 258 cubic meters per second (cumecs).

111. Kinjhar Lake is also being fed by the hill torrents during floods from the western side. The catchment area of these hill torrents are about 1664sq km and have their outfall into the Kinjhar Lake. These hill torrents includes; Rodh Nai and Liari Nai. Baran Nai which is the principal source of flood drops into the River Indus downstream of Kotri barrage.

112. Kinjhar Lake is the main source of fresh water for drinking and irrigation for the areas downstream of Jhimpir including the city of Karachi. Kinjhar Lake is an artificial water storage reservoir located in Thatta district. It came into existence as a consequence of implementation of the Kotri Barrage canals Irrigation Project. This artificial reservoir has been formed out of natural depressions of Sonheri and Kinjhar Dhands.

113. The gaps between the surrounding hills of the dhands were closed with the construction of earthen embankments having an average height of about 7.6m.

114. Apart from KB Feeder, hill torrents and Kinjhar lake there is no other source of surface water available in the area. The quantity of water in Kinjhar lake is ample to fulfil the requirements of the downstream areas for irrigation and drinking purposes.

Ground Water Hydrology

115. Jhimpir area has meager ground water resources, which are mostly saline. Scattered patches of sweet ground water do exist. In general the aquifer is of limited thickness to poor and paucity (very limited presence of water) aquifer.

116. The yield varies from 10m3/hr to 50m3/hr down to 150m. The mean annual rainfall is about 200mm with maximum occurring in the monsoon season. The consolidated deposits exposed are sedimentary in nature and are the extensions of Kirthar range and southern axial belt. These sedimentary rocks consist mainly of limestone, shale, sandstone and conglomerate and have little interstitial porosity.

117. Generally all the tube wells in the project area area drilled to between 50m to 80m depth and have a yield of about 50m3/hr. Except for one (Sheikh Nasir which has sweet water), all the other tube-wells have saline/brackish water, though the locals were using it for domestic, livestock, drinking and irrigation purpose.

118. According to the locals, the water quality improves as one moves north-west. Locals usually bring drinking water in tankers from the Nooriabad area where government and private tube wells deliver sweet water on payment.

119. Raw water supply for construction, operation and drinking could be managed from Kinjhar lake and tube wells in the Nooriabad area if required.

4.2.10 Noise

120. Noise from vehicles and other powered mechanical equipment such as the Wind turbines is intermittent. There are no significant disturbances to the typical setting.

4.3 Ecological Resources

4.3.1 Flora

121. The flora of the sub-project area is governed by the type of soil and the amount of moisture available. The Thatta district has a wide range of soil types due to its diverse landforms, which include sandy, deltaic, alluvial, gravel, coastal and mountainous. In the Kohistan region the dominant trees and shrubs are hubul (acacia arabica), kaneli (prosopis spicegra) pi (salvadora olioides), karil (capparis aphylla), rhazya stricta, deamia extensa and many other.

122. The dominant trees, shrubs and under shrubs of sands dunes are represented by ak (calotropis procera), lai (tamerix diocia) beside babul, kandi and karil, etc. The plants found cultivated or wild near villages in the alluvial tracts are neem (azadirachta indica), ber (zizyphus jujube) and serrel (albizzia lebbeck) etc.

4.3.2 Fauna

123. The wildlife in the sub-project area has been affected by colonization of the area and many wild life species have either diminished or vanished. At present,

hyenas and wolves are hardly ever seen. Jackals are fairly common and foxes are seen in the rapidly contracting area of dry waste.

124. Hog deer which were still found once seen along the bank of river Indus are uncommon and pigs though diminished are still found in small number. Hare and deer are fairly common. The Kenjhar, Haleji hadero Lakes are located on the international flying routes of the birds.

125. Among birds, both grey and black partridges are very common in the forest plantation. Most of the common kind of wild duck and water fowl are seen in the cold season. Kunj are also regular winter visitors. Sand grouse of various kinds visit the district in the cold weather, but the expansion of the cultivated area has driven them away. This also applies to the houbara which was quite common in former times.

126. Quails are common. The other birds are found in the area are Indian cursor, small Indian swallow plover, Asian open bill stork, black and glossy ibris, sirkeer malikoha or commonly known as cuckoo, Indian scoops owl, dusky horned owl etc. The water fowl census revealed the biggest concentration in the whole of Pakistan on Kenjhar Lake.

127. There are many migratory bird species, which still visit or pass through the modified ecozones. These include geese and ducks, cranes, many waders, raptors and large variety of passerine birds such as larks, cuckoos, rooks, ravens, starlings, tits, warblers and finches. Some of these birds fly in to stay for the winter, while the rest fly through the year. For many species the province serves as a breeding ground while others procreate in other areas but have been spotted in this region.

Protected and Religious Trees

128. There are no protected or religious trees in the sub-project area. The works, however, must deal with any trees that need to be lopped or removed for safety reasons, with the necessary permissions and compensation if required.

4.3.3 Protected Areas/National Sanctuaries

129. There is no protected area in the sub-project area.

4.3.4 Game Reserves & Wildlife Sanctuaries

130. No game reserves and wildlife sanctuaries exist in the sub-project area.

4.4 Socioeconomic Resources

4.4.1 Land Acquisition & Resettlement

131. No land acquisition and resettlement is to be conducted under this sub-project since the proposed activtiies shall be conducted within the boundaries of the existing Jhimpir – I sub-station.

4.4.2 Human and Economic Development

Administrative Setup

132. The scope of work for the sub-project lies in Thatta district. As per Provincial Local Government Ordinances, 2001, Union Council is the lowest tier of the local government system. It is constituted of selected council normally representing five to ten villages depending upon population, while four to five union councils form the next higher tier of governance, viz., Tehsil Council. Tehsils are sub-units of a district, which is the highest tier of local government system and deals with the administrative and revenue matters. District is normally constituted of three to five tehsils, and is governed by District Council.

133. In the existing local government system of the project area, the union councils consist of members directly elected through open competition, who also form the Electoral College for the selection of members of the next higher tiers. In this way, it has also been ensured that the councils have a sizeable representation from the vulnerable groups particularly the labor and female members of communities.

134. Thatta district comprises of four talukas i.e. Thatta, Mirpur Sakro, Keti Bander and Ghorabari.

Population and Settlements

135. Jhimpir being in the administrative control of Thatta district is unique in terms of population sensibility and characteristic. The total area of Thatta is 17,355 sq/km. the total population consists of 1,113,194. Gender wise distribution shows the figure as 589,341 are male and 523,853 are females. The population density of Thatta is 64.1 per sq/ km. the percentage of total population residing in urban setting is 11.2 %. The average household of size is of 5.1 persons. The average growth rate of population has remained from 1981-98 as 2.26.

Religion

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

Languages

137. The mother tongue in the area is Sindhi with Urdu spoken as the national language.

Health Care

138. The following health care facilities are present in UC Jhimpir:

BHU = 2
Family Welfare Centre= 1
Lady Health Worker= 43

Dispenser Clinic'= 4
Doctor (MBBS) Clinic = 7

Occupations

139. Cultivation and the related businesses are the main occupations in the project area. The other key economic activities include fisheries, livestock rearing, government and private sector jobs. In the coastal areas of Thatta and badin, fisheries are among the prime livelihood activities of the majority of the people.

140. Livestock is also one of the key livelihood sources for the rural population of the area. The farmers, in these districts traditionally keep a few head of livestock, ranging from bullocks to plough, cows for milk and poultry for egg and meat. Good breeds of buffalos and cows are also found in these districts.

Education

141. Literacy rate for Thatta is amongst the lowest in Sindh. The total literacy rate stands at 22 %. There are marked urban and rural and male and female differential in Thatta as 46% urban and 19% rural.

Archaeological and Cultural Heritage

142. No archaeological or cultural heritage has been observed during the survey and neither was it reported. 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.

NGOs working in area

143. Different national and international NGOs are working in Thatta district with the help of their local partners. Their scope of work Ranges from relief operation in coastal areas of Thatta to social welfare and livelihood improvements initiatives.

144. Some are working on CPI (Community Physical Infrastructure). Some have found their way in providing microfinance to local communities through social collateral. Few of these are also working on awareness and advocacy. NGOs and institution working in the area include NRSP (National Rural Support Program), Aga Khan Planning and Building Services (AKPBS), PPAF (Pakistan Poverty Alleviation Fund), IUCN, WWF, SPO and Pakistan Fisher Folk Forum.

4.4.3 Economic Development

Agriculture and Livestock

145. The use of land is governed by several interacting factors, which are physical, biological, social and economic in nature. A clear vision of these factors is essential for increased agricultural production in any given region. The Pakistani agricultural research council (PARC) in 1980 divided Pakistan in 10 agroecological

zones, based on a survey carried out by FAO and review of the available literature on Physiography, climate, soils, land use and other factors affecting agricultural production.

146. Agriculture is the key source of livelihood in Sindh since the majority of the population is associated with this sector. Total 14.1 million hectares land area of Sindh, represent 18% of total geographic area of Pakistan. Out of this, nearly 50 percent or 7 million ha is available for cultivation. More than 80% of rural population depends on agriculture and its allied businesses.

147. Agriculture is the dominant economic activity in the province. About 80% of the agriculture land of the province is cultivated through controlled irrigation system. The irrigation system of Sindh comprises of three barrages Sukkar, Guddu and Kotri, having a gross command area of 15 million acres. However, cultivation takes place on only 8 million acres.

148. The major crop of Sindh includes rice, wheat, cotton, sugarcane and oilseeds. Sindh is also known for its orchards, mango, banana, guava and dates being some of the key fruits.

5 Potential Environmental Impacts and Mitigation Measures

149. This chapter presents the potential environmental impacts related to construction and operation phases of the proposed sub-project 5. 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

150. 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.

151. 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 feedback and provide updated mitigation requirements for any significant unpredicted impacts. The analysis primarily focuses on the key environmental issues likely to arise from the sub-project implementation, to prescribe mitigation measures to be integrated in the project design, to design monitoring and evaluation schedules to be implemented during sub-project construction and to estimate costs required for implementing sub-project mitigation measures.

152. The EMP plan must be reviewed when the sub-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 Potential Environmental Impacts during Pre-Construction Stage

5.2.1 Cultural Heritage & Religious Sites

Impact analysis

153. The location of cultural and other heritage sites with respect to the sub-project has been reviewed in Chapter 4. No temples or religious sites are in close proximity to the proposed sub-station site to cause a nuisance. In addition, the proposed works are to be conducted within the boundaries of the existing Jhimpir I sub-station.

Mitigation measures

No measures required.

5.3 Potential Environmental Impacts during Construction Stage

154. The summary of the key potential impacts during the construction phase is provided in **Table 5.1** below.

Table 5.1: Summary of key potential Impacts during Construction Phase

S/No.	Environmental Aspect	Potential Issue from Environmental Aspect	Potential of Impact	Mitigation Measures
1	Ambient Air Quality	Dust emissions from site preparation, excavation, material handling & other construction activities at site within sub-station for development of the building structure to house the equipment components.	Dust emissions expected at work site, located within the sub-station. However, minor and short-term impact expected which will be temporary in nature.	Regular water sprinkling on the exposed surfaces to reduce dust emissions and proper maintenance of all equipment at regular intervals to minimize impact of exhaust emissions
2	Noise	Noise generated from construction activities, operation of construction machinery, equipment and their movement for development of the building structure to house the equipment components.	Noise levels expected to vary during activity based upon the nature of work being conducted. Noise levels expected to generally be low due to nature of works to be conducted i.e. installation of batteries.	Follow construction best practices to ensure noise levels are minimized.
3	Solid Waste	Disposal of excavated soil, construction debris and other waste including domestic waste, which can cause soil contamination and other health and safety issues.	Minor negative impact expected.	Proper solid waste management programme to be designed and implemented
4	Land Use	Soil excavation of land at sub-station site requiring rehabilitation	Minor negative impact expected	Excavation and rehabilitation to be conducted as per EMP.
5	Soils	Excavation activity within sub-station leading to topsoil removal and erosion.	Minor negative impact expected	Necessary measures to be taken to replace removed soil as per EMP.

Physical Resources

5.3.1 Air Quality

Impact analysis

155. Air quality will be affected by the fugitive dust and emissions from the construction machinery, and vehicular traffic during the construction phase during construction of the dedicated building for housing the equipment components.

156. 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

157. The following mitigation measures are proposed:

- The applicable NEQS/international regulations for 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 dust emissions are high, katcha tracks will be overlain with shingle or surface treated. 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.
- Ensure proper tuning of the construction vehicles.
- The construction material will be stored in the boundary wall and no disturbance to surrounding areas is expected.
- Careful planning of the supply of materials from controlled sources should minimize the need for large stockpiles.

5.3.2 Noise

Impact analysis

158. It is anticipated that powered mechanical equipment and some local labor with hand tool methods will be used to construct the sub-project works. Powered

mechanical equipment can generate significant noise and vibration. The cumulative effects from several machines can be significant.

Mitigation measures

159. The following mitigation measures are proposed:

- To minimize such impacts, the Contractor for this subproject should be requested by the construction supervision consultants (engineer) to provide evidence and certification that all equipment to be used for construction is fitted with the necessary air pollution and noise dampening devices to meet EPA requirements.

5.3.3 Hydrology and drainage aspects

Impact analysis

160. To ensure the proper implementation of best practices to ensure the hydrology of the area is not adversely impacted.

Mitigation measures

161. The following measures shall be implemented:

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

5.3.4 Water Quality

Impact analysis

162. To prevent adverse water quality impacts due to negligence and ensure unavoidable impacts are managed effectively. Ensure adverse impacts on water quality caused by construction activities are minimized.

Mitigation measures

163. The following measures shall be implemented:

- Storage of lubricants, fuels and other hydrocarbons in self-contained dedicated enclosures >50m away from water bodies.

- Proper disposal of solid waste from construction activities and labor camps.
- Cover the construction material and spoil stockpiles with a suitable material to reduce material loss and sedimentation and avoid stockpiling near to water bodies.
- Topsoil stripped material shall not be stored where natural drainage will be disrupted.
- Borrow sites (if required) should not be close to sources of drinking water.

5.3.5 Soil Contamination

Impact analysis

164. Lands 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. Unmanaged sewage can also contribute to contamination of soil.

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

Mitigation measures

166. The measures provided below shall be implemented:

- 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.
- Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities.
- 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.
- Solid waste generated at the campsites will be properly segregated, treated and safely disposed of only in the demarcated waste disposal sites.
- Proper drainage system shall be constructed to ensure proper disposal of sewage and wastewater, which will offset any impact on soil. Sewage will be connected to sewage network for offsite treatment or will be connected to septic tank.

5.3.6 Construction waste disposal

Impact analysis

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. The following measures shall be implemented:

- Identifying potential safe disposal sites close to the project or those designated sites in the contract.
- Used oil and lubricants shall be recovered and reused or removed from the site in full compliance with the national and local regulations.
- Oily wastes must not be burned. Disposal location to be agreed with local authorities/EPA.
- Machinery should be properly maintained to minimize oil spill during the construction.
- Solid waste should be disposed at an approved solid waste facility; open burning is illegal and contrary to good environmental practice.

5.3.7 Handling, transportation and storage of Construction materials

Impact analysis

169. To minimize contamination of the surroundings (due to Implementation of works, concrete and crushing plants).

Mitigation measures

170. The following measures shall be implemented:

In order to minimize and or avoid adverse environmental impacts arising out of construction material exploitation, handling, transportation and storage measures to be taken in line with any EPA conditions/recommendations in approval:

- Conditions that apply for selecting sites for material exploitation.
- Conditions that apply to timing and use of roads for material transport.
- Conditions that apply for maintenance of vehicles used in material transport or construction.
- Conditions that apply for selection of sites for material storage.
- Conditions that apply for aggregate production.

- Conditions that apply for handling hazardous or dangerous materials such as oil, lubricants and toxic chemicals.

5.3.8 Work camp operation and location

Impact analysis

171. The operation of work camps can adversely affect the surrounding environment and residents in the area if local regulations and internationally accepted best practices are not implemented.

Mitigation measures

172. The following measures shall be implemented:

- Identify location of work camps in consultation with local authorities. The location shall be subject to approval by the NTDC. If possible, camps shall not be located near settlements or near drinking water supply intakes.
- Cutting of trees shall be avoided and removal of vegetation shall be minimized.
- Water and sanitary facilities (at least pit latrines) shall be provided for employees. Worker camp and latrine sites to be backfilled and marked upon vacation of the sites.
- Solid waste and sewage shall be managed according to the national and local regulations. As a rule, solid waste must not be dumped, buried or burned at or near the project site, but shall be disposed off to the nearest sanitary landfill or site having complied with the necessary permission of local authority permission.
- The Contractor shall organize and maintain a waste separation, collection and transport system.
- Toilets will be self contained or shall be disposed off to a septic tank and no toilets will be located within 100 meters of any surface water body or any groundwater well.
- The Contractor shall document that all liquid and solid hazardous and non-hazardous waste are separated, collected and disposed of according to the given requirements and regulations.
- At the conclusion of the project, all debris and waste shall be removed. All temporary structures, including office buildings, shelters and toilets shall be removed.
- Exposed areas shall be planted with suitable vegetation.
- NTDC and Supervising Engineer shall inspect and report that the camp has been vacated and restored to pre-project conditions.

5.3.9 Vehicle and Equipment Exhaust

Impact analysis

173. The emissions from vehicles and combustion processes in generators and other construction equipment result in exhaust gases that can affect the ambient air quality locally and pose a health hazard particularly for communities resident in proximity to the project site.

Mitigation measures

174. The following measures shall be implemented:

- It shall be ensured that all vehicles, generators and other equipment used during the construction will be properly tuned and maintained in good working condition in order to minimize emission of pollutants.
- The stack height of generators will be at least 3 meters above the ground.

Ecological Resources

5.3.10 Wildlife and Fauna

Impact analysis

175. Mammals, Amphibians, birds and reptiles could be disturbed with the clearance of flora. Birds can easily fly away to any trees outside the project area.

Mitigation measures

176. The following mitigation measures should be implemented:

- Vehicle speed will be controlled to avoid incidental mortality of small mammals and reptiles.
- Staff working on the project will be given clear orders, not to shoot or trap any bird or animal.
- Lights used in the camps will be kept to the minimum requirement. Upward scattering lights will preferably be used.

Socio-economic Environment

5.3.11 Safety Precautions for Workers

Impact analysis

177. If necessary measures to ensure worker safety are not in place, the potential for any minor or major accidents exists.

Mitigation measures

178. The following measures must be implemented:

- Providing adequate warning signs.
- Providing workers with skull guard or hard hat.
- Contractor shall instruct his workers in health and safety matters, and require the workers to use the provided safety equipment.
- Establish all relevant safety measures as required by law and good engineering practices.

5.3.12 Indigenous, Vulnerable and Women headed Households

Impact analysis

179. During the field survey for the sub-project, no indigenous group of people was identified, which comes under the definition of 'Indigenous people'. Also, no vulnerable or women headed households were identified. Thus, no such impact is envisaged during the implementation of the sub-project.

Mitigation measures

No measures required.

5.4 Potential Environmental Impacts during Operation

5.4.1 Disposal of Batteries

Impact analysis

180. Once the useful life of the batteries has been completed, their disposal in accordance with international best practices must be ensured to prevent potential negative impacts on the environment in the project area.

Mitigation measures

181. The following steps must be ensured:

- The batteries must be disposed off by handing over to a licensed third party for disposal in accordance with international best practices.
- Potential arrangements to return the batteries to the vendor and receive new batteries by paying the adjusted cost can be examined as an option, as long as the vendor will have in place the required measures to handle the used batteries in an environmentally sustainable manner.

5.4.2 Impacts on Ecological Resources

Impact analysis

182. No tree cutting is to take place during the operation stage.

Mitigation measures

No measures required.

5.4.3 Enhancement

Impact analysis

183. Environmental enhancements are not a major consideration for this sub-project. However, it is noted that it is common practice 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 Cumulative impacts

184. There are no other infrastructure projects being planned in the project area. Thus, no cumulative impacts are expected.

6 Institutional Requirements & Environmental Management Plan

6.1 Introduction

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

186. The detailed EMP for this sub-project is provided as **Table 6.1** below**.**

187. The EMP shall ensure that the proposed sub-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 contractor engaged by NTDC, as well as for other parties concerned for mitigating possible impacts associated with the sub-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 construction and operational phases of the Project, and will allow for prompt implementation of effective corrective measures.

6.2 Environmental Management Plan (EMP)

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

- Delivery of the prescribed environmental outcomes during all phases of the Project;
- Formulating a system for compliance with applicable legislative and non-legislative requirements and obligations and commitments for the Project;
- Ensure that project design process incorporates best practice environmental design and sustainability principles to minimize potential impacts of construction and operation 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

189. 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

190. 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 **Fig. 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.

191. 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.

192. 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.

193. 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.

194. 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.

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

196. The specific roles and responsibilities for environmental management are provided in **Tables 6.1** and **6.2** below.

Figure 6.1: NTDC's Institutional Setup for Project Implementation

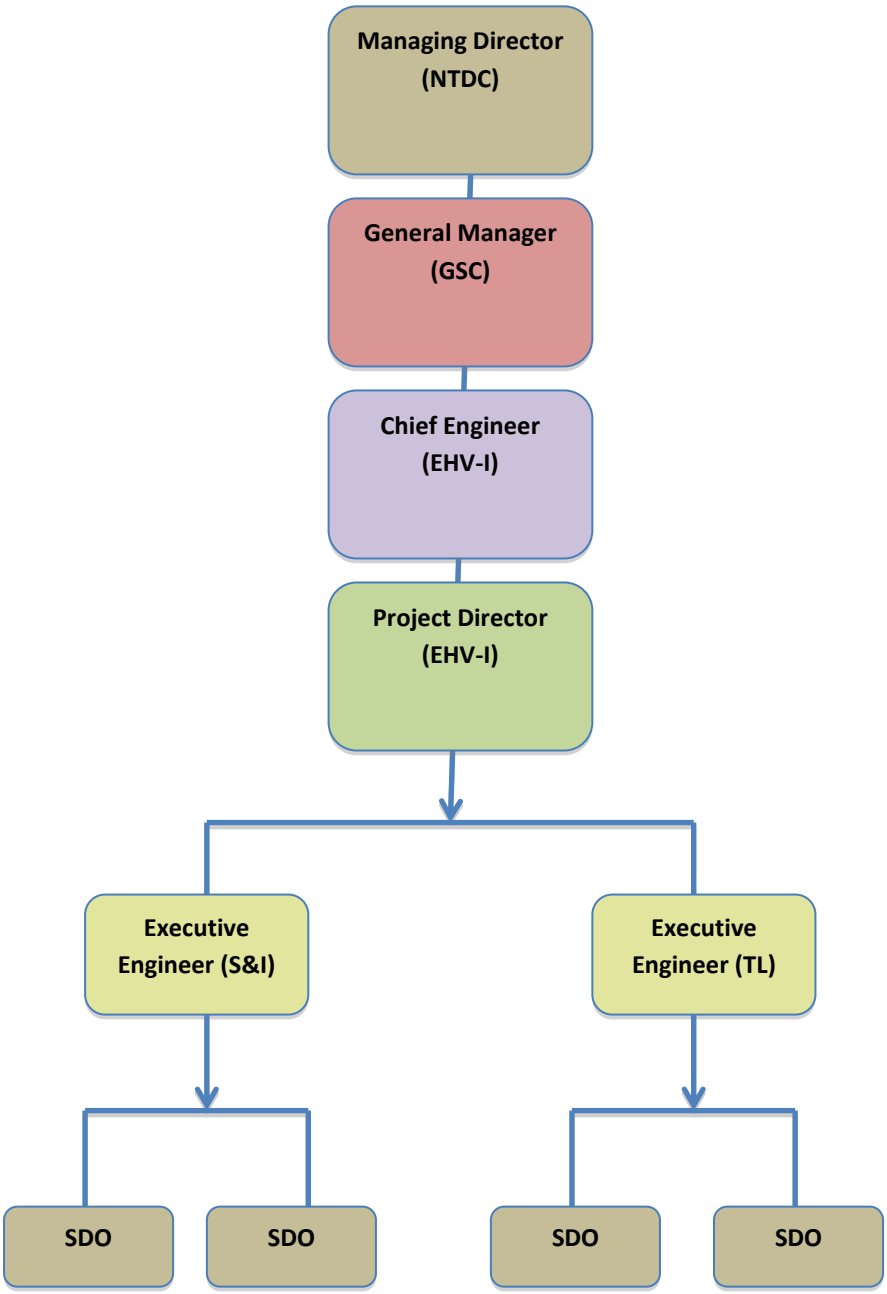
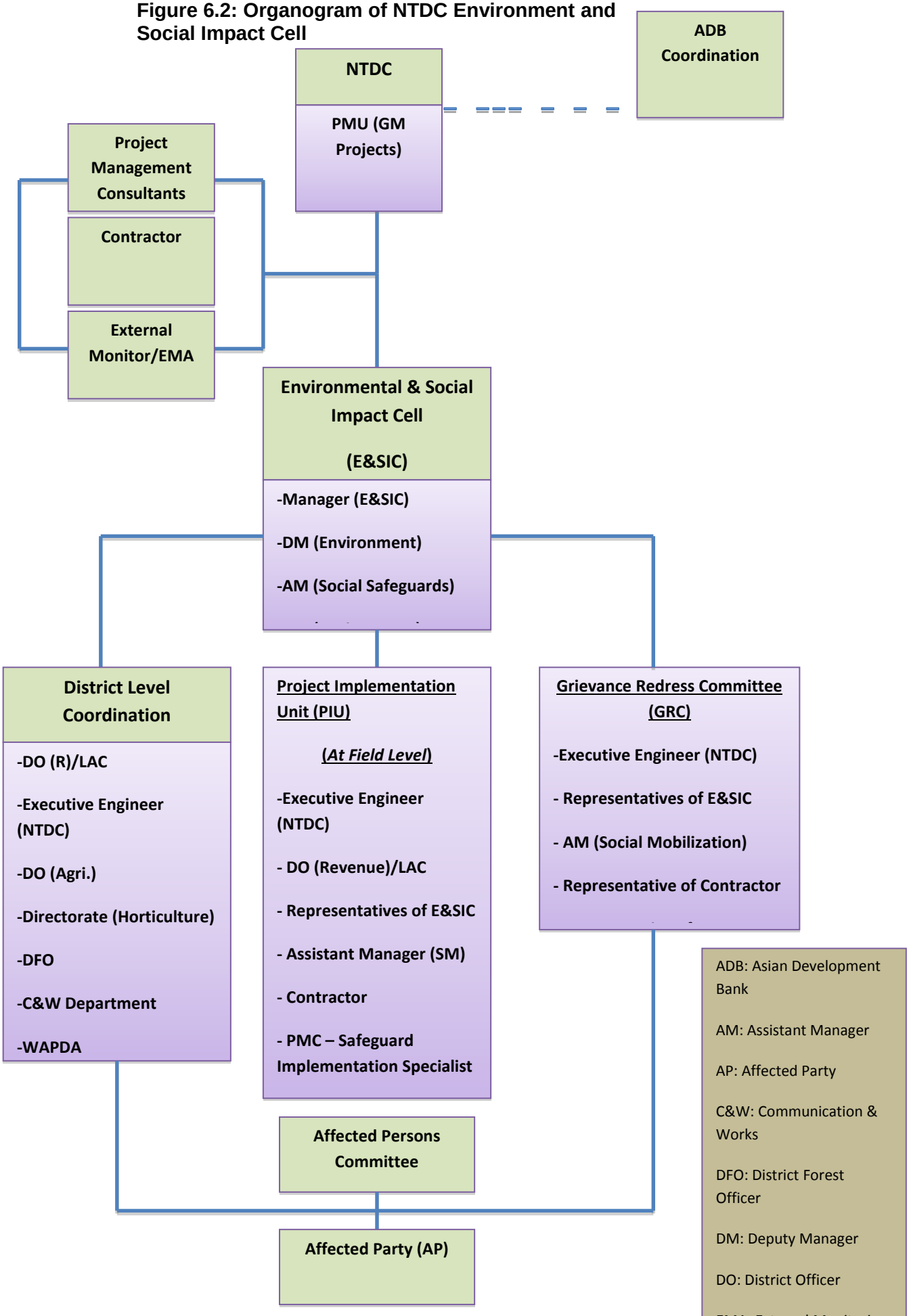


Figure 6.2: Organogram of NTDC Environment and Social Impact Cell



197. The EMP was prepared taking into account the capacity of the NTDC to conduct environmental assessments of the subproject. But it is envisaged that the NTDC's Environmental and Social Impact Cell (ESIC) will conduct monitoring of the subproject to check the compliance of EMP provisions and will obtain environmental approval from EPA Punjab.

198. The ESIC is composed of one Manager, one Deputy Manager, and two Assistant Managers (refer to **Fig 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.

199. 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 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

6.4.1 Environmental and Social Monitoring by ESIC

200. The general monitoring responsibilities of the NTDC Environment and Social Impact Cell will consist of:

- Assist in valuation of the trees, crops etc. and negotiation with the owners.
- Assist in checking genuine ownerships of the claimants, in consultation with the Revenue staff for prompt payment to the affectees.
- Assist the Contractor for the timely payments of negotiated price.
- Check that the Contractor backfills, compacts, and leaves the ground in the original condition after excavation of pits for subsurface investigations, and for the tower footings.
- 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.
- Monitor, that pollution of wetlands is not excessive during the excavation for the tower footings.
- To see that the Contractor keeps the damages to the minimum during the substation construction especially while making tracks for accessibility and that the damage is rectified properly.
- 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/camps tidy so as to avoid unhealthy impacts on the work force.

The environmental monitoring plan is provided as **Table 6.2.**

Table 6.1: Environmental Management Plan for Sub-project 5

Environmental Concern	Objectives	Mitigation Measures (MM) recommended	Timing to implement MM	Location to implement MM	Responsibility	
					Implementation	Monitoring
Construction Stage						
Air Quality	To minimize effectively and avoid complaints due to the airborne particulate matter released to the atmosphere.	▪ The applicable NEQS/international regulations for 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 dust emissions are high, katcha tracks will be overlain with shingle or surface treated. Where necessary, dust emissions will be reduced by a regular sprinkling of water for keeping the dust settled, at least twice a day.	All construction sites.	A list of locations to be included in contract and other sensitive areas identified by the CSC within the project area during works.	Contractor	NTDC & CSC

		▪ Haul-trucks carrying sand, aggregate and other materials will be kept covered with tarpaulin. ▪ Ensure proper tuning of the construction vehicles. ▪ The construction material will be stored in the boundary wall and no disturbance to surrounding areas is expected. ▪ Careful planning of the supply of materials from controlled sources should minimize the need for large stockpiles.				
Noise	To minimize noise level increases during construction phase.	▪ To minimize such impacts, the Contractor for this subproject should be requested by the construction supervision consultants (engineer) to provide evidence and certification that all equipment to be used for construction is fitted with the necessary air pollution and noise	During Construction	The most sensitive locations within the project area	Contractor shall meet the acceptable standards	NTDC & CSC

		dampening devices to meet EPA requirements.				
Hydrology and Drainage Aspects	To ensure the proper implementation of best practices to ensure the hydrology of the area is not adversely impacted.	▪ Consideration of weather conditions when particular construction activities are undertaken. ▪ Limitations on excavation depths in use of recharge areas for material exploitation or spoil disposal. ▪ Use of landscaping as an integrated component of construction activity as an erosion control measure. ▪ Minimizing the removal of vegetative cover as much as possible and providing for its restoration where construction sites have been cleared of such areas.	During Construction	1. Locations of each construction activity to be listed by the engineer. 2. Special locations are identified within the project area by the contractor to minimize disturbance. 3. A list of locations of irrigation channels/ drains to be compiled by the contractor.	Contractor	NTDC & CSC
Water Quality	To prevent any adverse impacts on water quality.	▪ Storage of lubricants, fuels and other hydrocarbons in self-contained dedicated enclosures >50m away	During Construction	Within sub-project area	Contractor	NTDC & CSC

		from water bodies. ▪ Proper disposal of solid waste from construction activities and labor camps. ▪ Cover the construction material and spoil stockpiles with a suitable material to reduce material loss and sedimentation and avoid stockpiling near to water bodies. ▪ Topsoil stripped material shall not be stored where natural drainage will be disrupted. ▪ Borrow sites (if required) should not be close to sources of drinking water.				
Soil Contamination	To ensure no soil contamination takes place as a result of construction activities	▪ 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	During Construction	At project site	Contractor	NTDC and CSC

		or other impermeable material will be spread on the ground to prevent contamination of soil. ▪ Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities. ▪ 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. ▪ Solid waste generated at the campsites will be properly segregated, treated and safely disposed of only in the demarcated waste disposal sites. ▪ Proper drainage system shall be constructed to				

		ensure proper disposal of sewage and wastewater, which will offset any impact on soil. Sewage will be connected to sewage network for offsite treatment or will be connected to septic tank.				
Handling, Transportation and Storage of Construction Materials	To minimize contamination of the surroundings	In order to minimize and or avoid adverse environmental impacts arising out of construction material exploitation, handling, transportation and storage measures to be taken in line with any EPA conditions/recommendations in approval: ▪ Conditions that apply for selecting sites for material exploitation. ▪ Conditions that apply to timing and use of roads	During Construction	1. List of borrow areas, if applicable to be prepared one month prior to construction and to be approved by CSC. 2. List of routes of transport of construction material is to be prepared for the contract and agreed one month prior to construction. 3. Report of vehicle conditions is available. 5. Environmental accident checklist and a list of banned substances are included in the contractor's manual.	Contractor	NTDC & CSC

		for material transport. ▪ Conditions that apply for maintenance of vehicles used in material transport or construction. ▪ Conditions that apply for selection of sites for material storage. ▪ Conditions that apply for aggregate production. ▪ Conditions that apply for handling hazardous or dangerous materials such as oil, lubricants and toxic chemicals.				
Construction Waste Disposal	Minimize the impacts from the disposal of construction waste.	▪ Identifying potential safe disposal sites close to the project or those designated sites in the contract. ▪ Used oil and lubricants shall be recovered and reused or removed from the site in full compliance with the national and local regulations. ▪ Oily wastes must not be	During Construction	A list of temporary stockpiling areas and more permanent dumping areas to be prepared at the contract stage for agreement.	Contractor	NTDC & CSC

		burned. Disposal location to be agreed with local authorities/EPA. ▪ Machinery should be properly maintained to minimize oil spill during the construction. ▪ Solid waste should be disposed at an approved solid waste facility; open burning is illegal and contrary to good environmental practice.				
Work Camp Operation and Location	To ensure that the operation of work camp does not adversely affect the surrounding environment and residents in the area.	▪ Identify location of work camps in consultation with local authorities. The location shall be subject to approval by the NTDC. If possible, camps shall not be located near settlements or near drinking water supply intakes. ▪ Cutting of trees shall be avoided and removal of vegetation shall be minimized. ▪ Water and sanitary facilities (at least pit	During Construction	At Work Camp sites	Contractor	NTDC/ MC

		latrines) shall be provided for employees. Worker camp and latrine sites to be backfilled and marked upon vacation of the sites. ▪ Solid waste and sewage shall be managed according to the national and local regulations. As a rule, solid waste must not be dumped, buried or burned at or near the project site, but shall be disposed off to the nearest sanitary landfill or site having complied with the necessary permission of local authority permission. ▪ The Contractor shall organize and maintain a waste separation, collection and transport system. ▪ Toilets will be self contained or shall be disposed off to a septic tank and no toilets will be located within 100 meters of any surface water body or any				

		groundwater well. ▪ The Contractor shall document that all liquid and solid hazardous and non-hazardous waste are separated, collected and disposed of according to the given requirements and regulations. ▪ At the conclusion of the project, all debris and waste shall be removed. All temporary structures, including office buildings, shelters and toilets shall be removed. ▪ Exposed areas shall be planted with suitable vegetation. ▪ NTDC and Supervising Engineer shall inspect and report that the camp has been vacated and restored to pre-project conditions.				

Vehicle and Equipment Exhaust	To ensure the emissions resulting from construction vehicles and equipment do not exceed applicable air quality guidelines	▪ It shall be ensured that all vehicles, generators and other equipment used during the construction will be properly tuned and maintained in good working condition in order to minimize emission of pollutants. ▪ The stack height of generators will be at least 3 meters above the ground.	During Construction	At work sites in the project area	Contractor	NTDC & CSC
Wildlife and Fauna	To protect wildlife and fauna within project area	▪ Vehicle speed will be controlled to avoid incidental mortality of small mammals and reptiles. ▪ Staff working on the project will be given clear orders, not to shoot or trap any bird or animal. ▪ Lights used in the camps will be kept to a minimum. Upward scattering lights will preferably be used.	During Construction	Within project area and at work camps	Contractor	NTDC & CSC

Safety Precautions for the Workers	To ensure safety of workers	▪ Providing adequate warning signs. ▪ Providing workers with skull guard or hard hat. ▪ Contractor shall instruct his workers in health and safety matters, and require the workers to use the provided safety equipment. ▪ Establish all relevant safety measures as required by law and good engineering practices.	Prior to commencement and during construction	Location to be identified by the CSC with Contractor.	Contractor	NTDC/ CSC
Operation Phase						
Disposal of Batteries	To ensure disposal of expired batteries in accordance with international best practices.	▪ The batteries must be disposed off by handing over to a licensed third party for disposal in accordance with international best practices. ▪ Potential arrangements to return the batteries to the vendor and receive new batteries by paying the adjusted cost can be examined as an option, as long as the vendor will have in place the required	-	Mechanism to be in place atleast one year prior to expiry of batteries	Contractor	NTDC/ CSC

		measures to handle the used batteries in an environmentally sustainable manner.				

CSC : Construction Supervision Consultant

NTDC : National Transmission and Despatch Company

ADB : Asian Development Bank

Table 6.2: Environmental Monitoring Plan for Sub-Project 5

Environmental Concern	Performance Indicator (PI)	Frequency to Monitor	Timing to Check PI	Locations to implement PI	Responsible to implement PI	Cost of Implementation	Responsible PI Supervision	Cost of Supervision
Pre-Construction/Design Phase								
Review of EMP	EMP is reviewed	During detailed design (later monthly by Contractor to cover any unidentified impacts)	By completion of detailed design	NTDC proposed project locations.	Contractor	Initially NTDC Cell / later Contractor cost	NTDC, ESIC cell / Environment al Specialist	ESIC cell staff cost
Environmentally Responsible procurement (ERP)	Contract follows ADB Guidelines on ERP	Once, before Contract is signed	Once, before Contract is signed	Method Statements	NTDC Project Cell	Contractor cost	NTDC, ESIC cell / Environment al Specialist	ESIC cell staff cost

Environmental Concern	Performance Indicator (PI)	Frequency to Monitor	Timing to Check PI	Locations to implement PI	Responsible to implement PI	Cost of Implementation	Responsible PI Supervision	Cost of Supervision
Waste disposal	Disposal options for all waste, residually contaminated soils, scrap metal agreed with NTDC and local authority.	1. Monthly or as required in waste management plan to identify sufficient locations for disposal of residually contaminated soils and scrap metal 2. Include in contracts for unit rates for re-measurement for disposal. 3. After agreement with local authority, designate disposal sites in the contract and cost unit disposal rates accordingly.	1.Prior to detailed design stage no later than prequalification on or tender negotiate ones 2. Include in contract	Locations approved by local waste disposal authorities	NTDC cell with the design/supervision consultant.	ESIC cell	ESIC cell	NTDC
Noise and air quality mitigation in design.	Design changes included in IEE	During detailed design by Contractor	Complete on of detailed design	As defined in IEE & EMP	NTDC Cell / Contractor	Contractor cost	NTDC / /Environment specialist	NTDC Cell staff cost
Construction Phase								

Environmental Concern	Performance Indicator (PI)	Frequency to Monitor	Timing to Check PI	Locations to implement PI	Responsible to implement PI	Cost of Implementation	Responsible PI Supervision	Cost of Supervision
Orientation for Contractor, and Workers	1. Contractor agreed to provide training to professional staff and workers. 2. Special briefing and training for Contractor completed. 3. Periodic progress review sessions.	1. Once 2. Ongoing 3. Ongoing	1. Before contract is signed 2. Before construction areas are opened up 3. Every month	All staff members in all categories. monthly induction and monthly refresher course	Contractor with ESIC-NTDC assistance and record details.	Contractor cost	NTDC and NTDC to observe and record success	NTDC Cell staff cost
Plans to control environmental impacts	1. Waste Management plan; 2. Noise and Dust Control plan, 3. Safety Plan	Deliverable in final form to NTDC cell one month before construction commences for any given stretch.	One month before construction commencement	All of NTDC Project sites	Contractor	Contractor cost	NTDC Project Cell	NTDC Cell staff cost
Spoil disposal and construction waste disposal	1. Waste Management Plan implemented. 3 No open burning of waste.	Monthly (line item when commencing construction).	Prior to construction. Update monthly.	NTDC proposed project site	Contractor	Contractor cost	NTDC and NTDC Cell	NTDC Cell staff cost
Noise	Noise mitigation measures implemented in line with guidelines for noise reduction	Monthly (line item when opening up construction).	Follow WB/IFC standards for residential areas -55 dB(A) day time	At and around Jhimpir 1 sub-station	Contractor should maintain the accepted standards	Contractor cost	NTDC / NTDC Project Cell will monitor sample activities	NTDC Cell staff cost

Environmental Concern	Performance Indicator (PI)	Frequency to Monitor	Timing to Check PI	Locations to implement PI	Responsible to implement PI	Cost of Implementation	Responsible PI Supervision	Cost of Supervision
Air quality	Noise and dust control plan implemented	Monthly (line item when opening up construction).	Prior to construction. Update monthly.	At and around Jhimpir 1 sub-station	Contractor	Contractor cost	NTDC and NTDC Cell	NTDC Cell staff cost
Soil Contamination	Contractors workforce instructed and trained in handling of chemicals	Monthly (line item when opening up construction).	Prior to construction. Update monthly.	At and around Jhimpir 1 sub-station	Contractor	Contractor cost	NTDC and NTDC Cell	NTDC Cell staff cost
Work Camp Location and Operation	1. Use of land agreed with surrounding residents & villages. 2. Waste Management Plan implemented. 3 No open burning	Monthly (line item when opening up construction).	Prior to construction. Update monthly.	At and around Jhimpir 1 sub-station	Contractor	Contractor cost	NTDC and NTDC Cell	NTDC Cell staff cost

6.5 Institutional Arrangements

201. The proposed project environmental management plan will require involvement of the following stakeholders in their specific roles:

6.5.1 Role and Responsibilities of Project Management Consultant (PMC)

202. A Supervisory Consultant appointed by NTDC will be designated as the "Engineer/Project Manager". The Consultant will be responsible for:

- Supervising the Project's Contractors and ensuring that all the contractual obligations related to the design and construction, as well as environmental and social compliance are met;
- Ensuring that the day-to-day construction activities are carried out in an environmentally and socially sound and sustainable manner and developing 'good practices' construction guidelines to assist the Contractors and NTDC staff in implementing the EMP; and
- Assisting the Chief Engineer (EHV-II) in coordinating with the EPAs, provincial agriculture, forest and Wildlife departments, NGOs/CBOs and other public/private sector organizations.

6.5.2 Role and Responsibilities of Project Contractor

203. For the proposed Project, NTDC will appoint Contractor(s) for construction and other project activities. The Contractor(s) will be responsible for the physical execution / implementation of EMP, or adherence to all the provisions of the IEE and EMP and any environmental or other code of conduct required by SEPA. Overall responsibility for the Contractor's environmental performance will rest with the NTDC.

204. The project contractor will also 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.

6.6 Estimated Environmental and Social Management Costs

205. The **Table 6.3** provides the estimated costs for the implementation of EMP.

Table 6.3: Estimated Costs for EMP Implementation for Sub-project 5

Item	Sub-Item	Estimated Total Cost (PKR)
Staffing, audit and monitoring	For entire project construction phase[1]	240,000
Monitoring Activities	As detailed under EMP[2]	160,000
Mitigation Measures	As prescribed under EMP and IEE[3]	200,000
	(i) Waste Management	200,000
Contingency	5% Contingency	30,000
Total		**630,000**

Note:

1 @ rate of PKR 60,000/month

7 Public Consultation and Information Disclosure

206. Public consultation sessions in detail are discussed in this section, which were held with the stakeholders/ groups likely to be affected by the project. The consultation process was carried out in accordance with the Asian Development Bank's Safe Guard Policy Statement (ADB SPS 2009).

7.1 Consultation Process

207. Since no sensitive receptors are present in the sub-project area and all works are to be conducted within the sub-station boundary and the nature of the works is quite benign with installation of batteries and inverters to be conducted, the consultations were quite benign in nature.

208. The focal NTDC staff along with site staff at the Jhimpir-1 station was consulted with regards to the scope of works for this sub-project.

209. The disclosure of information to the stakeholders beforehand has advantages in the environmental assessment and mitigation of impacts. Public consultation can also provide a conduit for the improvement of the project implementation to better serve the stakeholders.

210. The environmental assessment process under the Pakistan Environmental Protection Act only 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.

7.2 Consultation Findings

211. In general, no objection was raised to the proposed sub-project with all stakeholders expressing positive sentiments regarding the project with the hope being repeatedly expressed that this project and similar projects will result in a reduction in load shedding and energy crisis.

212. The key comments and concerns highlighted by the local communities, as the key stakeholder of this activity, were as follows:

- Employment as laborer during development of sub-project works

8 Grievance Redress Mechanism

8.1 General

213. 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 at the sub-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

214. The Executing Agency will establish a mechanism to receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance. The Executing Agency at site will be the Project Implementation Unit (PIU). The PIU will overall be responsible for executing the work at site. The Executive Engineer/Resident engineer will be in charge of the project. The Executive Engineer will be supported with Sub Divisional Officers and other supporting staff. The GRM will be established at each project location as described below.

215. Prior to the contractor's mobilization to the project site NTDC's Environment and Social Impact Cell (E&SIC) will assist the affected communities to establish a Grievance Redress Committee (GRC) and identify local representatives to act as Grievance Focal Points (GFP) for that community. The Grievance Redress Committee (GRC) will comprise of:

- Executive Engineer (NTDC) for the project;
- Representative of E&SIC (Assistant Manager (Environment));
- Environment Specialist CSC;
- Representative of Contractor; and
- GFP of relevant community.

216. The function of the GRC is to address the project related grievances of the affected parties that are unable to be resolved satisfactorily through the initial stages of the GRM procedure.

217. The Grievance Focal Points (GFPs) are designated personnel from within the community who will be responsible for: i) acting as community representatives in formal meetings between the project team (contractor, CSC, Assistant Manager (Environment), E&SIC and the local community he/she represents and ii) communicating community members' grievances and concerns to the contractor during project implementation. The number of GFPs to be identified for each project will depend on the number and distribution of affected communities.

218. A pre-mobilization public consultation meeting will be convened by E&SIC and attended by GFPs, contractor, CSC, E&SIC representatives and other interested parties (e.g. District level representatives, NGOs). The objectives of the meeting will be as follows:

- Introduction of key personnel of each stakeholder including roles and responsibilities,
- 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 routine (proactive) public relations activities proposed by the project team (contractor, CSC, E&SIC) to ensure communities are continually advised of project progress and associated constraints throughout project implementation;
- Identification of members of the Grievance Redress Committee (GRC); and
- Elicit and address the immediate concerns of the community based on information provided above.

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

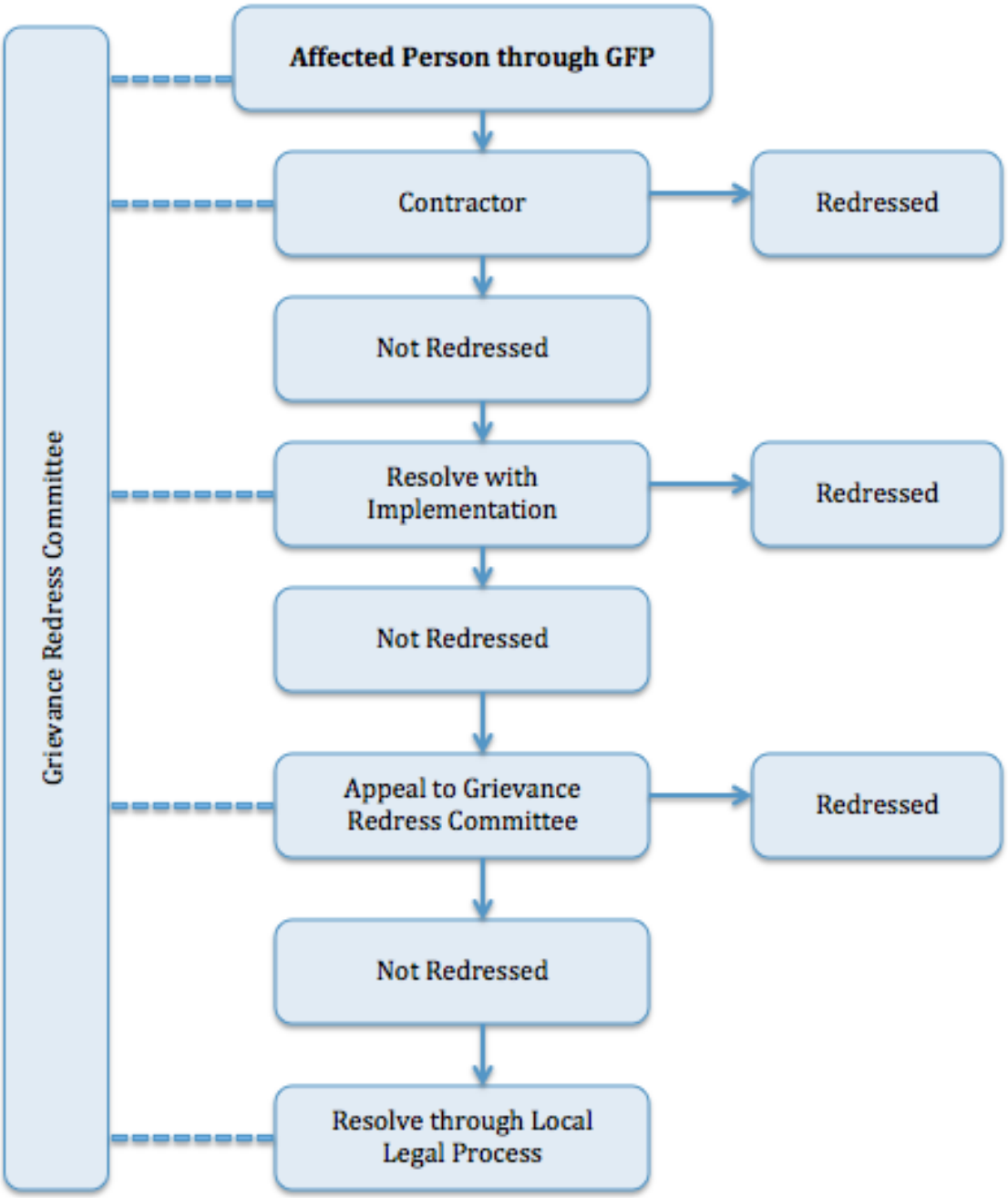
- Individuals will lodge their environmental complaint/grievance with their respective community's nominated GFP.
- The GFP will bring the individual's complaint to the attention of the Contractor.
- The Contractor will record the complaint in the onsite Environmental Complaints Register (ECR) in the 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 CSC's Environmental Specialist. The SC's Environment Specialist will then be responsible for coordinating with the Contractor in solving the issue.
- If the Complaint is not resolved within 2 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 2 weeks and the resolved complaint will have to be communicated back to the community. The Contractor will then record the complaint as resolved and closed in the

Environmental Complaints Register.

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

220. 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. E&SIC will also keep track of the status of all complaints through the Monthly Environmental Monitoring Report submitted by the Contractor to the SC and will ensure that they are resolved in a timely manner.

Figure 8.1: Grievance Redress Mechanism



9 Conclusions and Recommendations

9.1 Conclusion

221. The development of the proposed scope of work for sub-project 5 is of national significance and is of critical importance considering the significant energy deficit being faced by the country since several years.

222. Secondary data has been used to assess the environmental impacts of the activities to be conducted for this sub-project. This IEE report highlights any potential environmental impacts associated with the development of this sub-project and recommends mitigation measures, wherever felt necessary. All environmental impacts associated with the sub-project development need to be properly mitigated, wherever required, through the existing institutional arrangements described in this report.

223. The majority of the environmental impacts, however minimal and temporary in nature, are associated with the construction phase of the sub-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.

224. This IEE concludes that no significant negative environmental impacts are likely to occur due to construction and normal operations of the proposed sub-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.

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

9.2 Recommendations

226. Although comprehensive mitigation measures have been proposed in the report to minimize the negative impacts and to enhance the positive impacts of the sub-project, however, major recommended mitigation measures are summarized as under:

- Soil erosion and contamination, water contamination, air pollution and high noise levels should be controlled with the use of good engineering practices.

- Contractor should develop plan such as traffic management, solid waste management and material management etc. before commencing the construction activities.
- Contractor should warn the workers not to hunt the water birds, fish resources, etc.
- EMP proposed in Chapter 6 shall be implemented in its true letter and spirit.

10 References

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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:	**Sub-project 5: Grid Connected Battery Energy Storage System Pilot project**
Sector Division:	CWRD/CWEN

Screening Questions	Yes	No	Remarks
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?			The project's site is located well away from any 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
B. Potential Environmental Impacts Will the Project cause…			

Screening Questions	Yes	No	Remarks
▪ Encroachment on historical/cultural areas, disfiguration of landscape and increased waste generation?		X	No historical site(s) located in project area. Landscape is not expected to be disrupted since minimal waste will be generated from the civil works to be conducted for housing the battery banks.
▪ 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	Not Applicable
▪ Damage to sensitive coastal/marine habitats by construction of submarine cables?		X	The scope of work for this sub-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		There is a potential for water quality impacts from a labor camp and construction sites. Based on EMP provisions, respective mitigation measures will be followed.
▪ Increased local air pollution due to rock crushing, cutting and filling?	X		There is a potential for local air pollution due to construction activities on the storage site. EMP will contain mitigation measures such as water sprinkling will be adopted to minimize the impact.
▪ Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?		X	Minor OH&S risks are expected.
▪ Chemical pollution resulting from chemical clearing of vegetation for construction site?		X	Not applicable.
▪ Noise and vibration due to blasting and other civil works?	X		No blasting is required in this sub-project. High noise levels can potentially be generated during construction phase by heavy machinery. Any possible impacts will be mitigated by implementing the Environmental Management Plan. Among those measures are using noise reduction equipment (mufflers), temporary acoustic barriers, etc.
▪ Dislocation or involuntary resettlement of people?		X	No dislocation or resettlement of people is expected for this sub-project.

Screening Questions	Yes	No	Remarks
▪ Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	Not Applicable
▪ Social conflicts relating to inconveniences in living conditions where construction interferes with pre-existing roads?		X	No social conflicts are expected since the scope of sub-project works shall be conducted within the station boundary.
▪ Hazardous driving conditions where construction interferes with pre-existing roads?		X	No such issues are foreseen since all works for this sub-project shall be conducted within the station boundary.
▪ Creation of temporary breeding habitats for vectors of disease such as mosquitoes and rodents?	X		The potential of creation of temporary breeding habitats for disease vectors does exist during the construction phase of the sub-project. However, necessary measures will be implemented as per the EMP to prevent any long-term impacts.
▪ Dislocation and compulsory resettlement of people living in right-of-way of the power transmission lines?		X	Not applicable since this sub-project only involves installation of battery packs within an existing station.
▪ Environmental disturbances associated with the maintenance of lines (e.g. routine control of vegetative height under the lines)?		X	Not applicable since this sub-project only involves installation of battery packs within an existing station.
▪ 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 sub-project construction will aim to engage local labor as far as possible apart from engaging technical NTDC staff. Thus, no large population influx is foreseen.
▪ Social conflicts if workers from other regions or countries are hired?		X	Local labor 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		The possibility of poor sanitation and resulting transmission of diseases from workers to the local populations is remote, yet does exist. Thus necessary provisions in the EMP shall be provided to ensure any waste generated is disposed off in accordance with applicable NEQS guidelines.

Screening Questions	Yes	No	Remarks
▪ Risks to community safety associated with maintenance of lines and related facilities?		X	The risk to community safety does not exist since any maintenance activities will be conducted within the boundaries of the station.
▪ Community health hazards due to electromagnetic fields, land subsidence, lowered groundwater table, and salinization?		X	Not Applicable
▪ 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 works. Other materials such as fuel, oil etc. will be kept in the construction camps / storage places. Transport and disposal of such materials will be according to protective measures provided in EMP.
▪ 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	The risk to community safety does not exist since all sub-project related activities will be conducted within the boundaries of the existing station.

ANNEXURE-II

Record of Public Consultations

Public Consultations for Grid Connected Battery Energy Storage System Pilot Project (conducted during March 2018)			
Participant Name	**Village Name**	**Comment/Issues or Concerns expressed/Suggestions and Requests**	**Proposed Actions/Measures to address concerns**
Mr Mehr Khalid, NTDC **Mr Irfan, NTDC** **Mr Mohd Irfan, NTDC**	**Jhimpir I sub-station project area**	▪ The project focal points i.e. NTDC staff and site staff at the sub-project location are generally glad the respective project activities will be conducted. ▪ Information should be provided prior to commencement of work ▪ Employment as laborer to neighboring communities during sub-project works ▪ The NTDC staff reported that based on discusions with the residents, they had expressed hope that the increase in distribution capacity will reduce the amount of load shedding faced by them and will result in a reduction of the energy deficit in the country. ▪ The NTDC staff reported that based on discusions with the community residents, it should be ensured that a transparent hiring policy is implemented with preference given to residents of the project area.	None Required

ANNEXURE-III

NEQS Guidelines and WHO Standards

National Environmental Quality Standards for Gaseous Emission

Parameter	Source of Emission	Existing Standards	Revised Standards
Smoke	Smoke Opacity not to exceed	40% or 2 on Ringlemann scale	40% or 2 on Ringlemann scale or equivalent number
Particulate matter	a) Boilers and furnaces Oil fired Coal fired Cement Kilns b) Grinding crushing, clinker, coolers and related processes, metallurgical processes, converter, blast furnaces and cupolas	 300 500 200 500	 300 500 300 500
Hydrogen Chloride	Any	400	400
Chlorine	Any	150	150
Hydrogen Flouride	Any	150	150
Hydrogen Sulphide	Any	10	10
Sulphur oxides	Sulfuric acids/sulfuric acid plants Other plants	400 400	5000 1700
Lead	Any	50	50
Mercury	Any	10	10
Cadmium	Any	20	20
Arsenic	Any	20	20
Copper	Any	50	50
Antimony	20	20	20
Zinc	Any	200	200
Oxides of Nitrogen	Nitric Acid Manufacturing Unit Gas Fired Oil Fired Coal Fired	400 400	400 400 600 1200

WHO Guideline Values for Community Noise in Specific Environment

Specific Environment	LA eq (dB)	LAmax Fast (db)
Out door living area	55	
School class rooms and pre-schools (indoor)	35	
School Playground (outdoors)	35	
Hospitals Ward rooms (indoor	30 30	40
Hospital Treatment rooms (indoors)	#1	
Industrial, commercial, shopping and traffic areas (indoors and out doors)	70	110

#1– as low as Possible

WHO Drinking Water Quality Standards

Sr. No.	Constituent, mg/L	Recommended limit (1961 European)
1	Ammonia	0.5
2	Chlorides	350
3	Copper	0.05[a]
4	Flourides	1.5
5	Iron	0.1
6	Magnesium [b]	125[b]
7	Nitrates	50
8	Oxygen	5.0
9	Phenols	0.001
10	Sulphates	250
11	Zinc	5.0

a Maybe higher for new piping
b if 250mg/L SO_4 is present, Mg not to exceed 30mg/L