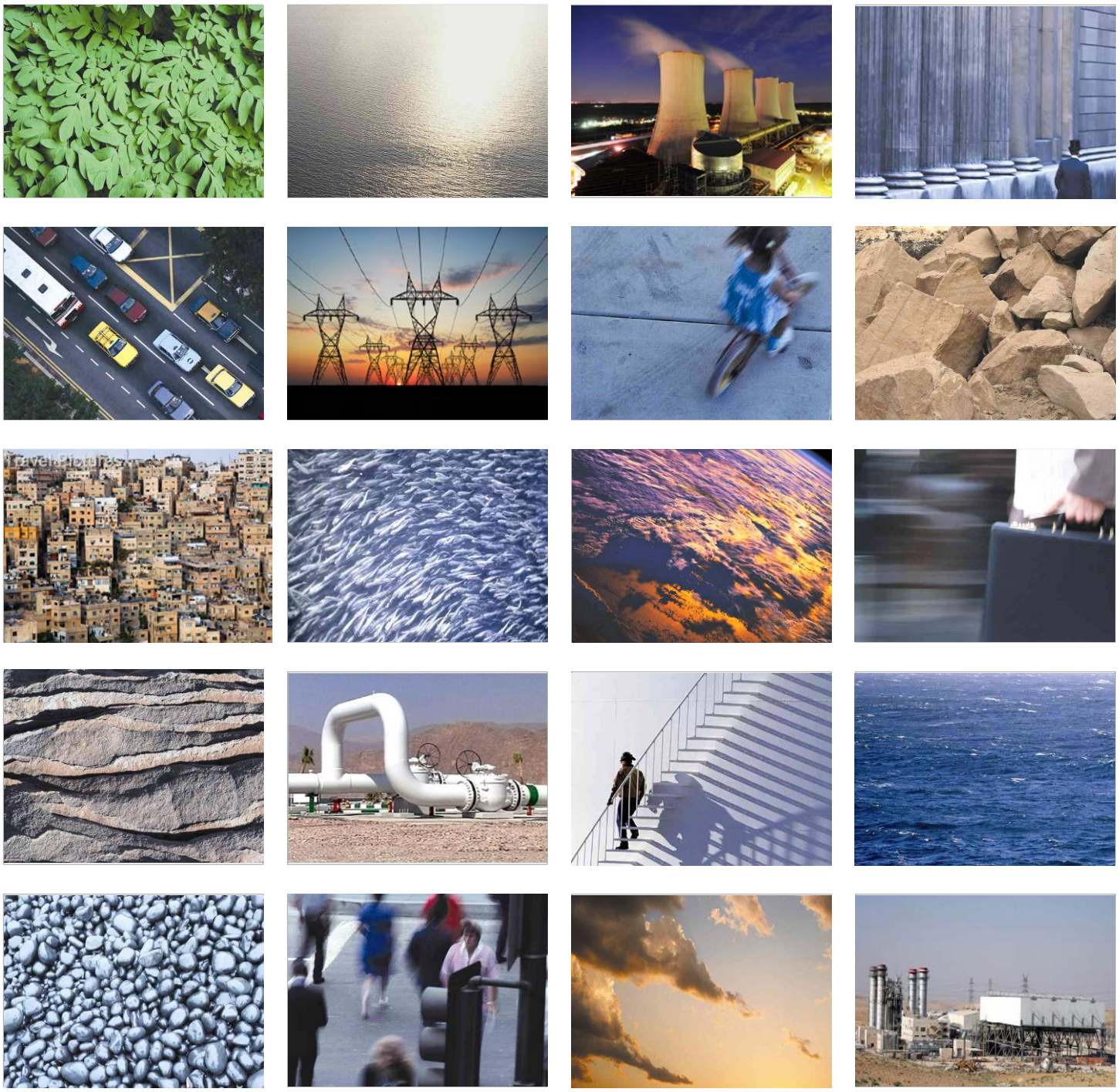

50 MW Wind Power Plant by Metro Power Company Limited: *Jhimpir, Pakistan*

Metro Power Company Limited

Initial Environmental Examination Update

July 2013

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50 MW Wind Power Plant by Metro Power Company Limited: Jhimpir, Pakistan

Initial Environmental Examination Update

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Client	Project No
Metro Power Company Limited	0187847
Project Summary Metro Power Company Limited is developing a 50 MW Wind Energy Project in association with the sponsors Mr Iqbal Alimohammed and Family and InfraCo Asia at Jhimpir area, Taluka and District Thatta in Sindh Province of Pakistan. ERM has been commissioned by MPCL to upgrade the existing Initial Environmental Examination report for the Wind Energy Project, which was prepared in April 2009 for local regulatory approval from the Environmental Protection Agency of Sindh Province. The IEE report upgrade presented herein has been prepared in accordance with applicable Equator Principles and International Finance Corporation / World Bank guidelines.	Date 23 July 2013 Approved by **Neena Singh** *Partner* *ERM*

Revision	Description	By	Checked	Approved	Date
1	Final Report	KK	NC	NS	23.07.13
0	Draft Report	NC	NS	AS	29.04.13

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Abbreviations

AEDB	Alternative Energy Development Board
AoI	Area of Influence
DEM	Digital Elevation Model
DIPL	Descon Integrated Project Private Limited
DOE	Descon Engineering FZE, UAE
DOS	Descon Engineering Limited
EHS	Environment, Health and Safety
EMF	Electromagnetic interference
EPA	Environment Protection Agency
EPC	Engineering Procurement and Construction
EPFIs	Equator Principles Finance Institutions
ESAP	Environment and Social Action Plan
ESMP	Environment and Social Management Plan
FFC	Fauzi Fertilizers Co.
GAWPL	Gul Ahmed Wind Power Limited
GIS	Geographical Information System
GoP	Government OF Pakistan
GoS	Government of Sindh
HESCO	Hyderabad Electric Supply Company
IFC	International Finance Corporation
IPP	Independent Power Producers
IUCN	International Union for Conservation of Nature
KVA	Kilo Volt-Ampere
LoI	Letter of Intent
LULC	Land Use and Land Cover
MNA	Minister of the National Assembly
MPA	Minister of the Provincial Assembly
MPCL	Metro Power Company Limited
NEQS	National Environmental Quality Standards
NGOs	Non-Government Organisations
NREL	National Renewable Energy Laboratory
NSE	Nordex Singapore Equipment Private Limited (NSE);
NSS	Nordex Singapore Service Private Limited
NTDC	National Transmission and Dispatch Company
O&M	Operation & Maintenance
OPC	Ordinary Portland Cement
PEPA	Pakistan Environment Protection Act
PEPCO	Pakistan Electric Power Company
PIDG	Private Infrastructure Development Group
PPIB	Private Power and Infrastructure Board
PPTA	Project Preparatory Technical Assistance
PS	Performance Standards
ROW	Right of Way
SEHS	Social, environment, Health and Safety
SEPA	Sindh Environmental Protection Agency
SEP	Stakeholder Engagement Plan

SPLs	Sound Power Levels
SRC	Sulphur Resistant Cement
TMA	Taluka Municipal Administration
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USAID	United States Agency for International Development
WAPDA	Water and Power Development Authority
WB	World Bank
WEP	Wind Energy Project
WHO	World Health Organisation
WTGs	Wind Turbine Generators
ZEPL	Zorlu Energy Pakistan Limited

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1 INTRODUCTION

1.1 PREAMBLE

Metro Power Company Limited (hereinafter referred to as "MPCL") is developing a 50 MW Wind Energy Project (hereinafter referred to as "WEP") in association with the sponsors Mr Iqbal Alimohammed and Family and InfraCo Asia at Jhimpir area, Taluka and District Thatta in Sindh Province of Pakistan.

MPCL is seeking project finance from international lenders/Equator Principles Finance Institutions (EPFIs) and hence require the project to comply with the applicable Equator Principle and International Finance Corporation (IFC)/World Bank (WB) guidelines relating to the environment, social issues and occupational health and safety matters, in addition to complying with local laws and regulations.

ERM has been commissioned by MPCL to update the existing Initial Environmental Examination ("IEE") report prepared in April 2009 for local regulatory approval from the Environmental Protection Agency (EPA) of Sindh Province, to meet the requirements of the specified reference framework as follow:

- Applicable national laws and regulations in Pakistan;
- IFC Performance Standards (2012);
- IFC /WB General EHS guidelines;
- IFC/WB – Environmental, Health and Safety sector specific Guidelines, in particular: IFC Guidelines for Wind Energy; Projects and Power Transmission and Distribution; and
- ILO Conventions and recommendations.

1.2 BACKGROUND

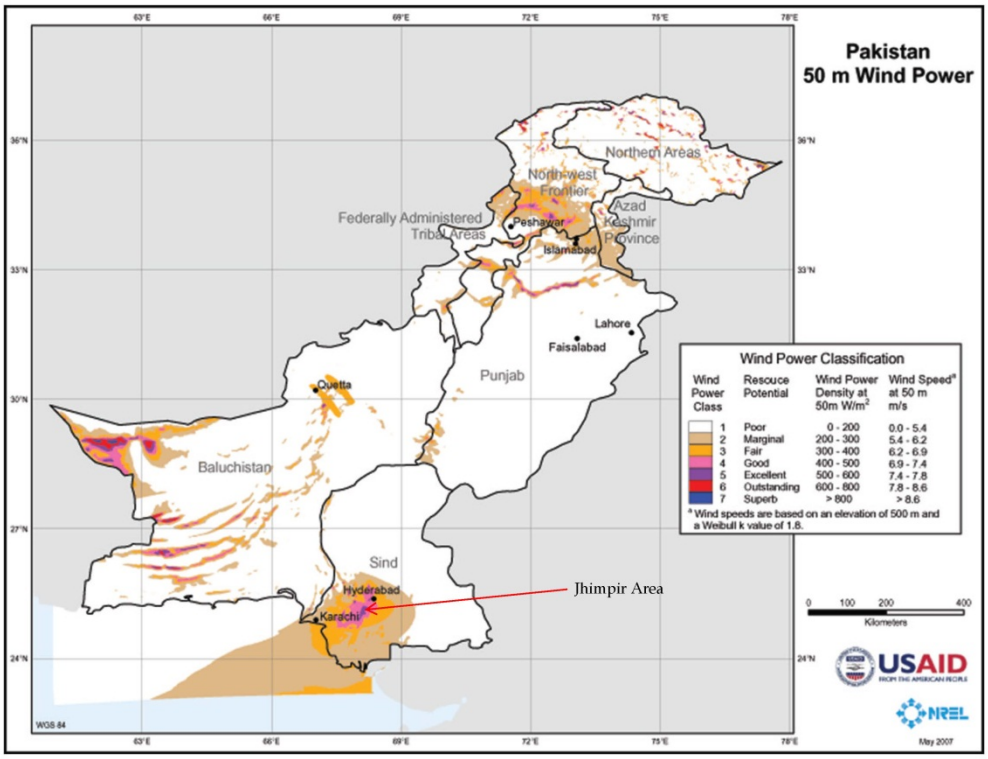
The Alternative Energy Development Board (AEDB) was founded by the Government of Pakistan in 2003. The purpose of AEDB was to reduce Pakistan's dependence on hydro and fossil fuel based power generation by identifying alternative energy resources like wind, solar, biogas and micro based run of the river projects.

Pakistan has a considerable potential of wind energy in the coastal belt of Sindh, Balochistan as well as in the Northern areas. The National Renewable Energy Laboratory (NREL), USA in collaboration with USAID, has carried out a wind resources study of Pakistan and has indicated a production potential of 346,000 MW as shown in ***Figure 1.1.*** The Gharo-Keti Bandar wind corridor, which spreads 60 km along the coastline of Sind Province and more than 170

km inland alone has a potential of approximately 50,000 MW (30% ~ 32% Capacity Factor estimated in Gharo -Keti Bandar area).

The wind map [1] of Pakistan classifies Jhimpir, Jamshoro, Nooriabad, Talhar and Keti Bandar as sites with excellent wind generation potential whereas sites such as Thatta, Thana Bola Khan, Hyderabad and Gharo are classified as "good". All these sites fall under the Gharo –kheti Bandar wind corridor.

Figure 1.1 Wind Atlas of Pakistan



Source: http://www.aedb.org

The Government of Pakistan (GoP), through the Alternative Energy Development Board (AEDB)[2] has endeavoured to harness this energy to meet the demands of the country. The objective of the AEDB is to assist and facilitate the development and generation of Alternative or Renewable Energy in order to achieve sustainable economic growth through a diversified energy generation. The AEDB procured certain parcels of land from the Government of Sindh pursuant to the Colonization and Disposal of Government Lands (Sindh) Act, 1912. Accordingly, the AEDB has sub-leased land and power generation capacity of generally 50 MW each to 11 independent power producers (IPPs) for generation of wind energy in Jhimpir in the Thatta district of Sindh Province in Pakistan. One of these 11 IPPs is MPCL , which is planning to set up 50 MW WEP in the Jhimpir area.

(1) (http://www.aedb.org/Download/windmap.jpg, 2007

(2) AEDB was established as an autonomous body for the purpose of implementation of various policies, programmes and projects in the field of Alternative or Renewable Energy Technologies by Act No.XIV of 2010, Gazette of Pakistan.

1.3 MPCL PROJECT PROPONENTS

MPCL is an IPP set up in November 2006 with a mission to provide quality and environment friendly power production to its customers. MPCL will establish, own and operate the 50 MW WEP in association with the sponsors Mr Iqbal Alimohammed and Family (1) and InfraCo Asia Keenjhar Wind Pte Ltd, a special purpose company incorporated in Singapore and subsidiary of InfraCo Asia Development Pte Ltd.

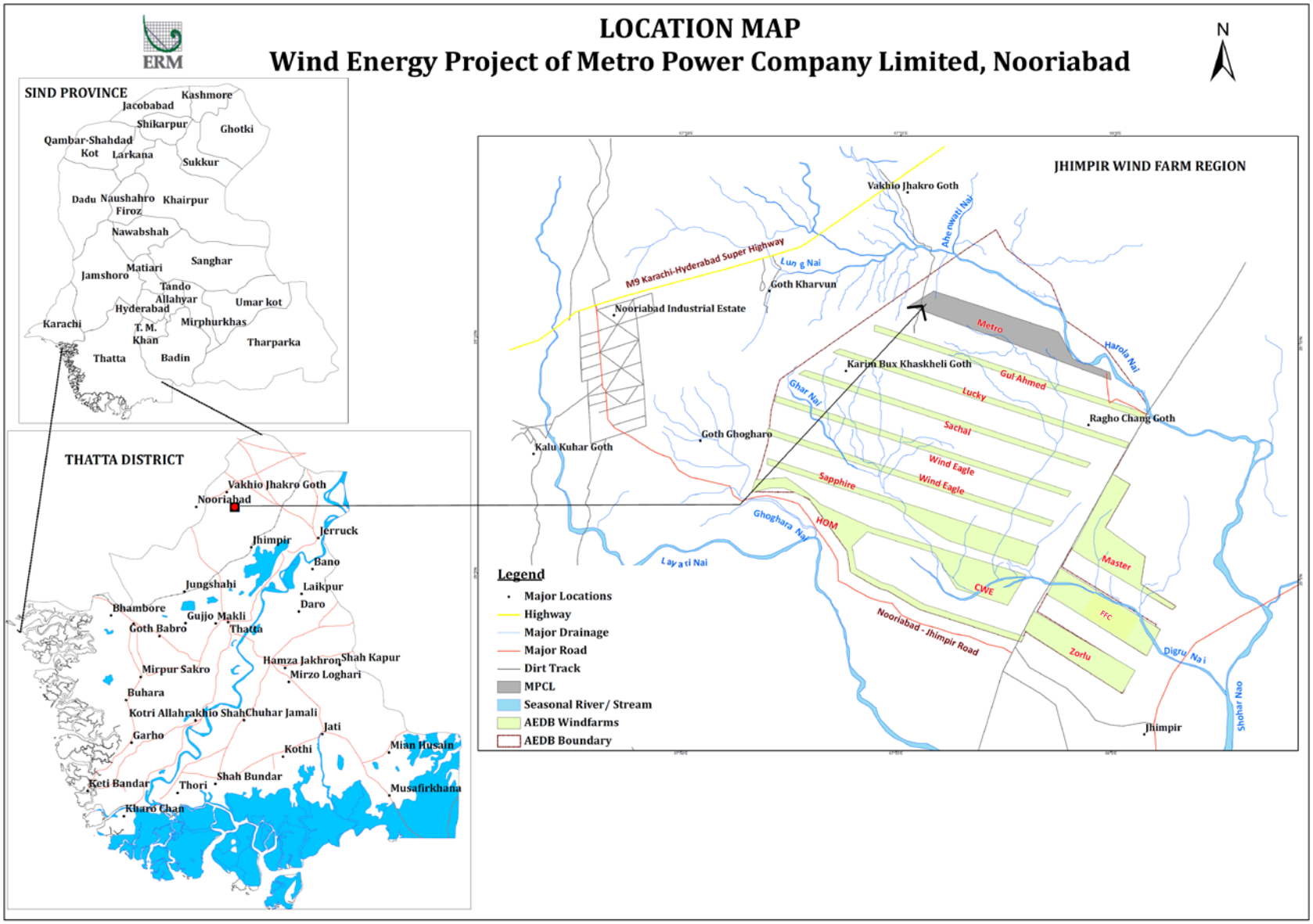
The InfraCo Asia Development Pte Ltd is an infrastructure project development and investment company registered in Singapore. It is a facility of Private Infrastructure Development Group (PIDG), which is a club of some eight European government donor agencies, AusAid and the World Bank Group's IFC. InfraCo Asia Development Pte Ltd is mandated by PIDG to facilitate private sector investment in infrastructure in selected countries in South and South East Asia.

1.3.1 *Project Overview*

The MPCL WEP (hereafter referred to as the Project) will comprise of 20 wind turbine generators (WTGs), each with a capacity of 2.5 MW resulting in an aggregate capacity of 50 MW. The location of the Project is shown in ***Figure 1.2.*** The project site is located in Deh Kohistan 7/1, Union Administration Jhimpir, Taluka and District Thatta. It falls under the Gharo-Jhimpir wind corridor in Sindh Province of Pakistan, about 140 km north-east from the city of Karachi. The key components of the Project are summarized in ***Table 1.1*** and are further discussed in detail in *Chapter 2.*

(1) Mr Iqbal Alimohammed and family are the owners of Teli Group, a business house in Pakistan. Teli Group's extensive business interest includes energy, textile, banking, insurance, security brokerage, real estate, beverages, chemical, IT, etc. This Group wa was among the first to set up captive power generation system in 1988-89 in their textile mills and also among first few Independent Power Producers (IPPs) to respond to the national needs of energy supplies by setting up Gul Ahmed Energy Limited (GAEL) in 1994.

Figure 1.2 Project Location



**Source: IEE Report (2009) and Google Earth*

Table 1.1 Key Components of MPCL WPP

Project Component	Description	Current Status
Wind Farm with 20 WTGs	Wind Farm at Deh Kohistan in Jhimpir spread across 1553 acres	Micro-sittings plan has been completed as per recommendations of M/s Garrad Hassan; MPCL has executed an agreement to sub-lease with the AEDB for 1553 acres of land.
Access roads	The site will be provided 18 km internal road to service the WTGs and 12-13 km dirt approach road from the existing Nooriabad to Jhimpir link road.	The approach road is partially constructed (about 4 km) for two existing projects (up to Fauji Fertilizer Company's Energy Ltd (FFC) wind farm) in the area and remaining about 8 km shall be further constructed. Responsibility for strengthening /construction of both internal and approach roads is with Engineering, Procurement and Construction (EPC) Contractor.
Office and Sub-station	Operations and Control Building and Sub-station in middle of the wind farm in between WTG 10 and 11	No site office currently exists. Responsibility of construction lies with EPC Contractor. Exact location of office and sub-station is not yet finalized.
Transmission Line	22 KV underground electrical collection System leading to the Project Sub-station and Overhead Transmission line from the Project Sub-station to connect to the National Transmission and Dispatch Company (NTDC)/ Hyderabad Electric Supply Company (HESCO) 132 KV system	No work has been started till date. Underground cabling up to the site sub-station is the responsibility of EPC contractor. Any line from the sub-station to the NTDC/HESCO grid is responsibility of the power purchaser i.e. NTDC.

1.3.2 Background to the IEE

Section 12 of the Pakistan Environmental Protection Act (PEPA), 1997 requires that projects generating 50 MW or less of electricity are categorized as Category B[1], Schedule II and require an IEE for environmental approval from the Environmental Protection Agency (EPA), Sindh.

MPCL sanctioned the IEE study to be carried out by a local consultant, "Research and Development Consultants" (R&DC), for establishment of the 50

[1] Details of Categorisation done by ERM is included in the GAP Assessment Report

MW WEP during the Project planning phase in 2009 to meet the following requirements:

- Address the regulatory requirements of responsible provincial authority (i.e. Environmental Protection Agency – Sindh) against the requirement of Pakistan Environmental Protection Act, 1997;
- Be acceptable to Alternative Energy Development Board (AEDB), Private Power and Infrastructure Board (PPIB) and Water and Power Development Authority (WAPDA) as well as the sponsors investing in its establishment and operation;
- Address the Equator Principles applicable to such projects;
- Address the International Finance Corporation (IFC) Performance Standards (2006); and
- Address the International Finance Corporation (IFC)/ World Bank (WB) – Environmental, Health and Safety Guidelines for Wind Energy, 2007.

Based on examination of the IEE study, EPA, Government of Sindh accorded environmental approval to MPCL for the Project through a letter dated 01.06.2009 (***Refer – Annex A***) and which was further extended through a letter dated 24.12.2012 (***Refer – Annex A1***). The requirements of the lenders and InfraCo Asia Development Pte Ltd for the Project necessitate an update of the existing IEE report which represents the scope for the assignment as detailed subsequently.

1.4 OBJECTIVES AND SCOPE OF WORK

The overall objectives of the assignment are to update the existing IEE report and the Environmental Management and Monitoring Plan (EMMP) to make it compliant with the IFC Performance Standards (2012), IFC/World Bank EHS Guidelines and Equator Principles (2006).

The scope of work entails:

- Undertaking a Gap Assessment of the existing IEE study report and develop an Environment and Social Action Plan (ESAP) for the project to implement mitigation measures and prepare a robust monitoring plan;
- Undertaking a stakeholder mapping, and developing Stakeholder Engagement Plan; Labour Management Plan; and Grievance Redressal Mechanism in line with IFC PS requirements for all phases of the project;
- Suggesting suitable mitigation plans for impact to Flora and Fauna;
- Conducting cumulative impact assessment of the planned development in the area with the help of the readily available information through secondary sources and with the help of information provided by the client;
- Incorporating, as applicable, the IFC PS requirements, the requirements included with the IFC guideline general EHS guidelines, IFC sector specific guidelines for Wind Energy and Electric Power Transmission and Distribution;

- As part of ESMP develop/upgrade management plan frameworks for construction, operation and decommissioning phases of the project, which include waste management, traffic safety, noise, occupational and community health and safety during construction, operation and decommissioning phases; and emergency preparedness and response; and
- Developing framework for environmental and social monitoring and reporting.

1.4.1 Approach and Methodology

ERM's approach and methodology is summarized in the following subsections:

Preliminary Discussions with Project Proponent

- Discussions were held with MPCL and Sponsors, to understand the Project, current status of agreements (i.e. land allocation, letter of intent with AEDB, power purchase agreement, electricity generation license etc.), Project milestones, legal requirements and scope; and
- Collation of relevant project documents such as the IEE report, WTG micro-siting and wind assessment report, energy assessment reports, grid study reports, copy of agreements with contractors, organization charts, transportation route plans etc.

Document Review and Gap Assessment

Desk based review of the relevant documents and available imagery of the project site and its surroundings was carried out to have a clear understanding of the Project and its impacts. The desk-based review focused on the following key information (but not limited to) about the Project and the facilities under the purview of the Project:

- MPCL location map, topographic survey Plans,
- DEM survey report by WP consultants;
- Wind assessment report;
- WTG technical specification data, Schedule 35 of EPC Nordex, August 2010;
- Preliminary geotechnical investigation report by Geotechnical Services, February, 2009;
- Energy assessment Report and WTG micro-sitting by GL Garrad Hassan, September, 2011;
- Feasibility study overview report by Sgurr Energy, October, 2011;
- IEE report by Research & Development Consultants, April 2009;
- Proposed bird study plan (Terms of Reference and scope) by MPCL along with Elan Partners Pvt Ltd, December 2012;
- Agreements signed by the client with sub-contractors and other parties;
- Legal documents to establish all applicable legal requirements related to wind power project and licenses/permits applicable to the Project;

- Existing socio-economic studies as part of existing IEE and other study reports in the area;
- Organization structures of sub-contractors and division of responsibilities between various sub-contractors;
- Grid study report by Power Planners International, February 2011; and
- Transmission network layout provided by MPCL.

Gap Assessment

A gap analysis was undertaken for the existing IEE report based on review of the report and documents available for the project and a draft action plan was shared with the Client. The gap assessment report prepared by ERM is attached as ***Annex B***. As the review and gap assessment progressed, ERM identified and requested for additional information.

Primary Consultations and Site Assessment

ERM appointed a local sub-consultant (M/s Tekcellent) to assess the present status at the Jhimpir site and to undertake primary socio-economic data collection and complete limited consultation. The scope of the sub-consultants work included the following:

- Site inspection of the project area of influence: A limited site visit was undertaken by the sub-consultant comprising of environmental, social, ecological experts, to verify the IEE information, identify any other key issues and seek some stakeholder feedback through consultation;
- The duration for the site visits were for 1-2 days and a total of 5 site visits were completed by the team;
- Primarily the site visits were undertaken for validation of the data provided as part of IEE and for conducting stakeholder mapping and some consultation with the community to gauge the response of the community regarding the upcoming project;
- The site visits also helped in closing some of the data gaps and in the development of the associated management plans (labour, stakeholder, community safety etc.);
- During the visit, the following were identified:
    - Key social and environmental risks/receptors in the Project influence area;
    - Human resource and labour issues, inclusive of potential occupational health and safety;
    - Issues of environmental pollution and resource usage;
    - Prevailing community engagement processes;
    - Aspects of community health and safety, if any, linked to the proposed company's operations;
    - Significance of impacts on biodiversity and natural resource management;
    - Discussions with the local communities in the vicinity to understand their view of the project as well as identify any issues on conflicts including current and historical environmental and social concerns.

Note: During discussions with the local communities, it emerged that there are two settlements (Qasim Burfat Goth and Bacho Jhakro Goth) that are located within the MPCL project sites. The socio-economic baseline provides a general assessment of their livelihood profile, however, at the stage of updation of the IEE report, no detailed household survey has been conducted to establish a detailed community profile and assessment of their land use and rights.

Updating the IEE and ESMP

- ERM scanned publicly available information and information collected on reported historical environmental and social issues, to identify possible historical risks and community conflicts;
- ERM also reviewed available reports, information and guidelines to understand cumulative impacts from other similar developments in the region;
- ERM studied the terms of reference for the bird monitoring Report; and
- IEE report was updated to include detailed Environmental and Social Management and Monitoring Plans.

Based on the above studies and reports submitted by the local consultant, ERM updated the IEE to meet the scope of work requirements with the available information.

1.5 LIMITATIONS

This report was written with the objective of updating the existing IEE study report. This was achieved by reviewing the list of documents made available by the client (refer section 1.4.1 –*document review)* limited consultations and site study by local sub-consultants appointed by ERM.

The updated IEE report for the MPCL WEP should be considered along with the following specific limitations:

- **Information Gaps**: Certain information gaps remain for the IEE report. These include documentation and process of consultation and engagement with the local community between 2009 and the present IEE updation in 2013. There also remain certain information gaps pertaining to the exact household profile and livelihood status of the local community residing in the two settlements that fall within the MPCL project site;
- **Scope**: The Scope of the report is to update the IEE conducted in 2009 with the gaps against IFC/EHS requirements. Hence, this report should not be construed as a comprehensive Environmental and Social Impact Assessment;
- **Baseline data**: Primary environmental, ecological and social baseline monitoring was not carried out by ERM. Data from the IEE report of 2009 has been utilized. ERM confirmed the applicability of the 2009 data and

social and environmental sensitivities through local consultants who undertook the site visits.

1.5.1 Uses of the Report

ERM is not engaged in consulting or reporting for the purpose of advertising, sales promotion, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes. Client acknowledges this report has been prepared for their and their clients' exclusive use and agrees that ERM reports or correspondence will not be used or reproduced in full or in part for such purposes, and may not be used or relied upon in any prospectus or offering circular. Client also agrees that none of its advertising, sales promotion, or other publicity matter containing information obtained from this assessment and report will mention or imply the name of ERM.

Nothing contained in this report shall be construed as a warranty or affirmation by ERM that the site and property described in the report are suitable collateral for any loan or that acquisition of such property by any lender through foreclosure proceedings or otherwise will not expose the lender to potential environmental or social liability.

1.6 LAYOUT OF THE REPORT

Section 1 *(this section)* provides an introduction, Project background, objectives, scope of work and methodology adopted, limitations of the IEE study;

Section 2 provides a description of Project and its components;

Section 3 discusses the applicable environmental and social regulatory framework and its relevance for Project;

Section 4 describes the Environmental and Social baseline context of Project;

Section 5 presents the stakeholder engagement and public consultations carried out for the Project;

Section 6 presents impact assessment methodology and identifies potential environmental and social impacts from the Project;

Section 7 analyses the alternatives that have been incorporated into the Project planning and design vis-à-vis impacts identified;

Section 8 provides an Environmental and Social Management Plan for the Project;

Section 9 concludes with overall observations and remarks on implementation of the ESMP.

Annexure

Annex A Environmental approval letter for the Project from EPA, Government of Sindh

Annex A1 Extension of Environmental Approval letter

Annex B ERM's Gap assessment Report

Annex C AEDB Letter of Intent to MPCL

Annex D Electricity generation license

Annex E Representative Site Photographs

Annex F Site sub-lease relevant Provisions

Annex F1 Handover of land

Annex G Ambient Air Quality Details

Annex H Stakeholder Consultation Minutes

Annex I TOR for Bird Monitoring Study

Annex J Shadow Flicker Assessment

Annex K MPCL Corporate Policies (EHS and Code of Conduct)

Annex L Proposed Framework Management Plans

Annex M Photo-documentation

2.1 OVERVIEW

The Gharo wind corridor is located in the south western parts of Sindh province. The wind corridor is located between latitudes 23°48' -25° 41' North and longitudes 67° 16'- 69° 25' East . The corridor is located across Thatta, Hyderabad and Badin districts of Sindh province. The total area of the Gharo wind corridor is approximately 24,450 square kilometres (sq.km). The location of the wind corridor is shown in ***Figure 2.1***. The Inland Jhimpir wind farm site is located between latitudes 25°12' - 25° 02' North and longitudes 67° 51' - 68° 01' East. The land for the development of the wind farms in coastal Gharo covers an area of approximately 102 sq. km whereas for Inland Jhimpir the allocated land area is approximately 157 sq. km.

Figure 2.1 Gharo Wind Corridor

Source: EIA-NBT-III, November, 2012

The MPCL Project site is located in the Inland Jhimpir site of the Gharo wind corridor. As mentioned earlier, AEDB has allocated land to 11 wind independent power producers (IPPS) for wind power generation projects of generally 50 MW each (including allocation to MPCL) in this area.

Box 2.1 and ***Figure 2.2*** provide a proposed layout map showcasing all the IPPs in the Jhimpir Wind Corridor.

Box 2.1 AEDB Allotment to IPPs

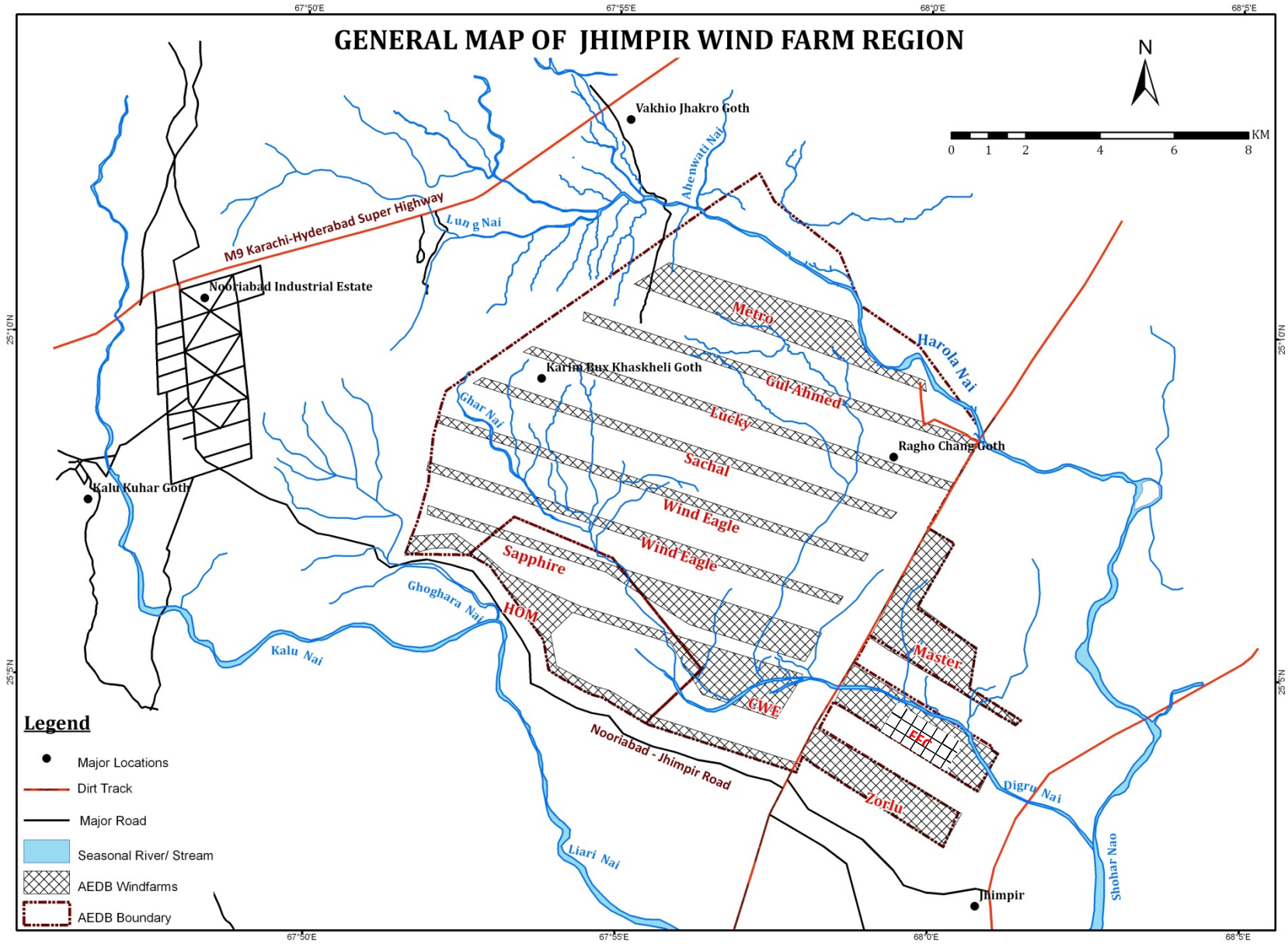
The following IPPs have been allotted land for wind power generation by AEDB in the Jhimpir Wind Corridor:

1. Master Wind Energy Ltd;
2. HOM Energy (Private Limited);
3. Sachal Energy Development Pvt Ltd;
4. Fauzi Fertilizer Company Ltd;
5. Lucky Energy (Pvt) Ltd
6. **Metro Power Co. Pvt Ltd**
7. Gul Ahmed Wind Power Ltd
8. Zorlu Enerji Pakistan Ltd
9. Wind Eagle Ltd. (Technology Plc Ltd)
10. Sapphire Wind Power Company (Pvt) Ltd
11. China Water Energy

Source: Current status of On-Grid wind power generation projects, www.aedb.org, April, 2013

Pre-feasibility studies, feasibility and micro-sitting assessments for number of these projects have already been completed. Zorlu Enerji Pakistan Ltd and Fauji Fertilizer Company Energy Ltd are either close to completing the construction or commenced their power generation. For instance, the 56.4 MW Zorlu Wind Energy Project was developed in two phases as the first internationally financed wind power project in Pakistan.

Figure 2.2 *Map showing eleven IPPs in the Jhimpir Wind Corridor*



**Source: Developed based on Energy Assessment Report by Garrad Hassan, September 2011*

2.1.1 The Project

The Project comprises of development, ownership and operation of a 50 MW WEP by MPCL as IPP. The Project will be in accordance with Government of Pakistan's (GoP's) policy and guidelines on development and generation of alternative or renewable energy, being implemented through AEDB.

AEDB issued the Letter of Intent (LoI) dated May 13, 2006 (Refer-***Annex C)***, against which MPCL took possession of land measuring 1,553 acres on May 6, 2008 and installed two wind masts for recording the meteorological data. Further, MPCL has been granted a generation licence for the WEP on December 26, 2011 with validity up to March 30, 2034 by the National Electric Power Regulatory Authority (NEPRA) (Refer-***Annex D***), Pakistan under Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

The power generated from the Project will be purchased by NTDC, which is responsible for transmission and distribution of electricity in Pakistan. The power collected at the Project sub-station will be evacuated to the NTDC/Pakistan Electric Power Company (PEPCO) grid station at Jhimpir and Nooriabad initially. As per the Draft Energy Purchase Agreement dated April, 2011, Schedule-2, the responsibility of the power evacuation from the Project Sub-station lies with NTDC.

NTDC also has plans to construct a sub-station (initially 132 kV system and upgraded later on to 220/132 kV) approximately 6.5 km away from the windfarm site. No documentation or information on the current status of the planning for the same is available with MPCL or in the public domain.

2.1.2 EPC Contractors

As per the Standard Reference Implementation Agreement, April 2011 between MPCL and AEDB, GoP, MPCL has the responsibility of designing, insuring, financing, acquiring, constructing, completing and commissioning the Windfarm and owning, operating and maintaining the windfarm, in accordance with all applicable laws of Pakistan. To meet the requirements, MPCL has appointed two main contractors, on joint and several basis, for the purpose of construction, commissioning and operations & maintenance (O &M). The contract for Engineering, Procurement and Construction (EPC) has been carried out with:

- Nordex Singapore Equipment Private Limited (NSE);
- Descon Engineering FZE, UAE (DOE);
- Nordex Singapore Service Private Limited (NSS);
- Descon Engineering Limited (DOS); and
- Descon Integrated Project Private Limited (DIPL) hereby jointly referred as "**EPC contractor"**.

The responsibilities of the EPC contractors for the construction and commissioning of the project are represented in ***Table 2.1***.

Table 2.1 EPC Contractor Responsibility

S. No.	Activity
1.0	**Wind Turbine Supply**
1.1	WTGS
1.2	Towers related except as indicated below
	Production of 80 m towers as per Nordex design
	Supply of lower ladders and brackets
	Supply of tower bolts and nuts
	Supply of tower flanges and plates
	Supply of touch up paint and application tools
2.0	**Transportation**
2.1	WTG : Ex-works to main Sea port Germany
2.2	At main Sea port Germany
2.3	From Sea port Germany to destination port Pakistan
	Loading to trailers
	Port and custom Clearances
2.4	WTG transportation from port of destination to Site
	Road survey
2.5	WTG transportation to site
	Storage
	Repair works if required
	Verification of underground utilities
	Crop damage compensation during transportation due to reasons attributable to contractor
	24 hr security at laydown areas
	Inspection of shipment on delivery at site
2.6	Tower Transportation related
2.7	Other transportation
	Transportation of lower service lifts and installation
	Transport of GSUs, RMUs, power cables and other internals
3.0	**Site Balance of Plant**
3.1	Civil Infrastructure related
	Specification and dimensions of temporary storage area
	WTG foundation review
	WTG foundation anchor cage installation
	Inspections
3.2	Electrical Infrastructure related
	Designing o sub-station, switchyard, drainage system, earthing system, design reviews
	Specifications for fiber optic cables for substation SCADA and communication system
	Foundation design
	Procurement and Supply related
	Construction related as security fence, water tanks, switch gear, RMU housing, earthings, foundations of generator setup
	Construction related design approvals
	Installation and erection
	Design of SCADA system
	Earthing and grounding
	Testing Pre-commissioning
	Fiber optics related to SCADA
	Protection and controls
4.0	**Installation**
4.1	Tower installation related
4.2	Nacelle installation

S. No.	Activity
4.3	Rotor (blades and hubs) installation
	Supervision
4.4	Converter installation
	Supervision
4.5	Other installations
5.0	**Site commissioning and testing**
	Commissioning of substation and switchyard
	Other commissioning
6.0	**Project Management**
6.1	Planning and coordination
6.2	Project site responsibilities
	Meals and accommodation for Nordex staff
	Site security -24 hours for site staff

Source: Schedule 40 EPC Division of Responsibilities Document

2.1.3 Operations & Maintenance (O&M)

The contract for O & M services and supply has been carried out with (a) Nordex Singapore Service Private Limited (Off shore contractor) and (b) Descon Engineering Limited (On-shore contractor), on joint and several basis, hereby referred jointly as O & M contractor. The responsibilities of contractors for the O& M phase is represented in ***Table 2.2.***

Table 2.2 O & M Contractor Responsibility

S. No.	Activities
1.0	**Maintenance**
1.1	Maintenance and service for WTGs
1.2	Supply of spare parts
1.3	Maintenance and services for BOP
1.4	Maintenance of spares, consumables and tools
1.5	Provision of crane for maintenance
2.0	**Service**
2.1	Provide technical assistance and guidance
3.0	**Operation**
3.1	Provide remote monitoring
3.2	Operation of the WTGs

Source: Schedule 40 O & M Division of Responsibilities Document

2.2 PROJECT SETTING

2.2.1 Site Setting

The site for the MPCL WPP is located in the wind corridor of Gharo-Keti Bandar under the Union administration of Jhimpir in Deh Koshitan 7/1, Taluka and District Thatta in Sindh Province of Pakistan. It is approximately 140 km to the northeast of Karachi City. The site can be accessed from the Karachi - Hyderabad Super Highway M-9 at 55 km to Hyderabad.

The project site is a narrow area which runs approximately 8.5 km in length and 1 km in width from northwest to 0.25 km in southeast. The MPCL boundary is demarcated by the coordinates as given in ***Table 2.3***. The Wind farm is spread across 1,553 acres land is mostly arid stony wasteland with

rocks, sand and gravel. The terrain at the site and surrounding area has elevations varying in between 60 m in the southeast to 120 m in northwest.

Box 2.2 MPCL WEP Site Boundary Surroundings

- North- Unsurveyed land Nalla Horola Nai and mountain
- South - Boundary of another Wind farm Gul Ahmed Wind Power Limited (GAWPL) owned by the same group as MPCL
- East - Horola Nai, local village Janoo Burfat Goth and unsurveyed land on the far east
- West - Layari Nai and Sui southern gas pipeline and Emirate Sheep Farm further west

Source: IEE Report, 2009 and site visit February-March 2013

Table 2.3 MPCL WEP Site Boundary Coordinates

S. No.	Longitude	Latitude
1	25° 09′ 12.60″	67° 59′ 56.20″
2	25° 10′ 44.42″	67° 55′ 13.64″
3	25° 11′ 03.75″	67° 55′ 47.34″
4	25° 10′ 12.99″	67° 58′ 42.62″
5	25° 09′ 39.05″	67° 59′ 02.94″
6	25° 09′ 22.03″	67° 59′ 54.44″
7	25° 09′ 12.60″	67° 59′ 56.20″

Source: IEE Report, 2009 provided by MPCL

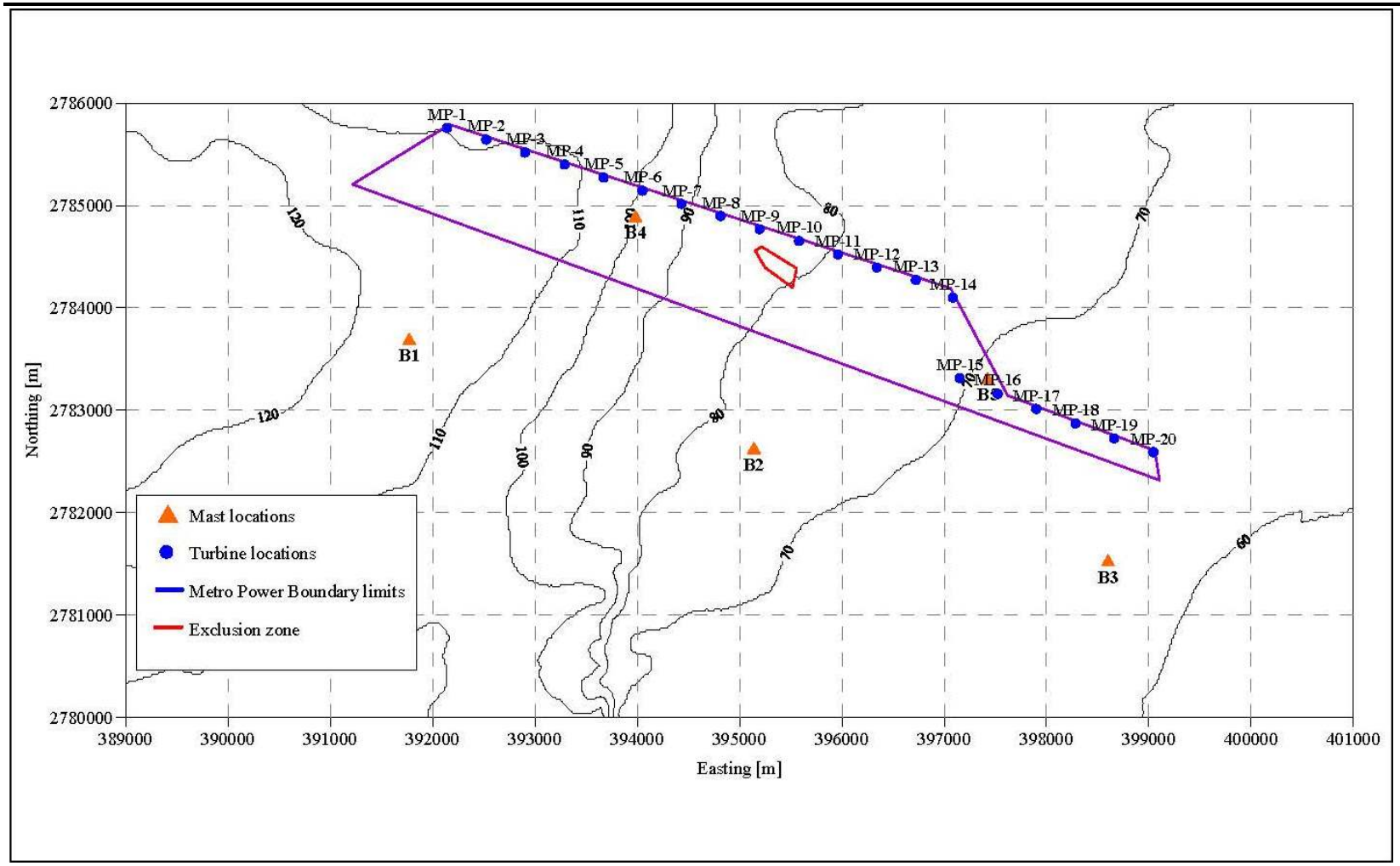
As per the Energy Assessment Study Report, 2011 by Garrad Hassan and Partners, the micro-sitting locations of the 20 WTGs along with the performance data are given in ***Table 2.4***and ***Figure 2.3***. The key site features of individual WTGs with the surroundings are provided in ***Table 2.5*** and a Google imagery of the WEP is given in ***Figure 2.4.*** Photographs of WTGs surrounding in all four directions is presented in Annex ***E.***

Table 2.4 MPCL Micro-siting UTM Coordinates with Performance Data

Turbine	Easting (m)	Northing (m)	Initiation Mast	Long Term wind speed at hub height (m/s)	Energy output (Gwh/annum)	Wake loss (%)
WTG-1	392140	2785759	B4	7.8	8.4	4.0
WTG-2	392524	2785643	B4	7.8	8.2	6.4
WTG-3	392904	2785516	B4	7.8	8.2	7.0
WTG-4	393290	2785398	B4	7.8	8.1	7.8
WTG-5	393671	2785271	B4	7.8	8.1	7.6
WTG-6	394051	2785143	B4	7.8	8.1	7.8
WTG-7	394432	2785015	B4	7.8	8.0	8.0
WTG-8	394815	2784897	B4	7.7	8.0	8.0
WTG-9	395196	2784769	B4	7.7	7.8	7.9
WTG-10	395581	2784653	B4	7.7	7.8	8.5
WTG-11	395961	2784523	B5	7.6	7.7	8.5
WTG-12	396341	2784395	B5	7.6	7.7	8.2
WTG-13	396723	2784273	B5	7.6	7.6	8.3
WTG-14	397086	2784101	B5	7.6	7.6	8.6
WTG-15	397152	2783315	B5	7.5	7.2	11.7
WTG-16	397523	2783161	B5	7.5	7.3	10.7
WTG-17	397900	2783014	B5	7.5	7.4	10.0
WTG-18	398283	2782874	B5	7.5	7.4	10.5
WTG-19	398661	2782727	B5	7.5	7.3	11.0
WTG-20	399044	2782592	B5	7.5	7.3	10.3

Source: Energy Assessment Report by Garrad Hassan, September 2011

Figure 2.3 MPCL Micrositing Map



Source: Energy Assessment Report by Garrad Hassan, September 2011

Note: Exclusion zone represents that no WTGs will be installed as this area consists of human settlements such as Qasim Burfat Goth and Bacho Jhakro Goth.

Table 2.5 WTG Specific Site and Surrounding Features

WTG	Type of Land	Landuse	No. of Trees	Nearest settlement	Distance from WTG	Topographic Profile (~ within 500 m)			
						North	East	West	South
MP-1	Flat	barren	5~10	Bacho Jhakro Goth (situated within MPCL Project site boundary)	550	Slope down	Slope down	slope down	mounds
MP-2	Hilly	vegetation	10~20		650	Slope down	flat	undulated	mounds
MP-3	Flat	vegetation	40~50		670	Slope down	flat	slope down	Slope down
MP-4	Hilly	vegetation	20~30			Slope down	Slope down	mounds	mounds
MP-5	Hilly	barren	10~20			mounds	Slope down	mounds	mounds
MP-6	Flat	barren	5~10			mounds	flat	mounds	flat
MP-7	Flat	barren	5~10			flat	Slope down	undulated	undulated
MP-8	Flat	Slight vegetation	1~2			flat	undulated	undulated	flat
MP-9	Flat	Slight vegetation	1~2	Qasim Burfat Goth (situated within MPCL Projecty site boubdary)	445	flat	flat	flat	flat
MP-10	Agriculture	bund	>100		345	flat	flat	undulated	Slope down
MP-11	Flat	barren	50~60		590	flat	flat	undulated	flat
MP-12	Flat	barren	10~20			flat	undulated	undulated	undulated
MP-13	Agriculture	bund	60~70			flat	Slope down	flat	Slope down
MP-14	Flat	barren	0~1			flat	undulated	mounds	flat
MP-15	Flat	barren	1~2			flat	undulated	flat	Slope down
MP-16	Flat	barren	1~2			Slope down	Slope down	undulated	undulated
MP-17	Flat	barren	4~5	Janoo Burfat Goth (situated outside MPCL Project site boundary)	840	flat	flat	undulated	mounds
MP-18	Flat	Slight vegetation	15~20		900	undulated	flat	mounds	flat

WTG	Type of Land	Landuse	No. of Trees	Nearest settlement	Distance from WTG	Topographic Profile (~ within 500 m)			
						North	East	West	South
MP-19	Flat	Slight vegetation	40~50			Slope down	Slope down	flat	flat
MP-20	Flat	Slight vegetation	40~50			Slope down	Slope down	flat	undulated

**Source: Primary Information from Site Visit in February and March 2013*

Note: This table captures the WTG site and its immediate vicinity up to 1 km especially with respect to settlements.

Figure 2.4 Satellite imagery of the MPCL Project Boundary

Source: Google imagery dated 8th April 2011

2.2.2 *Land Requirements*

The wind farm will be spread across 1,553 acres of land in Jhimpir which shall be sub-leased to MPCL by AEDB and leased by Government of Sindh (GoS) (***Refer Annex F***) as provided in the document on "agreement to lease" dated May 6, 2008 (Refer- ***Annex F1***). The site sub-lease deed is yet to be executed between AEDB and MPCL. AEDB will sign the actual lease document referred to as the "Site Sub Lease Deed" (pro forma has been attached to the agreement to lease) together with the signing of the Energy Purchase Agreement with NTDC.

The individual WTGs will require about 2.5 acres of land for each footprint. Thus, for the 20 WTGs, the actual land utilization is likely to be approximately 50 acres out of the total of 1,553 acres allotted by MPCL. In addition, during the construction phase, land will be required for assembly, warehouse and storage requirements of the EPC contractors. For the Operations and Maintenance phase, additional land may be utilized for the site office, control room etc. Other components for the land requirement include the access road for a length of about 18 km internal road to service the WTGs (~17.5 acres) and the sub-station (~5-10 acres).

2.3 *PROJECT COMPONENTS*

2.3.1 *Wind Farm*

The WEP will comprise of 20 WTGs of the Nordex N100/ 2500 aggregating to 50 MW. Each WTG will have a hub height of 80 m with a rotor diameter of 99.8 m and a tubular steel tower structure. The rotor speed will vary in between 9.6 to 14.9 rpm. A brief technical specification of Nordex N100 /2500 is given in ***Table 2.6*** and ***Figure 2.5.***

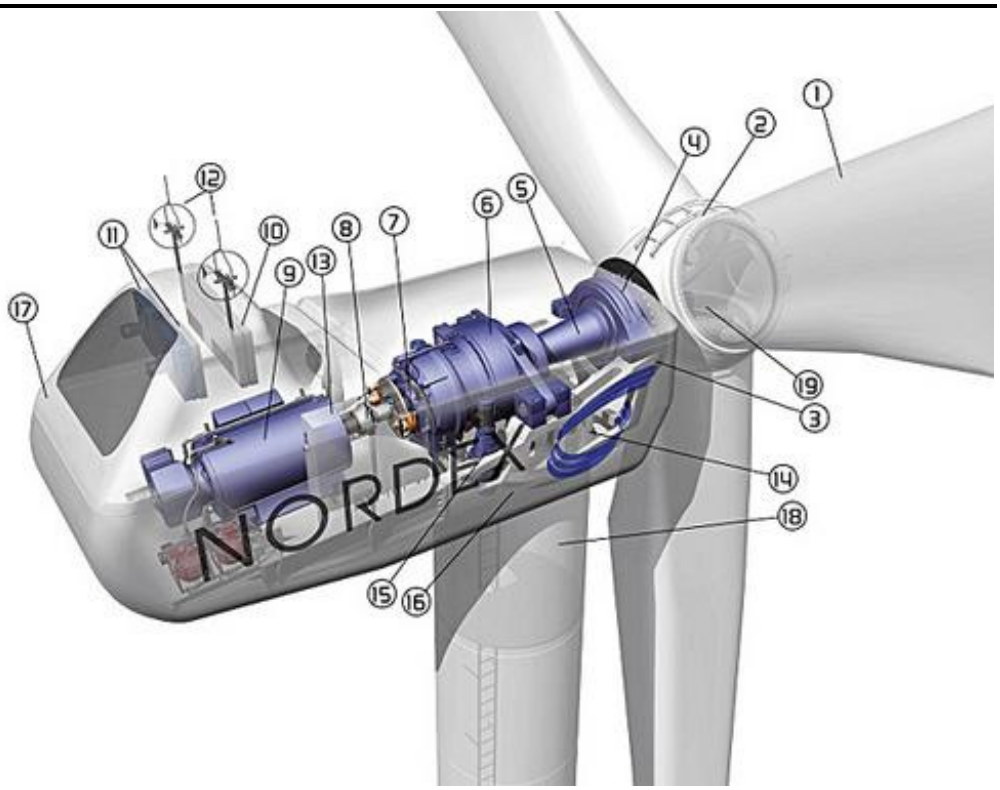
Table 2.6 Technical Specifications Nordex N100/2500

S.N	Components	Specifications
1	Operating data	
	Rated power	2,500 kW
	Cut-in wind speed	Approx. 3 m/s
	Cut-out wind speed	20 m/s
2	Rotor	
	Diameter	99.8 m
	Swept area	7,823 m²
	Operating range rotational speed	9.6 - 14.85 rpm
	Tip speed	Approx. 77 m/s
	Speed control	Variable via microprocessor
	Over speed control	Pitch angle
3	Rotor blade	
	Material	Glass-reinforced plastic
	Total length	48.7 m
	Total weight per blade	Approx. 9.8 tons
4	Gearbox	

S.N	Components	Specifications
	Type	Multi-stage planetary +one-stage spur gear or linkage with differential gears
	Nominal power	2775 kW
5	Generator	
	Construction	Double-fed asynchronous generator
	Cooling system	Liquid/air cooling
	Voltage	660 V
	Grid frequency	50/60 Hz
6	Control	
	Control centre	Programmable Logic Controller (PLC) controlled
	Grid connection	Via Insulated Gate Bipolar Transistor (IGBT) converter
	Distance control	Remote controlled surveillance system
7	Brake system	
	Main brake	Pitch angle
	Secondary brake	Disk brake
8	Lightning protection	Fully compliant with EN 62305
9	Tower	
	Construction	Tubular steel tower
	Rotor hub height/Certification	80 m/IEC 2a

Source: EPC Schedule 35

Figure 2.5 Typical diagram of Nordex Turbine



1.Rotor blades 2. Hub 3.Turbine Frame 4. Rotor bearing 5. Rotor Shaft 6.gear box 7. Disk Brake 8. Generator Coupling 9.Asynchronous generator 10. Cooling radiator 11.Fan coolers 12. Wind measuring system 13. Turbine Control system 14. Hydraulic system 15. Yaw Drive 16. Yaw bearing 17.Nacelle Cover 18. Tower 19. Pitch System

Source: http://www.power-technology.com/projects/crystal-rig/

According to the Garrad Hassan Energy Assessment Report (September 2011), the micro sitting has been undertaken on the basis of the computational optimisation of turbine spacing to maximize the energy output and optimize land utilization, i.e.

- 4 rotor diameter spacing between turbines within a row; and
- 8 rotor diameter spacing between rows in the prevailing wind direction.

As per the technical specifications of EPC contract, based on limited geotechnical data available, the WTG can be supported over shallow foundations. The foundations will be on concrete with suitable cement type Ordinary Portland Cement (OPC) or Sulphur Resistant Cement (SRC).

The wind farm site will also comprise of project infrastructure facilities, i.e. a SCADA station; workshop, a central lay down area (store yard which will be graded and fenced); site office; underground internal evacuation lines connected to the sub-station, ware house (including space for spare parts, mechanical workshop, electrical workshop covering 300 m^2 and height 5 m), dormitory for on-site staff (covering 172 m^2) and internal access roads to each WTG location.

2.3.2 Access Road

The Project site is about 5 km from the super highway connecting Karachi and Hyderabad at 55 km from Hyderabad. Access to the site is possible via an existing asphalt link road from the super highway, which passes through the industrial estate of Nooriabad. This link road is called Nooriabad-Jhimpir road. The road is asphalted up to approximately 12 km and rest 12 km is dirt track before reaching the Zorlu WEP site. From the Zorlu site another 12 km dirt track connects the MPCL site to the Norriabad-Jhimpir Road. This dirt track will require construction of 3 culverts and one long bridge besides considerable up-gradation of the dirt road to enable it for movement of heavy machinery during the construction phase of the Project. About 9 km of this dirt track would be shared with neighbouring GAWPL wind farm while 2-3km will be improved by MPCL. As the dirt track is also being used and will be used by other wind farms in the area, MPCL may jointly maintain certain sections of the dirt track road along with other wind developers.

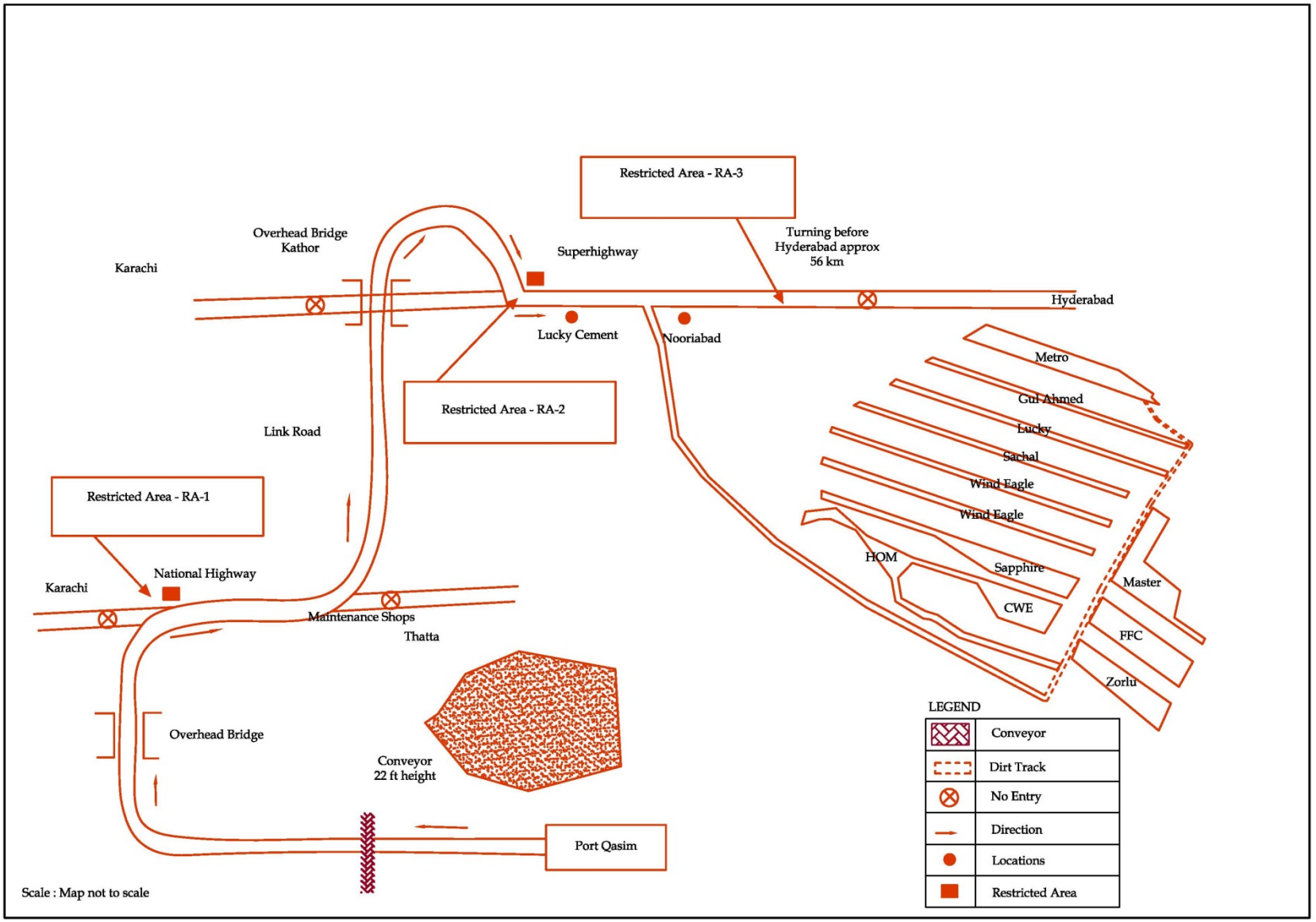
As per the technical specifications of the EPC contract, the total length of access road to be prepared will be from the public road to the Project site 12 km and width shall be 6 m. Besides roads construction of lay-byes are also required for smooth movement of heavy transport vehicles. About 18 km of internal road with width of 13 m is expected to be prepared for access to each WTG and sub-station. The contract for road construction has been given to EPC contractor.

It is understood that the land ownership for the stretch of access road from Jhimpir up to the project site is with the AEDB under master lease agreement with Government of Sindh that is to be used by all other wind energy projects in the area.

Equipment, supplies and personnel will move in and out from the site using the access road and the Super Highway M-9. Heavy vehicles carrying the

wind turbines and necessary equipment will operate from Port Qasim and take the Super Highway M-9 for onward journey to the site via the Nooriabad-Jhimpir link road (Refer ***Figure 2.6***). Further the link road will be connected to the site via the 12 km dirt road which will be upgraded to take the heavy load of towers (162 tons –transported in 8 sections), rotor blades (60 tons), turbines (Nacelle 82 tons), machinery and equipment. The access road to the MPCL site is shown in ***Figure 2.7.***

Figure 2.6 Transportation Route to MPCL Project Area from Port Qasim



Source: Modified from Route plan by Jehangir Services Pvt Limited and discussions with MPCL

Figure 2.7 Google imagery of Access Road

Source: Google Imagery dated April, 2011

2.3.3 Substation and Transmission Line

The electrical grid study for power collection and evacuation from the Project has been planned and designed by Power Planners International Ltd (PPI).

As per technical specifications of EPC contract, a 132 kV substation will be built within the wind farm area to transform the internal grid voltage level of 22 kV to 132 kV. The EPC contractor's scope is comprised of 132 kV Sub-station and 22 kV collection system including design, manufacturer, factory testing, delivery, installation, testing and commissioning.

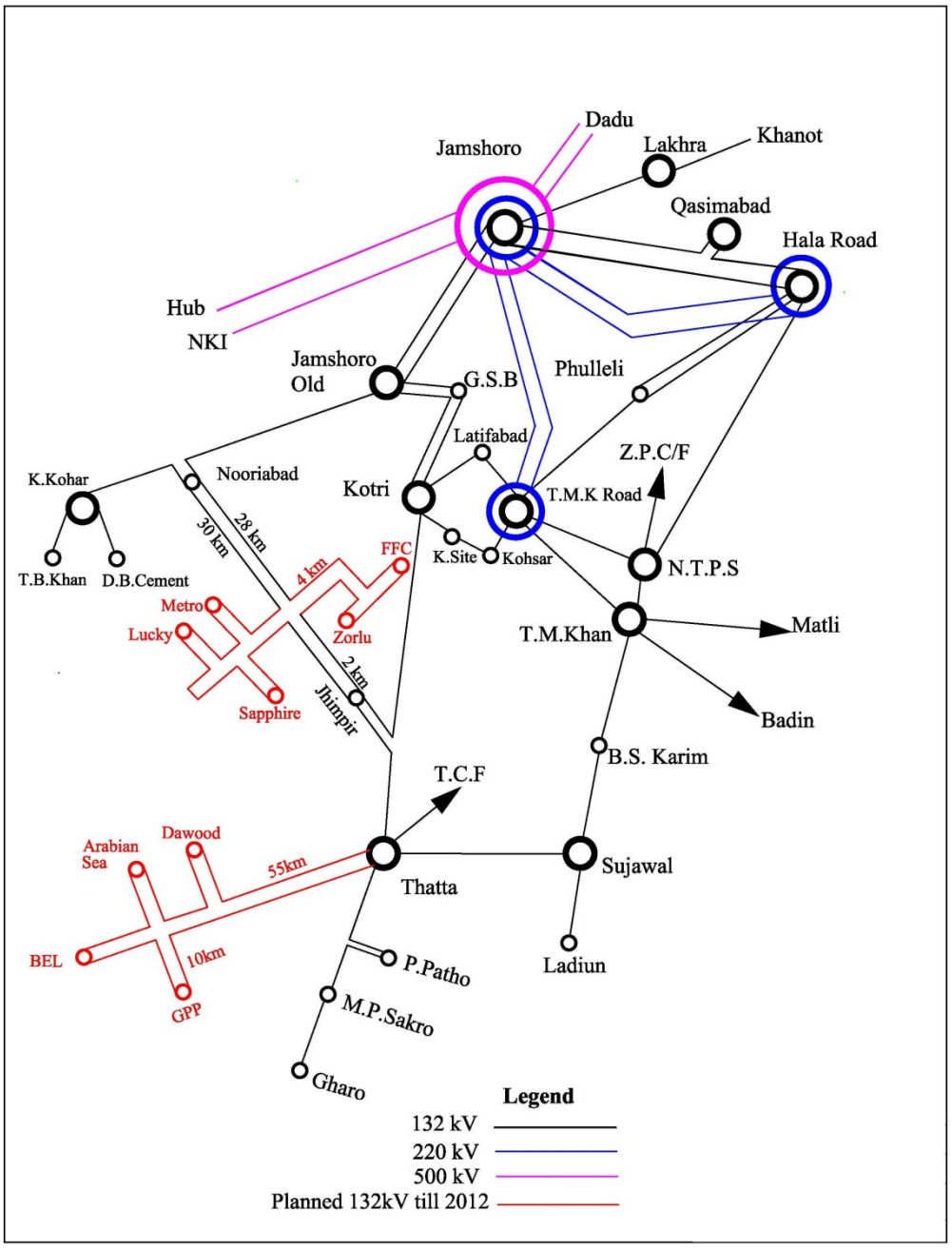
The sub-station for pooling of power from the WTGs will be built in between the 10 and 11th WTG close to south western edge of the MPCL site boundary. It will be about 550~600 m away from the Qasim Burfet village which is approximately also the middle of the wind farm. This was selected based on optimal interconnection between the wind farm substation and NTDC grid station. There will underground cable system of about 11 km for connection from the WTGs to the wind farm pooling sub-station.

Construction and commissioning of the power evacuation system from the wind farm sub-station is the responsibility of the power purchaser i.e. NTDC.

To connect the MPCL wind farm to the main grid of NTDC / Hyderabad Electric Supply Company (HESCO), the nearest 132 kV grid sub-station is at Jhimpir. However, as per the PPI report, Jhimpir sub-station may not be able to support the load. There is also a grid station at Nooriabad and connection of MPCL may be undertaken by looping in-out of existing Jhimpir-Nooriabad 132 kV single circuit. Other wind farms such as Fauzi Fertilizers Co. (FFC) and Zorlu Energy Pakistan Limited (ZEPL) are expected to be in commercial operation prior to MPCL WPP, and would be connected to the grid by looping in-out of Jhimpir, Nooriabad 132 kV double circuit. The same will be carried out for the MPCL WPP until the subsequent option comes up. The interconnection layout for power evacuation is shown in ***Figure 2.8.***

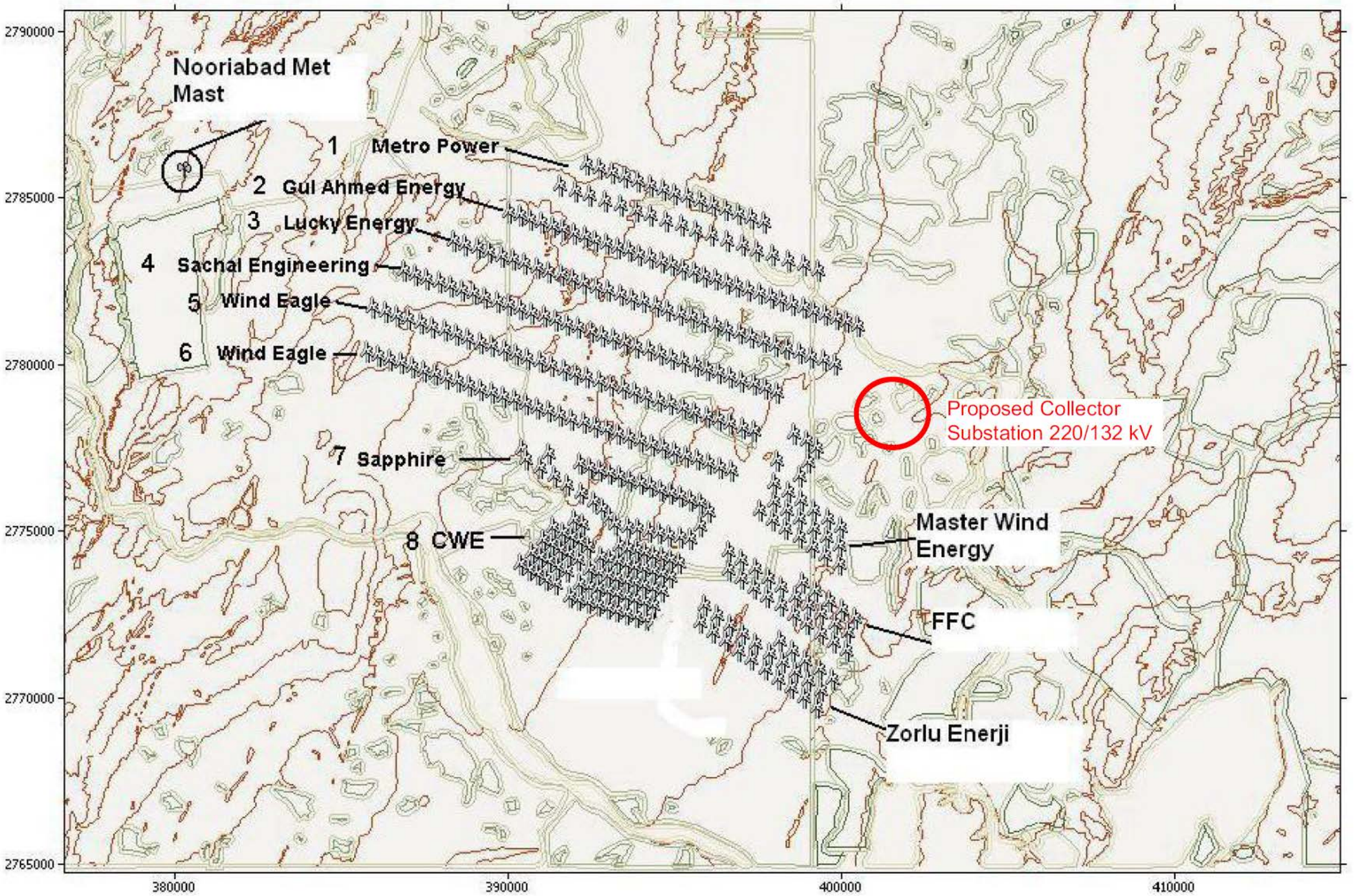
As per the Electric grid study report by PPI, with more wind farms coming in the area, a preferable solution would be to build a collector substation of 220/132 kV somewhere at a central location in the Jhimpir Wind Cluster; and then to connect MPCL WPP and the other wind farms in the same vicinity, with this collector substation. The proposed site of the collector station is indicated in ***Figure 2.9.*** The connection of the collector substation should be by looping in-out of the double circuit Jhimpir-Nooriabad 132 kV at collector substation. This scheme would also provide more reliable operation and control of generation from Wind Farms with the main grid.

Figure 2.8 Interconnection of MPCL WPP for power evacuation



Source: Electric Grid study report by PPI, February 2011

Figure 2.9 Proposed Site of NTDC Sub-station



Source: Electric Grid study report by PPI, February 2011

2.4 SUMMARY OF PROJECT ACTIVITIES

The project activities can be divided into four phases as follows: (a) Planning and Preconstruction; (b) Construction; (c) Operations & Maintenance; and (d) Decommissioning.

2.4.1 *Planning and Preconstruction Phase*

The pre-construction phase has four components:

- Identification of land area and site;
- Site surveys as topographic, geo-technical investigations, micro-siting studies, electrical grid studies etc.; and
- All necessary approvals/clearances
- Design and finalization of contractors**;**

MPCL in 2008 installed two 80 m masts and GAWPL (sister concern windfarm also owned by same client) adjacent to MPCL installed three, 80 m masts for wind measurement. M/s Garrad Hassan was engaged in 2010 to undertake the wind resource assessment and micro-sittings on the basis of data from these masts as well as other masts installed for neighbouring wind farms. Micro-sitting locations were identified based on wind resources data and energy modelling. M/s PPI was engaged in 2010 to analyse and design the power evacuation process.

The process of obtaining LOI from AEDB, taking over land from AEDB, obtaining generation license from NEPRA, environmental clearance from EPA were key component of the planning and pre-construction phase.

Preconstruction activities on the wind farm site also include site development activities, which have not yet commenced. These are likely to include:

- EPC contractor mobilisation;
- Upgrading/construction of access roads;
- Updating of detailed topographic survey of the site, incorporating as built information;
- Detailed geotechnical investigations;
- Clearing of vegetation form identified areas, and
- Mobilization of labour and equipment.
- Construction of concrete batching plant foundation.

2.4.2 *Construction Phase*

For the wind farm site, typical construction activities will include:

- Site clearance activities as excavation, piling and filling;
- Construction of auxiliary facilities such as camp site, equipment and supplies storage areas, water tank and water pits, fuel storage areas and waste pits.

- Construction of dormitory for 5 officers/technicians with total covered area of 172 m^2 with kitchen and mess facility etc.;
- Transportation of equipment including towers, blades, turbines, supply materials and fuels;
- Construction of turbine foundations and crane pad at each WTG location;
- Construction of foul water drainage, underground water reservoir;
- Installation of outdoor lightening, security fence and gate;
- Operating cranes for unloading and installation of equipment;
- Construction and installation of sub-station;
- Safe disposal of all construction debris and excavated earth
- Installation of the electrical collection system – underground and some overhead lines;
- Turbine testing to verify proper operation of the facility; and
- Commissioning.

2.4.3 Operations and Maintenance Phase

The design life of MPCL WEP is expected to be 20 years from the date of commissioning. The contract for O&M services and supply has been carried out with (a) Nordex Singapore Service Private Limited (Off shore contractor) and (b) Descon Engineering Limited (On-shore contractor) on join and several basis. The O&M agreement has been completed for 8 years post expiry of warranty period for the various parts of the turbine.

In-house as well as outsourced O&M activities will be carried out by trained staff for maintaining the availability of wind power and high performance.

The activities for the operations and maintenance phase will involve:

- Regular remote monitoring of the operations;
- Normal greasing and cleaning activities;
- Annual shut down for maintenance which will mostly include cleaning and greasing, change of parts etc.; and
- Internal road repairs, as and when required.

2.4.4 Decommissioning Phase

On the basis of the Master Lease Agreement between the Government of Sindh and the AEDB (2008), the 1,553 acres of land is to remain with the AEDB for a period of 30 years from 2008-09. The wind farm site, after having remained in operation for the lifecycle, estimated at 20 years will not lose its value as a wind power generation system. Its performance would on the other hand enhance the value of the site as a wind farm. This would demand upgrade rather than disposing of the plant and equipment or abandoning the site. It is anticipated that the existing WTGs would be replaced with a better system that may have developed in the future. Old towers and turbines may need replacement and would be sold as scrap, as appropriate.

If the site is to be abandoned after completion of the designed plant life or much before the designed plant life of 20 years, decommissioning will be initiated by dismantling the turbines, supporting towers, O&M building / sub-station, and transporting them out of the project area. It is expected that this activity will take approximately 6 months and will require about 300 heavy haul trucks (60-feet size) for the turbine components in addition to 600 truckloads of other materials. The turbine components will be sold as scrap. All scrap will, as per practice in Pakistan, be recycled to be refurbished.

The concrete will be broken up and removed to a landfill site. The stored fuel and oil, together with the containers, will be transported out of the site for sale . The site road embankments, if any, will be levelled and the material spread evenly over the whole site. Chances are that the embankments may have become regularized and may be used by the villagers. The site will, otherwise be restored as far as possible to its original condition. The access roads may be left intact, since local communities may have started to use them. If not, they too will be dismantled and the land returned to its original condition.

2.5 *RESOURCE REQUIREMENTS*

2.5.1 *Manpower*

Construction Phase

It is estimated that direct manpower required during the construction phase will be about 600. About 100 support staff will be present in addition to the above including technical, administrative and security. Expatriate workers are not expected to be on site. Unskilled jobs will be offered mainly to the local people particularly during the construction phase.

Camp Site

- Construction labour will be accommodated in camps established at a suitable sites identified by the Project Manager.
- The construction campsite will cover an area of about 2.47 acres (10,000 m^2) a with capacity for 600 personnel as it is understood that only unskilled workforce will be available in the local area. The camp sites would accommodate 4 construction trailers and 4 equipment storage trailers. There will also be vehicle parking and equipment staging areas.
- The camp would have living accommodation, mess and kitchen, prayer room, bathrooms and toilets, recreational facilities, fuel storage, water storage etc. The camp would have its own power generation arrangements in the form of diesel generators.
- Campsite facilities would include supply of safe drinking water; drainage, sewerage, and septic tanks.
- The water storage tank will be lined with an impervious liner to prevent seepage and loss of water.

- The wastewater from campsite will be discharged into sewerage lines and from there to septic tanks followed by soak pit system. The quality of effluent discharged into soak pit system will be monitored for its Bio-chemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) level**.**

Dormitory

- Site staff (5 officers/ technician) monitoring construction activities will be accommodated in Dormitory with total covered area of 172 m^2 with kitchen and mess facility etc.

Operations Phase

- A maximum of 10 persons per shift in addition to the security staff (approximately 20-23) will be working at the wind farm during the O&M phase;
- Accommodation shall be maintained at Nooriabad or Jhimpir for shift staff.
- The O&M Contractor shall provide the security personals needed as per requirement at the site.
- An average of 2 staff vans and an ambulance will be kept at the site to meet the transportation and emergency needs.

2.5.2 Water Requirement

Construction Phase

An estimated 200,000 m^3 of water will be required for civil works during the entire construction phase. The daily maximum will be around 40 m^3 of water for civil works. This water will be supplied by water tankers from a Kalri Baghar Feeder at Jherruck..

The construction camp will require 10 m^3 of potable water each day on-site stored in tanks. Potable water from the Nooriabad/ Jhimpir Pumping Station will be used for the camps. Water for other requirements as washing etc will also be obtained from the Kalri Baghar Feeder by tankers.

Table 2.7 Water Requirement during construction phase

S. No.	Area	Quantity m^3/day	Source
1	Construction	40	Kalri Baghar feeder by Tankers
2	Camp requirement (other purposes as washing etc)	10-15 (considering regular and Peak requirement)	Kalri Baghar feeder byTankers
3	Potable water	10	Nooridabad/Jhimphir Pumping stations

Operation Phase

1-1.5 m^3 per day of water will be required during the O&M phase. This will be obtained from Nooriabad and stored in a tank on-site. Packaged potable water would also be obtained from Nooriabad for meeting the requirements of 20 persons.

Conservation of Water

The wind farm facility as well as campsite will keep the scarcity of water in the region in view, and adopt recommended methods to reduce the usage of water, and use recycled water as much as possible. The wind farm on the 1,553 acre leased area slopes towards Harolo Nai and thus forms the drainage area of the Jhimpir wind corridor. Detailed design of the Project may consider diversion of the surface flow from the constructed areas through the natural drainage system into the field for vegetation of the otherwise barren land however, with care not to disturb the drainage pattern in the area.

2.5.3 Supplies

Construction Phase

All supplies, both for construction and for the camp, will be transported by trucks from Hyderabad or Karachi. This will include all fuels and oils, drilling requirements, spare parts for construction machinery and food and supplies for construction camp. A catering company will be contracted to supply the requirements for the campsite. The details of the construction materials required during the construction phase and their source is shown in ***Table 2.8.***

Table 2.8 Details of Materials required and their source during Construction Phase

S. No.	Material	Source
1	Soil	Hub crusher area
2	Aggregates	Hub crusher area
3	Cement	Govt. approved dealer from Karachi /Hyderabad
4	Re-bar steel	Govt. approved dealer from Karachi /Hyderabad
5	Structural steel	Govt. approved dealer from Karachi /Hyderabad
6	Water	Kalri Baghar feeder through Tankers

Source: IEE Report, 2009

Operations Phase

All supplies, both for operational requirements and for the site staff, will be transported by trucks from either Karachi or the adjacent areas e.g. Kotri or Hyderabad. This will include all fuels and oils, spare parts required for maintenance and food and supplies for the site staff.

2.5.4 *Fuel requirement and Storage*

Construction Phase

The onsite fuel requirement during construction will be about 1 million liters which shall be met by tanker trucks. Onsite storage of fuel will be limited to daily requirements and an onsite storage tank of 20,000 liters (on storage wheels) will be provided under due safety and security conditions for the daily on-going activities.

The onsite delivery of fuel or lubricant will be at designated location that will have an impervious base, with a dyke around to contain spills in case an accidental spill occurs.

Operations Phase

There will be above ground storage facility for 1,800 liters of fuel. Fuels and oils will be unloaded in designated areas and stored in the tank.

2.5.5 *Power Requirement*

Construction Phase

The expected maximum requirement of electricity for construction and the camp is estimated at 1000-1,500 KVA approx. Diesel generators will be used for power generation to operate the construction equipment and for the camp.

Operations Phase

Two small capacity, 200KVA and 100 KVA diesel generators, shall be installed for emergency power supply for the essential loads. The diesel emergency generators will be operated only as back-up.

2.5.6 *Pollution Control*

Construction Phase

A) Air Emissions during Construction Phase

There will be potential impact on air quality due to onsite construction activities. The likely emissions from construction activities would include the following

- Fugitive emissions from site clearing, digging, filling, material handling, transportation, use of construction machinery etc.;
- Fugitive dust emission from the dirt road;
- Vehicular emission from increased traffic volume from vehicles used for transport of construction material onsite; transportation of WTGS and accessories;
- Emissions from operation of emergency power diesel generators for construction purposes. The daily fuel requirement will be about 3500 liters. .

- Emissions from the generators will be controlled by ensuring that the engines are always properly tuned and maintained, and the generators are so located that emissions are dispersed away from the camp and work areas; and
- Provision of adequate stack height.

Operations Phase

DG sets and emissions

Under normal operations there will be no gaseous emissions from the operating areas. Two small capacity diesel generators 200 and 100 KVA shall be installed for emergency power supply for the essential loads.

B) Wastewater Management

Construction Phase

- The liquid effluents generated during the construction phase will include domestic sewage and grey water from camp operation;
- As part of the site preparation stage, a drainage and sewerage system will be constructed for the camp. The sewerage system will consist of soak pits for the collection of waste water from the camp kitchen and washing / ablution areas. Sewage from the toilets will go into lined septic tanks. Sewage disposal trucks will be used to periodically remove the sludge, sewage from the site;
- The grey water from kitchens and washing areas will be directed to separate soaking pits;
- The parking area and workshop at the campsite will have a slop tank system to minimize the spread of oily drip; and
- Slop/waste oil will be collected in containers and sold/given to contractors for recycling/suitable disposal.

Operations Phase

- The drainage and sewerage system constructed during the construction phase will be used during the operations phase of the project i.e. soak pits for the collection of waste water from kitchen and washing / ablution areas and septic tanks for sewage from the toilets.
- The operation phase may also generate small quantity of oil/oily water during the maintenance of pumping stations. This will be treated in oil/water separators**.**

C) Storm Water Management

- Storm water runoff from the campsite will be suitably diverted through a storm water drainage system into an existing surface drainage in the area next to the site.

- During operations phase, storm water runoff from the constructed areas of the wind farm will be harvested and diverted for irrigating the surrounding open area/provided to the villagers.

D) Waste Management

Construction Phase

The solid waste generated by the project will consist of construction camp waste, garage waste, metal scrap, and excess construction materials, the main types of waste that will be generated and sources are shown in ***Table 2.9.***

Table 2.9 Waste generated, their sources and method of disposal

S. No.	Waste Type	Source	Method of Disposal
1	Domestic solid waste	Construction Camp	About 70% of the domestic waste is expected to be biodegradable waste from kitchen/food waste. Food waste will be composed off in a pit dug out within the site away from any water body/drainage channel. Remaining domestic waste will be disposed of through recyclers or waste dealers..
2	Construction Debris (excavated earth	Construction of WTG, Access road, Dormitory, Storage yard etc.	To be used for backfilling and levelling and other debris will disposed at site approved by local authority
3	Packaging waste containing wood, cardboard and other recyclables	Packing material for WTGs and Accessorise	To be sold to scrap dealers
4	Sludge from Construction camp Wastewater Septic Tank	Construction Camp	Collected and disposed to landfill through contractors
5	All non- recyclables	Construction activities and Construction camps	Collected and disposed through contractor for designated landfill sites.

- The excavated earth, obtained during the piling procedure, will be used to construct the embankment for the road.
- The piling operation is not likely to generate any waste as only water based bentonite clay may be used during piling. As bulk concreting will be completed using concrete pump wastage of concrete will be minimal.
- Fuels, oils and waste oil, if stored at site, will be stored in containers in areas with impervious floors and surrounded by dyke walls.
- Most garage waste, such as used spare parts, is recycled in Pakistan. All such waste will be collected and sold / given to contractors .
- All efforts will be made to minimize waste generation during the construction period.

Operation Phase

- Recyclable materials, including garage waste, will be periodically transported out of the site and sold/given to contractors.
- Non-recyclable material will be collected and disposed of through contractors at designated landfill sites.
- Sewage and solid waste disposal trucks will be used to remove the sludge, sewage and solid waste from the site to designated landfill sites.

E) Noise Control

Construction

Noise emission from the vehicles and equipment's will not exceed 85 dB(A) at 7.5 m from the source, as per the noise emission criteria in Pakistan. Workers near noise generating machines will be provided with ear plugs as safeguard against occupational hazards.

Operations

Wind turbines produce noise when operating. The noise is generated primarily from mechanical and aerodynamic sources. Mechanical noise may be generated by machinery in the nacelle. Aerodynamic noise emanates from the movement of air around the turbine blades and tower. The types of aerodynamic noise may include low frequency, impulsive low frequency, tonal, and continuous broadband. In addition, the amount of noise may rise with increasing rotation speed of the turbine blades, therefore turbine designs which allow lower rotational speeds in higher winds will limit the amount of noise generated.

Schedule 17 of the EPC contract covers the requirements concerning the noise emission warranty. During the defects and liability warranty, the contractor will be liable and subject to impulsivity penalties for any increase of ≤ 2 dB(A) subject to certain conditions of turbulence intensity. The noise emission levels specified for the Nordex WTG N100/2500 are given below in ***Table 2.10***.

Table 2.10 Noise emission levels of Nordex N 100/2500 WTG at different wind speeds

S.No.	Standardised Wind speed (at 10 m height) V_s [m/s]	Apparent Sound power level L_{wa} [d(B)A]
1.	3	96.8
2.	4	98.8
3.	5	101.1
4.	6	104.4
5.	7	105.8
6.	8	106.0
7.	9	106.0
	10	106.0
8.	11	106.0
9.	12	106.0

Source: EPC Contract agreement Schedule 17

2.5.7 *Fire Safety and Security*

Construction

Appropriate fire fighting system and equipment shall be provided throughout the construction period.
According to the regulations of the authorities in charge of public security and fire fighting and the rescue procedure of emergency treatment, the independent rescue brigade at Nooriabad site will be availed. A dedicated ambulance shall be stationed at site for emergency needs.

Operations

Structural fire protection

Wind Turbines comprise predominantly non-flammable materials. Most components of the WTGs are predominantly metal. The only inflammable components are rotor blades and the panelling of the machine house, which are made from glass-fibre reinforced plastic, electric cables and electrical components, gear box, transformer and hydraulic oils, hoses and other plastic components. It is generally not possible for a fire to spread from the transformer station to the wind turbine or vice versa.

Fire prevention

The service personnel will take all appropriate measures to prevent fires. Lightening and over voltage protection based on the standard EN 62305 and thus any lightning strike gets conducted safely into ground. A lightning strike as a cause of fire is excluded.

Fire detection and fire alarms

A temperature sensor is installed in the machine house and gives a warning message to the remote monitoring office in case of temperature difference and the system is automatically shut down.

Fire extinguishers

Two-three portable powder fire extinguishers are supplied with the wind turbines. These extinguishers are meant for immediate fighting of fire in early stages. Fire extinguishers shall be installed one for each nacelle and one for each tower.

2.6 *PROJECT ORGANIZATIONAL STRUCTURE*

2.6.1 *Project Proponent*

At present, MPCL WEP is overseen by a management team at the corporate level in Karachi. A site team will be posted once the pre-construction activities start and will work in coordination with the contractors team for overseeing

the Project management. During the construction phase as illustrated inFigure 2.10. The EHS manager will look after all EHS issues and coordinate with the EHS team of EPC contractor. The social issues will be looked after by the community relations officer who will report to the EHS manager. The EHS manger will in turn report to the CEO.

During the Operation Phase, an officer from the engineering department will be nominated to look after EHS issues and a community relation officer will be working under the Human resources department (Refer ***Figure 2.11***).

2.6.2 Engineering Procurement and Construction (EPC) Contractor

MPCL has appointed Nordex, Descon and parties as the EPC contractor. EPC contractor has the responsibility of engineering, procurement, supply, construction, erection, installation, commissioning of the WTGs. The organization structure of the EPC project team can be referred from ***Figure 2.10***.

2.6.3 Operation and Maintenance (O&M) Contractor

MPCL has appointed Nordex and Descon as the O & M contractor. The responsibilities of the O & M contractor are as follows:

Maintenance

Maintenance and service for WTGs, supply of spare parts, maintenance of spares, consumables and tools, provision of crane for maintenance.

Service

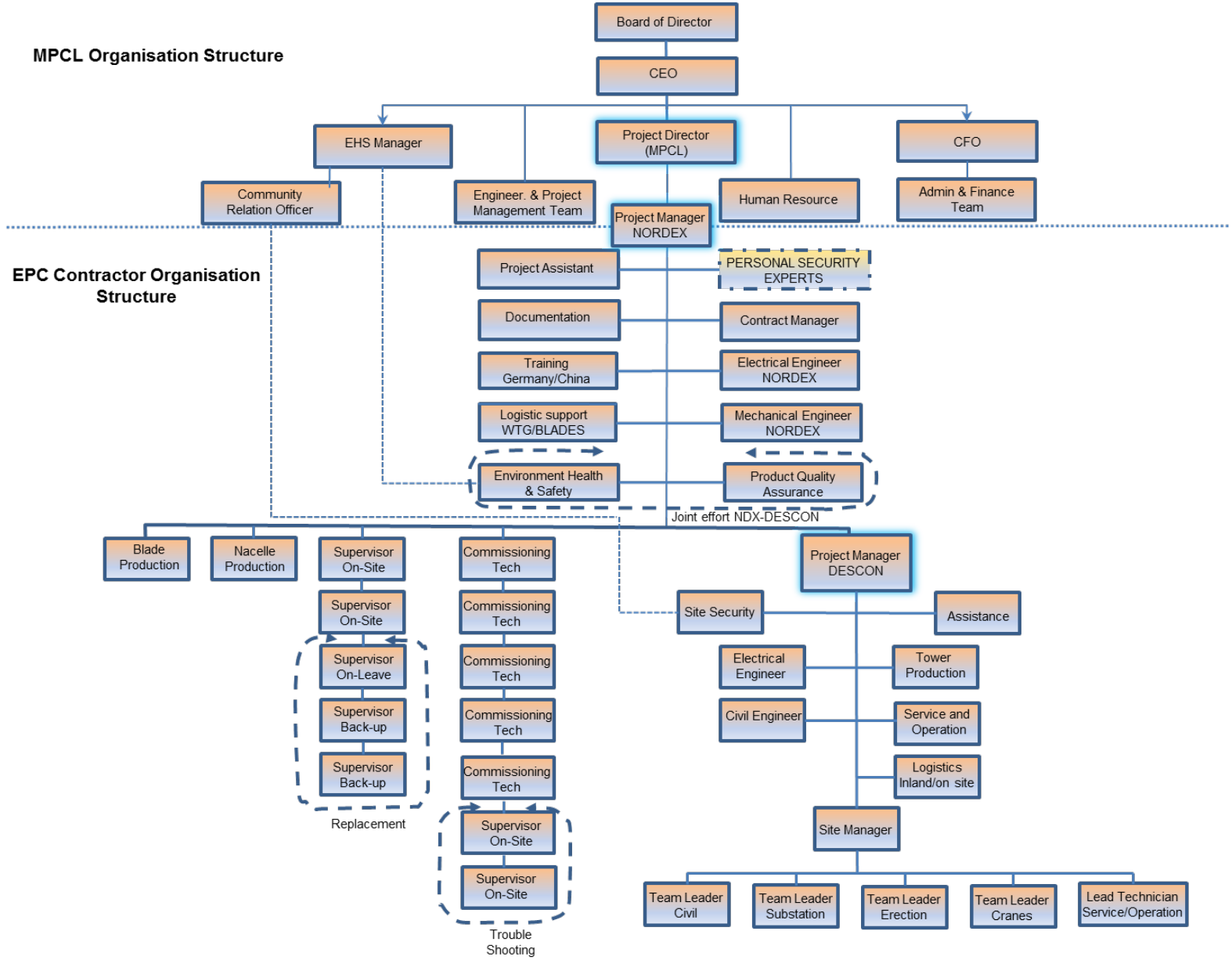
Provide technical assistance and guidance during O & M.

Operations

Provide monitoring and operations of the WTGs. Contractors will have operation personals (team of about 6 at a time) at site in the control room at sub-station.

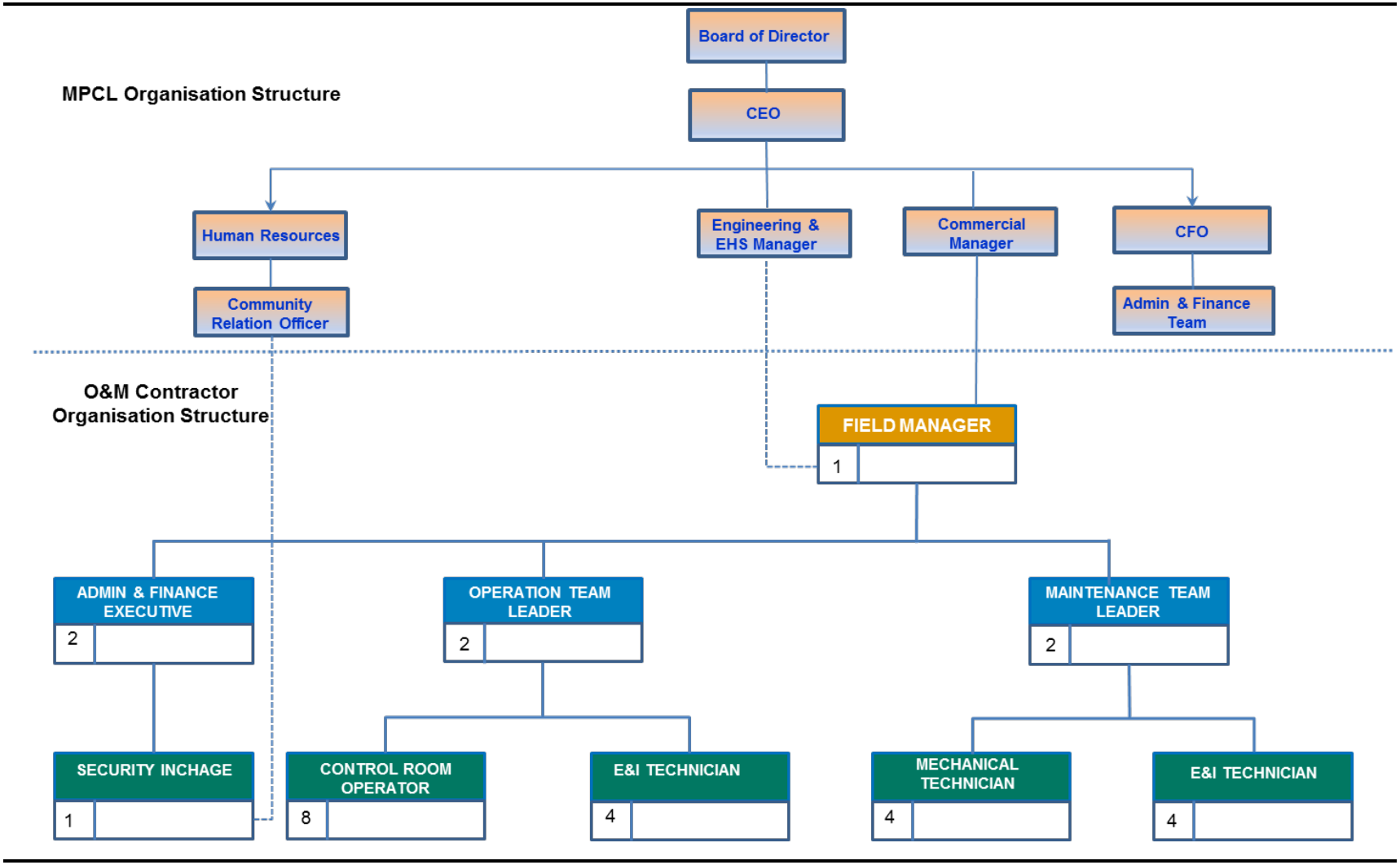
The organizational structure of O & M contractor can be referred from ***Figure 2.11***.

Figure 2.10 Organizational structure of MPCL and integration with EPC during Construction Phase



Source: MPCL

Figure 2.11 Organisational Structure of MPCL and integration with O &M contractor during the Operation Phase.



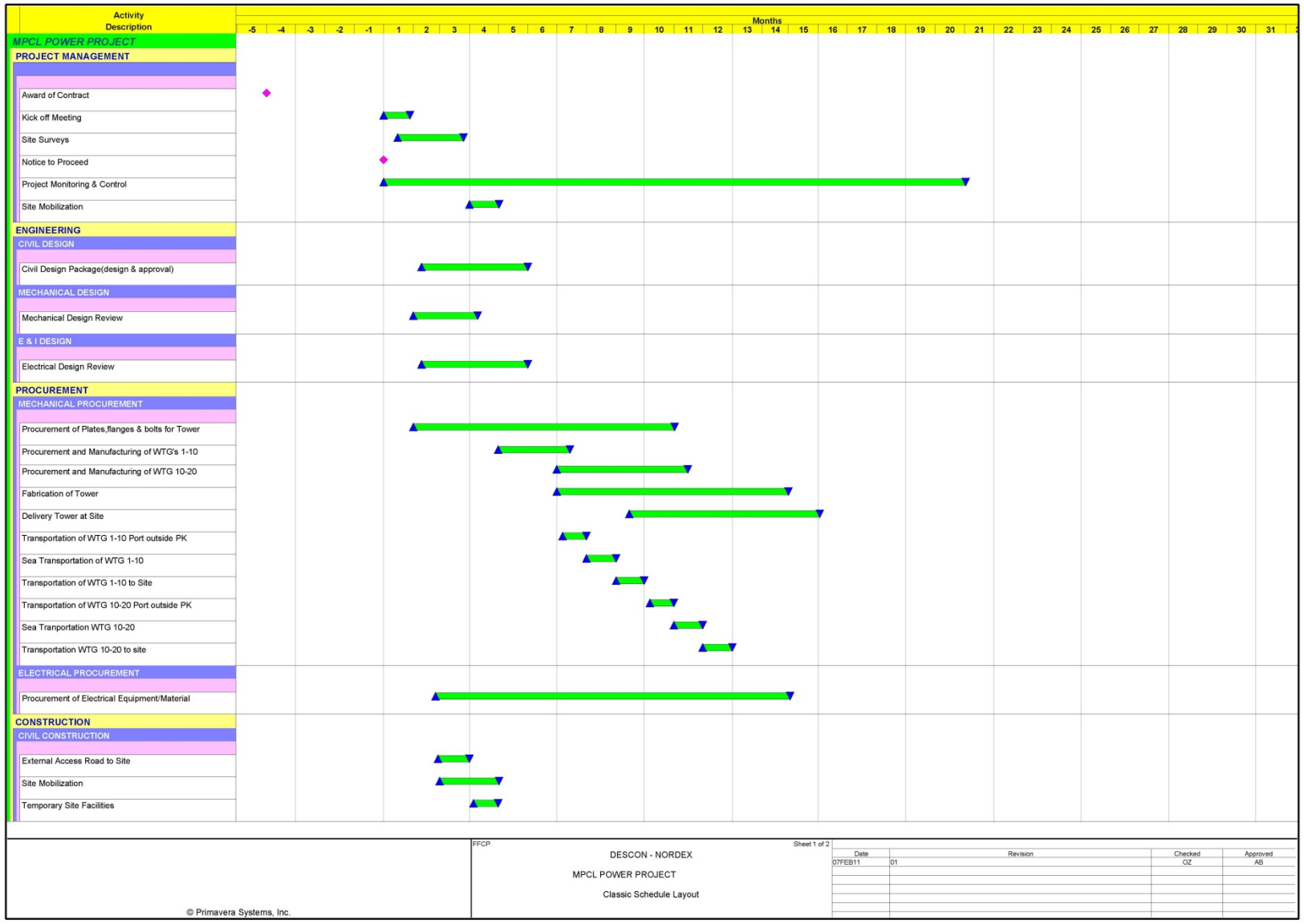
Source: MPCL

2.7 *TENTATIVE PROJECT SCHEDULE (EPC)*

The construction for the complete development including civil construction, internal road, external road to site, substation, commissioning of WTGS, testing, training of MPCL staff, facility testing etc. of the project is scheduled to be completed in 18months. It is expected that work on the project will commence during the last quarter of 2013.

Work will commence with the construction of the access road and site preparation (civil works). The exact schedule of activities is expected to be finalized during meetings between the contractors and MPCL however a tentative planned schedule has been presented in ***Figure 2.12.***

Figure 2.12 Tentative schedule of Project activities



Source: MPCL

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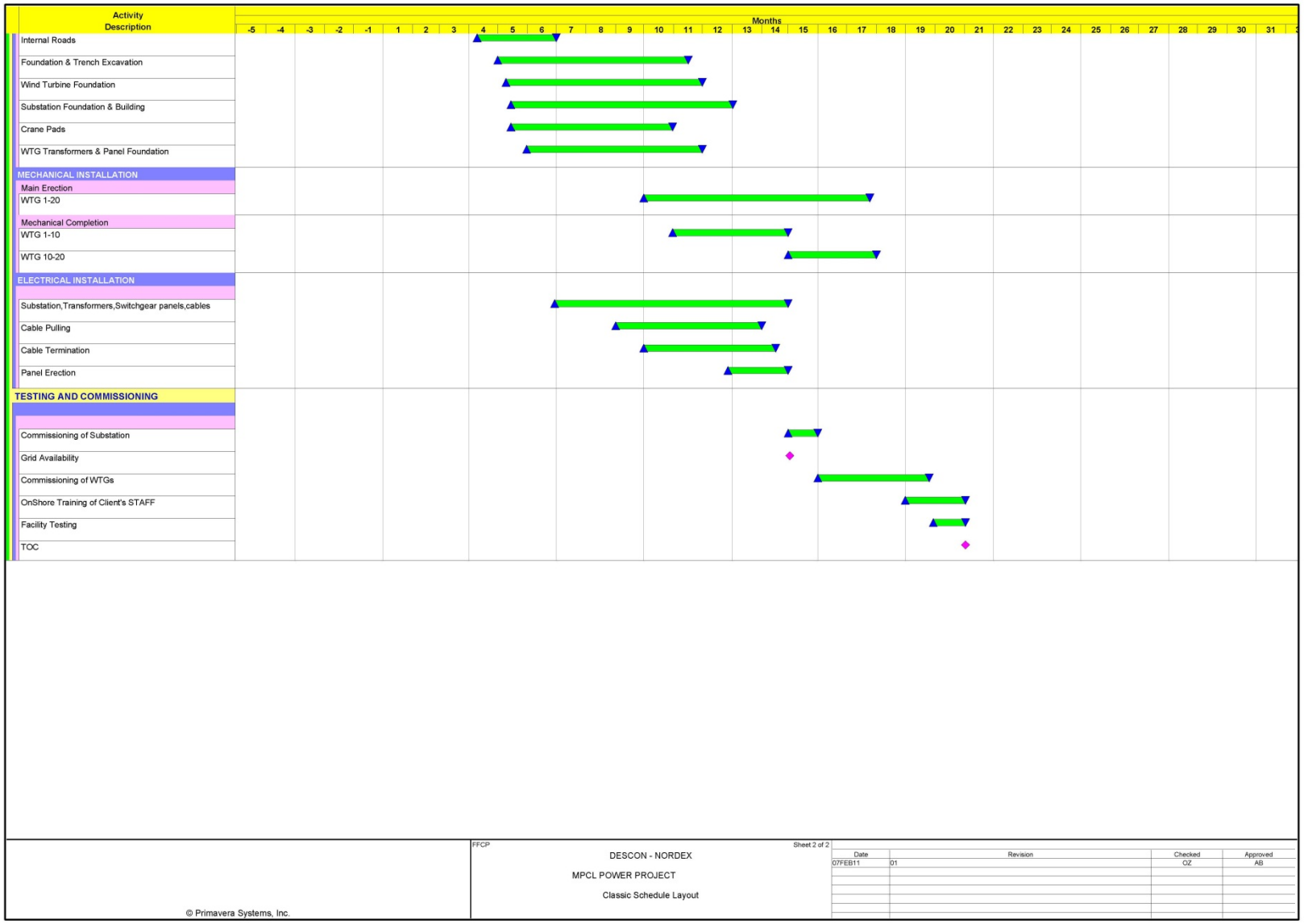
Activity Description
Months
-5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Internal Roads
Foundation & Trench Excavation
Wind Turbine Foundation
Substation Foundation & Building
Crane Pads
WTG Transformers & Panel Foundation
MECHANICAL INSTALLATION
Main Erection
WTG 1-20
Mechanical Completion
WTG 1-10
WTG 10-20
ELECTRICAL INSTALLATION
Substation,Transformers,Switchgear panels,cables
Cable Pulling
Cable Termination
Panel Erection
TESTING AND COMMISSIONING
Commissioning of Substation
Grid Availability
Commissioning of WTGs
OnShore Training of Client's STAFF
Facility Testing
TOC
© Primavera Systems, Inc.
FFCP
Sheet 2 of 2
DESCON - NORDEX
MPCL POWER PROJECT
Classic Schedule Layout
Date
Revision
Checked
Approved
07FEB11
01
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AB

3 APPLICABLE ADMINISTRATIVE FRAMEWORK

3.1 INTRODUCTION

The regulatory framework provided in this section summarizes the applicable environmental and social regulations, guidelines and policies for the proposed 50 MW WEP that is being developed by MPCL. This framework has been structured as follows:

- Key Guidelines on Energy Development;
- Applicable environmental and social regulations and policies in Sindh province and Pakistan;
- Institutional Framework for the implementation of the regulations;
- International Standards and international conventions; and
- Applicable Environmental Standards.

The applicable regulatory framework that has been provided in this IEE report should be used by MPCL to develop a comprehensive legal register for the project. This will be regularly monitored for the compliance of the entire project as well as updated to reflect changes in the policy environment for wind energy projects in Pakistan.

It is expected that the project proponents will adhere to all the relevant national legislations, international conventions and the wind farm development guidelines as well as other applicable international guidelines. The project proponents will also ensure conformance of its own staff and assigned contractors to these legislations and guidelines prior to start of the project activities.

3.2 KEY GUIDELINES ON WIND ENERGY DEVELOPMENT

The Pakistan Government Policy for Power Generation Projects (2002) aims: "To encourage and ensure exploitation of indigenous resources, which include renewable energy resources, human resources, participation of local engineering and manufacturing capabilities". In particular, the Pakistan Government Policy for Development of Renewable Energy (RE) for Power Generation (2006) has emphasized small hydro, wind and solar technologies in the development plans of the country. These projects will also be able to sell surplus power to Distribution Companies under the policy. The small renewable energy projects will also not require tariff determination from NEPRA. It has been allowed that wind and solar projects, irrespective of size of the plant (even more than 50 MW) will be handled by AEDB. ***Table 3.1*** describes the applicability of various environmental and social laws, regulations and policies relevant to the project.

Table 3.1 Applicable Environmental and Social Laws, Regulations and Policies

Pakistan Legislation/Guidelines /International Conventions	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks and applicability for the MPCL Project
Environment Protection						
Pakistan Environmental Protection Act, 1997 and Pakistan Environment Protection Agencies (Review of IEE/EIA) Regulations 2000	X	√	√	√	Ministry of Environment, Local Government and Rural Development, Government of Sindh, Environment Protection Agency	The Act particularly focuses on implementation of policies, delegation of powers to government agencies, enforcement of national environment quality standards, IEE/EIA review/procedures, and regulatory regime for hazardous wastes/substances. MPCL has already obtained the IEE Approval on 1st June 2009. The IEE approval provides specific conditions (Refer ***Box 3.1)*** that are to be complied with through the project lifecycle..
National Environment Quality Standards (Self-Monitoring and Reporting by Industries) Rules, 2001 and Environment Samples Rules, 2001	√	√	√	√	Ministry of Environment, Local Government and Rural Development Environment Protection Agency	The NEQS requires maintaining ambient air quality, noise levels and other parameters as stipulated. There are no specific standards for residential zones in the same and hence the WB/IFC EHS Guidelines will prevail.
National Environmental Policy (2005)	√	√	√	√	Government of Pakistan	The NEP identifies a set of sectoral and cross-sectoral guidelines to achieve its goal of sustainable development.
Pakistan Penal Code (1860)	√	√	√	√	Government of Pakistan	It authorises fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs so as to make them less fit for ordinary use.
The Ports Act (1908)	X	√	√	X	Karachi Port Authorities	The Act empowers the Government of Pakistan to make any rules to safeguard public health from the spread of any infectious or contagious disease. This will be applicable for any raw material

Pakistan Legislation/Guidelines /International Conventions	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks and applicability for the MPCL Project
						coming in through the Karachi Port.
Forest Clearance and Wildlife						
Sindh Wildlife Protection Ordinance 1972	√	√	√	X	Sindh Wildlife Department	Sindh Wildlife Protection Ordinance 1972 was enacted to protect Sindh's wildlife resources directly, and its other natural resources indirectly. The Ordinance specifies restrictions on hunting and trade in animals and also provides for the creation of special protected area. The site for the MPCL project does not have any ecological sensitivity and the nearest protected area is Keenjhar Wildlife Sanctuary, located at a distance of approximately 15 km.
Pakistan Forest Act, 1927	√	X	X	X	District Administration	No diversion of forest land is required for the MPCL project.
Land Acquisition and Resettlement						
Land Acquisition Act, 1894 and West Pakistan Land Acquisition (West Pakistan) Amendment Act 1969	√	√	X	X	District Administration and Revenue Department	It is understood that the MPCL site is located on Unsurveyed land that belongs to the Government of Sindh and that has been subsequently leased to AEDB. It is understood that no compensation or resettlement has been undertaken by the Government of Sindh/AEDB for communities that are within the Master Lease Agreement.
National Resettlement Policy, 2002	√	√	X	X	Ministry of Environment, Local Government and Rural Development	Any resettlement linked to the affected persons and settlements within the MPCL site or induced due to any adverse impacts will need to be managed in accordance to the policy. The policy sets out principles, entitlements and institutional arrangements to manage resettlement and rehabilitation in conjunction with the land acquisition regulations.
Project Implementation and Resettlement of Affected Persons	√	√	X	X	Ministry of Environment, Local	The ordinance lays down government and administrative responsibilities for managing resettlement from development projects. Any

Pakistan Legislation/Guidelines /International Conventions	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks and applicability for the MPCL Project
Ordinance, 2001					Government and Rural Development	physical impacts on the settlements within the sub-lease of the AEDB will need to incorporate the requirements of the Ordinance pertaining to defining affected persons, preparation of a resettlement plan etc.
Public Consultation						
Guidelines for Public Consultation under Environmental Protection Agencies 1997	√	√	√	√	Environment Protection Agency	While there is no provision for mandatory consent in the project due to the land being un-surveyed and sub leased by the government; there are guidelines for public consultation in the EPA 1997 which provide for information sharing and communication process
Labour and Working Conditions						
The Factories Act 1934 amended to 1997	X	√	√	X	Deputy Chief Inspector of Factories	There will be a need to comply to all requirements of factories rules and participate in periodic inspection during the Operations Phase
Labour Rights in the Constitution	X	√	X	√		Article 11, 17, 18, 25 and 37(e) of the Constitution of Pakistan will have to be complied.
The Employment of Children Act (ECA), 1991; The Bonded Labour System (Abolition) Act, 1992; The Prevention and Control of Human Trafficking Ordinance (promulgated in October 2002); The West Pakistan Minimum Wages for Unskilled Workers Ordinance, 1969; West Pakistan Maternity Benefit Ordinance, 1958	X	√	√	√	Labour Department; Industries and Commerce Department of Industries, Social Welfare Department, Government of Sind	Project will need to comply to the requirements of the these regulations

Pakistan Legislation/Guidelines /International Conventions	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks and applicability for the MPCL Project
Applicable International Conventions						
Conventions on the Conservation of Migratory species of wild animals and migratory species	√	√	√	√	State Forest Department	The project site does not fall in any migratory bird route as per discussions with the concerned forest department officials.
Kyoto Protocol: The 3rd Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in Kyoto in December 1997 introduced the Clean Development Mechanism (CDM) as a new concept for voluntary greenhouse-gas emission reduction agreements.	√	√	√	√	Designated UNFCCC authority for National Communications in Pakistan	The proposed project being a wind power generation project becomes the basis for CDM. MPCL is considering carbon financing subject to completion of registration and other procedures. For this purpose MPCL has engaged Umwelt-Projekt-Management GmbH of Germany (UPM), as project's CDM development consultant. The application for registration has been filed as of December end 2012. Bureau Veritas Certification, the independent certification body of Bureau Veritas, is appointed as Designated Operational Entity (DOE) for performing the validation of CDM/Joint Implementation (JI) project activity of power generation through wind energy at MPCL wind project.
IFC/World Bank Guidelines						
IFC Performance Standards	√	√	√	√	IFC, Equator Principles Financing Institutions (EPFIs)	The IEE report has been updated on the lines of the IFC Performance Standards (2012).
IFC/World Bank General EHS Guidelines	X	√	√	√	IFC, EPFIs	During the construction, operation and eventual decommissioning of the site, these guidelines will need to be followed.
IFC Guidelines for Power Transmission and Distribution	X	√	√	√	IFC, EPFIs	
IFC Guidelines for Wind Energy Projects	X	√	√	√	IFC, EPFIs	
IFC Guidance on Worker	X	√	√	√	IFC, EPFIs	

Pakistan Legislation/Guidelines /International Conventions	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks and applicability for the MPCL Project
Accommodation						
Other Legislations/Guidelines						
EPA's Social and Environmental Guidelines	X	√	√	√	Federal EPA	The Federal EPA has developed certain guidelines for conducting social and environmental assessments. This includes the guidelines for preparation of IEE and EIA reports, public consultation, assessment for critical and natural habitats and sector-specific guidelines.
Antiquity Act, 1975	X	√	√	√	Department of Archaeology	This act ensures protection of cultural resources in Pakistan and prohibits the construction of any facility in close proximity to any defined antiquity under this Act.
Policy for Development of Renewable Energy for Power Generation	X	√	√	√	Government of Pakistan	Over the short term, i.e. to mid-2008, technologies that are already in commercial use internationally are to be trialled through the mechanism of attractive power purchase contracts and partial risk coverage. In the medium term, that is until 2030, it is hoped to have installed at least 9700MW of capacity for renewable electricity in this way
Biodiversity Action Plan	√	√	√	√	Federal EPA	The plan recognises EIA as an effective tool for identifying and assessing the effects of a proposed operation on biodiversity.
Canal and Drainage Act (1873)	X	√	√	√	Federal EPA	This Act prohibits corruption or fouling of water in canals (defined to include channels, tube wells, reservoirs and watercourses), or obstruction of drainage.

3.3 INSTITUTIONAL AND ADMINISTRATIVE FRAMEWORK

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 National Conservation Strategy unit established in 1992 is responsible for overseeing the implementation of the strategy.

Environmental issues are governed by three levels of the government viz. Federal, Provincial and Local Government. The Ministry of Environment and Local Government is the Ministry at the Federal level, which oversees the affairs of the environment in the country. The Provincial Governments have designated the Ministries of Local Government to oversee matters related to the environment at the provincial level. The Provincial EPAs are directly under the respective Provincial Ministry of Local Government and Environment. Sindh EPA is placed under the Ministry of Environment and Alternative Energy, Government of Sindh (GoS).

Box 3.1 Sindh EPA IEE Approval

The following conditions are excerpts from the IEE Approval provided by Sindh Environmental Protection Agency (SEPA) to MPCL on June 1, 2009:

- During the project execution, safe distances of the under mentioned environmental sensitivities will be maintained: (a) 500m from communities, industries and main transport network; (b) 300m from community water wells; and (c) 100m from archaeological site/ cultural site/ monument
- Distance will be measured from the tip of turbine blade or/and transmission power lines associated.
- Project activity will not be carried out within buffer zone of any projected area designated under Sindh Wildlife Protection Act.
- Campsites will be located at least 1 km away from any settlement to avoid disturbance to the local people.
- No industrial or residential activity will be permitted on the land allocated for wind energy projects.
- Employment will be provided to local people and assured for unskilled jobs. Skilled jobs will be given to the locals after providing them proper field training, where a minimum training will be required.
- Benefits to local people will be offered under Corporate Social Responsibility (CSR) policy, community development schemes will be decided in consultation with local communities and may be facilitated by involving district/local Government office.
- Compensation will be provided to the inhabitants in case of loss of agriculture land, crop property, etc., in accordance with the rates, that are agreed upon. All conflicting issues regarding compensation etc. should be settled in advance prior to the start of activity.
- Implementation Report of all the mitigation measures and SMP laid down in the IEE Report be submitted to the SEPA office on quarterly basis for review. No violation of any Regulations, Rules, Instruction and Provisions of PEP Act, 1997, shall be made.

**Source: Sindh EPA Approval to the IEE for MPCL 50 MW Project (2009)*

The GoS involvement in local government and municipal affairs has been devolved to the Environment Department of the Union Council, Taluka and District Government. However, the devolution program has not been implemented since an environment officer, required to oversee the environmental issues has not been appointed. Coordination of the environmental monitoring activity continues as a provincial subject and is

assigned to Provincial EPAs, in this case EPA Sindh, which has been duly authorized to enforce environmental compliance.

3.3.1 Local Authorities

The main organizations responsible for providing services in the areas where the MPCL WEP is being established include the (1) AEDB; and (2) District Government of Thatta, which is the local government authority comprising the Union Administration (UA) Jhimpir.

AEDB

The AEDB was established as an autonomous body attached to the Cabinet Division on May 12, 2003. The Board was established to act as a central agency for development, promotion and facilitation of renewable energy technologies, formulation of plans, policies and development of technological base for manufacturing of renewable energy equipment in Pakistan.

AEDB has, for the development and generation of alternative or renewable energy through the IPPs, procured land in Jhimpir area from the Government of Sindh pursuant to the Colonization and Disposal of Government Lands (Sindh) Act, 1912 under terms and conditions set out in the Master Lease Deed and further agreed to lease by way of sub-lease, the land measuring 1553 acres to MPCL.

Box 3.2 National Resettlement Policy (2002)

In the absence of a resettlement policy for development purposes and for those who are adversely affected, the LAA 1894 has been the de facto policy governing resettlement of, and compensation to the project affected persons. Its provisions do not take into account the changed social, cultural, economic and environmental landscape in which they operate. The act is scale neutral and does not differentiate between projects that have different gestation periods. Whereas the compensation packages for projects differ with the source of funding. The budgetary priorities of federal and provincial governments tend to curtail provision of required funds, thus delaying timely payments of compensation and thereby delaying implementation of resettlement projects. The issues regarding resettlement have been properly addressed in the National Resettlement Policy of 2002 (PEPA, 2002). To resettle and compensate people displaced by the development projects, the GOP has issued the Project Implementation and Resettlement of Affected Persons Ordinance, 2001. National Resettlement Policy was promulgated in March 2002, and the PEPA issued Implementation Guidelines in October 2002.

District Government of Thatta

The representative institutions of the District Government, Taluka and UAs are headed by a Nazim and assisted by a Naib Nazim. The District Coordination Officer (DCO) is responsible, among other things for planning and development, for maintenance of roads and transport, and for land control, including unplanned settlements. The District Government is theoretically responsible for physical planning, town planning, environment, and maintenance of infrastructure facilities. However, these functions continue to be performed by the respective ministries of the Provincial Governments. This is evident from the Minister of the National Assembly

(MNA) and Provincial Assembly (MPA) MNA and MPA of Jhimpir-Thatta area being the public figures most powerful in the constituency.

Other stakeholders that may be important to engage as relevant at the district level include Sindh Wildlife Department, Forestry Department and the Telecommunications and Civil Aviation Departments.

3.4 INTERNATIONAL STANDARDS

3.4.1 IFC Requirements

IFC applies the Performance Standards (1) to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards may also be applied by other financial institutions choosing to support them in the proposed project. These performance standards and guidelines provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts.

Together, the eight Performance Standards establish standards that the client is required to meet throughout the life of an investment by IFC or other relevant financial institution:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Resource Efficiency and Pollution Prevention;
- Performance Standard 4: Community Health, Safety and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Performance Standard 7: Indigenous Peoples; and
- Performance Standard 8: Cultural Heritage.

(1) http://www.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards

Figure 3.3 Key Additions to the IFC Performance Standards, 2012

- IFC PS 1 requires stakeholder engagement beyond affected communities and also introduces participatory monitoring;
- IFC PS 2 establishes requirements for worker accommodation, provisions for migrant workers, retrenchment scenarios, assessment of the primary supply chain;
- IFC PS 3 introduces resource efficiency concept for energy, water, and core material inputs; determination of accountability with regards to historical pollution, and concept of "duty of care" for hazardous waste disposal;
- IFC PS 4 considers community risks from use, and/or alteration of natural resources and climate change through an ecosystems approach;
- IFC PS 5 extends scope to restrictions on land use as well as completion audit for resettlement;
- IFC PS 6 requires stronger measures for biodiversity offsets;
- IFC PS 7 land acquisition due diligence with regards to lands of Indigenous Peoples subject to traditional ownership or under customary use;
- IFC PS 8 requires the project proponent to allow access to cultural sites.

**Source: IFC Board Paper, August 2011*

In addition, during the construction, operation and eventual decommissioning of the site, the following guidelines will need to be adhered to the IFC EHS Guidelines for Wind Energy (1) and the *General Environmental, Health, and Safety (EHS) General Guidelines*[2] *(April 30, 2007*) will be applicable for this Project.

Where there is a discrepancy between the prevailing environmental standards in Pakistan on emission, discharge etc. and the corresponding standards published by the IFC/World Bank General EHS Guidelines, MPCL will incorporate the more stringent standard for the proposed WEP.

3.4.2 ILO Conventions

Pakistan has been a member of the ILO since 1947 and has thus far ratified 36 conventions. Of these, 33 are in force, whereas 3 have been denounced. The fundamental conventions which are being implemented across Pakistan through applicable labour laws include:

- C029 - Forced Labour Convention, 1930 (No. 29);
- C087 - Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87);
- C098 - Right to Organise and Collective Bargaining Convention, 1949 (No. 98);
- C100 - Equal Remuneration Convention, 1951 (No. 100);
- C105 - Abolition of Forced Labour Convention, 1957 (No. 105);
- C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111);

(1) http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_WindEnergy/$FILE/Final+-+Wind+Energy.pdf

(1) [2] http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS/$FILE/Final+-+General+EHS+Guidelines.pdf

- C138 - Minimum Age Convention, 1973 (No. 138)Minimum age specified: 14 years;
- C182 - Worst Forms of Child Labour Convention, 1999 (No. 182).

3.4.3 Applicable International Conventions

Applicable International Conventions ratified and signed by Pakistan have been presented in ***Table 3.2***.

Table 3.2 Applicable International Conventions

Convention	Application	Relevance
Conventions on the Conservation of Migratory species of wild animals and migratory species	Pakistan is contacting party to the convention on conservation of migratory species of wild animals and migratory species.	*According to the study conducted for the proposed project there is no Bird sanctuary within 10 kms of the project site. Nonetheless, the convention is relevant and signed by Pakistan in December 1987.*
Ramsar Convention: The Convention on Wetlands of International Importance Especially as Waterfowl Habitat, 1971	This convention was signed by Pakistan in July 1976 and ratified in November 1976. The convention requires protection of identified wetlands of international importance as identified under Ramsar convention. So far 18 sites in Pakistan have been declared as wetlands of International Importance or RAMSAR Sites. Of these, there are about 45 game sanctuaries and reserves spread over an area of 0.90 million hectares in Sindh.	*The proposed project does not fall in any area identified under Ramsar convention.*
Kyoto Protocol	The Kyoto protocol was ratified by Pakistan in January 2005. The convention pertains to the United Nations framework on Climate Change. The 3rd Conference of the Parties to the Framework Convention on Climate Change (FCCC) in Kyoto in December 1997 introduced the Clean Development Mechanism (CDM) as a new concept for voluntary greenhouse-gas emission reduction agreements between industrialized and developing countries on the project level	*The proposed project being a wind power generation project becomes the basis for Clean Development Mechanism. The project will reduce greenhouse emission and generate 50 MW of clean energy. The application for registration is filed as of December end 2012.*

Convention	Application	Relevance
Basel Convention	Basel convention was ratified in July 1994. The import and export norms for the hazardous waste have been provided in conformance with the Basel Convention.	*Pakistan is a signatory to the convention and it is understood that the nature of technology required and applied for the project does not trigger the application of the convention.*
International Convention on Biodiversity	Parties are also required to identify components of biodiversity that are important for conservation, and to develop systems to monitor the use of such components with a view to promoting their sustainable use.	*No such ecological or biodiversity hotspot is located within 5 km from the MPCL site.*
IUCN Red List	IUCN has published red list, it includes those species that are under potential threat of extinction. These species have been categorised as endangered, vulnerable in decline, lower risk species and data deficient species that may be at risk of extinction in the wild.	*No faunal species that fall under the IUCN Red List category were observed in the project site of MPCL.*

3.5 APPLICABLE ENVIRONMENTAL CONDITIONS AND STANDARDS

3.5.1 National Standards

The Pakistan Environmental Protection Agency has drafted the National Environmental Quality Standards (NEQS) for municipal and liquid industrial effluent, industrial gaseous emissions and motor vehicles exhaust and noise in 1994. These standards were revised in 1997 with full consultation of the private sector, industrialist, trade and business associations, and non-governmental organisations (NGOs) and subsequently in 2000.

Revised standards cover discharges limits of effluents into inland water, sewage treatment plant and the sea. The NEQS for municipal and liquid industrial effluent standards cover 32 parameters, while for industrial gaseous emissions they specify limits for 16 parameters, and the standards for motor vehicles prescribe maximum permissible limits for smoke, carbon monoxide and noise.

The NEQS are primarily concentration based. The limits on industrial effluents are neither industry specific nor have they any relationship with the quantum of production. The NEQS prohibit dilution, but this needs keen monitoring for effective implementation.

During the construction and operation phase of the project NEQS will apply to all effluents and emissions. NEQS for municipal and industrial effluents,

motor vehicle exhaust and noise, ambient air quality and ambient noise and drinking water quality have been provided in the tables subsequently.

Table. 3.3 NEQS for Municipal and Liquid Industrial Effluents (2001) [1,2]

Parameters	Standards		
	Into Inland Waters	Into Sewage Treatment[3]	Into Sea[4]
Temperature increase[5]	=<3°C	=<3°C	=<3°C
pH value	6 to 9	6 to 9	6 to 9
Five-day bio-chemical oxygen demand (BOD)[6] at 20°C	80	250	80[7]
Chemical oxygen demand (COD)	150	400	400
Total suspended solids (TSS)	200	400	200
Total dissolved solids (TDS)	3500	3500	3500
Grease and oil	10	10	10
Phenolic compounds (as phenol)	0.1	0.3	0.3
Chlorides (as Cl)	1,000	1,000	SC[8]
Fluorides (as F')	10	10	10
Cyanide total (as CN')	1.0	1.0	1.0
Anionic detergents (as MBAS)[9]	20	20	20
Sulfates (SO_4)	600	1,000	SC
Sulfides (s')	1.0	1.0	1.0
Ammonia (NH_3)	40	40	40
Pesticides[10]	0.15	0.15	0.15
Cadmium[11]	0.1	0.1	0.1
Chromium (trivalent and hexavalent)	1.0	1.0	1.0
Copper[4]	1.0	1.0	1.0
Lead[4]	0.5	0.5	0.5
Mercury[4]	0.01	0.01	0.01
Selenium[4]	0.5	0.5	0.5
Nickel[4]	1.0	1.0	1.0
Silver[4]	1.0	1.0	1.0
Total toxic metals	2.0	2.0	2.0
Zinc	5.0	5.0	5.0
Arsenic[4]	1.0	1.0	1.0
Barium[4]	1.5	1.5	1.5
Iron	8.0	8.0	8.0
Manganese	1.5	1.5	1.5
Boron[4]	6.0	6.0	6.0
Chlorine	1.0	1.0	1.0

(2) [1] Dilution of liquid effluents to bring them to the NEQS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.

(3) [2] The concentration of pollutants in water being used will be subtracted from the effluent for calculating the NEQS limits.

(4) [3] Applicable only when and where sewage treatment is operational and BOD = 80 mg/l is achieved by the sewage treatment system.

(5) [4] Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.

(6) [5] The effluent should not result in temperature increase of more than 3oC at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not define, use 100 m from the point of discharge

(7) [6] Assuming minimum dilution 1:10 discharge, lower ratio would attract progressively stringent standards to be determined by the Federal Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.

(8)

(9) [7] The value for industry is 200 mg/l

(10) [8] Discharge concentration at or below sea concentration (SC)

(11) [9] Modified Benzene Alkyl Sulfate assuming surfacetant as biodegradable

(12) [10] Pesticides include herbicides, fungicides, and insecticides

(13) [11] Subject to total toxic metals discharge should not exceed level given at S. No. 25

Table 3.4 Drinking Water Quality Standard Pakistan

S.N	Parameters	Unit	Limit
	Bacterial		
1	E.Coli or Themotolerant Bacteria		Must not be detectable in any 100 ml sample
2	Total Coliform		Must not be detectable in any 100 ml sample
	Physical		
3	Colour	TCU	< 15 TCU
4	Taste	-	Non Objectionable
5	Odour	-	Non Objectionable
6	Turbidity	NTU	<5
7	Total Hardness as CaCO3	mg/l	<500
8	Total Dissolved Solids	mg/l	<1000
9	pH		6.5-8.5
	Chemical		
10	Aluminium as (Al)	mg/l	<0.2
11	Antimony as (Sb)	mg/l	<0.005 (P)
12	Arsenic (As)	mg/l	<0.05
13	Barium (Ba)	mg/l	0.7
14	Boron (B)	mg/l	0.3
15	Cadmium (Cd)	mg/l	0.003
16	Chloride (Cl)	mg/l	<250
17	Chromium (Cr)	mg/l	<0.05
18	Copper (Cu)	mg/l	2
19	Toxic Inorganic	mg/l	
20	Cyanide (CN)	mg/l	<0.05
21	Fluoride (F)	mg/l	<1.5
22	Lead (Pb)	mg/l	<0.05
23	Manganese (Mn)	mg/l	<0.5
24	Mercury (Hg)	mg/l	<0.001
25	Nickel (Ni)	mg/l	<0.02
26	Nitrate (NO3)	mg/l	<50
27	Nitrite (NO2)	mg/l	<3 (P)
28	Selenium (Se)	mg/l	0.01 (P)
29	Residual Chlorine	mg/l	0.2-0.5 at Consumer end 0.5 -1.5 at Source
30	Zinc (Zn)	mg/l	5.0
	Radioactive		
31	Alpha Emitters	bq/L or pCi	0.1
32	Beta Emitters	bq/l or pCi	1

Source: http://www.environment.gov.pk/act-rules/dwqstd-may2007.pdf

Table 3.5 NEQS for Motor Vehicle Exhaust and Noise (2001)

Parameter		Measuring Method
Smoke	40% or 2 on the Ringelmann Scale during engine acceleration mode	To compared with Ringlemann chart at a distance of 6 meters or more
Carbon Monoxide	New Vehicle = 4.5% Used Vehicle = 6%	Under idling conditions: non-dispersive infrared detection through gas analyzer
Noise	85 dB (A)	Sound level at 7.5 meter from the source

National Environment Quality Standards (NEQS) came out with Ambient Air standards, as prescribed by EPA vide, Gazette Notification dated 18th October, 2010. The prescribed standards are given below in ***Table 3.6***.

Table 3.6 NEQS for Ambient Air Quality (2001)

S. No	Pollutant	Concentration in Ambient Air		Methods of Measurement
		Time Weighted Avg.	Effective from Jan'1 [µg/m³]	
1	Sulphur dioxide (SO_2)	Annual Average*	80	Ultraviolet
		24 Hours**	120	Fluorescence method
2	Oxides of Nitrogen as (NO)	Annual Average*	40	Gas Phase
		24 Hours**	40	Chemiluminescence
3	Oxides of Nitrogen as (NO_2)	Annual Average*	40	Gas Phase
		24 Hours**	80	Chemiluminescence
4	Ozone (O_3)	1 hour	130	Non dispersive UV Absorption method
5	Suspended Particulate Matter (SPM)	Annual Average	360	High Volume
		24 Hour	500	Sampling (Average flow rate not less than 1.1 m3/min
6	Respirable Particulate (PM_{10})	Annual Average*	120	β-ray absorption method
		24 Hours**	150	
7	Respirable Particulate ($PM_{2.5}$)	Annual Average	15	β-ray absorption method
		24 hour	35	
		1 hour	15	
8	Lead (Pb)	Annual Average*	1	-ASS method after sampling using EPM 2000 or equivalent filter paper
		24 Hours**	1.5	
9	Carbon Monoxide (CO)	8 hours*	5,000	Non dispersive infra-red (NDIR) Method
		1 hour	10,000	

Note: *Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform interval.
** 24 hourly/8 hourly/1 hourly monitored values, as applicable shall be complied with 98% of the time in a year. 2% of the time, it may exceed but not on two consecutive days of monitoring.

3.5.2 International Guideline values

World Bank/WHO ambient air quality guidelines are given in ***Table 3.7***and World Bank/WHO ambient noise guidelines are given in ***Table 3.8.***

Table 3.7 WHO Ambient Air Quality Guidelines

Pollutant	Averaging Period	Guideline value in µg/m³
Sulfur dioxide (SO_2)	24 hour	125 (Interim target-1)
		50 (Interim target-2)
		20 (guideline)
	10 min	500 (guideline)
Nitrogen dioxide (NO_2)	1 year	40 (guideline)
	1 hour	200 (guideline)
Particulate Matter (PM_{10})	1 year	70 (Interim target-1)
		50 (Interim target-2)

Pollutant	Averaging Period	Guideline value in µg/m³
		30 (Interim target-3)
		20 (guideline)
	24 hour	150 (Interim target-1)
		100 (Interim target-2)
		75 (Interim target-3)
		50 (guideline)
Particulate Matter ($PM_{2.5}$)	1 year	35 (Interim target-1)
		25 (Interim target-2)
		15 (Interim target-3)
		10 (guideline)
	24 hour	75 (Interim target-1)
		50 (Interim target-2)
		37.5 (Interim target-3)
		25 (guideline)
Ozone	8 hour daily maximum	160 (Interim target-1
		100 (guideline)

Source: General EHS Guidelines, World Bank Group, April 2007
Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

Table 3.8 World Bank Guidelines for Noise

Receptor	One hour Leq dB(A)	
	Day (07:00 - 22:00)	Night (22:00-07:00)
Residential, institutional education	55	45
Industrial, commercial	70	70

Source: General EHS Guidelines, World Bank Group, April 2007

Indicative values for treated sanitary sewage discharges are given in ***Table 3.9***. These are applicable to meet national or local standards or in the absence of national standards for sanitary wastewater discharges and where either a septic system or land is used as part of treatment system.

Table 3.9 Indicative values for treated sanitary wastewater discharges

Pollutants	Units	Guideline Value
pH	pH	6-9
BOD	mg/l	30
COD	mg/l	125
Total Nitrogen	mg/l	10
Total Phosphorous	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total Coliform bacteria	MPN*/100ml	400

Source: General EHS Guidelines, World Bank Group, April 2007 *MPN = Most probable number

4 ENVIRONMENTAL AND SOCIAL BASELINE

4.1 CONTEXT

This section provides a description of the physical, ecological, environmental, socio-economic and cultural conditions to provide a context within which the impacts of the proposed MPCL 50 MW WEP are to be assessed.

The baseline attempts to include information on all resources/receptors that were identified as having the potential to be impacted by the project.

4.1.1 *Specific Limitations*

Primary environmental, ecological and social baseline monitoring was not carried out by ERM. Data from the IEE report of 2009 has been utilized. Updates to this baseline information have been captured on the basis of the following:

- Secondary information: Information available on the basis of satellite imagery, publications and other sources in the public domain have been referenced to update the baseline;
- Field verification: ERM confirmed the applicability of the 2009 data and the present status of social and environmental sensitivities in the project area through an appointed local sub-consultant (M/s Tekcellent). The local consultant team consisted of environmental, flora and fauna and social experts who carried out five site assessments in February, March and April 2013 to confirm information available on the baseline; and
- Stakeholder Consultations: The primary site assessment included consultations with the local community within and around the project and its area of influence as well as relevant authorities of the Taluka and District Thatta.

4.1.2 *Project Area of Influence (AOI)*

The MPCL WEP site covers 1,553 acres of land situated in Deh Kohistan 7/1 of Jhimpir area in taluka and district Thatta in the Sindh province of Pakistan. Physically, there is no boundary or fencing for the Project Site boundary and hence it is contiguous along with the rest of the area, which has been allocated by the AEDB to other wind energy developers. As mentioned in ***Box 2.2 (Section 2),*** the land-use adjoining the site boundaries is as follows:

- North: To the north of Project site boundary lies degraded lands, a seasonal river Horola Nai followed by mountains;
- South: To the immediate south lies degraded land followed by the proposed GAWPL wind farm at a distance of 0.8 to 1 km;

- East: On the east of the Project site boundary across the Horola Nai moving towards north followed by village Janoo Burfat Goth at about 800 m distance; and
- West: on the west lies the Layari Nai followed by degraded lands.

Area of Influence (AoI)

The Project area of influence refers to the core wind farm site as well as to a larger area in its immediate vicinity. This includes the footprint of the associated project components (access road and transmission line) as well as the immediate surroundings that will see increased movement of vehicles, personnel and land-use change. Site assessments in February and March 2013 were undertaken by ERM local consultants to verify the environmental and social settings of the site.

Further to this, the AoI with respect to the environmental and social resources was considered based on the following reach of impacts:

- **Environmental parameters:** Project site boundary, immediate vicinity, access road and surroundings, i.e. a study area radius of approximately 5 km has been used to depict these parameters;
- **Air Quality:** Dustfall –typically up to 500 m from operations;
- **Noise:** Noise impact area (defined as the area over which an increase in environmental noise levels due to the Project can be detected) –typically 1-1.5 km from operations (this includes a distance of 10 times the size of the rotor diameter of the turbine);
- **Flora and Fauna (Terrestrial and Aquatic):** This includes: (a) the direct footprint of the project comprising the wind farm; (b) The areas immediately adjacent to the project footprint within which a zone of ecological disturbance is created through increased dust, human presence and project related activities (e.g., trampling, transportation activities). This kind of disturbance has been estimated to occur within 1 km of the project footprint;
- **Social and Cultural:** These include the local community and settlements within the project site and in the immediate vicinity up to the extent of 1 km from the wind farm project boundary. The socio-economic baseline profile has also considered a wider radius of 5 km from the MPCL site

Table 4.1 discusses the key settlements and other sensitivities in the immediate vicinity of the MPCL project site.

Table 4.1 Project and its Area of Influence

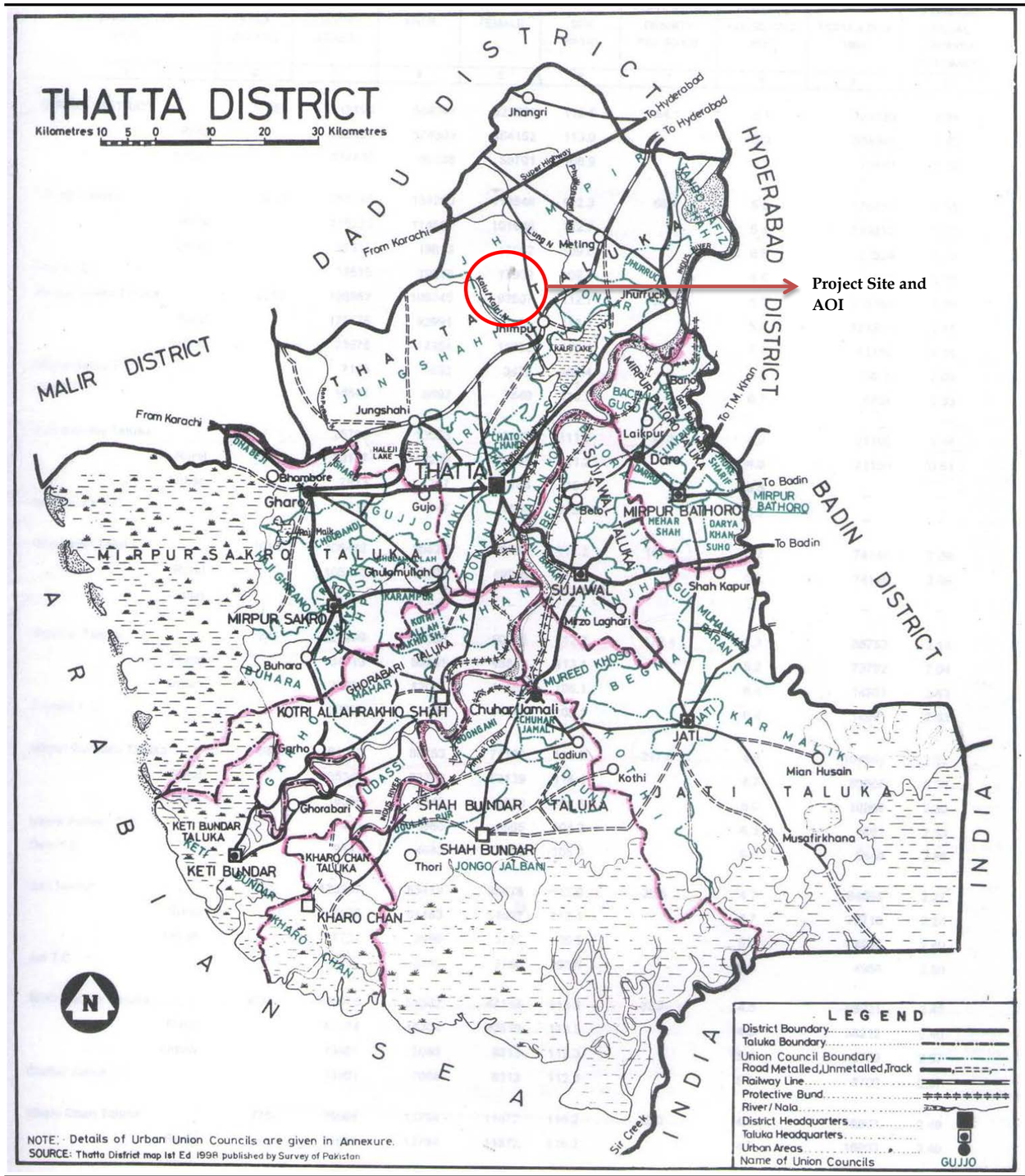
Component	Settlements/Habitations	Other Sensitivities
Wind farm site	Villages of Bacho Jhakro Goth and Qasim Burfat Goth are present within the project site	
1 km from project boundary	Nearest settlement is Janoo Burfat Goth at 800 m distance outside the Project boundary (840 -900 m from WTGs No.17 & 18)	Seasonal rivers of Harola Nai and Layari Nai is located near the northern, eastern and eastern perimeter of the site respectively.

Component	Settlements/Habitations	Other Sensitivities
Access road	The existing Nooriabad-Jhimpir link road passes through the Nooriabad industrial area. The 12 km dirt track further from this road to MPCL site does not have any settlements.	Seasonal stream Digru Nai
Substation	Qasim Burfat Goth located approximately 550~600 m away from the sub-station.	
Internal Transmission lines	MPCL WTGs would be connecting to the wind farm sub-station through underground cables. No Settlements.	

4.1.3 Administrative and Physical Setting

The proposed MPCL Project is located in the AEDB approved wind zone site of Jhimphir in Deh Kohistan 7/1 within the union administration of Jhimpir and district of Thatta, in the Sindh Province of Pakistan. *Thatta* District is spread over 17,355 km^2 or 1.735 million hectares and is located between 23°43' to 25°26'N and 67°05' to 68°45'E in *Sindh*, Pakistan. The district has a total population of 1,113,183 with a population density of 64 persons/sq km. The district is bounded on the north by *Dadu* district, on the east by Hyderabad and Badin districts, on the south by *Rann* of *Kutch* and the Arabian Sea and on the west by the *Karachi* district. An administrative map of Thatta is shown in ***Figure 4.1.***

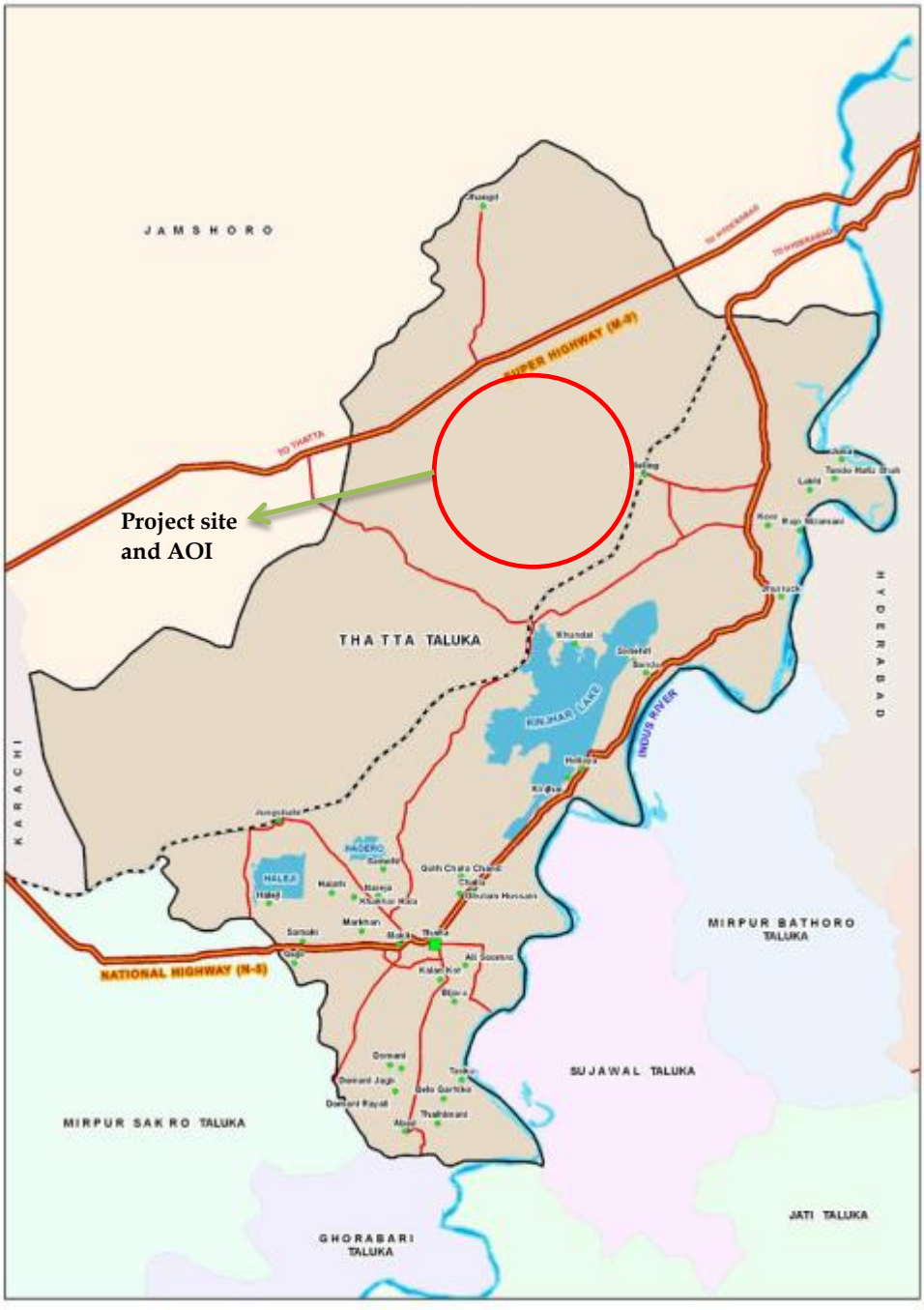
Figure 4.1 Administrative Map of Thatta District



*Source: http://www.childrenanddisasters.org.pk/files/Thatta.JP

According to the Census of Pakistan (1998), the district is administratively divided into 9 Talukas, 55 union councils and 812 villages. District administration in *Thatta* District is governed by the local government system comprising elected representatives and government functionaries. The District Government *Thatta* is headed by the District *Nazim*, who is an elected representative, and also by the District Coordination Officer (DCO) who is a government official. The district is administratively subdivided into 7 *tehsils* (talukas or sub-district): *Ghora Bari*, *Jati, Mirpur Bathoro, Mirpur Sakro, Shah Bunder, Sujawal, Thatta, Kharo Chan,* and *Keti Bunder*. The Taluka Map is shown in ***Figure 4.2***.

Figure 4.2 ***Taluka Map of Thatta***



**Source: http://www.districtthatta.gos.pk/thatta%20revenue.htm*

The seven *talukas* of District *Thatta* are governed by their respective *Taluka* Municipal Administration (TMA), while the 53 Union Councils of 7 *talukas* are governed by the Union Administration (UA). *Taluka Thatta* has 13 Union Councils, 61 revenue villages, 41,408 households with a population of 253, 748 and with an average size of 6.5 persons per household.

The 1,553 acre land area that has been agreed to be sub-leased by AEDB to MPCL is outside the settled area of Union Administration Jhimpir. The site is on the arid and stony wasteland of *Deh Kohistan*. The climate in the project area can be characterized by dry, hot and sub-humid conditions, typical of tropical arid belt lying in the heat zone of the monsoon region. The site and its immediate surroundings have been degraded by rampant sand/gravel/stone excavation, exacerbated by wood cutting. The shrubs have dried out; trees are dwarfed while groundwater has gone deep down or dried up due to over-extraction.

4.2 ENVIRONMENTAL BASELINE

4.2.1 Land Use and Land Cover (LULC)

Land use/cover inventories are an essential component in land resource evaluation and environmental studies. The data provides spectral, spatial and temporal variations in landscape characteristics. Geographical Information System (GIS) in conjunction with satellite remote sensing is not only helpful in improving the accuracy of the classification and integrating ancillary information but also for monitoring the changes. The land use study for the proposed wind farm and its 5 km buffer was undertaken by ERM with the following objectives:

- To establish the pre/existing scenario through mapping and developing an inventory of key natural resources using satellite data and ancillary information viz. land use/cover, settlement and transportation.
- To create a GIS database for various thematic layers viz. base map, site plan, drainage & water bodies.
- To prepare land use/cover map in core and buffer zone (Land use / cover analysis for 5 km, 2 km, 1 Km, 500 m area and within the site boundary).
- Generation of digital elevation model (DEM) and preparation of elevation contour map.
- To provide inputs for environmental planning of the MPCL site and it's 5 km buffer area by analysing the existing landuse/ land cover scenario of the 5 km, 2 km, 1 km, 500 m area and within the site boundary.

Methodology

Satellite remote sensing is bestowed with capturing the object signature of the earth surface by virtue of its multi-spectral capability and synoptic viewing. The optical sensors capture the spectral reflectance emerging from the ground

object in narrow bands viz. green, red, infrared and short wave infrared. The extended sensitivity of the sensors augments the subtle information on the earth surface. Synergy of spectral signature along with other image characteristics viz. texture, pattern, association is used in knowledge-based classification of different land use and their changes over time scale. In the present study for delineation and analysis of land use / land cover, multi-temporal IKONOS[1] imagery has been used for the month October of 2011. The details of the scenes, multi-spectral bands, spectral and spatial resolutions and date of pass are given in ***Table.4.2***. Besides multi-spectral data set, field surveys were used for mapping of settlements, roads etc.

Land use classification was analysed using the individual multi-spectral scenes only. Land use / land cover analysis was carried out using hybrid approach i.e. both digital as well is visual interpretation scheme. The mixing of the classes are maximum in the digital image classification as maximum area fall in the waste land category with high brightness and similar tone. Therefore the land with scrub and land without scrub visual interpretation scheme is applied here. The methodology was carried out in 6 steps viz.:

- Base map preparation;
- Development of interpretation key;
- Preliminary pre field interpretation;
- Ground truth collection and verification;
- Correction/ modification and transfer of post-field details on to base map; and,
- Final map preparation and area estimation.

Locations of habitat areas were marked from a 250 K topo sheet and the extent of settlement was delineated using satellite data and verified during ground truthing. The identification of features of religious importance, major roads and tracks were delineated and updated through satellite data and correct locations were transferred using GPS for particular spots.

Table.4.2 Details of Satellite Data used in the Study

Satellite and Sensor	Scene identifier	Date of Pass	Spatial Resolution (m)	No. of Bands and Band width (Microns)
IKONOS Sensor:	200007569350 6THC	6/10/2011	4	Blue- 0.445–0.516 µm Green-0.506–0.595 µm Red- 0.632–0.698 µm Near IR- 0.757–0.853 µm

[1] **IKONOS** is a commercial earth observation satellite, and was the first to collect publicly available high-resolution imagery at 1- and 4-meter resolution. It offers multispectral (MS) and panchromatic (PAN) imagery.

Satellite and Sensor	Scene identifier	Date of Pass	Spatial Resolution (m)	No. of Bands and Band width (Microns)
Landsat 4/5 TM (Path/ Row-152/043)	LE7152043201 1322PFS00	18/11/2011	4	B-G : 0.45 - 0.52 G: 0.52 - 0.60 R: 0.63 - 0.69 IR: 0.76 - 0.90 MR : 1.55 - 1.75 Thermal IR : 10.40 - 12.50 Mid IR : 2.08 - 2.35

Land use Interpretation of the MPCL Project Site and Area of Influence

Description of different land use classes and their extent: To evaluate the existing environmental status of the Project area has been divided in the 5 zones namely –

- (Within the site boundary);
- (0–500 m radius);
- (0-1 km radius);
- (0-2 km radius); and
- (0-5 km radius).

The Project area contains the following land use / land cover classes *viz.:* built-up, agricultural land, wasteland, water bodies and mining/ excavated area at Level-I classification system. The land use / cover classes at the Level-I, Level-II and Level-III classification system along with statistics are shown in ***Table 4.3***. IKONOS data for the month of *October* was used for the delineation of the crop boundary near the small bunds.

In the 5 km project area, majority of the land is arid and sandy. The next major category is Land without scrub. In the present report the figures / numbers of 'area in hectare' and 'percentage' are calculated from the total Project area.

(A) Built-up land

It is defined as an area of human habitation development due to intensive non-agricultural use. They appear in dark bluish green in core built-up area and bluish in the periphery irregular and discontinuous in appearance in satellite imageries. Due to the small size and sparse distribution the settlements are not separable in the digital image processing and digital signature collection was avoided. All small settlement mass are digitized and later on incorporated with the other thematic layers. The major categories discernible on the satellite data within the Project area include several rural residential areas. No concrete settlement area with high reflectance was found. All are hutments. No industrial or urban or mixed built-up area were visible within the 5 km buffer area. The total built-up land area is 67.39 ha (0.41%) in the 5 km buffer area.

(B) Agricultural land

Agricultural land use by and large is dependent on agro-climatic condition prevalent in the area. Cropped areas appear in bright red in colour with varying size and pattern. A number of small check dam/nalah bunds are observed within the Project area. These structures are constructed across gullies, nalahs or streams to check the flow of surface water in the stream channel and to retain water for longer durations in the previous soil or rock surface. Agriculture is confined to the nalah bund region only. Based on the nallah bunds the size and pattern of the crop fields are also vary from one field to other. Crop vigour is not high in the Project area. The total agriculture area is 1529.06 ha (9.36 %) in the 5 km buffer area.

(C) Wasteland

Wasteland is described as 'degraded land' which can be brought under vegetative cover with reasonable effort and which is currently under-utilized for the lack of appropriate water and soil management or on account of natural causes. In the Project area existent wasteland classes are barren/ rocky/stony area, land with scrub, land without scrub, gullied /ravines, degraded pasture/grazing land and the arid sandy area. Wasteland is the major landuse category of the Project area covering maximum of the total geographical area of the studied 5 km buffer zone and is recoded as 14538.58ha (88.96%). For all other buffer zones viz. 2 km, 1 km and 500 m buffer area and within the site boundary wasteland covers the maximum geographical area. The individual statistics for the all wasteland category are given below:

(i) Barren/ Rocky/Stony area: These are rock exposures of varying lithology often barren and devoid of soil and vegetation Cover. They occur amidst hill-forests as openings or as isolated exposures on plateau and plains. Such lands can be easily discriminated from other categories of wastelands because of their characteristic spectral response. They appear in greenish blue to yellow to brownish in colour depending on the rock type. They vary in size with irregular to discontinuous shape with a linear to contiguous pattern. Within the Project area this class is located in the eroded plains associated with barren and exposed rocky/stony wastes.

(ii) Land with scrub: This is a land, which is generally prone to deterioration due to erosion. They appear in light yellow to brown to greenish blue depending on the surface moisture cover and vary in size from small to large having either contiguous or dispersed pattern. In the Project area the majority of the scrub areas are confined along the 'Rod nai' (Harola Nai) river bed and they are open and sparse.

(iii) Land without scrub: This land is also generally prone to deterioration due to erosion. They appear in light greenish blue depending on the surface moisture cover. In the study buffer these areas are basically confined to the barren rocky region and the gullied portion Sometime scrub grown to that regions and dried and gives the characteristic light greenish blue signature.

(iv) Gullied/Ravines: Gullies are formed as a result of localized surface run off affecting the unconsolidated material resulting in the formation of perceptible channels causing undulating terrain. They appear in light yellow or bluish green in colour depending on the surface moisture and depth of erosion. They vary in size, shape with irregular broken network pattern. They are mostly associated with stream courses and slopping grounds and entrenched drainage. Ravines are basically an extensive systems of gullies developed along river courses. Along the 'Harola nai' and 'Lung nai' several gullied regions with undulating terrain are found. In the northern side also some gullied areas are found.

(v) Degraded Pasture/Grazing land: Grasslands/ Grazing lands are the areas of natural grass along with other vegetation, predominated by the former or grass like plants (Monocots) and non-grass like herbs. They appear in light red to light brown of varying sizes. They possess irregular shapes with contiguous or non- contiguous appearance. In the Project area these classes are associated with the check / nala bunds and the agricultural fields in the present case.

(vi) Arid Sandy area: These are the areas that have stabilized accumulation of sand. They appear as white to light yellow bluish depending on moisture content and at time light red when vegetation is associated with the class, vary in size, with regular to irregular shape with contiguous to linear pattern.
The Project area has desert sands those confined to arid environment where the rainfall is low. These lands are barren and are characterized by accumulation of sand developed in situ or transported by Aeolian processes.

(D) Water bodies
Several river/streams and small water bodies are seen in the Project area. These water bodies are clearly seen on the satellite image in blue to dark blue or cyan color depending on the depth of water according to the season. The major river in the Project area is Harola Nai flowing through the eastern side of the project site. Some small drains are also draining in the area. Small streams are also visible in the western terrain, namely Layari nai, Mera nai, Lung nai, Mucha nai and Ahenwari nai. All are tributaries of Harola nai. Ghar nai a tributary of the Andho nai is also falling within the 5 km buffer through the south-western corner. The rivers are not perennial in nature and remain dry either partially or totally throughout the year. No major water body is present within the site boundary.

E) Others
Mining/ excavated areas are one of the most important classes of the Project area. These areas are scattered all around the western side of the study buffer.

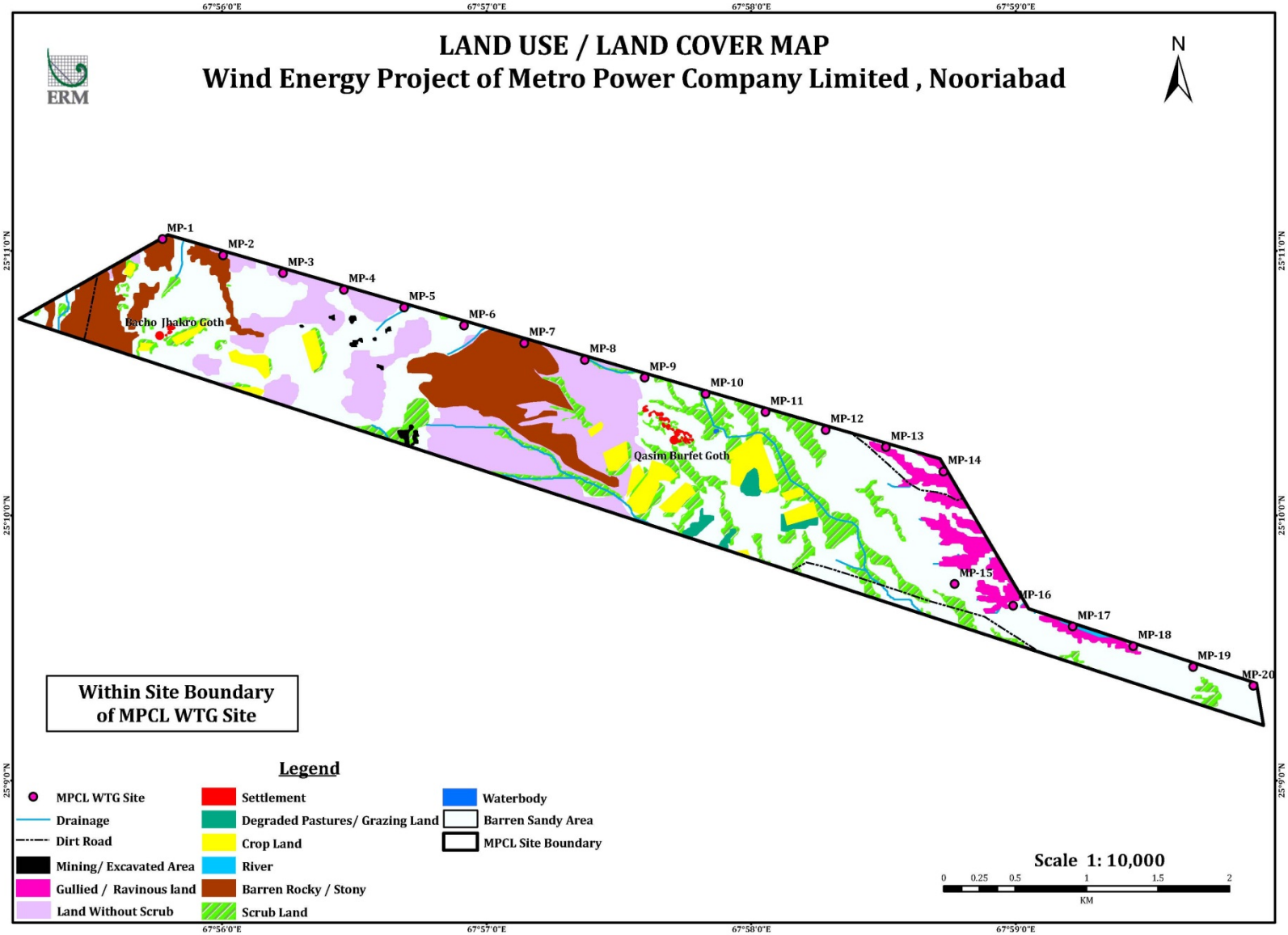
The landuse/landcover map of the MPCL Project site and 5 km Project area is shown in ***Figure 4.3*** and ***Figure 4.4***

Table 4.3 Landuse/Land cover statistics of MPCL Project area

			MPCL Site within Boundary		500 m buffer		1 km buffer		2 km buffer		5 km buffer	
Level –I	**Level –II**	**Level –III**	**Area (Ha)**	**% of Geog. Area**	**Area (Ha)**	**% of Geog. Area**	**Area (Ha)**	**% of Geog. Area**	**Area (Ha)**	**% of Geog. Area**	**Area (Ha)**	**% of Geog. Area**
Built up	Built-up	settlement	1.49	0.24	2.63	0.17	7.32	0.28	15.78	0.30	67.39	0.41
		Sub- Total	1.49	0.24	2.63	0.17	7.32	0.28	15.78	0.30	67.39	0.41
Agricultural	Cropland	Single crop	29.64	4.72	43.19	2.76	66.63	2.52	190.49	3.65	1529.06	9.36
		Sub- Total	29.64	4.72	43.19	2.76	66.63	2.52	190.49	3.65	1529.06	9.36
Wasteland	Land with & without scrub	Land with scrub	70.47	11.23	262.90	16.80	415.08	15.71	786.30	15.06	2000.30	12.24
		Land without scrub	110.56	17.61	275.04	17.58	453.06	17.15	749.06	14.35	2663.16	16.30
		Gullied /Ravines	24.52	3.91	57.99	3.71	95.08	3.60	148.02	2.83	279.47	1.71
	Grazing land	Degraded Pasture/Grazing land	5.29	0.84	13.11	0.84	14.14	0.54	39.21	0.75	237.24	1.45
	Barren Rocky / Stony area	Barren Rocky / Stony area	77.99	12.43	138.62	8.86	214.44	8.11	295.61	5.66	608.23	3.72
	Sandy area	Arid Sand	304.40	48.50	731.59	46.75	1315.80	49.79	2874.24	55.05	8750.18	53.54
		Sub- Total	593.22	94.52	1479.26	94.54	2507.59	94.90	4892.45	93.70	14538.58	88.96
Water bodies	River/Stream	River/Stream	1.11	0.18	34.11	2.18	52.58	1.99	93.91	1.80	152.86	0.94
	Waterbody	Waterbody	0.09	0.01	0.09	0.01	0.18	0.01	0.79	0.02	7.67	0.05
		Sub- Total	1.20	0.19	34.20	2.19	52.76	2.00	94.71	1.81	160.53	0.98
Others	Mining/Excavated Area	Mining/Excavated Area	2.09	0.33	5.50	0.35	8.18	0.31	28.04	0.54	47.81	0.29
		Sub- Total	2.09	0.33	5.50	0.35	8.18	0.31	28.04	0.54	47.81	0.29
		Total	627.64	100.00	1564.78	100.00	2642.49	100.00	5221.47	100.00	16343.35	100.00

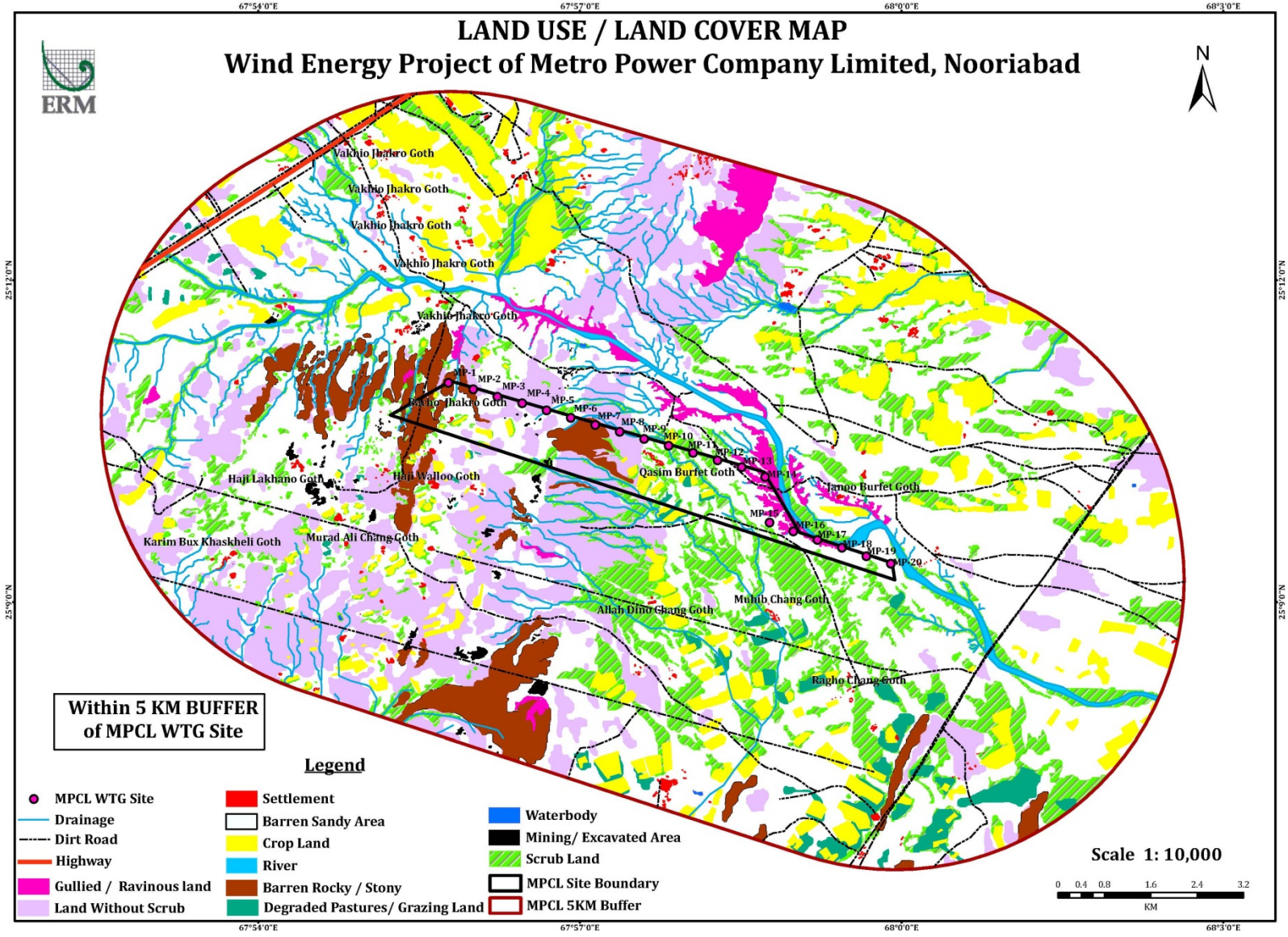
Source: Calculated based on Satellite data as given in table 4.2

Figure 4.3 Land use/ land cover of the MPCL Project Site



Source: Prepared using Satellite data as given in table 4.2

Figure 4.4 Land Use/ land cover of the 5 km Project Area



Source: Prepared using Satellite data as given in table 4.2

4.2.2 Topography

Topograhic undulation of the Deh Kohistan area is substantially large with the relative elevation varying between 40 m to 250 m. The hilly areas are located in the north and west while the low lying and flat fields are located on the south west of the area.

Within 5 km of the MPCL Project area, the lowest elevation of 50 m is near the eastern most corner of the project buffer. The region is very near to the Harola Nai (Rod nai). The highest elevation is 130 m on the western side of the 5 km area. The elevation in the Project area ranges from 50 m to 130m.

The maximum elevation (110 m) of the project site is at the southwest, southern and western boundary and passes near the proposed wind turbine site MP-1. The maximum depression i.e., about 60 m, is located in the south east and north east side of the project site near wind turbine site MP-20. A contour map of the Project site and surrounding 5 km area is shown in ***Figure 4.5.***

The DEM shows that the Project area is plain in the eastern side near the head of the Harola Nai with the elevation value 50 m which increases gradually towards the western side with maximum elevation 120 m within the western most corner of the 5 km buffer. This clearly depicts that the area slopes from west to east.

Within the Project site, the DEM shows that the area is plain in the eastern side with the elevation value 50-90 m up to the proposed wind turbine site MP-7. The elevation near MP-6 is about 100 m. The elevation again increases up to the proposed wind turbine site MP-2 (~106 m) MP-1 and MP-2 has the similar level of elevation. DEM map is shown in ***Figure 4.6.***

Figure 4.5 Contour Map of the MPCL Project Site and 5 km Buffer

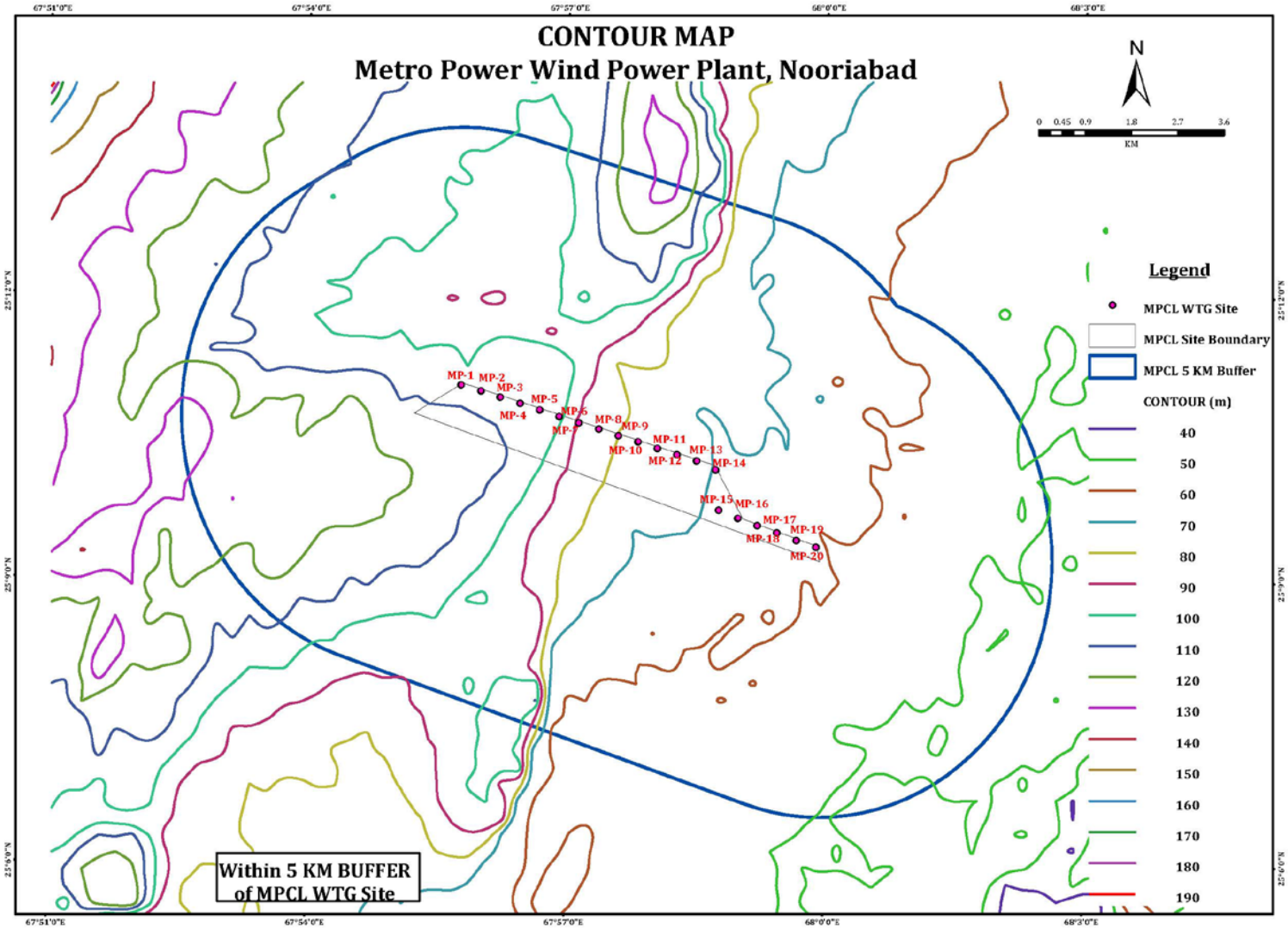
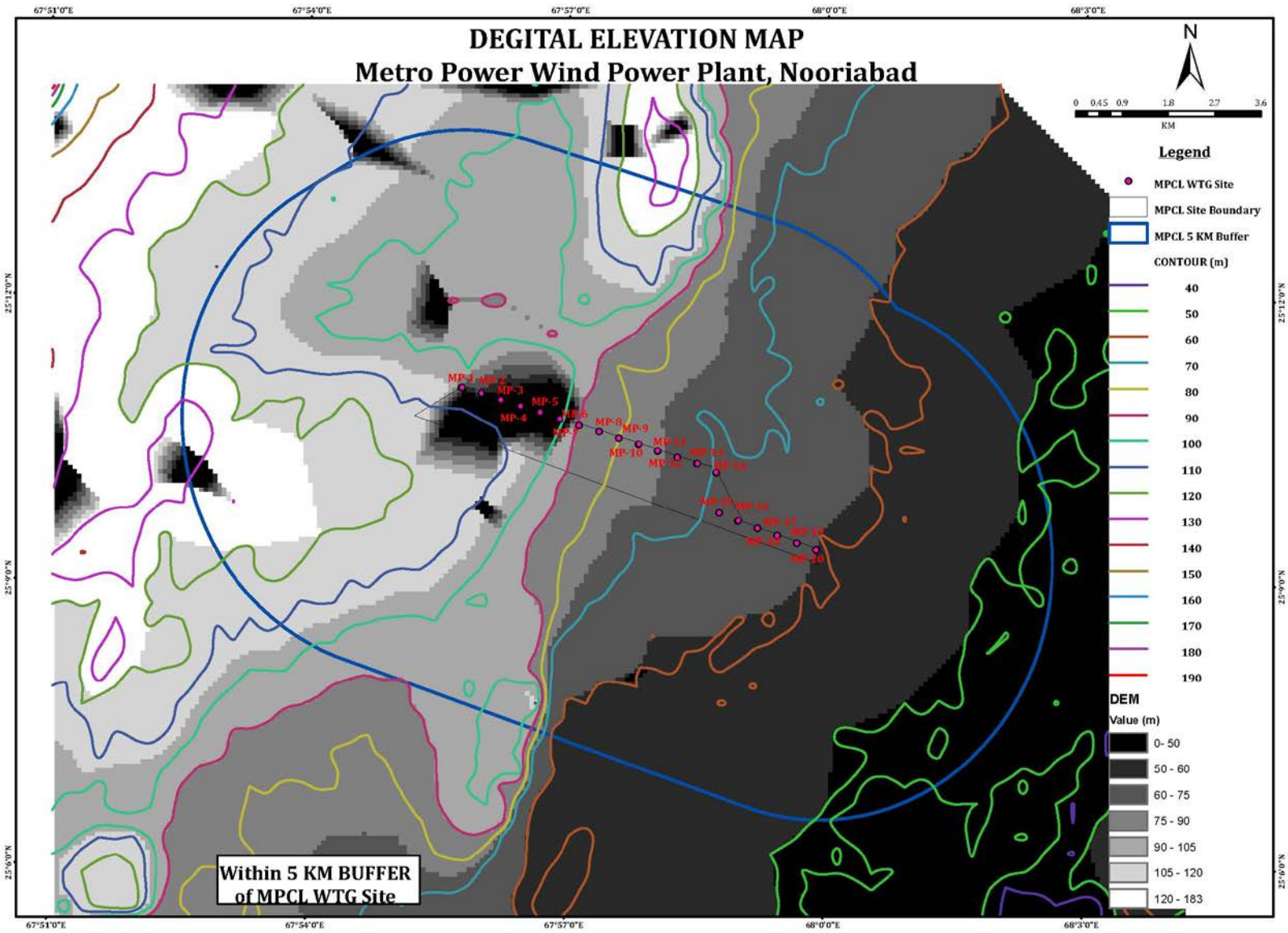


Figure 4.6 Digital Elevation Model of the MPCL Project Site and 5 km Buffer



4.2.3 Geology

The geology of the Sindh region of Pakistan is closely related to the formation process of Himalayan mountain ranges resulting in intense deformation with complex folding, high angle strike-slip faults and crust thickening expressed in a series of thrust faults. ***Figure 4.7***shows the geology of the Project area within Sindh Province.

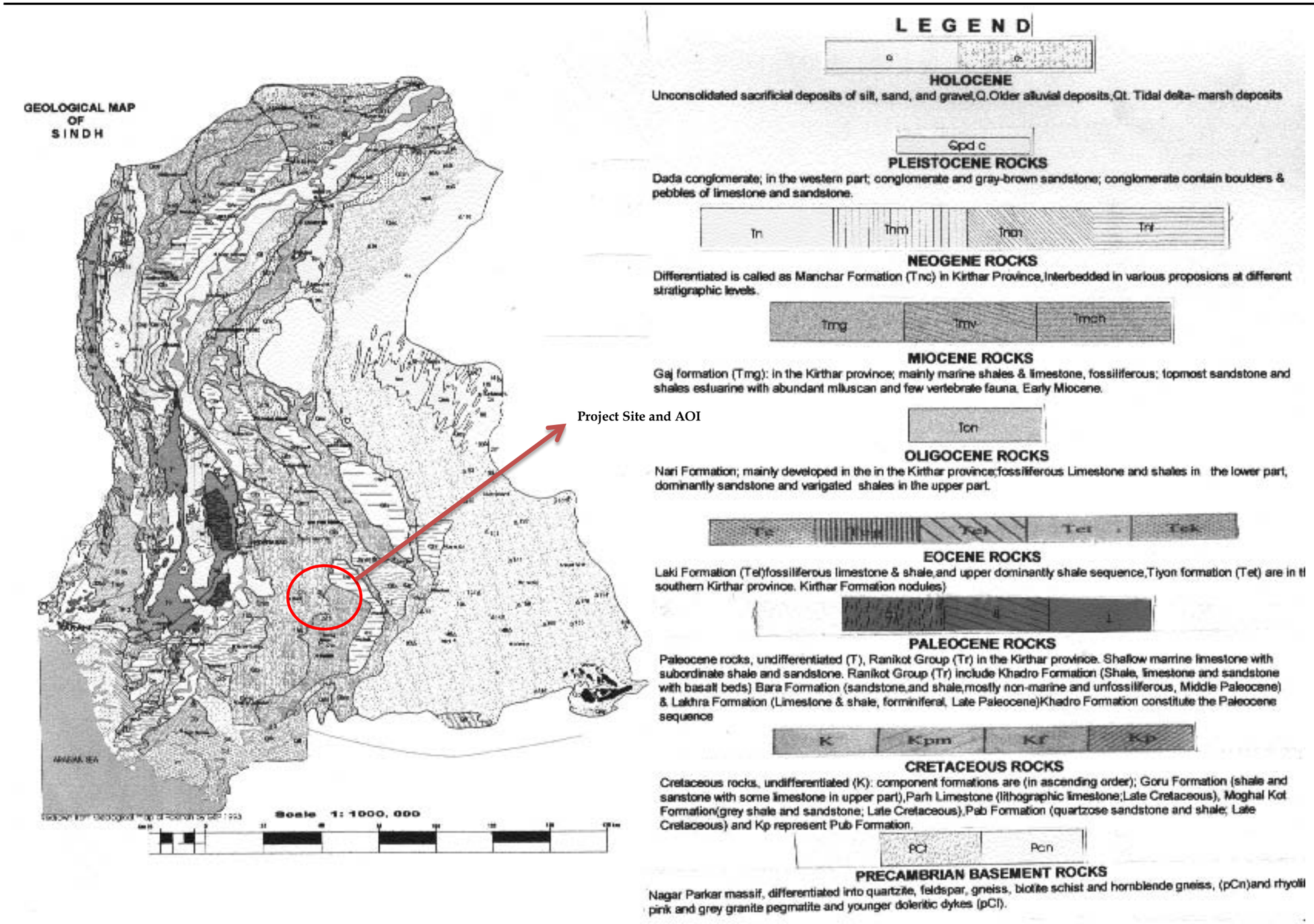
Most parts of Sindh are covered either by recent alluvium or wind-borne sand. The principal features of geological significance are to be found in the hilly portions of the province, towards the west of the Indus. Outlying extensions of this hilly tract occur east of the Indus as well, near Sukkur, Hyderabad and Jerruck.

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 neighbourhood that there are some exposed rocks belonging to the next older system, the Cretaceous. With the exception of some volcanic beds associated with these Cretaceous strata, all the rock formations of western Sindh are of sedimentary origin. All the important hill masses consist of limestone.

A sequence of lateritic clay and shale with beds of arenaceous sandstone of Laki Formation, named as Sonhari Member of Eocene age is found in Deh Kohistan, where the proposed MPCL Project is located.

Geotechnical investigations report of MPCL Project site, February 2009 prepared by Civil and Geotechnical Engineers Testing Laboratory gives the stratum description of the Project site. A study of the borehole logs shows that the top 6-8 m comprise of silty clay, shale, sand and claystone deposits. The silty clay/shale deposits possess medium to high plasticity. Such high plasticity strata are susceptible to swelling upon wetting and shrinkage upon drying. The borehole log details of the MPCL Project site are summarized in ***Table 4.4***

Figure 4.7 Geology of Sindh



Source: Sindh State of Environment and Development, IUCN, 2004

Table 4.4 Sub-surface lithology

S. No.	Coordinates	Depth (m)	Elevation	Stratum Description
Borehole No. 1	N 25°09′18″ E 67°59′51″	Surface to 1.5 m	58.5 m	Brown sandy gravel, some clay
		1.5-6.0 m	54 m	Reddish brown, medium hard, claystone, fractures
		6.0-10.5 m	49.5 m	Greyish brown, medium hard, shale/claytsone, fractured
		10.5 m - 25m	35 m	Brown hard, silty clay/shale, some silty sand, lenses of sandstone and claystone
		25-30 m	30 m	Reddish brown, dense, cemented fine sand
		30-31.5 m	28.5 m	Greyish brown, medium hard, claystone fractured
		31.5-35 m	25 m	Greysh brown, friable, sandstone
Borehole No.2	N 25°09′32″ E 67°59′51″	Surface to 3 m	56	Brown, dense to very dense, medium to coarse Sand, some gravel, little silt
		3.0 - 5.0 m	54	Brown, medium hard sandy Limestone, fractured
		5.0 - 6.0 m	53	Brown, very dense; sandy Silt
		6.0 - 9.0 m	50	Greyish brown, medium hard, Claystone, Fractured
		9.0 – 10.5 m	48.5	Brown, medium hard, Sandstone, fine to coarse grained, interlayers of clayey silt
		10.5 - 30 m	29	Greyish brown, medium hard, Claystone, fractured
Borehole No.3	N 25°09′46.5″ E 67 °58′45.7″	Surface to 3.0 m	66 m	Brown, very dense, gravelly coarse, Sand
		3.0- 4.5 m	64.5 m	Brown, hard, clayey Silt/Siltstone,
		4.5 -5.0 m	64 m	Brown hard sandy Boulder
		5.0-6.0 m	63 m	Grey is!) brown, medium hard, Sandstone
		6.0-9.0 m	60 m	Greyish brown, medium hard, Claystone, fractured
		9.0-12.0 m	57 m	Greyish brown, medium hard, Claystone, fractured with interlayers of limestone
		12.0- 16.5 m	52.5 m	Greyish brown, medium hard, Claystone, fractured with interlayers of sand
		16.5 -19.0 m	50 m	Greyish brown, very dense; sandy Silt with interlayers of sandstone
		19.0-25 m	44 m	Greyish brown, medium hard, Shale/Claystone
Borehole No. 4	N 25°10′13.7″ E 65°58′17″	Surface to 1m	67 m	Brown, sandy Gravel, some clay
		1.0-2.5 m	65.5 m	Brown, medium dense to dense, silty/clayey, fine to coarse Sand
		2.5 -4.0 m	64 m	Brown, sandy Gravel, trace clay & lime
		4.0 m -8.0 m	60 m	Greyish brown, medium hard, Shale/Claystone with lime, fractured
		8.0-9.0 m	59 m	Brown, hard, sandy Limestone
		9.0-9.5 m	58.5 m	Brown, medium hard, Sandstone

S. No.	Coordinates	Depth (m)	Elevation	Stratum Description
		9.5-12.0 m	56 m	Brown, medium hard, silty Clay/Claystone some silty sand
		12.0 -15.2 m	52.8 m	Greyish brown, very dense, fine Sand with cementation, little silt
		15.2 -25 m	43 m	Off white, medium hard, chalky Limestone, fractured
Borehole No. 5	N 25°10'9.5" E 67 °57'36.2"	Surface to 1m	64 m	Brown, sandy Silt
		1.0-7.5 m	57.5 m	Off-white, hard, Limestone, fractured
		7.5 -12.0 m	53 m	Off-white, medium hard, Limestone, fractured
		12.0- 30.0 m	35 m	Off-white, hard, Limestone, fractured
Borehole No.6	N 25°10'35" E 67 °57'03"	Surface to 1.5 m	83. 5 m	Off white, sandy Limestone
		1.5 -6.0 m	79 m	Brownish white, medium hard to hard, chalky Limestone, fractured
		6.0-11.0 m	74 m	Brownish white, hard, Limestone, fractured
		11.0 -25.0 m	60 m	Off white, medium hard to hard, Limestone, fractured, porous
Borehole No.7	N 25°10'28.2" E 67 °56'23.3"	Surface to 4.5 m	99. 5 m	Brown, hard sandy Limestone
		4.5 -6.5 m	97.5 m	Off white, medium hard, chalky Limestone, fractured
		6.5 -8.0 m	96 m	Yellowish brown, hard, Sandstone fractured
		8.0- 25 m	79 m	Off white, medium hard, Limestone, fractured, porous
Borehole No. 8	N 25°10'48.0" E 67 °55'45.0"	Surface to 1.5 m	107.5 m	Off white, pieces of Limestone
		1.5-7.5 m	101. 5 m	Off white, medium hard, Limestone, fractured
		7.5 -12.0 m	97 m	Off white, hard, Limestone, fractured
		12.0-30.0 m	79 m	Off white, medium hard, Limestone, fractured

Source: Geotechnical Investigation Report of MPCL, Feb 2009

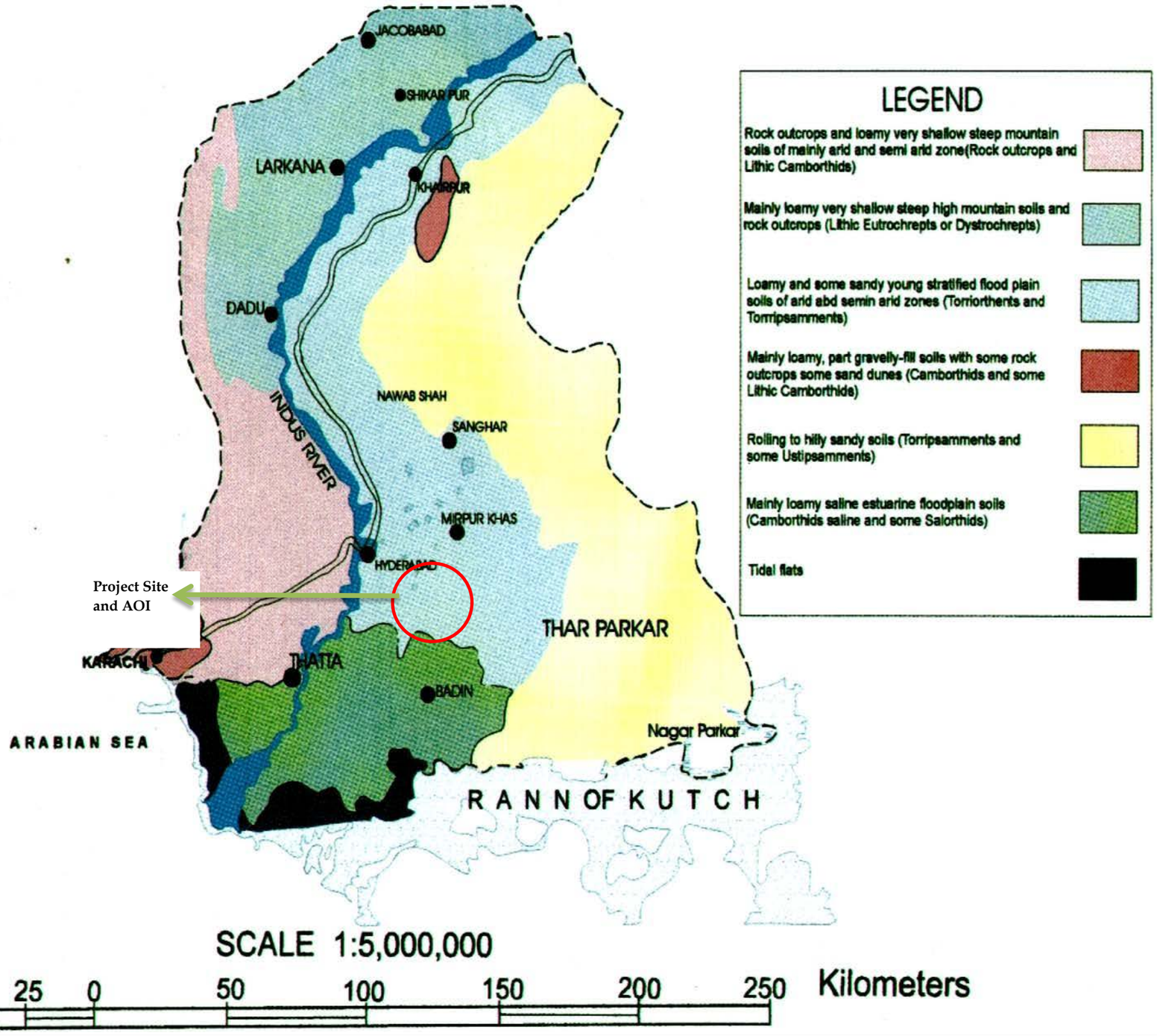
4.2.4 Soil Types

The soil of Project area comprise of rock outcrops and loamy very shallow steep mountain soils of mainly arid and semi-arid zone. Soil of the Sindh Province including Project and its AOI is shown in the ***Figure 4.8.***

The soil cover of the MPCL Project site and its AOI is very thin due to severe wind erosion and soil erosion in the drainage basin. Most of the rocks contain limestone. Natural vegetation has almost disappeared from the surface plain. The soils are shallow, strongly calcerous silt loam with weak structure. The slope of the entire Project site is towards west to east i.e. towards the river Horola Nai. The outcrops comprise either bare rocks or have very shallow soils.

Overall, the physical, geographical and hydrogeological features of the Project site and AOI portray the distinctive features of desertified arid land.

Figure 4.8 Soil Map of Sindh with Project Site



Source: Study of Riverine Forest Upstream Sukkur and Downstream Kotri, 2008, WWF Pakistan

4.2.5 Earthquake Hazard

Structurally Sindh generally contains gently folded anticlinal features trending in north-south direction. The major active faults in the province are:

- **Surjani Fault:** N-S trending, located west of Larkana. It cuts Quaternary deposits. The maximum magnitude of the earthquake associated with the fault is of the order M=6.1 on Ritcher Scale.
- **Jhimpir Fault:** N-W trending, a number of epicenters are located on the fault. The fault has produced an earthquake of M=5.6 on Ritcher Scale.
- **Pab Fault:** NN-W trending, located in the eastern part of Pab range. The maximum magnitude of the earthquake associated with fault is of the order M=7.0 on Ritcher Scale.
- **Rann of Kutch:** E-W Trending the fault has produced an earthquake of the order M=7.6 on Ritcher Scale. Recent studies have revealed that this fault traverses the Karachi Metropolitan Area. This fault system passing through Karachi and extending into the Arabian Sea, intersects another system of faults associated with a major tectonic boundary that has produced devastating earthquakes as far north as Quetta in the past. Together these systems of faults have produced historically large earthquakes within Kohistan, notably in the Pab Range, Thatta taluka, and Jhimpir areas especially the one in Bhuj, Gujarat (India) 2001.

Over the last sixty years, earthquakes of intensity lower than 5 on the Richter scale, including those in 1945 and 1985, have struck the region including the project site and AOI and thus far they have been of minor significance. This is mainly because the earthquakes here are not "Inter-Plate" or "Plate Boundary" earthquakes which occur commonly along narrow zones that follow the edges of tectonic plates. A list of earthquakes occurring near Jhimpir in the last 40 years is shown in ***Table 4.5***. The seismic hazard map of Pakistan is represented in ***Figure 4.9*** and location of faults in and around Jhimphir area is shown in ***Figure 4.10***.

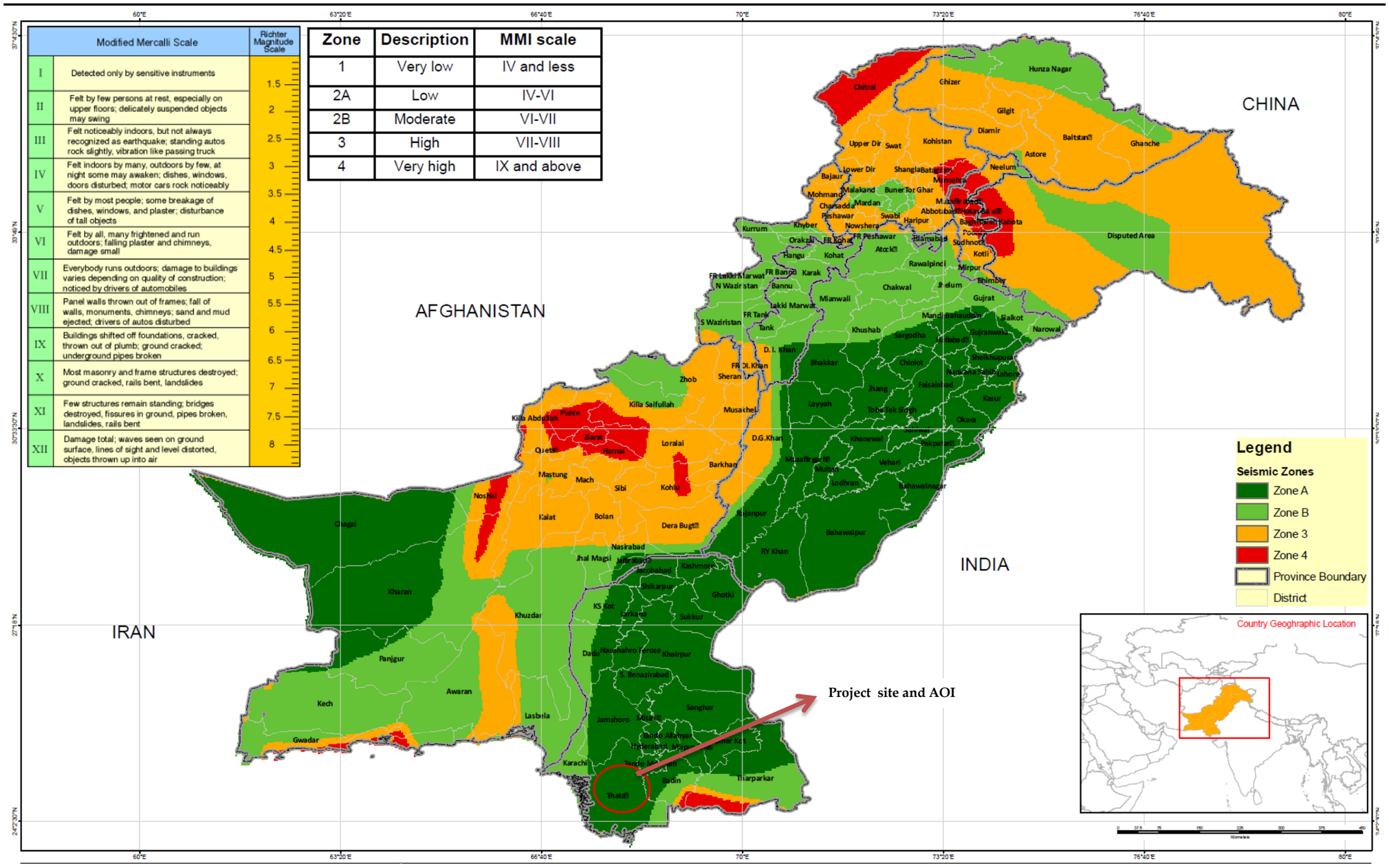
Table 4.5 Earthquake Hazard Occurrence in and around Jhimphir, Thatta and Karachi Regions

Year	Coordinates	Depth	Magnitude [Richter Scale]	Intensity [MM]	Location
1962	24º70′N 66 º 00′E	0	4.50	-	Karachi
1965	25 º 03′N, 67 º 76′E	40	4.50		Karachi
1966	25 º 0′N, 68 º 00′ E	-	5.0	VI-VII	Jhimpir
1968	24 º 61′N, 66 º 42′ E	19	4.10	-	Karachi
1970	25 º 28′N, 66 º 65′ E	33	4.90	V	Karachi
1971	25 º 00′N, 68 º 00′ E -	-	4.50	V	Jhimpir
1972	25 º 35′′N, 66 º 71′ E	33	4.50	V	Karachi
1973	25 º 00′N, 68 º 00′ E	-	5.00	VI	Jhimpir
1973	25 º 48′N, 66 º 33′ E	57	4.90	V	Karachi
1975	25 º 50′N ,66 º 80′ E	-	4.50	V	Gadani
1975	25 º 22′N ,66 º 59′ E	33	4.90	V	Karachi
1976	24 º 96′N 70 º 38′ E	14	4.70	V	Karachi
1984	25 º 86′N 66 º 41′ E	33	4.70	VI	Karachi
1985	24 º 90′N 67 º 39′ E	33	5.00	VI	Karachi

Year	Coordinates	Depth	Magnitude [Richter Scale]	Intensity [MM]	Location
1986	25 º 34′N 66 º 60′ E	33	4.50	V	Karachi
1992	25 º 25′N 67 º 76′ E	33	3.60	IV	Karachi
1996	25 º 06′N 66 º 76′ E	33	-	-	Karachi
1998	25 º 69′N 66 º 46′ E	33	4.40	V	Karachi
1998	24 º 85′N 66 º 35′ E	33	4.50	V	Karachi
2009	24 º 31′ N 67 º 18 ′E	10	2.2	IV	Thatta

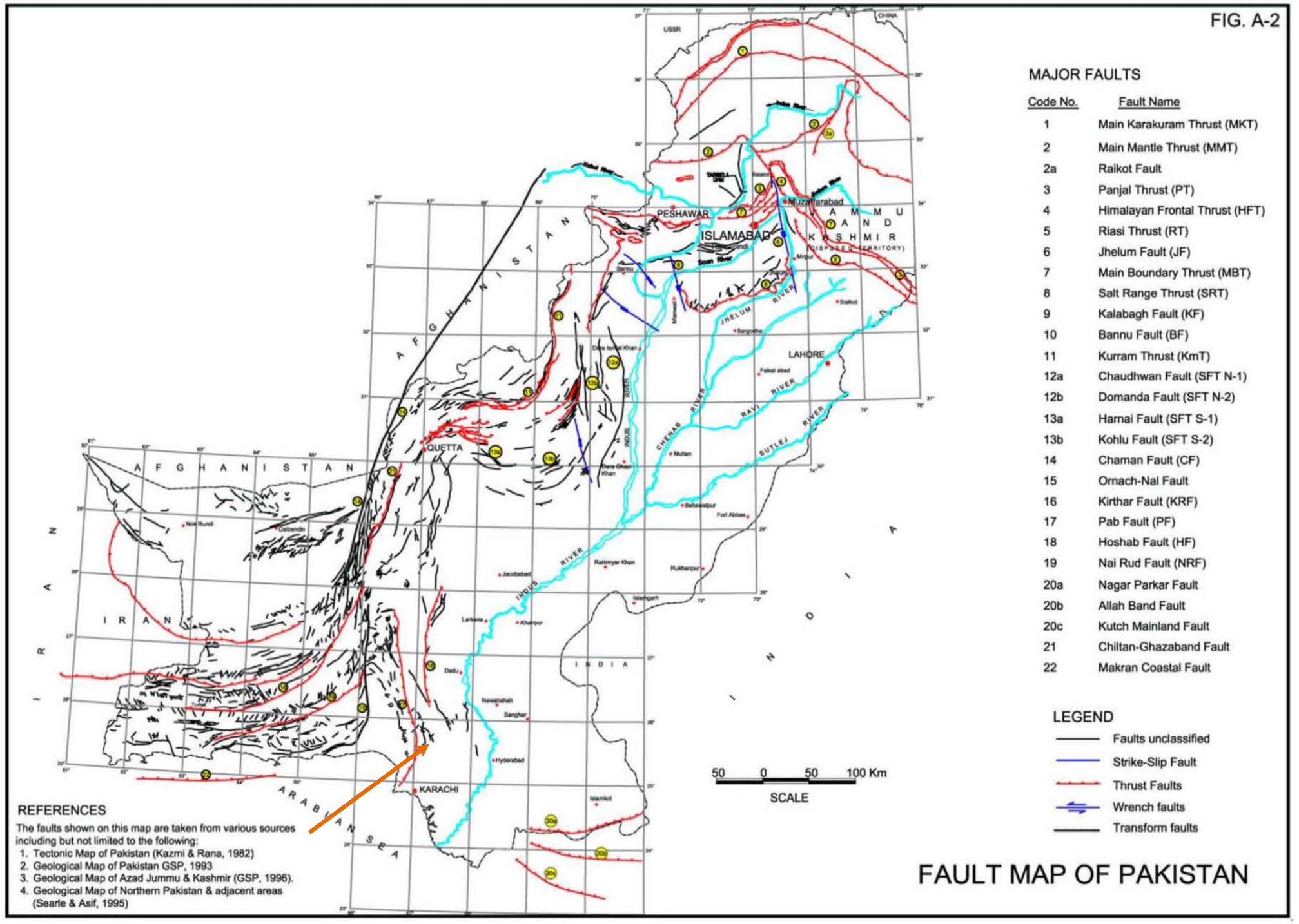
Source: IEE report, 2009

Figure 4.9 Seismic Hazard Map of Pakistan



Source: http://www.unhabitat.org.pk/Maps-updated/UNH-PAKOV_SZ_A3_02122010.pdf

Figure 4.10 Faults Lines in Pakistan



Source: http://nceg.upesh.edu.pk/workshop-21-26-09/lectureslides/Day1/SeismicHazardPakistan_Dr_Asif.pdf

4.2.6 *Climate and Meteorology*

The climate of most parts of Sindh region is arid characterized by the following four distinct seasons in a year:

- Winter Season - Mid-November to February;
- Spring season - March and April;
- Summer Season - May to Mid-September; and
- Autumn - Mid-September to Mid-November

Dry and humid conditions persists round the year along the coastal belt. There exist several meteorological stations in Sindh; data recorded at some of these stations is provided in the following sections.

Temperature

Monthly mean maximum and minimum temperature recorded at various stations in Sindh Province is given in ***Table 4.6*** and ***Table 4.7*** and shown in ***Figure 4.11*** and ***Figure 4.12*** respectively. From the available information, high temperatures were observed during the month of May and lower temperatures during the month of January at all stations.

Table 4.6 Monthly Mean Maximum Temperature recorded at Met Stations in Sindh Province

	Monthly Mean Max				
Month/Stations	**Hyderabad**	**Umerkot**	**Sanghar**	**Badin**	**Jacobabad**
January	25.04	26.49	24.31	25.78	22.6
February	28.15	29.16	27.06	28.59	25.24
March	33.38	34.52	33.29	34.02	31.28
April	38.87	39.12	39.25	38.40	38.00
May	41.62	41.49	43.53	39.85	43.08
June	40.15	39.72	43.23	38.02	44.33
July	37.4	36.19	40.37	35.11	40.56
August	36.3	34.51	38.60	33.61	38.24
September	36.84	35.7	38.14	34.36	37.00
October	37.19	37.12	37.14	35.80	35.32
November	31.95	32.98	31.59	31.87	30.06
December	26.27	29.95	25.53	26.28	24.11

Source: IEE Zorlu Energy Project 2010

Table 4.7 Monthly Mean Minimum Temperature recorded at Met Stations in Sindh Province

	Monthly Mean Max				
Month/Stations	**Hyderabad**	**Umerkot**	**Sanghar**	**Badin**	**Jacobabad**
January	11.08	5.42	5.92	8.73	7.68
February	13.62	8.71	8.72	11.6	10.48
March	18.5	14.29	14.22	16.8	16.3
April	22.98	20.12	19.71	21.8	22.33
May	26.16	24.5	24.59	25.47	26.74
June	28.07	27.17	27.67	27.46	29.38

Month/Stations	Monthly Mean Max				
July	27.81	26.82	27.6	27.04	29.22
August	26.71	25.73	26.33	26.06	28.25
September	25.34	23.88	23.77	24.87	25.85
October	22.27	18.54	18.8	21.7	20.29
November	17.29	11.89	12.23	15.86	14.08
December	12.5	6.62	7.39	10.1	8.74

Source: IEE Zorlu Energy Project 2010

Figure 4.11 Monthly Mean Maximum Temperature recorded at Met Stations in Sindh Province

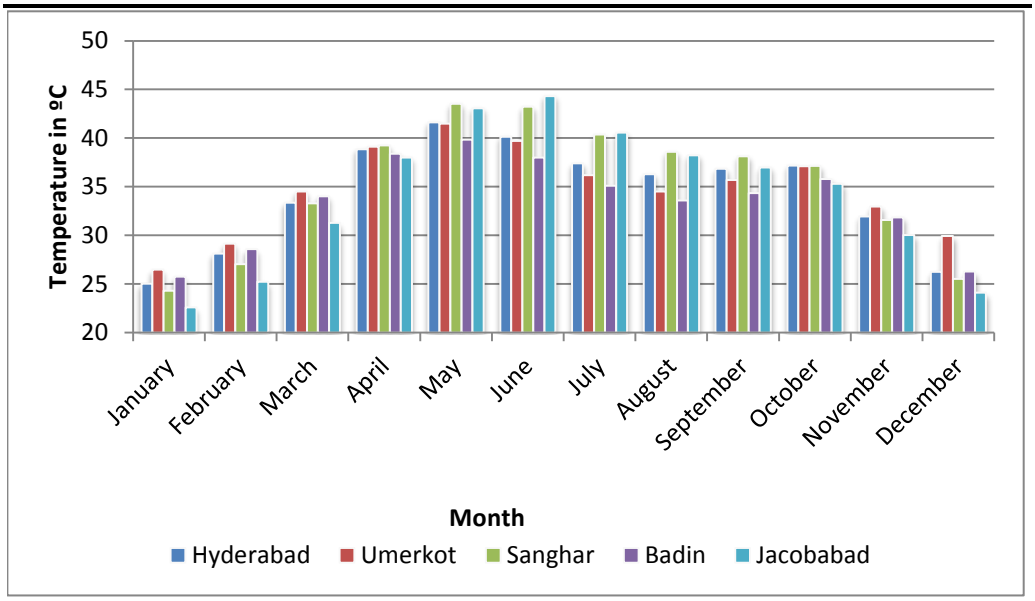
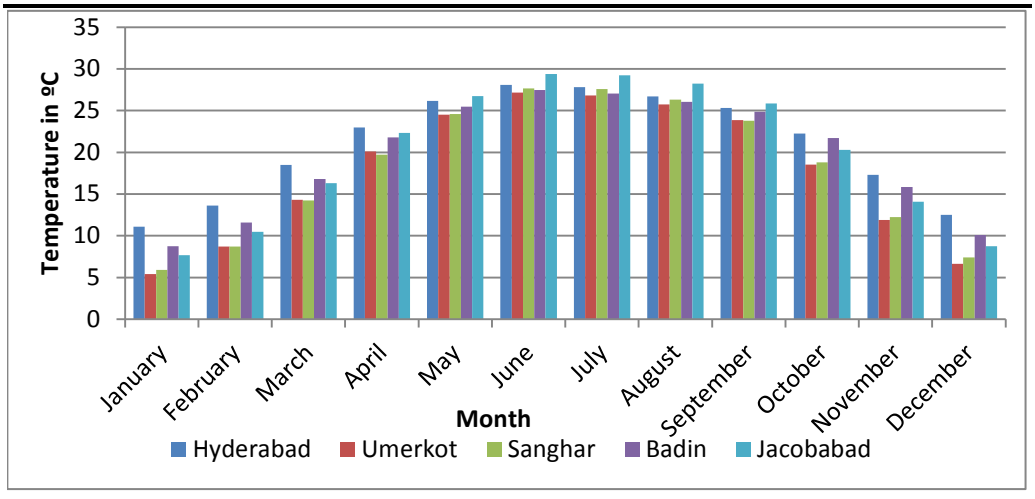


Figure 4.12 Monthly Mean Minimum Temperature recorded at Met Stations in Sindh Province



Relative Humidity

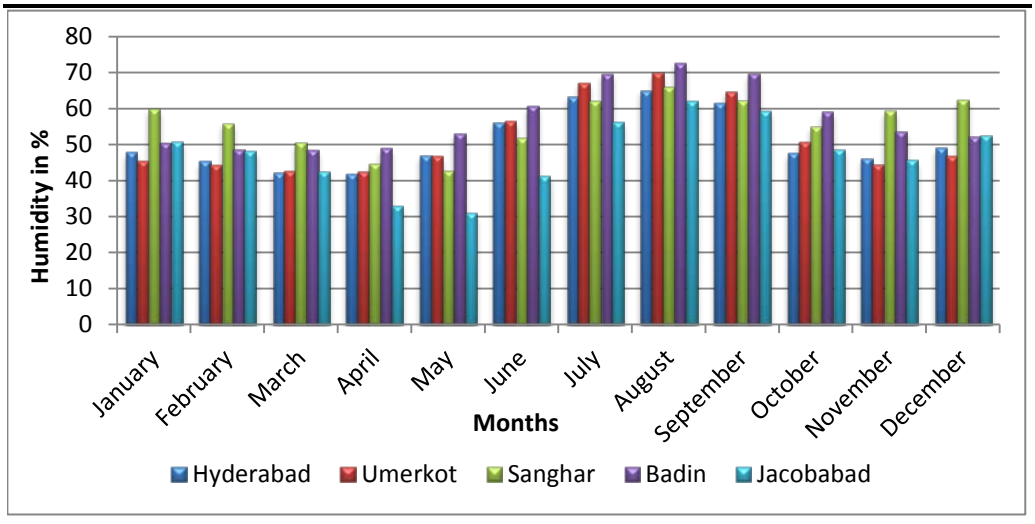
Monthly mean relative humidity observed at different stations in Sindh Province are provided in ***Table 4.8*** and ***Figure 4.13.*** The data shows high humidity between July to September for all the monitoring stations. The minimum humidity was observed during February to April months.

Table 4.8 ***Monthly Mean Relative Humidity observed at different stations in Sindh Province***

Month/Stations	Hyderabad	Umerkot	Sanghar	Badin	Jacobabad
January	47.9	45.52	59.98	50.38	50.88
February	45.38	44.45	56	48.81	48.23
March	42.4	42.55	50.62	48.36	42.76
April	41.88	42.73	44.66	48.97	33.01
May	46.96	46.81	42.63	53.1	30.93
June	56.35	56.4	51.81	60.7	41.16
July	63.42	67.23	62.1	69.61	56.18
August	65.26	70.15	66.06	72.55	62.2
September	61.37	64.76	62.38	69.78	59.38
October	47.65	50.78	55.16	59.15	48.87
November	46.4	44.58	59.48	53.88	45.75

Source: IEE Zorlu Energy Project 2010

Figure 4.13 ***Monthly mean relative humidity in Sindh Province***



Climate at Thatta

Temperature

The monthly minimum and maximum temperatures observed during 2008 to 2010 are given in ***Table 4.9*** and shown in ***Figure 4.14*** and ***Figure 4.15***. Minimum temperatures were observed during the month of January and maximum temperature during the month of April and May.

Table 4.9 ***Monthly Mean Minimum and Maximum Temperature observed at Thatta during 2008 to 2010***

	Minimum Temperature			Maximum Temperature		
Month/Year	2008	2009	2010	2008	2009	2010
January	9.39	13.07	10.9	22.61	24.23	27.75
February	11.41	15.09	12.09	26.72	29.97	30.04
March	19.19	19.82	20.44	34.32	21.34	36.58
April	22.43	21.9	23.75	36.1	39.05	38.86
May	26.23	26.31	26.85	35.39	38.36	38.95
June	27.73	26.37	27.08	26.23	36.17	37.69
July	26.63	26.78	26.94	33.06	34.55	35.72

Month/Year	Minimum Temperature			Maximum Temperature		
August	25.77	26.57	26.05	30.9	32.63	34.02
September	25.18	25.47	23.57	33.32	32.82	35.87
October	22.24	20.2	22.52	34.35	36.12	36.14
November	16.48	14.7	16.94	31	32.87	25.11
December	13.22	12.61	10.22	24.92	28.04	27.04

Source: Junejo et al 2012. **Study of sugarcane germplasm varieties for flowering ability under agro-climatic conditions of Thatta, The Journal of Animal & Plant Sciences, 22(3): 2012, Page: 688-694.**

Figure 4.14 Monthly minimum temperature observed at Thatta during 2008 to 2010

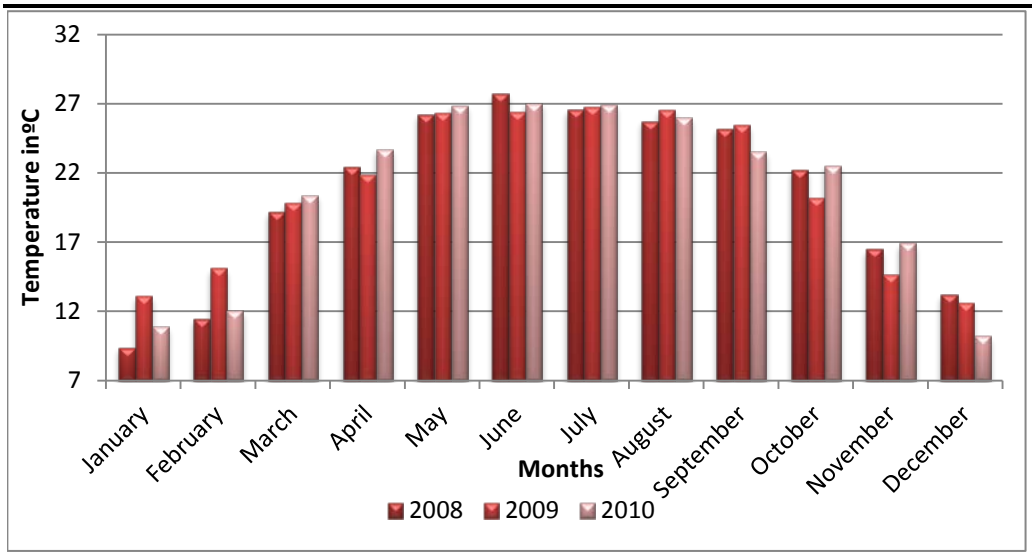
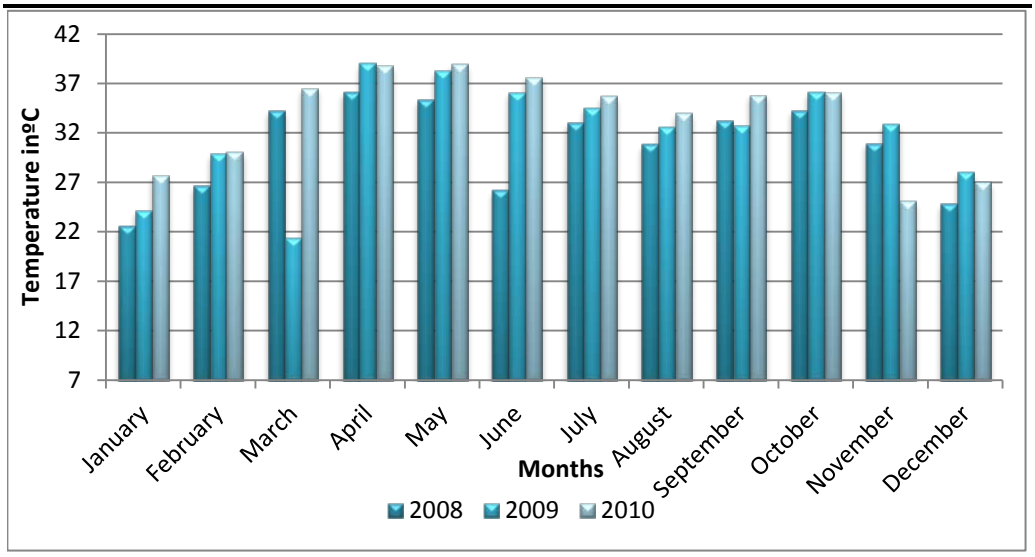


Figure 4.15 Monthly Maximum temperature observed at Thatta during 2008 to 2010



Source: Junejo et al 2012. **Study of sugarcane germplasm varieties for flowering ability under agro-climatic conditions of Thatta, The Journal of Animal & Plant Sciences, 22(3): 2012, Page: 688-694**.

Humidity

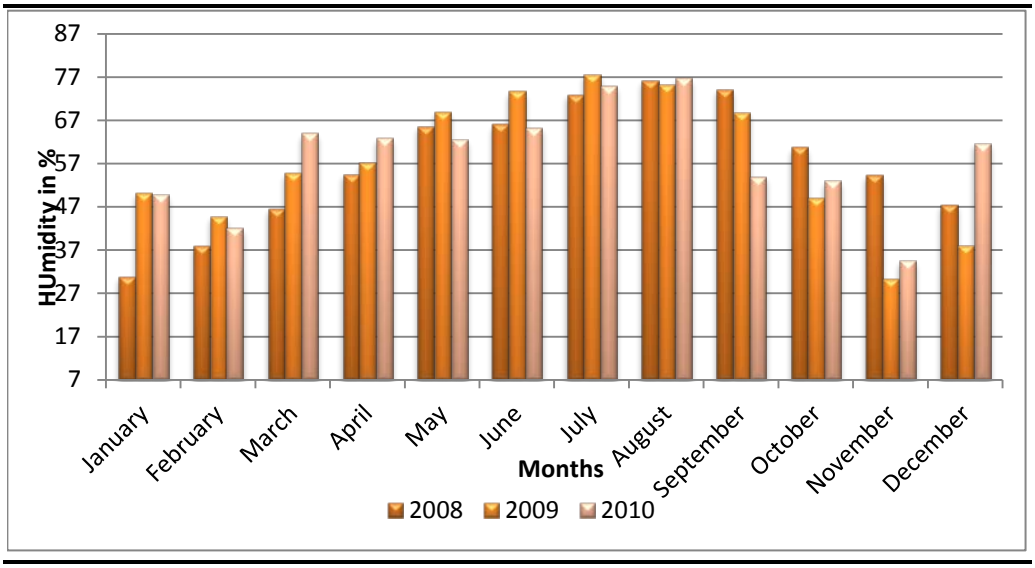
Monthly average humidity reported by Junejo et al 2012 during the 2008 to 2010 is given in ***Table 4.10*** and shown in ***Figure 4.16***. Low humidity is noted during the months of December to February and maximum humidity during the month of July to September.

Table 4.10 Relative humidity observed in Thatta during 2008 to 2010

Month/Year	2008	2009	2010
	Humidity (%)		
January	30.87	50.19	50
February	38.07	44.9	42.08
March	46.58	54.88	64
April	54.7	57.38	62.86
May	65.61	69.04	62.66
June	66.07	73.76	65.3
July	72.94	77.78	75
August	76.27	75.44	76.71
September	74.21	69	54
October	60.76	49	53.23
November	54.32	30.31	34.61
December	47.52	38.14	61.9

Source: Junejo et al 2012

Figure 4.16 Relative humidity observed at Thatta during 2008 to 2010



Rainfall

Monthly average rainfall reported by *Junejo et al 2012,* during 2008 to 2010 are given in ***Table 4.11*** and shown in ***Figure 4.17***. The maximum rainfall was recorded during July and August, while during the remaining months the rainfall was nil or low.

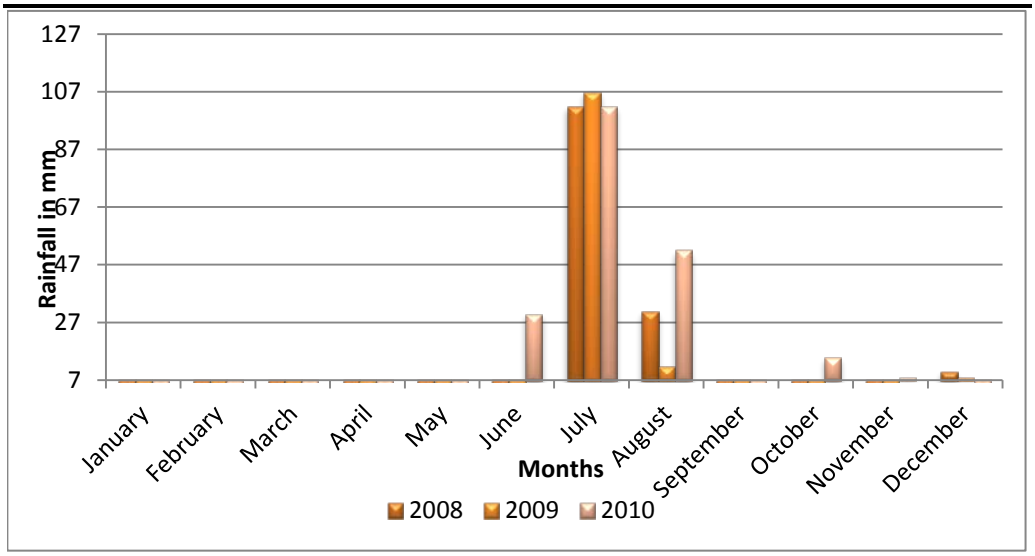
Table 4.11 Rainfall observed at Thatta during 2008 to 2010

Month/Year	2008	2009	2010
January	☞ 0	☞ 0	☞ 0
February	3	5	0
March	0	0	0
April	0	0	0
May	0	0	0
June	0	0	30
July	102	107	102
August	31	12	52
September	0	0	0

Month/Year	2008	2009	2010
October	0	0	15
November	0	0	8
December	10	8	0

Source: Junejo et al 2012. **Study of sugarcane germplasm varieties for flowering ability under agro-climatic conditions of Thatta, The Journal of Animal & Plant Sciences, 22(3): 2012, Page: 688-694.**

Figure 4.17 Rainfall observed at Thatta during 2008 to 2010



Source: Junejo et al 2012. **Study of sugarcane germplasm varieties for flowering ability under agro-climatic conditions of Thatta, The Journal of Animal & Plant Sciences, 22(3): 2012, Page: 688-694.**

Wind

The wind direction at the area is predominantly west-northwesterly at 250°, which suggests that it has a direction almost perpendicular to the 11 km long site, which is oriented at the Project site at about 20° above the west-east axis. The wind direction in the area is generally west-northwesterly during the summer monsoon and east-northeasterly during the short winter monsoon season. The wind speed at ground level varies between 0 and 2 m/s during the calm months to 4 and 8 m/s during the pre-monsoon season. The normal wind direction during 1961-1990 is provided in ***Table 4.12.***

Table 4.12 Climatology of Thatta (1961-1990): wind direction and wind velocity

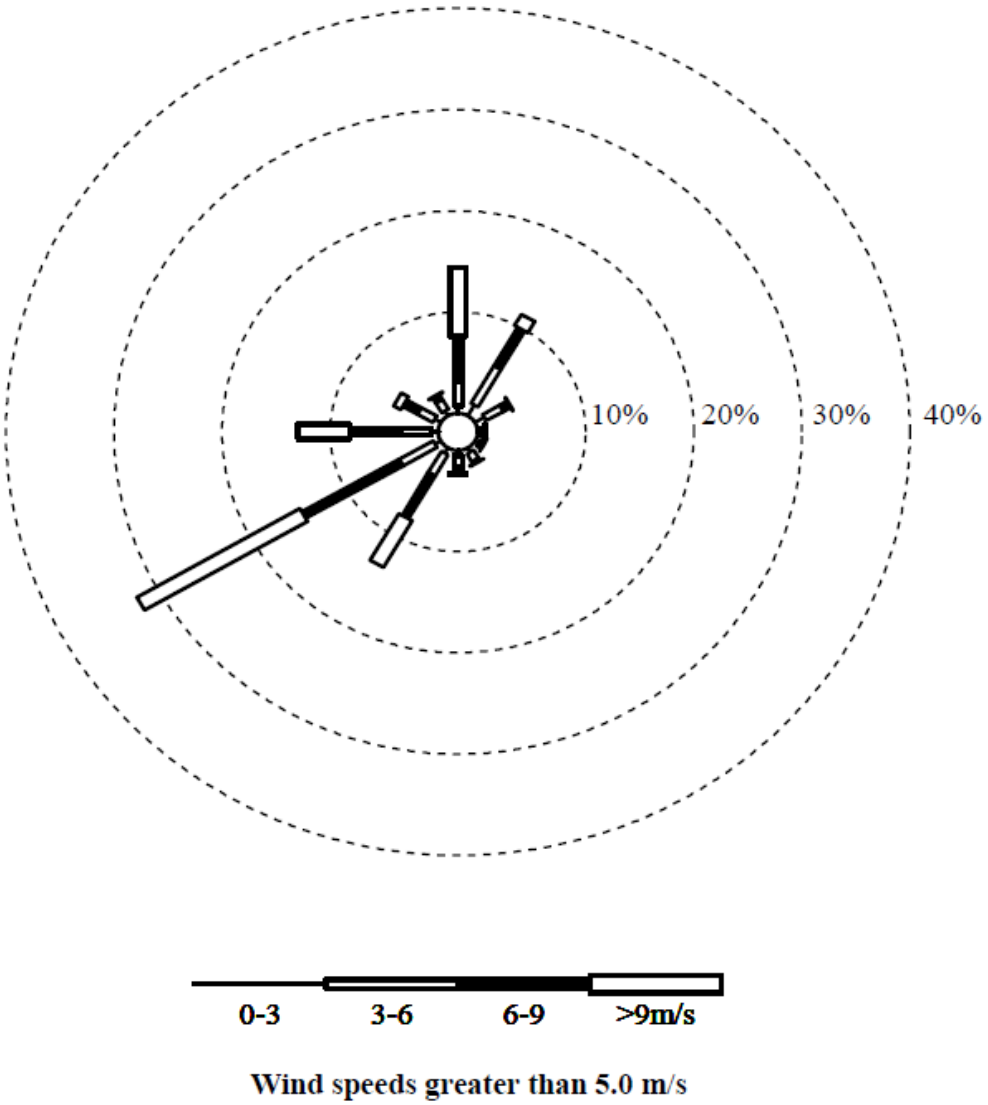
Month	Wind Direction in Degrees	Wind Velocity in Knots	Wind Steadiness (%)
January	36	2.5 to 3.0	31
February	320	3.1 to 3.7	19
March	263	3.9 to 5.0	72
April	259	5.9 to 6.3	87
May	256	8.2 to 8.6	91
June	249	8.2 to 8.7	84
July	255	7.8 to 9.1	85
August	263	8.3 to 8.6	88
September	265	6.9 to 7.1	82
October	259	3.2 to4.0	81
November	34	2.7	31
December	47	2.2 to 2.8	38

Source: IEE report, 2009

Detailed analysis of wind data recorded at MPCL Project site by GL Garrad Hassan during the Energy Assessment study in 2011 shows that the wind speed and direction were both erratic. A comparison with wind speed noted at Jherruck shows that this is typical of the entire area for the calm period of mid-February to mid-March.

The mean monthly speed ranged from 5.7 m/s to 9.9 m/s with average monthly wind speed of 7.59 m/s for the thirty five months monitoring moths. Predicted wind speed and direction for the Project site as shown in ***Figure 4.18***, Which shows that the predominant wind direction is SW, N, SSW, W, NNE etc, with varying wind speed from 5.7 to >9 m/s.

Figure 4.18 ***Predicted long term Wind rose for the MPCL Project site***



Source: Assessment of the Energy Production of the Proposed Metro Power 20 Wind Farm, Garrard Hassan September 2011

Table 4.13 gives the wind speed recorded at 80 m height at the MPCL site from August 08 to June 11. The mean monthly speed ranged from 5.7 m/s to 9.9 m/a. The average monthly wind speed of 7.59 m/s for the thirty five month investigation period is of the same order as recorded and reported by Energy assessment report, 2011 (Garrad Hassan).

Table 4.13 Monthly Average wind Speed and Direction at MPCL Site Mast B4 at 80 M height during August 2008 to April 2011

Months	Wind Speed m/s
August 08	9.9
September 08	8.0
October 08	6.6
November 08	7.1
December 08	7.0
January 09	7.8
February 09	6.2
March 09	6.3
April 09	7.4
May 09	8.8
June 09	8.6
July 09	9.4
August 09	9.0
September 09	8.4
October 09	5.7
November 09	6.9
December 09	6.9
January 10	6.5
February 10	6.6
March 10	6.8
April 10	8.2
May 10	9.8
June 10	9.7
July 10	8.0
August 10	7.2
September 10	6.6
October 10	6.1
November 10	6.4
December 10	7.0
January 11	6.5
February 11	6.8
March 11	-
April 11	7.7
May 11	9.9
June 11	8.5

Source: Assessment of the Energy Production of the Proposed Metro Power Wind Farm, Garrard Hassan September 2011

4.2.7 Ambient Air Quality

The IEE report, 2009 includes results of ambient air quality monitored at one location near the MPCL Project site for 24 hour period at 15 minutes interval on 9 March 2009. The parameters monitored were PM_{10}, SO_2, CO, and NOx. Results of ambient air quality monitoring are summarized in ***Table 4.14*** and detailed in ***Annex G.***

Table 4.14 Ambient Air Quality at MPCL site

	SO_2 (µg/m³)	NOx (µg/m³)	CO (mg/m³)	Particulate Matter (PM_{10}) (µg/m³)
Average	26.26	21.45	1.35	134.1
Minimum	20.08	15.16	0.22	36.0
Maximum	32.45	30.14	2.1	152.0
Pakistan NEQS	**120**	**40**	**5**	**120**
World Bank guideline value	**20**			**50**

Source: IEE report, 2009

*Note- The averaging period for all parameters is 24 hrs except CO which is 8 hrs.

SO_2 level ranges between 20 to 32 µg/m³ which is much lower than 120 µg/m³ recommended for the 24-hourly average by the NEQS, while NOx level ranges between 15 to 30 µg/m³ which is much lower than 40 µg/m³ recommended for the 24-hourly average by the NEQS. CO level ranges between 0.22 to 2.1 mg/m³. PM_{10} concentration ranged between 36.0 µg/m³ and 152 µg/m³ with the average at 134.1µg/m³ which exceeds both NEQS and World Bank guideline values.

It is evident from the results that the average observed value of ambient air quality parameters are below the NEQS and World Bank Guidelines except for PM_{10} which exceeds both the limits and for SO_2 which is within NEQS but exceeds the World Bank guideline values.

Tekcellent, during site and surroundings survey in February-March 2013, reported that there are no air permanent emission sources within the Project area. However the entire area is dry arid with sparse vegetation and high wind velocity which contributes to high dust levels. Also stone excavation activities completed by local people contribute to increased dust concentrations in the vicinity of such activity areas.

4.2.8 Noise Environment

As outlined in the IEE study Report, 2009, ambient noise level monitoring was undertaken for 24 hours at 11 different locations to analyse the acoustic or noise levels over a period of four (4) days. The ambient noise levels recorded in the IEE are in ***Table 4.15*** and shown in ***Figure 4.19***.

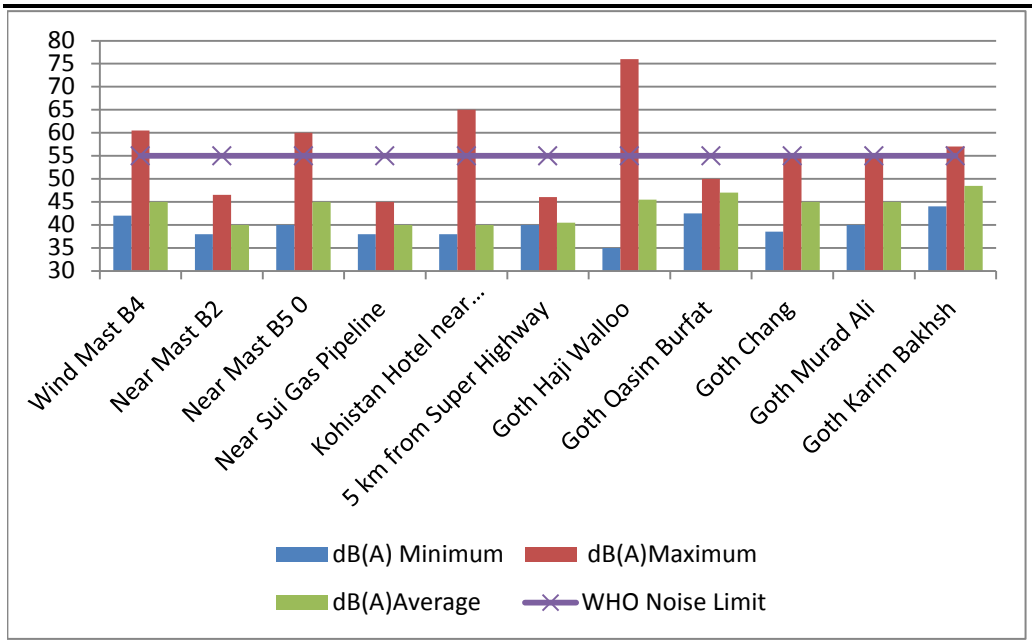
Table 4.15 Noise level at different locations around the proposed Project

S.N	Locations	Minimum dB(A)	Maximum dB(A)	Average dB(A)
1.	Wind Mast B4	☞ 42.0	☞ 60.5*	☞ 45.0
2.	Near Mast B2	38.0	46.5	40.0
3.	Near Mast B5 0	40.0.	60.0*	45
4.	Near Sui Gas Pipeline	38.0	45.0	40.0
5.	Kohistan Hotel near Super Highway 5	38.0	65.0*	40.0
6.	5 km from Super Highway	40.0	46.0	40.5
7.	Goth Haji Walloo	35.0	76.0*	45.5

S.N	Locations	Minimum dB(A)	Maximum dB(A)	Average dB(A)
8.	Goth Qasim Burfat	42.5	50.0	47.0
9.	Goth Chang	38.5	55.0	45.0
10.	Goth Murad Ali	40.0	55.0	45.0
11.	Goth Karim Bakhsh	44.0	57.0*	48.5

Source: IEE Report, 2009
*Facing wind

Figure 4.19 Noise Level at different locations in the Project area



It is evident from the findings that the Noise level average ranged between 40 – 48.5 dB(A). As reported in the IEE, the Project site is calm with noise level ranging between 38 dB(A) and 55 dB(A). The few cluster of huts in the area have an average noise level of 45.0 to 48.5 dB(A). The background noise levels are raised in the area by the peak noise emission from the hissing and rustling of the wind in particular the gusts and whirl wind. It was reported that quite often the rustling of wind induced vibration of the stay wire of the masts, which raised the noise level to over 70 dB(A).

The general observation during the surveys by Tekcellent in February-March, 2013 was that there are no permanent noise generation sources in the area. The nearby villages located on and around the MPCL Project site are quiet settlement's with rural settings. Temporary noise sources in the area include the operation of power shovels for sand and gravel extraction and movement of trucks.

4.2.9 Water Environment

Surface water

As per the IEE Report, 2009, the MPCL Project area is located in a dry arid region with no perennial sources of water.

As per the satellite imagery and other secondary sources, the Project area is drained by few seasonal rivers/ streams. The river crossing near the MPCL Project north and east boundary is Harola nai (Rod nai). The Layari nai flows near the western boundary.

In the 5 km area, other small streams such as Mera nadi, Lung nadi, Mucha nadi and Ahenwari nai flow from the Kirthar ranges and meet the Harola Nai river on the western terrain. These streams are mostly dry throughout the dry months and only carry water during the rains. The Harola Nai river drain towards the Keenjhar fersh water lake situated 15 km away from the MPCL Project site. The drainage map of the area is shown in ***Figure 4.20***.

As reported by the Tekcellent, no water pollution sources were noted in the Project area.

Groundwater

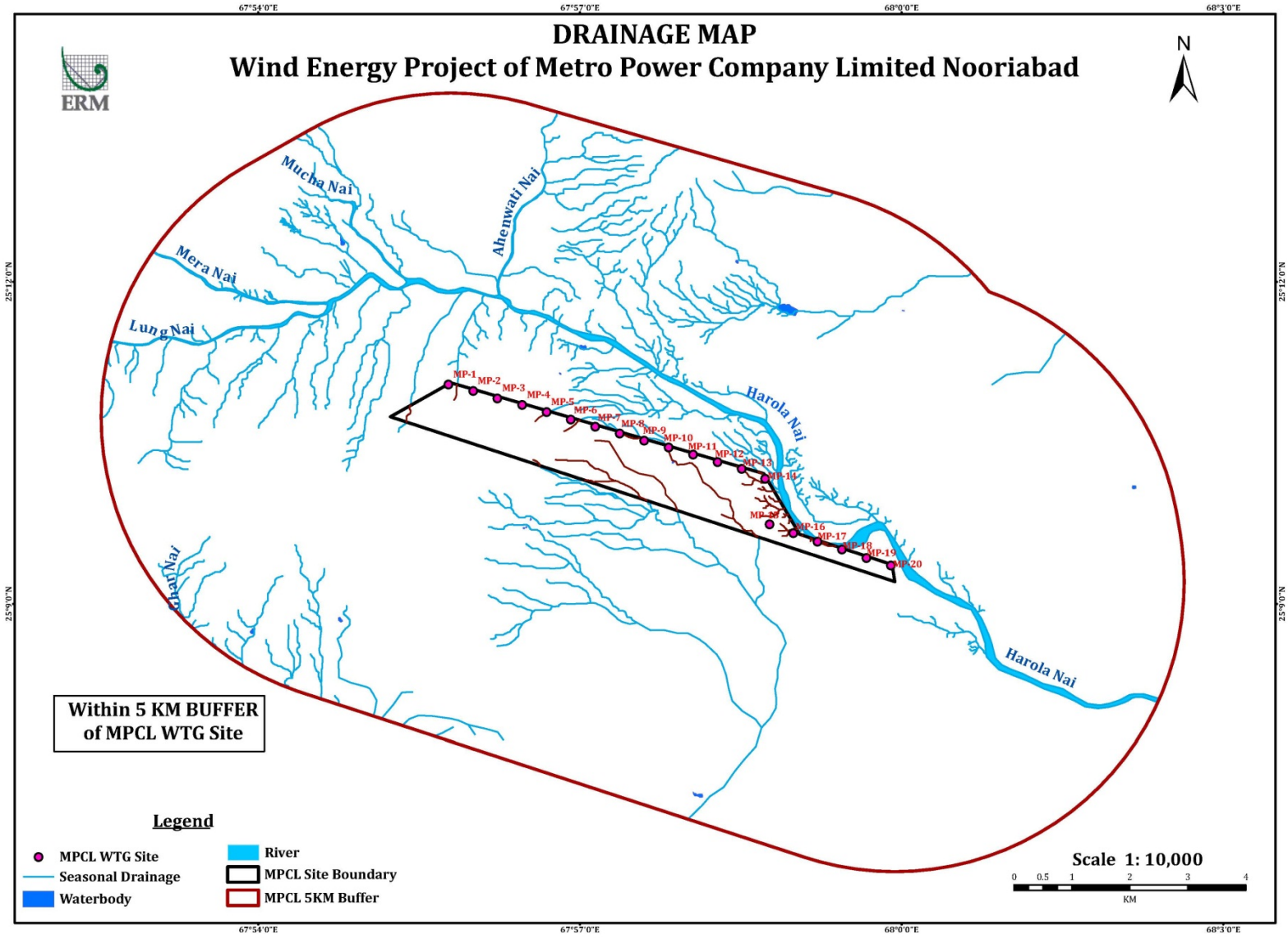
In the Kohistan arid region, groundwater levels are at more than 25 m depth. Ground water quality varies from place to place, being brackish or moderately brackish in areas or sweet in others and suitable for drinking. As per the geotechnical investigation report, the borehole well studies at the Project site reveal that the water table level is much below 20 m and the strata in the vicinity of the water table has dried up.

The existing water supply to the Project area is from Nooriabad. At Nooriabad, the water extraction is limited to less than 2 million gallons/day from underground water sources. During dry spells this supply falls further. The limited supply of 2 mgd is one of the main factors for the investors being uninterested in any industrial development in the area. The drilling of further tube wells is not possible as the lowering of water table has already made some wells non-productive.

Wetland

There is no water body designated as wetland except Keenjhar (Kalri) Lake located 15 km from the MPCL wind farm, 19 km north-northeast of Thatta, and 100 km east of Karachi.

Figure 4.20 Drainage Map of the MPCL Project area 5 km



Water Quality

As reported in the IEE Report, 2009, one surface water and one groundwater source was sampled in the Project area and analysed for quality. The results are provided in ***Table 4.16.***

Table 4.16 Result of Surface and Groundwater Quality at MPCL Project site

S.N	Parameters	Units	Harolo Nai (Rodh Nai)	Nooriabad Groundwater	Pakistan NSDWQ,	*WHO Limits
1	pH Value	SU	7.72	7.99	6.5-8.5	6.5-8.5
2	Total Dissolved Solids (TDS)	mg/L	182.37	1074.83	<1,000	1,000.0
3	Sodium (Na+)	mg/L	17.96	234.39		200.0
4	Potassium (K+)	mg/L	9.07	18.24		10-12
5	Calcium (Ca+2)	mg/L	16.82	53..79		200.0
6	Magnesium (mg+2)	mg/L	11.27	37.83		125.0
7	Chloride (Cl-)	mg/L	41.83	396.06	<250.0	250.0
8	Bicarbonates (HCO3)	mg/L	48.76	173.0		150 - 200
9	Sulphate (SO4-2)	mg/L	34.0	138.0		250.0
10	Nitrate (NO3)	mg/L	1.60	13.84	<50.0	50.0
11	Total Plate Count @ 37°C/24 hrs	Cfu	-ve	TNTC		<20 colony/ml
12	Total Plate Count @ 22°C/48 hrs	Cfu	-ve	TNTC		< 100 colony/ml
13	Feacal Coliform @44°C/24 hrs	Cfu	-ve	TNTC	0 colony/100 ml	0 colony/100 ml
14	Total Coliform @ 37°C/48 hrs	Cfu	-ve	>350	0 colony/100 ml	0 colony/100 ml
15	Total Coliform @ 37°C/48 hrs	Cfu	-ve	350	0 colony/100 ml	colony/100 ml
16	Feceal Streptococci @ 35-37°C for 24 hrs	Cfu	-ve	>200	-	-
17	Escherichai Coli (E. Coli) @35-37°C for 24 hrs	Cfu	-ve	TNTC	0/100 ml	0/100ml
18	Salmonellae species @35-37° for 24 hrs	Cfu	-ve	+ve	-	-
19	Shigella species @35-37°C for 24 hrs	Cfu	-ve	+ve	-	-

Source: IEE Report, 2009

- pH of the surface and ground water samples of 7.72 and 7.99 respectively was recorded against the WHO and Pakistan drinking water norm of 6.5 to 8.5. Graphical representation of pH is depicted in ***Figure 4.21;***
- Total dissolved solids in the groundwater and surface of 1,074 and 182 mg/l respectively were recorded. Ground water samples exceeded the WHO guideline value and Pakistan NSDWQ, however the surface water sample was within the guideline value. The graphical representation of TDS in water samples is shown in ***Figure 4.22***;

- Chloride concentration of groundwater and surface of 396 mg/l and 42 mg/l respectively was recorded. Ground water samples exceeded the WHO guideline value and Pakistan NSDWQ however the surface water sample is within the guideline value. The graphical representation of chloride content in water samples is shown in ***Figure 4.23;*** and
- Total coliform and faecal coliform were absent in Ground water samples while reported in surface water samples. In general the various parameter of surface water quality of the project site is within guideline value for both WHO and NSDWQ; however the ground water exceeds the guideline value for both.

Figure 4.21 pH of Surface and Groundwater Samples

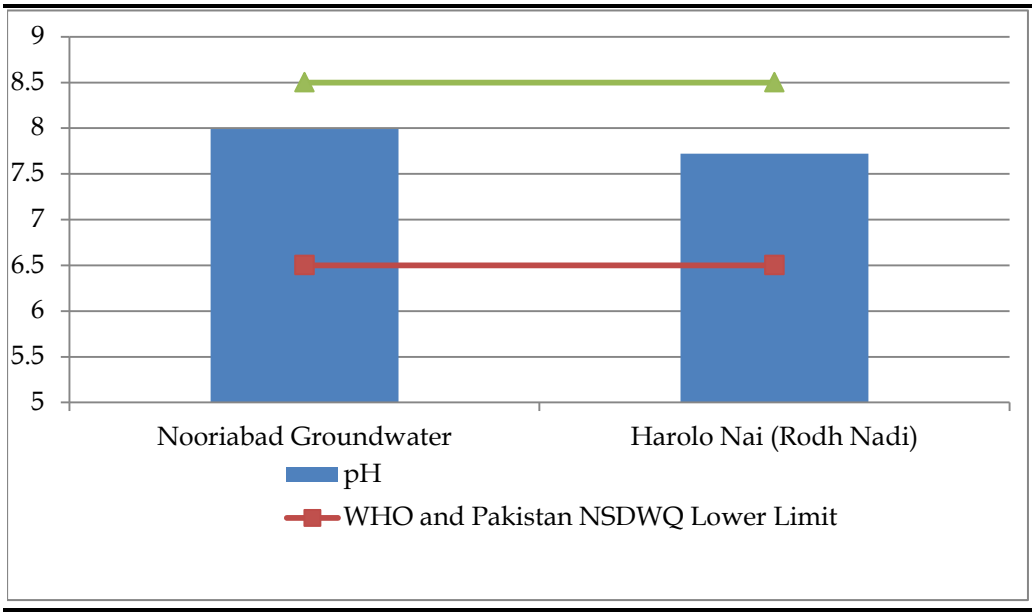


Figure 4.22 TDS Concentration in Surface and Groundwater

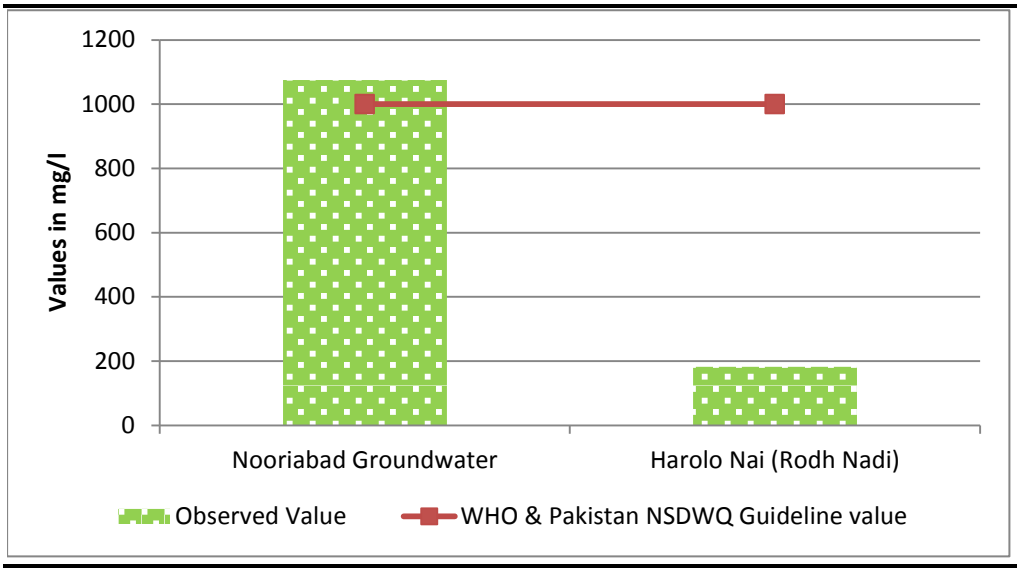
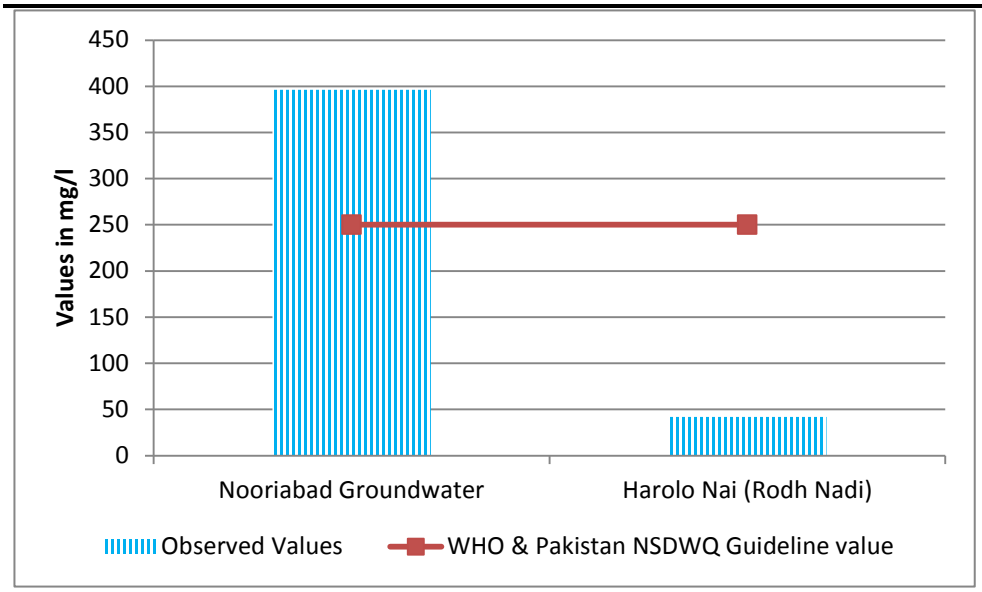


Figure 4.23 Chloride Concentration in Surface and Groundwater



4.3 ECOLOGY

Forested areas of the Project site and its surrounding areas can be categorized as degraded forest, rock and gravel areas and irrigated agricultural area. The plant and animal species reported in the IEE report, 2009 and during site visits made by Tekcellent indicate those commonly found in the xeric habitats. The flora and fauna described in the sections below are based on the IEE carried out in 2009 and its validation by the experts of Tekcellent at site during February-March 2013.

4.3.1 Flora

The floral species reported in the area are: trees, shrubs, herbs and grasses as outlined in ***Table 4.17***.

Table 4.17 List of Vegetation present in the MPCL Project site & Surrounding Areas

S.N	Species	Local Name	Family	Presence	Native/ Cultivated
Trees					
1	*Prosopis juliflora*	Devi	Mimosaceae	Perennial	Native
2	*Acacia nilotica*	Babul	Mimosaceae	Perennial	Native
3	*Salvadora oleoides*	Khabar	Salvadoraceae	Perennial	Native
4	*Acacia senegal*	-	Mimosaceae	Perennial	Native
5	*Prosopis glandulosa*	-	Momosaceae	Perennial	Native
6	*Prosopis cineraria*	Kandi	Mimosaceae	Perennial	Native
7	*Tamarix aphylla*	-	Tamaricaceae	Perennial	Native
8	*Tecomella undulata*	Rohiro	Bignoniaceae	Perennial	Native
9	*Azadiracta indica*	Nim	Meliaceae	Perennial	Native
10	*Salvadora persica*	Jaar	Salvadoraceae	Perennial	Native
Shrubs					
1	*Commiphora wightii*	-	Burseraceae	Perennial	Native

S.N	Species	Local Name	Family	Presence	Native/ Cultivated
2	*Senna holoserica*	-	Caesalpinaceae	Perennial	Native
3	*Calotropis procera*	-	Asclepiadaceae	Perennial	Native
4	*Indigofera oblongifloia*	-	Fabaceae	Perennial	Native
5	*Fagonia indica*	-	Zygophyllaceae	Perennial	Native
6	*Grewia tenax*	-	Tiliaceae	Perennial	Native
7	*Barleria acanthoides*	-	Acanthaceae	Perennial	Native
8	*Rhazya stricta*	-	Apocynaceae	Seasonal	Native
9	*Heliotropium crispum*	-	Boraginaceae	Perennial	Native
10	*Leptadenia pyrotechnica*	-	Asclepiadaceae	Perennial	Native
11	*Ziziphus nummularia*	Janguri Ber	Rhamnaceae	Perennial	Native
12	*Maerua arenaria*	-	Capparidaceae	Perennial	Native
13	*Pteropyrum olivierii*	-	Polygonaceae	Perennial	Native
14	*Capparis decidua*	Kikir	Capparaceae	Perennial	Native
15	*Abutilon indicum*	-	Malvaceae	Perennial	Native
16	*Lycium edgeworthii*	-	Solanaceae	Perennial	Native
17	*Echinops echinatus*	Unt Katara	Asteraceae	Annual	Native
18	*Cassia holoserica*	Jangli Sana	Caesalpiniaceae	Perennial	Native
19	*Grewia tenax*	Kango	Tiliaceae	Perennial	Native
Herbs					
1	*Inula grantioides*	-	Asteraceae	Perennial	Native
2	*Trichodesma indicum*	Indian Borage	Boraginaceae	Seasonal	Native
3	*Convolvulus glomeratus*		Convolvulaceae	Perennial	Native
4	*Aerva javanica*	Bui	Amaranthaceae	Perennial	Native
5	*Heliotropium crispum*	-	Boraginaceae	Perennial	Native
6	*Fagonia indica*	Damma	Zygophyllaceae	Perennial	Native
7	*Euphorbia granulata*	Dodi khurd	Euphorbiaceae	Perennial	Native
8	*Blepharis sindica*	Bhangri	Acanthaceae	Perennial	Native
9	*Corchorus depressus*	-	Tiliaceae	Annual	Native
10	*Zygophyllum simplex*	-	Zygophyllaceae	Annual	Native
11	*Fagonia cratica*	-	Zygophyllaceae	Perennial	Native
12	*Helotropium ophioglossum*	-	Boraginaceae	Perennial	Native
13	*Rynccosia minima.*	-	Fabaceae	Perennial	Native
14	*Trichodesma indicum*	-	Boraginaceae	Annual	Native
Grasses					
1	*Aristida mutabilis*	-	Poaceae	Seasonal	Native
2	*Dactyloctenium scindicum*	-	Poaceae	Perennial	Native
3	*Dicanthuim annulatum*	Murgha ghaas	Poaceae	Perennial	Native
4	*Desmostachya bipinnata*	BaroonDhab	Poaceae	Perennial	Native
5	*Chloris barbata*	-	Poaceae	Perennial	Native
6	*Arisdita adscensionis*	-	Poaceae	Perennial	Native
7	*Cenchrus ciliaris*	-	Poaceae	Perennial	Native
8	*Cenchrus biflorus*	-	Poaceae	Annual	Native
9	*Cenchrus pennisetiformis*	-	Poaceae	Annual	Native
10	*Cynodon dacdylan*	Doob	Poaceae	Perennial	Native
11	*Cymbopogon jwarancusa*	-	Poaceae	Perennial	Native
13	*Ochthochloa compressa*	-	Poaceae	Perennial	Native
14	*Cymbopogan aucheri*	-	Poaceae	Perennial	Native
15	*Saccharum bengalense*	Sarkanda	Poaceae	Perennial	Native
16	*Dactyloctenium scindicum*	-	Poaceae	Perennial	Native
17	*Sorghum vulgaris*	Indian Corn	Poaceae	Annual	Native

Source: IEE Report 2009

4.3.2 *Fauna*

Faunal species surrounding the wind farm site and its surroundings are detailed in the following sections.

Reptiles

Seven species of reptiles were reported/ observed in the Project area is given in ***Table 4.18.*** The monitor lizard population in the micro-environment of MPCL Project site is low, while that of spiny-tailed lizard is abundant.

Table 4.18 Reptiles in the project area

S.N	Common Name (Local Name)	Scientific Name	Conservation Status as per IUCN	Sources
Lizards				
1	Indian Monitor lizard (Wadhi Go/Gioh)	*Varanus bengalensis*	Least Concern	R1, R2
2	Monitor lizard	*Varanus griseus*	Not Assessed	R1, R2
3	Indian Spiny Tailed Ground Lizard (Sandho/ Sandha)	*Uromastyx hardwickii*	Not Assessed	R1
4	Yellow-headed Agama (Batth Kirro/Zard Sar Pahari Girgit)	*Laudakia fusca*	Not Assessed	R1, R2
5	Indian Garden Lizard (Wann Kirro/Rang badal Girgit)	*Calotes versicolor*	Not Assessed	R1, R2
6	Long-tailed Desert Lacerta (Wadhi Puch Kirri/ Taweel dum Sandhi)	*Mesalina guttulata*	Not Assessed	R1
7	Sindh Sand Gecko (Thari Kirri/Regi Chhupkali)	*Crossobamon orientalis*	Not Assessed	R1
Snakes				
8	Indian Sand Boa	*Eryx johni*	Not Assessed	R1
9	Saw-scaled Viper	*Echis carinatus*	Not Assessed	R1
10	Black Cobra	*Naja naja*	Not Assessed	R1
11	Indian Common Krait	*Bungarus caeruleus*	Not Assessed	R1
12	Oxus Cobra	*Naja oxiana*	Data Deficient	R1

Note: R1: Reported in previous Study (IEE 2009)[1]; R2: Recorded (observed) in recent (2013) site visit

Birds

Most common birds found in the macro environment (larger surrounding area outside the Project site at 10-15 km radius) are Sparrow, Robins, and Doves. A list of bird species reported /observed in the wind farm area and its surrounding are given in ***Table 4.19***.

[1] The data used in IEE, 2009 is of the Zorlu site, more than 5 km away from MPCL site. The detailed bird study for MPCL Project site and surroundings is being carried out and will be completed by end of May 2013

Table 4.19 List of Bird Species observed/reported in the Project area and its surrounding

S.No.	Species	Scientific Name	Conservation Status as per IUCN	Sources
1	Black Winged Kite	*Elanus caeruleus*	Least Concern	R2
2	Black Kite	*Milvus migrans*	Least Concern	R2
3	Tawny Eagle	*Aquila rapax*	Least Concern	R1, R2
4	Common Kestrel	*Falco tinnunculus*	Least Concern	R2
5	Saker Falcon	*Falco cherrug*	Endangered	R1
6	Griffon Vulture	*Gyps fulvus*	Least Concern	R1
7	Gray Partridge	*Francolinus pondicerianus*	Least Concern	R1,R2
8	See see Partridge	*Ammoperdix griseogularis*	Least Concern	R1
9	Common Quail	*Coturnix coturnix*	Least Concern	R1
10	Button Quail	*Turnix sylvatica*	Least Concern	R1
11	Common Crane	*Grus grus*	Least Concern	R1
12	Houbara Bustard	*Chlamydotis macqueeni*	Not Assessed	R1
13	Redwattled Lapwing	*Vanellus indicus*	Least Concern	R2
14	Indian Sand grouse	*Pterocles exustus*	Least Concern	R1,R2
15	Painted Sand grouse	*Pterocles indicus*	Least Concern	R1
16	Blue Rock Pigeon	*Columba livia*	Least Concern	R1,R2
17	Ring Dove	*Streptopelia decaocto*	Least Concern	R1,R2
18	Little Brown Dove	*Streptopelia senegalensis*	Least Concern	R1,R2
19	Rose ringed Parakeet	*Psittacula krameri*	Least Concern	R1
20	Indian Quail	*Eudynamys scolopacea*	Least Concern	R1
21	Spotted Owlet	*Athene brama*	Least Concern	R1
22	Green Bee-eater	*Merops orientalis*	Least Concern	R2
23	Blue-cheeked Bee-eater	*Merops persicus*	Least Concern	R2
24	Kashmir Roller	*Coracias garrulus*	Near Threatened	R1
25	Indian Roller	*Coracias benghalensis*	Least Concern	R1
26	Common Hoopoe	*Upupa epops*	Least Concern	R1,R2
27	Eurasian Wryneck	*Jynx torquilla*	Least Concern	R1
28	Sind Fuel woodpecker	*Dendrocopos assimilis*	Least Concern	R1
29	Black crowned Finch Lark	*Eremopterix nigriceps*	Least Concern	R2
30	Desert Lark	*Ammomanes deserti*	Least Concern	R2
31	Crested Lark	*Galerida cristata*	Least Concern	R2
32	Sand Lark	*Galerida deva*	Least Concern	R2
33	Common or Barn Swallow	*Hirundo rustica*	Least Concern	R2
34	Isabelline Shrike	*Oenanthe isabellina*	Least Concern	R2
35	Pale Crag Martin	*Hirundo rupestris*	Least Concern	R1
36	Southern Grey Shrike	*Lanius meridionalis*	Not Recognized	R2
37	Black Drongo	*Dicrurus macrocercus*	Least Concern	R2
38	Indian Myna	*Acridotheres tristis*	Least Concern	R1,R2
39	House Crow	*Corvus splendens*	Least Concern	R2
40	White-cheeked Bulbul	*Pycnonotus leucotis*	Least Concern	R2
41	Red Vented Bulbul	*Pycnonotus cafer*	Least Concern	R2
42	Common Babbler	*Turdoides caudatus*	Least Concern	R2
43	Long tailed Bush Warbler	*Prinia burnesii*	Near Threatened	R2
44	Desert Warbler	*Sylvia nana*	Least Concern	R2
45	Lesser Whitethroat	*Sylvia curruca*	Least Concern	R2
46	Common Chiffchaff	*Phylloscopus collybita*	Least Concern	R2
47	Pied Bushchat	*Saxicola caprata*	Least Concern	R2
48	Isabelline Wheatear	*Oenanthe deserti*	Least Concern	R2
49	Desert Wheatear	*Oenanthe picata*	Least Concern	R2
50	Variable Wheatear	*Saxicoloides fulicata*	Least Concern	R2
51	Indian Robin	*Nectarinia asiatica*	Least Concern	R2
52	Purple Sunbird	*Cinnyris asiaticus*	Least Concern	R2
53	House Sparrow	*Passer pyrrhonotus*	Least Concern	R1,R2

S.No.	Species	Scientific Name	Conservation Status as per IUCN	Sources
54	Jungle Sparrow	*Lonchura malabarica*	Least Concern	R2
55	Indian Silverbill	*Petronia petronia*	Least Concern	R2
56	Rock Sparrow	*Hirundo smithii*	Least Concern	R2
57	Plain martin	*Riparia paludicola*	Least Concern	R2
58	Imperial eagle	*Aquila heliaca*	Vulnerable	R2
59	Tawny pipit	*Anthus campestris*	Least Concern	R2

Note: R1: Reported in previous Study (IEE 2009)[1]; R2: Recorded (observed) in recent (2013) site visit

Out of the 59 species reported from the project and surrounding areas, the Saker Falcon (*Falco cherrug*) was listed as Endangered as per the IUCN category; Imperial eagle (*Aquila heliacal*) was listed as Vulnerable; and the Long tailed Bush Warbler (*Prinia burnesii*) and Kashmir Roller (*Coracias garrulous*) were listed as Near Threatened.

Mammals

Thirteen species of mammals were reported/observed in the project area and are provided in ***Table 4.20***, one species, the Indian Pangolin, is reported in the IUCN Red List as Near Threatened.

Table 4.20 List of Mammal species reported/Observed in the Project area

S.N	Species	Local Name	IUCN Red List Category	Sources
1	Indian Pangolin (Scaly Anteater) (*Manis crassicaudata*),	Safna Shikam	Near Threatened	R1
2	Jackal (*Canis aureus*)	Geedar	Least Concern	R1, R2
3	Ratel (Honey Badger) (*Mellivora capensis*)	Gorrpat/Qabar Ka Bijju	Least Concern	R1
4	Small Indian Mongoose (*Herpestes javanicus*)	Chhota-Neula	Least Concern	R1, R2
5	Black-naped Hare (*Lepus nigricollis dayanus*)	Saho/Khargosh;	Least Concern	R1
6	Grey Spiny Mouse (*Mus saxicola*)	Kandan Waro Kuo/Kharpusht Chooha	Least Concern	R1
7	Red Fox (*Vulpes vulpes*)	Lomrri, Lomarr	Least Concern	R1, R2
8	Five-striped Palm Squirrel (*Funambulus pennantii*)	Galahri	Least Concern	R2
9	Indian Gerbil (*Hemiechinus collaris*)	-	Least Concern	R2
10	Desert Gerbil (*Meriones hurrianae*)	-	Least Concern	R2
11	House Mouse (Mus musculus)	Chooha	Least Concern	R2
12	Crested Porcupine (*Hystrix indica*)	Zhuzh	Least Concern	R2
13	Desert Hare (*Lepus nigricollis*)	Khargosh, Dushwari	Least Concern	R1

Note: R1: Recorded in previous Study (IEE 2009); R2: Recorded(observed) in recent (2013) Site visit

[1] The data used in IEE, 2009 is of the Zorlu site, more than 5 km away from MPCL site. The detailed bird study for MPCL Project site and surroundings is being carried out and will be completed by end of May 2013

Livestock

Four species of livestock observed in the Project area are provided in ***Table 4.21.***

Table 4.21 Livestock observed in the project area

S.N	Species	Local Name	Sources
1	Domestic Goat (*Capra hircus*)	Bakri/Bakra	Observed
2	Domestic Sheep (*Ovis aries*)	Bhairru/Bhairr	Observed
3	Domestic Cattle (*Bos taurus*)	Gaon/Dhaggo, Dhaggi (male, female	Observed
4	Domestic Donkey (*Equus asinus*)	Gadduh/Gadah	Observed

Source: Site visit, Feb-March 2013

Protected Areas

No wildlife reserves are located in close vicinity of the Project site. Keenjhar Lake Wildlife Sanctuary is located at 15 km outside of the macro environment. The Kinjhar (Kalri) Wildlife Sanctuary is a designated Ramsar wetland and Important Bird Area as per category A1 (1), A4i (2) , A4iii (3) . This is the largest freshwater lake in Pakistan, supports extensive reed beds and rich submerged and floating vegetation. This is also a breeding, staging area for wintering water birds. It is estimated to support as many as 140,000 birds, including European Wigeon, Black Coot and Common Pochard. The lake is a major source of drinking water for Karachi and supports an important fishery.

4.4 SOCIO-ECONOMIC ENVIRONMENT

The socio-economic baseline profile of the proposed MPCL WEP has considered a macro environment of 5 km in the immediate vicinity of the site and a project area of influence of 1 km radius. This section provides a representation of the primary survey of villages in *Jhimpir* division in *Thatta* District of the province of *Sindh* in Pakistan. Two (2) of these villages are located within the MPCL site boundary.

The socio-economic baseline has used secondary information as well as primary consultations with villagers in the immediate vicinity of the wind farm site and its macro environment of 5 km; key informants and stakeholders as well as secondary information. Data from secondary sources, such as the

(1) **A1**. Globally threatened species: The site qualifies if it is known, estimated or thought to hold a population of a species categorized by the IUCN Red List as Critically Endangered, Endangered or Vulnerable. In general, the regular presence of a Critical or Endangered species, irrespective of population size, at a site may be sufficient for a site to qualify as an IBA. For Vulnerable species, the presence of more than threshold numbers at a site is necessary to trigger selection.
(2) **A4 i**.: This applies to 'waterbird' species as defined by Delaney and Scott [3] and is modelled on criterion 6 of the Ramsar Convention for identifying wetlands of international importance. Depending upon how species are distributed, the 1% thresholds for the biogeographic populations may be taken directly from Delaney & Scott, they may be generated by combining flyway populations within a biogeographic region or, for those for which no quantitative thresholds are given, they are determined regionally or inter-regionally, as appropriate, using the best available information.
(3) **A4iii:** This is modelled on citerion 5 of the Ramsar Convention for identifying wetlands of international importance. The use of this criterion is discouraged where quantitative data are good enough to permit the application of A4i and A4ii, .

Census of Pakistan (1998); Regional Assessment Report for the Gharo Wind Corridor (2009), and Livelihood Studies for the Thatta District (2005), conducted by research organizations and the provincial government have also been used to highlight contextual factors that may be relevant to consider during the lifecycle of the MPCL WEP.

4.4.1 Demographic Profile

According to the 1998 census of Pakistan, *Thatta* had a population of 1,113,194 of which 88.8% was rural and only 11.2% were urban. Based on available estimations, the population of *Thatta* District (2010) is estimated to be 1.58 million. The gender ratio of the district is 888 females per 1000 males which is lower than the national ratio. In comparison, the taluka of *Thatta* in which the project is located had 22% of the total district population in 2010 with a slightly improved sex ratio of 885 females per 1,000 males.

The primary survey conducted in the Project area suggests that a total of 36 households or 216 persons are located within the MPCL site. There are two settlements/communities that come inside the MPCL project site, namely: *Bacho Jhakro Goth* and *Qasim Burfat Goth.* There are another 498 households or 3,630 people in a 5 km radius from the project boundary as illustrated below in ***Table 4.22.***

Table 4.22 Snapshot of communities in the Project Area

Name	Aerial Distance from the nearest MPCL WTG (m)	Approximate No. of Households	Approximate Population	Average Household Size
Within the MPCL Project Site				
Bacho Jhakro Goth	550	8	16	2
Qasim Burfat Goth	345	28	200	7
Sub - Total		**36**	**216**	**6**
Radius of 5 km from the Project Boundary				
Haji Walloo Jhakro	1600 m	16	160	10
Haji Lakhadino Jhakro	1700	20	200	10
Murad Ali Chang	1940	15	100	9
Karim Bux Khaskheli	3600	15	100	9
Jan Muhammad Jhakro	535	5	30	6
Ameer Bux Jhakro	1170	7	40	5
Vakhio Jhakro	3335	400	2800	7
JanooBurfat Goth	840	20	200	10
Sub - Total		**498**	**3,630**	**8**
Total Project Area		**534**	**3,846**	**8**

**Source: Site visit and survey,*

The average household size within the project site is 6 as compared to that for the Project area which is 8. Overall, approximately 3,846 people reside within a 5 km radius of the project locations, which indicates a low population density of 153 persons/km^2.

Settlement Pattern

The proposed area for the installation of the MPCL wind farm is set in a rural landscape which is sparsely populated and which has a scattered settlement pattern with each *goth* (village) at least 700 m to 1 km away from one another. The primary data suggests that the number of small hamlets has increased over time. The number of households and population show the preference of habitants to dwell in small groups instead of living in larger communities.

Settlements in the rural areas are located at a considerable distance from one another to make maximum utilization of the available environmental services and natural resources. The settlement pattern can be linked to the erstwhile transhumant movements of communities in the area, which over the years have become semi-nomadic, leading to the gradual development of villages.

Figure 4.24 Settlements in the Project Area

Qasim Burfat Goth Bacho Jhakro Goth

Consultations with the local community in Qasim Burfat Goth and Bacho Jhakro Goth suggest that some of the households have other ancestral or permanent homes in other villages of Thatta taluka, more than 10-12 km away. However, for a majority of the households, the houses within the MPCL project site are their main residences that have been established for at least one or two decades with the gradual change in their patterns of transhumance. A majority of the head of households possessed computerized national identity cards which state the names of the settlements, i.e. Qasim Burfat Goth and Bacho Jhakro Goth, as the place of residence.

Preliminary consultations were undertaken on the number of household members and type of house with 18 of the 36 households (50%). It emerged that 9 of the 18 structures that were visited were "pucca" (permanent) in nature with stone and brick masonry. Whereas, the remaining 9 structures were "kuccha" (semi-permanent) and made out of locally available mud and thatch.

Figure 4.25 Settlements in the Project Area

Mud and Thatch Structures | Stone and Brick Masonry Structures

Literacy

Sindhi is the most prominent language in the district with 85.66% people speaking *Sindhi*. It is followed by Urdu (11.20%), *Punjabi* (1.07%), *Pashto* (0.75%), *Balochi* (0.65%), *Seraiki* (0.10%) and others (0.58%).

The Thatta District census report (1998) suggests that the total literacy rate in the district is 22.14%. It was reported that the male literacy rate is less than 30% and female literacy is even below that. It was reported that lack of educational facilities in the area and poverty are the main reasons for very low literacy level in the project area.

Ethnic Profile

As per the 1998 census, 96.72% people in *Thatta* follow Islam with Hindus comprising of only 2.89% of the population. In contrast, urban areas such as Nooriabad have a larger population of Hindus constituting 7.96% of the population. Other minority religious groups include Christians (00.18%), *Ahmadiyas* (0.04%) and others (0.17%).

Majority of the population are *Sindhis* of Sindh descent and most of the population in *Thatta* district belong to the Sunni sect, further classified into sub-sects such as *Sayed, Samma, Jokhio, Palejo, Baloch, Rind, Khaskheli, Khawaja, Memon, Mallah, Mirbahar, Jat, Lashari, Burfat, Jamali* castes.

The project area of influence is predominantly Islam with major community groups that include *Jhakro, Chang, Burfat, Khaskheli and Brohi.* The *Jhakro* community is in majority, whereas *Burfats* are powerful in terms of political networks and influence over the area.

The social setup in the project area exhibits a strong *biradri* (kinship) system, which defines the inter- and intra-community hierarchy, gender dynamics and allegiance, and also plays an important role in conflict resolution at the local level. Every social group has its own *Sardar* or *Mukhia* (Chief), who represents

the entire community. Most of the disputes among the community members are resolved at village level by the *Sardar*.

Gender Dynamics

Gender dynamics in the project area, remain rooted in traditional norms of social behaviour and customs which include marriages at an earl y age, preferential treatment towards sons, unequal treatment in decision making at the household level, lesser economic and social freedoms and opportunities. Women across the major communities (*Jhakro, Burfat, Brohi* etc.) are not seen in social and economic interactions, thus limiting their participation in decision making, political and income-earning opportunities etc. At the level of a household, key decisions (including marital issues) are taken by men.

Consultations with women groups suggest that marriages are arranged within close relatives and preference is given to first cousin marriages. In Deh Kohistan, women are predominantly engaged in household chores and in labour-based tasks within agricultural operations. Women are also involved in making handicraft products like bed sheets, pillows, embroidered covers etc. Women are also engaged in natural resource activities that include fuel wood gathering, fetching water and cattle rearing.

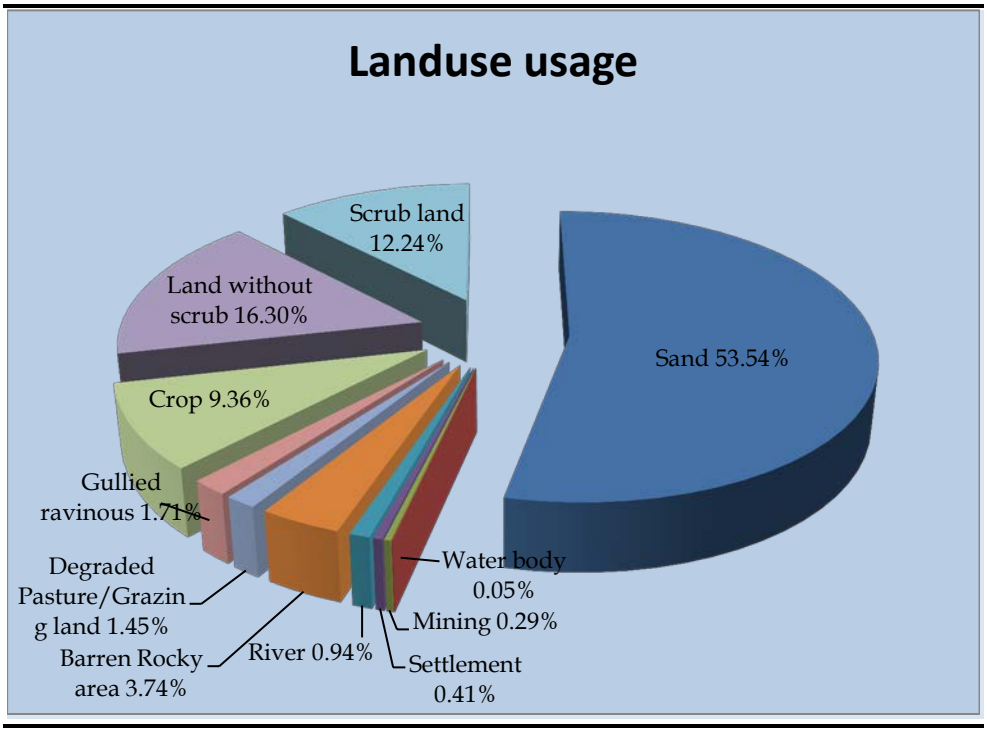
The limited development in health and educational infrastructure is influencing trends in literacy within the project area. For instance, a comparison between 2008-9 and 2010-11 indicates that the proportion of illiteracy rate, both among males and females has increased (6.4% and 3%, respectively) along with an increase in out-of-school boys and girls (12.9% and 2.7%, respectively).

4.4.2 Land Use

The project area of influence (including the project site and a radius of 5 km from the project boundary) comprises of high altitude tracts with hills and outcrops from Jherruck to Kirthar Mountains. There is limited vegetation as the area falls within the desert region of Pakistan.

The subsequent figure illustrates the predominant land use in the 5 km Project area. As provided, the land that is under actual use is around 11% of the total area with 9% being under cultivation and remaining falling under mining, grazing and settlements. It should be noted that land under cultivation is also used for grazing along with 12% of the land under scrub vegetation. As the area falls in arid zone, there are very few water bodies depicted by a very low share (less than 2%) in the area.

Figure 4.26 Land use Profile



**Source: Land use Statistics from Satellite Imagery*

The microenvironment of the project site near the proposed MPCL wind farm is presently highly degraded flat land. It is surrounded on all sides by unconsolidated gravel. The area is studded with rocky spurs and small mounds on barren lands with scant bushes and grasses in low lying areas, thus making it hostile for intensive cultivation.

Land Rights and Landholding Patterns

The arid land scape provides less subsistence or economic opportunities, thus encouraging local communities to share scant resources. Consultations indicate that there is no formal demarcation of land rights amongst communities for land and other natural resources. Since large landholdings are rare and not extremely important in the local economic system, communities have settled into subsistence based livelihoods with a sense of equity in the distribution of available resources.

The status of land and rights of communities in the project area has not been clearly defined. According to government records, the land is classified as unsurveyed government land and does not include any formally owned /used plots of agricultural land or "paimooda". This land has thus been subsequently sub-leased for industrial development, notably wind energy projects, through the AEDB. Thus, the status of these settlements becomes akin to squatters without a formal or recognizable right on land that is being used for agriculture, mining or grazing even though the available land constitutes the only source of livelihood.

Due to the absence of formal rights on land, the demarcation of land to households is assumed to be in the form of an unwritten agreement where the village sardars play the role of arbitrators in case of disputes arising because of land and ownership, among many other things. As per the Regional Assessment study for Thatta District (2008), almost 70% of landowning households have less than 5 acres of land.

Common Property Resources

In the project area, there are many land-based resources that are used by the community as a whole. This includes grazing land, natural resources such as fuelwood, rocky outcrops which are used for local stone excavation. The most important land use in Deh Kohistan is grazing. Villagers also consider sites such as mosques, grave yard areas as well as school buildings which can be used as 'autaqs' or guestrooms by the villagers.

Irrigation Sources

The major source of water in Thatta District and the project area is River Indus which feeds the extensive irrigation network across its catchment in the Sindh Province. This water is diverted through the *Guddu*, *Sukkur* and *Kotri* barrages utilized for irrigation of 2.12 million ha land area in the year 2006-07 for cultivation. The *Kalri Baghar* feeder originating from the Indus and *Keenjhar* lakes provides irrigation water to the area on the northwest of the Project site. There is a plan to divert about 5 MGD water from *Jhimpir* near *Keenjhar* lake, from where the water will be taken for *Nooriabad* Industrial Estate. *Nooriabad* is at present getting its water supply of about 2 MGD from groundwater sources.

Bunds are localized areas dedicated to collecting rain water as it flows downhill due to surface runoff. As the water is collected in a basin it seeps into the ground below making the barren soil, moist. This makes the soil fertile to some extent by the addition of trace minerals from the rain water. Agricultural activities are then carried out on these localized areas where different kinds of crops are grown.

Availability of sweet groundwater in the area southwest of the Project site is quite limited. The thin layer of sweet water that exists over the brackish aquifer is under serious stress. This water is being supplied to the communities in and around *Nooriabad*, *Jhimpir* and much of *Deh Kohistan*. Hence the usage of groundwater for the irrigation purposes is quite limited. While the perennial availability is only 62% in the province, it is restricted to only 19% in Thatta. Hence, people in the area construct *bunds* which collect rain water and this water is stored to be used for irrigation.

4.4.3 Livelihoods

The rural economy in the Project area is essentially agro-pastoral with dependent upon land-based livelihoods for subsistence as discussed subsequently:

Agriculture and Cultivation

In *Thatta* District, during *rabi* (winter) season, mostly wheat and vegetables are grown, whereas during *kharif* (summer) season, most of the farmers grow rice, sugarcane and vegetables. As there is acute shortage of water in the area, coupled with low levels of irrigation, people in the Project area mostly grow maize, *jowar*, vegetables like *guar*, pulses including *moong*, wheat, and fodder for livestock. The maize is ground to produce flour and bread, which forms the staple diet of the locals of this area.

The project is located in an arid stony waste land which hardly receives rainfall. However, occasional torrential rain brings some surface flow which is diverted through channels into ponds. These ponds are called '*bunds*' in local language. Cultivation on deep valley soils depends mainly on spate irrigation practiced by diverting torrent water into fields which have high embankment, for ponding of water. The soil is seldom soaked with water to grow crops which have to mature usually on only one soaking and it gets more than one watering. Hence, coarse grains like Jowar and bajra are the main crops in this region. Discussions with farmers revealed that a maximum profit from such system of cropping can fetch from PNR 6000 to 8000 per hectare per annum.

The agricultural marketing practices are also traditional. Almost all the agricultural produce is sold to local wholesale dealers who in-turn influence farmers through money lending and the debt cycle. The produce is therefore required to be sold at a rate which is invariably lower than the market rate. Moreover the farmers are usually unaware of the open markets in larger towns and cities, and they find it convenient to sell their produce to the whole sale dealers at lower-than-market rates. Dhabeji, Gharo, Mirpur Sakro and Jhimpir are the major markets for villages inhibiting the two project areas of Gharo and Jhimpir. In addition to these markets, some major commercial centers in Thatta district include Sujawal, Jati, Chuhar Jamali, Shahd Bunder, Ghora Bari, Mirpu Sakro, and Daro. Rice, leather and wool are important trade items in the district.

Livestock

In Kohistan and Chorr revenue circles (Jhimpir), livestock rearing is a predominant source of livelihood due to the arid landscape. However, this activity is subsistence-based due to the lack of commercialisation or any formal dairy network in the project area. Meat and milk are two products used by the community that are also important as nutritional sources. Consultations indicate the importance of cattle as a source of money in case of emergencies, festivities and other occasions.

In the project area, most households have around 30-60 ruminants that include goats and cattle. When natural vegetation dries up and it is costly to buy green or dry fodder and water for animals, the people move their livestock and animals to *Jherruck* where the *Kalri–Baghar* Feeder canal provides sufficient

water and moisture for the vegetation to grow. The people are used to this type of living or in-migration for a long time now.

The key markets for livestock and livestock produce in the project area of influence include Mirpur Sakro and Dhabeji which operates once a week. Lack of perennial sources of irrigation and non-availability of veterinary services are key constraints within an area where the community is heavily dependent upon livestock for subsistence and income. The average number of goats in settlements around the project site is 132 and that of cattle is 71, per village visited. Some settlements have a sense of collective ownership and sharing of benefit from livestock.

Resource-based Livelihoods

Stone Excavation: The excavation of materials (stone, gravel etc.) is another opportunity specific to this area. Quarrying, stone cutting, gravel and sand are collected from the local terrain and are sold for use in building construction in nearby cities. The stones are sold on a per truck basis and purchased by the building contractors. This is a labour intensive activity that is typically performed by women, children and the elderly. Average income per month from such activities for a family is approximately PNR 1800-2500 per month.

Forest Gathering: People in the area also collect fuel wood for household consumption and sell to the urban clusters and nearby markets. The desert and semi-arid areas of Sindh, Punjab and Balochistan are also wintering habitats for a number of migratory birds including the Houbara bustard. As reported, the Thatta district as well as Jhimpir has been allocated for Houbara bustard hunting. It was reported that a few people are also engaged as facilitators to the Arab Princes in the season of bird hunting.

Wage Labour and Self-employment

Wage labour is required for agricultural tenancy, cotton-picking, poultry farms and the salt industry. Both men and women in the project area supplement their major income source with handicrafts. Women develop hand made products like rali, comforters called sour, sagi, agath and embroidery on shirts, bed-sheets, pillows, handkerchiefs and table covers. Analysis of differences in wages between men and women indicates that women were either underpaid or involved in low-paid (unskilled) rural non-farm activities.

There is little opportunity for livelihood diversification. The local community is not able to respond to demand for labour from industrial areas in Nooribad and Kotri due to the lack of education and paucity of required skill sets.

Box 4.1 Government Support Schemes

One of the key livelihood interventions that are being conducted by the Government is referred to as the Benazir Income Support Programme. The beneficiaries of this program are women who receive PNR 1,000 per month to be utilized in skill development towards generating self-employment options.

The program focuses on women to acquire vocational training that encompasses both a recognized training format that leads to the development of a certificate-based skill, and a non-recognized training such as in-house or product-based training under the BISP framework. Subsequently, it will aim to lead towards capacity building and professional development."

4.4.4 Income Levels

Although a formal area poverty profile has not been prepared for Lower Sindh including Thatta, secondary data generated by the project preparatory technical assistance (PPTA) showed that 54% of the population in 2004 are among the "poorest" category and 79% may be characterized as poor. In a 2004 national survey Pakistan's poorest district was assessed to be Thatta. Primary consultations indicate that the average monthly household income in the project area is between PNR 5000 to 7000, whereas, the expenditure levels are higher at around PNR 7, 000 to 10,000/-. The gap between monthly expenditure and income is met by borrowing from baniyas (traditional moneylenders) of Jhimpir and Thano Boula Khan and this debt is typically repaid by selling livestock during festive seasons such as Eid-ul- Adha. Most of the families are indebted by about Rs.20, 000/- to Rs.50, 000 /- annually. Due to lack of awareness and low literacy levels, people do not pay attention towards the income consuming factors like illness or unnecessary expenditures over marriage ceremonies or stimulant consumption.

Box 4.2 Key Implications for the Project

- The livelihood profile of the area is a reflection of the constraints in subsistence and income generation capacity in the context of the physiological profile of the land scape;
- A majority of the population depends on agriculture for income and subsistence, with smaller parcels of arable land. Livestock rearing is the only bankable source of consistent income in the project area;
- Despite development of industrial towns like Nooriabad in the neighbourhood, lack of entitlement, infrastructure and education etc. limit the socio-economic groeth of the area;
- Vulnerability in the Project Area has been defined in the context of socio-economic status of households. Economic poverty and gender sensitivities are important issues in the project area. Other vulnerabilities include physical handicaps and lack of asset ownership.

4.4.5 Physical Infrastructure

Physical infrastructure includes infrastructure which is essential for maintenance and supply of basic services and amenities resulting in economic and social well-being. These networks are tangible in nature and mostly involve service provisioning facilities/assets like water taps, drains, roads, railways, airports and so on come under this category.

Electricity

There is a state power grid at *Nooriabad* and a 132kV regional substation of WAPDA (1) near *Jherruk* town. The voltage in the state grid is low and in poor condition, frequently suffering from load shedding. There is no electricity supply for domestic or any agricultural or commercial use for the villages in the project's area of influence as well as in the 5 km radius. Regular supply of electricity has emerged as a key expectation from wind energy development in the project area.

Drinking water

There is an acute shortage of drinking water in the project area. Ground water level is too deep at ~200 ft. and there is no regular water supply scheme in villages of the project area and residents get water through tanker service. The tankers collect water from *Nooriabad* and delivers into a tank outside one or two villages from where each household has to purchase its share. Two villages near *Qasim Burfat* have arrangements for delivery of water collected from ponds excavated in the bed of *Harolo Nai* in small canisters and loading them on donkey carts. It was informed that water supplied by the tankers is of poor quality and is not of desired quality for human consumption. The supply by donkey cart obtained from the bed of *Harolo Nai* is, however, sweet and fit for drinking.

People usually pay for water tanks that can go up to almost 50% of their monthly income. A tank of water can sustain a family of 5-6 people for an average of two weeks. There are hand pumps in selected villages but the quality of water is usually not good. Keenjhar lake provides water to a large portion of villages in the Jhimpir area. MPCL has also provided some bore wells and hand pumps in the villages within their area of influence.

Transport and Connectivity

The Super Highway M-9 (*Karachi-Hyderabad*) is about 9 km from the Project site. A dirt road taking off from *Kohistan* Hotel at 55 km to *Hyderabad* provides alternative access to the Project site. The dirt road will be improved for heavy vehicle worthiness so that the large and heavy towers, turbines and equipment could be transported within turbine locations across the 1553 acres. The closest railway station is 9 km at *Jhimpir* which falls on the Karachi-Hyderabad railway line. Indus River does not cater to the needs of inland water transportation. The closest port is Karachi which is Pakistan's main port.

(1) WAPDA, the Pakistan Water and Power Development Authority, was created in 1958 as a Semi-Autonomous Body for the purpose of coordinating and giving a unified direction to the development of schemes in Water and Power Sectors, which were previously being dealt with, by the respective Electricity and Irrigation Department of the Provinces. Since October 2007, WAPDA has been bifurcated into two distinct entities i.e. WAPDA and Pakistan Electric Power Company (PEPCO). WAPDA is responsible for water and hydropower development whereas PEPCO is vested with the responsibility of thermal power generation, transmission, distribution and billing. - *Source: http://www.wapda.gov.pk/*

The villagers often go to *Jungshahi*, *Nooriabad* and *Kotri*, which are 25 km, 23 km and 35 km away. They use the trucks and carriages that transport sand and gravel to reach Super Highway. They take a bus or van from there and pay PNR 50 fare per journey and PNR 100 for return journey to local transporters to reach *Kotri*. In case of emergency they have to hire a truck and pay PNR 1000 to reach the nearest clinic.

4.4.6 Social Infrastructure

Health Facilities

Settlements in the project area do not have any healthcare services. Generally, villagers access *Jhimpir*, *Nooriabad*, or *Thano Bola Khan* for general ailments and to *Kotri*, *Jamshoro* or *Hyderabad*, at a distance of 30-40 kms for treatment of major diseases. The cost of healthcare in the project area is exorbitant due to the associated transportation charges, consultation fees and availability of medicines.

Villagers in the Jhimpir area utilize the Jhimpir Basic Health Unit (BHU) and the industrial centre of Nooriabad. Fever, Malaria, Tuberculosis, respiratory tract congestion, asthma, sugar, blood pressure, diarrhoea, skin ailments, typhoid, vomiting, Hepatitis B, kidney stone are the prevalent diseases. Water borne diseases are common in the villages using the tanker supply while those near *Burfat* village have no specific complaints.

Education Facilities

There are two primary school buildings for boys in the Project area but only one, in *Brohi* village is functional. In addition, *Qasim Burfat* village has one *Madressa*. The school building at *Jan Mohamad Burfat Goth* is being used by the village hierarchy as '*autaq*'. Under the circumstances the school going children remain in *Jherruck* where the families have a secondary/ancestral home. MPCL and other wind energy developers have supported these educational facilities by providing salaries of the teachers and other institutional stakeholders.

Development Schemes and NGOs

The provincial government has addressed problems pertaining to disasters such as earthquakes as well as floods and cyclones for the population in the coastal part of Thatta district. In response to the drought since 2005-2010, the government has provided funds for relief operations, waived land taxes, postponed the recovery of loans, provided subsidized wheat, and mobilized medical and veterinary teams to the areas. A wide range of short, medium-term measures such as the construction of roads, installation of pipeline water scheme, electrification and public work programs were implemented. Despite

all these measures, the steps taken by government are far from adequate. Most measures have had a limited impact on rural livelihoods and most affected households feel that the Government has undertaken little to ameliorate their suffering or provide basic services.

Some of the key governmental schemes operational in the Thatta district include the Sindh Rural Development Program and the Sindh Devolved Social Services Program. Another institutional scheme is the Pakistan Poverty Alleviation Fund (PPAF that is designed to provide micro-credit through local NGOs as well as provide assistance for community infrastructure projects. These include the National Rural Support Program (NRSP) and the National Commission for Human Development (NCHD).

The capacity of these local NGOs to undertake sustainable development programs is generally limited. Most of them are small welfare oriented organisations, which do not have the experience and the capacity to provide services. They work on a small scale and generally do not have strategies that are likely to contribute to sustainable increases in incomes or livelihoods.

Box 4.3 Key Development Needs

- Health infrastructure that caters to maternal issues as well as improved access to veterinary care;
- Potable and regular source of drinking water supply;
- All-weather and motorable access roads which can in turn encourage the development of transportation options;
- Requirement for capacity building and vocational training to enable the local community to take benefits from industrial development.

**Source: Primary Consultations*

4.4.7 Cultural Environment

There are no prominent cultural or archaeological features in or around the MPCL Project site. The nearest graveyard is beyond *Harolo Nai* on the north at a distance of appox. 4 km from MPCL Wind Mast (MP-3) and the same does not have marks of antiquity. Places of archaeological, historical and religious significance in District *Thatta* are located in *Thatta* and are 60 km from the Project site. The UNESCO World Heritage site of *Makli* Hill which is one of the largest necropolises of the world is among them.

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Figure 4.27 Sites of Local Cultural Significance

Mosque at Qasim Burfat *Eid Gah near Vakhio Jhakro*

Box 4.4 Key Socio-cultural issues from cumulative Wind Energy Development

Certain contextual issues in the project area of influence are important in consideration of the cumulative effects of multiple wind energy projects in the Gharo and Jhimpir wind corridor:

- The community is wary of the degradation of its cultural norms and social practices due to the gradual industrial development of the project area. The issue with the influx of migrants, new values and socio-cultural practices will be brought in which the locals fear will erode the traditional social fabric of the local community;
- The influx in the project area may be long-term due to the simultaneous development of wind projects one after the other and the labour that may stay back to avail of continued economic opportunities and potentially improved infrastructure. The local community is apprehensive about influences on their privacy and stress on the resources, both natural and man-made;
- The influx of workers and job seekers from outside and the resultant demographic shift can add pressures on already scarce resources and infrastructure. The availability of water is an issue which is of huge importance to the local community as the increasing numbers might deplete the water sources in the area; and
- The lack of formal rights on the land and increasing alienation from the land by the government to wind energy developers can pressurize the locals from leaving the area as they are being seen as encroachers on the present land.

**Source: Primary Consultations*

5 STAKEHOLDER ENGAGEMENT AND PUBLIC CONSULTATION

5.1 INTRODUCTION

This section provides a brief discussion of key stakeholders and assesses their influence/concerns towards the proposed project along with the details of formal engagement and consultation activities that have been carried out so far. At the outset, it should be emphasised that the most important stakeholders for the proposed MPCL 50 MW WEP are:

- **Institutional stakeholders**: District administration in Thatta and regulatory bodies such as the AEDB and the Sindh EPA authorities; and
- **Local Community**: Community living within the project site (Qasim Burfat Goth, Bacho Jhakro Goth) as well as settlements in close proximity of the project boundaries (e.g. Jan Muhammad Burfat Goth, and Haji Wallo Jakhro etc.)

Formal stakeholder consultation and documentation for the project have been carried out in two phases:

- **Phase I (2009)**(1) for the preparation of the Initial Environmental Examination Report (IEE); and
- **Phase II (2013)** for the update to the IEE report to reflect the present status of activities at the project site.

In both phases efforts have been made to provide available information on the project, including proposed design, and to facilitate informed consultation on community needs, concerns and expectations. It is pertinent to mention that MPCL has also carried out stakeholder engagement and consultation activities that are not directly linked to the environmental and social studies. These consultations, however, have not been formally documented although reference to the same has been provided in this section where relevant.

5.1.1 *Objectives of the Process of Stakeholder Engagement*

The project is to be developed in a rural socio-economic context with limited precedents of industrial development of this scale or environmental and social effects from projects of this nature. It is understood that two other wind energy projects have come up in the Deh Kohistan region and Jhimpir Wind Corridor over 2012-2013 and other than MPCL, another 8 (eight) projects are also in various stages of development.

In this context, the stakeholder engagement and consultation process has the following objectives:

(1) Although an IEE report has suggested mechanism for continual stakeholder consultations and engagements however no documents were made available to ERM during IEE updating process.

- To ensure timely and consistent disclosure of project information to all stakeholders and facilitate their feedback, any decision making and expression of concerns;
- To assess awareness levels of the project and to determine the impacts of future development plans on the project area;
- To provide opportunities and channels to affected communities to raise/voice their concerns, grievances and clarifications;
- To ensure a process by which any grievances, suggestions or general feedback are accepted and addressed in a timely manner and incorporated in the project where relevant.

5.2 STAKEHOLDER MAPPING AND IDENTIFICATION

The project consists of a range of stakeholders with varied interests and influence in the project. ***Table 5.1*** maps the initial stakeholder groups based on the consultations of Phase I (2009) during the initial consultations for the project:

A stakeholder is "a person, group, or organization that has a direct or indirect stake in a project/organization because it can affect or be affected by the Project/organization's actions, objectives, and policies". Stakeholders thus vary in terms of degree of interest, influence and control they have over the project. While those stakeholders who have a direct impact on or are directly impacted by the project are known as **Primary Stakeholders,** those who have an indirect impact or are indirectly impacted are known as **Secondary Stakeholders**.

Table 5.1 Preliminary Stakeholder Grouping (IEE, 2009)

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community	• Sub-contractors • Staff and Labourers • Local Community • Vulnerable Community	• Local community living within the project area of influence within 5 km of the project boundary
Institutional Stakeholders	• Project investors and lenders • IUCN • Pakistan-World Wildlife Fund	• Village and other community based Institutions • Political Parties; • Pakistan Space and Upper Atmosphere Research Commission (SUPARCO)
Government Bodies / Regulatory Authorities	• District Administration • Sindh Environmental Protection Agency • Ministry of Environment and Alternative Energy • Government of Sindh	• Sindh Wildlife Department • Ministry of Local Government • Rural Development, • Department of Archaeology, • Meteorology Department
External Groups	• Other wind farm projects	• Media • NGOs and Civil Society Groups

These stakeholder groups have since been revised to cover those that have been mapped and profiled subsequently:

Table 5.2 Identification and Mapping of Key Stakeholder Groups

Stakeholder Groups and Profile	Levels of Influence	Expectations/Concerns/ Interest
Internal Stakeholders		
Metro Power Company Limited (MPCL) is an independent Company and some Directors of MPCL are also Directors of Gul Ahmed Wind Power Limited . They are among the first to set up captive power generation system in 1988-89 in their Gul Ahmed Textile Mills (GATML) and they were also the first few Independent Power Producers (IPPs) to respond to the National needs of energy supplies by setting up Gul Ahmed Energy Limited in 1994.	High	• Wind energy portfolio is one of the upcoming and sustainable project • Financial closure and credit to be in place to ensure timelines and efficient progress
Employees both direct and contractual for the construction, operations & maintenance phase. It is expected that employees will be mostly migrant due to the necessity of highly competent skills and technical knowledge required to commission and operate the project.	Medium	• Adequate working conditions; • Ensuring sustained engagement with the company across portfolios and projects
Contractors and Sub Contractors: • **Nordex Singapore Pvt. Ltd.:** is a 100% subsidiary of Nordex Group (Nordex Energy GmbH). Nordex SE is a management holding company with its headquarters in Rostock. The domicile of the board and administration is Hamburg. Nordex SE's task is to control and coordinate the activities of the two 100 per cent subsidiaries Nordex Energy GmbH and Nordex Energy B.V. • Descon Engineering Ltd. Descon Engineering Limited is an integrated engineering services and manufacturing company operating in Pakistan and the Middle East. The integrated package of services encompasses engineering, procurement, manufacturing, construction, commissioning and maintenance. • Descon Integrated Project Pvt. Ltd: A Multidimensional Engineering, Procurement and Construction Company 100% owned company of Descon Engineering Ltd with Head Office in Lahore, Pakistan. • They reportedly have the required capacities to adequately implement environment and health & safety systems.	High	• Site access and basic infrastructure facilities, such as access to sanitation, drinking water etc.; • Guidance on aligning and implementing the expected social and environmental standards; • Grievance redressal for any execution level issues; • Liaisoning with government authorities for labour and other compliance.
Project Investors and Financiers: These include lenders, investors and other development finance institutions including InfraCo Asia, the IFC and other EPFIs	High	• Minimum project risks in the short and long term; • Sustained environmental and social compliance and performance; • Mitigation of adverse impact

Stakeholder Groups and Profile	Levels of Influence	Expectations/Concerns/ Interest
IUCN: protection and conservation of ecology and nature	Low	• Impact on any bird migration paths; • The damages to fragile eco system including flora and fauna must be avoided and impacts should be mitigated in planned and strategic manner
Pakistan-WWF: Protection of species and habitat with special interest in protecting river ecology round Indus		
SUPARCO: Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) is mandated to conduct R&D in space science, space technology, and their peaceful applications in the country. They are mandated to also undertake monitoring activities in the project area as an third-party.	Low	• There should be limited changes in the geography and land use in the region
Local Community		
Qasim Burfat and BachoJhakro village settlements: Approximate population of 216 with subsistence-based dependence on agriculture, livestock cultivation etc. on the project land	High	• Community seems concerned about the potential health and safety and livelihood impacts within the MPCL area;
Other settlements: located near to MPCL proposed project boundary. These habitations have 20-25 households with an approximate population of 150 people in each settlement. They have limited access to basic services and the main source of livelihood is animal rearing, illegal quarrying of limestone and labour. Due to extreme weather conditions and scarcity of water agriculture is limited to monsoon and production is very low.	Medium	• Their key expectations of the community from the project were development along with the availability of basic infrastructure and services • Community expects to get local employment and small contracts • Their key concerns include (a) lack of participation and information disclosure; (b) fear of losing their traditional values (c) privacy of women may get disturbed
Communities living along access/ approach roads and project components	Medium	• Compensation for any damage to livestock, property of land; • Community health & safety issues
Regulatory Authorities		
Alternate Energy Development Board	High	• Generally involved in providing environmental and technical clearances for various project components; • They are keen to ensure that the project meets its commitments with respect to compensation, getting clearances,
Ministry of Environment and Alternative Energy		
Sindh Environmental Protection Agency		
Sindh Wildlife Department		
Ministry of Local Government & Rural Development	Medium	
Department of Archaeology		
Meteorology Department		

Stakeholder Groups and Profile	Levels of Influence	Expectations/Concerns/ Interest
		permits and complying with rules and regulations governing their project operations
District and Local Administration		
District Collectors Office (Nazim)	Medium	• Seek to clarify any land use rights/claims from people who bring forth usage certificates
Hyderabad Electricity Supply Company (HUSCO), National Transmission and Dispatch Company	Medium	• To be involved for power transmission and distribution
Other Institutional Stakeholders		
Local Conservation Groups/ Organisation: The physical presence of local conservation groups was not reported in the proposed project zone however such groups may have regional presence. Although there are no specific NGOs presently, there may be some activity subsequent to the cumulative development of wind energy in the near future.	Low	• Alert to any non-compliance /controversial issues like land degradation of ecology • They are generally concerned with the migration measures, resettlement and participation in planning and executing developmental tasks.
Village level Community-based Organisations: The villages falling under the proposed project area were sparsely located with very less population. There were no recognised CBOs however informally they are under the local leadership of village chiefs.	Low	• Want to be considered for implementation of community development activities;

5.3 *APPROACH AND OUTCOME*

MPCL has commenced the process of stakeholder engagement and consultation for the project as discussed subsequently:

5.3.1 *Preparation and Update of the IEE*

Stakeholder consultation was an important process for the IEE conducted in 2009 and that has been updated in 2013. The consultation process followed so far includes information from both formal and informal discussions with the stakeholders through focused group discussions, semi-structured interviews and general public meetings as provided in ***Table 5.3***. ***Annex H*** captures the minutes and key discussion summaries as recorded by the local consultants that were engaged by MPCL.

Table 5.3 Identification and Mapping of Key Stakeholder Groups

S. No	Stakeholder	Outcome
IEE Report Prepetition Stage(April 2009)		
1	***Institutional/ Govt./ Regulatory Agencies*** • Sindh Environmental Protection Agency • Ministry of Environment and Alternative Energy Government of Sindh • SUPARCO • IUCN – Pakistan • WWF – Pakistan • Sindh Wildlife Department • Ministry of Local Government & Rural Development • Department of Archaeology, Government of Pakistan • Meteorology Department	Continuous liaisoning through the progress of the project
2	Community • Qasim Burfat Goth • Janoo Burfat Goth • Jakhro Jamali • Brohi Goth	General community expectations on employment and development needs
IEE Update Report Prepetition Stage(Feb- March 2013)		
3	Institutional/ Govt./ Regulatory Agencies/NGO/Others • Social Welfare Officer Thatta • District Educational Officer Thatta • Plan International (Mangi Programme Unit) • Teachers of Jhimpir High School • Social activist cum Educationalist	Potential options to improve community support, stakeholder profiling for construction and operations phase
4	Community • Qasim Buraft Goth • Janoo Jakhro Goth • Bacho Jakhro Goth • Haji Wallo Jakhro Goth • Murad Ali Chang Goth • Janoo Burfat Goth • Vakhio Jakho Goth	Present constraints and concerns over impacts from wind farms, compensation for use of land, other opportunities to continue livelihoods etc.
5	Discussions with vulnerable groups and women	Livelihood challenges and potential support

Although an initial public hearing was conducted in 2009, in order to account for any changes in the project specification, as well as details of impacts associated with livelihoods, environmental parameters and community health and safety, MPCL will conduct a general stakeholder meeting to disclose the findings and executive summary of the updated IEE report.

5.3.2 On-going Engagement

MPCL had developed a broad consultation framework to guide stakeholder engagement through the project lifecycle. However, no formal records of consultation or documentation of any community meetings have been maintained. Since 2009, MPCL have focused on the following key areas for continued engagement:

- **Local community development:** MPCL have collaborated with other wind energy developers in the project vicinity to engage with village settlements in providing support for drinking water needs, local institutions and sanitation;
- **Employment:** MPCL have thus far engaged some local personnel for security, guarding of the wind masts and other menial jobs at site. Employment was provided subsequent to discussion with village elders in order to make the process transparent and consultative. MPCL and the sister concern wind developer Gul Ahmed Wind Private Limited (GAWPL) have provided employment to at least 11 local people.

MPCL representatives are known to regularly liaise with authorities that include the Sindh EPA, AEDB and local agencies of Thatta District. There is no formal organisation that requires regular interaction of all the 11 wind developers; however, MPCL has been proactive at engaging with other project proponents to understand any constraints, challenges etc.

5.4 KEY EXPECTATIONS/OUTCOMES

Feedback from the range of institutional authorities and local community groups have been summarised as follows. This feedback indicates the prevalent expectations, awareness levels and needs in the project area.

5.4.1 Strengths of the Project

- Officials and public representatives expressed the need of the wind power project because it will make the country less dependent on fossil fuel and would engage the highly skilled manpower through employment and technical support opportunities; and
- Authorities appreciate the installation of indigenous technology for renewable energy development.

5.4.2 Perceived Weaknesses

- There is lack of awareness among the local community on the perceived benefits from the project as a majority expect that the project will enable them to avail of regular power supply; and
- Local community seemed satisfied with development support provided by MPCL through provision of drinking water etc. However, members of Qasim Burfat and Murad Ali Chang were concerned about the potential influx of migrant workers and perceived risks of social conflicts and disruption of privacy and security of women.

5.4.3 Potential Opportunities

- The regulatory agencies were of the opinion that the proposed project will have very less direct benefit to the local community; however in a long run

it may provide increased business opportunity, expanded infrastructure and improved quality of life; and
- The wind energy projects coming up in the Jhimpir area are perceived to be able to provide much-needed employment opportunities to improve the socio-economic and subsistence dependence of the local communities on existing resources.

5.4.4 Potential Threats

- Although the management of wildlife is not a major issue for the project, local authorities expect that the existing flora and fauna should be accounted for (including the high flying birds and the reptiles in particular the spiny-tailed lizard - *Uromastix hardwickii*);
- Consultations have indicated resettlement and health & safety concerns among the population residing within the settlements on MPCL land. In addition, people are also aware of certain precedents on land compensation and employment being offered by other wind energy projects in the vicinity; and
- Overall, although the community does not appear concerned about the loss of land, there is lack of awareness on the legal status of users of land for cultivation and the implications on the rights of land being used by the local community, but that has been sub-leased by the AEDB.

5.4.5 Specific Needs

Specific consultations with vulnerable groups and residents of the nearby communities have indicated the following feedback:

- Communities have expressed that need for reclamation of land, promotion of technologies for water conservation to provide water security during drought, schemes for upgrading skill and generating income , electricity, schools and employment;
- There is a sense of uneasiness amongst locals who believe the land belongs to them by virtue of traditional rights. There is an accompanying fear that the government may take these lands anytime for development projects or industries, which is the case in the project area;
- Women emphasized the need for a dispensary and mother and child healthcare support, educational support, access to vocational training cum production centre, availability of drinking water near to their hamlets to reduce their efforts in fetching water from long distances; and
- Key informants and local leaders expressed the need for communication of a clear cut and transparent policy on local employment, petty contract procurement, development work and also have asked for clarifications on concerns raised from in-migration and installation of construction camps. There are expectations that no construction camps or offices will be located in the proximity of settlements to avoid disrupting the privacy of women.

5.5 WAY FORWARD

Annex L provides guidance for MPCL to develop a stakeholder engagement plan under which consultations should not be treated as a one-time activity, but rather as a dynamic process of continuous feedback mechanisms, information disclosure and grievance redressal.

A Stakeholder Engagement Plan (SEP) will enable MPCL to undertake regular consultations in a phased, planned and systematic manner along with the requirement for it to be culturally appropriate and gender-sensitive. The implementation of the SEP will not only bridge the information gaps but also provide an opportunity to stakeholders to make informed decisions where relevant.

6 IMPACT ASSESSMENT AND MITIGATION

This section identifies and assesses the potential changes in the environment, ecological and social scenario in the Deh Kohistan region of Jhimpir Union Administration, Taluka and District Thatta, Sindh that could arise from the project of MPCL. The analysis discussed below assesses the manner in which the project will interact with elements of the physical, biological, cultural and human environment to produce impacts to resources/receptors. The assessment has been organized according to environmental, ecological and social receptors with a discussion of potential impacts across the project lifecycle, including construction, operation and decommissioning.

The specific purpose of this section is to:

- Identify and assess the range of potential impacts and extent of their severity;
- Explain the ways in which the Project might affect environment, ecology, and socio-economic resources; and
- Propose viable mitigation measures for the identified impacts.

The impact assessment section has been organized across identified environmental and social receptors that were scoped as sensitive for the project. The discussion for each receptor has been organised as per the various stages of the project lifecycle including construction, operation and decommissioning in order to understand the risks and impacts associated with each of these individual stages.

6.1 IMPACT ASSESSMENT METHODOLOGY

The principal impact assessment steps are summarized in ***Figure 6.1*** and comprise:

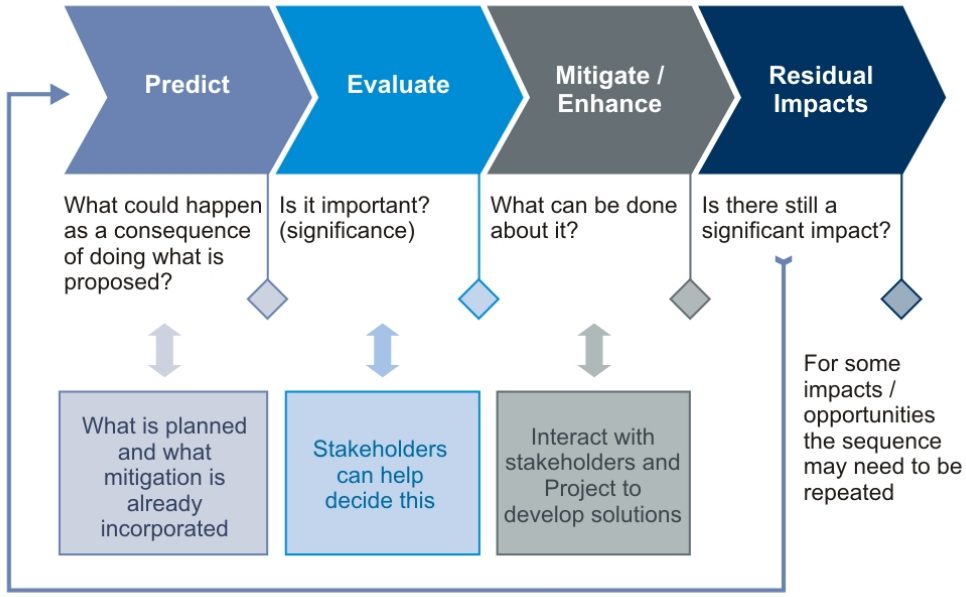
Impact prediction: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities;

Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor;

Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts;

Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

Figure 6.1 Impact Assessment Process



6.1.1 *Prediction of Impacts*

Prediction of impacts was carried out with an objective to determine what is likely to happen to the environment as a consequence of the Project and its associated activities (*See the interaction matrix in* ***Table 6.4***).

Each impact was described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in ***Table 6.1.***

Table 6.1 Impact Characteristic Terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect)	Direct Indirect Induced
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.)	Local Regional International
Duration	The time period over which a resource/ receptor is affected.	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)	[no fixed designations; intended to be a numerical value or a qualitative description of "intensity"]
Frequency	A measure of the constancy or periodicity of the impact.	[no fixed designations; intended to be a numerical value or a qualitative description]

The definitions for the *type* designations are shown in ***Table 6.2.*** Definitions for the other designations are resource/receptor-specific.

Table 6.2 Impact Type Definitions

Type	Definition
Direct	☞ Impacts that result from a direct interaction between the Project and a resource/ receptor
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project.

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is likelihood. The likelihood of an unplanned event occurring was designated using a qualitative scale, as described in ***Table 6.3.***

Table 6.3 Definitions for Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions
Possible	The event is likely to occur at some time during normal operating conditions
Likely	The event will occur during normal operating conditions (i.e., it is essentially inevitable)

Once an impact's characteristics were defined, the next step in the impact assessment phase was to assign each impact a 'magnitude'. Magnitude is typically a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent
- Duration
- Scale
- Frequency

Additionally, for unplanned events only, magnitude incorporates the 'likelihood' factor discussed above.

Magnitude essentially describes the intensity of the change that was predicted to occur in the resource/receptor as a result of the impact. As discussed above, the magnitude designations themselves are universally consistent, but the descriptions for these designations vary on a resource/receptor-by-resource/receptor basis. The universal magnitude designations are:

- Positive
- Negligible
- Small
- Medium
- Large

In the case of a positive impact, no magnitude designation (aside from 'positive') was assigned. It was considered sufficient for the purpose of the Impact Assessment to indicate that the Project was expected to result in a positive impact, without characterising the exact degree of positive change likely to occur.

In the case of impacts resulting from unplanned events, the same resource/ receptor-specific approach to concluding a magnitude designation was utilised, but the 'likelihood' factor was considered, together with the other impact characteristics, when assigning a magnitude designation.

6.1.2 Evaluation of Impacts

In addition to characterising the magnitude of impact, the other principal impact evaluation step was definition of the sensitivity/ vulnerability/ importance of the impacted resource/receptor. There are a range of factors that was taken into account when defining the sensitivity/vulnerability/ importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors were also considered when characterising sensitivity/ vulnerability/importance, such as legal protection, government policy, stakeholder views and economic value. The sensitivity/ vulnerability/importance designations used herein for all resources/receptors are:

- Low
- Medium
- High

Once magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor have been characterised, the significance was assigned for each impact. Impact significance is designated using the matrix shown in ***Figure 6.2.***

Figure 6.2 *Impact Significance Matrix*

		Sensitivity/Vulnerability/importance of Resource/Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/ vulnerability/ importance designations that enter into the matrix. ***Box 6.1*** provides a context for what the various impact significance ratings signify.

Box 6.1 *Context of Impact Significances*

An impact of **negligible** significance is one where a resource/ receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/ receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.

An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of Impact Assessment is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

It is important to note that impact prediction and evaluation has taken into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the project design, regardless of the results of the Impact Assessment Process).

6.1.3 Mitigation and Enhancement

The impact assessment process is intended to reduce the negative impacts and enhance the benefits of an intended activity by identifying potential impacts and benefits and the ways of dealing with them. Planned mitigation measures will be described; additional mitigation measures/controls will be recommended where impacts are considered unacceptable. Recommended post-project monitoring will be identified and included in the separate environmental and social management plans.

In this assessment the mitigation hierarchy for planned events is as follows:

- **Avoid at source/ reduce at source:** Avoiding or reducing at source is essentially designing the Project so that a feature causing an impact is designed out or altered;
- **Abate at site:** This involves adding something to the basic design to abate the impact – pollution control falls within this category;
- **Abate at receptor:** If an impact cannot be abated on site then measures can be implemented off site;
- **Repair or remedy:** Some impacts involve unavoidable damage to a resource. Repair involves restoration and reinstatement type measures;
- **Compensate in Kind/ compensate through other means:** Where mitigation approaches are not possible or fully effective, then compensation for loss or damage might be appropriate.

6.1.4 Residual Impacts

In some cases, it may only be possible to reduce the impact to a certain degree. These impacts are therefore residual in the sense that they remain after mitigation measures have been designed into the intended activity. In this assessment residual impacts have been identified and their significance evaluated.

6.2 ASSESSMENT OF IMPACTS

The MPCL Project will involve the following key project activities:

- Setting of construction camp and material storage facility;
- Improvement of access track and construction of internal road network linking all wind turbines;
- Road transportation of prefabricated steel tower, turbine machinery, and rotor blades of up to 45 m length;

- Piling for foundation of 20 towers;
- Installation of 20 wind turbines;
- Installation of step-up transformers mounted at the foot of each turbine tower;
- Construction of 11 KV underground electrical collection system leading to the project sub-station;
- Construction of operations/maintenance and control facility and substation within the wind farm
- Operation and maintenance of wind farm; and
- Decommissioning.

Based on the various activities pertaining to the Project, the impacts have been evaluated and significance assessed. The activity– impact interaction matrix for the all the phases of the Project is presented in ***Table 6.4.***

Table 6.4 Activity-Impact Interaction Matrix for Planning, Construction, Operation and Maintenance phases

Project Phase and Activity	Land-use	Land and Soil environment	Water Environment	Ambient Air Quality	Ambient Noise Levels	Ecology	Settlements and community access	Land based Livelihoods	Social and demographic	Economy and Employment	Cultural Environment	Community Health and Safety
Pre-construction Phase												
Execution of Site sub-lease deed							✓	✓				
Upgrading/construction of access roads	✓	✓	✓	✓	✓	✓			✓	✓		✓
Detailed geotechnical investigations			✓	✓	✓	✓						
Clearance of vegetation from identified activity areas	✓	✓		✓		✓		✓				
Mobilization of labour and equipment	✓	✓	✓	✓	✓	✓			✓	✓		✓
Construction Phase												
Internal access road construction (connecting WTGs) within WF site	✓	✓	✓	✓	✓	✓			✓	✓		✓
Construction of auxiliary facilities such as camp site, storage areas for WTG parts and other equipment, water tanks crane pads, drainage etc.	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
WTG parts transport to site		✓		✓	✓	✓				✓		✓
Site clearance, foundation excavation and construction at each of WTG sites and sub-station	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓
Transmission line inside wind farm site – excavations for underground cabling and cable laydown	✓	✓	✓	✓	✓	✓		✓			✓	
WTGs erection and substation installations	✓	✓		✓	✓	✓				✓		✓
WTGs and project commissioning	✓				✓					✓		✓
Operations and Maintenance Phase												
Regular remote monitoring of operations					✓							

Project Phase and Activity	Land-use	Land and Soil environment	Water Environment	Ambient Air Quality	Ambient Noise Levels	Ecology	Settlements and community access	Land based Livelihoods	Social and demographic	Economy and Employment	Cultural Environment	Community Health and Safety
Scheduled maintenance activities (WTGs, sub-station)		✓	✓									✓
Decommissioning												
Replace WTG turbines with new ones		✓		✓	✓	✓				✓		✓
Remove WTG parts and ancillary facilities	✓	✓	✓	✓	✓	✓				✓		✓
Remove internal Extra High Voltage transmission lines and access roads	✓	✓	✓	✓	✓	✓				✓		✓
Return wind farm site land	✓		✓	✓		✓			✓		✓	✓

***Note**: The activity-impact interaction matrix has considered one single project component, i.e. the wind farm site. As described in the limitations, the transmission line from MPCL sub-station to NTDC sub-station is not in the scope of MPCL's development and has not been included. It is also understood that the access road will not be widened and the existing dirt track is to be used and strengthened.*

6.3 ENVIRONMENTAL RECEPTORS AND IMPACTS

6.3.1 Land Use Change

Context

The project area in Deh Kohistan, is characterized by mostly degraded lands. The topography includes barren sandy areas, rocky areas or lands with scrub having dry thorny vegetation. Anthropogenic activities are few and sparse and include agriculture, grazing and excavation (limestone, sand and gravel). Two village settlements of Qasim Burfet and Bacho Jhakro are located within the project boundary of MPCL.

The project would result in change of the land use within the land parcels (2.5 acres per turbine) where the WTGs are to be located. Construction of internal roads and crane pads would result in certain levelling in the vicinity of the WTGs and setting up of a construction camp dormitory (~2.47 acres), parking bays and central laydown areas. These activities would alter the land use. The actual area of land use impact would be limited to the footprint and immediate vicinity of the 20 WTGs, which represent around 50 acres of the total leased area of 1,553 acres. For the Operations and Maintenance phase, additional land may be utilized for the site office, control room etc. Other components for the land requirement include the access road (~17.5 acres) and the sub-station (~5-10 acres).

During the Operation phase the wind farm, with the erection of the 20 WTGs, would change the visual landscape of the project area. The WTG footprint along with the sub-station would also permanently change the existing land use.

Significance of Impact

Pre-construction and Construction

The rural settings would be transformed by the activities of the pre-construction and construction phase like continuous movement of vehicles, equipment lay down areas, labour and construction camps and increased activity in the area. However, this impact would be short term up to the commissioning of the project in a phased manner (approximately 15 months), and limited to the immediate vicinity of the on-going activity. The construction camp and other activity areas are proposed to be located 1 km away from the village settlements to minimize the impacts from the changed land use on the nearby community. Also, as can be referred to from the summary of the WTGs and surroundings presented in ***Table 2.4***, no agricultural lands are present in immediate vicinity of the WTGs.

On the basis of the above factors, the overall impact significance of the change in landuse during pre-construction and construction phase is assessed as **minor**.

Impact	Change in landuse during pre-construction and construction phase			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Limited to Project Boundary (specifically WTG locations, internal roads, laydown areas, parking bays, construction camp and dormitory)			
Frequency	Not applicable			
Likelihood	Likely			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **minor.**			

Operations Phase

The entire area is mostly barren land with sparse vegetation and largely un-inhabited (as can be referred from ***Table 4.3***). The entire project area and its area of influence (AOI) are to be allotted by AEDB to different wind farm developers. There are about 11 wind farm projects proposed in the Jhimpir area of which FFC situated about 8-9 km away from the MPCL boundary is already operational and Zorlu shall be operational in next few months. Wind masts also exist in the area from the year 2008 onwards. Thus this Project has precedents of wind farm related activities, but not in the immediate vicinity of the Project AOI.

The Project lands are used by villagers for rain fed agricultural activities (29.64 ha within MPCL boundary), cattle grazing (5.29 ha) and, stone excavations (2.09 ha). The WTGs land parcels (about 50 acres) would get fenced by MPCL for safety and security of the WTGs during the operation stage and thus prevent such uses in future, within these areas. However, majority of the area of the 1553 acres would remain free for access to the villagers. Further looking at the vast stretches of similar lands in the entire area also being used for similar activities, the impact would be minor.

The impact would be for long duration of about 20-25 years though limited to the WTG land parcel and immediate facilities as substation complex, dormitory, and other activity areas to be used during operation and maintenance.

On the basis of the above factors, the significance of the impact due to change in landuse during operation phase is predicted as **minor**.

Impact	*Change in Land use during Operation Phase*		
Impact Nature	Negative	Positive	Neutral
Impact Type	Direct	Indirect	Induced

Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Limited to Project Boundary (specifically WTG footprint, internal roads, and sub-station)			
Frequency	Not applicable			
Likelihood	Likely			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **minor.**			

Mitigation Measures

Mitigation measures pertaining to the livelihood impacts of land use change have been discussed in *Section 6.6*.

6.3.2 *Landscape-Visual Impacts*

Context

There will be a significant change to visual quality of the area resulting from development or change in land use that will alter the landscape. Changes in the visual landscape will range from construction phase to commissioning of the turbines and further during operations. From the MPCL site, currently WTGs of Zorlu and FFC can be observed on the far south western horizon (**Refer *Figure 6.3*)**

Figure 6.3 View of other WTGS from MPCL Project site

View from wind mast B4 on MPCL site

Significance of Impact

The vertical forms of the WTG towers and movement of the turbine blades would be prominently visible from the nearby villages and access road though not from the M-9 super highway.

<u>Construction and Operation Phase</u>

There are precedents due to existing Zorlu and FFC WTGs installed in the past 2-3 years. Significance of the potential visual impact of the wind farm is likely to differ between different people, depending on their perception. As the entire area has a similar landscape and WTGs are generally located at gaps of minimum 400 m from each other, the change may not result in a drastic reduction of the existing visual quality. Presently, as the WTGs are on the horizon; the local community does not relateWTGs with changes in visual landscape as interpreted from consultations.

Based on the above, the significance of the visual impact on landscape during construction as well as the operation phase of the project has been assessed as **minor.**

Impact	*Landscape- visual impact*				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Upto 8 -9 km depending on terrain				
Frequency	Operation Phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Mitigation Measures

- Plantations near settlements which can buffer or screen the view to a certain extent; and
- Landscape development around the wind turbine site with the participation of the local community.

6.3.3 Soil Environment

Context

The land on which the WTGs are proposed are mostly barren, have scanty vegetation or have bunds (Refer ***Table 2.4***). Use of the land environment is limited to certain agricultural activities near MP 10 and MP 13 as well as some stone excavation near MP 4. The main receptor would be land and soil of WTG land parcels, roads and other facility areas as stockyards and adjacent areas.

The baseline studies of the soil of the project area shows rocky outcrops and loamy very shallow steep mountain soils. The borelog analysis data reveals that the strata is mostly sand, gravel and little silt up to 3 m depth and hard,

sandy limestone up to 5m.This soil quality is indicative of being erodible in nature and water retention is low due to low clay content.

Pre-construction and Construction Phase

Potential sources of impacts to land/soil from the pre-construction and construction phase activities include:

- Levelling, grading and proof rolling for the access road (8 km x 6 m), internal roads (18 km x 13 m) and crane pads (15 m x 35 m dimension at each WTG location);
- Removal of top soil stratum as part of the site preparation phase involving excavation for WTG foundation, underground cabling etc.;
- Storage and handling of construction materials;
- Storage, handling and disposal of wastes generated from site clearance, site excavation and formation, civil works and construction camps (general waste and sewage); and
- Leakage and spillage from transport vehicles, construction equipment, DG sets etc.

Significance of Impact

Each WTG foundation would result in generation of 400 -600 m^3 of top stratum. In addition, cutting and levelling would be required for land parcels at a few locations which may entail further top stratum removal. This would result in destabilisation of slopes and increased soil erosion as the Project area has an undulating terrain.

There would be compaction of soil in the area where the transportation vehicles and machineries will be parked, on the internal roads and crane pads. Spills and leakages from transportation vehicles and machinery may also result in soil contamination in the parking areas, along roads, maintenance sites and stockyards.

As described in ***Section 2.5.6***, there are plans to use the top stratum and construction debris in various levelling and filling activities, slope stabilization etc. in and around the WTG sites within the wind farm battery limits and on access/internal roads. EPC contractor plans for designated areas for storage of construction material and wastes. Transportation vehicles will be run through designated haulage roads and parked at specific areas only and if required these areas will be cleaned up after completion of construction activities. Wastes and sewage from the construction camp will only be routed through proper collection and containment/treatment. Fuels and oils, if stored at site, will be stored in containers in areas with impervious floors and surrounded by dyke walls.

The above impacts will be mainly confined to the WTG land parcels and along access/internal roads and camp site. On the basis of the above the impact on

soil quality during pre-construction and construction phases of the project is assessed to be **minor**.

Impact	*Soil and Land environment-Preconstruction and Construction Phase*				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	WTG land parcels, construction camps, access/internal roads , parking bays				
Frequency	Limited to construction Phase				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Proposed Mitigation Measures

- Implementation of construction materials inventory management system to minimise over-supply of the construction materials, which may lead to disposal of the surplus materials at the end of the construction period;
- Topography should be restored to the extent possible and re-vegetated for slope stabilization and to prevent soil erosion;
- Transport vehicles and equipment should undergo regular maintenance to avoid any oil leakages;
- Drip containments should be available and used in case of leaks/ transfers;
- An unloading and loading protocols should be prepared for oil and used oil respectively and workers trained to prevent/contain spills and leaks ; and
- Activity areas around the WTG locations should be earmarked to restrict movement of vehicles, machinery and storage of material and WTG parts within that area and to avoid impact on the surrounding areas.

Operation Phase

The main sources which can impact land and soil during operation phase are:

- Spillage of chemicals or oil during maintenance work such as lubricating oils from gearbox systems, hydraulic systems of the turbine;
- Spillage of oil from activities in the substation area e.g. transformer oil;
- Other wastes as oil, grease, rags, and used oil generated from the substation area.
- Solid waste (food and office waste) generated at substation (about 5 – 10 kg/day).

Significance of Impact

The spillages/leaks may contaminate the soil at the WTG and substation location. Storm water run-off from the contaminated area can pollute the downstream soil.

The probability of the impact is only during WTG maintenance and therefore occasional. Each WTG contains about 20 litres oil and gear oil in a wind turbine is changed after unit logs 25,000 to 50,000 service hours. As the quantities are not massive any oil contamination may be limited to minor spills. The chances of storm water run-offs contaminating the downstream soils are also rare as the area faces average annual rainfall of 100-120 mm in a year.

The waste and sewage from the sub-station complex would be routed through proper collection and treatment/containment. There will be storage facility for oil and unloading of the same will be carried out at designated area.

Based on the above the impact on land and soil during operation phase is assessed to be **negligible**.

Impact	*Land and soil environment –Operation Phase*				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	WTG land parcels, construction camps, access/internal roads , parking bays				
Frequency	Operation Phase O & M activities				
Likelihood	Unlikely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

6.3.4 *Water Environment*

Context

The project and its AOI are located in dry arid zone and do not have any perennial water bodies. The surface water bodies in the project AOI are Harolo Nai and Layari Nai, which are ephemeral and originates from the foothills of the Kirthar range. These streams carries storm water from the surrounding hills of the Kohistan region and culminates into the Keenjhar Lake. During July-August, it carries strong torrents of water and brings with it boulders, stones, and debris. The heavy flow lasts only for two-three days or till rain water accumulation is there in the hills. Small bunds could be

observed to be built by villagers in the Project area to retain the rain water. These are used mainly for agricultural activities.

The baseline water quality analysis reveals that surface water quality of Harolo Nai conforms to the WHO and Pakistan NSDWQ (Refer ***Table4.16***) limits for drinking water standard.

The depth to groundwater across the project site is more than 20 m with the strata dried up in vicinity of the water table. In the Project AOI, at some places ground water table goes below 50 m and quality varies from brackish to moderately brackish and sweet at few places. Hand pumps were observed near the Qasim Burfet being used by villagers which were provided by MPCL.

Groundwater quality analysed reflects that it exceeds the limits for dissolved solids, sodium, potassium, chloride and coliform. (***Refer Table 4.16***)

Pre- construction and Construction Phase

The key sources of impact to the surface and/or ground water environment are from the following:

- Construction of access roads, WTG levelling etc. leading to changes in drainage patterns;
- Siltation of water courses from sediment laden run-offs;
- Entry of pollutants to water course from contaminated storm and surface water run-off from parking bays, construction camps discharges, equipment laydown area; and
- Contamination of groundwater from spill/leaks and waste water discharge from construction camps.

Significance of Impact

The activities such as construction of roads, levelling, excavations and run-off of sediment and silt may alter the natural drainage patterns. The contaminated surface water run-off (polluted with oil, grease and other chemicals and wastes) to the natural gullies in turn may pollute the ephemeral surface water bodies especially in rains. In addition, chances of surface water pollution of the Horolo Nai are there because of the proximity to Project site.

As provided in EPC scope of work, some of the impacts caused on surface water environment will be taken into consideration. Care will be taken to maintain the natural drainage in the area so that rain water can take its path without any restriction by the civil constructions at site. Cross channels will be provided where required to minimizing alteration of the drainage pattern. Further steps will be taken to prevent any waste and wastewater disposal to water sources through proper collection, disposal and containment as discussed in ***Section 2.5.6***.

Chances of groundwater contamination would be minimum with the spills/leaks control and waste management measures as mentioned in ***Section 2.5.6.*** Also as the groundwater level is well below 20 m, no immediate ground water table contamination is likely to take place from small spills/leaks. However, as the region is water scarce, the resource has been assessed as medium sensitivity. Based on the above, the impact on surface and ground water quality during pre-construction and construction phases are assessed as **minor**.

Impact	*Water environment-Preconstruction and construction phase*				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Project site and associated facilities				
Frequency	Limited to construction Phase				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Proposed Mitigation Measures

- Limit vegetation removal to the extent possible;
- Installation of erosion and sediment control measures prior to vegetation clearance and start of constructions work as temporary diversion drains from planned areas as parking bays, storage areas etc.;
- Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels;
- Providing a bunded designated parking bay for site vehicles/ equipment away from natural drainage channels;
- Construction of temporary sedimentation basins in low lying areas along the construction sites to serve as points of discharge into natural drainage and should be cleaned post construction;
- Progressively rehabilitate or stabilise disturbed areas to prevent erosion;
- Use of licensed contractors for management and disposal of waste and sludge;
- Planning and preparation in advance for the rains (especially July month) to avoid and/ or minimize sediment and contaminated run-offs; and
- Labourers should be given training towards proactive use of designated areas/bins for waste disposal and encouraged to use toilets.

Operation Phase

The key sources of water pollution during the operational phase are:

- Contaminated storm water run-offs from oil leaks, spills from maintenance activities, sub-station areas; and
- Domestic waste water disposal.

Significance

Soil contamination and resultant polluted storm water runoff from sub-station can impact ground water and the surface water body (Horolo Nai).

The chances of storm water run-offs will be only during rains and the project area receives average annual rainfall of only 100-120 mm. Storage tank and containments will be used for storing oil and used oil/chemicals. Oil/water separators will be used for small quantity of oil/oily water during maintenance activities in sub-station. The drainage and sewerage system will be used i.e. soak pits for the collection of waste water from kitchen and septic tanks for sewage from the toilets.

Based on the above, the impact on ground and surface water quality during operation phase due to the project is assessed as **negligible.**

Impact	*Water environment –Operation Phase*				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to WTG Footprint and vicinity, substation area				
Frequency	Not Applicable				
Likelihood	Unlikely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Proposed Mitigation Measure

- Surface water run-offs from impervious and developed areas can be diverted through use of swale drains for infiltrating/storing; and
- The swale drains should be vegetated.

6.3.5 *Air Quality*

Context

The MPCL Project area is mostly dry lands used for agriculture, grazing or stone quarrying. No anthropogenic sources of air pollution are observed in the area. The ambient air quality analysis reveals that the air shed is unpolluted though the particulate matter is on the higher side (refer ***Table 4.14***) . This is

attributed to the high aridity and wind velocity resulting in dust movements. The nearest receptors are the residents of the villages of Qasim Burfet and Bacho Jhakro.

Pre-construction and Construction Phase

Air quality will largely get impacted from the following sources during the construction phase:

- Dust generated from excavation, cutting and levelling work at WTG sites and roads from use of proof rollers, excavators, dump trucks and other construction equipment;
- Dust and exhaust emissions from continues movement of vehicle plying construction material and equipment; and
- Exhaust emissions from operation of construction machineries, other heavy equipment as bull dozers, excavators, compactors and DG sets.

Significance of Impact

During pre-construction and construction phase almost all the activities envisaged above will adversely contribute to the ambient air quality of the project area.

About 3,500 litres fuel will be required daily during the construction phase. This will be responsible for emission of approximately 130 kg CO, 7 kg SO_2, 32 kg NOx, and 7 kg particulate matter, besides 8 tons of CO_2. These emissions will be dispersed into the environment of the project area. Dust and air emissions resulting from the above activities may affect residents depending upon prevailing wind directions and speed.

In addition, it will be a challenge to prevent further addition to the particulate levels in the project area from the project activities. Measures as sprinkling of water, storage of construction material in sheds, covering of construction materials during transportation will be undertaken for reducing dust as part of the embedded controls.

Emissions from the generators and other stationary machines will be controlled by ensuring that the engines are always properly tuned and maintained. The generators are so located that emissions are dispersed away from the camp and prevailing downwind direction from settlements. Provision of adequate stack height will also be ensured.

However the impact on air quality would be short-term, restricted to the construction period. Based on the above the impact is assessed to be **minor.**

Impact	*Air environment –preconstruction and construction phase*			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent

Impact Extent	Local		Regional		International
Impact Scale	Project area and vicinity				
Frequency	Not Applicable				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Proposed Mitigation Measures

- Keeping areas of open excavation to a minimum;
- Minimising stockpiling by coordinating excavations, spreading, re-grading, compaction and importation activities;
- Cease or phase down work if excess fugitive dust is observed, investigate source and take suppression measures;
- Restricting traffic to defined roads and implementing speed limits;
- Regular maintenance of equipment and vehicles to ensure it remains in good condition; and
- Prevent idling of vehicles and equipment.

Operation Phase

As the project is a renewable and clean energy development project, the operation phase would be largely free from air emissions. Some sources of air pollution are:

- Use of unpaved, intra-site access pathways, and
- DG sets operations during power failure.

Significance of Impact

The above mentioned activities would be confined to the WTG locations and occasional in nature. DG sets would only be used as back-ups. During operation phase therefore the ambient levels will not be impacted significantly by the project activities.

Based on the above the impact on air quality during operation phase of the project is assessed to be **negligible**.

Impact	*Air environment –Operation phase*			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Within 500 m of WTG locations and WTG control area, and within 100 m of internal roads			
Frequency	Not Applicable			

Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

6.3.6 *Noise*

Pre-construction and Construction Phase

Sources of Impact

The potential sources of increase in ambient noise levels during the construction phase of the Project will mainly arise from the equipment, machineries and transportation used for the construction activities. The heavy equipment used for the construction activities will be the major sources of noise. There is expected to be an increase in traffic and thereby in traffic noise impacts to receptors near the existing dirt tracks in and around the project site from the transportation of equipment, construction materials and workers.

Construction works are expected to last for 15 months and construction activities will be limited to daytime only. Tentative noise generation from construction equipment and machinery has been presented in ***Table 6.4***. Specific information about types, quantities, and operating schedules of the construction equipment was not available at the time of assessment from EPC contractor and therefore, assumptions have made regarding the type, number and Sound Power Levels (SPLs) of construction equipment, based on similar projects and publicly available data. It has been assumed that only one of each type of plant will be on-site during any day or night period. Re-assessment of noise levels may be required if the actual construction equipment inventory and SPL vary from the assumed list.

Table 6.4 Assumed Construction Equipment Sound Pressure Level Inventory

Construction Equipment	Average Noise Level at 50ft [dB(A)]
Bulldozer	82
Backhoe	78
Loaders	79
Vibratory roller	102
Fuel truck	85
Cranes	81
Dump truck	76
Grader	85
Compressors	78
Generators	85
Rock drill	81
Grader	85
Concrete mixer truck	79
Concrete pump truck	81
Scraper	85

Source: The SPLs of the construction equipment have been taken from FHWA noise specification 721.560[1] and ERM's internal database

Criteria

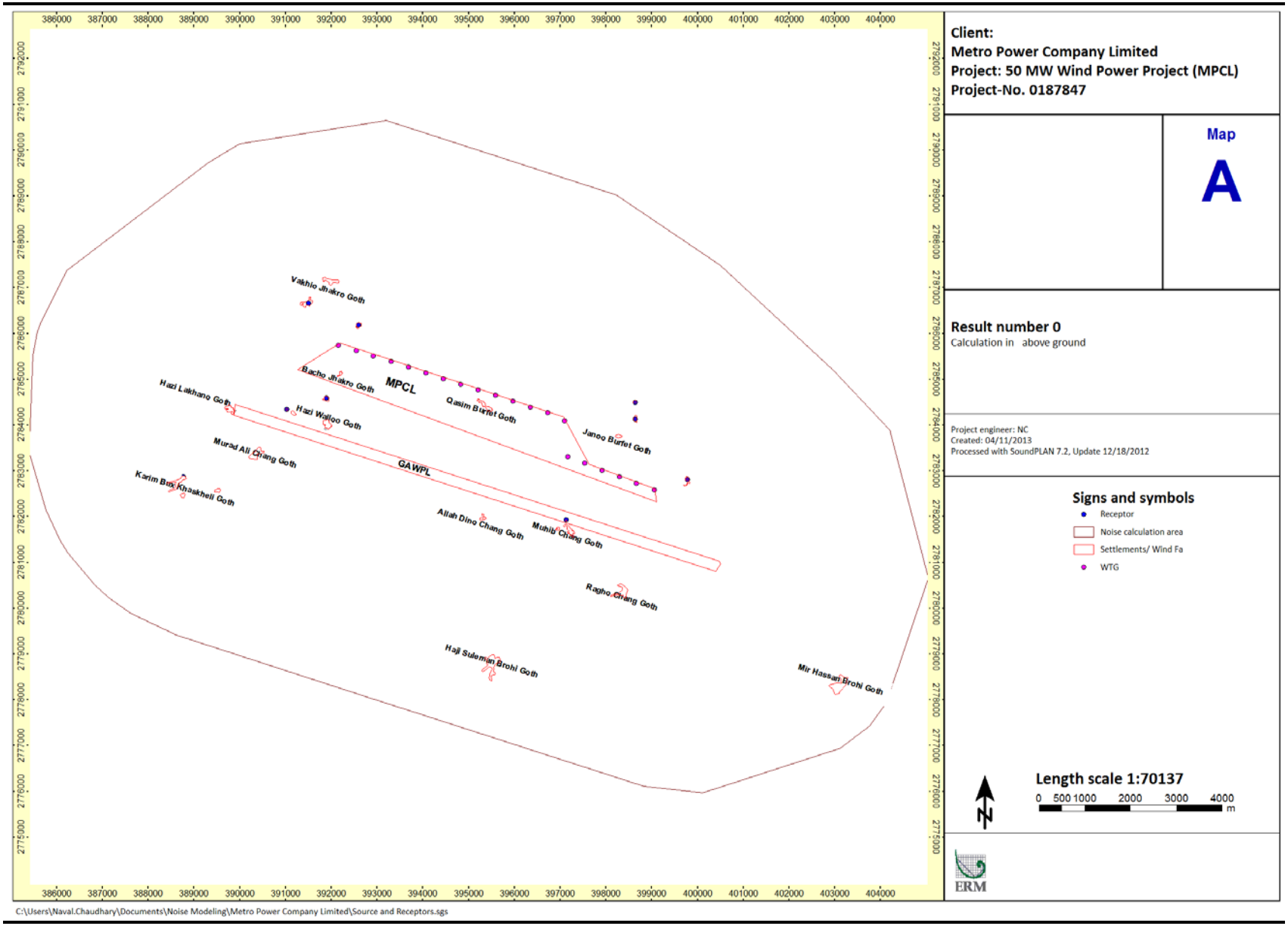
In the absence of any national standard for prescribing ambient noise limits for residential, commercial, industrial areas or silence zones in Pakistan, the noise emission criteria specified in the WB/IFC EHS Guidelines is being used. However, for motor vehicle noise levels 85 dB(A) noise emission standard will be followed.

Receptors

The nearest noise receptor (Qasim Burfet Goth) is located at 320 m from the MP-10 WTG in the southern side, whereas other settlement within MPCL boundary (Bacho Jhakro Goth) is located about 570 m away from MP-2 WTG. Other settlements are outside the MPCL boundary and are much farther away from the WTGs. Location map showing WTGs and sensitive receptors within 5 km from the MPCL boundary has been presented in ***Figure 6.4***.

[1] Construction Noise Handbook. FHWA-HEP-06-15; DOTVNTSC-FHWA-06-02; NTIS No. PB2006-109102. Final Report August 2006 (updated5/20/2010). <http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook

Figure 6.4 Map showing MPCL WTGs and Noise Sensitive Receptors in the surroundings



Significance of Impact

The project area of MPCL is about 1,553 acres, whereas construction activities will be limited to the WTGs locations, access dirt tracks, construction camp and construction camps. Based on the scattered activity areas and ERM's previous experiences, impact of construction activities will be limited within 500 m of the WTGs locations and within 100 m from the dirt tracks, which will be developed and used for man and material movement within and outside the project area. It shall also be noted that there are only two settlements within the project area, which would be affected by noise generated during construction activities in nearby WTGs only.

MPCL along with EPC contractors has plans to locate the construction camp minimum of 1 km away from the settlements. Further it will plan accordingly to place noise generating equipment such as DG sets away from the settlements. Based on the above the impact is assessed to be **minor**.

Impact	Noise generation from construction activities and transportation of man/ material			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Limited to within 500 m of WTGs and within 100 m of access dirt tracks to be used for man/material transportation and camp site			
Frequency	Limited to construction phase			
Likelihood	Possible			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **minor.**			

Mitigation Measures

The following mitigation measures will be implemented to minimise potential noise impacts during the construction phase in all periods:

- Normal working hours of the contractor will be between 06:00 and 21:00 hours from Monday to Sunday. If work needs to be undertaken outside these hours, it should be limited to activities that do not exceed the noise criteria at nearby noise sensitive receptors;
- Only well-maintained equipment will be operated on-site;
- Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components should be conducted;
- Machinery and construction equipment that may be in intermittent use shall be shut down or throttled down during non-work periods;
- Low noise equipment shall be used as far as practicable;

- The number of equipment operating simultaneously shall be reduced as far as practicable;
- Equipment known to emit noise strongly in one direction should be orientated so that the noise is directed away from nearby NSRs as far as practicable;
- DG sets with acoustic enclosures shall be used;
- Minimal use of vehicle horns in the Project area shall be encouraged; and
- Equipment noise should be 85 dB(A) at 1 m from the source in line with WB/IFC EHS guidelines;

Operation Phase

Sources of Wind Turbine Sound

The sources of noise emitted from operating wind turbines can be divided into two categories: (a) mechanical noise, from interaction of turbine components; and (b) aerodynamic noise, produced by the flow of air over blades.

Mechanical sounds originate from the relative motion of mechanical components and the dynamic response among them. Sources of such sounds include:

- Gearbox
- Generator
- Yaw drives
- Cooling fans
- Auxiliary equipment (e.g. hydraulics)

Aerodynamic sound is typically the largest component of wind turbine acoustic emissions. It originates from the flow of air around the blades. Aerodynamic sound generally increases with rotor speed.

The MPCL project will have 20 WTGs of Nordex N100/2500, which will be located near the northern part of MPCL area. Location of WTGs micro-sitting has been presented in ***Figure 6.4***. Noise emissions by Nordex N100/2500, according to IEC 61400-11:2002 at a hub-height of 80m with different standardised wind speeds at 10 m height has been presented in ***Table 6.5***.

Table 6.5 Nordex N100/2500 Noise Levels with Hub Height 80 m

Standardised Wind Speed (at 10 m height) V_s [m/s]	**Apparent Sound Pressure Level L_{wA} [dB(A)]**
3	96.8
4	98.8
5	101.1
6	104.4
7	105.8
8	106.0
9	106.0
10	106.0
11	106.0
12	106.0

Source: Noise Levels – Nordex N100/2500 (http://www.dpea.scotland.gov.uk/Documents/qA328203/A4506824.pdf)

Receptors

The nearest noise receptor (Qasim Burfet Goth) is located at 320 m from the MP-10 WTG in the southern side, whereas other settlement within MPCL boundary (Bacho Jhakro Goth) is located about 570 m away from MP-2 WTG. Other settlements are outside the MPCL boundary and are much farther away from the WTGs (refer ***Figure 6.4***).

Criteria

At present there exist no national standard for prescribing ambient noise limits for residential, commercial, industrial areas or silence zones in Pakistan. In the absence of the same, the noise emission criteria specified in the WB/IFC EHS Guidelines, as presented in ***Table 6.6***, has been used for assessment of noise impacts. In order to assess the significance of the impact, noise impact should not exceed the levels presented in ***Table 6.6***, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 6.6 Noise Emission Criteria [1]

Location	Noise Level Limit (dB(A)	
	Daytime (0700 – 2200 hrs)	**Night-time (2200 – 0700 hrs)**
Industrial; commercial	70	70
Residential; institutional; educational	55	45

[1] *Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organisation (WHO), 1999.*

Prediction of Impacts

Methodology: The environmental noise prediction model SoundPlan 7.2 was used for modelling noise emissions from the WTGs. In order to consider worst case scenario, it has been assumed that the WTGs are operational at standardised wind speed of ≥ 8 m/s at 10 m height and producing 106.0 dB(A) sound pressure level. Noise assessment is also performed for variable standardised wind speeds from 3 m/s to 7 m/s. Operating of WTGs with 100% usage scenario was modelled to cover the operation phase of the Project. In addition, to represent a worst-case scenario for the assessment, all WTGs were assumed to be operating simultaneously and for 24 hours. Noise generation had been considered at the hub height of 80 m above ground. As a conservative approach to the assessment, atmospheric absorption during sound transmission was not included in the assessment. Local terrain has been considered for putting noise sources as well as receptors in the model.

Predicted Noise Levels at Receptors: The predicted noise levels within the Project AOI during daytime with standardised wind velocities (at 10 m height) of 3 m/s, 5 m/s and ≥ 8 m/s are presented in ***Figure 6.5***, ***Figure 6.6*** and ***Figure 6.7***, respectively. Predicted noise levels at elevan receptors have been presented in ***Table 6.7***. It is evident from the predicted results that in the worst case scenario, the nearest receptor Qasim Burfet Goth (320 m from MP-10 WTG) will have a daytime as well as night time noise levels of 31.6 dB(A),

35.9 dB(A) and 40.5 dB(A) with standardised velocity of 3m/s, 5m/s and ≥ 8m/s, respectively during the operation phase.

Figure 6.5 *Predicted Operation Phase Noise Levels of MPCL Project during Daytime (Leq $_d$) [Standardised Velocity = 3 m/s and L_{wA} = 96.8 dB(A)]*

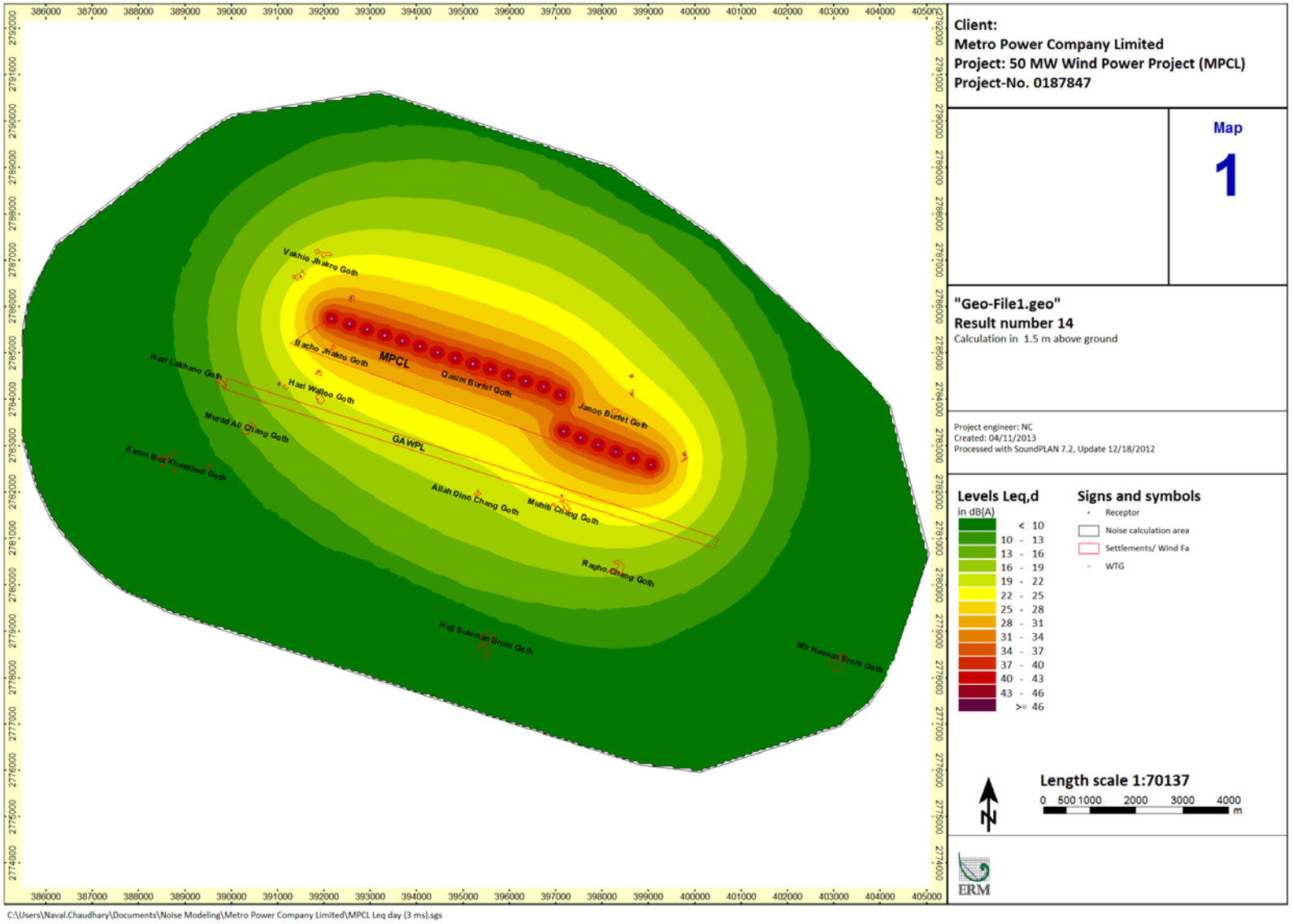


Figure 6.6 *Predicted Operation Phase Noise Levels of MPCL Project during Daytime (Leq $_d$) [Standardised Velocity = 5 m/s and L_{wA} = 101.1 dB(A)]*

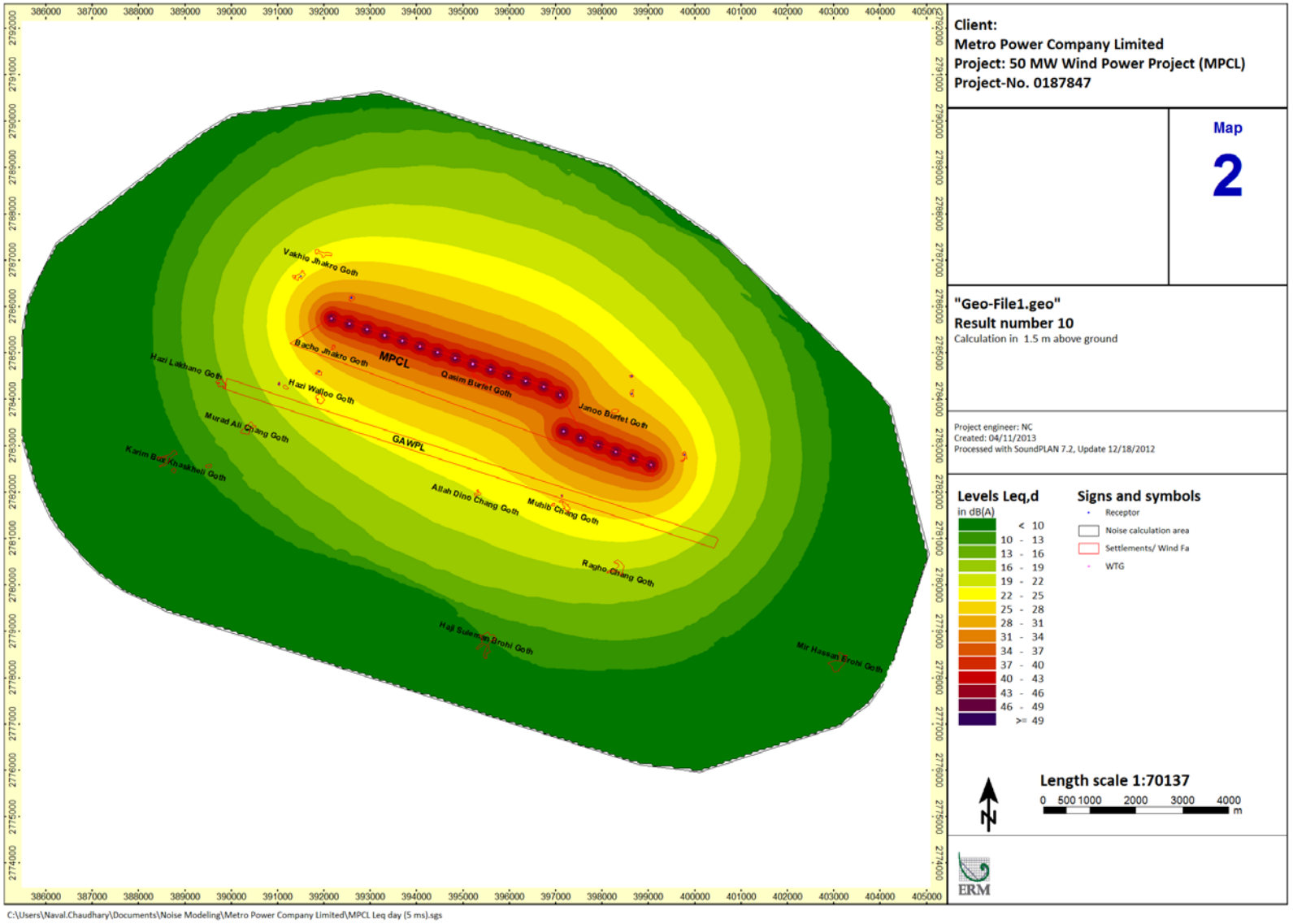


Figure 6.7 *Predicted Operation Phase Noise Levels of MPCL Project during Daytime (Leq $_d$) [Standardised Velocity ≥ 8 m/s and L_{wA} = 106.0 dB(A)]*

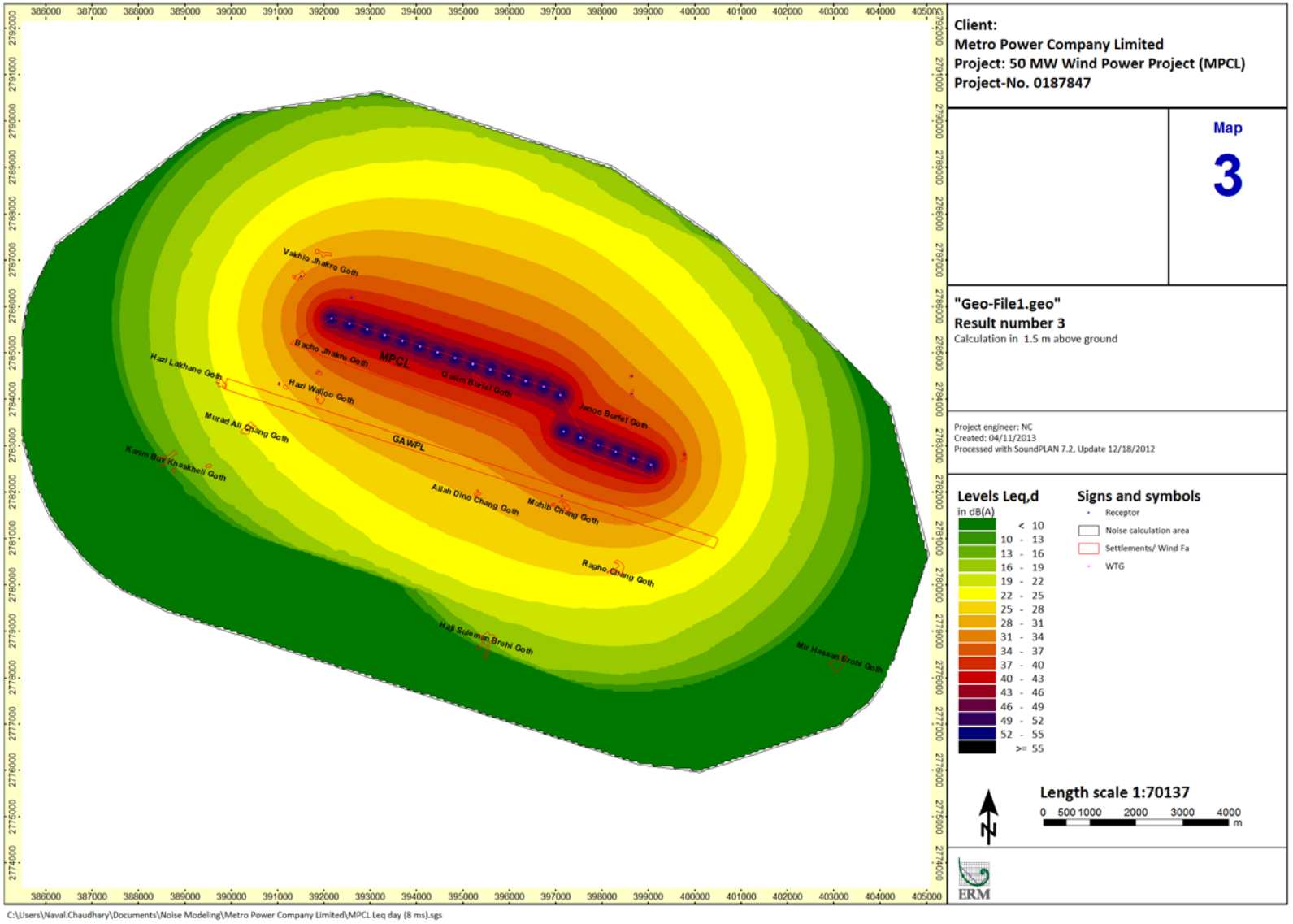


Table 6.7 Predicted Noise Levels at Noise Receptors during Operation Phase of MPCL Project with different standardised velocities

S. No.	Receiver	Nearest WTG	Distance from WTG [m]	Predicted Leq [dB(A)][1]						WB/IFC Guidelines[2]	
				with Vs ≥ 8m/s and L_{wA} [106.0 dB(A)]	with Vs = 7m/s and L_{wA} [105.8 dB(A)]	with Vs = 6m/s and L_{wA} [104.4 dB(A)]	with Vs = 5m/s and L_{wA} [101.1 dB(A)]	with Vs = 4m/s and L_{wA} [98.8 dB(A)]	with Vs = 3m/s and L_{wA} [96.8 dB(A)]	Day	Night
1	Bacho Jhakro Goth	MP-2	570	40.5	40.3	38.9	35.9	33.4	31.6	*55*	*45*
2	Qasim Burfet Goth	MP-10	320	47.6	47.3	46	43	40.5	38.7	*55*	*45*
3	Janoo Burfet Goth	MP-17	770	38.8	38.6	37.2	34.2	31.8	29.8	*55*	*45*
4	Janoo Burfet School	MP-14	1570	33.2	33.2	31.5	28.5	26.3	24.2	*55*	*45*
5	Vakhio Jhakro Goth	MP-2	510	40.6	40.4	39.1	36	33.6	31.7	*55*	*45*
6	Hazi Waloo Goth	MP-2	1220	34.0	33.8	32.3	29.3	27	24.9	*55*	*45*
7	Hazi Lakhano Goth	MP-1	2700	23.8	23.9	21.9	19.1	17.2	14.7	*55*	*45*
8	Murad Ali Chang Goth	MP-1	2780	24.1	24.2	22.2	19.4	17.5	15	*55*	*45*
9	Muhib Chang School and Mosque	MP-16	1290	34.2	34.1	32.5	29.5	27.3	25.2	*55*	*45*
10	Mubib Chang Goth	MP-17	1430	33.5	33.4	31.8	28.8	26.6	24.4	*55*	*45*
11	Ragho Chang Goth	MP-20	2270	27.2	27.1	25.3	22.4	20.4	18	*55*	*45*

(1) Predicted noise levels during day and night time will be same as the operation of WTGs has been considered 24 hours and no variation of wind speed during day and nighttime is considered in this assessment.

(2) IFC/WB EHS Guidelines: Noise Management dated April 30, 2007 gives, Noise level guidelines for Residential; institutional and educational receptors in daytime (07:22:00) and night time (22:00-7:00) as 55 and 45 one hour Leq dB(A) respectively. For industrial and commercial receptors it is 70 one hour Leq dB(A) for both night and day time. Highlighted Text shows Leq which exceeds the IFC/WB EHS Guidelines of 45 dB(A) applicable during night time.

It is evident from ***Table 6.7*** that ambient noise levels due to operation of the project will be well within the WB/IFC guideline values for daytime at all the receptors, including the nearest receptor at Qasim Burfet Goth, however night time noise levels at Qasim Burfet Goth with standardised wind speed ≥ 6 m/s show exceedance with respect to WB/IFC EHS guideline values for night time. Therefore, the impact of noise on the nearest receptor during day time due to operation of WTGs has been estimated as **negligible**, whereas during night time it has been estimated as **minor.**

Impact	Noise generation from operation of the WTGs during daytime				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to within 500 m of WTGs				
Frequency	Entire operation phase of the Project				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Impact	Noise generation from operation of the WTGs during night time				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to within 500 m of WTGs				
Frequency	Entire operation phase of the Project				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Mitigation Measures

To mitigate operational noise impacts following measures are proposed:

- Installation of acoustic enclosures for equipment casing radiating noise;
- Regular maintenance of WTGs;
- Periodic monitoring of noise near to the sources of generation to ensure compliance with design specification;
- Plantation towards the WTGs direction near the settlements shall be developed to provide noise barrier effect; and

- In case of complaints of higher noise levels and uncomforting received from the inhabitants of nearby settlements, possibility of putting noise barriers near to the receptor need to be considered.

6.4 ECOLOGICAL ENVIRONMENT

6.4.1 Overview

Context

The project site and its AOI fall under degraded lands with rocky out crops and few irrigated areas. Vegetation and vegetative growth in the project area is constrained by aridity, topography and relief. The stony wasteland of the areas is devoid of much natural vegetation which is further getting reduced as a result of human pressure by activities as stone excavations, overgrazing and deforestation for fuel wood etc.

As indicated in the baseline section, natural vegetation found in the area, mostly consists of trees, grasses, forbs and bushes common to the arid zones. No trees were found on any of the WTG locations. None of the plant species in the area belong to protected, endangered category.

There is no Wildlife Reserve in close vicinity of the project site. The nearest Sanctuary is the Keenjhar Lake Wildlife Sanctuary, located 15 km away from the project boundary in south-east direction.

As indicated in the baseline section, fauna found in the area are mostly mammals found in arid habitats as jackals, fox, wild hare, honey badger and porcupines, reptiles as snakes, lizards and birds. Out of these mammals, Scaly Ant Eater is listed in the IUCN red list near threatened. Among birds, Saker Falcon (*Falco cherrug*) was listed as Endangered as per IUCN category, Imperial Eagle (*Aquila heliacal*) was listed as Vulnerable, Long tailed Bush Warbler (*Prinia burnesii*) and Kashmir Roller (*Coracias garrulous*) were listed as Near Threatened. Among the reptiles, the spiny-tailed lizard and monitor lizard are included in Appendix III[1] of the CITES.

The setup of the project would have following impacts on the ecology of the area:

6.4.2 Loss of Natural Vegetation

Construction Phase

Land will be cleared for constructing roads, turbine tower foundations, construction camps, lay down areas as well as establishing sub-station.

[1] Appendix III is a list of species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation. International trade in specimens of species listed in this Appendix is allowed only on presentation of the appropriate permits or certificates.

Significance of Impact

The loss of vegetation may result in habitat loss or disturbance for many flightless birds, reptiles and mammals. The project site is mostly barren with bushy vegetation at scattered places and cluster of 20- 25 trees near village Burfet. The project activities would not result in large tree cutting. The entire area is of similar ecology which can act as habitat for disturbed fauna.

Based on above the impact due to loss of natural vegetation is assessed as **minor.**

Impact	Loss of Vegetation –preconstruction and construction phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project Boundary (specifically WTG locations, internal roads, laydown areas, parking bays, construction camp and dormitory)				
Frequency	Not applicable				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

6.4.3 *Loss and Disturbance of Habitat*

Construction Phase

The following sources would result in loss and disturbance of habitat of wildlife:

- The continuous movement of vehicles, machinery and personnel in the project area as a result of the construction works;
- Clearance of bushes and forbs;
- Excavation and levelling for WTG foundations, cable trenches, crane pads and roads; and
- Noise generated from the various activities would scare away the birds;

Significance of Impact

All these activities will result in loss and disturbance of habitat for the mammals, flightless birds and reptiles. The project site along with the surrounding area is major habitat for 12 species of reptilian fauna and 13 species of mammals.

The activities would be confined to specific areas such as approach road and WTG locations. There is an availability of large stretches of similar habitat for the wildlife to move. Based on the above the impact due to loss and disturbance of habitat is accessed as **minor**.

Impact	Loss and disturbance of habitat –preconstruction and construction phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project Boundary (specifically WTG locations, internal roads, laydown areas, parking bays, construction camp and dormitory)				
Frequency	Not applicable				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Proposed Mitigation Measures

- Removal of vegetation should be limited to the extent possible;
- Damage to the natural topography and landscape should be minimized;
- General awareness regarding wildlife should be enhanced through trainings, posters etc. among the staff and labourers;
- Strict prohibition should be implemented on trapping, hunting or injuring wildlife;
- Camp waste should be collected and disposed in a manner that it does not attract wild animals;
- A minimum possible number of routes should be authorized for use during construction by the labourers and staff;
- Strict prohibition on use of fuel wood and shrubs as fuel;
- Temporary barriers should be installed on excavated areas;
- Stage-wise re-vegetation with local species should be undertaken immediately after completion of construction work;
- Speed limits should be set for the construction vehicle movement; and
- The footprint of the construction activities should be kept to the minimum to reduce disturbance to flora and fauna.

6.4.4 *Disturbance to Birds and Birds Collision Risk*

Operation Phase

The main causes of disturbances and bird collision are from:

- Movement of the turbine blades; and

- Noise generation from the WTGs.

Significance of Impact

The baseline study indicates presence of 59 species of avifauna occurring in the study area[1]. A list of raptors and high flying birds was enumerated referred as target species and is given in ***Table 6.8.*** These target species are likely to be affected due to operation of wind farm.

Table 6.8 Target List of Raptor Species observed/reported in the study area and its surrounding

S. No.	**Species**	**Scientific Name**	**Conservation Status as per IUCN**	**Sources**
1	Black Winged Kite	*Elanus caeruleus*	Least Concern	R2
2	Black Kite	*Milvus migrans*	Least Concern	R2
3	Tawny Eagle	*Aquila rapax*	Least Concern	R1, R2
4	Common Kestrel	*Falco tinnunculus*	Least Concern	R2
5	Saker Falcon	*Falco cherrug*	Endangered	R1
6	Griffon Vulture	*Gyps fulvus*	Least Concern	R1
7	Common Crane	*Grus grus*	Least Concern	R1
8	Houbara Bustard	*Chlamydotis macqueeni*	Not Assessed	R1
9	Kashmir Roller	*Coracias garrulus*	Near Threatened	R1
10	Indian Roller	*Coracias benghalensis*	Least Concern	R1
11	Imperial eagle	*Aquila heliaca*	Vulnerable	R2

Note: R1: Recorded in Previous Study (IEE 2009); R2: Recorded in site survey by ERM local Consultants, Feb and March 2013

These birds can collide with the moving turbine, turbine tower or the wake behind the rotors causing injury or mortality. Though the noise generation from the movement of the turbines is also beneficial in preventing bird collisions by scaring birds away, it may also scare the birds away from their natural habitats. This may also effect in reduced breeding productivity or reduced survival as a result if birds are displaced from preferred habitat and are unable to find suitable alternatives.

Some of the measures being followed by MPCL are:

- All WTGs are being erected at a distance of more than 400 m to avoid the avian collision and to give the birds a wider corridor for the access in the project area;
- The WTG towers will be identical thus increasing visibility for the birds; and
- Internal lines from each WTG to the Project Sub-station will be underground thus reducing collision chances.

[1] This data is as per the IEE, 2009 and site visit carried out by Tekcellent team. The data used in IEE, 2009 is of the Zorlu site, more than 5 km away from MPCL site. The detailed bird study for MPCL Project site and surroundings is being carried out and will be completed by end of May 2013.

To access the exact impact of the WTGs on the birds in the Project area, detailed studies would be required. Bird monitoring study will be carried out by MPCL appointed consultants Élan Partners (Pvt.) Ltd. The scope and the initial report of the bird monitoring study are attached as ***Annex I*** for further reference. Brief mitigation measures have been included in the subsequent section below to avoid bird collision.

Proposed Mitigation Measures

- Flash lamps on the WTGs will prevent bird collision at nights.
- Regular checking of the vacuums or holes in the towers to avoid nesting facility of any of the birds;
- Bird mortality count in the immediate vicinity is proposed to establish a strong link between the wind turbines and birds mortality for two years starting from the commissioning of the wind farm;

Any necessary further mitigation measures can only be proposed based on the outcome of the detailed bird monitoring study.

6.5 SOCIO-ECONOMIC ENVIRONMENT

This section discusses socio-economic impacts in the pre-construction, construction and operation & maintenance phase of the project. The discussion on socio-economic impacts has considered the following social sensitivities/receptors:

Table 6.9 Summary of Socio-economic Impacts

No.	Social Sensitivity/Receptor	Potential Socio-economic Impacts
1	Settlements and Community Access	• Avoidance of impact on homestead areas, residential structures or secondary structures; • Avoidance of impact on community infrastructure in the settlements
2	Land-based Livelihoods	• Impact on cultivation on the WTG footprints; • Impact on access to land for agriculture, grazing, fuel wood collection;
3	Social and Demographic Structures	• Influx of Workforce; • Community development and dependence; • Improved infrastructure and public services
4	Economy and Employment	• Short-term Employment and procurement opportunities during construction; • Long-term employment and procurement opportunities during operation & maintenance; • Potential retrenchment during decommissioning
5	Cultural Environment	• Impact on sites of local cultural and religious significance such as mosques, grave sites etc.
6	Community Health & Safety	• Construction phase impacts due to nuisance, road traffic, vector-borne diseases etc; • Operations phase impacts due to shadow flicker, blade throw and noise

6.5.1 Settlements and Community Access

Context

The project has to be developed on 1553 acres of land. On the basis of the "Agreement to Lease" dated 28th March 2008, the AEDB has obtained parcels of land admeasuring 1,553 acres from the Government of Sindh and has further agreed to lease the land, by way of a sub-lease to MPCL. The site sub-lease for 1,553 acres is to be executed subsequent to the signing of the power purchase agreement with NTDC.

This Agreement to Lease presently accords certain rights to MPCL which include installation of a wind measuring mast, unlimited access to the site and erection of fencing. However, the Agreement to Lease does not mention the presence of any settlements or villages within the site. The Agreement to Lease also states that no other industrial or residential activity will be permitted within the lease area, other than those for Windfarm development.

Based on site observations and local consultations, there are a total of two village settlements within the MPCL project boundary, i.e. Bacho Jhakro Goth and Qasim Burfet Goth. These settlements occupy approximately 1% of the total area which was earlier unsurveyed government land and which will now be sub-leased to MPCL. Consultations with key informants in the Thatta District indicated that none of the members of the local community have thus far produced any land use or land occupation documentation to enable them to establish any tenure on the unsurveyed government land.

MPCL will not directly impact the habitation or settlements as none of the turbine locations or associated footprints require the actual habitation land of the two settlements falling within the 1553 acres (***Refer Fig 4.3***). However, visual observations, primary consultations and satellite imagery have indicated occupancy, residential use and community access of these two settlements within the 1,553 acres of land.

Prevailing Occupancy and Community Access

A total of 2 (two) village settlements (Bacho Jhakro Goth and Qasim Burfet Goth) are located within the site which will be sub-leased by AEDB in the favour of the project proponents, i.e. MPCL. These settlements include 36 households with an estimated total population of 216 persons as detailed subsequently.

Table 6.10 Profile of Settlements

Name of Settlement	Number of Households	Total Population	Estimated Area (Acres)	Key Village Infrastructure
Bacho Jhakro Goth	8	16	~5 acres	Water Tanker
Qasim Burfet Goth	28	200	~6 acres	Water tanker, Mosque

**Source: Primary Observations*

Of the 36 households, preliminary consultations with 18 households suggest that at least 50% of the residential structure are "kuccha" or semi-permanent in nature that have been constructed from locally available material such as thatch, straw and mud bricks. It is understood that some of these households may have other ancestral homes in villages within the same Thatta taluka, approximately 10-12 km away. This is indicated by the "place of residence" on the national identity cards for at least 4 heads of households among the 18 that were consulted. These settlements also have certain common facilities like area for keeping cattle, water tanks and schools. However, other physical infrastructure such as electricity, sanitation or community water bodies are not available.

Presently, there is no precise or accurate information available that ascertains or establishes the exact number of population or households residing within the site or using the site area for livelihood activities. Although these settlements will fall within the site sub-lease of 1,553 acres, MPCL has avoided any physical impacts on the residential or village infrastructure. MPCL has also committed that there will be no adverse impacts of physical displacement to the local community and that the community will be allowed to continue their social and livelihood profile during the construction and operations phase of the project.

Although there will be no physical impacts on these settlements (including their homestead areas, residential structures or community infrastructure), the project will still need to commit to sustaining the existing informal rights and other safeguards under the requirements of IFC's Performance Standards 5. This will require a primary survey to ascertain the exact baseline and establish a cut-off date of households within the project site to prevent any future in-migration.

The impact significance from any physical displacement of these two settlements is assessed to be **negligible**.

Impact	Settlements and Community Access				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to 2 settlements with approximately 216 people				
Frequency	Not Applicable				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Proposed Project Commitments

MPCL has committed to the following safeguards to allow the settlements to continue accessing their homesteads in Qasim Burfat and Bacho Jhakro Goth:

- Establishment and documentation of a household-level socio-economic baseline and informal rights of the community in these two settlements with accurate information on their place of residence, livelihood and income profile, movement around the site, access to onsite community infrastructure and cultural sites;
- Facilitation of a documented process (in consultation with the two settlements and the local authorities) that provides commitments which prevent any curtailment of current rights with appropriate safety and other technical limitations (i.e. avoidance of any use in the immediate vicinity of any turbine locations etc.);
- MPCL will commit to providing priority in benefits and development activities to these settlements as well as ongoing consultation and communication and a readily accessible grievance process;
- In the event of any potential curtailment or restriction of community access rights to the site (such as any future eviction or land use restrictions), MPCL will provide a fair and transparent grievance process under which the community will be allowed to seek mitigation options such as compensation;
- MPCL will engage a third-party social expert to undertake a quarterly review of the grievances during the construction phase and a six-monthly review during the operations phase in addition to consultations with the community in these settlements to ascertain compliance to commitments of avoiding physical displacement.

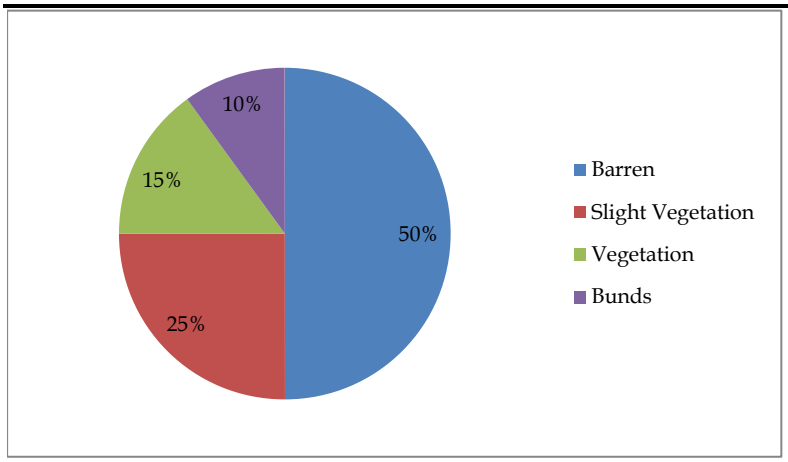
6.5.2 Land-based Livelihoods

Context

As discussed in the socio-economic baseline profile of the project area, the local community is dependent upon land and natural resources for their livelihoods and subsistence. Subsistence activities include agriculture, fuel wood collection, stone/gravel excavation and cattle rearing. These activities are carried out on unsurveyed government land and hence, the local community does not have formal rights of ownership or use on the same. Agriculture is carried out on "bunds" that have been developed by the community by levelling the available land and enabling irrigation through collection of rainwater.

MPCL will require approximately 60 to 80 acres of land to locate the WTG footprints, site office, and warehouse and storage facilities. The subsequent figure illustrates the available land use information of the footprints of the turbine locations, as per which only 2 turbines are impacting existing "bunds" or agricultural fields.

Figure 6.8 Land use of WTG Footprints



**Source: Primary Survey of Available Footprint Locations*

The requirements of IFC PS 5 consider that any impact on actual land or natural resources as well as the project's impact on access to land and natural resources will imply economic and livelihood impacts.

Economic and Livelihood Impacts

Primary consultations indicate that the local community make use of the existing physiological features of the terrain to meet their subsistence and income-generating needs. For instance: (a) scrubs or bush land is used for grazing livestock (goats and cattle); (b) rocky or barren land is used to excavate stone and gravel that is sold to middle men from Jhimpir and Nooriabad area; and (c) bunds have been created to cultivate one-time seasonal crops such as millets, lentils and vegetables.

Table 6.11 Approximation of Livelihood Loss

Type of Livelihood	Details	Approximate Income Generation
Agriculture	Two bunds within MPCL lease used for cultivation	PNR 7000/ha/annum
Fuel wood collection	-	Subsistence
Grazing and Cattle Rearing	~130 goats and 70 cattle in the two settlements	PNR 1800-2000/household/month
Stone Excavation	2-3 sites of excavation on rocky land	PNR 1800-2000/household/month

**Source: Primary Survey*

None of these impacts have been formally quantified by AEDB or the local authorities as the local population does not have any formal rights of use on the land. In addition, in the absence of any household survey, the extent of income loss, loss of access to land or natural resources land loss per landowner to ascertain marginalization and/or landlessness could not be determined. The loss of some agricultural land currently used for the production of rabi crops may result in reduced access to subsistence for a number of households.

MPCL has stated that livelihood activities and use of natural resources will be allowed to continue within the project area of 1,553 acres. However, at present, the absence of information on the exact number of land users (individual and community) and the form of land use and rights indicates the need to adopt a conservative approved to significance of Land and livelihood impacts which has been assessed as moderate.

Impact	Economic and Livelihood Impacts				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	No exact numbers of land users in the project area				
Frequency	Not Applicable				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **moderate.**				

Context for cumulative livelihood impacts: The significance of land-based impacts needs to consider the cumulative wind farm development of 10 other projects around the immediate vicinity/along the same plateau of the wind farm site in the Jhimpir wind corridor. As a result, this may lead to long-term livelihood loss as well as change in occupational patterns. However, such cumulative impacts could not be accurately ascertained due to the lack of information on adjoining wind energy projects.

Proposed Mitigation and Project Commitments

- MPCL will include an assessment of any land users within the 1,553 acres site (individual or community) that are engaged in subsistence activities such as seasonal cultivation, grazing, fuel wood collection, stone excavation etc.;
- Any potential livelihood loss due to the siting of the project footprint or its associated component on used parcels of land will be compensated through a mutually acceptable deal with the land user that takes into account long-term livelihood loss;
- Any standing crops or farm-based assets located within the project footprint (such as any privately owned trees etc.) will be compensated;
- MPCL will establish a Livelihoods Restoration Program that will aim at improving the skills and employability of the local community in the context of cumulative impacts of wind projects.

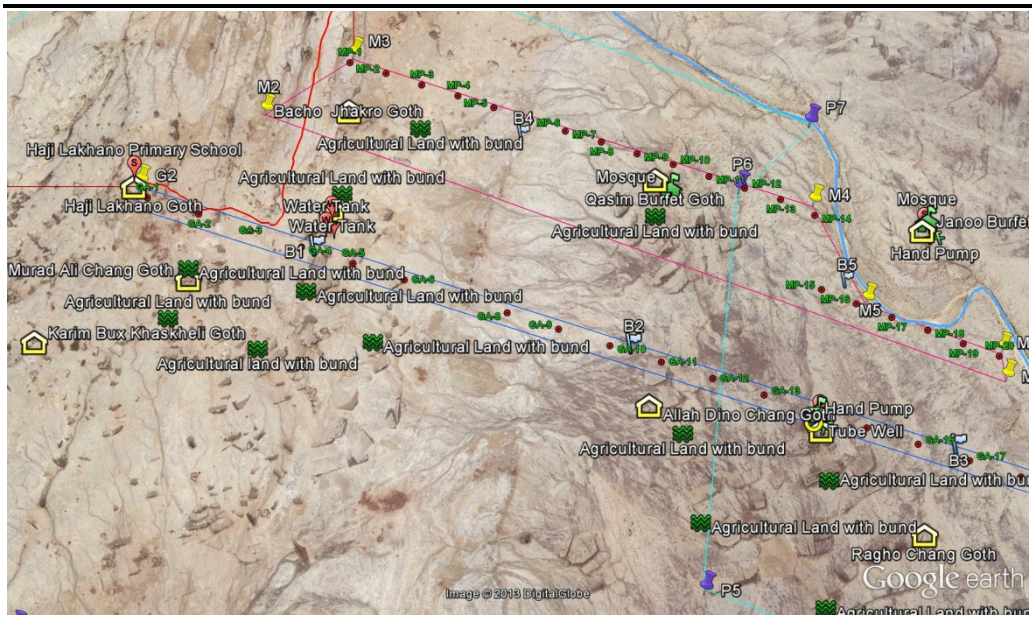
6.5.3 *Social and Demographic Structure*

Context

There are approximately 10 settlements that are located within a buffer zone of 5 km from the MPCL site with approximately 4000 inhabitants. The socio-

economic baseline has provided an overall profile of the local community and the stakeholder consultation section has discussed the overall expectations. There will be a change in the social and economic demographics and existing social welfare systems and infrastructure of the broader project area resulting primarily from the cumulative development of wind farm projects as well as potential influx of job seekers. Some of the Project infrastructure will also add additional strains on existing infrastructure e.g. roads, water and power requirements not as a result of direct project activities, but as a result of indirect or cumulative factors.

Figure 6.5 Local Settlements and Resources



Influx of Workers during the Construction Phase

The construction phase of the project is likely to commence subsequent to financial closure and likely to carry on for at least 18-22 months. Peak construction period is likely to last for over 6 months which is likely to see around 200 construction workers to be deployed around the wind farm site. Construction workers will be sourced by the main contractors, i.e. Nordex and Descon through their sub-contractors. It is estimated that most of the workers to be deployed for the construction and erection of wind turbines will be skilled and will be largely migrant workers.

The respective EPC Contractor will be responsible for the construction of temporary construction camps and provide the workers with water supply, electricity, sanitary facilities, medical aid and other basic amenities. This is not likely to require additional land as the construction campsites (~2.5 to 3 acres) are likely to be accommodated within the existing wind farm and sub-station area. However, the influx of migrant workers in the short to medium term is likely to have the following risks:

- Pressure on key local infrastructure such as water, healthcare, electricity;

- Spread of communicable diseases, especially sexually transmitted diseases, which accompany many major constructions;
- Lack of hygiene and adequate sanitation facilities would create health ailments related to food poisoning or diseases like malaria, viral fever, gastroenteritis which could spread within the community;
- Socio-cultural issues associated with gender sensitivities in the project area.

In spite of the risks from influx of migrant workers, there are also positive effects which are likely to benefit the local community in the immediate vicinity of the project area:

- There would be sub-contractors or casual labourers who are typically "camp followers" who would find their own accommodation in rental accommodation in villages. This leads to short-term income generating opportunities for villagers;
- Short-term petty business opportunities targeted to the construction camps;
- Increase in daily wage rates for labour, impacting the availability of agriculture labour for cultivation activities; and
- There could be an enhancement of local skills and skill sets through interaction of local unskilled or semi-skilled labourers with the skilled migrant workers.

Increased expectations in the Pre-construction Phase

Due to the lack of industrial and income-generating opportunities in the project area, the proposed WEP has created high expectations among the local communities for employment opportunities and improvement of infrastructure facilities. Primary consultations indicate several demands pertaining to health and educational facilities, improvement in roads, employment for every household, 24 hour uninterrupted power supply and need for drinking water etc. Additionally, the community also expects to be given priority in any local contracting opportunities as well as menial tasks in the plant area, housing colony etc.

Infrastructure and Public Services

Changes in local demographic patterns, such as influx of migrant workers, job seekers etc. will place a high level of pressure on the already limited local infrastructure and services. In particular, housing (potential increase in informal settlements), water and sanitation, education and health care facilities, and roads will be placed under severe strain.

Construction workers employed by the Project will be housed in worker accommodation and will be provided with all necessary services (utilities, medical facilities etc.). Therefore it is not expected that there will be any additional demand on local infrastructure as a direct result of construction workers.

Off-site infrastructure of the access roads, transmission lines from WTG to project Sub-station and internal access roads will be constructed by the project proponents. This is likely to generate local employment and local materials contracting from the wider region around Thatta District.

The key infrastructure benefits perceived by the local community from the project are (a) improvement of access due to widening and strengthening of the local roads; (b) accessibility of more transport networks due to the improvements in roads; and (c) improved availability of water in the immediate vicinity of the wind farm site due to the development of tube wells, etc.

Community Development and Dependence

The project proponents are likely to undertake community development activities which would aim at improving livelihoods and social infrastructure networks of the local community.

The implementation of community development activities and creation of infrastructure which are a one-time investment and not sustainable in the long-run may create dependence of the local community on the project proponents. During the closure of operations, there would be an immediate breakdown of community investment as well as community relations as the overall investment would reduce. This can lead to potential issues of conflict between the community and the company due to the prevailing industrial sentiment and dependence on the company.

Impact	Social and Demographic Structures				
Impact Nature	Negative	Positive			Neutral
Impact Type	Direct	Indirect			Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local	Regional			International
Impact Scale	Likely to be within the macro environment of 5 km				
Frequency	Construction and Operations Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium			High
Impact Significance	Negligible	Minor	Moderate		Major
	Significance of impact is considered **minor.**				

Proposed Mitigation and Enhancement

- Changes in local populations and demographics in the immediate vicinity of the MPCL site will be monitored during the construction phase where in-migration is considered to be a significant risk;
- An influx/in-migration management plan will be developed for the Project in consultation with the relevant local authorities and other wind

energy developers setting out measures to manage in-migration so as to avoid adverse impacts on local communities;
- Construction camps should not be located within close proximity of village settlements and they should be provided with basic amenities and sanitation facilities to avoid pressure on local natural resources (water bodies, fire wood) and infrastructure (drinking water, health care etc.);
- Social interactions between migrant labour and the host community will be closely monitored by the project. The community will be consulted at regular intervals and any complaints or concerns with respect to labour should be addressed without delay;
- Local community development will be undertaken in consultation with affected communities and on the basis of a needs assessment. To the extent possible, the project should not try to replicate existing infrastructure that is available and linkages should be explored with local governing entities and community-based organisations for execution.

6.5.4 Local Economy and Employment

Context

The development of the 50 MW WEP will employ workers in the construction and operations phase. MPCL plans to employ 600 workers during the entire construction phase in addition to 100 support staff that includes technical, security and administration. The manpower requirement in the operations phase will reduce to approximately 10-20 permanent staff and some contractual workforce for security.

The project will also require considerable resources in terms of construction material, consumables etc. which has the potential to benefit the local economy. Potential impacts include:

- Direct and indirect employment opportunities at the Project site for MPCL and their contractors; and
- Income generation and procurement opportunities for local businesses supplying goods and services to the Project.

Employment in the Construction Phase

The proposed project is likely to create the following direct and indirect employment opportunities:

- Civil works for the access roads and wind farm site may require local subcontractors and unskilled labour from the local area;
- Self- employment options for individuals possessing vocational or technical training skills like electricians, welders, fitters etc., which may be sourced locally; and
- Contracting opportunities for locals possessing tractors, dumper trucks or other vehicles which would be needed to carry away excavated soil and other material.

A multiplier effect will be felt on the creation of indirect employment through the local community establishing small shops like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores etc. However, these are likely to be temporary.

Given current understandings of local capabilities and skills specific to the construction industry, any employment opportunities for local people during construction are expected to be in the form of unskilled positions with some limited opportunities in semi-skilled positions that may not substantially contribute to the area's overall skills development. It is expected that a significant proportion of the skilled and semi-skilled workforce will be from outside the immediate project area, possibly from towns such as Nooriabad and Karachi.

Households who secure employment - even temporary - on the Project may experience significant uplift in their economic status and their ability to secure future similar employment.

Employment Opportunities in the O&M Phase

The operations and maintenance phase will be managed by contractors of MPCL and will directly employ up to 30 workers, most of whom are likely to be highly skilled. Locally procured services will include maintenance work for balance of plant facilities, 24 hour security and housekeeping/cleaning contracts.

For the local community, there will be employment opportunities for security as well as housekeeping tasks around the associated infrastructure within the wind farm site (i.e. the control/monitoring rooms, scrapyard, any temporary housing/site office etc.). There will also be a number of contract jobs including skilled balance of plant maintenance personnel for electrical works and crane operators/crew.

Local Procurement and Business Development

A majority of the material required for construction of the wind energy project is likely to be transported to the site via the Karachi port. As these are specialist components, they will not be available locally, so it is unlikely that significant opportunities will exist for local businesses to supply the Project.

MPCL has not yet determined how to supply the campsites for the construction workforce with consumables, however it is unlikely that significant quantities will be purchased locally during the construction phase, as the volumes required will be extremely large and it will not be possible to ensure sufficient security and quality of supply given the short timeframe before construction.

Primary consultations have not indicated a variety of existing businesses or service providers that may benefit from the presence of the project; however

the potential exists for these to be developed through the lifecycle. For instance, in the Operations phase, there would be opportunities for growth of the local supply chain and the additional benefit that would flow from this. This also includes the generation of rent-earning opportunities for any MPCL or contractor employees that may stay in the Jhimpir area.

Retrenchment in the Decommissioning Phase

The decommissioning of the WEP, after 20 years, may lead to retrenchment. In the event that other ancillary developments (such as other wind farms) are not able to absorb workers, there may be a tendency to out-migrate as the "employability" of the local community would have improved.

Impact	Local Economy and Employment				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	200-600 persons in construction and up to 50 in operations along with ancillary local business and procurement networks				
Frequency	Construction and Operations Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large

Proposed Enhancement Measures

- MPCL will develop an Employment Plan to define requirements and procedures to be followed by all Project personnel when identifying and developing employment opportunities, managing employees, recording and reporting employment data, terminating work contracts, and other labour-related issues;
- Unskilled and semi-skilled labour will be preferentially hired from the local communities;
- MPCL will establish skill development programs to develop employability of the local population;
- The Project will identify suitable local business and suppliers to support local enterprise development. Where appropriate, procurement targets will be defined in consideration of what is possible and in consultation with potential suppliers.

6.5.5 *Cultural Environment*

Context

At the outset, it should be stated that there are no sites (tangible or intangible) of national or archaeological importance within the MPCL site or the larger study area. However, due to the presence of settlements within the site and in close proximity to the project area, some sites of local cultural and religious significance, such as mosques, communal grave sites etc. may be impacted.

Key features of the proposed WEP that have the potential to affect cultural heritage will be the large amount of earth works limited to a maximum of 100 acres across the overall footprint of the site (1553 acres) and associated roads, the change in the character of the landscape and the changes in potential for access to sites or areas of importance.

Other proposed changes in the area which are potentially of significance are the increased level of background noise as compared to baseline levels and change in noise character of the area.

The impacts to cultural environment will be managed taking cognizance of Pakistan's antiquity laws as well as the requirements of IFC PS 8 on Cultural Heritage.

Impacts in the Construction Phase

The project has to address the following key impacts envisaged on the local/ regional cultural environment through the project life cycle during its planning phase:

- Impact due to project traffic passing through and during rural market days, religious, cultural and festival sites/ days;
- Impact on local culturally sensitive receptors (mosques/grave sites) in and around WTG sites and other subcomponents of the project;
- Chance finds of archaeological, historical, religious and cultural remains of previous civilisations;
- Conflict with local cultures, values and religious/societal sentiments could arise between project engaged staff/ labourers and local community.

During construction phase, the key impacts that need to be addressed include:

- Scheduling road construction and maintenance work through and during rural markets, religious, cultural and festival sites/ days;
- Heavy project related traffic traversing through and during rural markets, religious, cultural and festival sites/ days;
- Impact on culturally sensitive receptors: along external access roads; within Wind farm site; along EHV transmission line alignment corridor; in and around transit sites;
- Chance finds of archaeological, historical, religious and cultural remains at foundation sites of WTGs, or EHV poles.

There is potential for cultural differences leading to conflict scenarios between workers engaged at project site and local community due to on behavioural, regional, traditional, and religious aspects through the project life cycle and more so during the construction phase when large workforce from outside the region will be deployed. This specifically pertains to potential gender issues.

During O&M and decommissioning phase, no specific impact has been envisaged other than what have been discussed above.

Impact	Cultural Environment			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Local sites of religious or cultural significance			
Frequency	Construction and Operations Phase			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **negligible.**			

Proposed Mitigation Measures

- Field surveys and consultation with local communities will be undertaken to identify any sites or features of importance for cultural heritage. This will include both tangible features or sites and locations of intangible cultural importance;
- If a cultural heritage site is damaged in any way, this will be treated as an incident, investigated and managed in accordance with the approved incident management procedures established for the Project;
- The Project will operate a Chance Finds Procedure in accordance with IFC Performance Standard 8. If any finds are encountered, work will cease immediately and temporary protection of the area will be established. The find will be reported and relevant specialists will be appointed to determine an appropriate course of action;
- All Project personnel will be required to respect local cultural traditions and religious festivals, funerals and other traditional events. Induction training for all personnel will include appropriate cultural awareness training.

6.5.6 Community Health and Safety

Context

The receptors for impacts on community health and safety include project site workers, settlements in the close proximity of the Project site (within 500 m) and along the access road (with 100 m) are the receptors, which will be exposed to health impacts from construction related activities.

The discussion of impacts has referred to the WB/IFC General EHS Guidelines for Wind Energy Projects.

Construction Phase Impacts

Possible sources of impacts to community health and safety during the construction phase are:

- Changes in environmental quality due to construction activities;
- Increased prevalence of disease arising from the influx of construction workers; and
- Heavy traffic movement.

Increased Road Traffic Movement

During construction there will be a significant increase in the number of vehicle movements. Traffic increases will occur as goods and materials are brought in to construct the project.

Once operational there will be a reduction in the number of traffic movements except when turbine parts are to be maintained or changed.

There is a potential health and safety risk to the community and the livestock due to the increased number of vehicles on the road and on the smaller village access roads. There is also a possibility of deterioration in the quality of the roads, specially the unpaved village roads which have been constructed for 10 tonne axle loads. Traffic movement in the vicinity of the project location are likely to be handled by more than one sub-contractor and in the absence of co-ordination/traffic management plans, this may further add to risks from poorly managed traffic. This is particularly likely where roads pass through communities. Furthermore, as the existing traffic levels are low, the level of awareness of risks is also low.

Mitigation measures will include road safety initiatives, regular maintenance of vehicles etc.

Changes in Environmental Conditions

Changes in baseline environmental conditions can be experienced by the local community in terms of increased nuisance levels from emissions to air, contamination of surface water or ground water and high noise levels during the construction phases.

An increase in dust and noise during the construction period has the potential to lead to health impacts associated with eye irritation and general disturbance to daily activities.

The discharge of domestic waste effluent from sanitary facilities for construction workers may have the potential to cause contamination of surface water and groundwater in this area.

However, due to the sparse population density around the project area, the potential for long term impacts to community health are minor.

Increased Prevalence of Disease

A total of 200workers will be employed for the construction phase from commencement up to peak construction and commissioning. This influx of workers to the community may cause impacts to public health, especially an increase in prevalence of diseases as well as pressures on existing health infrastructure.

There is also the possibility of increase in sexually transmitted diseases such as HIV/AIDS as a result of the expected influx of workers to the area. In addition, vector-borne diseases will be sensitivity for settlements closer to campsites for the construction phase labour, particularly due to lack of hygienic conditions.

Pollution control (Refer *section 2.5.6*) and mitigation measures will be implemented to reduce the likelihood of contamination of surface and groundwater from sanitary effluents generated during construction. For instance, any construction camp is to be located at least 1 km away from the nearest settlement

The impact to community health and safety during the construction phase is evaluated to be of **minor** significance due to the low density of population and certain embedded controls, such as location of construction camps.

Impact	Community Health & Safety				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Settlements around the project site and along the access roads				
Frequency	Construction Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Proposed Mitigation Measures

Road safety initiatives will be implemented to minimise risks to other users, including: (a) Emphasizing safety aspects among drivers, particularly with regard to safe driving speeds; (b) Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure; (c) Collaboration with local communities and responsible authorities to improve signage, visibility and awareness of traffic and pedestrian safety; and (d) Coordination with

emergency responders to ensure that appropriate first aid is provided in the event of accidents.

Measures to reduce the prevalence of diseases will include screening of workers, undertaking health awareness among communities, implementation of vector control programs and avoiding presence of unsanitary conditions.

Operations Phase Impacts

According to IFC EHS guidelines, community health and safety hazards specific to wind energy facilities primarily include the following and which are discussed in detail in the following paragraphs:

- Shadow flicker;
- Blade glint;
- Blade throw;
- Electromagnetic interference and radiation; and

Shadow Flicker

A shadow flicker phenomenon may be considered an adverse impact for every household falling within 500 m of an existing WTG tower location. For the MPCL project, the primary topography profile indicates that the following distances of turbine locations from settlements:

Table 6.12 Settlement distances from WTG locations

Name of Settlement	WTG Number	Distance (m)
Bacho Jhakro Goth	MP1	550
	MP2	650
	MP3	670
Qasim Burfat Goth	MP9	445
	MP10	345
	MP11	590
Janoo Burfat Goth	MP17	840
	MP18	900

Depending upon the orientation (direction) of the affected households, intensity of the impact on the receptor will vary due to shadow flicker. Impact due to shadow flickering has to be analysed in field after implementing the project and in consultation with concerned stakeholder, appropriate mitigation measures such as installing vegetative screens should be explored during O&M phases.

A shadow flicker assessment for the proposed MPCL project was conducted by applying a threshold of 30 hours and using ReSoft WindFarm software. The shadow flicker assessment report is attached as ***Annex J***. The key results are summarized as under:

- A total of 26 structures have been identified as being within the study area of the Metro Power Wind Power Plant site. These properties are a mix of residential and community receptors;
- The results show that theoretical shadow flicker occurs at 16 properties (3 community and 13 residential) within the zone of potential impact. Impacts are the result of the placement of two turbines, MP 10 and MP11. The number of hours per year when shadow flicker occurs ranges between 14.4 and 66.0;
- The 5 properties affected by turbine 10 are affected between the dates of the 17th of May and the 29th of August and the 14 properties affected by turbine 11 are affected between the dates of the 22nd of March and the 25th of September;
- All properties are affected between the hours of 5 am and 6.30 am.

Given the guidelines of 30 hours or less per year being acceptable, the operation of the Metro Power Wind Power Plant theoretically results in shadow flicker impacts that could be considered as significant. In this case, all 16 properties will, in theory, experience a significant shadow flicker impact as maximum hours per day of shadow flicker exceeds this value.

In terms of embedded controls, the likelihood of direct line of sight to the location of proposed turbine locations can be assessed visually and the potential for using screening can be explored at problem locations.

Note: It is relevant to emphasise that predicted hours of shadow flicker effects are worst case scenarios. Assumptions made during the analysis include optimal meteorological, natural light and geometrical conditions for the generation of shadow flicker. For instance:

- The assessment does not account for trees or other obstructions that intervene between receptor and turbine during times when effects may occur. The assessment calculation is therefore an over estimation in the probability of effects;
- It should also be noted that for shadow effects to occur, properties need to be occupied, with blinds or curtains open and views to the wind turbine unobstructed. Many receptors within the study area contain straw fencing around property boundaries screening potential effects. It is also unlikely for example that community properties (mosques) affected will be occupied between the hours of 5 am and 6.30 am and the intensity of sunlight will be much less during early morning hours when shadow flicker effected is noted. However, for the purposes of assessment, it has been assumed that all worst-case circumstances apply.

Blade Glint:

Blade glint issues have been largely addressed by WTG manufacturers as the WTG parts are coated with a low reflectivity treatment paint that prevents reflective glint from the surface of the blade, nacelle, hub and tower. Experiences from other wind energy projects in South Asia that are currently

in operational phase indicate that blade glint is a non-issue at any hour of the day.

Blade Throw:

Blade throw issue has been addressed through two ways. Firstly, setback distance between two WTGs and nearest sensitive receptors is strictly followed. Blade throw should be considered a rare event and embedded controls include large enough distances between the turbine and nearby villages.

Electromagnetic interference and radiation:

Electromagnetic interference (EMF) and radiation impacts due to WTG projects has not been realised to be significant by the concerned stakeholders though the wind energy projects are in operation for the last decade or so in South Asia. The EMF impact due to HT transmission lines have been identified as more important relatively when compared to WTG towers. Considering the rural and hilly environment, EMF and radiation issues are not considered significant at the project site. Another embedded control that should be specified is that all the cables are proposed to be constructed underground.

Impact	Community Health & Safety during Operations Phase				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Limited to the settlements in the vicinity of at least 300 m from turbines				
Frequency	Operations Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor		Moderate	Major
	Significance of impact is considered **moderate.**				

Proposed Mitigation Measures

- The project will communicate about the technical aspects of the construction and operations along with their community safety and nuisance implications;
- There will be close monitoring through engagement with residents during the operational phase where there are predicted impacts from shadow flicker;
- Consult the concerned stakeholders to formulate appropriate mitigation measures such as installing vegetative screens, curtains and integrate the same as part of project design and implement the same;

- Monitor and implement additional mitigation measures in addition to those recommended in the Planning and Construction phase EMPs to mitigate shadow flicker issue at individual WTG locations, if necessary.
- Regularly consult and obtain affected stakeholder feedback to formulate appropriate corrective action.

6.6 *CUMULATIVE IMPACTS*

Cumulative impacts can result from an accumulation of effects from numerous activities along the present and future period of time on an area. These cumulative impacts can be different and synergistic in nature, larger in magnitude, greater in significance, more-long lasting, and/or greater in spatial extent as compared to individual impacts. Detailed data is required to identify and predict the significance of such cumulative impacts.

The MPCL Project is to be developed in the AEDB Gharo Wind Corridor in Jhimpir where along with MPCL; ten other WEPs are planned. Out of the ten, two are already established i.e. Zorlu and FFC. These large number of wind farms in the area will definitely have cumulative impacts on different components of the regional environment. Gul Ahmed will be the closest wind farm located south of the MPCL project site. The distance between the boundaries of both the Project sites vary in between 0.8-1 km and shortest distances between two WTGs of the two wind farms is 1.12 km.

For the MPCL Project, the following aspects were assessed for potential cumulative impacts in line with the available data till date.

6.6.1 *Visual Impacts of all the WTGs installed in the area*

As mentioned in Section 6.4.1, presently WTGs are visible only at a distant horizon in the far south west direction. With the other wind farms coming up in the area, there will be definite impact on the landscape character as described below:

***Effects on sense of remoteness or wilderness*:** Currently the entire area is semi-arid, barren lands with rock outcrops and sparse vegetation. The WTGs visible against the skylines would reduce the sense of remoteness or wilderness amongst the villagers and the travellers crossing the area.

***People perception towards the changes in skyline and landscape*:** As mentioned earlier, presently people in the MPCL Project area are used to see the WTGs in far distant horizon and do not have any negative perceptions. However, with the development of other wind farms in the area, their perception may change.

Currently the cumulative impact cannot be gauged appropriately as the number of WTGs to be installed in the other wind farms is not exactly known.

The distance between each WTGs, the colour of the turbines towers and blades etc. will play a role in the overall landscape quality.

6.6.2 Shadow Flicker

Chances of shadow flickering due to other windfarms in the area is not a possibility because the nearest windfarm i.e. GAWPL is situated south of MPCL project site at a distance of more than 1 km (nearest GAWPL turbine is 1.3 km away from Qasim Burfet village). Therefore there is no possibility of cumulative impact of shadow flickering.

6.6.3 Noise

It is evident that a total of 11 wind energy projects are coming up in the AEDB's Jhimpir wind corridor and the nearest one to the MPCL is GAWPL wind farm. In order to assess cumulative impact of noise due to these two wind energy projects in the surrounding settlements, noise prediction model was used. Both the projects are of 50 MW generation capacities with 20 wind turbines of 2.5 MW each (Nordex N100/2500), with hub height of 80 m and rotor diameter of 99.8 m. Micro-sitting of GAWPL was also made available by MPCL for the assessment.

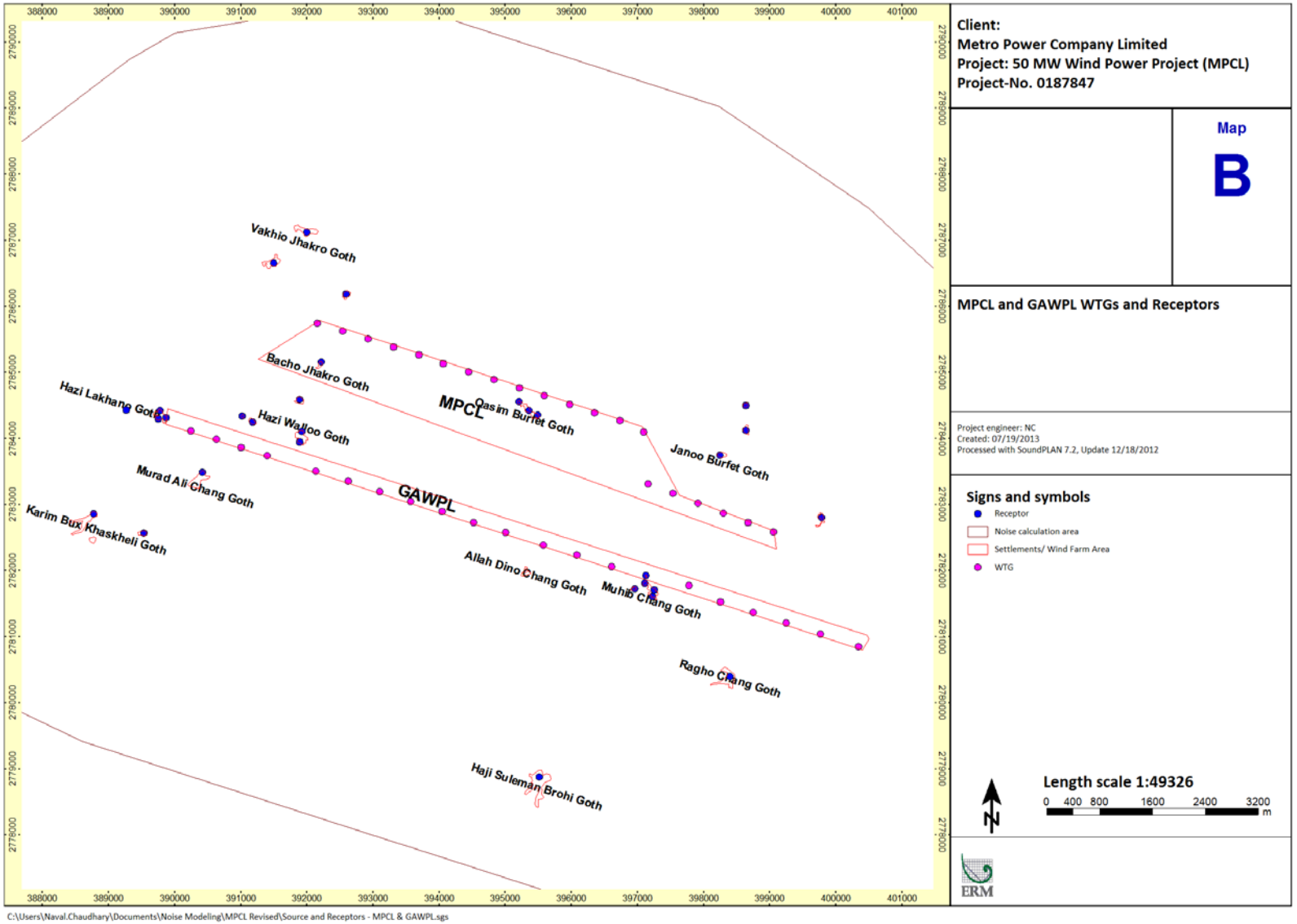
Criteria

In the absence of any national standard for prescribing ambient noise limits for residential, commercial, industrial areas or silence zones in Pakistan, the noise emission criteria specified in the WB/IFC EHS Guidelines is being used. However, for motor vehicle noise levels 85 dB(A) noise emission standard will be followed.

Receptors

The nearest noise receptor (Qasim Burfet Goth) is located at 345 m from the MP-10 WTG in the southern side, whereas other settlement within MPCL boundary (Bacho Jhakro Goth) is located about 570 m away from MP-2 WTG. Other settlements are outside the MPCL boundary and are much farther away from the WTGs. However, with respect to the GAWPL site, nearby receptors are Muhib Chang Goth School (within GAWPL site); Hazi Lakhano Goth and Muhib Chang Goth (just outside the GAWPL boundary). A location map showing WTGs at both the project sites and sensitive receptors within 5 km from these projects has been presented in ***Figure 6.9***.

Figure 6.9 Map showing MPCL and GAWPL WTGs and Noise Sensitive Receptors in the surroundings



Methodology: The environmental noise prediction model SoundPlan 7.2 was used for modelling noise emissions from WTGs of MPCL and GAWPL. In order to consider worst case scenario, it has been assumed that the WTGs are operational at standardised wind speed of ≥ 8 m/s at 10 m height and producing 106.0 dB(A) sound pressure level (refer ***Table 6.5***). Noise assessment is also performed for variable standardised wind speeds from 3 m/s to 7 m/s. Operating of WTGs with 100% usage scenario was modelled to cover the operation phases of these two projects. In addition, to represent a worst-case scenario for the assessment, all WTGs were assumed to be operating simultaneously and for 24 hours. Noise generation had been considered at the hub height of 80 m above ground. As a conservative approach to the assessment, atmospheric absorption during sound transmission was not included in the assessment. Local terrain has been considered for putting noise sources as well as receptors in the model.

Predicted Noise Levels at Receptors: The predicted cumulative noise levels within the Project AOI during daytime with standardised wind velocities (at 10 m height) of 3 m/s, 5 m/s and ≥ 8 m/s are presented in ***Figure 6.10***, ***Figure 6.11*** and **Figure 6.12**, respectively. Predicted noise levels at eleven receptors have been presented in ***Table 6.13***. It is evident from the predicted results that in the worst case scenario, the nearest receptor of MPCL project i.e. Qasim Burfet Goth (320 m from MP-10 WTG) will have daytime as well as night time cumulative noise levels of 38.8 dB(A), 43.1 dB(A) and 47.7 dB(A) with standardised velocity of 3m/s, 5m/s and ≥ 8m/s, respectively during the operation phase of these two projects; whereas higher noise levels will be at Hazi Waloo Goth and Hazi Lakhano Goth due to proximity of these two receptors with GAWPL WTGs.

Figure 6.10 *Predicted Operation Phase Noise Levels of MPCL and GAWPL Projects during Daytime (Leq $_d$) [Standardised Velocity = 3 m/s and L_{wA} = 96.8 dB(A)]*

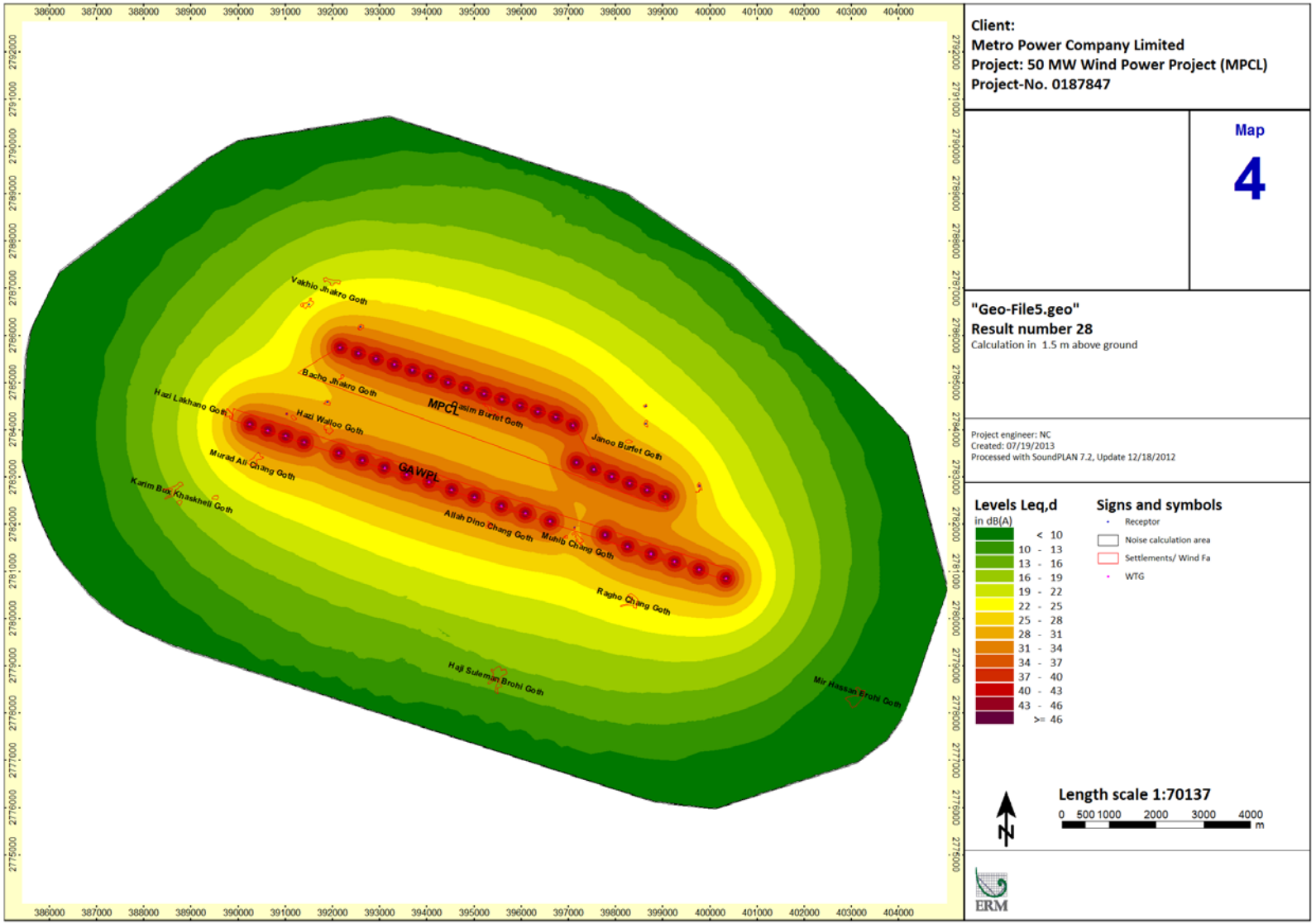


Figure 6.11 *Predicted Operation Phase Noise Levels of MPCL and GAWPL Projects during Daytime (Leq $_d$) [Standardised Velocity = 5 m/s and L_{wA} = 101.1 dB(A)]*

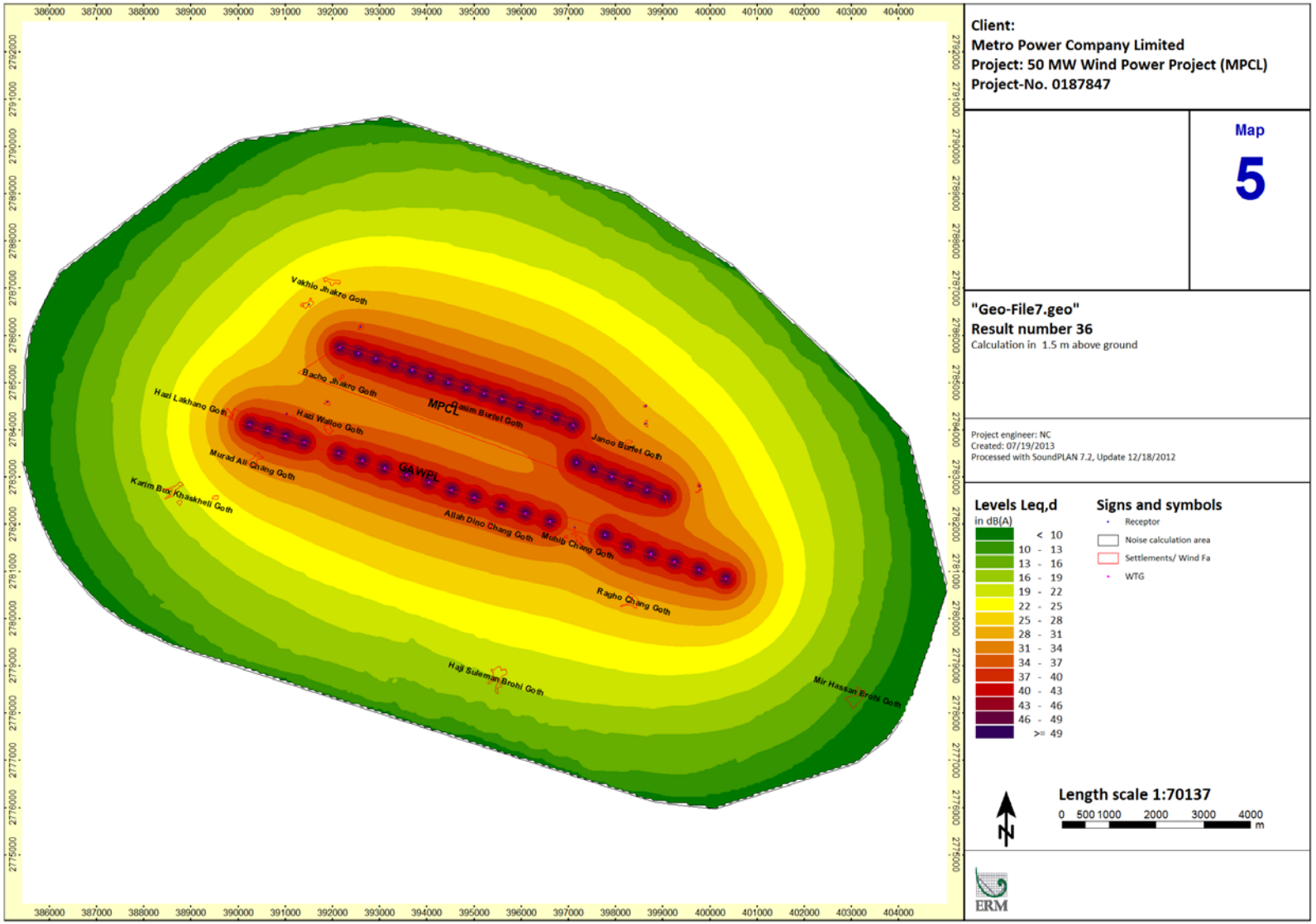


Figure 6.12 *Predicted Operation Phase Noise Levels of MPCL and GAWPL Project during Daytime (Leq $_d$) [Standardised Velocity ≥ 8 m/s and L_{wA} = 106.0 dB(A)]*

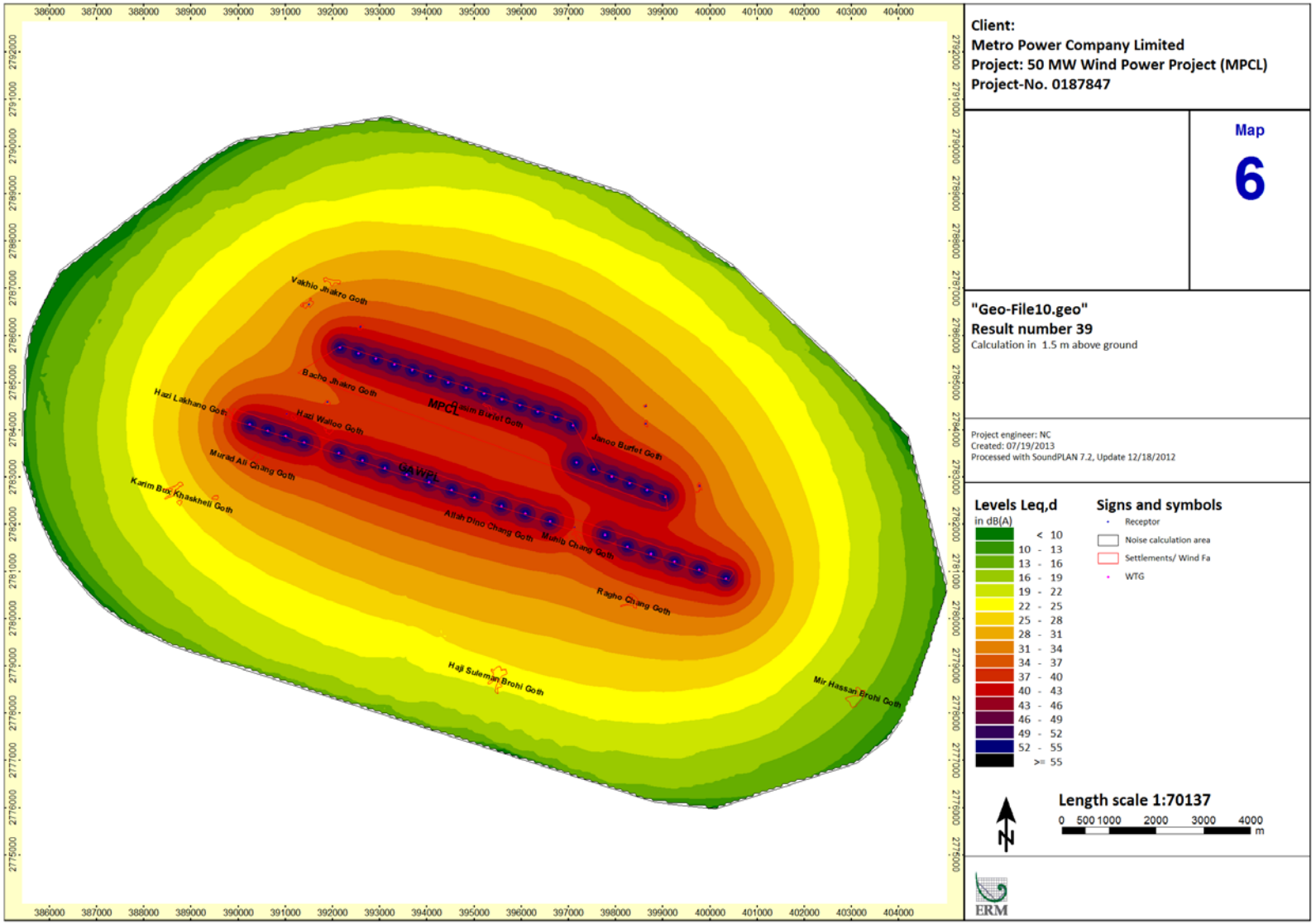


Table 6.13 Predicted Noise Levels at Noise Receptors during Operation Phase of MPCL and GAWPL Projects with different standardised velocities

S. No.	Receiver	Nearest MPCL WTG and (Distance [m])	Nearest GAWPL WTG and (Distance [m])	Predicted Leq [dB(A)][1]						WB/IFC Guidelines[2]	
				with Vs ≥ 8m/s and L_{wA} [106.0 dB(A)]	with Vs = 7m/s and L_{wA} [105.8 dB(A)]	with Vs = 6m/s and L_{wA} [104.4 dB(A)]	with Vs = 5m/s and L_{wA} [101.1 dB(A)]	with Vs = 4m/s and L_{wA} [98.8 dB(A)]	with Vs = 3m/s and L_{wA} [96.8 dB(A)]	Day	Night
1	Bacho Jhakro Goth	MP-2 (570)	GA-4 (1590)	41.0	40.9	39.5	36.4	34.0	32.1	*55*	*45*
2	Qasim Burfet Goth	MP-10 (320)	GA-10 & GA-11 (1890)	47.6	47.4	46.1	43.1	40.6	31.4	*55*	*45*
3	Janoo Burfet Goth	MP-17 (770)	GA-15 (2045)	39.2	39.1	37.6	34.6	32.2	30.3	*55*	*45*
4	Janoo Burfet School	MP-14 (1570)	GA-15 (2500)	33.9	33.9	32.2	29.2	27.1	24.9	*55*	*45*
5	Vakhio Jhakro Goth	MP-2 (510)	GA-4 (2720)	40.8	40.6	39.2	36.2	33.8	31.9	*55*	*45*
6	Hazi Waloo Goth	MP-2 (1220)	GA-5 (500)	42.8	42.6	40.7	38.2	35.7	33.9	*55*	*45*
7	Hazi Lakhano Goth	MP-1 (2700)	GA-1 (430)	40.3	40.1	38.8	35.8	33.3	31.4	*55*	*45*
8	Murad Ali Chang Goth	MP-1 (2780)	GA-2 (540)	40.7	40.5	39.2	36.2	33.7	31.8	*55*	*45*
9	Muhib Chang School and Mosque	MP-16 (1290)	GA-14 (530)	41.0	40.8	39.4	36.4	34.0	32.1	*55*	*45*
10	Muhib Chang Goth	MP-17 (1430)	GA-15 (530)	40.8	40.6	39.3	36.2	33.8	31.9	*55*	*45*
11	Ragho Chang Goth	MP-20 (2270)	GA-17 (1030)	35.9	35.8	34.3	31.2	29.0	26.9	*55*	*45*

[1] Predicted noise levels during day and night time will be same as the operation of WTGs has been considered 24 hours and no variation of wind speed during day and nightime is considered in this assessment.

[2] IFC/WB EHS Guidelines: Noise Management dated April 30, 2007 gives, Noise level guidelines for Residential; institutional and educational receptors in daytime (07:22:00) and night time (22:00-7:00) as 55 and 45 one hour Leq dB(A) respectively. For industrial and commercial receptors it is 70 one hour Leq dB(A) for both night and day time.

Yellow Highlighted text shows Leq which exceeds the IFC/WB Guideline Value of 45 dB(A) during night time.

It is evident from ***Table 6.13*** that ambient noise levels due to operation of MPCL and GAWPL projects will be well within the WB/IFC guideline values for daytime at all the receptors, including the nearest receptors at Qasim Burfet Goth (MPCL) and Hazi Lakhano Goth (GAWPL), however night time noise levels at Qasim Burfet Goth with standardised wind speed ≥ 6 m/s show exceedance with respect to WB/IFC EHS guideline values. Therefore, the cumulative impact of noise on the nearest receptor during day time due to operation of WTGs has been estimated as **negligible**, whereas during night time it has been estimated as **minor.**

Impact	Cumulative noise from operation of MPCL and GAWPL WTGs during daytime				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to within 500 m of WTGs				
Frequency	Entire operation phase of the Project				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Impact	Cumulative noise from operation of MPCL and GAWPL WTGs during night time				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to within 500 m of WTGs				
Frequency	Entire operation phase of the Project				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Mitigation Measures

- Installation of acoustic enclosures for equipment casing radiating noise;
- Regular maintenance of WTGs;
- Periodic monitoring of noise near to the sources of generation to ensure compliance with design specification; and,
- Periodic monitoring of ambient noise levels in nearby noise sensitive receptors to ensure compliance with ambient noise level guidelines and

construction of noise barriers to attenuate noise, in case of complaints received from the local population.

6.6.4 Bird and Bat Collision

The entire area may serve as a barrier to movement of birds and bats especially the migratory birds. This in turn may disrupt the ecological links between feeding, wintering, breeding and moulting areas.

The assessment of cumulative effects on birds is a complex and specialized process and high degree of uncertainty can be introduced at a number of stages.

The detailed study is proposed to assess the impact on birds and monitoring of collision, as mentioned in ***Section 6.4.4*** will help in identifying if the area lies in the route of migratory birds. Further, cumulative impacts can be assessed post availability of data on number, height and location of WTGs, from other wind farms.

6.6.5 Social Aspects

The cumulative development of multiple wind energy projects in the Gharo wind corridor will result in a gradual change in the socio-economic landscape of the project area of influence over time. Successive progression from construction to commissioning and operations will be on going over a period of at least 3 to 7 years. The key effects that are to be considered include:

- Livelihood implications of change in land use patterns across land that is allocated by AEDB for wind farm development;
- Extensive movements of vehicles, people and material in the 5 km buffer around the MPCL site is likely to create some community health & safety impacts;
- Influx of migrant labour as well as job-seekers into the project area;
- Beneficial infrastructure development due to investments by multiple project proponents into road works, power supply and other physical infrastructure networks;
- Enhancement of local supply networks to provide consumables as well as other cater to service requirements of project developers;
- Gradual change/shift in the skill sets of the local community with an increase in employability.

7 ANALYSIS OF ALTERNATIVES

This chapter discusses the various alternatives of the proposed MPCL project in terms of no project scenario, use of conventional power generation sources, site location, route options etc.

7.1 PROJECT ALTERNATIVES

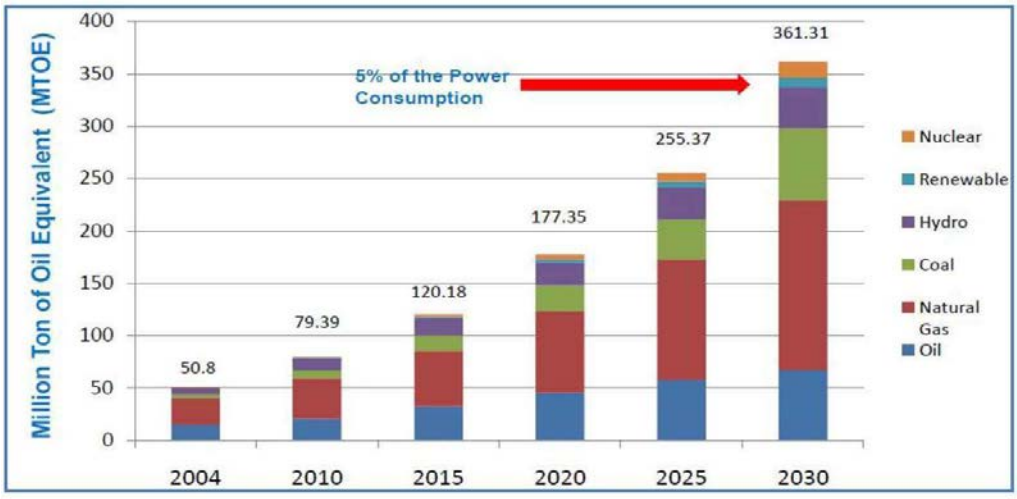
The MPCL WEP aims at harnessing wind energy, the renewable energy source potential in the Jhimpir Wind Corridor in Deh Kohistan as an alternative to the conventional system that depends on fossil fuel, and thus meet the shortfall in the current energy production in the country. The following alternatives are available:

- **No Project Scenario:** continuation with the existing condition and
- **Use of Conventional Energy:** No new system alternative that involves renewable energy but continuation with the use of fossil fuel;

7.1.1 *No Project Scenario*

Electricity demand in Pakistan had already exceeded supply in the year 2002. Pakistan has remained an energy deficient country, dependent upon imports, mostly oil and oil products (Pakistan Power sector - Osec, 2011). Pakistan has had more success in finding natural gas than oil, and as a result, gas over took oil as the largest source of primary energy supplies, as shown in ***Figure 7.1.***

Figure 7.1 ***Energy Mix Plan Projections***



Source: Vision 2030, Planning commission, Government of Paksistan

To support growth in Gross Domestic Product, it is imperative to increase the generating capacity in consonance with the projected demand. The "No Project Scenario" does not respond to:

- The urgent and strategic needs of enhanced power production to meet the demand of industry, agriculture as well as commercial and domestic consumers of the country; nor does it propose better level of service for improvement of quality of life.
- The need to increase the current power production capacity in view of the shortfall in energy availability resulting in load shedding of 6 to 8 hours every day.
- The requirement of slowing down on fossil fuel consumption and further addition to global warming.

In view of the above shortcomings the "No Project Alternative" cannot be considered.

7.1.2 Use of Conventional Energy

Petroleum oil and gas is presently the main (83.8%) source of fuel in Pakistan. Rising oil consumption and levelling off in oil production together with inadequate refining capacity has left Pakistan heavily dependent on petroleum product imports from Middle East.

Pakistan's coal resources are estimated at 185 billion tonnes (82,700 MTOE, or 2 per cent of the world coal resources), 95 per cent in the Thar coal field in Sindh. This coal is of lignite rank having high moisture content and low heating value and it would take time to develop this resource for making it a potential source of energy (Integrated Energy Plan 2009-2022, March 2009) Further, the "Use of conventional Energy" will lead to:

- further increased dependence on imports from other countries; and
- increase in pollution and global warming from fossil fuels.

In view of the limitations on national reserves of oil and gas, GoP is considering it essential to broaden the outlook on the energy mix and thus exploring indigenous sources that are renewable. So the use of renewable energy is preferred over conventional energy especially in a region where wind corridors are available for harnessing.

7.2 SELECTION OF ALTERNATIVE LOCATION/SITE

There was not much option on site alternatives as wind corridors exists in specific areas and the Gharo-Jhimpir wind corridor is one of the earmarked zones by AEDB .

The advantages of development of the MPCL wind farm in the Project area are:

- It is suitable for wind classes 4 to 5;
- Wind is the only resource in the area with vast ecologically degraded lands;

- It has accessibility to infrastructure facilities for the establishment of wind farms and for providing energy to NTDC when it goes into operation;
- The area has rural settings with sparse population thus reducing the issue of shadow flicker, noise, electromagnetic interferences among communities when compared to development of wind farms in more urban and populated areas;
- Site is away from ecologically sensitive and protected areas.

7.2.1 Transportation Route

The current route being used for accessing the site from the M-9 super highway is via the Nooriabad-Jhimpir link road and dirt track of 12 km north from the link road. So the total length of about 35 km from M-9 super highway has to be traversed for reaching the site.

The alternative which was considered was a dirt track that forks off from the super highway and after crossing a nallah (natural drainage) it passes through 4.9 km of rough and rocky terrain to reach the plain area about 2 km from the Project site. This alternative route would require total improvement/ upgradation of approximately 11 km of dirt road

However, the alternative was not used as the road would pass through private lands and RoW for the road would have to be acquired/purchased. The road passes through heavy village settlements of Vakhio-Jhakro Goth and others and would require extensive cutting/ levelling.

In order to avoid ROW issues, changes in landscape and road safety risks and disturbance to the villagers, the Nooriabad-Jhimpir link road was selected. Further this road is being used by other windfarms of Zorlu and FFC and is relatively well maintained.

8 MANAGEMENT AND MONITORING

8.1 ENVIRONMENTAL AND SOCIAL MANAGEMENT REQUIREMENTS

Environmental and social management requirements for the project describes the measures identified in the Updated IEE, which will be implemented to mitigate the adverse impacts of the project and enhance its positive impacts, by avoiding impacts where possible, and by reducing, remedying or compensating for impacts where they cannot be avoided. The environmental and social management plan (ESMP) for the project represents a consolidated list of mitigation measures and commitments from the impact assessment and aims to:

- set out the arrangements that will be put in place by the Project to manage the environmental and social performance of the MPCL project;
- outline further studies and surveys that may be required to redefine predicted impacts and design appropriate mitigation strategies;
- describe the monitoring programmes required to assess accuracy of predicted impacts and adequacy of mitigation strategies; and
- provide a framework for compliance auditing and inspection of the Project that will give the company, regulators and external stakeholders assurance that the Project's commitments to environmental and social mitigation and its aims with respect to environmental and social performance are being met.

The primary objectives will be to comply with:

- all applicable Pakistani legislation including international conventions and treaties to which Pakistan has acceded;
- the International Finance Corporation's Performance Standards and EHS Guidelines; and
- MPCL policies, code of conduct and guidelines.

Where these vary the most stringent standard will apply.

8.2 THE COMPANY'S ORGANISATIONAL STRUCTURE AND EHS PRINCIPLES

8.2.1 Company Structure

The organisational structure during the construction and operation phases of the Project is illustrated in ***Figure 2.10*** and ***Figure 2.11*** respectively**.** The EHS manager will look after all EHS issues and coordinate with the EHS team of EPC contractor for management of impacts and implementation of ESMP. The social issues will be looked after by the Community Relations Officer who will report to the EHS Manager. The EHS manger will in turn report to the MPCL CEO.

The EHS Manager will need to build a team (who may be nominated from the engineering and Project management team, on –site supervisors and EPC contractors) to monitor the EHS aspects of the construction activities. It will be the role of the EHS manager to train the team on how to implement the ESMP. In addition, the EHS manger will have to work in close coordination with the health and safety department of the EPC contractors and train them in the applicable ESMP requirements to ensure its proper implementation.

During the operations phase, the EHS manager will be part of the Engineering team and work in close coordination with O &M contractors and MPCL site employees for management of impacts and implementation of ESMP.

8.2.2 Company's Environmental and Social Principles

As per MPCL's "Code of Business Conduct and Ethics" (***Refer Annex K)***, MPCL is committed to conducting its business in compliance with all applicable environmental and workplace health and safety laws and regulations and MPCL Social Environment Health & Safety Policy.

MPCL people are expected to provide a safe and healthy work environment for all employees, and they should also act so as to avoid adverse impact and injury to the environment and the communities in which MPCL conducts business. MPCL people are therefore responsible for maintaining MPCL facilities free from recognized hazards, obeying all MPCL safety rules, and complying with all applicable environmental laws and MPCL's Social Environment Health & Safety Policy. MPCL people are expected to report any known violation of an environmental or safety law or regulation by a third party to their supervisor

MPCL also has Social, environment, health and safety (SEHS) Policy (***Refer Annex K***) and Human Resource (HR) Policy. The SEHS Policy ensures to safeguard their commitment and strive to achieve and sustain excellence in Environment, Social, Occupational Health and Safety performance by ensuring the goals that construct their corporate Social Environmental Health and Safety (SEHS) policy.

MPCL employees and Contractors will need training and awareness to achieve the SEHS Policy requirements.

8.3 ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM (ESMS)

8.3.1 Introduction

MPCL will need to develop the following elements of an ESMS:

- Management programs that, in sum, will describe mitigation and performance improvement measures and actions that address the identified environmental and social risks and impacts of the project.;
- Build organizational capacity and competency through trainings;
- Implement and train people on emergency preparedness and response;
- Develop a system of stakeholder engagement and
- Monitor and review of the entire mechanism.

8.3.2 Roles and Responsibilities

MPCL will have ultimate responsibility for implementing the provisions of the ESMS. This role will include the on-going management of environmental impacts, implementing the commitments on social and environmental performance, monitoring of contractor performance as well as development of mechanisms for dealing with HSSE related issues.

MPCL will also ensure that the activities of its contractors are conducted in accordance with 'good practice' measures, implementation of which will be required through contractual documentation. In order to facilitate this, and to demonstrate commitment to the ESMP, MPCL and the Contractor will conduct regular internal site inspections, the results of which will be documented.

8.4 SUPPORTING MANAGEMENT PLANS

As a part of the ESMP, the ***Annex L*** includes the Framework management plans for:

- Stakeholder engagement and Grievance Redressal;
- Construction labour management;
- Emergency response and preparedness;
- Health and safety management consisting of occupational, community and traffic safety

8.5 PROJECT ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.5.1 Introduction

The ESMP has been formulated to mitigate potential environmental and social impacts for both the construction and operations phases of the MPCL wind energy project in accordance to IFC Performance Standards 1. The proposed ESMP recommends control measures to be adopted during the construction and operation phases and can be referred from ***Table 8.1***.

8.5.2 Structure of the ESMP

The ESMP discusses the aspect/potential impacts and specific action to be taken for its management. It refers to the responsible person ensuring commitment for implementation and means of verifying whether the same has been implemented. The timing and frequency of monitoring along with the supervision responsibility and reporting requirements are also provided.

8.5.3 Project Commitments

As a part of the ESMP, MPCL has committed to recognizing the existing rights of the local communities in Qasim Burfat Goth and Bacho Jhakro Goth within the project site of 1,553 acres. MPCL will not restrict or curtail the rights of these communities, in terms of residence, livelihoods, movements, access to cultural sites or community infrastructure that may be located within the site. In the event of any need to use land occupied by the community or restrictions on certain land use, MPCL will provide the local community with access to a grievance mechanism.

8.5.4 Contractor Management

MPCL management will be responsible for the performance of all contractors and ensuring that all MPCL commitments and policy requirements are translated into 'contractors' requirements and that these requirements are implemented to their full intent and extent.

Contractors will be responsible for implementation of and adherence to all the mitigation measures outlined in this ESMP. All contractors will be required to comply with the provisions of the ESMP and with any HSSE related codes of conduct required by MPCL. MPCL will require all contractors to introduce regular environmental inspection and reporting to the concerned departments to enable monitoring of their performance.

8.5.5 ESMP Audit, Reporting and Corrective Action

The aim of the ESMP is to be live and allow environmental and social performance to be monitored. MPCL needs to form a system through which they can audit the implementation of ESMP, check the robustness of the ESMP, introduce changes where required and take corrective actions.

8.5.6 Change Management Principles

It is possible that changes may occur to the project during the it's lifecycle and accordingly modifications will need to be introduced to the ESMP. MPCL has to form a change management process to deal with any such changes.

Table 8.1 Proposed Environmental and Social Management Plan for the MPCL Wind Energy Project

Environmental/ Social Resource	Aspect, Potential impact/issue	Updated IEE ref	Specific Actions	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase		
										Pre-Construction	Construction	Operation
Land use	Change in land use	6.3.1	• Construction camps and construction camps to be kept minimum 1 km away from settlements	EPC Contractor	Discussion with EPC, Visual inspection	Once at each location where camps will be set up	EHS Manager and EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☒	☒	☐
			• Vegetation removal from the Project site will be done only for essential areas only i.e. WTG Sites, Access road, Construction camps, etc.	EPC Contractor	Visual inspection	Twice at each location (before and after the work)	EHS Manager and EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☒	☒	☐
Landscape	Visual impact	6.3.2	• Plantations near settlements which can buffer or screen the view to a certain extent;	EPC and O & M contractors along with MPCL	Visual inspection and survival rate assessment	Annual (post-monsoon season)	EHS Manager and EPC EHS Team	EHS Manager	Annual internal report of plantation and survival rate	☐	☒	☒
			• Landscape development around the wind turbine site with the participation of the local community.	Community Relations Officer, EHS Manager, EPC and O&M Contractor	Visual inspection	Annual (post-monsoon season)	Community Relations Officer	EHS Manager	Annual report to management on participation and achievements	☐	☒	☒
Soil environment	Loss of Topsoil stratum and soil erosion	6.3.3	• Preservation of the top stratum (WTG Sites, Access road, Construction camps, etc.)	EPC Contractor	Visual inspection	Twice at each location (during excavation and after reinstatement of site)	EHS Manager and EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
			• Use of top stratum in various levelling and filling activities	EPC	Visual inspection	Twice at each location (during excavation and after reinstatement of site)	EHS Manager and EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
			• Topography to be restored to the extent possible and re-vegetated for slope stabilization and to prevent soil erosion	EPC	Visual inspection	Twice at each location (during excavation and after reinstatement of site)	EHS Manager and EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
			• Progressively rehabilitate or stabilise disturbed areas to prevent erosion;	EPC	Visual inspection	Twice at each location (during excavation and after reinstatement of site)	EHS Manager and EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
	Soil compaction		• Transportation vehicles allowed to run through designated haulage roads	EPC along with Transportation sub-contractors/drivers	Visual inspection	Monthly (based on activity areas)	EPC On-site Supervisor	EHS Manager	Mapping of designated haulage roads and monthly internal report from EPC to EHS Manager	☐	☒	☐
			• Parking for construction equipment and transportation vehicles at specified areas only	EPC along with Transportation sub-contractors/drivers	Visual inspection	Monthly	EPC On-site Supervisor	EHS Manager	Mapping of designated parking areas and monthly internal report from EPC to EHS Manager	☐	☒	☐

Environmental/ Social Resource	Aspect, Potential impact/issue	Updated IEE ref	Specific Actions	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase		
										Pre-Construction	Construction	Operation
			• Transportation vehicles and construction equipment to be maintained on regular basis for preventing oil/fuel leaks	EPC along with Transportation sub-contractors/drivers	Visual inspection	Monthly	EHS Manager and EPC EHS Team	EHS Manager	Monthly internal report from EPC to EHS Manager	☐	☒	☐
	Contamination of soil		• Fuels and oils to be stored in containers in areas with impervious surfaces and surrounded by dyke walls.	EPC, O &M and MPCL	Visual inspection	Planning during design phase and quarterly inspection	EHS Manager and EPC/ O&M EHS Team	EHS Manager	Quarterly internal report from EPC/O&M to EHS Manager	☐	☒	☒
			• DG sets placed on platforms/impervious surface	EPC, O & M and MPCL	Visual inspection	Once during installation of DG sets. In case of moving DGs, during each site change	EHS Manager and EPC/ O&M EHS Team	EHS Manager	Quarterly internal report from EPC to EHS Manager	☐	☒	☒
			• Drip containments should be available and used in case of leaks/ transfers;	EPC, O & M and MPCL	Visual inspection	Quarterly	EHS Manager and EPC/ O&M EHS Team	EHS Manager	Quarterly internal report from EPC/ O&M to EHS Manager	☐	☒	☒
			• An unloading and loading protocols should be prepared for oil and used oil respectively	EPC and O&M	Documentation review	Once	EPC/ O&M EHS Team	EHS Manager	Protocol from EPC/O&M to EHS Manager	☐	☒	☒
			• Workers trained to prevent/contain spills and leaks	EPC and O&M	Training records	Quarterly	EPC/ O&M EHS Team	EHS Manager	Training records and material to EHS Manager (internal reporting)	☐	☒	☒
	Disposal of debris		• Implementation of construction materials inventory management system	EPC	Documentation review and visual inspection	Quarterly	EPC Site Supervisor and EHS Team	EHS Manager	Quarterly material inventory to MPCL	☐	☒	☐
			• Construction debris stored and used for levelling, filling and slope stabilization within WTG sites or access/internal road	EPC	Documentation review and visual inspection	Quarterly	EPC Site Supervisor and EHS Team	EHS Manager	Quarterly debris generation and utilisation report to EHS Manager	☐	☒	☐
			• Recyclables sold to dealers	EPC and O&M	Documentation review and visual inspection	Quarterly	EPC/O&M EHS Team	EHS Manager	Quarterly report of recyclable waste generation and disposal to EHS Manager	☐	☒	☒
	Disposal of solid waste generated		• Collection system/dustbins for solid waste;	EPC and O&M	Visual inspection and inventory check	Quarterly	EPC/O&M EHS Team	EHS Manager	Internal report to EHS Manager (Quarterly)	☐	☒	☒
			• Proper storage and handling of solid waste;	EPC and O&M	Visual inspection	Quarterly	EPC/O&M EHS Team	EHS Manager	Internal report to EHS Manager (Quarterly)	☐	☒	☒
			• Recyclables sold to dealers;	EPC and O&M	Documentation review	Quarterly	EPC/O&M EHS Team	EHS Manager	Internal report to EHS Manager (Quarterly)	☐	☒	☒
			• Food waste to be composted in a pit dug away from water bodies and kept covered to prevent flies; fenced to keep away wild animals	EPC and O&M	Visual inspection	Monthly	EPC/O&M EHS Team	EHS Manager	Internal report to EHS Manager (Quarterly)	☐	☒	☒

Environmental/ Social Resource	Aspect, Potential impact/issue	Updated IEE ref	Specific Actions	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase		
										Pre-Construction	Construction	Operation
Water Environment	Changes in Drainage pattern	6.3.4	• Topography changes to be avoided	EPC	Visual inspection	Twice at each location (during excavation and after reinstatement of site)	EHS Manager and EPC EHS Team	EHS Manager	Inspection report of each site to EHS Manager	☐	☒	☐
			• Any temporary drainage diversion should be restored back post construction	EPC	Visual inspection	Twice at each location (during excavation and after reinstatement of site)	EHS Manager and EPC EHS Team	EHS Manager	Restoration report of each site to EHS Manager	☐	☒	☐
			• Limit vegetation removal to the extent possible;	EPC	Design and planning	Twice at each location (before and after the work)	EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☒	☒	☒
	Siltation of water courses		• Installation of erosion and sediment control measures as bunds prior to vegetation clearance and start of constructions work	EPC	Visual inspection	Prior to rainy season	EPC Site Supervisor and EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☒	☒	☐
			• Top soil strata storage away from natural drainage channels and water courses	EPC	Visual inspection	Prior to rainy season	EPC Site Supervisor and EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
			• Planning and preparation in advance for the rains (especially July month) to avoid and/ or minimize sediment and contaminated run-offs	EPC	Documentation review and Visual inspection	Prior to rainy season	EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
			• Progressively rehabilitate or stabilise disturbed areas to prevent erosion;	EPC	Visual inspection	Post reinstatement of each activity area	EHS Manager and EPC EHS Team	EHS Manager	Reinstatement completion report of each site from EPC to EHS Manager	☐	☒	☐
	Entry of pollutants to water courses and water contamination		• Providing a bunded designated parking bay for transportation vehicles/ equipment away from natural drainage channels;	EPC	Visual inspection and planning documents review	Planning stage and quarterly during construction phase	EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☒	☒	☐
			• Provision of septic tanks and soak pits for wastewater from construction camps;	EPC	Visual inspection and planning documents review	Planning stage and monthly inspection	EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
			• Use of licensed contractors for management and disposal of sludge;	MPCL	Documentation review	Quarterly	EHS Manager	MPCL	Legal compliance report to MPCL	☐	☒	☒
			• Workers trained for proactive use of waste bins/designated areas for waste;	EPC and MPCL	Training records review	Half Yearly	EPC/O&M EHS Team	EHS Manager and HR Manager	Internal written report and training records to MPCL HR	☐	☒	☒
			• Surface water run-offs from impervious and developed areas can be diverted through use of swale drains for infiltrating/storing;	EPC and O&M	Design documents review and visual inspection	Planning stage, Pre- and post-monsoon	EHS Manager with Team Leader Civil	MPCL	Internal written report to EHS Manager	☐	☒	☒
Air Environment	Dust generation	6.3.5	• Keep areas of open excavation to a minimum;	EPC	Visual inspection	During civil works and activity areas reinstatement	EPC EHS Team	EHS Manager	Internal written report to EHS Manager	☐	☒	☐
			• Minimise stockpiling by coordinating excavations, spreading, re-grading, compaction and importation activities;	EPC	Visual inspection	During civil works and activity areas reinstatement	EPC EHS Team	EHS Manager	Internal written report to EHS Manager	☐	☒	☐

Environmental/ Social Resource	Aspect, Potential impact/issue	Updated IEE ref	Specific Actions	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase		
										Pre-Construction	Construction	Operation
			• Covering of construction material during transportation	EPC and transportation sub-contractors	Visual inspection	Weekly	EPC EHS Team	EHS Manager	Internal compliance report to EHS Manager	☐	☒	☐
			• Storage of construction materials in shed	EPC	Visual inspection	Fortnightly	EPC EHS Team and Site Supervisor	EHS Manager	Internal compliance report to EHS Manager	☐	☒	☐
			• Cease or phase down work if excess fugitive dust is observed, investigate source and take suppression measures;	EPC and MPCL	Visual inspection	As the situation arise	EPC EHS Team and Site Supervisor	EHS Manager	Internal reporting of incidents and actions taken to EHS Manager	☐	☒	☐
			• Restrict traffic to defined roads and implementing speed limits;	EPC, transportation sub-contractors and MPCL	Planning documents review and visual inspection	Fortnightly	EPC EHS Team and Logistics Team	EHS Manager	Internal compliance report to EHS Manager	☐	☒	☒
	Exhaust emissions		• Regular maintenance of equipment and vehicles to ensure it remains in good condition	EPC and transportation sub-contractors	Visual inspection and Pollution control certificates	Once for each vehicle prior to entry to site and after that quarterly	EPC EHS Team and Logistics Team	EHS Manager	Internal inspection report to EHS Manager	☐	☒	☒
			• Provision of adequate stack height for DG sets	EPC and O&M	Visual inspection	Prior to installation	EPC/O&M EHS Team	EHS Manager	Internal inspection report to EHS Manager	☐	☒	☒
			• Prevent idling of vehicles	EPC and transportation sub-contractors	Visual inspection	Fortnightly	EPC EHS Team	EHS Manager	Internal inspection report to EHS Manager	☐	☒	☐
Noise Environment	Increased ambient noise	6.3.6	• Construction camps to be kept minimum 1 km away from settlements	MPCL	Visual inspection	Prior to setting up of camps	EPC	EHS Manager	Mapping of location wrt settlements and report to EHS Manager	☒	☒	☐
			• Location of noise generating equipment away from settlements	EPC	Planning documents review and Visual inspection	Prior to installation	EPC	EHS Manager	Mapping of location wrt settlements and report to EHS Manager	☐	☒	☐
			• Set working hours and any work outside this time should be restricted to activities not generating noise	MPCL	Records review	Fortnightly	EPC	EHS Manager	Daily working hours records summary to EHS Manager (Monthly)	☐	☒	☐
			• Well-maintained vehicle to reduce noise generation; Equipment noise should be 85 dB(A) at 1 m from the source in line with WB/IFC EHS guidelines;	EPC and transportation sub-contractors	Noise levels monitoring	Quarterly	EPC/ O&M EHS Team	EHS Manager	Monitoring reports to EHS Manager	☐	☒	☒
			• Regular maintenance of construction equipment	EPC	Maintenance records	Quarterly	EPC EHS Team	EHS Manager	Summary report of maintenance to EHS Manager	☐	☒	☐
			• Low noise equipment shall be used as far as practicable; DG sets to be used with acoustic enclosures; Minimal use of vehicle horns in the Project area shall be encouraged	EPC	Visual inspection	Monthly	EPC/O&M EHS Team	EHS Manager	Internal compliance statement to EHS Manager	☐	☒	☒

Environmental/ Social Resource	Aspect, Potential impact/issue	Updated IEE ref	Specific Actions	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase		
										Pre-Construction	Construction	Operation
			• Regular maintenance of WTGs	O&M	Maintenance records and visual inspection	As per maintenance schedule	O&M EHS Manager	EHS Manager	Maintenance records review report to EHS Manager	☐	☐	☒
			• Periodic monitoring of noise near to the sources of generation to ensure compliance with design specification;	MPCL	Ambient noise levels monitoring	Once every month (day and night time)	EHS Manager	MPCL	Monitoring report	☐	☐	☒
			• Plantation that block line of site between WTGs direction should be developed near potentially impacted settlements to provide a noise barrier effect;	O & M contractors along with MPCL	Visual inspection and survival rate assessment	Annual (post-monsoon season)	EHS Manager and EPC EHS Team	EHS Manager	Annual internal report of plantation and survival rate	☐	☐	☒
			• In case complaints of higher noise levels and associated discomfort are received from the inhabitants of nearby settlements, consider erecting noise barriers near to the receptor.	Community Relations Officer, EHS Manager, EPC and O&M Contractor	Consultation	On-going process	Community Relations Officer	EHS Manager	Annual report to management on participation and achievements	☐	☒	☒
Ecological environment	Loss of natural vegetation	6.4.2	• Vegetation removal from the Project site will be done only for essential areas only i.e. WTG Sites, Access road, Construction camps, etc.	EPC	Visual inspection	Weekly during civil works	EHS Manager and EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
	Loss and disturbance of habitat		• Construction and related activities footprint to be confined to specific areas	EPC and MPCL	Review of project design, visual inspection	Monthly during civil works	EHS Manager and EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
			• A minimum possible number of routes should be authorized for use during construction by the labourers and staff;	EPC and MPCL	Review of internal road network design and visual inspection	Fortnightly	EHS Manager and EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
			• Temporary barriers should be installed on excavated areas;	EPC	Site safety provisions review during civil works and visual inspection	Daily by EPC EHS Team and Weekly by EHS Manager	EHS Manager and EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
			• Awareness Programmes regarding wildlife in the area among staff and labour	MPCL	Training records review	Half Yearly	EPC/O&M EHS Team	EHS Manager and HR Manager	Internal written report and training records to MPCL HR	☐	☒	☒
			• Strict prohibition implemented on trapping, hunting or injuring wildlife	MPCL	Signage, awareness campaign, visual inspection	During induction and half yearly	EPC/O&M EHS Team	EHS Manager and HR Manager	Internal written report and training records to MPCL HR	☐	☒	☒
			• Food waste should be collected and disposed in a manner that it does not attract wild animals;	MPCL and EPC	Disposal mechanism review	Fortnightly	EPC/O&M EHS Team	EHS Manager	Internal written report to EHS Manager	☐	☒	☒
			• Strict prohibition on use of fuel wood and shrubs as fuel;	MPCL	Signage, awareness campaign, visual inspection	Fortnightly	EPC/O&M EHS Team	EHS Manager	Internal written report to EHS Manager	☐	☒	☒
			• Stage-wise re-vegetation with local species should be done immediately after completion of construction work	MPCL	Visual inspection	As per WTGs and other activity areas reinstatement schedule	EPC EHS Team	EHS Manager	Internal written report to EHS Manager	☐	☒	☐
	Disturbance to Birds and Bird collision risk		• All WTGs being erected at a distance of more than 400 m to reduce the risk of avian collision and to give the birds a wider corridor for the access in the project area	MPCL				EHS Manager		☐	☒	☐

Environmental/ Social Resource	Aspect, Potential impact/issue	Updated IEE ref	Specific Actions	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase		
										Pre-Construction	Construction	Operation
			• The WTG towers will be identical thus increasing visibility for the birds	MPCL				EHS Manager		☐	☒	☒
			• Internal lines from each WTG to the Project Sub-station will be underground thus reducing collision chances.	MPCL				EHS Manager		☐	☒	☐
			• Flash lamps on the WTGs will prevent bird collision at nights	EPC and O & M contractor	Functioning of flash lamps	Fortnightly	EPC/O&M EHS Team	EHS Manager	Internal written report to EHS Manager	☐	☐	☒
			• Regular checking of the vacuums or holes in the towers to reduce the risk of birds nesting in the WTGs	O & M contractor	Visual inspection	Fortnightly	O&M EHS Team	EHS Manager	Internal report to EHS Manager	☐	☐	☒
			• Bird mortality count in the immediate vicinity is proposed to establish any link between the wind turbines and birds mortality for two years starting from the commissioning of the wind farm	MPCL	Visual inspection	As per the recommendation of Bird Monitoring Study	O&M EHS Team	EHS Manager	Internal report to EHS Manager	☐	☐	☒
Socio-economic environment	Settlements and Community Access	6.5.1	• Undertake household survey to establish project baseline and existing rights of settlements;	MPCL	Baseline household survey and third party consultations	Quarterly during construction and bi-annually during the operations phase	MPCL with Third Party Expert	MPCL	External evaluation and monitoring reports	☒	☒	☒
			• Avoidance of any physical impacts on the settlements with commitment to sustain existing activity in the construction and operations phase;	MPCL	Consultation with local people within project site in order to develop a documented process; Review of grievances		MPCL with Third Party Expert	MPCL		☒	☒	☒
			• Access to grievance redressal process in case of any future eviction or restriction that may be imposed along with mutually acceptable safeguards	MPCL	Regular review of grievances and access to community through third-party monitoring		MPCL with Third Party Expert	MPCL		☒	☒	☒
	Livelihood Impacts	6.5.2	• Undertake a socio-economic survey of land-users to develop a livelihoods restoration plan that is to be monitored over the project lifecycle;	MPCL	Socio-economic survey	At pre-construction stage	MPCL with Local Authorities	MPCL	Progress of Livelihood Restoration Plan	☒	☒	☐
			• Allow access to natural resources for the local community to practice agriculture, grazing, fuel wood collection etc.	MPCL	Monitoring of onsite livelihood activities	6 monthly	MPCL and Third Party Expert	MPCL	Report on Grievances			
			• All direct impacts on agriculture or assets to be compensated by means of replacement value as per the Government of Pakistan Land Compensation Policy and Act and as discussed with .	MPCL	Agreements between MPCL and land users	Grievances and any compensation records	MPCL with Local Authorities	MPCL	Report on Grievances	☒	☒	☐
	Impact on community use and access of land		• Engagement with the local community to understand the most commonly accessed regions/areas on the wind farm site with respect to grazing, fodder collection, firewood collection etc;	MPCL	Communication of lands demarcated for grazing, fuel-wood collection and other community use to all the settlements	Quarterly	EPC and MPCL	Community Development Officer	Internal records of all communications	☒	☒	☐
			• Land area not required in O&M phase will be allowed to grazing, cultivation or any other purpose of local community;	MPCL	Community grievances	On-going	O&M Contractor	Community Development Officer	Internal records of all communications	☐	☐	☒

Environmental/ Social Resource	Aspect, Potential impact/issue	Updated IEE ref	Specific Actions	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase		
										Pre-Construction	Construction	Operation
	Influx of construction workers, set up of construction camps, social conflicts, stress on local infrastructure	6.5.3	• MPCL will ensure its "Code of Conduct" is implemented throughout the construction phase. This will take into account (a) the predominantly rural community in the vicinity; (b) health & safety aspects; (c) restrictions on activities – Dos and Don'ts; (d) construction camp regulations; (e) briefing on the local area/immediate vicinity etc. (f) zero tolerance of illegal activities by construction personnel including: unlicensed prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting. These requirements will be shared with all contractors for induction of their employees/supervisors/workers; (Refer Annex K for MPCL code of conduct)	MPCL	Code of conduct implementation Training of all supervisors, workers and labourers on community health & safety aspects, Code of Conduct and any other local regulations;	On-going	EPC and O&M Contractors	MPCL HR	Reporting of any incident of non-following to MPCL HR	☐	☒	☒
			• Construction camps should not be located within close proximity of village settlements (Refer to Annex L on Construction Labour Management Plan);	MPCL	Visual inspection	Prior to setting up of camps	EPC	EHS Manager	Mapping of location wrt settlements and report to EHS Manager	☒	☒	☐
			• Construction camp should be provided with basic amenities and sanitation facilities to avoid pressure on local natural resources (water bodies, fire wood) and infrastructure (drinking water, health care etc);	MPCL and EPC	Monitor contractors for compliance on labour laws as well as PS2.	Monthly	EPC EHS Team	EHS Manager	Monthly report to EHS Manager	☐	☒	☐
			• Iinflux/in-migration management measures should be developed for the Project development in the wind corridor in consultation with the relevant local authorities and other wind energy developers setting out measures to manage in-migration so as to avoid adverse impacts on local communities	MPCL with other wind energy projects developers	Ensure that all construction camps and other temporary structures are dismantled to minimize the risk of encroachment	Quarterly	Community Development Officer	MPCL	Maintaining records of any such consultation and follow-ups	☐	☒	☐
			• Social interactions between migrant labour and the host community will be closely monitored	MPCL	The project will keep the local administration and police informed about the details of outside labourers as also a list should be provided to the local administration in a format provided by the local labour laws.	On-going	EPC contractor	Community Development and Security Officer	Maintaining records of any incident.	☐	☒	☐

Environmental/ Social Resource	Aspect, Potential impact/issue	Updated IEE ref	Specific Actions	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase		
										Pre-Construction	Construction	Operation
			• The community will be consulted at regular intervals and any complaints or concerns with respect to labour should be addressed without delay	MPCL	Linkage of Communication, Disclosure and Grievance Redressal Mechanism to also cover labourers so that any concerns on working conditions and/or contractor mal-practices can be managed	On-going	EPC Contractor	Community Development Officer	Maintaining records of community consultations, grievances and Redressal	☐	☒	☐
			• Workers will be trained on behavioural expectations of the local community, including knowing and respecting prevalent socio- cultural systems of the host community etc.	MPCL	Training records	Quarterly	EPC and O&M EHS Team	EHS Manager and MPCL HR	Maintaining records of trainings conducted	☐	☒	☒
			• Conduct routine medical check-ups, health and safety training and sensitization programmes to raise awareness about STDs, and HIV amongst the labourers.	MPCL	Medical records, Awareness programmes	Half Yearly	EPC EHS Team	EHS Manager and MPCL HR	Maintaining records of trainings conducted	☐	☒	☐
			• Where possible, maximise procurement of goods and supplies catering to the construction camps from the local markets.	MPCL and EPC			EPC Contractor	Community Development Officer	Maintain records of any such procurement	☐	☒	☐
			• Local community development will be undertaken in consultation with affected communities and on the basis of a needs assessment.	MPCL	Consultation	On-going	MPCL	Community Development Officer	Maintain records of consultations and outcome	☐	☒	☒
	Local economy and Employment	6.5.4	• Develop an Employment Plan to define requirements and procedures to be followed by all Project personnel when identifying and developing employment opportunities, managing employees, recording and reporting employment data, terminating work contracts, and other labour-related issues;	MPCL	Employment opportunities, managing employees, recording and reporting employment data, terminating work contracts, and other labour-related issues	Monthly	EPC and O&M Contractor	MPCL HR	Monthly records to be maintained	☐	☒	☒
			• Unskilled and semi-skilled labour will be preferentially hired from the local communities	EPC and O&M	Records of employment to local communities	Monthly	EPC and O&M Contractor	MPCL HR	Monthly records to be maintained	☐	☒	☒
			• Establish skill development programs to develop employability of the local population	MPCL with EPC and O&M	Skill development program for local people	On-going	MPCL	Community Development Officer	Maintaining records of skill development programs developed and outcome	☐	☒	☒
	Cultural Environment- Conflict of culture Regional bias	6.5.5	• As far as practicable, maximise the number of local people employed, with a particularly focus on available unskilled roles	EPC ad O&M	Employment records	Monthly	EPC	MPCL HR	Monthly record of total unskilled workers and local participation	☐	☒	☐

Environmental/ Social Resource	Aspect, Potential impact/issue	Updated IEE ref	Specific Actions	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase		
										Pre-Construction	Construction	Operation
			• Establishment of construction camps by construction contractor away from Habitats. The camps will have civic amenities for construction labours. –(Refer to Annex L on Construction Labour Management Plan);	MPCL and EPC	Discussion with EPC, Visual inspection	Once at each location where camps will be set up	EHS Manager and EPC EHS Team	EHS Manager	Internal written report from EPC to EHS Manager	☐	☒	☐
			• Identify any sites or features of importance for cultural heritage. This will include both tangible features or sites and locations of intangible cultural importance;	MPCL	Field surveys and consultation with local communities will be undertaken to	Prior to construction activities at sites	MPCL	Community Development Officer	Maintaining records of field surveys and consultations	☐	☒	☐
			• If a cultural heritage site is damaged in any way, this will be treated as an incident, investigated and managed in accordance with the approved incident management procedures established for the Project;	MPCL	Incidents reporting	As and when required	EPC Contractor	Community Development Officer with Local Government Authorities	Maintaining incident records and actions taken	☐	☒	☐
			• Develop and implement a Chance Finds Procedure followed in accordance with IFC Performance Standard 8. If any finds are encountered, work should cease immediately and temporary protection of the area will be established. The find will be reported and relevant specialists will be appointed to determine an appropriate course of action;	MPCL	Incidents reporting	As and when required	EPC Contractor	Community Development Officer with Local Government Authorities	Maintaining incident records and actions taken	☐	☒	☐
			• Induction training for all personnel will include appropriate cultural awareness training.	MPCL with EPC and O&M Contractors	Trainings and awareness programs conducted	At the time of induction	EPC and O&M	MPCL HR and Community Development Officer	Maintaining records of induction trainings conducted	☐	☒	☒
	Community Health and Safety: Increased Road Traffic	6.5.6	• Emphasizing safety aspects among drivers, particularly with regard to safe driving speeds	MPCL and transportation sub-contractors	Training and awareness	Half Yearly	EPC and O&M	EHS Manager and MPCL HR	Maintaining records of training and awareness programmes	☐	☒	☒
			• Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure	MPCL, EPC and transportation sub-contractors	Vehicle maintenance records, accidents records,	Quarterly	EPC and O&M Logistics Team	EHS Manager	Internal written report to EHS Manager	☐	☒	☒
			• Collaboration with local communities and responsible authorities to improve signage, visibility and awareness of traffic and pedestrian safety	MPCL with EPC and O&M Contractor	Signage, traffic awareness	Quarterly	MPCL in consultation with local authorities	EHS Manager	Maintaining records of signage, traffic awareness	☐	☒	☒
			• Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents	MPCL	First aid delivery records, accidents reporting	Fortnightly	EPC and O&M EHS Team	EHS Manager	Internal written reports of near misses, incidents, accidents and first aid delivery to EHS Manager	☐	☒	☒
			• Communicate and regularly educate members of the local community on the technical aspects of the construction and operations along with their community safety and nuisance implications;	MPCL	Periodic awareness programmes on project and community safety and nuisance implications	Quarterly during construction and semi-annually during operations	MPCL	Community Development Officer and EHS Manager	Maintaining records of awareness programmes	☐	☒	☒

Environmental/ Social Resource	Aspect, Potential impact/issue	Updated IEE ref	Specific Actions	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase		
										Pre-Construction	Construction	Operation
			• Ensure that the main contractors are committed to health and safety of workers as well as the community and their property and will communicate the precautions that will be taken.	EPC and O & M contractors	Adherence with respective EHS policies as well as MPCL EHS policy	On-going	EPC and O&M	EHS Manager	Maintaining records of any deviation and corrective actions taken. Quarterly report to EHS Manager	☐	☒	☒
			• Exposure visits of community representatives to construction sites to increase awareness on community H&S aspects;	MPCL	Visit of community to construction sites and awareness program	Need to be determined based on consultation with EPC and community	MPCL	EHS Manager and Community Development Officer	Maintaining records of exposure visits	☐	☒	☐
			• Review the construction phase accident and incident records	EPC Contractor	Construction phase incidents and accidents records	Monthly	EPC EHS Team	EHS Manager	Monthly internal written report to EHS Manager and follow-up actions	☐	☒	☐
			• Training of contractors and their labourers on precautions to be taken to minimize nuisance for the local community	MPCL with EPC and O&M Contractor	Awareness on community relationship	Quarterly during construction and semi-annually during operations	EHS Team	Community Development Officer and EHS Manager	Maintaining records and quarterly reports to MPCL HR	☐	☒	☒
	Prevalence of diseases		• Health screening of workers, ,	EPC and O&M	During induction	Once	EPC and O&M EHS Team	EHS Manager	Medical records to be provided to EHS Manager	☐	☒	☐
			• Undertaking health awareness among communities	MPCL	Health camps and awareness camps	Periodic (frequency need to be determined based on need based assessment)	Community Development Officer and EHS Manager	MPCL	Need based assessment and camps records to be maintained by Community Development Officer	☐	☒	☒
			• Avoiding presence of unsanitary conditions.	EPC and O&M	Visual inspection	Fortnightly	EPC and O&M EHS Team	EHS Manager	Internal written report to EHS Manager	☐	☒	☒
			• Implementation of vector control programs	EPC and O&M	Vector control program monitoring	Periodic (frequency need to be determined as per requirement at site)	Community Development Officer and EHS Manager	MPCL	Internal written report to EHS Manager	☐	☒	☒
	Operational risks - Shadow flicker; Blade glint; Blade throw; Electromagnetic interference and radiation;		• Communicate about the technical aspects of the construction and operations along with their community safety and nuisance implications;	MPCL	Communication documentation	On-going	EPC and O&M EHS Team	Community Development Officer and EHS Manager	Maintaining records of consultation	☐	☒	☒
			• There will be close monitoring through engagement with residents during the operational phase where there are predicted impacts from shadow flicker	MPCL	Communication documentation	On-going	EPC and O&M EHS Team	Community Development Officer and EHS Manager	Maintaining records of grievances	☐	☐	☒

Environmental/ Social Resource	Aspect, Potential impact/issue	Updated IEE ref	Specific Actions	Responsibility for ensuring mitigation implementation	Means of verification that mitigation has been met	Timing and frequency of monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting requirements	Phase		
										Pre-Construction	Construction	Operation
			• Consult the concerned stakeholders to formulate appropriate mitigation measures such as installing vegetative screens and integrate the same as part of project design and implement the same;	MPCL	Communication documentation	On-going	EPC and O&M EHS Team	Community Development Officer and EHS Manager	Maintaining records of grievances and follow up corrective actions	☐	☐	☒
			• Monitor the need for and as necessary implement additional mitigation measures in addition to those recommended in the Planning and Construction phase EMPs to mitigate shadow flicker issue at individual WTG locations, if necessary	MPCL and O & M	Review and implementation of additional measures	As per the need arises	EPC and O&M EHS Team	Community Development Officer and EHS Manager	Maintaining records of additional mitigation measures and their effectiveness	☐	☐	☒
			• Regularly consult and obtain affected stakeholder feedback to formulate appropriate corrective action.	MPCL	Communication documentation	On-going	EPC and O&M EHS Team	Community Development Officer and EHS Manager	Maintaining records of consultation	☐	☐	☒
Cumulative Impacts	Increased ambient Noise	6.6.3	• Periodic monitoring of noise near to the sources of generation to ensure compliance with design specification;	O&M Contractor	Noise level monitoring near WTGs	Monthly once during day and night time	O&M EHS Team	EHS Manager	Monthly monitoring reports to EHS Manager	☐	☐	☒
			• Periodic monitoring of ambient noise levels in nearby noise sensitive receptors to ensure compliance with ambient noise level guidelines and construction of noise barriers to attenuate noise, in case of complains received from the local population	MPCL	Community Relations Officer, EHS Manager, EPC and O&M Contractor	Consultation	On-going process	Community Relations Officer	EHS Manager	☐	☐	☒
	Bird and Bat collision	6.6.4	• Mitigation measures identified in detailed bird study should be implemented	MPCL	Visual inspection	As per the recommendation of Bird Monitoring Study	O&M EHS Team	EHS Manager	Internal report to EHS Manager	☐	☒	☒

Note: Decommissioning phase (WEP closure, dismantling of equipment, transportation and site restoration) related environmental and social management plan is not presented in the above. Decommissioning phase may result in environmental and social impacts, however, due to no clarity of the project after expiry of energy purchase agreement and land lease is known at this stage. Though in case of decommissioning, process for the plant decommissioning to be developed prior to the culmination of the MPCL WTGs operational life and adequate decommissioning plan need to be formulated in accordance with the regulatory requirements as well as international guidelines. Environmental and social due diligence before and after decommissioning phase also need to be conducted to ensure no environmental and social liability of MPCL after leaving the site.

9 CONCLUSION

This updated IEE has assessed the environmental and social impacts that are likely to arise due to the construction, operation and decommissioning of 50 MW WEP, in the Gharo wind corridor of Thatta taluka and district of Pakistan. The purpose and aim of this report is to update the existing IEE report of 2009 and to provide information about environmental and social impact and management of the proposed MPCL Project and its components.

The project and its key components (i.e. the access road, the sub-station and the internal transmission line) are likely to generate some adverse environmental impacts on baseline parameters such as land-use, ecology, noise, traffic etc. due to the nature of activities in the immediate rural vicinity of WTGs. The social impacts from the project are assessed to be generally beneficial with regards to local area development. The impact assessment outcome is summarized in ***Table 9.1.***

The Environmental and Social Management Plan (ESMP) describes mitigation measures for impacts specific to project components and also discusses the implementation mechanism. Overall, mitigation measures for potential impacts on the social and environmental baseline have been specified through:

- Application of environmental, health & safety and social guidelines as specified in the reference framework;
- Implementation of a transparent stakeholder engagement and grievance redressal processes;
- Incorporation of social, environmental and ecological sensitivities into the project implementation; and
- Ensuring compliance to applicable social and environmental regulations.

The mitigation measures outlined above and included in the Environmental and Social Management Plan will provide a basis for ensuring that the potential beneficial and adverse impacts associated with the establishment of Project are enhanced and mitigated respectively.

To conclude the IEE study together with the ESMP and implementation of the recommended management actions will help MPCL in complying national/state regulatory framework; meet the requirements of IFC performance standards and achieve sustainability.

Table 9.1 Impact Assessment Outcomes

S. No.	Project activities/Impacts	Significance of Impact	
Pre-Construction and Construction Phase		**With Embedded Controls**	**With Additional Mitigation Measures [1]**
1.	Change in landuse	Minor	Negligible
2.	Soil and land environment	Minor	Negligible
3.	Water environment	Minor	Negligible
4.	Air environment	Minor	Negligible
5.	Noise environment	Minor	Negligible
6.	Ecological environment- loss of vegetation	Minor	Negligible
7.	Ecological environment- loss and disturbance of habitat	Minor	Negligible
8.	Social and demographic structure	Minor	Negligible
9.	Cultural environment	Negligible	Negligible
10.	Community health and safety	Minor	Negligible
Operation Phase			
11.	Change in landuse	Minor	Negligible
12.	Landscape-visual impacts	Minor	Negligible
13.	Soil and land environment	Negligible	Negligible
14.	Water environment	Negligible	Negligible
15.	Air environment	Negligible	Negligible
16.	Noise environment (day time)	Negligible	Negligible
17.	Noise environment (night time)	Minor	Negligible
18.	Ecological environment- disturbance to birds and bird collision	Exact impact can only be assessed post detailed bird study	
19.	Settlements and community access	Negligible	Negligible
20.	Shadow Flicker	Negligible	Negligible
21.	Economic and livelihood impact	Moderate	Minor
22.	Social and demographic structure	Minor	Negligible
23.	Cultural environment	Negligible	Negligible
24.	Community health and safety	Moderate	Minor
Cumulative Impacts			
25.	Noise environment (day time)	Negligible	Negligible
26.	Noise environment (night time)	Minor	Negligible
27.	Shadow flicker	Negligible	Negligible

[1] Refer *Table 8.1*

Annex A

Environmental approval letter for the Project from EPA, Government of Sindh

Reference No: EPA/2009/5/14/IEE/37/09

ENVIRONMENTAL PROTECTION AGENCY

GOVERNMENT OF SINDH

Plot # ST-2/1, Sector 23, KIA, Karachi-74900
Ph: 5065950, 5065598, 5065637
5065532, 5065946, 5065621
epasindh@cyber.net.pk
Facsimile: 5065940

Dated: 01-06-2009

DECISION ON INITIAL ENVIRONMENTAL EXAMINATION (IEE).

1.	**Name & Address of Proponent:**	**Mr. Danish Iqbal, Chief Executive Officer, M/s Metro Power Company Limited**
2.	**Description of Project:**	**50 MW Wind Power Project**
3.	**Location of Project:**	**Jhampir District Thatta.**
4.	**Date of Filing of EIA:**	**14-05-2009**

5. After careful review and analysis of the Initial Environmental Examination (IEE) report, the Environmental Protection Agency (EPA), Sindh has decided to accord its Approval subject to the following conditions:

i. During the project execution, safe distances of the under mentioned environmental sensitivities will be maintained:
   - 500m from communities, industries and main transport network
   - 300m from community water well
   - 100m from archaeological / cultural site / monument
   - Distance will be measured from the tip blade of turbines or/and transmission power lines associated.

ii. Project activity will not be carried out within buffer zone of any projected area designated under Sindh wildlife protection act.

iii. Effect on wildlife will be monitored during the migratory season of birds and reports of findings will be submitted to SEPA.

iv. Campsites will be located at least one kilometer away from any settlement to avoid disturbance to the local people.

v. No industrial or residential activity will be permitted on the land allocated for wind energy projects.

v. No industrial or residential activity will be permitted on the land allocated for wind energy projects.

vi. The project area will be restored to its original nature to the possible extent. For the purpose, documentation (Photographs) will be kept in record.

vii. The project shall be constructed in the prescribed time strictly as per schedule, which shall be submitted to this office at the start of construction activity.

viii. Employment will be provided to local people and assured for all unskilled jobs. Skilled jobs will be given to the locals after providing them proper field training, where a minimum training will be required.

ix. Benefits to local people will be offered under Corporate Social Responsibility (CSR) policy, community development schemes will be decided in consultation with local communities and may be facilitated by involving district/local Government office.

x. The proponent shall ensure facilitation to the EPA officer(s)/official(s) for the regular inspections to verify the compliance of the PEP Act, Rules and Regulations framed there under and the conditions contained in this approval.

xi. Compensation will be provided to the inhabitants in case of loss of agriculture land, crop property, etc., in accordance with the rates, that are agreed upon. All conflicting issues regarding compensation etc. should be settled in advance prior to the start of activity.

6. This approval shall be treated cancelled if any of the conditions, mentioned in para-5 above is violated. In follow up of the cancellation of this approval prosecution under the provision of Pakistan Environmental Protection Act, 1997 will be initiated against the proponent.

7. The proponent will be liable for compliance of Regulations 13, 14 and 17 of EIA/IEE Regulation, 2000.

8. The proponent will be liable for compliance of Regulations 18 of EIA/IEE Regulation, 2000, which permits the authority i.e. Environmental Protection Agency to enter, inspect and monitor the development of the project so that the conditions are effectively monitored.

9. This approval does not absolve the proponent of the duty to obtain any other approval or consent that may be required under any other law in force.

10. Implementation Report of all the mitigation measures and EMP laid down in the IEE Report be submitted to this office on quarterly basis for review. No violation

of any Regulations, Rules, Instruction and Provisions of PEP Act, 1997, shall be made.

11. All the environmental conditions of this approval shall be incorporated in the terms and conditions of tender document and will be component of health safety and environment policy in the project for commitment and compliance.

12. The relevant organization/proponent will submit separate EIA to EPA, Sindh for construction of new grid station to cater electricity generation from proposed wind energy project.

(Shakil A. Hashmi) 1/6/09

Director General

Annex A1

Extension of Environmental Approval Letter

Reference No: EPA/ 5/14/EE/137/2012.

ENVIRONMENTAL PROTECTION AGENCY
GOVERNMENT OF SINDH

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Ph: 5065950, 5065598, 5065637
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Date: 24-12-2012

To,
Mr.Danish Iqbal
Chief Executive,
Metro Power Company Limited
Karachi.

SUBJECT: REQUEST FOR EXTENSION OF IEE OF 50 MW WIND POWER PROJECT PROPOSED BY M/S METRO POWER COMPANY LIMITED.

After careful review and analysis of the Initial Environmental Examination (IEE) report, the Environmental Protection Agency (EPA), Sindh has decided to extend its approval subject to the following conditions:

v. All conditions laid down in previous IEE approval should be compliance.

vi. Implementation report of all the mitigation measures and EMP laid down in the IEE Report be submitted to this office on quarterly basis for review. No violation of any Regulations, Rules, Instruction and Provisions of PEP Act, 1997, shall be made.

vii. Benefits to local people will be offered under Corporate Social Responsibility (CSR) policy, community development schemes will be decided in consultation with local communities and may be facilitated by involving district/local Government office.

viii. Compensation will be provided to the inhabitants in case of loss of agriculture land, crop property, etc., in accordance with the rates, that are agreed upon. All conflicting issues regarding compensation etc. should be settled in advance prior to the start of activity.

Rafiuddin
Director General

Annex B

MPCL IEE Gap Assessment Report

General Project Information

Name of the company:	Metro Power Company Limited (MPCL)
Name of the Assignment:	Review and Gap Analysis of existing Initial Environmental Examination (IEE) report of 50 MW Metro Power Company Limited (MPCL).
Project Categorization:	The project has been categorised as **Category B** (limited impacts) as per the Equator Principles (EP) in the IEE. With respect to the National regulatory requirements, wind power sector is not covered in the Schedule I or II of the Review of IEE and EIA Regulations, 2000[1], however, as per the Sectoral Guidelines for Environmental Reports – Wind Power Projects (Draft – February 2010) of Pakistan Environmental Protection Agency (Pak-EPA)[2], any onshore wind farm project of under 100 MW in design output will be considered as a Category B project requiring only an IEE study. Considering this, the project has been classified as **Category B**. The above categorisation need to be reviewed and updated based on the IFC[3] and ADB[4] requirements.

Introduction

ERM has been commissioned to undertake a gap assessment and updation of the existing Initial Environmental Examination report (IEE) and the Environmental Management and Monitoring Plan (EMMP) for wind energy project of 50 MW to meet the IFC Performance Standards, World Bank guidelines, ADB Safeguard Policy Statement (SPS) and Equator Principle (EP) requirements.

ERM understands that Metro Power Company Limited (hereinafter referred to as "MPCL") is developing a 50 MW wind power project in association with the sponsors Mr Iqbal Alimohammed & Family and InfraCo Asia.

Mr Iqbal Alimohammed & Family are the owners of Teli Group, a business house in Pakistan. Teli Group's extensive business interest includes energy (GAEL), textile, banking, insurance, security brokerage, real estate, beverages, chemical, IT, etc

InfraCo Asia Development Pte ltd ("lnfraCo Asia") is an infrastructure project development and investment company registered in Singapore. It is a facility of Private Infrastructure Development Group (PIDG) which is a club of some eight European government donor agencies, AusAid and the World Bank Group's IFC. InfraCo Asia is mandated by PIDG to facilitate private sector investment in infrastructure in selected countries in South and South East Asia.

This report discusses the findings of the preliminary assessment and identified the gaps in the IEE based available documentation for the wind power project against the IFC/World Bank requirements, ADB Safeguard Policy Statement (SPS) and suggests recommendations and way forward to address the same.

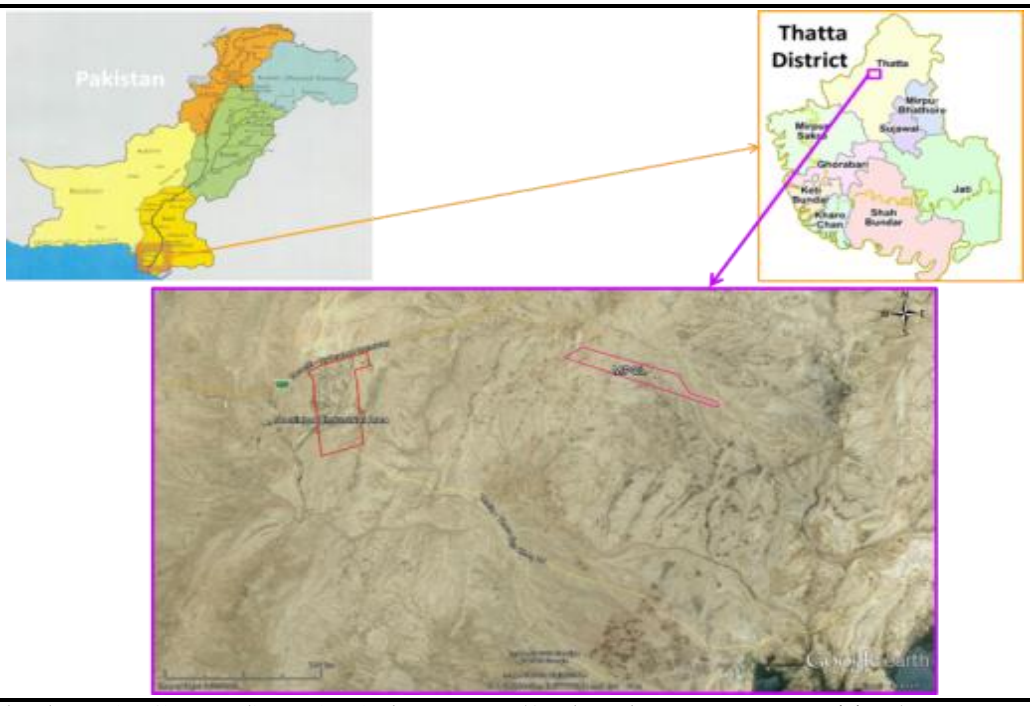
Project Background

The project site is located in the south of Pakistan between Karachi and Hyderabad, approximately 100 km inland from the coast in a semi desert area located close to the union administration of Jhimpir in Taluka and District of

[1] The Review of IEE and EIA Regulations, 2000 of the Pakistan Environmental Protection Agency
[2] http://www.environment.gov.pk/EA-GLines/Draft%20EIA%20Guidelines%20for%20Wind%20Power%20Projects%20-%20Feb%2013%20draft.pdf
[3] Definitions of project categories as per IFC (http://www1.ifc.org/wps/wcm/connect/corp_ext_content/tobedeleted/definitionofprojectcategories/projectcategoriesdefinitions)
[4] ADB safeguard categories for environment, involuntary resettlement and indigenous peoples (http://www.adb.org/site/safeguards/safeguard-categories)

Thatta in Sindh Province Location map showing both the Project has been presented in **Figure 1**. The site is accessible through the Super Highway M-9 and dirt road.

Figure 1 – Location Map of MPCL Project Site



Source: Developed based on Project Sites co-ordinates given in the IEE reports (Google Earth pro – Imagery Date: 8/4/2011)

The project site for MPCL is among the eleven zones earmarked for wind farm development in the Jhimpir area by Alternate Energy Development Board (AEDB) of Pakistan as follows:

- For MPCL, AEDB has provided a total area of 1553 acres leased from Government of Sindh for developing the Project in February 2008 and two wind masts were set up at site in August 2008.

As per the information provided in the IEE, power will be purchased by National Transmission and Distribution Company (NTDC). The IEE further informs that the project site falls within a desert area with little vegetation, and some small villages and irrigated farmed areas which are in close vicinity to the site boundaries. In addition, as the site is among the eleven zones earmarked by AEDB of Pakistan, there are likely to be several other wind energy projects in Gharo-Jhimpir Wind Corridor.

As per IEE, the Project area is outside inhabited areas of Union Administration of Jhimpir. The neighbourhood of the MPCL site has four villages, all of them at distances over 2.5 km, except one village Haji Qasim Burfat Goth which is 1.2 km outside the boundary of the Project site.

Context

ERM understands that the wind power project has received environmental approvals from the local regulatory authority on the basis of the IEE report which was carried out and submitted by a local consultant in 2009. It is understood MPCL has obtained the tariff orders and generation license from National Electric Power Regulatory Authority (NEPRA), the electricity regulator of Pakistan. Letter of Support from AEDB, a key approval needed for signing the offtake and implementation agreements and for financing of the project, was issued by AEDB to the company in August of 2012.

MPCL is in discussions with various Development Finance Institutions (DFIs) to arrange debt for the projects and hence this gap assessment of the existing IEEs and the EMMPs with respect to the requirements of the IFC/World Bank guidelines, ADB Safeguard Policy Statement (SPS) and Equator Principles (EP).is being undertaken (relevant reference framework defined in subsequent section scope of review and approach)

Brief profile of MPCL wind energy project as per IEE

Specification	MPCL
Capacity	50 MW
Number of Turbines	20
Design Details	WTGs- N100 2500 kW Nacelles , 3 pcs of blades for each WTG with rotor diameter of 80-90 m, Tubular Steel Towers, NC2 SCADA System
Height of the turbine	80 m -90 m
Transmission Infrastructure	11 kV underground electrical collection system from 20 WTGs to the Project Sub-station, Grid connection to NTDC 132 KV system
Other Infrastructures	Internal Road development, Strengthening of access road, Operations and Control Building
Total Project Area	1553 acres
Requirement of Forest Area	None

Land-use around the site as per IEE

Direction	MPCL
North	Mountain and unsurveyed land
East	Nalla Horola Nai, local village and unsurveyed land on the far east
West	Layari Nai and Sui southern gas pipeline and Emirate Sheep Farm further west
South	Land allocated to GAWPL (a wind farm project developer) and further Lucky wind farm and railway line and Jhimpir Grid station on far south

Scope of the review and Approach

The scope of the review for the gap assessment for the two wind energy project includes:

- Review of all documentation (including IEE reports) made available by the Client;
- Verifying to what extent the E&S aspects are in accordance with the Reference Framework;
- Undertake Gap Assessment and develop an Environment and Social Action Plan (ESAP) for the project to implement mitigation measures and prepare a robust monitoring plan;
- Ascertain compliances to the existing local laws and regulations.

The gap assessment has taken cognizance of the subsequent reference framework:

- Applicable national laws and regulations in Pakistan;
- IFC PS and WB EHS guidelines; IFC Performance Standards;
- IFC/WB – Environmental, Health and Safety Guidelines, in particular: IFC Guidelines for Wind Energy; Projects and Power Transmission and Distribution;
- ILO Conventions and recommendations;
- ADB SPS Requirements.

The gap findings and observations have been categorized to record status of compliance to the reference framework and implication of the gaps for the updation of the IEE/EMMP as follows:

Non-Compliant - Significant Action Required	
Partially-Compliant – Moderate Action Required	
Compliant – Limited Action Required	

Limitation

This gap assessment is based on desk based review of following documents and information provided by the client:

- IEE Reports and approval letters;
- Energy Assessment Report by Garrad Hassan;
- DEM Survey Report by WP Consultants;
- Generation License;
- Letter of Interest and Letter of Support;
- Land documents related to sub-lease from AEDB;
- EPC and Operations and Maintenance Contract Agreements;
- Grid Study Reports by Power Planners International;
- Transportation Route Plans;
- Transmission Network Estimated Layouts;
- Bird Monitoring Reports by Elan Partners (Pvt) Ltd; and
- Feasibility Study Overview by Sgurr Energy.

The assessment is entirely based on the documents reviewed at this stage and no reconnaissance survey/ consultation with the stakeholders was conducted during the gap assessment.

Findings of environmental and social review of IEE Report of MPCL 50 MW Wind Power Project

PS 1 - ASSESSMENT AND MANAGEMENT OF ENVIORNMENTAL AND SOCIAL RISKS AND IMPACTS	Applicable Yes ☒ No ☐

Requirements:

- Environmental and Social Assessment:
- Environmental and Social Management System
- Policy
- Stakeholder Engagement
- Monitoring and Review
- External Communications and Grievance Mechanisms

As per the Pakistan Environmental Protection Agency (Pak-EPA) Review of IEE and EIA regulations 2000, Schedule I Generation of Power 50 MW or less require Initial Environmental Examination (IEE) report and approval from Pak-EPA. MPCL has obtained Approval from Pak-EPA during 2009 on the basis of submission of IEE report and which has been again renewed on 24 December 2012. The IEE report is now being revised and updated in accordance to IFC/Word Bank/ADB requirements;.

S.No.	PS 1- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
a)	The IEE report has been prepared with respect to the national regulatory requirements and IFC Performance Standards of 2006 and thus it does not reflect key requirements of the standards applicable from January 2012.		The updated IEE report will need to conform to the IFC PS 2012 standards and applicable EHS guidelines. It also requires inclusion of ADB SPS.
b)	The IEE report has provided a legal framework that discusses the applicable social and environmental regulations and policies for the 50 MW project. However, there is lack of information on the compliance status of the project to these requirements.		A legal register for applicable laws, licenses, permits and approvals need to be developed by MPCL to ensure legal compliance. The updated IEE report needs to include the current permitting and compliance status of regulations as applicable in the pre-construction, construction and operations phase.
c)	IEE lacks formal Environmental and Social Management System (ESMS) and linkages with Subcontractor during construction and operation phases of the Project. MPCL has selected Nordex and Descon as the EPC contractor and O & M contractors, respectively. However, the responsibilities are not defined in the IEE.		MPCL needs to develop ESMS and Frame management plans covering key risks identified. The ESMS will incorporate the following elements as per IFC PS • Social and Environmental Assessment (SEA or EIA) • Management program • Organisational capacity

S.No.	PS 1- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
			• Training • Community engagement • Monitoring • Reporting Organizational structures with clearly defined responsibilities of EPC and O & M contractor needs to be integrated in the IEE.
d)	IEE does not identify any Organizational structure of MPCL for effective implementation of ESMS during construction and operation phases of the project. The organizational structure of the EPC contractor and the O&M contractor include technical and health & safety aspects but responsibilities with environment and social are not provided.		MPCL needs to develop an organizational structure with EHSS team for implementing the ESMS. EMMP implementation responsibilities will be defined as per the Organization structure and updated in the IEE.
e)	IEE includes an emergency preparedness and response plan however does not assess emergency situations/areas and community risks. It misses on proper linkage between wind energy producers and various stakeholders, such as nearby community, govt. authorities etc for effective handling of such situations.		IEE needs to o identify risk and emergency situations/areas associated with the project, affected parties and accordingly updated
f)	The IEE report does not indicate an assessment of cumulative environmental and social impacts of the wind energy projects in the region. These will include in-migration, employment generation, loss of any common property resources and grazing areas etc.		IEE need to be updated to the extent possible through incorporating cumulative impact of planned developments with help of readily available information and through secondary sources as many other windfarms are located in the vicinity of the Project area.
g)	The IEE report provides a detailed understanding of the key stakeholders relevant for MPCL as well as public consultation and disclosure activities associated with the communication of the project. However, there is lack of information on a continuous plan to engage and consult the relevant stakeholders. There is no information to ascertain the consultation activities that have taken place since 2009.		The updated IEE will include a Stakeholder Engagement Plan to map the engagement, information disclosure and consultation activities that will be required across the project lifecycle.
h)	The IEE report does not provide a grievance handling procedure that is accessible to all stakeholders (employees, labour, neighboring communities etc.)		MPCL has to provide information on the existing channels that are presently under implementation used to raise concerns on environmental, labour and

S.No.	PS 1- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
			social aspects/grievances. IEE will be updated based on the current grievance management system and if required, additional suggestions for grievance Redressal mechanism will be provided in the IEE.
i)	The IEE report EMMP is only focussed on environmental aspects and does not include any social impact and monitoring mechanism, considering no settlement within 1.2 km of the Project site. However, it has been noted that there are few settlements within the Project site and its close vicinity based on the DEM maps provided by the Client and aerial view of the Project site in Google Earth.		The IEE will be updated based on the environmental and social impacts identified and will provide monitoring plan with implementation responsibilities and frequency. The roles and responsibilities will be included based on the organization structure provided by MPCL.

PS 2 - LABOUR AND WORKING CONDITIONS	Applicable Yes ☒ No ☐

Requirements:

- Working conditions and management of worker relationship
- Protecting the work force (child labour/ forced labour)
- Occupational Health and Safety
- Workers engaged by third parties
- Supply chain management

It is estimated that approximately 600 workers will be employed during the construction phase (Approximately 22month) and around 40 staff will be working in shifts to operate the wind energy plant. Construction and O&M work will be primarily dealt by the EPC and O&M Contractors, respectively.

S.No.	PS 2- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
a)	No specific Human Resource policy was available for review to ascertain the incorporation of relevant aspects of the IFC PS 2 requirements, such as commitments on worker health & safety, working conditions etc.		MPCL should develop a Human Resource Policy to address the same. This should address information dissemination to workers regarding their rights, regulating working conditions, staff welfare, health, non-discrimination, equal opportunity, non-tolerance of child & forced labor, workers associations, retrenchment, grievance redress mechanisms and subcontractor monitoring & management of labour and

S.No.	PS 2- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
			their working conditions.
b)	The IEE report mentions general facilities that will be made available for the labourers at the construction campsite, such as water, sanitation etc. However, no specific requirement as specified by legal laws or the IFC Guidelines on Worker Accommodation is provided.		The EMMP will provide recommendations on labour camp layout, facilities and management to be aligned to local conditions and the IFC requirements.
c)	The applicable legal requirements do not mentioned the labour laws in Pakistan which are to be followed for construction workers as well as during the operations phase.		IEE will update the legal requirements to include these matters.
d)	The Terms and Agreements with the EPC and O&M contractor as provided by the client were reviewed and it was observed that there is no separate responsibilities assigned to ensure labour compliance for aspects such as child labour, working conditions, appropriate wage payment etc.		IEE will include an updated organizational structure to include these responsibilities. It will also provide specific commitments on all other aspects of PS 2 that are relevant for the project.

PS 3 - RESOURCE EFFICIENCY AND POLLUTION PREVENTION	**Applicable** **Yes ☒ No ☐**

Requirements:

- Resource Efficiency
  - Reduction in GHG emission
  - Reduction in water consumption)
- Pollution Prevention
  - Wastes
  - Hazardous materials management
  - Pesticide use and management

Performance of Project against International environmental standards will be relevant during the construction as well as the operations phase. The project will not result in any significant air emissions, wastewater discharge or solid/hazardous waste generation during operational phase. However, construction phase may affect the baseline environmental quality.

S.No.	PS 3- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
a)	IEE identifies the sources of air emissions during construction and operation phases of projects (emission from DG set, vehicles, fugitive emission etc.). However no quantification of emission is carried out and mitigation measures proposed are generic in nature		
b)	IEE have identified national laws and standards, International Standards applicable for the projects and compared the same.		Further relevant applicable International best practices will be identified as per the IFC PS and updated in the IEE
c)	IEE does not quantify and attempted to provide		Pollution sources should be

S.No.	PS 3- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
	generic mitigation measures for the wastewater streams such as domestic effluent from labour camps, surface water runoff, etc. during construction and operation phases of the Project.		identified and potential pollutants should be quantified and updated in the IEE and relevant applicable mitigation measures as per the IFC PS hierarchy should be proposed and monitoring mechanisms integrated in the ESMS.
d)	IEE does not cover conservation/reuse and recycling as well as measures to prevent contamination during construction activities		As measures towards resource efficiency, IEE needs to be updated with plans/ efforts by client in coordination with contractors for conserving raw materials, energy, and water and reusing/recycling. If benchmarking data are available, then IEE will establish the relative level of efficiency
e)	IEE has not identified and quantified all potential hazardous waste (use of paints, chemicals, waste oil etc) streams generated on site during construction and operation phases of project.		Any potential risk and hazards associated with handling of hazardous waste will be identified and relevant applicable mitigation measures as per the IFC PS, EHS guideline, WB guidelines etc., waste management hierarchy will be proposed and monitoring mechanisms will be integrated in the EMMP.
f)	IEE mentions about the GHG emissions from a 50 MW fossil fuel power plant and how this Wind power plant would prevent potential emissions. However it fails to quantify the amount of GHG generated from its various activities throughput the Project lifecycle.		IEE needs to be updated with GHG emissions quantification (approx.) based on equipment and machinery to be used during construction phase.
g)	IEE does not address pesticide use and management during life cycle of the Project		Pesticides may not be used directly however it may be used as vector management practice in labour camps or clearance of weeds, if applicable. IEE needs to be updated with the potential uses of pesticides in the Project area and its management as per the IFC PS requirements.

PS 4 – COMMUNITY HEALTH, SAFETY AND SECURITY	**Applicable**

	Yes ☒ No ☐

Requirements:

- Community Health and Safety
  - Infrastructure and equipment design and safety
  - Hazardous materials management and safety
  - Ecosystem services
  - Community exposure to disease
  - Emergency preparedness and response
- Security Personnel

The site location is predominately barren hilly tract devoid of any major settlements within 1km. However, there are community settlements along the access road to the site. The IEE states that the project activities and scale do not pose excessive risk to local and nearby communities. The key activities that are likely to involve risks to community health and safety include transportation, influx of labourers and shadow flicker/noise etc.

S.No.	PS 4- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
a)	IEE does not establish community health and safety especially during construction period eg Heavy motor vehicle movement carrying construction materials and WTG parts may pose road safety risks especially through congested areas as Nooribad, deep burrow areas for foundations may pose hazards for community and their livestock.		IEE needs to be updated with risks and impacts associated with community health and safety during Project lifecycle and propose mitigation measures to commensurate with the nature and magnitude of the impacts.
b)	IEE does not address in detail the Health and safety issues during erection and decommissioning of WTGS as these activities may pose a major safety challenge because of the heavy and large parts as the rotor blades, turbine tower and nacelle		The risks and hazards of the WTGs needs to be addressed in IEE.
c)	IEE mentions that shadow flicker does not have any significance because of the far away location of the villages and sufficient setback areas. It mentions about detailed studies during the siting stage for final layout. However, as per DEM maps provided by MPCL, settlements are shown within the Project area boundary. In such a scenario, the shadow flickering study should be conducted with respect to settlements within the Project site and its periphery.		IEE needs to be updated with Shadow flicker study which is to be provided by MPCL and proposed mitigation measures will be included in the EMMP.
d)	IEE does not address community health issues from potential sources of hazardous material to be used by the project during construction and operation phases of project and method of safe handling disposal (Used oil from Dg Sets, paints etc.)		IEE needs to identify and address the potential sources of hazardous waste material and safe handling and disposal as per the IFC PS hierarchy, if any
e)	IEE mentions about engaging local labour to the extent possible but there is no mention of labour camps, its locations and potential interaction with local community, influx of labour from other regions and resultant vector borne and sexually transmitted diseases.		IEE needs to address impacts related to influx of labourers, labour camps and the potential local community interaction and exposure to diseases and propose relevant mitigation measures as applicable based

S.No.	PS 4- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
			on further information.
f)	IEE mentions about an Emergency Response Plan however emergency situations are not identified and resources and responsibilities are not linked properly. The IEE does not specify the security and political unrest in the vicinity of the project		IEE should identify the emergency situations and mention response plan with implementation responsibilities and disclosure procedures about the same to Affected Communities, relevant government agencies, or other relevant parties
g)	The Emergency Response Plan does not include a communication process to sensitize key stakeholders (such as neighboring wind energy producers, communities in the 5 hamlets etc) of any onsite events or incidents which have implications on wider community safety.		IEE will include an updated ERP with a process for off-site communication.
h)	IEE states that the impact due to noise generated from the wind turbines will be of the order of 55 – 60 dB(A) and at a distance of 1.5 km, where three villages are located, the noise levels would be just perceptible. However, as per the Google Earth aerial picture of the Project site as well as DEM maps provided by MPCL, there are settlements within the Project site. Impact on those settlements due to noise was not assessed in the IEE report.		IEE will include a noise impact assessment based on the micrositting of the WTGs within the Project site and impact on the settlements will be evaluated.
i)	IEE states that there will be no Electromagnetic Interference (EMI) effect induced by operation of the wind turbines as the nearest settlement is about 1.2 km away from the Project site.		Considering the settlements within the Project site, MPCL need to assess the EMI caused by the Project. Based on this, IEE will address potential risk and hazards associated with EMI and propose relevant applicable mitigation measure as per the requirement of IFC and monitoring mechanisms integrated in the EMMP.
j)	IEE mentions briefly about the Security arrangements		IEE will be updated with a system for grievance mechanism for Affected Communities to express concerns about the security arrangements and acts of security personnel.

PS 5 – LAND ACQUISITION AND INVOLUNTARY RESETTLEMENT	**Applicable** **Yes ☒ No ☐**
Requirements:	

- General
  - Compensation and benefits for displaced persons
  - Community engagement
  - Grievance mechanism
  - Resettlement and livelihood restoration planning and implementation
- Displacement
  - Physical displacement
  - Economic displacement
- Private sector responsibilities under Government-managed resettlement

Approximately 647 acres of land has been sub-leased to MPCL by AEDB as per an agreement dated 28th March 2008. The lease arrangements have been undertaken as per provisions of the Colonization and Disposal of Government Lands (Sindh) Act, 1912 and will be provided for the project over a period of 30 years. The land-use has been described as arid and stony wasteland and the IEE has ascertained that there will be no involuntary economic or physical impacts associated with the site.

S.No.	PS 5- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
	No information is presently available on the specific routes of the access roads from Nooriabad-Jhimpri road up to the project site. These access roads may require private land and hence right of way will need to be compensated as per applicable legal requirements.		MPCL should ensure that any compensation is paid in a fair and transparent manner and is at par with market value.
	The cumulative development of the wind farms in the wind zone identified by AEDB will entail lease of 34,000 acres of land. There is no information available to document any limited or negligible livelihood impacts of acquiring this land. In addition, there is limited discussion on the use of such land for any common property uses such as grazing, fuel wood collection etc. There is no information on any unorganized activities, such as sand and gravel collection that may be adversely impacted.		IEE will provide further information to ascertain the applicability of any cumulative livelihood impacts for the acquisition of 34,000 acres of land.

PS 6 – BIODIVERSITY CONSERVATION AND SUSTAINABLE MANAGEMENT OF LIVING NATURAL RESOURCES	**Applicable** **Yes ☒ No ☐**

Requirements:

- Protection and Conservation of Biodiversity
- Legally protected and internationally recognized areas
- Invasive alien species
- Management of ecosystem services
- Sustainable management of living natural resources

The IEE states that the project site is barren hilly tract and devoid of any major ecological resources. No protected/environmentally sensitive features present within 10km radius of the project boundary.

PS 6- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)

PS 6- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
IEE identifies that there are no wildlife reserves in close proximity to the site and did not consider terrestrial ecology to be particular issue at the site. It mentions about the Kinjhar Lake wild life sanctuary located about 15 km from the Project Site. This lake is largest freshwater lake in Pakistan, falls under Ramsar Convention and is one of the most important breeding, staging and wintering location for water birds.		As WTGs have been a major concern for migratory birds, the IEE needs to be updated with findings of detailed bird monitoring study to identify bird routes and proposed mitigation measures.
IEE identifies the area is not considered to offer a suitable habitat for falcons and other high flying birds however recommended for monitoring for impact on birds to confirm an issues on collision risk.		Based on the finding of the bird monitoring study, IEE needs to be updated with suitable mitigation measures
Mitigation measures suggested in IEE for flora and fauna are inadequate in terms of impact from Site clearance, movement of vehicles, cutting trees for fuel by labour/camps etc		IEE needs to updated with impacts to local flora and fauna habitats from construction phase activities as labour camps, heavy vehicular movements, site clearance, construction of access roads and suitable mitigation measures needs to be included.
IEE does not mention anything about presence or absence of invasive alien species		IEE needs to be updated with identification of invasive species if any in the Project area and its management.

PS 7 - INDIGENOUS PEOPLES	Applicable Yes ☒ No ☐

Requirements:

- Avoid, mitigate and compensate the impacts in a culturally appropriate manner
- Participation and consent
- Assessment of impacts on lands and natural resources subject to traditional ownership or under customary use
- Development of ongoing relationship with IPs and forums for expressing concerns
- Protect their cultural heritage
- Provide opportunity for their development

The IEE report has not ascertained the existence of any indigenous communities who are to be adversely impacted by the project. However, any stakeholder and public consultation activities to be undertaken for the project will require incorporating cultural specificities of the community in the vicinity.

PS 7- Gaps identified	Gap Classification	Actions Required (Recommended by ERM)
The IEE report has reported the non-existence of any indigenous communities who are to be adversely impacted by the		The updated IEE report will verify and assess existence of any indigenous people within the project boundaries as per the requirements of

Project. However, the IEE report also mentions existence of Jakhro tribe along the access road and it has also been informed that nomadic tribes are using the area during and post-monsoon for cultivation.		IFC PS and ADB SPS. An indigenous people management plan will be developed, if required.

PS 8 - CULTURAL HERITAGE	**Applicable** **Yes ☒ No ☐**

Requirements:

- Identify impacts on both tangible and intangible forms of cultural heritage
- Avoid removing cultural heritage & consult with host community
- Comply with national laws and Implement procedures d through the ESA process

The IEE report states that there is no prominent cultural or archaeological feature in or around the Project site and mentions that places of archaeological, historical and religious significance in Thatta District are located in Thatta, which is about 50 km away from the Project site.
The IEE has not ascertained any adverse impacts on heritage or cultural sites in the vicinity of the MPCL project site.

PS 8- Gaps identified	**Gap Classification**	**Actions Required (Recommended by ERM)**
The IEE report has ascertained that there is no impact on heritage or cultural sites within the project site and vicinity of the MPCL project site.		As a good practice, the EMMP will need to include chance find procedures; specifically relevant for excavation of turbine locations. The updated IEE report will verify and assess existence of any tangible/ intangible cultural heritage within the project boundaries as per the requirements of IFC PS and ADB SPS. An indigenous people management plan will be developed, if required.

Way Forward

The IEE report for the MPCL wind energy project will need to be updated based on the gaps identified in this report. ERM will work with the Client to facilitate the completion of any additional studies, data collection that may be required to close out gaps. To assess the environmental and social setting of the Project as well as to validate the baseline conditions presented in the IEE reports, ERM's subcontractor will conduct a site reconnaissance survey and will have consultation with the stakeholders including the people residing within the Project site and its neighbourhood. Support from client with respect to free access to the site and security at site will be needed. The requirements of the subcontractor to perform the study will be intimated to the Client one week in advance. Considering the communities within and close to the Project site shadow flicker and EMI studies would be required from the Client. The outcome of these studies will be incorporated in the updated IEE report.

Annex C

AEDB Letter of Intent to MPCL

Government of Pakistan
Alternative Energy Development Board (AEDB)
344, B Prime Minister's Secretariat, Islamabad
Ph: 051-9223427 / Fax: 051-9205790

AEDB

B/3/16/2006

13 May 2006

Mr. Iqbal Alimohamed
Chief Executive
Metro Power. Co. Pvt. Ltd
36-F, Block-6, P.E.C.H.S.,
Karachi-75400

Subject: **LETTER OF INTEREST FOR 50 MW WIND POWER GENERATION PROJECT AT GHARO ~ KETI BANDAR CORRIDOR**

This refers to your Letter No. MSL/SM/2006/002 Dated 11th May, 2006.

2. In terms of the provisions of the Guidelines for Determination of Tariff for Wind Power Generation 2006 and in consistence with the Policy for Power Generation Projects 2002, The GoP hereby confirms its interest in your proposal for establishing an approximately 50 MW wind power generation project in Gharo ~ Keti Bandar corridor. Land for the wind projects is being leased out to AEDB for sub-leasing to Sponsor(s) by the Government of Sindh upon availability. AEDB has no obligation to provide land to the Sponsor(s). By issuance of this LOI the Sponsor(s) has automatically been added in the queue for land allocation. Land would be offered to the Sponsor(s), in order of merit, and at the same rates as offered to AEDB, as soon as it is available from the Government of Sindh.

3. The Sponsor(s) also has the option to proceed with the acquisition of its own land if he desires to move on a fast track basis. The Sponsor(s) will be required to get its land validated by the AEDB with regards to its bearings within the wind corridor and suitability of land for wind farm.

4. The Sponsor(s) is required to complete the Feasibility Study for the subject project, at no risk no cost to, and without any obligation on part of, the GoP and its agencies, within a period of twelve (12) months from the date of procurement of land. On allocation of land by GoS or approval from AEDB incase of a privately procured land, the Sponsor(s) is required to post a bank guarantee in favour of the AEDB of the value of US$ 500 per MW of the project's installed capacity, valid for a period extending six months beyond the original validity of the LOI.

5. The Sponsor(s) is required to carry out the Feasibility Study, complete, at internationally acceptable standards and in accordance with the terms and conditions stipulated in the Policy. The Feasibility Study must include micro-siting details, detailed, soil tests reports, technical details pertaining to wind turbines to be used in the wind farm, project cost, financing plan, carbon credits, financing terms, tariff calculations and assumptions for financial calculations including economic/financial analysis. The Sponsor is also advised to liaise with

Government of Pakistan
Alternative Energy Development Board (AEDB)
344, B Prime Minister's Secretariat, Islamabad
Ph: 051-9223427 / Fax: 051-9205790

the power purchaser while determining site, project layout, sub-station design and layout and the transmission line and interconnection arrangements etc.

6. The validity of this LOI is twelve (12) months from the date of procurement of land or twenty four months (24) from the date of the signing of this LOI, whichever comes later, where after it will automatically lapse immediately. Issuance of this LOI or the lapsing of its validity, or your conducting a feasibility study there under, cannot form the basis of any claim for compensation or damages by the Sponsor(s) or the project company or any party claiming through them against the Government of Pakistan / AEDB or any of its agencies, employees or consultants on any grounds whatsoever, during or after the expiration of its validity.

7. The Sponsor is therefore required to complete the Feasibility Study for the subject project within the validity of this LOI. Incase there is a delay in completion of the Feasibility Study or procurement of land within the validity of this LOI, a one-time extension may be granted upto a maximum period of 180 days, provided that AEDB is satisfied that the Feasibility Study is being conducted in a satisfactory manner and is likely to be completed shortly.

8. Incase, if the Sponsor(s) fails to meet the relevant milestones and standards, AEDB will terminate this LOI and encash the bank guarantee.

9. This LOI has been issued in duplicate on the date hereof, and it shall come into affect when one copy is received by AEDB after having duly countersigned by you. Nevertheless, this LOI shall lapse if the countersigned copy is not received at AEDB within 15 days of its issuance.

For and on behalf of
Metro Power. Co. Pvt. Ltd

(Brig Dr. Nasim A. Khan)
Secretary / Member Technical

Annex D

Electricity generation license

National Electric Power Regulatory Authority
(NEPRA)
Islamabad – Pakistan

GENERATION LICENCE

No.
WPGL/14/2011

In exercise of the Powers conferred upon the National Electric Power Regulatory Authority (NEPRA) under Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act 1997, the Authority hereby grants a Generation Licence to:

METRO POWER COMPANY LIMITED

Incorporated under the Companies Ordinance, 1984
Under Certificate of Incorporation
No. 00000013382/20061107, dated November 22, 2006

for its Generation Facility/Wind Farm Located at Jhampir, near Nooriabad District Thatta, Sindh

(Installed Capacity: 50.00 MW Gross ISO)

to engage in generation business subject to and in accordance with the Articles of this Licence.

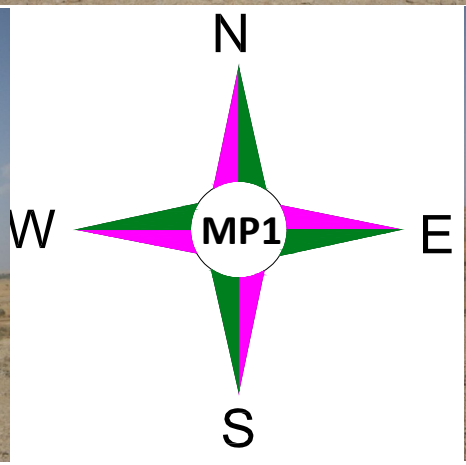
Given under my hand this 26th day of December Two Thousand & Eleven and expires on day of 30th March, Two Thousand & Thirty Four.

Registrar

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
NEPRA

Annex E

Representative Site Photographs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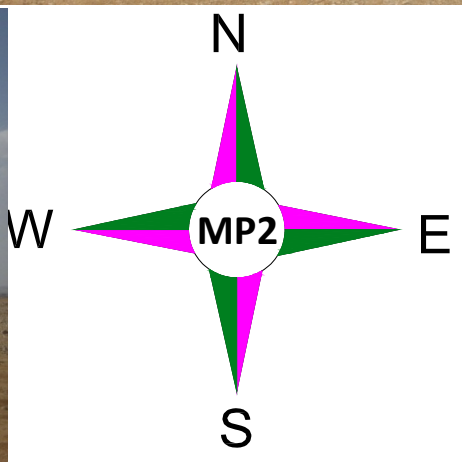
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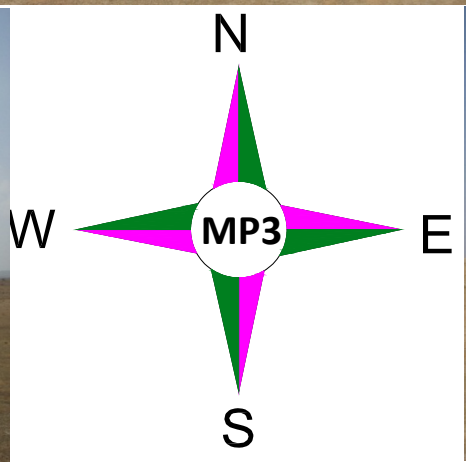
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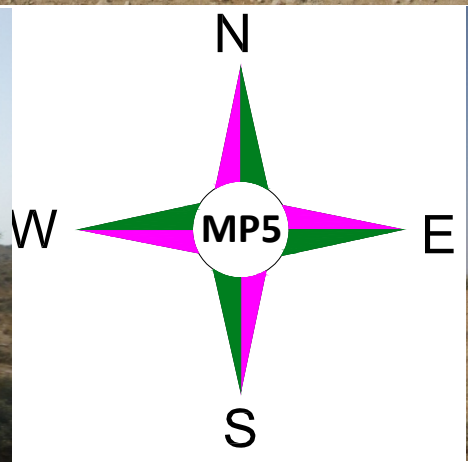
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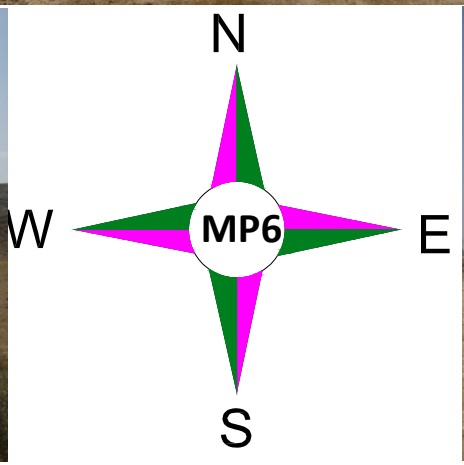
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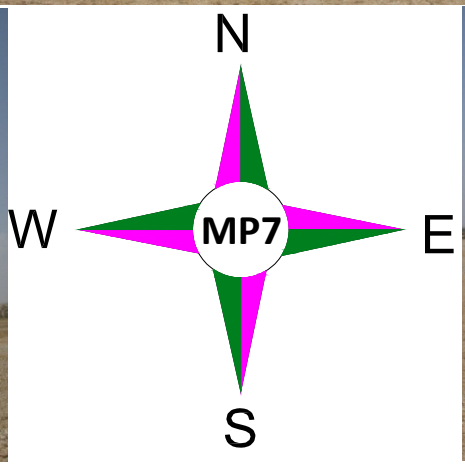
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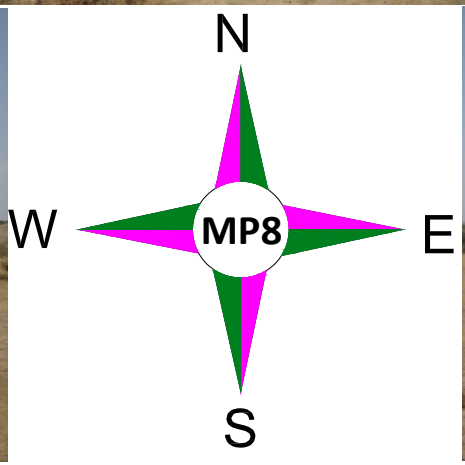
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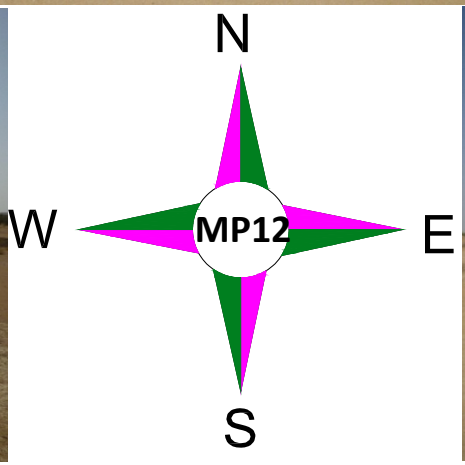
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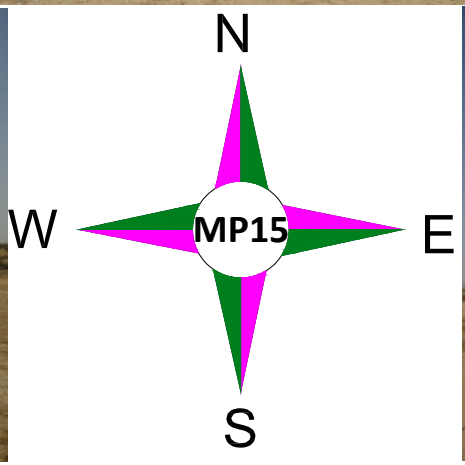
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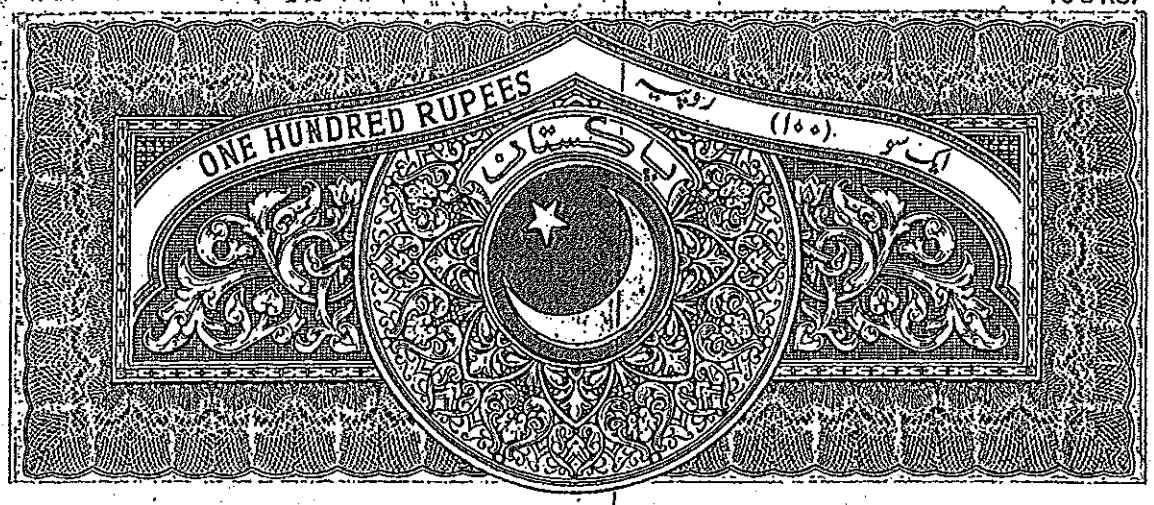
Annex F

Site Sub-lease Relevant Provisions

SCHEDULE 21

SITE SUB-LEASE RELEVANT PROVISION

PAKISTAN 100 RS.



ALTERNATIVE ENERGY DEVELOPMENT BOARD

And

METRO POWER CO. (~~PVT~~) LTD

AGREEMENT TO LEASE

-RELATING TO-

PROPOSED WIND POWER GENERATION COMPLEX

AT

JHIMPIR, DISTRICT THATTA

MADE AT
ISLAMABAD, PAKISTAN

COUNSEL FOR AEDB: COUNSEL FOR COMPANY

Government of Pakistan Alternative Energy Dev. Board Camp Office, Karachi

AGREEMENT TO LEASE

This Agreement to Lease is made at Karachi on this 28th day of March 2008

By and Between

ALTERNATIVE ENERGY DEVELOPMENT BOARD, a statutory body established by and under the Alternative Energy Development Board Ordinance, 2007 (hereinafter referred to as "AEDB" which expression shall, wherever the context requires or permits, include its successors in interest and assigns)

And

METRO POWER CO. ~~(PVT)~~ LTD, a company incorporated under the laws of Pakistan (hereinafter referred to as the "Company", which expression shall, wherever the context so requires or permits, include its successors in interest and permitted assigns), having its registered office at 36-F, Block-6, P.E.C.H.S, Karachi-75400.

Each of AEDB and the Company is hereinafter referred to individually as a "Party" and, collectively, as the "Parties".

RECITALS

A. WHEREAS, pursuant to the GOP (as hereinafter defined) policy to involve the private sector in the development and generation of Alternate or Renewable Energy (as hereinafter defined), AEDB has been established as the principal instrumentality of the GOP to, *inter alia*, facilitate power generation through Alternative or Renewable Energy sources;

B. WHEREAS, consistent with the GOP's policy and guidelines on development and generation of Alternative or Renewable Energy, to be implemented through the AEDB, the Company has proposed to establish a wind power generation facility, and AEDB has, issued to the Company the Letter of Intent (as hereinafter defined) in this behalf;

C. WHEREAS, for the purposes mentioned in Recitals A and B, AEDB has procured certain parcels of land from the Government of Sindh pursuant to the Colonization and Disposal of Government Lands (Sindh) Act, 1912 under the terms and conditions set out in the Master Lease Deed (as hereinafter defined); and further agreed to lease, by way of a sub-lease, the Site (as hereinafter defined) to the Company, which shall be executed by the Parties in the form attached hereto together with the other Project Documents (as hereinafter defined);

C. WHEREAS, in the interim, the Company requires access to the Site to undertake feasibility study and other preparatory works, and AEDB has agreed to grant such access to the Company upon terms and conditions herein set out.

NOW, THEREFORE, in consideration of the mutual benefits to be derived and the representations and warranties, conditions and undertakings herein contained, and intending to be legally bound hereby, the Parties hereby agree as follows:

ARTICLE I
DEFINITIONS & RULES OF INTERPRETATION

1.1 Definitions

Wherever used in this Agreement to Lease, the following terms shall bear the meaning ascribed below:

"AEDB" - The meaning ascribed thereto in the Recitals to this Agreement to Lease.

"Company" - The meaning ascribed thereto in the Recitals to this Agreement to Lease.

"GOP" - The Government of the Islamic Republic of Pakistan.

"GOS" - The Government of Sindh, Pakistan.

"Laws of Pakistan" - The federal, provincial and local laws of Pakistan applicable to this Agreement.

"Letter of Intent" - The Letter of Intent dated 11th May 2006 issued by AEDB to the Company for purposes of the Project.

"Letter of Support" - The Letter of Support to be issued by AEDB to the Company for purposes of the Project.

"Master Lease Deed" - The Deed of Lease dated 11th February 2008 entered in to by and between AEDB and the GOS, a copy whereof is attached herewith as Schedule I.

"Party" or "Parties" - The meaning ascribed to it in the Recitals to this Agreement to Lease.

"Project" - The proposed establishment of a 50 MW wind power project at Site by the Company, subject to the terms of the Project Agreements.

"Project Agreements" - The Implementation Agreement, the Energy Purchase Agreement, the Site Sub-Lease Deed and such other agreements required by AEDB for purposes of the Project.

"Site" - All that piece and parcel of land, measuring 1,553 acres of land situated in Taluka Jhimpir, District Thatta, and more particularly described in Schedule II, agreed to be sub-leased to the Company by AEDB under this Agreement to Lease.

"Site Sub-Lease Deed" – The Site Sub-Lease Deed to be entered in to by and between the Parties pursuant to this Agreement, which shall be consistent with the form attached hereto as Schedule III.

"Schedule" - A Schedule to this Agreement to Lease, which shall constitute an integral part of this Agreement to Lease.

"Term" - The term of this Agreement to Lease.

ARTICLE II
AGREEMENT TO LEASE

2.1 AEDB represents and warrants to the Company that AEDB is well seized of and has, and shall have and maintain, during the Term, good and valid legal and beneficial leasehold ownership, right, title and interest in and to the Site, and is entitled under the Laws of Pakistan to grant the exclusive rights therein to the Company for purposes of the Project in accordance with the terms of this Agreement to Lease.

2.2 Subject to the Company having been granted the Letter of Support and entering in to the Project Agreements, AEDB agrees to demise unto the Company the Site by way of an exclusive sub-lease, together with all rights, easements and privileges appurtenant thereto to be held and enjoyed by the Company for purposes of the Project, upon the terms and conditions specified in the Site Sub-Lease Deed.

ARTICLE III
RENT RESERVED

3.1 The Company shall pay to AEDB the rent for the Site in the manner, at the rate and on or before the times specified in the Site Sub-Lease Deed.

ARTICLE IV
TERM AND TERMINATION

4.1 The Term of this Agreement to Lease shall commence on the date hereof and, subject to Article 4.2 below, shall continue until execution of the Site Sub-Lease Deed.

4.2 In the event (a) the Company is unable to procure from AEDB approval of the feasibility study for the Project within 12 months of the date hereof; or (b) the Company is unable to secure a Letter of Support from AEDB within 18 months from the date hereof, which ever is later, this Agreement to Lease shall stand terminated, *ipso facto*.

ARTICLE V
ACCESS AND RIGHTS

5.1 AEDB hereby grants the Company the right to access the Site for purposes of undertaking the activities specified in Article 5.2 below.

5.2 Immediately upon the execution of this Agreement to Lease, the Company shall have, as the authorized licensee of AEDB, the right to:

5.2.1 Unlimited access to the Site for purposes of undertaking the required feasibility study of the Project, and other associated studies thereat;

5.2.2 Set up at its sole cost and expense (without any claim for reimbursement of any kind at any time whatsoever) a wind measuring mast and related equipment subject to prior written approval of AEDB. The Parties agree that the Company shall duly record wind and related data from such mast and provide the same to the AEDB on a quarterly basis; and

5.2.3 Erect fencing at the Site with the prior approval of AEDB at its sole cost and expense Company (without any claim for reimbursement of any kind whatsoever).

5.3 The Parties recognize and agree that this Agreement does not create or purport to operate to create, in present or future, any proprietary right, interest or title in or over the Site in favour of the Company. Nothing herein contained shall be construed to allow the Company to undertake construction of any structure permanently attached to the ground (except basic civil works for erecting the wind measuring mast as aforesaid).

5.4 In the event of termination of this Agreement to Lease under Clause 4.2 above, AEDB shall allow the Company to remove the wind mast and other equipment at Site, at the Company's sole cost and expense, without causing any damage or harm to the Site.

ARTICLE VI
MISCELLANEOUS

6.1 Any notice, demand, or communication required or permitted under this Agreement to Lease shall be in writing and shall be either: (i) delivered personally; (ii) mailed by certified mail, return receipt requested; (iii) sent by courier delivery service; or (iv) facsimile machine, to the respective Parties at the following addresses, unless and until a different address has been designated by written notice to the other Party:

AEDB:
Alternative Energy Development Board
3, Street No. 8, F-8/3, Islamabad
Attention: Chief Executive Officer
Fax No: +92-51-9205795

The Company:
Metro Power Co. ~~(Pvt)~~ Ltd
36-F, Block-6, P.E.C.H.S,
Karachi-75400
Attention: Chief Executive Officer
Fax No: +92-21-4530844

6.2 The Company shall not assign or transfer any of its rights under this Agreement to Lease.

6.3 This Lease constitutes the entire agreement between the Parties with respect to the subject matter hereof and supersedes all prior understandings and communications between the Parties in respect thereof, however, nothing herein shall derogate from or supersede any obligation of the Company under the Letter of Intent.

6.4 This Agreement to Lease shall not be amended or modified orally and no amendment or modification of this Agreement to Lease shall be effective unless and until the same is in writing and duly executed by both Parties.

6.5 This Lease shall be governed by and construed in accordance with the Laws of Pakistan.

6.6 Each Party represents and warrants to the other that it has all power, authority and approval required to enter into, execute and deliver this Agreement to Lease and to perform fully its obligations hereunder, and that it has duly executed and delivered this Agreement to Lease, which constitutes its valid and binding obligation, enforceable in accordance with the terms hereof.

IN WITNESS WHEREOF the Parties hereto have hereunto set their hands and seals in the presence of subscribing witnesses:

SIGNED, SEALED AND DELIVERED.

On behalf of AEDB

By: Air Marshal (R) Shahid Hamid
Title: Chief Executive Officer
Signature:

On behalf of Company

By: UBAID AMANULLAH
Title: GENERAL MANAGER
Signature:

In the presence of Witnesses:

(1)
LT Col Asim Foad.
28-3-08

(2)
M. AMIN BHIMANI
28-3-08.

Government of Pakistan
Alternative Energy Dev. Board
Camp Office, Karachi.

List of Schedules

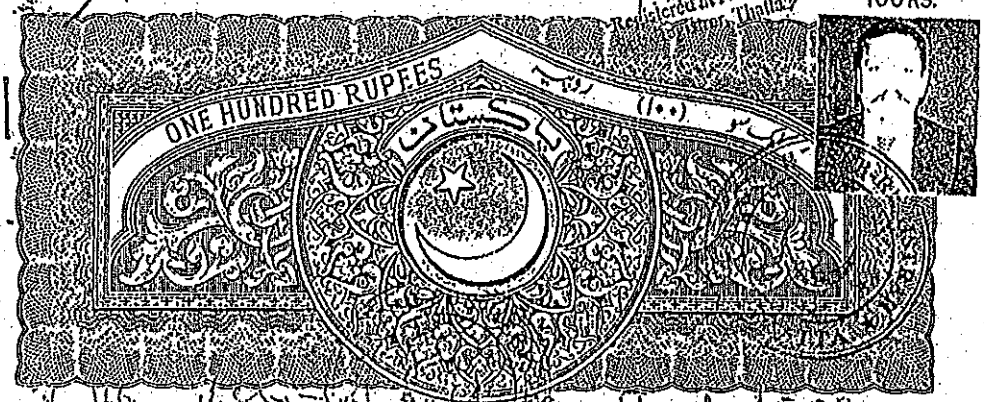
I. Copy of Master Lease Deed
II. Site Plan
III. Form of Site Sub-Lease Deed (Subject to Contract)

PAKISTAN

Registered at No. 20 Thatta

100 RS.

Anx - B



Serial No: 40

Presented at the Office of the Sub-Registrar Thatta, on 14.2.2008 between hours of 12.45 A.M/P.M

Head Quarter, Sub-Registrar, Thatta

ENDORSEMENTS AS UNDER

Registration Fee
Paging Fee
Searched Fee for Rs.
Endorsement Fee
Process Fee No. Dated
Copying Fee (folios)
Stamp Fee
Delivered on
Applicant of M/s
Total 75-00

Head Quarter, Sub-Registrar, Thatta.
Sub-Registrar, Thatta.

AGREEMENT OF DEED

This deed of lease is made by Lt. Col. Asim Fwad Siddiqi, Director General Alternative Energy Development Board Prime Minister Secretariat Islamabad at District Officer (Revenue & Estate), Thatta, this 11th day of February 2008 between the Government of Pakistan (hereinafter called Government) hereinafter called to as the lessor which term shall include his successors in office, legal representatives and executors acting through the Federal Government of Pakistan AEDB the first part and hereinafter called the lessee which term shall include his successors in office, legal representatives and executors acting through the of the second part.

Whereas in pursuance of the statement of conditions published with the Land Utilization Department Notification No. 09-294-03/SO-I/336 Dated: 25.02.2006, the lessor Secretary to Government of Sindh Land Utilization Department Sindh Karachi, vide his letter No. 03-05-60-06/SO-II/91 dated 09.02.2008 has leased out to lessee admeasuring 14169-00 acres situated in Deh Kohistan 7/1 (Makan Gangan Waro, Banghan Khado, Ghattan, Doonhi Wari, Chakri) Taluka Thatta (Jhampir area) and more particularly described in the schedule below which vests to the Government of Installation of Wind Mills on the following terms and conditions, with effect from Kharif 1908/09.

NOW, THEREFORE, this deed witnesses as follows:

1. The lease shall be subject to the provisions of the Colonization of Government Lands Act, 1912 and the conditions provided in the said statement.

2. Subject to other conditions, the land is granted on lease for a period of 30 years commencing from 2008/09.

3. (i) The land shall be solely used for installation of Wind Mills generating electricity hereinafter referred to as the Project.

(ii) The land shall not be used for any other purpose unless the lessee obtains prior permission from the lesser and the lessee fulfill the conditions on which permission is granted.

4. The lessee may, on its successful completion be renewed on the same terms and condition herein contained on the payment of revised rates of lease money and increased rent determined by the District Officer (Revenue), Thatta, with the approval of the Government.

5. If the District Officer (Revenue), Thatta is satisfied that the lessee has committed any breach or not observance of the condition(s) hereinbefore contained, action may be taken under section 24 of the said Act.

6. The lease shall be revoked if and when the land is required by the Government for public purposes.

7. The lease money shall be paid as under: -

a) For first 10 years at the rate of Rs: 500/- per year, which has been deposited in Government Treasury vide Challan No. P1/5 dated 12.02.2007 for Rs. 8,85,10,500-00, No. P/5 dated 02.02.2008 for Rs. 1,01,00,000-00 & No. 9 dated: 7,12,69,500-00 totaling Rs 16,98,80,000-00 for entire area of 33976-00 acres which includes this area of Deh Kohistan 7/1 Taluka Thatta.

b) For next 10 years at the rate of Rs: 1000/- per year which shall be deposited on or before 01.02.2018 of each year.

c) For next 10 years, at the rate of Rs.2000/- per year on or before 01.02.2028 of each year.

8. The lease money for the first 10 years viz Rs: 16,98,80,000-00 has been deposited in lump sum and receipt copy of Challan is attached with this agreement.

9. The lessee can authorize any one to use the land between the lowers up to a height of a meter in consultation with the lessee.

10. The lessee, under intimation to the lessor, may sub-lease the land or any portion thereof to any person or party.

IN WITNESS THEREOF the Director General South Alternative Energy Development Board has by order and on behalf of the lessor set this hand and affixed his official seal and the said lessee has hereinto set his / it hand and seal the day and year first herein before written.

SCHEDULE

Details of the land

Measurement and plan of land bounded by: -

ON THE NORTH	MOUNTAIN AREA
ON THE SOUTH	RAILWAY LINE & JHAMPIR GRID STATION
ON THE EAST	NALA HAROLO NAI
ON THE WEST	M/S EMIRATE SHEEP FARM & LAYARI NAI

hereinafter referred to as the Project.

Lessee:

Lt. Col. Asim Fwad Siddiqi,
Director General,
Government of Pakistan AEDB
Islamabad

Government of Pakistan
Alternative Energy Dev. Board
Camp Office, Karachi.

Lessor:

Hadi Bakhsh Kalhoro
District Officer (Revenue Estate),
Thatta

Witness:

Muhammad Khan s/o Muhammad Moosa Khatti
Mukhtiarkar (H.Q.) Estate
Thatta.

Shahzad Hasan s/o Ch. Ghulam Hussain
Survey Officer AEDB,
Camp Office Karachi.

Registered at No.....
Sub-Registrar, Thatta.

SEAL OF REGISTRAR THATTA.

3. (i) The land shall be solely used for installation of Wind Mills generating electricity hereinafter referred to as the Project

Hadi Bux
S/o Haji Nasir Ahmed
Executing Party, Zakwan Kallhoro Muslim
Adult, I/Oo: ...
...
admits execution of this deed.

He is exempted from his personal appearance in his Official capacity u/s 88 of the Registration Act. He is personally known to the u/s S.R.

Ghulam Murtaza
Sarki S.R. Thatta.

State that he knows the above executants and identifies him / them who is personally known to the under signed Registering Officer.
Dated: 4.3.2008

Sub-Registrar, Thatta.

ENTERED URGENT MICRO FILMING
Fees Rs: 400/- Vide
Receipt No: 49 Dated: 04.03.2008

Sub-Registrar, Thatta.

Registered at No: 20
Book No: 1
Dated: 04-03-2008

Sub-Registrar, Thatta.

SEAL OF THE SUB-REGISTRAR

M.F. Roll No: U 487
3603
Photo-Registrar, Hyderabad
Date 06-03-2008

SCHEDULE-II

DESCRIPTION OF SITE

Details of the land — 1,553 acres land in Jhimpir, District Thatta whose coordinates are given as below:

Sr. No.	Longitude	Latitude
1	25° 09' 20.45"	68° 00' 02.06"
2	25° 10' 44.43"	67° 55' 13.65"
3	25° 11' 03.75"	67° 55' 47.34"
4	25° 10' 06.60"	67° 59' 03.60"
5	25° 09' 35.50"	67° 59' 54.90"
6	25° 09' 31.00"	67° 59' 52.80"

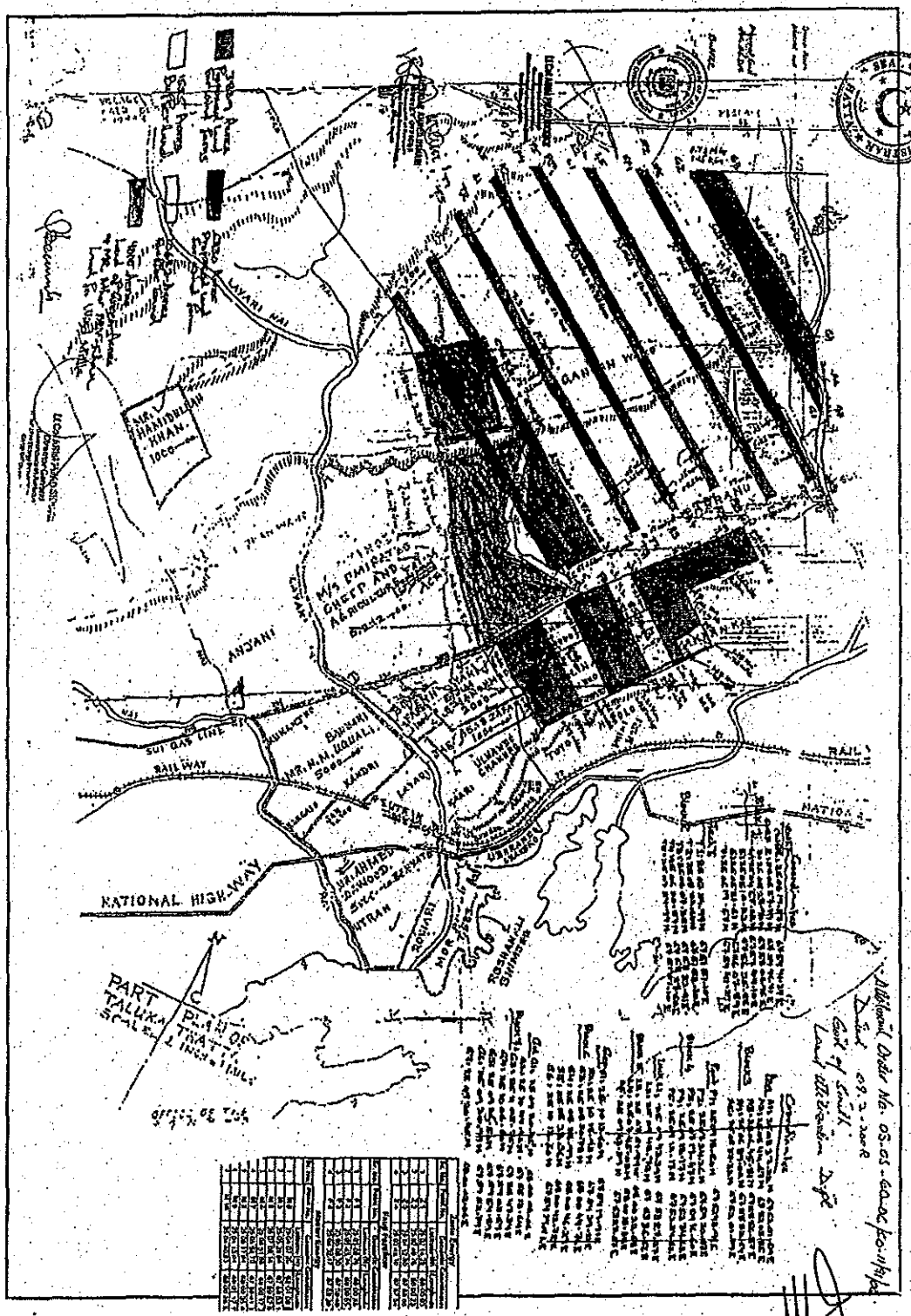
Measurement and plan of land bounded by: -

ON THE NORTH — Mountain Area and unsurveyed land

ON THE SOUTH — 6 Wind Power Projects including Gul Ahmed Wind [redacted] Ltd; Railway Line & Jhimpir Grid Station

ON THE EAST — Nala Harolo Nal; Local village and unsureyed land

ON THE WEST — M/s Emirate Sheep Farm; Layari Nal; Unsurveyed land and National Super Highway


NATIONAL HIGHWAY
RAILWAY
SUI GAS LINE
ANJANI
PART TALUKA PLAN
SCALE
OFFICE OF THE

STANDARDIZED SITE SUB-LEASE DEED

ALTERNATIVE ENERGY DEVELOPMENT BOARD ("AEDB")

And

[_____]

SITE SUB-LEASE DEED

-RELATING TO-

WIND POWER GENERATION COMPLEX

AT

[_____]

MADE AT

ISLAMABAD, PAKISTAN

COUNSEL FOR AEDB:

COUNSEL FOR COMPANY

&

SITE SUB-LEASE DEED

This **SITE SUB-LEASE DEED** is made at _____ on this _____ day of ____

By and Between

ALTERNATIVE ENERGY DEVELOPMENT BOARD, a statutory body established by and under the Alternative Energy Development Board Ordinance, 2007 (hereinafter referred to as **"AEDB"** which expression shall, wherever the context requires or permits, include its successors in interest and permitted assigns)

And

[Name of Company], a company incorporated under the laws of Pakistan (hereinafter referred to as the **"Company"**, which expression shall, wherever the context so requires or permits, include its successors in interest and permitted assigns), having its registered office at [Registered Address of the Company].

Each of AEDB and the Company is hereinafter referred to individually as a **"Party"** and, collectively, as the **"Parties"**.

RECITALS

A. WHEREAS, pursuant to the GOP (as hereinafter defined) policy to involve the private sector in the development and generation of Alternate or Renewable Energy (as hereinafter defined), AEDB has been established as the principal instrumentality of the GOP to, inter alia, facilitate power generation through Alternative or Renewable Energy sources;

B. WHEREAS, consistent with the GOP's policy and guidelines on development and generation of Alternative or Renewable Energy, to be implemented through the AEDB, the Company has proposed to design, engineer, construct, commission, insure, finance, operate and maintain the Complex (as hereinafter defined) together with allied and incidental infrastructure and facilities at the Site (as hereinafter defined) for supply of electric power in terms of the Implementation Agreement (as hereinafter defined) and the Energy Purchase Agreement (as hereinafter defined); and

C. WHEREAS, AEDB has, for the purposes mentioned in Recitals A and B, procured, among other parcels of land, the Site under the Master Lease Deed (as hereinafter defined) for sub-lease to the Company.

NOW, THEREFORE, in consideration of the mutual benefits to be derived and the representations and warranties, conditions and undertakings herein contained, and intending to be legally bound hereby, the Parties hereby agree as follows:

ARTICLE I
Definitions & Rules of Interpretation

1.1 Definitions

Wherever used in this Site Sub-Lease Deed, the following terms shall bear the meaning ascribed below:

"Additional Consents" - The consents specified in Schedule I, which the AEDB shall procure from the GOS to enable the Company to enjoy the Site for purposes of the Project for the Term on the terms and conditions set out in this Site Sub-Lease Deed.

"AEDB" - The meaning ascribed thereto in the Recitals to this Site Sub-Lease Deed.

"Alternate or Renewable Energy" - The meaning ascribed thereto in the Alternative Energy Development Board Ordinance, 2007, and when used in relation to the Complex, means electric energy generated from wind energy by use of wind turbine generators.

"Arrears" - Any cesses, dues, demands, fees, impositions, levies, liabilities, rents, taxes, or similar other charges payable to the GOS on account of the use or occupancy of the Site, except the Rent and any payment claimed by GOS on account of default by the Company of the terms of this Site Sub-Lease Deed.

"Conditions Precedent" - The conditions precedent to the effectiveness of this Site Sub-Lease Deed, as specified in Article V.

"Company" - The meaning ascribed thereto in the Recitals to this Site Sub-Lease Deed.

"Complex" - The meaning ascribed thereto in the Implementation Agreement.

"Cut Off Date" - [*Insert date*], as may be extended by the Parties by mutual consent but, in any event, not beyond [*Insert date*], by which the Company shall have fulfilled the Conditions Precedent.

"Encumbrances"- Any mortgage, charge, lien or any other arrangement or agreement having the legal effect of creating security on whole or part of the Site, except as set out in this Site Sub-Lease.

"Energy Purchase Agreement" - The Energy Purchase Agreement to be entered in to by and between _____ and the Company in relation to the Project.

"GOP" - The meaning ascribed thereto in the Implementation Agreement.

"GOS" - The Government of Sindh, Pakistan.

"Implementation Agreement" - The Implementation Agreement to be entered in to by and between the GOP and the Company in relation to the Project.

"Laws of Pakistan" - The meaning ascribed thereto in the Implementation Agreement.

"Lenders" - The meaning ascribed thereto in the Implementation Agreement.

"Master Lease Deed" - The Deed of Lease dated _____ entered in to by and between AEDB and the GOS, a copy whereof has been provided by the AEDB to the Company.

"Party" or "Parties" - The meaning ascribed to it in the Recitals to this Site Sub-Lease Deed.

"Project" - The meaning ascribed thereto in the Implementation Agreement, together with allied and incidental infrastructure and facilities to be developed by the Company at Site.

"Project Agreements" - The meaning ascribed thereto in the Implementation Agreement.

"Rent" - The meaning ascribed to it in Article III.

"Site" - All that piece and parcel of land, measuring _____ acres of land situated in Taluka _____, District Thatta, and more particularly described in Schedule II, being sub-leased to the Company by AEDB under this Site Sub-Lease Deed.

"Site Sub-Lease" - This Site Sub-Lease Deed entered in to by and between the Parties pursuant to the Master Lease Deed, as may be amended, varied or modified by the Parties from time to time.

"Schedule" - A Schedule to this Site Sub-Lease Deed, which shall constitute an integral part of this Site Sub-Lease Deed.

"Term" - The term of this Site Sub-Lease as set out in Article IV.

1.2 Rules of Interpretation

For the purposes of this Site Sub-Lease, the rules of interpretation agreed to between the Parties in Clause 1.2 of the Implementation Agreement are incorporated by reference herein.

ARTICLE II
GRANT OF SUB-LEASE

2.1 AEDB represents and warrants to the Company that AEDB is well seized of and has, and shall have and maintain, during the Term, good and valid legal and beneficial leasehold ownership, right, title and interest in and to the Site, and is entitled under the Laws of Pakistan to grant the exclusive rights therein to the Company for purposes of the Project in accordance with the terms of this Site Sub-Lease Deed. AEDB further represents that it shall, subject to the Company not defaulting under any of the Project Agreements, support and use all reasonable efforts to procure timely grant of the Additional Consents.

2.2 Subject to the Company fulfilling the Conditions Precedent on or before the Cut Off Date, in consideration of the Company agreeing to enter in to, and performing under, the Project Agreements and agreeing to pay the Rent herein reserved, AEDB hereby demises unto the Company the Site by way of an exclusive sub-lease, together with all rights, easements and privileges appurtenant thereto, free from any Encumbrances or Arrears, to be held and enjoyed by the Company for the Term and other terms and conditions herein specified.

2.3 The Company accepts the Site, and as a sub-lessee thereat, undertakes to develop at the Site, in accordance with the Project Agreements, an Alternative or Renewable Energy supported electric power generation facility in an efficient and timely manner, in accordance with the terms of this Site Sub-Lease Deed.

ARTICLE III
RENT RESERVED

3.1 The Company shall pay to AEDB the rent for the Site in the manner, at the rate and on or before the times specified below (the "Rent"):

(a) For the first ten (10) years of the Term, the Rent is fixed at the rate of Rs. 500/- (Rupees five hundred) per acre per year. AEDB acknowledges receipt of a sum of Rs. _____ as Rent for such period and confirms that the same has been credited to the relevant Head of Account of the GOS;

(b) For the next (10) years of the Term, the Rent is fixed at the rate of Rs. 1,000/- (Rupees one thousand) per acre per year. Such Rent shall be paid by Company in advance for each year, on or before _____, commencing prior to _____.

(c) For the remaining Term, the Rent shall be fixed at Rs. 2,000/- per acre per year. Such Rent shall be paid by Company in advance for each year, on or before _____, commencing _____.

3.2 The Rent fixed in terms of Clause 3.1 is all inclusive and shall not be subject to any variation, upwards or down wards, except as expressly provided herein. The Company shall not be liable to pay to the GOS or the AEDB or any local government or authority any additional rates, charges, taxes, levies, cesses or other impositions of whatever nature and howsoever called in relation to the sub-lease of the Site by the Company hereunder, except any such demand on account of default by the Company of this Site Sub-Lease.

3.3 The Rent paid, and payable hereunder, shall be liable to withholding and deduction in accordance with the Laws of Pakistan, and the Company shall furnish AEDB evidence of payment of such withholding or deduction promptly.

ARTICLE IV
TERM AND TERMINATION OF SITE SUB-LEASE

4.1 The Term of this Site Sub-Lease shall commence on the date hereof and shall continue in full force for a period equal to the term of the Energy Purchase Agreement (including, for the avoidance of doubt, any extension in the term of the Energy Purchase Agreement) unless terminated earlier in accordance with the provisions of this Site Sub-Lease.

4.2 In the event the Company is unable to fulfill the Conditions Precedent on or before the Cut Off Date, this Site Sub-Lease Deed shall cease to have any effect and the Rent paid by the Company in advance under Clause 3.1 (a) for the unutilized period of the Term shall be refunded to the Company by AEDB.

4.3 AEDB may terminate the Site Sub-Lease Deed if the Company is unable to cure a default under this Site Sub-Lease Deed or any of the Project Agreements for a period of ninety (90) days, or a longer period if mutually agreed by the Parties, from the date of notice by AEDB.

4.4 The Company may terminate this Site Sub-Lease Deed at any time by written notice to AEDB without thereby incurring any liability other than that specified in the Project Agreements.

ARTICLE V
CONDITIONS PRECEDENT

5.1 This Site Sub-Lease shall not become effective and confer any rights in the Company under Article II unless the Company has satisfied the following conditions precedent on or before _____ (the "Cut Off Date"):

(a) The AEDB has issued notice in writing to the Company to take, and the Company has taken, possession of the Site;

(b) the Project Agreements shall have been duly executed by the Parties; and

(c) the Company shall have achieved Financial Closing (as defined in the Standardized Implementation Agreement).

5.2 The Parties may by mutual consent extend the Cut Off Date, provided, however, that it shall not be extended beyond _____.

ARTICLE VI
MISCELLANEOUS

6.1 Any notice, demand, or communication required or permitted under this Site Sub-Lease shall be in writing and shall be either: (i) delivered personally; (ii) mailed by certified mail, return receipt requested; (iii) sent by courier delivery service; or (iv) facsimile machine, to the respective Parties at the following addresses, unless and until a different address has been designated by written notice to the other Party:

AEDB:
Alternative Energy Development Board
PM Secretariat, Islamabad
Attention: Chairman
Fax No:

The Company:
[Name and Address]
Attention: Chief Executive Officer
Fax No: [insert]

6.2 The Company shall not assign or transfer any of its rights under this Site Sub-Lease Deed, except to the Lenders as permitted under the Implementation Agreement.

6.3 This Lease constitutes the entire agreement between the Parties with respect to the subject matter hereof and supersedes all prior understandings and communications between the Parties in respect thereof, however, nothing herein shall derogate from or supersede any obligation of the Company under any of the Project Agreements.

6.4 This Site Sub-Lease shall not be amended or modified orally and no amendment or modification of this Site Sub-Lease shall be effective unless and until the same is in writing and duly executed by both Parties.

6.5 The failure to exercise or delay in exercising a right or remedy under this Site Sub-Lease shall not constitute a waiver of the right or remedy or a waiver of any other rights or remedies and no single or partial exercise of any right or remedy under this Site Sub-Lease shall prevent any further exercise of the right or remedy or the exercise of any other right or remedy.

6.6 This Lease shall be governed by and construed in accordance with the laws of the Islamic Republic of Pakistan.

6.7 The Parties shall enter into and execute such further agreements, deeds, instruments or documents as may be necessary or desirable to give effect to this Site Sub-Lease.

6.8 Each Party represents and warrants to the other that it has all power, authority and approval required to enter into, execute and deliver this Site Sub-Lease Deed and to perform fully its obligations hereunder, and that it has duly executed and delivered this Site Sub-Lease, which constitutes its valid and binding obligation, enforceable in accordance with the terms hereof.

IN WITNESS WHEREOF the parties hereto have hereunto set their hands and seals in the presence of subscribing witnesses:

SIGNED, SEALED AND DELIVERED.

On behalf of AEDB

By: _____
Title: _____
Signature: _____

On behalf of Company

By: _____
Title: _____
Signature: _____

In the presence of Witnesses:

(1) _____

(2) _____

Schedule I

Additional Consents

[To be developed]

Annex F1

Handover of Land

Government of Pakistan
Alternative Energy Development Board (AEDB)
13-Khayaban-e-Bahria, Phase- V
DHA, Karachi
Tel: 5342708 - Fax: 5847610

6-5- 2008

No. B/3/12/2008/khi

Subject: **HANDING/TAKING OVER OF THE LAND: JHAMPIR**

I DANISH IQBAL NIC # 42201-4584613-1 have taken over the physical possession of 1553 acres of land in Jhampir, District Thatta from Lt Col. Asim Fwad Director General AEDB Camp Office Karachi on behalf of M/S. Metro Power Co. (Pvt) Ltd. 36-F, Block 6, PECHS, Karachi on 6-5-08 for wind farms. I have seen the area and fully satisfied with the position. I have also received map of land with the following coordinates.

Sr. No.	Point No.	Geodetic Coordinates	
		Latitude (N)	Longitude (E)
1	Met 1	25 09 12.60	67 59 56.20
2	Met 2	25 10 44.42	67 55 13.64
3	Met 3	25 11 03.75	67 55 47.34
4	Met 4	25 10 12.99	67 58 42.62
5	Met 5	25 09 39.05	67 59 02.94
6	Met 6	25 09 22.03	67 59 54.44
7	Met 7	25 09 12.60	67 59 56.20

Handed Over by

Lt. Col Asim Fwad Siddiqi
Director General
Camp Office Karachi

Taken Over By

Government of Pakistan
Alternative Energy Dev. Board
Camp Office, Karachi

Annex G

Ambient Air Quality Details

Ambient Air Quality Monitored at 15 Minute Interval near MPCL MAST B4

Date	Time	SO2 (µg/m³)	NOx (µg/m³)	CO (mg/m³)	Dust (µg/m³)	Noise (dB)
9/3/2009	12:00	12.1	15.3	1.6	145.0	45
9/3/2009	12:15	12.3	15.6	1.2	148.0	42
9/3/2009	12:30	12.1	15.4	1.5	147.0	45
9/3/2009	12:45	12.5	15.0	1.3	145.0	45
9/3/2009	13:00	12.1	15.2	1.4	142.0	45
9/3/2009	12:15	12.1	15.3	1.2	152.0	47
9/3/2009	13:30	12.3	15.4	1.5	142.0	45
9/3/2009	13:45	12.1	15.6	1.6	145.0	48
9/3/2009	14:00	12.6	15.2	1.2	147.0	45
9/3/2009	14:15	12.3	16.3	1.8	142.0	47
9/3/2009	14:30	12.5	15.9	1.3	145.0	45
9/3/2009	14:45	12.4	15.4	1.2	142.0	48
9/3/2009	15:00	12.6	15.3	1.5	139.0	47
9/3/2009	15:15	12.5	15.2	1.4	138.0	45
9/3/2009	15:30	12.1	15.1	1.2	145.0	41
9/3/2009	15:45	12.3	14.9	1.2	136.0	45
9/3/2009	16:00	12.4	14.6	1.3	132.0	41
9/3/2009	16:15	12.1	14.7	1.2	145.0	45
9/3/2009	16:30	12.1	14.5	1.2	136.0	44
9/3/2009	16:45	12.3	14.3	1.3	135.0	45
9/3/2009	17:00	12.1	14.1	1.2	134.0	47
9/3/2009	17:15	12.3	13.9	1.3	136.0	45
9/3/2009	17:30	12.1	13.5	1.2	135.0	47
9/3/2009	17:45	11.9	13.4	1.2	134.0	45
9/3/2009	18:00	11.7	13.6	1.3	136.0	47
9/3/2009	18:15	11.6	13.1	1.2	132.0	44
9/3/2009	18:30	11.8	13.6	1.3	135.0	45
9/3/2009	18:45	11.6	12.9	1.2	132.0	48
9/3/2009	19:00	11.5	12.9	1.3	139.0	52
9/3/2009	19:15	11.4	12.8	1.9	135.0	45
9/3/2009	19:30	11.2	12.6	1.2	132.0	47
9/3/2009	19:45	11.3	12.8	1.1	136.0	45
9/3/2009	20:00	11.5	12.66	1.2	135.0	54
9/3/2009	20:15	11.4	12.5	1.1	134.0	45
9/3/2009	20:30	11.2	12.4	1.2	132.0	44
9/3/2009	20:45	11.3	12.6	1.1	136.0	45
9/3/2009	21:00	11.2	12.6	1.3	135.0	47
9/3/2009	21:15	11.5	12.8	1.2	132.0	45
9/3/2009	21:30	11.1	12.4	1.3	134.0	47
9/3/2009	21:45	11.3	12.3	1.2	138.0	45
9/3/2009	22:00	11.1	12.1	1.2	136.0	47
9/3/2009	22:15	11.3	11.3	1.3	135.0	45
9/3/2009	22:30	11.2	11.6	1.2	136.0	47
9/3/2009	22:45	11.1	11.8	1.1	135.0	46
9/3/2009	23:00	10.9	1106	1.2	134.0	48
9/3/2009	23:15	10.8	11.4	1.2	36.0	47
9/3/2009	23:30	10.5	11.2	1.3	135.0	45
9/3/2009	23:45	10.0	11.3	1.2	132.0	47
10/3/2009	0:00	9.9	11.2	1.3	139.0	45
10/3/2009	0:15	9.8	11.3	1.2	137.0	47
10/3/2009	0:30	9.9	11.1	1.3	135.0	45
10/3/2009	0:45	9.8	10.9	1.2	136.0	47
10/3/2009	1:00	9.8	10.8	1.3	135.0	42
10/3/2009	1:15	9.9	10.6	1.2	134.0	45
10/3/2009	1:30	9.8	10.5	1.3	132.0	47

Date	Time	SO2 (µg/m³)	NOx (µg/m³)	CO (mg/m³)	Dust (µg/m³)	Noise (dB)
10/3/2009	1:45	9.7	10.8	1.2	136.0	45
10/3/2009	2:00	9.3	10.4	1.1	132.	47
10/3/2009	2:15	9.2	10.3	1.0	135.0	44
10/3/2009	2:30	9.1	10.5	0.9	134.0	44
10/3/2009	2:45	8.9	10.2	0.9	132.0	45
10/3/2009	3:00	8.7	10.6	0.9	136.0	47
10/3/2009	3:15	8.9	10.7	0.9	132.0	45
10/3/2009	3:30	8.7	10.5	0.8	136.0	48
10/3/2009	3:45	8.5	10.2	0.9	132.0	47
10/3/2009	4:00	8.6	10.1	0.8	136.0	41
10/3/2009	4:15	8.7	9.9	0.9	134.0	42
10/3/2009	4:30	8.4	9.8	0.9	135.0	45
10/3/2009	4:45	8.5	9.9	0.8	132.0	47
10/3/2009	5:00	8.3	9.7	0.9	134.0	45
10/3/2009	5:15	8.5	9.8	0.9	129.0	45
10/3/2009	5:30	8.3	9.6	0.8	128.0	55
10/3/2009	5:45	8.1	9.8	0.9	127.0	45
10/3/2009	6:00	8.1	9.5	0.8	129.0	48
10/3/2009	6:15	8.3	9.6	0.9	128.0	47
10/3/2009	6:30	8.1	9.5	0.8	127.0	45
10/3/2009	6:45	7.9	9.1	0.9	128.0	47
10/3/2009	7:00	7.8	9.2	0.8	129.0	45
10/3/2009	7:15	7.9	9.3	0.9	128.0	47
10/3/2009	7:30	7.8	9.2	1.0	127.0	45
10/3/2009	7:45	7.9	9.2	1.2	129.0	47
10/3/2009	8:00	7.8	8.9	1.3	129.0	45
10/3/2009	8:15	7.8	8.9	1.2	128.0	47
10/3/2009	8:30	7.9	8.7	1.6	129.0	45
10/3/2009	8:45	8.9	8.6	1.2	132.0	48
10/3/2009	9:00	8.7	8.5	1.3	135.0	47
10/3/2009	9:15	8.9	8.9	1.2	134.0	45
10/3/2009	9:30	8.5	8.7	0.2	136.0	47
10/3/2009	9:45	8.6	8.6	1.2	132.0	45
10/3/2009	10:00	8.5	8.2	1.2	136.0	47
10/3/2009	10:15	8.6	8.+	1.2	134.0	45
10/3/2009	10:30	8.4	8.5	1.3	132.0	47
10/3/2009	10:45	8.6	8.9	1.2	132.0	45
10/3/2009	11:00	8.7	9.1	1.1	131.0	47
10/3/2009	11:15	8.3	9.3	1.2	136.0	46
10/3/2009	11:30	8.2	9.5	1.2	132.0	48
10/3/2009	11:45	8.3	9.4	1.1	132.0	47
10/3/2009	12:00	8.1	9.6	1.3	131.0	46
10/3/2009	12:15	8.9	9.2	1.2	136.0	49
10/3/2009	12:30	9.1	9.8	1.2	135.0	52
10/3/2009	12:45	9.3	10.6	1.3	134.0	47
10/3/2009	13:00	9.5	10.5	1.2	132.0	45
10/3/2009	13:15	9.6	10.9	1.1	136.0	48
10/3/2009	13:30	9.4	11.2	1.2	132.0	47
10/3/2009	13:45	9.9	11.3	1.3	136.0	46
10/3/2009	14:00	9.8	11.4	1.1	132.0	48
10/3/2009	14:15	10.2	11.3	1.2	136.0	47
10/3/2009	14:30	10.5	11.2	1.3	132.0	45
10/3/2009	14:45	10.6	11.6	1.1	136.0	48
10/3/2009	15:00	10.9	11.1	1.2	132.0	47
10/3/2009	15:15	11.1	11.0	1.1	136.0	46
10/3/2009	15:30	11.3	11.5	1.2	132.0	47
10/3/2009	15:45	11.5	11.9	1.3	136.0	48
10/3/2009	16:00	11.1	11.2	1.2	132.0	47

Date	Time	SO2 (µg/m³)	NOx (µg/m³)	CO (mg/m³)	Dust (µg/m³)	Noise (dB)
	Average	10.2	11.6	1.2	134.1	46.1
	Maximum	12.6	16.3	1.9	152.0	55.0
	Minimum	7.8	8.2	0.2	36.0	41.0

Source: IEE Report, 2009

Annex H

Stakeholder Consultation Minutes

1.1 STAKEHOLDER CONSULTATIONS (2009)

Details of Stakeholder Consultations organized during the preparation of IEE report in year 2009 are given in the following tables.

Table 1.1 List of Institutional Stakeholders Consulted during preparation of IEE Report in Year 2009

S. No.	Designation
1	Director Sindh EPA
2	Director General Sindh EPA
3	Secretary Ministry of Environment and Alternate Energy
4	Sindh Wildlife Department
5	Conservator Wildlife GoS
6	National Development Coordinator Clean Energy IUCN
7	Coordinator Natural Resource Management
8	Head Forestry and Natural Resource Management
9	Deputy Director, Department of Archaeology, Karachi

Table 1.2 Details of Stakeholder Consultation with Community during IEE Report Preparation in 2009

S. No.	Name of Goth	Number of Participants	Remarks
1	Qasim Burfat	8	Residents appreciate the project and look forward to employment of their young men, getting safe drinking water supply, healthcare facility. They do not have a school but have a madressa.
2	Janoo Burfat	2	Residents appreciate the project and look forward to employment of their young men, getting safe drinking water supply, healthcare facility and school teachers.
3	Jhakro Jamali	3	Residents appreciate the project and look forward to employment of their young men, getting safe drinking water supply, healthcare facility and school teachers.
4	Brohi Goth	3	Residents appreciate the project forward to employment of their young men, getting safe drinking water supply, and healthcare facility. They have a school that is functional.

Information Disclosure and enquiries at MPCL site	Observations/responses of the communities
Participants were informed at the outset about the objectives of the wind farm project and about the prevailing environmental condition at the site. People were informed that according to initial observation at the site, the area was highly underdeveloped. There was no water, no electricity while dust and firewood was for free. There was room for upgradation of the general condition The wind power project could be one step towards	Participants were appreciative of the initiative taken by AEDB in identifying the potential of wind energy in Deh Kohistan, which has remained an underdeveloped area since ages. They appreciated the initiative at bringing the environmental issues to the forefront, and also incorporating mitigation measures and provision of facilities such as water supply for construction, and provision of safe drinking water, besides handing over the water supply

Information Disclosure and enquiries at MPCL site	Observations/responses of the communities
achieving the upgradtion, but like all other development projects, it has limitations of its own. Those limitations are imposed by environmental aspects. These limits are identified by environmental impact assessment. The purpose of our visit, the participants were explained, was to share information on the environmental baseline and impact that the different activities will have on the physical and social environment. The impact of activities involved in bringing the machinery and equipment to site, their installation, and operation will be assessed and finally the environmental performance will be evaluated. The participants were informed about the different environmental aspects and their impact on the physical and living environment and how the severity of impact will be reduced. They were informed that evaluation of social soundness of the project was just as important as physical and biological soundness. For this purpose it is important to have information on Living conditions at Project site and in the surrounding villages, name of villages, number of households, distance from Project site; distance from important towns, mode of transport; Availability of water and safe drinking water; Pattern of disease and common ailments in the area; Availability of healthcare facilities, and their performance, schools and their performance; General living conditions, occupation, professional affiliation, type of family, Size of family, Indigenous communities in the area, ethnicity, Treatment of disadvantaged communities. The people of the area nominated Mir Mohammad Burfat to provide all information since very few among them could interact in Urdu.	and wastewater disposal system to the village residents at the end of construction period There were observations on impoverishment of the environment resulting from inattention to improve the general condition of the area and maintaining it. Poverty was the main issue confronting the stakeholders in particular the residents of villages at great distances from the site. There were observations that ecological resources were being depleted at a rapid rate while subsistence farming was unable to meet the day-to-day needs of the local population. Others observed that poverty level in the district was almost the same, if not lower than the average in the rural areas of Sindh and the household income of at least 50% population was less than Rs 6000 per month/household. Employment opportunities were low and the young e r generation was not prepared to remain in poverty; leading to considerable migration to Karachi in search of jobs. Poverty has mostly been caused by the following factors: • Scarcity of water • Recurring drought • Low return from crop and livestock farming • Low wages from stone cutting • Low literacy rate • Lack of training • High population growth • Lack of access to employment in industrial area • Increasing unemployment • High cost of healthcare In individual interview and focus group discussions, women identified the following issues: • Need for a dispensary and Mother and Child • Healthcare Centre for Deh Kohistan • Awareness on education • Access to vocational training centre for women to earn through working at home • Establishment of industrial home type of institution for production of hand made goods • Gender discrimination • Compulsion to engagement in stone cutting to supplement their family income • Fetching water from long distances, some times more than once • Malnourishment.

Information Disclosure and enquiries at MPCL site	Observations/responses of the communities
	Community Expectations from MPCL: All respondents i.e. males as well as females expect the following from the proposed project: • Safe drinking water** • Job Opportunity* • Healthcare centres particularly for women and children** • Schools* • Vocational training • Black top link roads* • Poverty alleviation schemes*

1.2 STAKEHOLDER CONSULTATIONS DURING IEE UPDATE (FEBRUARY – MARCH 2013)

Details of village wise Community Consultations (including Men and Women) given in the following tables organised between February – March 2013:

Date:	**2 March 2013**	
01	**Summary of participants**	
	Number of Participants: 3 (Male : 3 Female: 0) **Main Occupation of the Participants :** Cattle Rearing, Agriculture and Labor **Literacy level of the participants:** Illiterate **Clan:** Burfat **Religion:** Islam	
	Village: Janoo Burfat	
	Union Council: Jhimpir	**Taluka/Tehsil:** Thatta
	Number of Households in village: 20	
	Clans living in village: Burfat	
	Average Number of Females:80	
	Number of Schools at village:01 GBPS closed as teacher remains absent	
	Enrolment of Students in School:40	
	Number of Teachers at School:01	
	Average literacy ratio: nil	
	Health Facility in village (If any):nil	
	Common Diseases: fever, Malaria, cough and cold, skin scabies. One polio case has	
	Electricity to village: not available	**Source of Drinking water:** Hand Pump
02	**Agriculture (Which crops are cultivated & how many houses are involved in):** Agriculture depends upon rain water. The main crops are Jowar, vegetables like guar,	
	Livestock: 40 Goats and 20 cows. no sheep and no buffaloes	
	Fishing: Nil	
	Laboring: Quarrying, stone cutting, gravel and sand collection	
	Other Occupations: Wood cutting, some males have employment in the company as security in-charge and watchmen. Some males facilitate Arab	
	Average Income: PKR. 7000 per month	

03	**Culture and Customs:** • They do not work with outside males • They live in small hamlets • They wear traditional shalwar, kameez with sindhi cap & ajrak on their heads • Females never vote
	Marriages: • They have marriages within very close relatives. They prefer 1st cousins marriages.
	Shrines of the area: Mano shah shrine Rot Makkan graveyard
04	**Views/ Comments on Power Wind Project: (any reservations)** • The females expect that the company will address the following issues, which directly affect males: • Employment opportunities be fair for all • Potable Drinking Water Issue • Availability of teachers in schools • Electricity Two people are employed in the company. They have just one main concern that during the construction phase, there would be privacy issue regarding females.

Date:	2 March 2013	
	Summary of participants	
01	**Number of Participants: 3** (Male : 3 Female: 0) **Clan:** Jakhro **Religion:** Islam **Main Occupation of the Participants :** Cattle Rearing, Agriculture and Labor **Literacy level of the participants:** Illiterate	
	Village: Vakhio Jakhro	
	Union Council: Jhimpir	**Taluka/Tehsil:** Thatta
	Number of Households in village:400	
	Clans living in village: Jakhro	
	Average Number of Females:1000 (Total Population = 2800)	
	Number of Schools at village:01 GBPS (closed)	
	Enrollment of Students in School: 45	
	Number of Teachers at School:01	
	Average literacy ratio:5 percent	
	Health Facility in village (If any):nil	
	Common Diseases: fever, Malaria, cough and cold, skin scabies.	
	Electricity to village: not available	**Source of Drinking water:** hand pump , tube well
02	**Agriculture (Which crops are cultivated & how many houses are involved in):** Agriculture depends upon rain water. The main crops are Jowar, vegetables like guar,	
	Livestock: 200 Goats. Few sheep and no buffaloes	
	Fishing: Nil	
	Laboring: Quarrying, stone cutting, gravel and sand collection	
	Other Occupations: Wood cutting. Some males are drivers at trucks.	
	Average Income: PKR. 8000 to 12000 per month	
	Culture and Customs: • They do not work with outside males • They live in small hamlets • They wear traditional shalwar, kameez with Sindhi cap & Ajrak on their heads	

03	**Marriages:** • They have marriages within very close relatives. They prefer 1st cousins marriages.
	Shrines of the area: Mano shah shrine Rot Makkan graveyard
04	**Views/ Comments on Power Wind Project: (any reservations)** The females expect that the company will address the following issues, which directly affect females: • Potable drinking water • Availability of teachers in schools • Electricity

Date:	**3 March 2013**	
01	**Summary of participants**	
	Number of Participants: 3 (Male : 3 Female: 0) **Main Occupation of the Participants :** Cattle Rearing, Agriculture and Labor **Literacy level of the participants: Metric (2)&** Illiterate (**1)** **Clan:** Chang **Religion:** Islam	
	Village: Murad Ali Chang	
	Union Council: Jhimpir	**Taluka:** Thatta
	Number of Households in village: 15 (4 pucca)	
	Clans living in village: Chang	
	Average Number of Females:60 (total population = 150)	
	Number of Schools at village:1 functional	
	Enrollment of Students in School:40 (as these are the months of migration, hence the attendance has drastically	
	Number of Teachers at School:1	
	Average literacy ratio:5% (2 boys are matriculate & 3 are primary pass).	
	Health Facility in village (If any):nil	
	Common Diseases:fever, Malaria, cough and cold, skin scabies	
	Electricity to village: Solar panels since last 7 years	**Source of Drinking water:** Hand Pump
02	**Agriculture (Which crops are cultivated & how many houses are involved in):** Agriculture depends upon rain water. The main crops are Jowar, vegetables like guar,	
	Livestock: 70 Goats and 45 cows. 30 sheep and no buffaloes	
	Fishing: Nil	
	Laboring: Quarrying, stone cutting, gravel and sand collection	
	Other Occupations: Wood cutting. Only one male has employment in the company	
	Average Income: PKR. 9000 – 10,000 per month	
03	**Culture and Customs:** • They do not work with outside males • They live in small hamlets • They wear traditional shalwar, kameez with Sindhi cap & Ajrak on their	
	Marriages: • They have marriages within very close relatives. They prefer 1st cousins marriages.	
	Shrines of the area: Mano shah shrine Rot Makkan graveyard	

04	**Views/ Comments on Power Wind Project: (any reservations)** • The females expect that the company will address the following issues, which directly affect males: • Employment opportunities be fair for all • Potable Drinking Water Issue • Availability of teachers in schools • Electricity Two people are employed in the company.

Date:	**2 March 2013**	
01	**Summary of participants**	
	Number of Participants: 3 (Male : 1 Female: 2) **Main Occupation of the Participants :** Cattle Rearing, Handicraft ,Agriculture and Labor **Literacy level of the participants:** Illiterate (**3)** **Clan:** Jakhro **Religion:** Islam	
	Village: Vakhio Jakhro	
	Union Council: Jhimpir	**Taluka :** Thatta
	Number of Households in village: 16 (4 pucca)	
	Clans living in village: Jakhro	
	Average Number of Females: 70 (total population = 160)	
	Number of Schools at village: 0	
	Enrollment of Students in School: 0	
	Number of Teachers at School: 0	
	Average literacy ratio: 0	
	Health Facility in village (If any): nil	
	Common Diseases: fever, Malaria, cough and cold, skin scabies	
	Electricity to village: No	**Source of Drinking water:** water tanker (they need about 4 tankers per week, which costs
02	**Agriculture (Which crops are cultivated & how many houses are involved in):** Agriculture depends upon rain water; hence in this area due to water shortage they do limited agriculture. The main crops are Jowar, vegetables like guar, pulses including moong, wheat. They migrate to nearby Jhimpir and Jherruck towns during the months of March	
	Livestock: 250 Goats and 100 cows. A Few sheep and no buffaloes	
	Fishing: Nil	
	Laboring: Quarrying, stone cutting, gravel and sand collection	
	Other Occupations: wood cutting	
	Average Income: PKR. 7000 per month	
03	**Culture and Customs:** • They do not work with outside males • They live in small hamlets • They wear traditional shalwar, kameez with big dupatta on their heads • Sons are preferred • Combine family system	
	Marriages: • They have marriages within very close relatives. They prefer 1st cousins marriages. • They sell their livestock to cover the expenses of marriage ceremonies • The decision regarding finalization of proposal is done by the elder males of the family. Females have no importance in decision making for marital matters.	

	Birth of Child: • Sons are preferred over girls • There are no maternity homes • During deliveries, several females and new born have lost their lives • There is no caesarean case in the village
	Shrines of the area: Mano shah shrine Rot Makkan graveyard
04	**Views/ Comments on Power Wind Project: (any reservations)** The females expect that the company will address the following issues, which directly affect females: • Potable Drinking Water Issue • Availability of teachers in schools • Electricity Two people are employed in the company but they expect more employment. They have just one main concern that during the construction phase, there would be privacy issue regarding females.

Date:	**2 March 2013**		
01	**Summary of participants**		
	Number of Participants: 3 (Male :0 Female: 3) **Main Occupation of the Participants :** Cattle Rearing, Handicraft ,Agriculture and Labor **Literacy level of the participants:** Illiterate (**3)** **Clan:** Burfat **Religion:** Islam		
	Religion: 1. Islam	**2.** Islam	**3.**Islam
	Education: 1. illiterate	**2.** Illiterate	**3.** illiterate
	Village: Qasim Burfat		
	Union Council: Jhimpir	**Taluka/Tehsil:**	
	Number of Households in village: 25 (4 pucca)		
	Clans living in village: Burfat		
	Average Number of Females: 80		
	Number of Schools at village: 0		
	Enrollment of Students in School: 0		
	Number of Teachers at School: 0		
	Average literacy ratio: 0		
	Health Facility in village (If any): nil		
	Common Diseases: fever, Malaria, cough and cold, skin scabies		
	Electricity to village: not available	**Source of Drinking water:** Hand Pump	
02	**Agriculture (Which crops are cultivated & how many houses are involved in):** Agriculture depends upon rain water. The main crops are Jowar, vegetables like guar,		
	Livestock: 100 Goats and 120 cows. no sheep and no buffaloes		
	Fishing: Nil		
	Laboring: Quarrying, stone cutting, gravel and sand collection along with their family males		
	Other Occupations: wood cutting, about 15 males have employment in the company as security in-charge and		
	Average Income: PKR. 7000 to 10,000 per month		
	Culture and Customs: • They do not work with outside males • They live in small hamlets • They wear traditional shalwar, kameez with big dupatta on their heads • Combine family system		

03	**Marriages:** • They have marriages within very close relatives. They prefer 1st cousins marriages. • They sell their livestock to cover the expenses of marriage ceremonies • The decision regarding finalization of proposal is done by the elder males of the family. Females have no importance in decision making for marital matters. • They made a considerable number of bed sheets, pillows with embroidered
	Birth of Child: • Sons are preferred over girls. • There are no maternity homes • During deliveries, several females and new born have lost their lives • There is no cesarean case in the village
	Shrines of the area: Mano shah shrine Rot Makkan graveyard
04	**Views/ Comments on Power Wind Project: (any reservations)** The females expect that the company will address the following issues, which directly affect females: • Availability of teachers in schools • Electricity • Health facility Females were very happy with the company because it has provided them the facility of hand pump and some of their males are employed in the company. Females and girls were asking for the company coordinator, as they assumed that we were from the company. They did not raise any concern.

Date:	**2 March 2013**	
01	**Summary of participants**	
	Number of Participants: 3 (Male: 0 Female: 3) **Main Occupation of the Participants :** Cattle Rearing, Handicraft ,Agriculture and Labor **Literacy level of the participants:** Illiterate (**3)** **Clan:** Burfat **Religion:** Islam	
	Religion: 1. Islam **2.** Islam **3.**Islam	
	Education: 1. illiterate **2.** illiterate **3.**illiterate	
	Village: JanooBurfat	
	Union Council: Jhimpir	**Taluka/Tehsil:** Thatta
	Number of Households in village: 20	
	Clans living in village: Burfat	
	Average Number of Females: 80	
	Number of Schools at village: 01 GBPS closed as teacher remains absent	
	Enrollment of Students in School: 40	
	Number of Teachers at School: 01	
	Average literacy ratio: nil	
	Health Facility in village (If any): nil	
	Common Diseases: fever, Malaria, cough and cold, skin scabies. One polio case has	
	Electricity to village: not available	**Source of Drinking water:** Hand Pump
02	**Agriculture (Which crops are cultivated & how many houses are involved in):** Agriculture depends upon rain water. The main crops are Jowar, vegetables like guar,	
	Livestock: 40 Goats and 20 cows. no sheep and no buffaloes	
	Fishing: Nil	
	Laboring: Quarrying, stone cutting, gravel and sand collection	
	Other Occupations: wood cutting, some males have employment in the company as security in-charge and	
	Average Income: PKR. 7000 per month	

03	**Culture and Customs:** • They do not work with outside males • They live in small hamlets • They wear traditional shalwar, kameez with big dupatta on their heads • Females never vote
	Marriages: • They have marriages within very close relatives. They prefer 1st cousins marriages.
	Birth of Child: • Sons are preferred over girls. • There are no maternity homes • During deliveries, several females and new born have lost their lives • There is no cesarean case in the village
	Shrines of the area: Mano shah shrine Rot Makkan graveyard
04	**Views/ Comments on Power Wind Project: (any reservations)** The females expect that the company will address the following issues, which directly affect females: • Potable drinking water • Availability of teachers in schools • Electricity

1.3 CONSULTATION WITH INSTITUTIONAL STAKEHOLDERS DURING IEE UPDATE (MARCH 2013)

This section provides information related to institutional stakeholders conducted on March 13, 2013. All the findings are based on the observations of TPL team .

1.3.1 Meeting with Mr Saleh Muhammad Mangi-Programme Unit Manager, Plan-International

The team went to an NGO, "Plan-International" which works for promoting children's education in the deprived districts of Sindh and met with Mr Saleh Muhammad Mangi. Ms Naz informed Mr Mangi about the project area and made him aware of the educational problems in the Deh Kohistan Area of Sindh. He had no idea about the current situation over there.

After this discussion, the TPL team inquired about his efforts in opening new schools in the Kohistan Area to which he responded positively and showed an interest in developing educational facilities in those areas after consultation with the international offices of this NGO.

Currently this NGO has opened up new schools in four (4) Union Councils of Thatta, namely; Belo UC, Ali Bahar UC, Jar UC, and Kinjhar UC as these are some of the less educated areas of Sindh, and has plans to open up new schools in other parts of the province as well; chiefly in Tharparkar and Umerkot.

1.3.2 Meeting with Education Officials of Thatta

The TPL team met with three (3) education officials from the Thatta district.

Mr Nizam-Education Expert for Thatta Region

Mr Abbasi explained the project area and location to Mr Nizam. Mr Nizam informed us that he is from Jhimpir region. Interestingly we learnt that he had visited many districts in the province, so was well acquainted with the education scenario in interior Sindh.

He said that the provincial government had plans of appointing twenty (20) male and fifteen (15) female teachers in forty (40) ghost schools that exist in the Thatta district. He commented that the local people had no inclination towards education and were resistant. Their mind-set towards education of girls especially was conservative and majority of the families refused to send their daughters to school.

He said that eighteen (18) Additional District Officers (ADOs) oversee 18 tehsils of Thatta, one for each tehsil. Under these ADOs, there are various supervisors that visit each school and check whether the teachers are doing their job.

Mr Nizam was of the view that Thatta's geographical extent was so large that it was impossible for the teachers to go in far flung areas on foot, as some teachers came from nearby cities. Thus, this factor along with the unwillingness of the local people contributes to lower literacy levels in Thatta.

Mr Khudabaksh Behrami-Social Welfare Officer, Thatta

Mr Behrami's views, however, sharply contrasted those of Mr Nizam's. In his opinion, the local villagers are very keen to send their children to schools and even promote education of girls. He observed an inclination towards the progress of educational institutions in this district by the locals.

Mr Behrami commented that there is an administrative failure for provision of educational facilities. The laziness of the government officials and concerned departments led to the collapse of education system in rural Sindh.

International donor agencies like UNICEF and UNDP are working towards promoting education of girls and improvement of school buildings and other educational facilities.

According to Mr Behrami, politics impacted the education system a lot. Political influence in some areas, feudal lords and corruption in government departments were all to be blamed for educational backwardness. Feudal lords prohibit the villagers from sending their children to schools.

Mr Behrami claimed that the Social Welfare Department works for the provision of basic facilities for the people, conducts surveys, and looks after vocational training centres. However no additional details were available and he declined to comment further.

Mr Behrami also informed that there were meagre health resources available to the people of rural Sindh. The doctors present in dispensaries in the remote locations don't even have an MBBS degree. Yet they charge fees comparable to those of private doctors in major hospitals. This is a major area of concern as there's no proper and dedicated health facility in these rural areas.

Mr Huzoorbaksh-District Officer of Education, Thatta

Mr Huzoorbaksh supported Mr Behrami's and Mr Nizam's viewpoint and acknowledged that absence of proper and dedicated teachers is a major drawback towards imparting quality education. He further highlighted that prioritization for the selection of districts for educational development is done purely on a political basis, rather than being based on survey results.

1.3.3 Meeting with Mr Rasool Bux Dars, Teacher, Jhimpir High School

The team met Mr Rasool Bux Dars, who is a poet, writer, social activist and a teacher in Jhimpir High School. He said that the area is famous for the extraction of dolomite, of which there are significant quantities available. Dolomite extraction is carried out by mining companies.

1.3.4 Additional Information

We were informed of a unique event that occurred around a year back. The company that had installed a previous wind farm had used excessive detonation material than was required for the removal of material. The construction of the wind farm continued and whatever waste generated from the activities was dumped and buried in the ground. When there was rainfall in this area, the hazardous and toxic chemicals leached out to the surface and continued downwards until they reached the Keenjhar Lake. There, it adversely affected a 6 km portion of the lake. All the aquatic life including fish, shrimps, turtle and other animals died in the affected areas.

The local villages situated along this stretch of affected waters were also impacted by the release of chemicals. As they obtain their drinking water from the lake, they could no longer continue to do so. This event had a significant environmental as well as a social impact on the region.

Consequently, a case was filed against the wind farm company. The firm was ordered to collect samples of the affected water. Instead it took samples form the clean portion of the lake and denied that they had caused any pollution in the Keenjhar Lake. This case is thus far pending in the local court.

1.3.5 Conclusions

Based on the comments of all the officials, TPL team concluded that politics, corruption and feudalism are the major reasons for drawback of literacy levels in the district. Until and unless these issues are resolved, education in the area cannot flourish.

Fig1: Mr Modi and Mr Abbasi having interview with the members of Haji Qasim Burfat Goth.

Fig 2: Mr Modi talking with Haji Qasim Burfat.

Fig 3: Mr Modi and Mr Abbasi having interview with Mr Mir Mohammad (representative of Haji Qasim Burfat).

Fig 4: Mr Abbasi interviewing with Mr. Usman, head of Usman Jhakro Goth.

Fig-5: View of consultant interviewing with the locals in Haji Walloo Goth

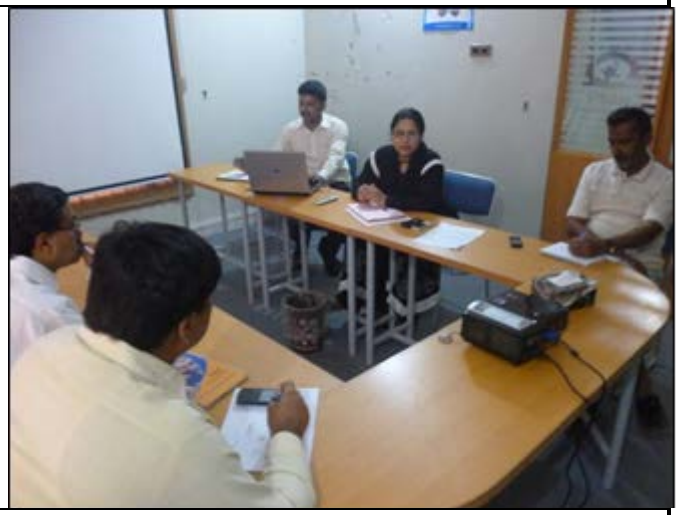


Fig 6: Consultant interviewing with all Sindh Government Officials.

Project: MPCL Wind Power Project

ERM India Private Limited
Building 10, 4th Floor, Tower A, DLF Cyber City
Gurgaon – 122 002, NCR ,India
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Fig 7: From left to right NGO (Plan-International) member, Huzoor Bux (D.O Education Thatta), Khuda Bux Behrami (Social Welfare Officer Thatta).

Fig8: Consultant interviewing with Mr Rasool Bux Dars (Social activist, Poet, Writer and teacher in Jhimpir High School).

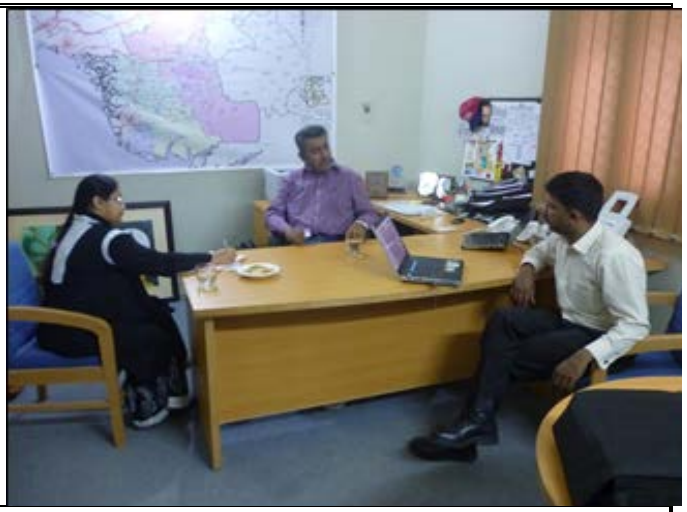

Fig9: Socioeconomic consultant interviewing with Mr. Saleh Muhammad Mangi (Programme Unit Manager of NGO)

Fig10: Information given to the officials about the project.

Fig-11: Village woman grinding grains using a stone mill in Haji Qasim Burfat Goth

Photo 12: Woman making mat from dried leaves in Haji Walloo Goth

Project: MPCL Wind Power Project

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Annex I

TOR for Bird Monitoring Study

BIRDS MONITORING PLAN FOR METRO WIND POWER PROJECT AT JHIMPIR DISTT.THATTA, SINDH

Final Report

Ref.: FRT12V04-MPCL

December, 2012

Prepared for
Metro Power Company Limited

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Report Disclaimer

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ACRONYMS

ADB	Asian Development Bank
AEDB	Alternative Energy Development Board
BOOT	Build-Own-Operate-Transfer
BHUs	Basic Health Units
CDWP	Central Development Working Party
CDM	Clean Development Mechanism
DDOR	Deputy District Officer Revenue
DDWP	Departmental Development Working Party
EEE	Energy, Environment and Economics
EMMP	Environmental Management and Monitoring Plan
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
ECA	Employment of Child Act
ESAP	Endangered Species Awareness Program
EHS	Environment, Health and Safety
FA	Field Assistant
GAEL	Gul Ahmed Energy Limited
GOP	Government of Pakistan
GWh	Giga watt hour
GPS	Global Positioning System
HSE	Health, Safety and Environment
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
MW	Mega Watt
MPCL	Metro Power Company Limited
NDZ	Noise Disturbance Zone
NED	Nadirshaw Edulji Dinshaw
PC	Public Consultation
PEC	Pakistan Engineering Council
Pak-EPA	Pakistan Environmental Protection Agency
PEPA	Pakistan Environmental Protection Act

PEPO	Pakistan Environmental Protection Ordinance
PEPC	Pakistan Environmental Protection Council
SWD	Sindh Wildlife Department
SAARC	South Asian Association for Regional Cooperation
UC	Union Council
UNEP	United Nations Environment Program
UNIDO	United Nations Industrial Development Organization
WAPDA	Water and Power Development Authority
WB	World Bank
WEF	Water Environment Federation
WWF	World Wide Fund for Nature
WAPDA	Water and Power Development Authority
WB	World Bank
WEF	Water Environment Federation
WWF	World Wide Fund for Nature

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1. INTRODUCTION

Pakistan is an agricultural country. More than 60% of its population lives in rural areas where domestic fuel needs are met mainly from fire wood and dung cakes. Use of wood fuel is giving negative impact on wild flora and is one of the major causes of soil erosion. Similarly use of dung as fuel is more wasteful than its use as green fertilizer. Fast rate of growth of human population has created shortage of energy and more demand for it. Quite so often the monsoons are weak and delayed in Pakistan, and the below normal precipitation is felt especially in some districts that have economies dependent on agriculture. In some districts the sowing of sugarcane causes high demand for power for irrigation.

In Pakistan power generation is dominated by thermal power plants wherein furnace oil and gas are being used as a fuel. The price of furnace oil is dependent on international price of crude oil. The price of crude oil in the international market is increasing day by day, thereby increasing the cost of power generation proportionately. Gas being an indigenous fuel, is comparatively cheap but domestic production of gas is on the decline and not available for power generation in required quantity. Therefore, the government has to rely on power generation, mostly on furnace oil, resulting in more costly power generation. The steep high electricity bills have made it difficult for middle income and low income consumers to afford.

Pakistan is located on such a geographical location that abundant quantum of renewable energy potential including wind energy is available.

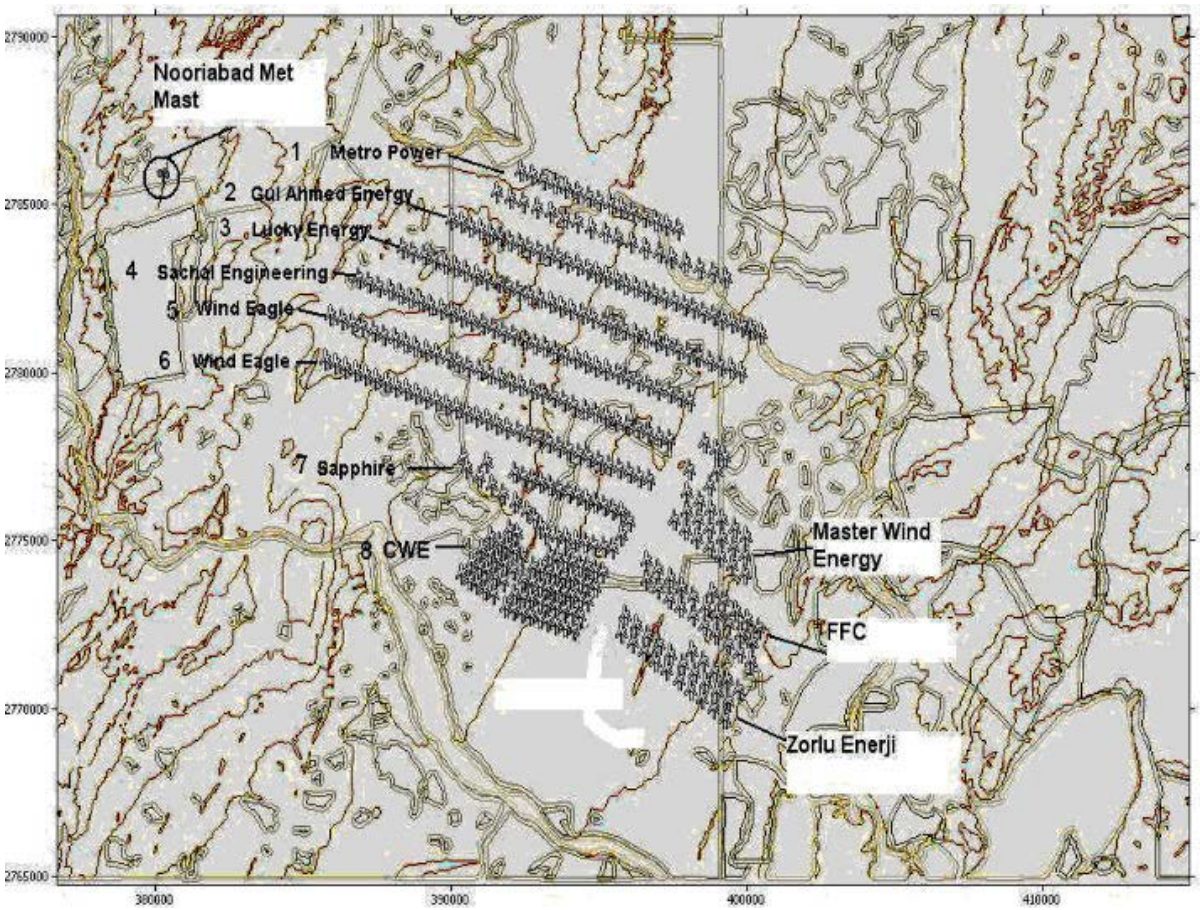
Pakistan adopted a policy of the use of renewable energy in 2006 and revised it in 2011. This policy encourages the private sector to implement renewable energy projects, including wind power generation, by providing various regulatory, fiscal and financial incentives.

The AEDB has issued a number of LOIs to private sector investors for development of wind power projects of 50 MW each that includes the Metro Power Company Limited (MPCL). A map showing locations of power plants for which LOIs has been issued in Jhimpir area is presented at **Figure 1-1** whereas wind power potential in Pakistan is presented at **Figure 1-2.** The development of wind power plants will not only be helpful in meeting power shortage in the country but will also be environmental friendly as it will not produce any so_x and no_x in the atmosphere. In addition it will provide electrical energy to national grid at almost same tariff for whole concession period whereas the tariff of power produced by thermal resources is increasing day by day.

Metro Wind Power have taken the advantage of incentives offered in the Policy, obtained a Letter of Intent for development of 50 MW wind energy farm (WEF)

around 13 km almost north of Jhimpir and at a distance of more than 15 km from Keenjhar lake wildlife sanctuary.

Figure 1-1: Location Map



Metro Power Company Limited (MPCL) has been established by Mr Iqbal Alimohamed & Family and InfraCoAsia Keenjhar WindPte Ltd. The company incorporated as a Private Limited Company on November 2006 has registered office at 36-F, Block-6 PECHS Karachi-75400, Pakistan.

Mr. Iqbal Alimohamed and Family are part of Teli Group, one of the premier business house in Pakistan. Teli Group's extensive business interest includes energy (Gul Ahmed Energy), textile, banking, insurance, security brokerage, real estate, beverages, chemical and IT.

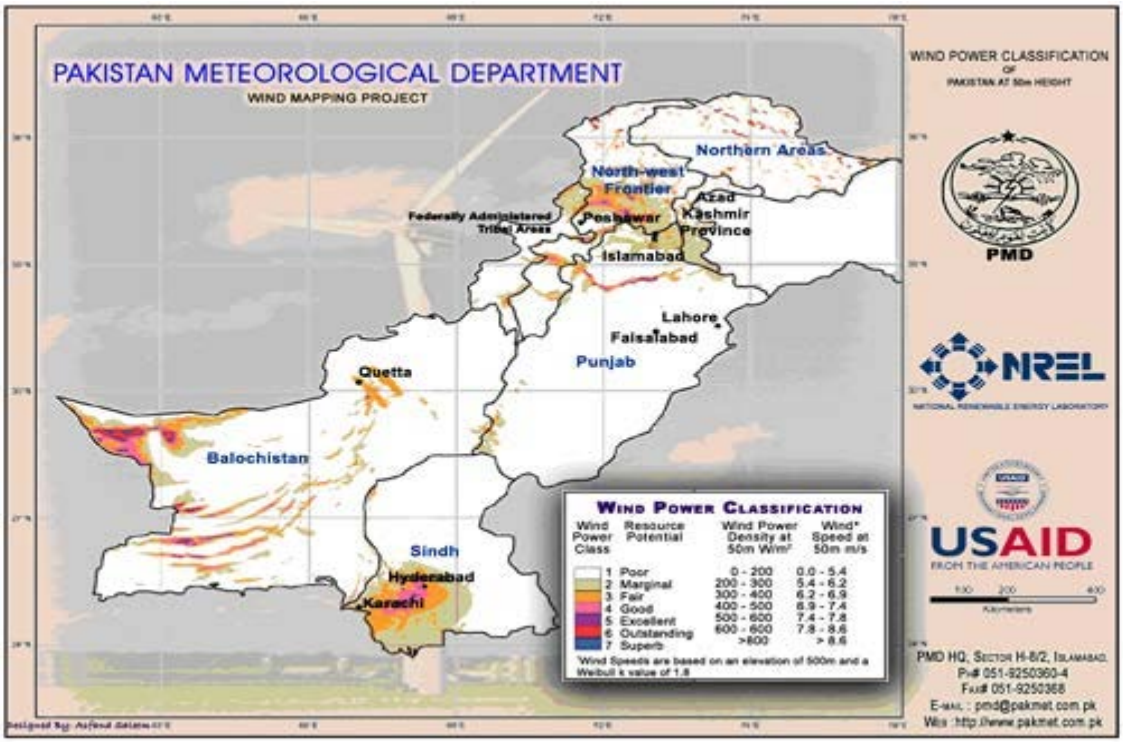
InfraCo Asia Keenjhar Wind Pte Ltd is a subsidiary of infraCo Asia development Pte Ltd, a infrastructure project development and investment company registered in Singapore. It is a facility of Private Infrastructure Development Group (PIDG), a club of eight European government donor agencies; AusAid and the World Bank Group's IFC. InfraCo Asia is mandated by PIDG to facilitate private sector investment in infrastructure in selected countries in South and South East Asia.

Objective of this company is exclusively established to undertake operation to generation power and meet the power shortage in the country. In this regard, the

company has so far acquired 1553 acres of land at Jhimpir, District Thatta, Sindh, Pakistan, authorized by Alternative Energy Development Board (AEDB) to set up a 50 MW Wind Power Project.

The company is committed to enhance power generation using wind energy and to carry on the business of generating and supply of electric power and to carry on all or any of the business of generating, transforming, converting, supplying and dealing in electricity and all other forms of energy and products or services associated therewith and of promoting the conservation and efficient use of electricity and to perform all other acts which are necessary or incidental to the business of electricity generation.

Figure 1-2 : Wind Power Potential



1.1 Background

The project area is located at about approximately 15 km aerial distance from ***Keenjhar*** Lake which is one of the declared Ramsar Sites (Convention on Wetlands -- an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories) in Pakistan.

The ***Keenjhar*** Lake is one of the main destinations of birds which migrate from northern latitudes in autumn, overwinter here for around 3-4 months during the winter and then migrate back to their breeding grounds in spring. According to the

renowned ornithologists of the country, these birds fly at much higher altitude than the height of the high tension transmission lines, transmission towers or the wind turbine blades. The Sindh Wild Life Department has practically no data available with them which can ascertain the mortality of such birds by the wind farm towers or other installations in the area. However, Élan Partners (Pvt) Limited is monitoring birds at Zorlu Enerji Group WEF at Jhimpir, who have already commissioned several turbines. According to the data collected from April 2012 to end June there are 35 resident species of birds which feed and breed in the study area. So far there is no mortality of even a single bird reported from Zorlu Enerji Group WEF due to collision with Wind turbines or with transmission lines or its towers. Apart from this meager data, there has been no study of the bird mortality due to collusion in WEFs any where in the country. On the contrary there are reports of many bird accidents with Wind Turbines and power lines in the western world although preventive measures are taken by them to avoid such accidents.

It is worth to mention that five wind turbines of Phase-I of ZorluEnerji WEF at Jhimpir are in operation. However, bird monitoring was started in April 2012. There is no report of any mortality of the local birds due to collision with the wind turbines during the non migration season, which has ended now. However, since migratory species of birds start arriving in the area by mid September the bird diversity and density is likely to increase after that. Due to this reason it has become much more important that the mortality of birds both local as well as migratory species must be monitored.

Élan Partners (Pvt.) Ltd.

Élan is a 3E's (Energy, Environment and Economics) international company offering services and provide economic and technical solutions to Pakistan's rapidly expanding economy in general and energy sector in particular. Élan is registered with Pakistan Engineering Council (PEC), Asian Development Bank (ADB) and affiliated with Climate Resource Exchange Pte. Ltd. (Singapore). The services we provide encompass the top level advice, project management, evaluation and monitoring, procurement, engineering, environmental, and financial aspects of various projects in public and private sectors.

The Élan team comprises highly qualified professionals with many years of technical experience in their respective fields, supplemented by a long-term vision geared towards developing sustainable solutions for public and private sectors of Pakistan. The team works in strict accordance with international consulting standards, and its own experience is augmented by leading field specialists hired to customize each project team.

At Élan, we rely on a customized approach that draws on teamwork and optimum resource utilization, and produces solutions that are tailored to our clients' needs without compromising on technical integrity. Field data is cross-checked at every

stage of any study to ensure that it is technically sound and capable of delivering a result-oriented analysis. Every study is preceded by an examination of the project area in question, and its grassroots situation in the context of relevant established practices in the country and international guidelines.

2. SCOPE OF ASSIGNMENT

2.1 Development of Bird Monitoring Program

Following is the broad out line of the scope:

- Study secondary literature/data on the subject
- Collection of primary data where needed
- Detailed site visit
- Consultation with concerned government agency in Sindh

3. PROJECT DESCRIPTION

Pakistan is located on such a geographical location that abundant quantum of renewable energy potential including wind energy is available. Under Pakistan Renewable Energy Policy 2006 (revised in 2011) AEDB has issued letter of intent to Metro Power Company Limited for development of 50 MW wind energy farm near Jhimpir. The wind farm is located around 15 km north of Jhimpir and about 15km from Keenjhar Lake. The site is adjacent to the National Highway which provides clear access to the Project site.

In this regard, the company has acquired 1553 acres of land at Jhimpir, District Thatta Sindh.

Metro Wind Farm shall generate 50 MW of electricity through the latest state of the art wind turbines. The Wind farm will consist of 33 x 1.5 MW or 20 x 2.5 MW WTGs having rotor diameter of 80 to 100 m respectively, mounted at a hub height of 80 meters, power collecting substation and 132 kV switchyard. The designed life of wind turbines is 20 years.

The Wind Farm will be integrated in National Grid System, where a number of different energy sources supply electricity, like hydro, nuclear, thermal plants running on natural gas and diesel / heavy fuel oil.

4. THE BIRD MONITORING PLAN[1]

In this section of the report the Bird Monitoring Plan has been discussed in detail. It elaborates tools required for monitoring, manpower required, time line, necessary proforma for record keeping and analysis and training of bird observers.

4.1 Introduction

The Environment Impact Assessment / Initial Environmental Examination (EIA/IEE) is a legal requirement before the development of any area under the Environmental Protection Act 1997 adopted by the government of Sindh by virtue of the Article 270 AA of the Constitution of Islamic Republic of Pakistan. However, the project falls under 50MW Category A – Schedule II as per EIA Regulation 2000(1,2) so Initial Environmental Examination (IEE) had been carried out.

The biological environment of any area includes the natural flora, fauna of the biodiversity of water and soil. The protection of species as covered by the law involves protection from hunting, killing, netting, capturing and destruction of habitats, pollution and disturbance. All wind energy farms poise risk of killing the birds by collision with the huge revolving blades of the turbines, power transmission lines and power transmission towers particularly if these are located on migration route of birds or if they are close to a relatively large wetland. Additionally these have impact of disturbance due to noise on bird behavior, diversity and their density during the construction work and afterwards from the running activities of the WEF.

4.2 Why Bird Monitoring

The important role of birds in running the ecosystems has already been realized, and Pakistan's wildlife conservation authorities as well as international conservation agencies are conscious about the declining trends of some migratory as well as local bird species in the country or internationally.

International Legal Bindings Regarding the Impacts of Developments on Biodiversity (wild living things that includes wild birds) -- The **Convention on Biological Diversity** (**CBD**),is an international legally binding treaty, which was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993. Pakistan is a signatory to this convention. The Convention requires countries to prepare a national biodiversity strategy (or equivalent instrument) and to ensure that this strategy is mainstreamed into the

[1] Sindh Wildlife Department and WWF are the stakeholders in this respect and accordingly they need to be consulted before finalization of the plan. However the Consultant had also prepared such plan for Zorlu Wind Farm project and detailed consultation were made with these departments and the plan so prepared was shared with them. Both the departments showed complete satisfaction with the Zorlu's Bird monitoring plan. Therefore it was not felt necessary to consult with them once again for the same issue.

planning and activities of **all those sectors whose activities can have an impact (positive and negative) on biodiversity.**

Article 14 of the Convention on Biological Diversity requires parties to introduce appropriate Environmental Impact Assessment procedures for projects, programs, and policies that may have significant adverse impacts on biodiversity. Wind Energy Turbines may or may not cause bird collusion. This can be determined with at least one year bird monitoring of Wind Energy Farms.

The International Union for Conservation of Nature IUCN is the world's oldest and largest global environmental organization. It is neutral forum for governments, NGOs, scientists, business and local communities to find practical solutions to conservation and development challenges. Pakistan is a member country of IUCN and is legally bound to implement its recommendations. Therefore, development of Wind Energy Farms must not have negative impacts on the fauna where these operate. As the birds are likely to collide with rotating Wind Energy Turbines, therefore, at least one year bird monitoring at the Wind Energy Farms is desirable.

IUCN is more concerned about the conservation of bird species which it has categorized as 'Least Concern'; 'Near Threatened'; 'Total Threatened'; 'Vulnerable'; 'Endangered '; 'Critically Endangered'. The IUCN has compiled a list of wild species, including the birds, which according to the investigated facts gives the above mentioned status the wild species. This is named as red list. It is the most comprehensive source of information on the status of global species. 'Bird Life International' is the official 'Red List Authority' for birds for the 'IUCN Red List', supplying the categories and associated detailed documentation for all the world's birds to the 'IUCN Red List' each year.

The threats to the world's birds include human disturbance and incidental mortality, direct exploitation of bird populations or from the indirect impacts on bird populations. Pakistan has many IUCN threatened species of birds. Bird monitoring can identify any IUCN threatened bird species in the Wind Energy Farm

Mission and Vision of **IUCN: "Secure Living in a Just and Healthy Environment".**

The World Conservation Strategy points out issues of failure to integrate conservation and development, threats to wild species and conservation of threatened species. One year of bird monitoring will identify any conservation issue that may arise due to the Wind Energy Farm.

Therefore, there is a list of bird species of concern, both at international level as well as at our country level, for which legal protection is given in our Conservation Acts. Wildlife conservation is a provincial matter in Pakistan; therefore, the Sind province has the responsibilities of protection of the species found in and around the proposed location of MPCL, WEF.

So far we have only two months monitoring data of the summer season of 2012 regarding the response of birds towards some of the commissioned wind turbines in Zorlu Wind Energy Farm, which is only eight kilometers areal distance from MPCL site. Bird monitoring training and guidance was provided by Élan Partners (Pvt) Ltd. During the summer season only 35 species of local birds were observed in that study area which covers the project site including almost two kilometer 0.40 dB(A) sound impact area all around.

There is a significant number of bird species that have the ranges of occurrence that cover the MPCL site. This includes the water birds that just fly pass over the WEF site. We do not know how many of these birds will have their daily ritual to fly from or to Keenjhar Lake. We do not know how high these will fly pass over the WEF. Several migratory water bird species are known to have their nocturnal movements, even in pitch dark nights. We have no information whether these will be flying low or high over this WEF which is 15 Km distance from Keenjhar Lake.

We are aware that the birds of prey when these swoop-dive for their prey they might be or might not be very conscious about the rotating blades of the wind turbines, and so they are subject to the risk of collusion. However, we have no information about such diurnal predators daily soaring or hovering over the area.

There is no data on the density and diversity of bird species of the study area for comparison with post construction period data to judge the impact of the project on the birds.

We are aware that the fruit bats do collide with low-tension power lines along the roads or in urban areas. But that is more of electrocution than mere collusion, because fruit bats have good nocturnal vision. However, MPCL site does not appear to be an area where fruit bats will occur.

Nocturnal small bats have very poor visibility and they navigate with the use of echolocation. They are not likely to collide with the blades of wind turbines as they are capable of safe flights in pitch dark caves without the risk of collusion with the cave walls.

There are bird migration routes; there are migratory birds' staging areas or the areas of transit stay and there are birds wintering areas (see **Appendix A** "bird migration map"). Birds flying south or north in the western part of the sub-continent follow mainly the Indus flyway. It is estimated that 70 % of the migrants cross over winter on the lakes of Sind. Thatta district's lakes are wintering grounds for huge numbers of water fowl. These lakes are also staging ground for birds migrating further south or back. It is not known what density of migratory water fowl passes over the MPCL wind energy farm. Therefore, bird monitoring of the WEF is a must.

The monitoring requires special methodology to give reliable scientific observations to enable us to properly interpret the impacts of the project on the birds including the migratory bird species as well as the local bird species. The proper monitoring task requires internationally acceptable monitoring plan, which is carefully written below. The data collected under this plan will enable the administration of the farm to decide whether certain mitigation measures are needed, and if so, then how quickly? Although the Sind Wildlife Act is silent about the collision risks, yet some international conservation agencies like 'Birdlife International' suggest monitoring and mitigation measures at wind energy farms.

Figure 4-1: Keenjhar Lake

4.3 Site Visit

As a first step it was considered necessary for the bird experts to visit the project area to refresh knowledge of the area, although they had already seen the general area earlier in connection with regard to field work for their publications that includes:

- "Field Guide to the birds of Pakistan",
- "A pocket Guide to Khirthar National Park and its adjoining protected Areas",
- Illustrated handbook of Biodiversity of Pakistan", as well as my other field activities.

Accordingly the project site was visited on 5th September 2012. The area where the wind farm is proposed to be established is a barren green field and is ideal for such project. This visit enabled the Consultant to consider how the '**Bird observer'** should

start his observations keeping in view the terrain and the extent of the monitoring area, that should include one nearby 'control area' for the comparison of the data.

This monitoring plan has been written with simple and clear methodology, however, authenticity of data depends on the accuracy of the birds field identifications, punctuality of observations and the regularity of field work of the 'Bird Monitor'.

4.4 Brief Training of the Bird Monitor

In order to get the reliable and authentic data of monitoring, which is a fundamental requirement for correct analysis of data so collected, it is suggested that a full time '**Bird Monitor'** who should be a graduate, responsible and hard worker, be appointed by the Company. After the appointment of the 'Bird Monitor**'**, as a first step, a short training in the field (capacity building) for identification of birds and briefing on the field methodology, including marking of the sample plots will be necessary.

A list of the field equipment, hard copy maps of the study site, observation Performa, list of the birds of concern and literature required for the field work has been provided in this report.

4.5 Scope of Monitoring (The Study Area)

The Wind turbines are to be installed on an irregular shapeland, approximately 9 km long and wider towards the North-West side (about 800m to 1000m) with a strip ranging about 200m wide spanning towards South-East direction. Estimated noise impact of the wind turbines will cover almost half kilometer all around the turbines. It could be called as noise disturbance zone (NDZ) for sampling reference. The monitoring will include another half kilometer beyond the outer edge of NDZ. The bird observation samples will start from the center of the wind turbines row, and will extend two kilometers outward to the outer edge of NDZ and beyond up to another half a kilometer. This half a kilometer beyond NDZ will constitute **'Control Area'** for comparison sake.

All samples will be marked on the map, as well as on the ground. The samples will be of two types:

a). **Linear or Strip Samples,**

b). **Point samples**.

4.5.1 Linear or Strip Samples

There will be three linear samples of 50 meters width and 2,000 meters length. These will be marked on the map as well as on the ground at three places for regular observations of the birds throughout the year.

4.5.2 Point Samples

Three Point samples will be located at three vantage points, one at the north-western edge of the study area, one at the middle of the study area and the third one at the south-eastern edge of the study area. These will be for the observations of the flying birds over the turbines.

4.6 Determining Flight Paths of Migratory Birds

Vantage points help in noting the flocks of migratory birds over the turbine towers. If such a flock will be seen it will be identified, estimated for its number, its direction of flight, flight speed and approximate height. Time and coordinates will also be recorded.

4.7 Determining Daily Flight Paths of Local Birds between Their Roosting Places and Feeding Areas

Vantage points help in noting the birds flying over the turbine towers at all times of the day. These will be identified, estimated for the number; flight direction and approximate height will be noted. Time and coordinates will also be recorded.

4.8 Birds' Collision or Killed Birds Carcass Search

There will be two more linear samples along the lines of wind turbines to search for bird carcasses after their collusions with the wings of the turbines. This will be done in the early mornings on alternate days during autumn and spring days, which are migration seasons. Otherwise, depending on the rate of collision these may be done once every week in winter when turbines rotate slowly, and twice a week in summer when turbines move faster.

4.9 Foraging Birds within the Study Area

When the birds get adapted to human environment they get used to even the working turbines. These will feed on ground of the project area on seeds and vegetation that is likely to grow there. Since the area is not to be fenced there might be grazing of domestic livestock. Some birds will find grasshoppers as the livestock moves in the foraging area. Some birds find food from fresh dung. Some times huge flocks of short-toed larks or even house sparrow are present in such habitats. These attract falcons and hawks. These birds of prey dive or chase their prey bird at a tremendous speed that increases their chance of colliding with the moving blades of the turbines.

4.10 General Description of the Study Area

The topography and the habitat are almost uniform arid, stony, degraded wasteland from one end to the other. However, there is some scattered vegetation in the area which has been briefly described in the IEE of the project.

4.11 Monitoring Techniques

Birds are usually active in the morning about Sunrise and again in the evening about Sunset, particularly during the summer. Therefore, each sample will be taken twice a day, one just after the Sunrise and the second two hours before Sunset.

The observer will walk along straight line up to two kilometers at a normal pace. He will watch birds 25 meters on the right and 25 meters on the left and the same distance ahead of him. First he will note the date & time of the start and weather conditions including the temperature on the field notebook and walk along the central line of the strip with a binoculars in the hands held usually at chin level, for bringing it to eyes as a bird is seen. Field Guide to birds of Pakistan by Z. B. Mirza should be kept in the chest pocket of the shirt for quick consultation after the bird is watched through the binocular. Coordinates to be noted on the GPS and noted on the field notebook. Time of observations is also to be recorded on the field notebook. When the observer will reach the end of the NDZ he will note the time and the coordinates.

4.11.1 Control Site Data Collection

After entering the control zone of the strip he will note his observations in the same way as was done in the NDZ until the end of the sample strip.

Evening samples will be repeated in the same strip and in the same way.

4.11.2 Field Equipment

Following field equipment is required by the Field Observer:

1. A pair of good Binoculars;
2. Telescope and tripod;
3. G. P. S.
4. Field notebook & Ballpoint pen;
5. Plastic bags for bird carcasses.
6. An air thermometer;
7. Field Guide to birds of Pakistan.

Field Performa: Following Performa will be used by the Field Observer**:**

a. Date;

b. Sampling Strip #

c. Start time;

d. Weather: Clear sky, hazy, partly cloudy, cloudy, drizzle, rain.

e. Wind: Still, light, slow, medium, fast.

f. Air temperature:

g. End time

4.12 Monthly Timetables for Field Work

Prior to the regular data collection all the linear samples and the spot observation point will be marked on ground of the study area.

1st month: Week I: Mornings and evenings linear strip surveys on three days.

Mornings and evenings point surveys on three days.

Morning carcass-search on one day.

There will be Week II, Week III, Week IV Repeat the surveys.

There will be repeat survey ritual throughout the monitoring period.

4.13 Monthly Monitoring Report

It will be written by the Consultant and submitted to the Client which will include the following:

- **Linear sampling:** Species observed; density; relative abundance will be included in the monthly report.
- **Control area:** Species observed; density; relative abundance; Variance from disturbance area will be included in the monthly report.
- **Point observations** will be included in the monthly report
- **Bird collisions:** Species killed and their number will be included in the monthly report
- **Seasonal variations** in the data will be expressed in the reports.

Data interpretation, discussion and conclusion will be provided in the reports. In case the mortality is insignificant then there is no issue otherwise, the final report will also suggest possible mitigation measures.

4.14 Yearly Monitoring Report

Monitoring will be done in the same manner as indicated above for **entire monitoring** after commissioning of the project.

5. TEAM

Team of experts who worked for development of this plan is provided in this section of the report.

S.No.	Name	Position	Responsibility
1.	Muhammad Ziauddin	Chief of Party/Team Leader	Overall Management
2.	Zahid Baig Mirza	Ecologist	Senior Wildlife Specialist
3.	Nehal Ahmed	Coordinator	Project Coordination
5	Muhammad Awais	System/Web Administrator	Report Formatting

A brief citation of team members are as under:

Muhammad Ziauddin

Mr. Ziauddin is a professional electrical engineer having more than thirty years experience in power generation, transmission and distribution system of Pakistan. Till recently he was at a very senior position in Government of Pakistan heading Power Section of Planning Commission of Pakistan. He remained deeply involved in detailed power demand and supply analysis/projections; preparation of policies, tariff analysis; technical, financial, economic, and environmental appraisals of power generation, transmission, energy loss reduction, and distribution projects, including detailed transmission studies; development of various tariff scenarios offered to the private sector for KotAddu power plant; completed a study on WAPDA's power plant with regard to the induction of the private sector in power generation; familiar with system operation codes.

Professor Z .B. Mirza

Prof. Mirza is a zoologist with over 55 years of professional experience in natural history of Pakistan. He is author of 17 books on mammals, birds, biodiversity and ecosystems of Pakistan. The last book is in 12 volumes. He has more than 60 research publications, three Country Reports on Environment, 16 Management Plans, Environmental Impact Assessments (EIAs) and Baseline studies, 13 Technical Reports, 13 types of Environment Awareness and Education publications to his credit. He has practically contributed in making of 7 Natural History Museums Pakistan and in foreign countries. He has been involved in postgraduate teaching and has related technical experience in 6 institutions in Pakistan and abroad. He has Supervised Field Research of three Ph. D., ten M. Phil. and several M.Sc. Scholars. He has conducted over 25 environment awareness workshops for the Civil Service

and Armed Forces Officers. He has been creating environment awareness through print and electronic media. He held respectable positions in the Government, WWF, IUCN, Birdlife International, and as Government of Pakistan's Biodiversity Consultant for SAARC countries. He is internationally and locally decorated as well as his one of the books received Best Book Award.

He is the President of Pakistan Wildlife Foundation, Snow Leopard Foundation and Centre for Environmental Research & Conservation.

Nehal Ahmad

Mr. Nehal holds degree in Electrical Engineering from NED Engineering College Karachi and has diversified experience in study, planning, preparation, evaluation and award of tenders, supervision, project coordination and progress monitoring of various power projects within the country and abroad.

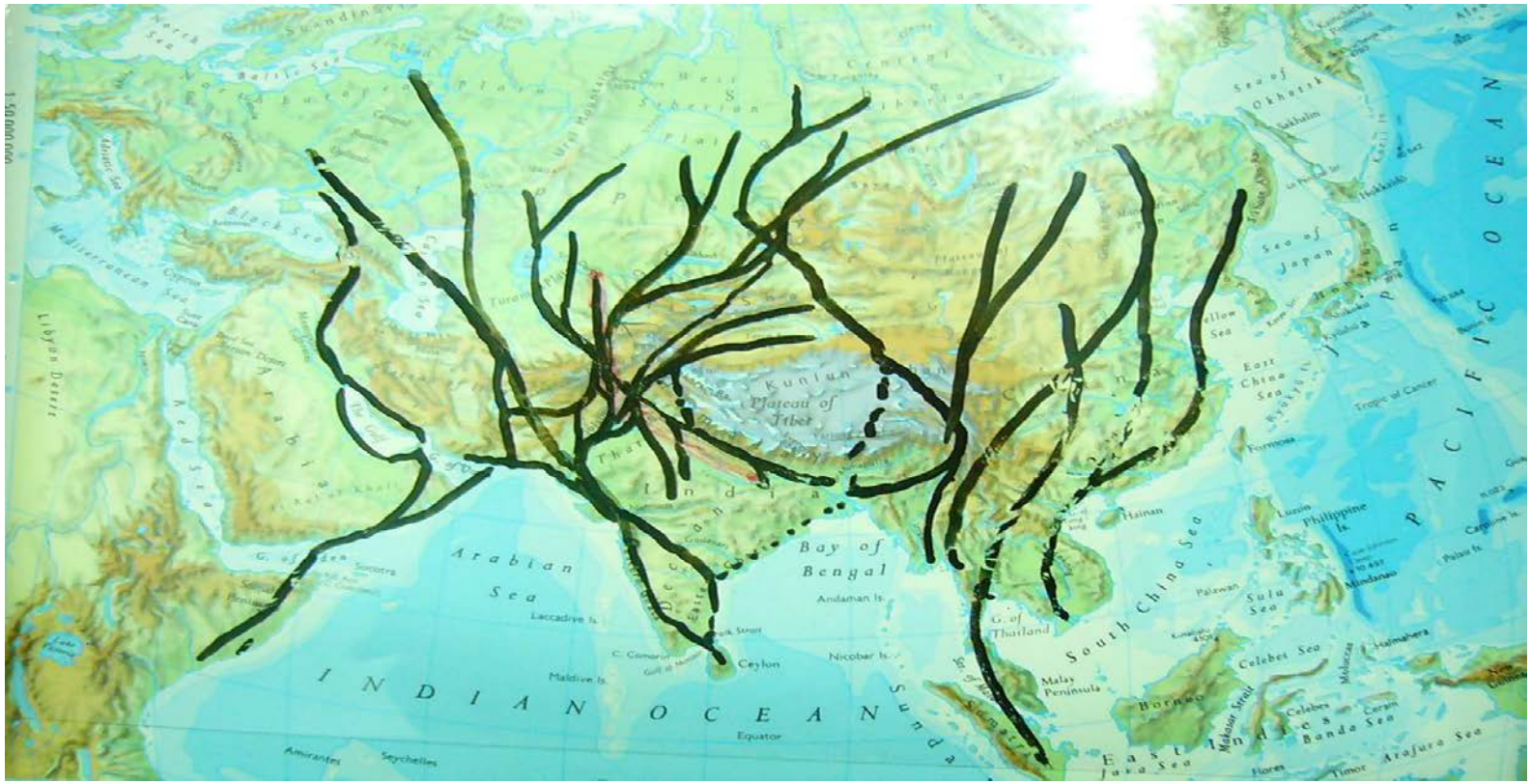
While working at public sector organization, he had been actively involved in preparation of feasibilities, PC-I, PC-II towards seeking approval of DDWP, CDWP of various development projects and has in-depth working knowledge of World Bank, Asian Developments Bank, GOP Procurement Rules as well as experience in contract drafting, inventory control and human resource management. He has adequate exposure of processing CDM projects. He has attended various seminars and training workshops in relation to CDM.

Muhammad Awais

Mr. Awais works as System/Web Administrator at Élan. His MS in Information Security is under progress form National University of Science and Technology, Islamabad. He has a BS degree in computer science, and a professional background in the management and troubleshooting of computer networks and websites at corporate level. His specific areas of expertise include Networks operations management, E-mail management, Software and Hardware troubleshooting and website development and maintenance. Mr. Awais has prepared website for Élan and also working for the maintenance of the Website.

APPENDIX- A: THE BIRD MIGRATION MAP

Migration of Waterfowl based on ringing records & Z B Mirza's personal observations



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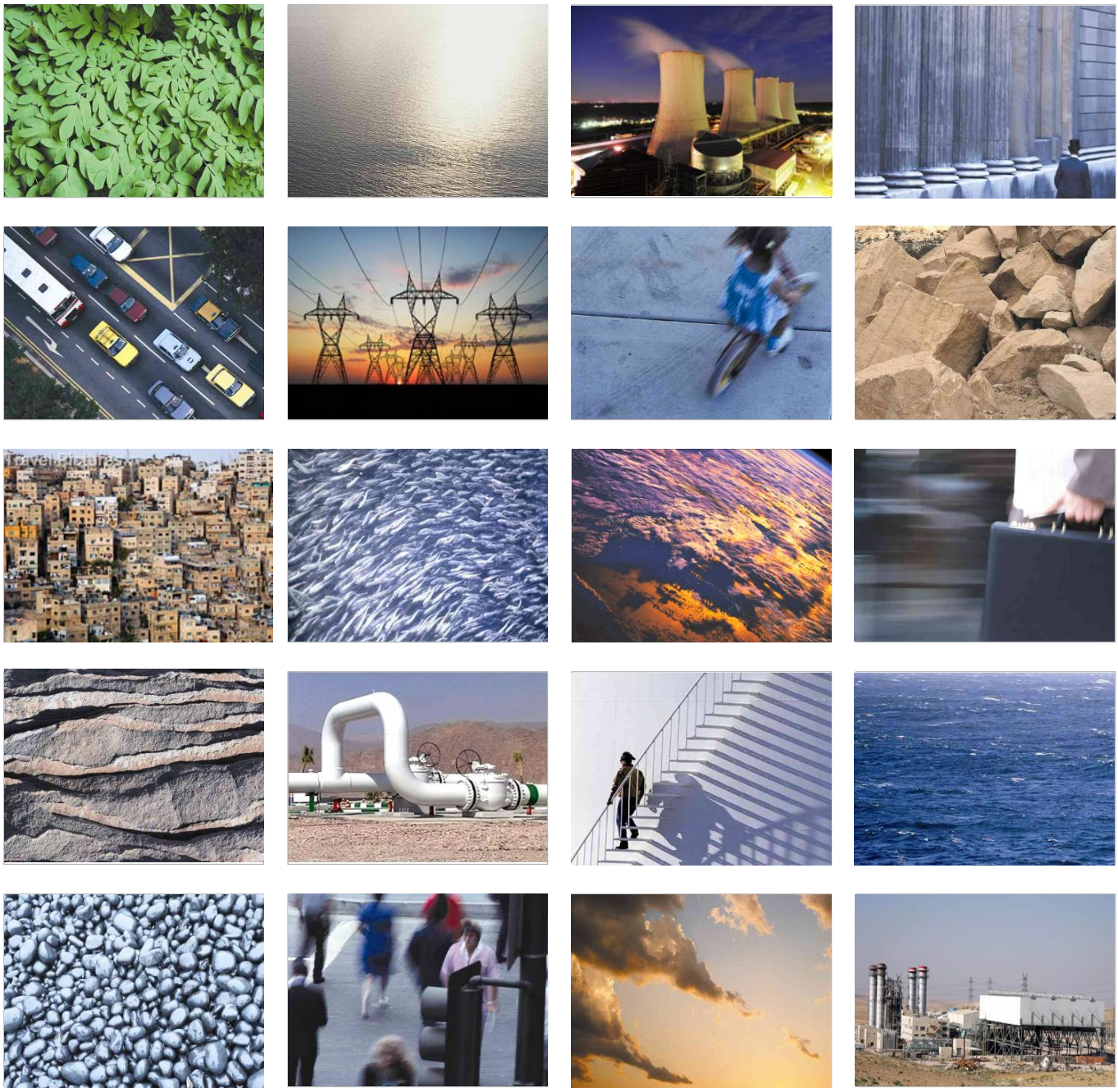
Annex J

Shadow Flicker Assessment



Metro Power Wind Power Plant Nooriabad, Pakistan

Shadow Flicker Assessment

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Shadow Flicker Assessment

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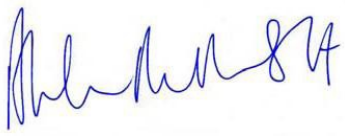
Client	Project No
Metro Power Company Limited	0187847

Project Summary

This report presents the findings of a Shadow Flicker Assessment conducted for a 50 MW wind power project proposed in Nooriabad, Pakistan.

Date
24 April 2013

Approved by



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Revision	Description	By	Checked	Approved	Date
1	Final Report	PM	JF	AS	25.04.13
0	Draft Report	PM	JF	AS	24.04.13

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1.1 SHADOW FLICKER

Introduction

1.1.0 This shadow flicker study has been conducted as part of updating the IEE study as per IFC PS 2012 for Metro Power Company Limited (MPCL) wind energy project at Jhimpir area of taluka and district Thatta in Sindh Province of Pakistan.

Overview

1.1.1 Shadow flicker is a term used to describe the pattern of alternating light intensity observed when the rotating blades of a wind turbine cast a shadow on a receptor under certain wind and light conditions. Shadow flicker occurs under a limited range of conditions when the sun passes behind the hub of a wind turbine and casts an intermittent shadow over neighbouring properties.

1.1.2 Pakistan energy and planning policy contains limited shadow flicker requirements and recommendations, therefore United Kingdom policy/recommendations have been substituted for some aspects of this assessment. Shadow flicker is usefully defined in paragraph 73 of the United Kingdom companion guide *PPS22 (2004) Renewable Energy* (1):

> *"Under certain combinations of geographical position and time of day, the sun may pass behind the rotor of a wind turbine and cast a shadow over neighbouring properties. When the blades rotate, the shadow flicks on and off; the effect is known as 'shadow flicker'. It only occurs inside buildings where the flicker appears through a narrow window opening. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the potential site. For sites where existing or proposed developments may be subject to this problem, applicants for planning permission for wind turbine installations should provide calculations to quantify the effect."*

1.1.3 An analysis of those conditions that may lead to shadow flicker and the location of potential sensitive receptors (residential and community properties) is provided in this section. The timing and duration of this effect can be theoretically calculated from the geometry of the proposed wind turbines, their orientation relative to nearby houses and the latitude of the potential site, using specialised software such as ReSOFT Windfarm. The results provide the total number of hours in a year when a theoretical shadow flicker will occur. This is most pronounced during sunrise and sunset when the sun's angle is lower and the resulting shadows are longer. Shadow flicker does not occur where there is vegetation or other obstructions such as terrain between the turbines and houses; if windows facing a turbine are fitted with blinds or shutters; or if the sun is not shining brightly enough to cause shadows. The theoretical calculations done by ReSOFT Windfarm do not take into account the reduction in shadow flicker due to these onsite factors.

(1) ODPM (2004) Planning for Renewable Energy: A Companion Guide to PPS22

Simple geometry relating to the position of the sun and the angle of the turbine blades can also eliminate or significantly reduce the effects of shadow flicker. In addition, shadow flicker will only occur inside buildings where the flicker is occurring through a narrow window opening.

1.1.4 The draft Pakistan Sectoral Guidelines for Environmental Reports – Wind Power Projects (2010) [1] provides a number of guidelines and statements in relation to shadow flicker analysis. The maximum horizontal distance between a receptor affected by shadow flicker and turbine location for example has been identified as being equal to the diameter of the turbine multiplied by ten. In this instance, turbine rotor diameter is 100 m therefore an area envelope of 1000 m from the nearest turbine is used in shadow flicker analyses.

1.1.5 The United Kingdom companion guide to PPS22 also provides additional guidelines in relation to shadow flicker. It states that properties within 130 degrees either side of north, relative to the turbines, can be affected at these latitudes. *Figure 1* illustrates the shadow flicker study envelope.

1.1.6 Weather conditions at the site, such as bright sunshine, will greatly enhance the occurrence and intensity of shadow flicker, whereas haze or fog will cause a reduction. Receptors further away from the turbines which may have experienced a shadow flicker effect under bright sunshine conditions will, as a result of haze or fog, experience either no effect or one which is greatly reduced in intensity.

1.1.7 The distance between receptors and turbines has a large effect on the intensity of shadow flicker. Shadow flicker intensity can be defined as the difference in brightness between the presence and absence of a shadow at any given location. This study does not examine variations in intensity but rather the occurrence in number of hours shadow flicker may occur, whether or not this is clearly distinct or barely noticeable. The assessment assumes a conservative worst case of bright sunshine conditions in all periods when flicker may occur.

1.1.8 Considering all of the above points, the likelihood of shadow flicker occurring is greatest when the circumstances listed below exist simultaneously.

- The receptor is at a position which is between 130° clockwise [2] and anticlockwise from north and located within 10 turbine rotor diameters of the wind turbine (1000 m).

- The sun is shining and visible in the sky.

(1) Pakistan Environment Protection (2010) Sectoral Guidelines for Environmental Reports - Wind Power Projects. (These guidelines are in draft and have not been adopted by the Pakistan EPA.)
(2) It is acknowledged by this assessment however that Pakistan is at a lower latitude than the UK and therefore angles of shadow flicker may be narrower.

- The wind speeds are between 3 ms-1 and 25 ms-1 and the turbine is therefore in operation.

- The turbine blades are perpendicular to the line between the sun and the observer or receptor.

1.1.9 Due to lack of data regarding epilepsy rates in Pakistan and operation levels below of 1 Hz for modern turbines, seizures caused by shadow flicker are considered to be extremely unlikely. The Nordex N100/2500 turbines being considered operate at a frequency outside the range where negative health effects may result (1). Potential effects on people are likely to be limited to nuisance.

Potential Significant Impacts

1.1.10 In Pakistan and within the UK at present, there is no agreed level of shadow flicker identified as causing a significant effect. However, the Danish Wind Industry Association note on their website that in Germany, the rule of thumb is that 30 hours shadow flicker a year received at a property is acceptable (2). The 'Wind Energy Development Guidelines, 2006' published by the Irish Government Department of the Environment, Heritage and Local Government recommend that shadow flicker at neighbouring offices and dwellings within 500 m should not exceed 30 hours per year or 30 minutes (0.5 hours) per day. A threshold of 30 hours has therefore been considered and applied for this assessment.

Assessment Methodology and Modelling

1.1.11 Shadow flicker calculations have been made using ReSoft WindFarm software. The model used in this analysis is very conservative and assumes the following conditions:

- there are clear skies every day of the year;

- the wind turbines are always operating;

- the blades of the wind turbines are always perpendicular to the line from the turbine to the sun (so that the shadow is always at its maximum possible size and circularity, rather than elliptical);

(1) See Health and Safety Executive/Local Authority Enforcement Liaison Committee (HELA) circular, entitled 'Disco Lights and Flicker Sensitive Epilepsy' (available at http://www.hse.gov.uk/lau/lacs/51-1.htm). It provides medical details on flicker frequencies likely to give rise to epileptic effects. It states: 'In 1971 the Greater London Council banned the use of flicker rates greater than 8 fps but to be effective the above figures show that any advice on restriction of flicker rate has to limit the frequency to below 5 fps.' The greatest rate of flicker from an Nordex N100/2500 (at 14.9 rpm) is 44.7 flickers per minute (ie 3 blades passing at 14.9 rpm) or 0.8 fps. This is well below any statistically concerning level of flicker.
(2) www.windpower.org

- there are no trees, buildings or vegetation on the surface which may obscure the line of sight between receptor and turbine;

- the sun can be represented as a single point;

concrete structures within settlements are community receptors such as mosques (1) ;

- straw huts within settlements are residential receptors (2) ; and

- all structure openings meet the narrow vertical parameters previously described and face towards wind turbines.

1.1.12 In practice it is likely that shadow flicker effects would occur for considerably less time than the worst case conditions listed above. At all other times, shadow flicker is therefore unlikely to occur.

1.1.13 The following data inputs were used in this study:

- a digital elevation model of the site (National Aeronautic and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) Data at 90 m resolution);

- latitude and longitude at centre of the site used to calculate the position of the sun (calculated in GIS using WGS84);

- turbine locations – coordinates (identified in GIS);

- turbine rotor diameter (100 m);

- height to bottom of Turbine hub (80 m);

- tilt angle of the 'window' (always assumed vertical);

- community receptors contain on average two openings both measuring 1.8 m by 1.8 m facing towards wind turbines;

- residential receptors contain on average one opening of 1.8 m by 0.9m facing towards wind turbines ; and

- height above ground level of the 'window' 0.9 m.

(1) It should be noted that some concrete structures could be residential however for the purpose of this assessment all are assumed to be community buildings.
(2) It should be noted that this assumption is for the worst case scenario and some straw structures may be used to shelter cattle.

Baseline

1.1.14 *Figure 1* shows the study area of the assessment (within 1000 m (10 rotor diameters) of a proposed turbine location) and the surrounding nearby settlements. A total of 26 structures have been identified as being within the study area of the Metro Power Wind Power Plant site (See *Figure 2*). These properties are a mix of residential and community receptors (see *Photographs 1 and 2). Table 1.1* lists the receptor types.

Photograph 1 Typical Residential Receptor

Photograph 2 Typical Community Receptor - Mosque

Table 1.1 Receptors Potentially Impacted

Receptor	Type
1	Community Building
2	Community Building
3	Residential
4	Residential
5	Residential
6	Residential
7	Community Building
8	Residential
9	Residential
10	Community Building
11	Community Building
12	Residential
13	Residential
14	Residential
15	Residential
16	Residential
17	Residential
18	Residential
19	Residential
20	Residential
21	Residential
22	Residential
23	Residential
24	Residential
25	Residential
26	Residential

Impact Assessment

1.1.15 The results of the shadow flicker assessment are shown in *Figure 2, Table 1.2* below and the supporting graphs provided in *Annex A*. The graphs shown in *Annex A* illustrate the times of the year at each of the 26 properties in the analysis where theoretical shadow flicker was predicted to occur.

Table 1.2 Shadow Flicker Effects at Each Receptor

Receptor	Window	Days per year**	Max hours per event	Mean hours per event	Total hours*	Turbine
1	1	0	0	0	0	N/A
1	2	0	0	0	0	N/A
2	1	0	0	0	0	N/A
2	2	0	0	0	0	N/A
3	1	0	0	0	0	N/A
4	1	0	0	0	0	N/A
5	1	0	0	0	0	N/A
6	1	108	0.77	0.55	**59.1**	10 and 11
7	1	91	0.83	0.72	**65.8**	10
7	2	91	0.83	0.73	**66.0**	10
8	1	40	0.50	0.39	15.5	11
9	1	40	0.49	0.38	15.3	11
10	1	62	0.56	0.44	27.4	11

Receptor	Window	Days per year**	Max hours per event	Mean hours per event	Total hours*	Turbine
10	2	63	0.56	0.43	27.1	11
11	1	68	0.61	0.47	**32.1**	11
11	2	67	0.61	0.47	**31.6**	11
12	1	56	0.57	0.44	24.6	11
13	1	0	0	0	0	N/A
14	1	0	0	0	0	N/A
15	1	0	0	0	0	N/A
16	1	84	0.82	0.63	**53.1**	10
17	1	105	0.82	0.57	**59.6**	10 and 11
18	1	83	0.61	0.43	**36.0**	10 and 11
19	1	39	0.48	0.37	14.4	11
20	1	43	0.52	0.41	17.4	11
21	1	89	0.56	0.48	**42.4**	11
22	1	93	0.59	0.49	**45.8**	11
23	1	93	0.63	0.51	**47.4**	11
24	1	73	0.58	0.51	**37.5**	11
25	1	0	0	0	0	N/A
26	1	0	0	0	0	N/A

*Figures in bold greater than 30 hours per year

1.1.16 The results show that theoretical shadow flicker occurs at 16 properties (3 community and 13 residential) within the zone of potential impact. Impacts are the result of the placement of two turbines, 10 and 11. The number of hours per year when shadow flicker occurs ranges between 14.4 and 66.0. The 5 properties affected by turbine 10 are affected between the dates of the 17th of May and the 29th of August and the 14 properties affected by turbine 11 are affected between the dates of the 22nd of March and the 25th of September. All properties are affected between the hours of 5 am and 6.30 am. *Figure 3* illustrates the extent of theoretical shadow flicker at levels of 30 hours per year. Theoretical shadow flicker occurs above this level at 10 properties in the Metro Power Wind Power Plant study area.

1.1.17 Given the guidelines of 30 hours or less per year being acceptable in 1.1.10, the operation of the Metro Power Wind Power Plant theoretically results in shadow flicker impacts that could be considered as significant for the purposes of EIA. In this case, all 16 properties will, in theory, experience a significant shadow flicker impact as maximum hours per day of shadow flicker exceed this value.

1.1.18 It is relevant to emphasise that predicted hours of shadow flicker effects are worst case scenarios. Assumptions made during the analysis include optimal meteorological, natural light and geometrical conditions for the generation of shadow flicker. The assessment does not account for trees or other obstructions that intervene between receptor and turbine during times when effects may occur. The assessment calculation is therefore an over estimation in the probability of effects. It should also be noted that for shadow effects to occur, properties need to be occupied, with blinds or curtains open and views to the wind turbine unobstructed. Many receptors within the study area contain straw fencing around property boundaries screening potential effects. It is also unlikely for example that community properties (mosques) affected

will be occupied between the hours of 5 am and 6.30 am and the intensity of sunlight will be much less during early morning hours when shadow flicker effected is noted. However, for the purposes of assessment, it has been assumed that all worst-case circumstances apply.

1.1.19 It should also be taken into account that the information provided by Met Office (1) indicates that in the Pakistan, sunshine occurs for 10 to 12 hours a day in the hot season and between 6 to 7 hours in the cool season, 35.4 % on average. Taking the Met data average sunshine hours into consideration it can be calculated that a less conservative estimate of hours of shadow flicker effects would be in the range of 5.09– 23.4 (2) hours a year (this takes into consideration the average sunshine ie 35.4% a year).

Mitigation Measures

Measures to Mitigate Potential Impacts

1.1.20 There will be close monitoring through engagement with residents during the operational phase where there are predicted impacts from shadow flicker. The likelihood of direct line of sight to the location of proposed turbine locations can be assessed visually and the potential for using screening such as higher fencing can be explored at problem locations. The use of curtains can also be explored. If these prove effective and the impacts mitigated, the shutting down of turbines during certain environmental conditions, which meet the physical requirements for theoretical shadow flicker to occur, will not be required.

1.1.21 Should the impact of shadow flicker be identified, and the mitigation measures proposed above prove ineffective, further analysis can be carried out to identify the exact timings and conditions under which shadow flicker occurs, and a technical solution sought. This is likely to involve pre-programming the turbine with dates and times when shadow flicker would cause a nuisance for nearby receptors. A photosensitive cell can be used to monitor sunlight, and the turbine could potentially then be shut down, when the strength of the sun, wind speed and the angle and position of the sun combines to cause a flicker nuisance.

Assessment of Residual Impacts

1.1.22 The results of the ReSoft WindFarm shadow flicker assessment show a worst case estimate and the mitigation measures discussed in *Paragraph 1.1.19* to *1.1.20* will be implemented for the identified properties that experiences shadow flicker.

1.1.23 Residual impacts following the application of required mitigation measures, as discussed above, is likely to result in not significant impacts.

(1) Met Office [Online] http://www.metoffice.gov.uk/weather/asia/pakistan_past.html
(2) Calculated using Met Data average ie 35.4% of 14.4 and 66 hours.

Turbine Location

Zone of Potential Shadow Flicker Effect

Settlement

0 500 1,000

Meters

N

Figure 1
Zone of Potential Shadow Flicker Effect
Metro Wind Power Plant, Nooriabad, Pakistan

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SIZE: A3	DRAWN: PM
PROJECT: 0187847	CHECKED: NT
DATE: 18/04/2013	APPROVED: JF

ERM

CLIENT:

Infraco Asia

PROJECTION: WGS 1984 UTM Zone 42N

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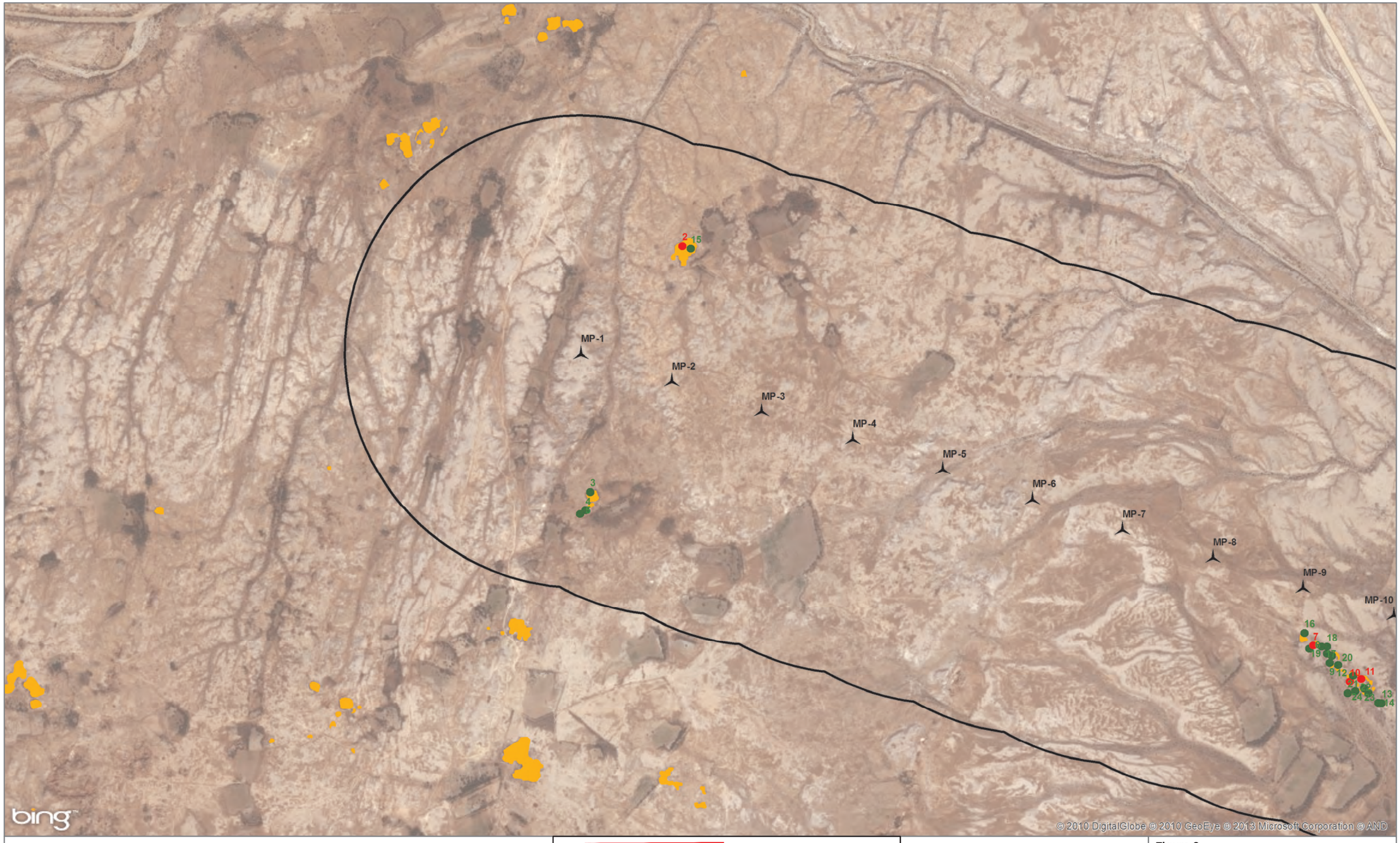


Turbine Location

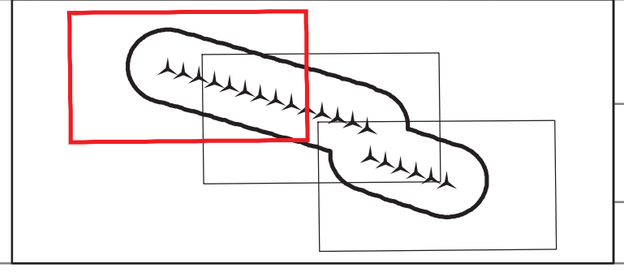
Zone of Potential Shadow Flicker Effect

Settlement

Indicative Receptor (Type)

Residential

Community Facility



0 100 200 300 400 500

Meters

N

Figure 2
Potentially Affected Receptors Map 1 of 3
Metro Wind Power Plant, Nooriabad, Pakistan

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DATE: 18/04/2013	APPROVED: JF

ERM

CLIENT:

Infraco Asia

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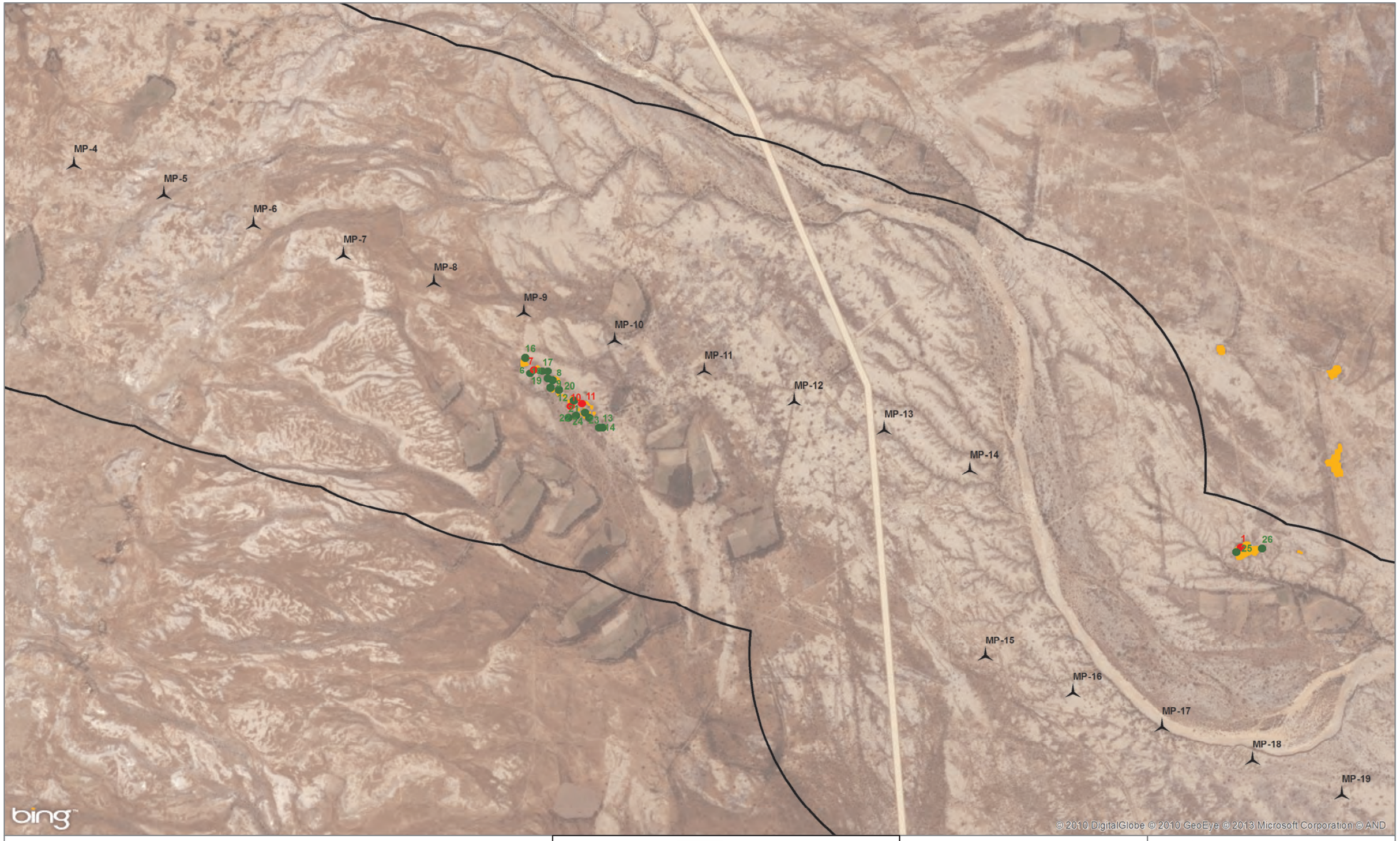


Turbine Location

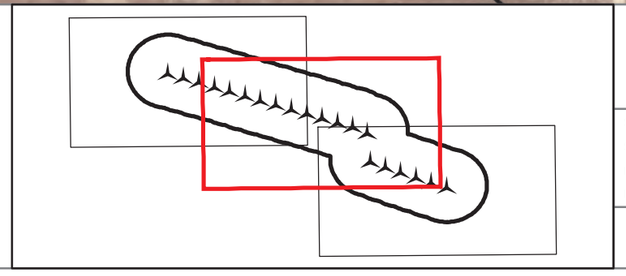
Zone of Potential Shadow Flicker Effect

Settlement

Indicative Receptor (Type)

Residential

Community Facility



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Meters

N

Figure 2
Potentially Affected Receptors Map 2 of 3
Metro Wind Power Plant, Nooriabad, Pakistan

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DATE: 18/04/2013	APPROVED: JF

ERM

CLIENT:

Infraco Asia

PROJECTION: WGS 1984 UTM Zone 42N

SOURCE: Unspecified

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Turbine Location

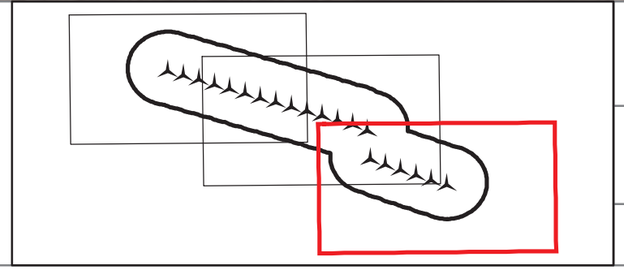
Zone of Potential Shadow Flicker Effect

Settlement

Indicative Receptor (Type)

Residential

Community Facility



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Meters

N

Figure 2
Potentially Affected Receptors Map 3 of 3
Metro Wind Power Plant, Nooriabad, Pakistan

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Infraco Asia

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MP-8
MP-9
MP-10
MP-11
MP-12
16
7
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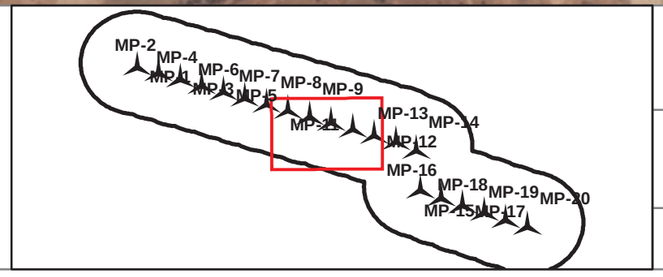
21
24

Turbine Location

Indicative Receptor (Type)

- Residential
- Community Facility
- Receptor Subject to >30hrs Shadow Flicker Effect per Year
- Zone of Potential Shadow Flicker Effect



0 100 200
Meters

N

Figure 3
Receptors Affected by Shadow Flicker Metro Wind Power Plant, Nooriabad, Pakistan

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PROJECT: 0187847	CHECKED: NT
DATE: 18/04/2013	APPROVED: JF

ERM

CLIENT:
Infraco Asia

PROJECTION: WGS 1984 UTM Zone 42N

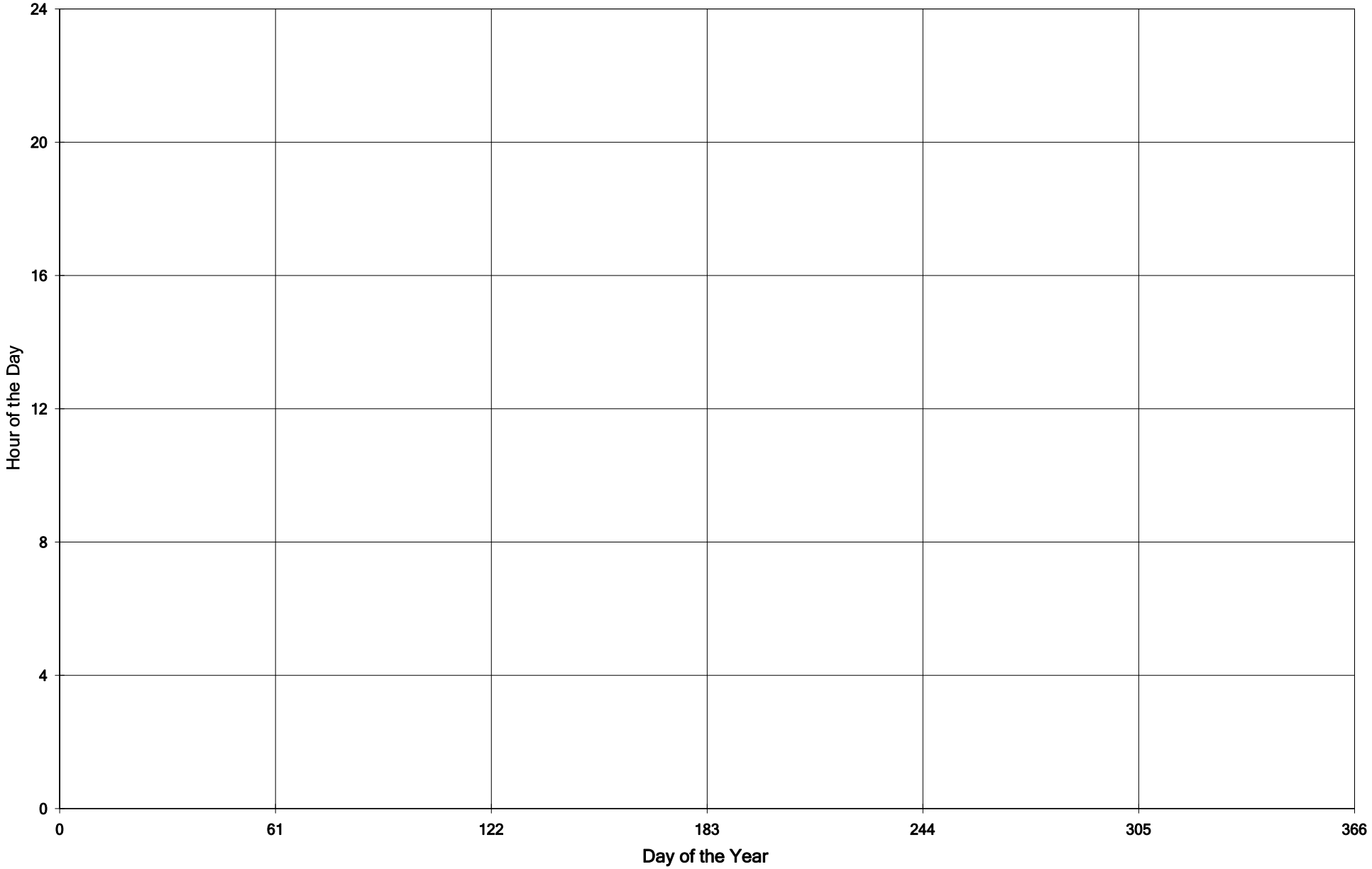
SOURCE: Unspecified

Path: T:\Projects\0187847_MCPLTTurbinesShadowFlicker_PM_NC\MAPS\MCPL_Figure3_AffectedReceptors.mxd

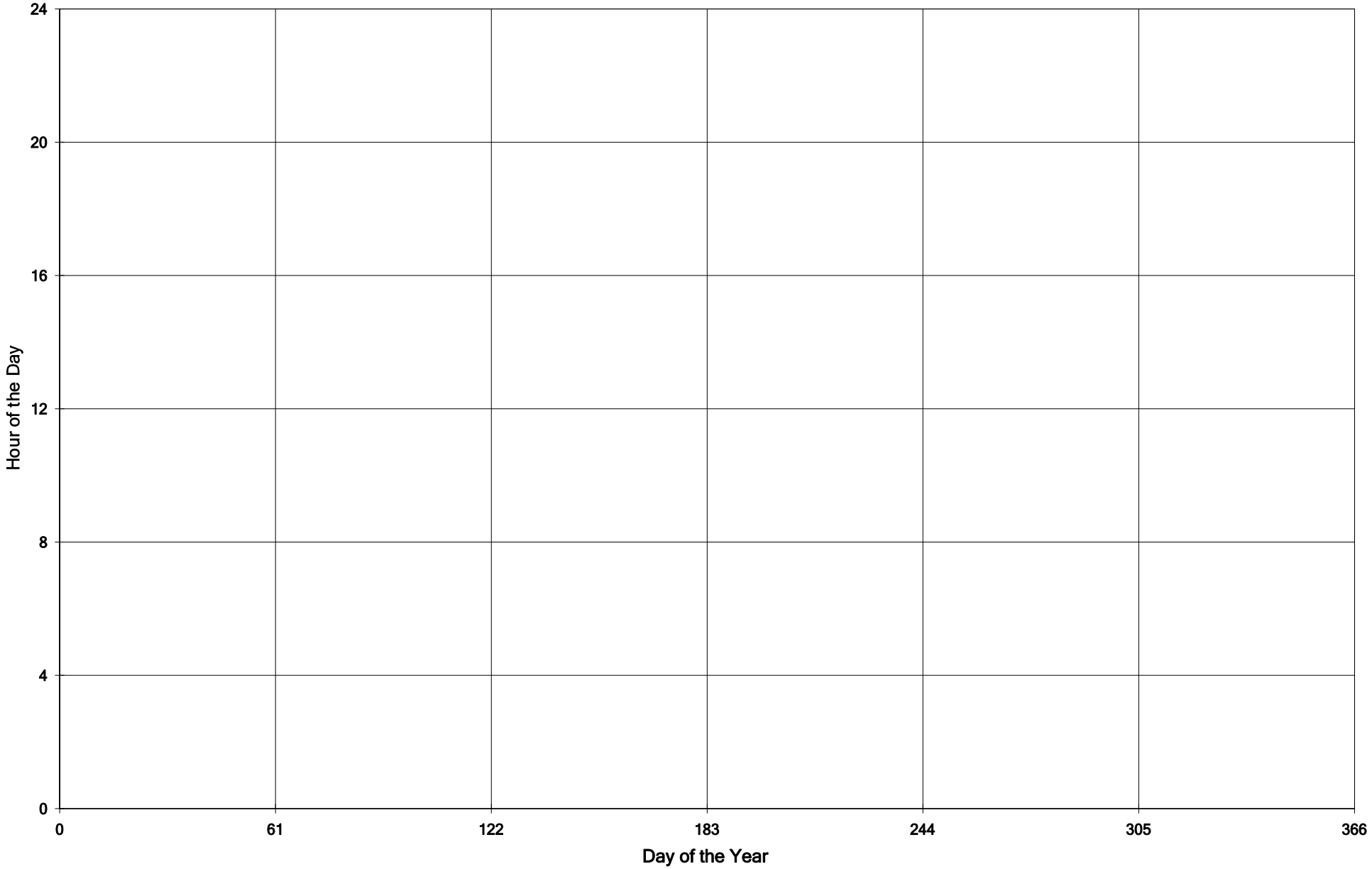
Annex A

Time Periods of Shadow Flicker Effects at Each Receptor

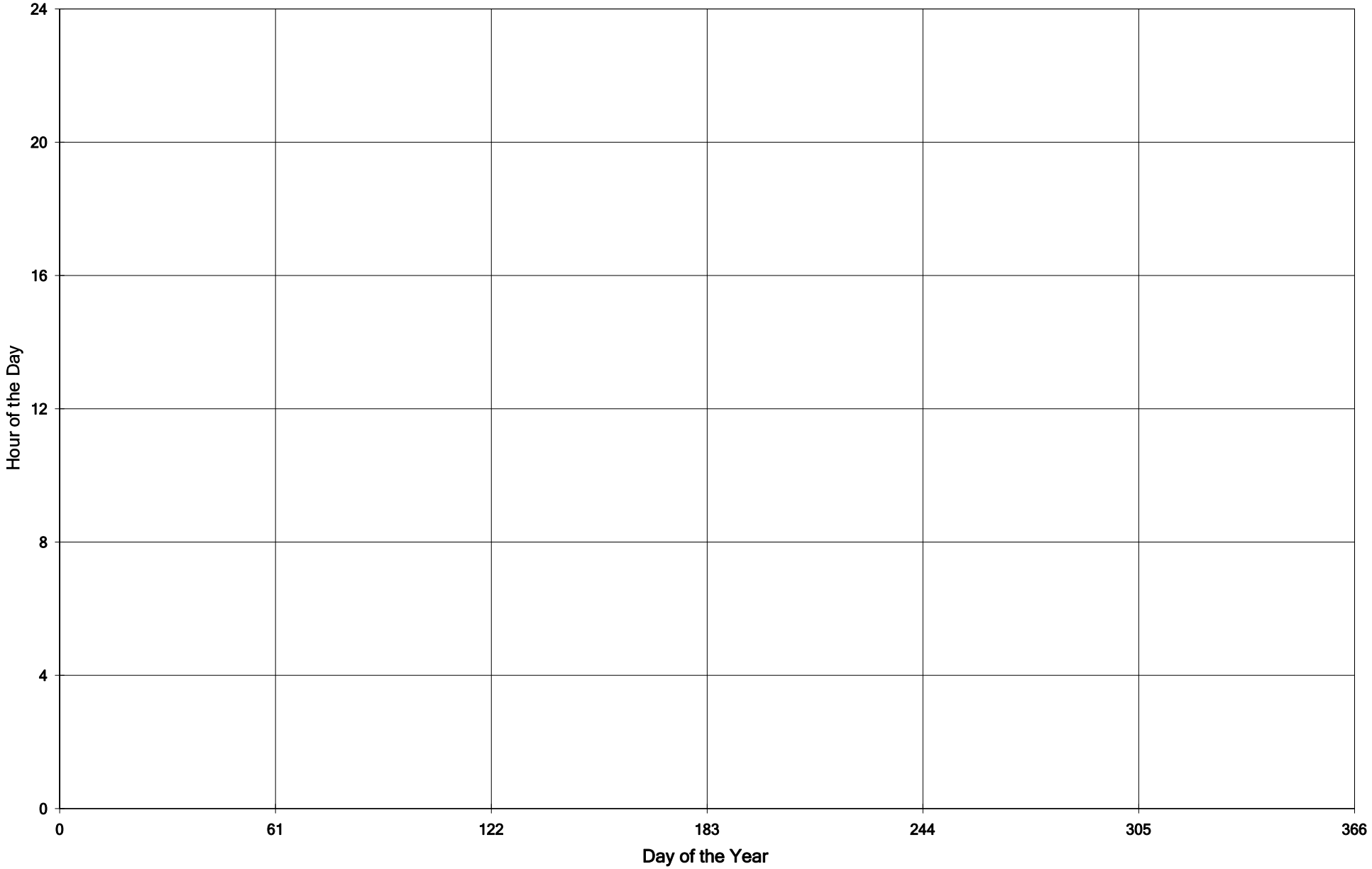
MCPL_42_SFLICK
Shadow Times on House 1, Window 1 from all turbines



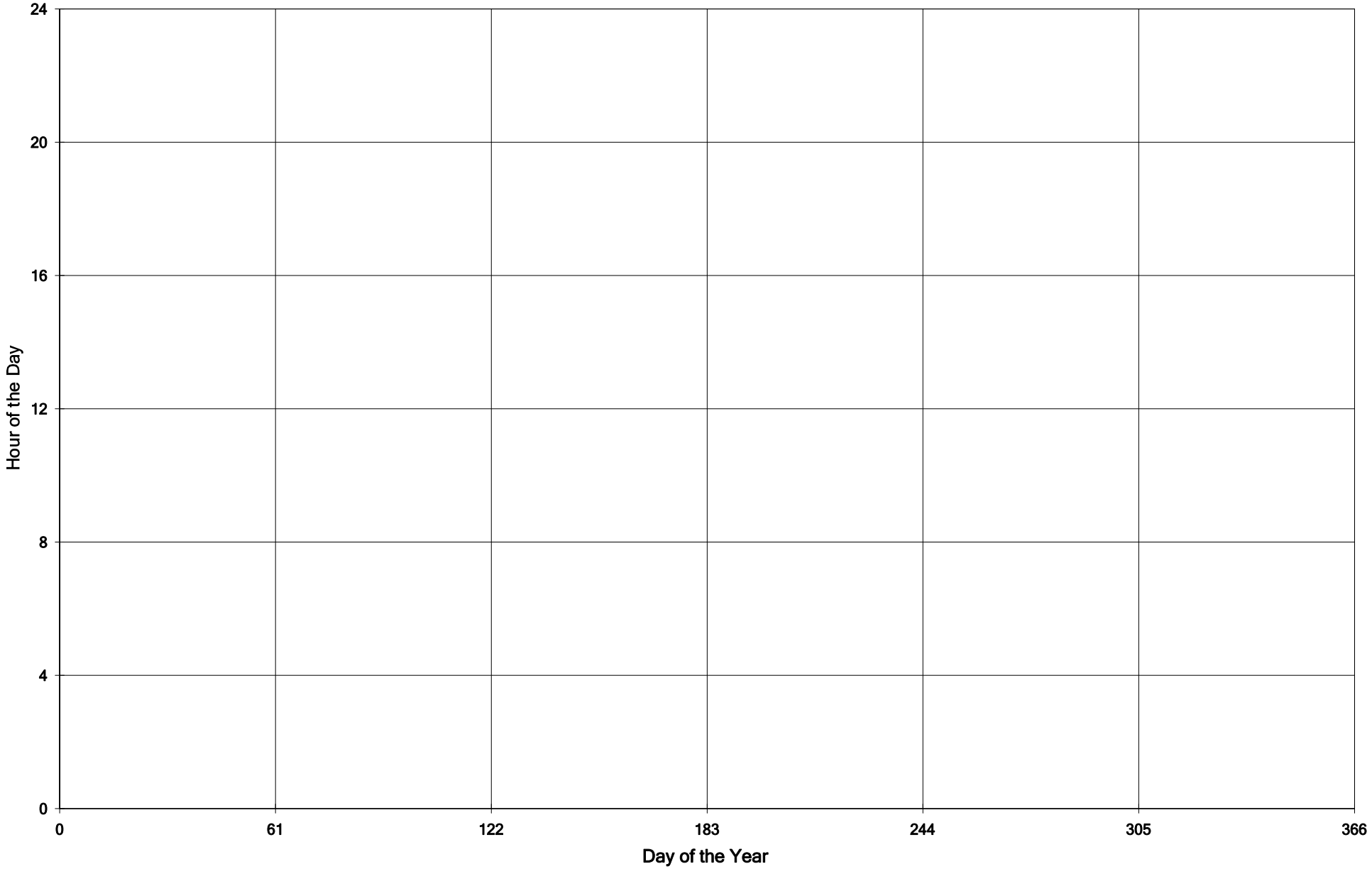
MCPL Wind Power Plant
Shadow Times on House 1, Window 2 from all turbines



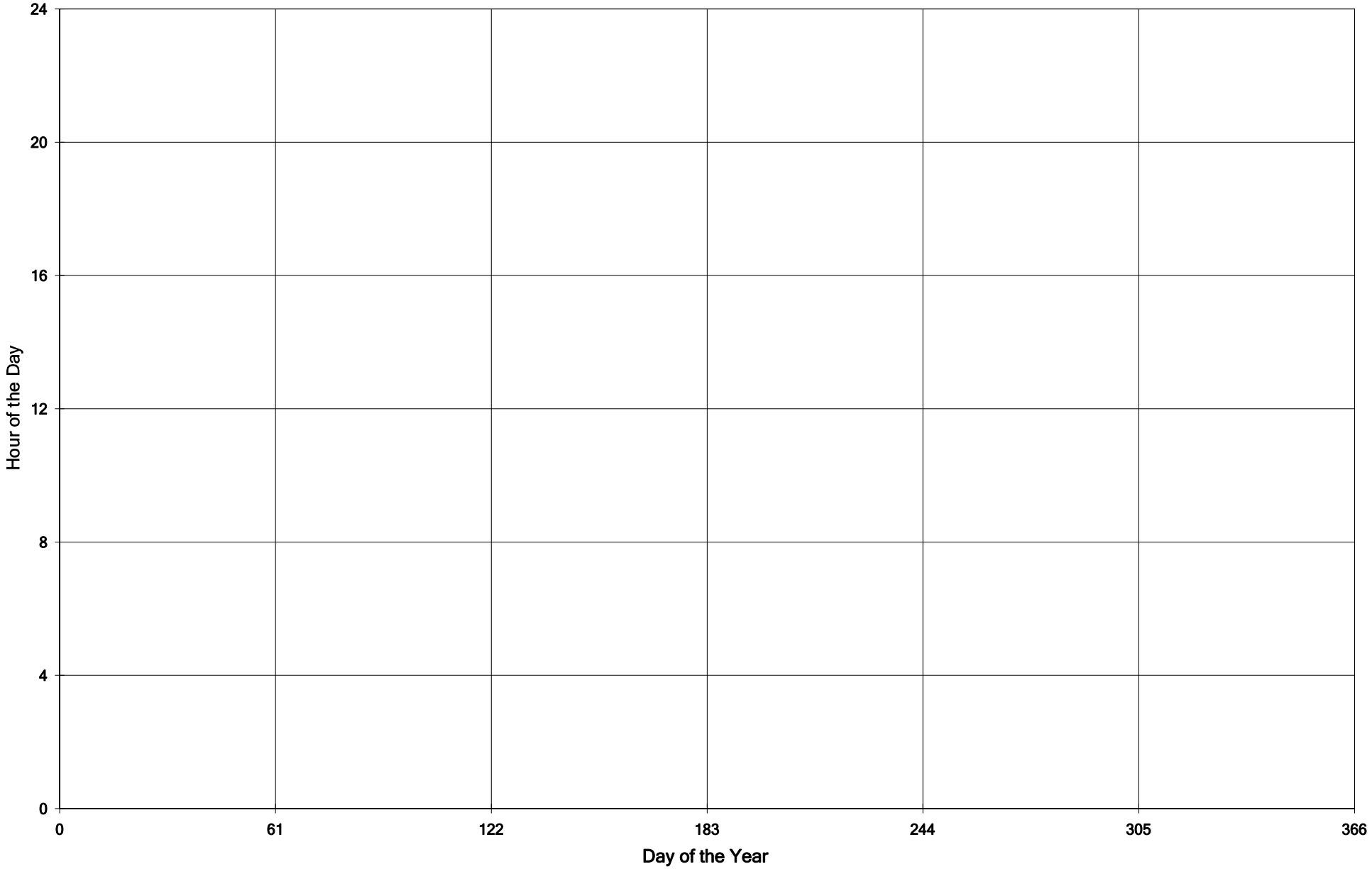
MCPL Wind Power Plant
Shadow Times on House 2, Window 1 from all turbines



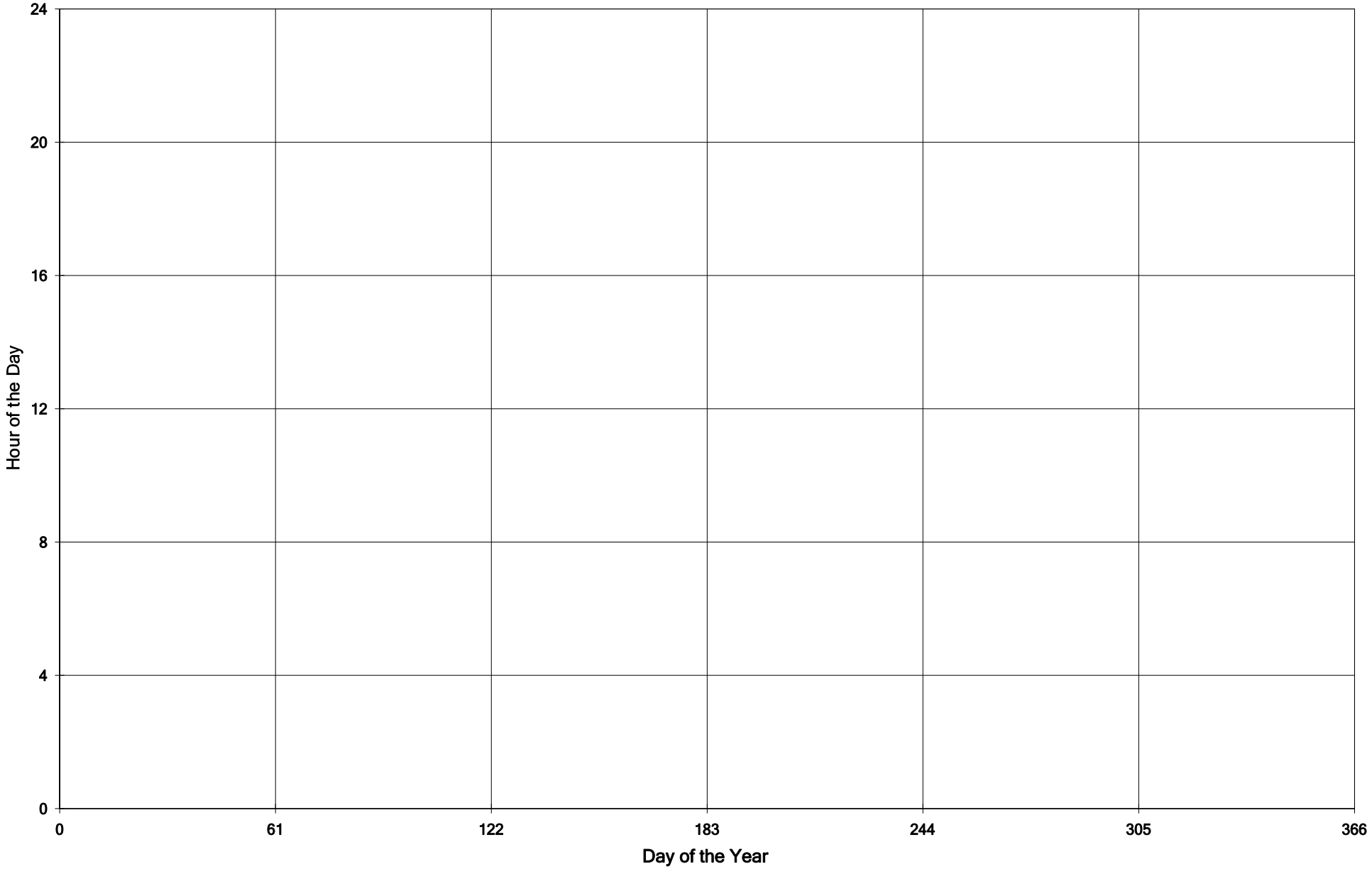
MCPL Wind Power Plant
Shadow Times on House 2, Window 2 from all turbines



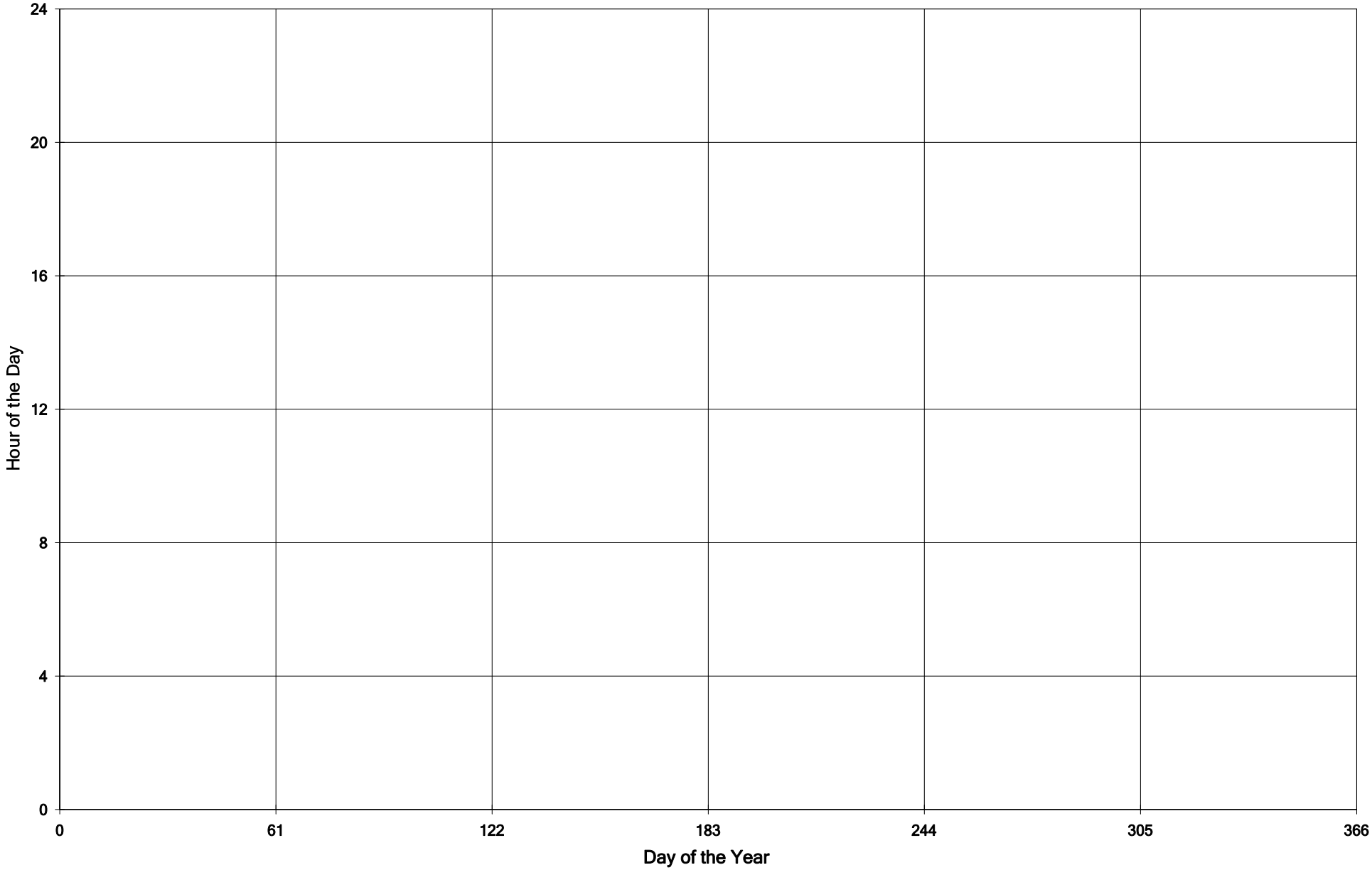
MCPL Wind Power Plant
Shadow Times on House 3, Window 1 from all turbines



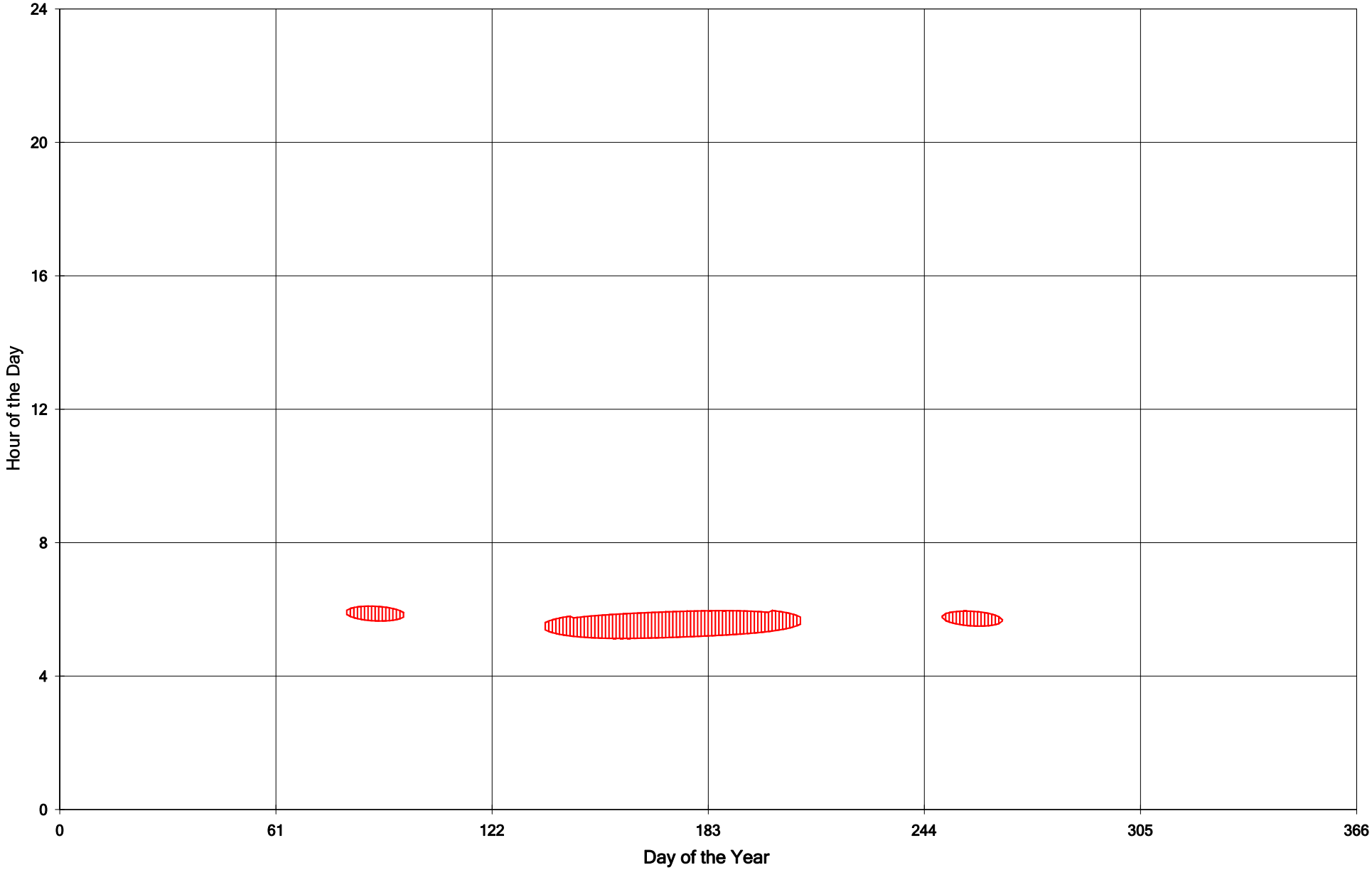
MCPL Wind Power Plant
Shadow Times on House 4, Window 1 from all turbines



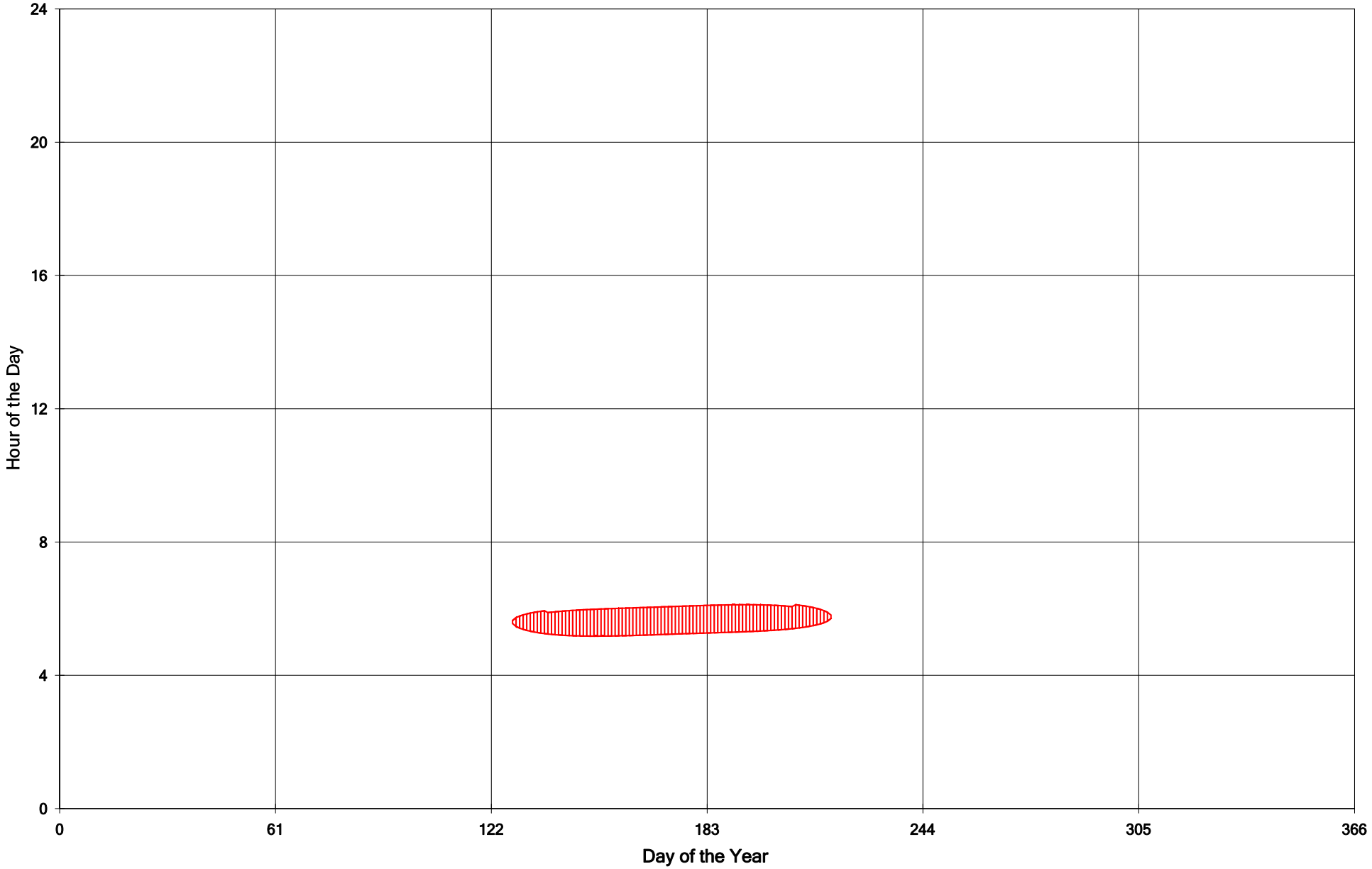
MCPL Wind Power Plant
Shadow Times on House 5, Window 1 from all turbines



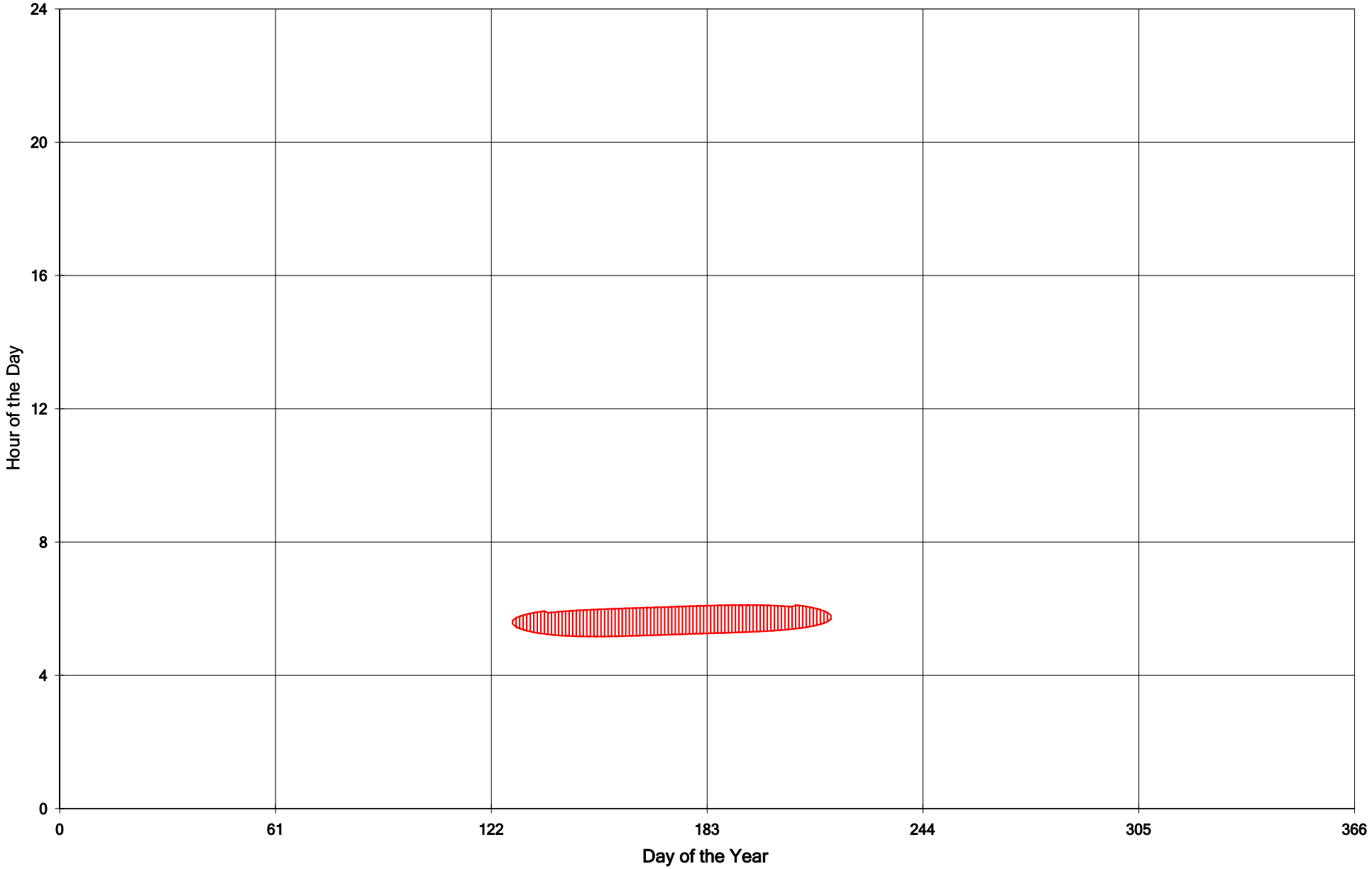
MCPL Wind Power Plant
Shadow Times on House 6, Window 1 from all turbines



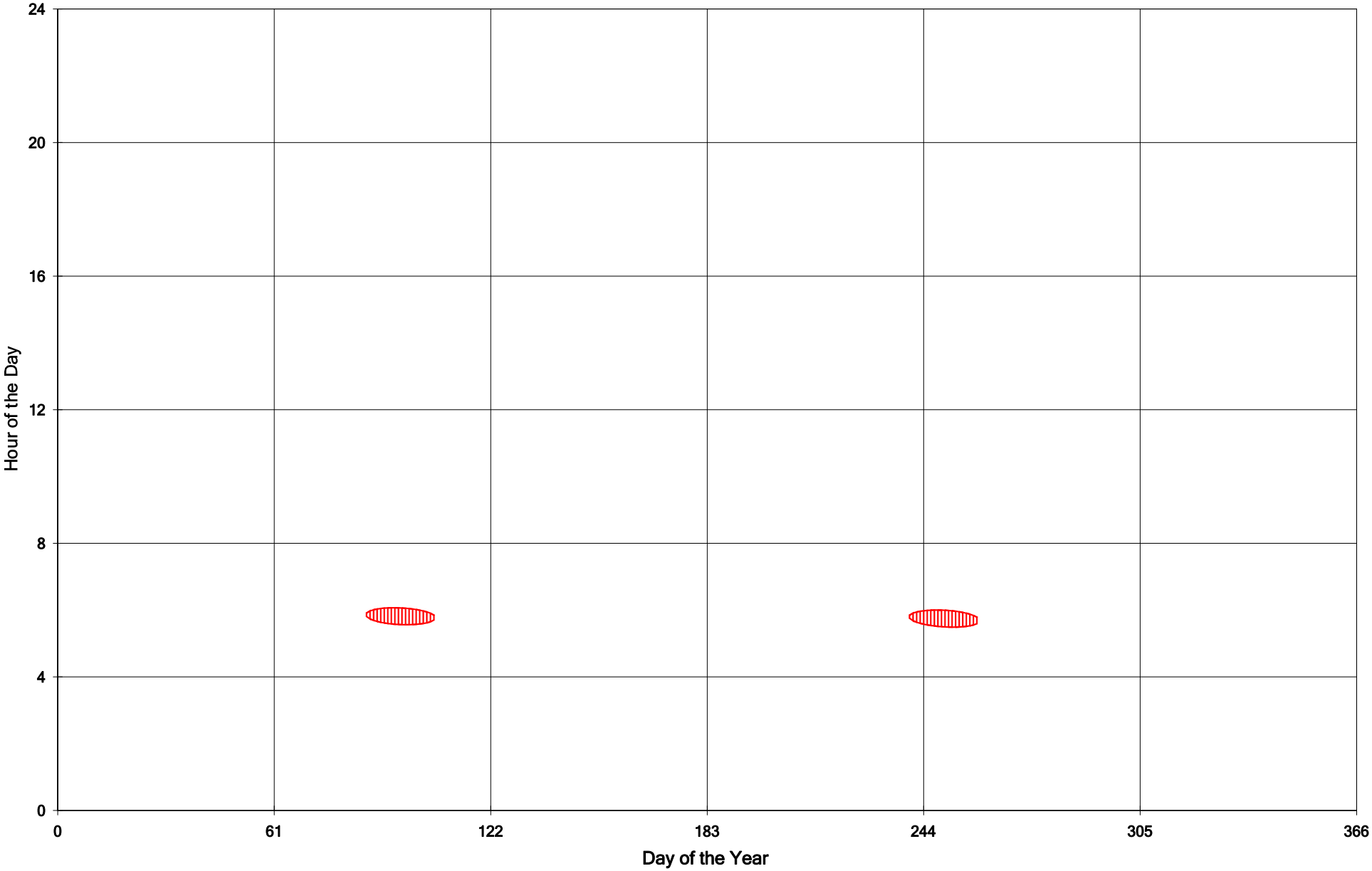
MCPL Wind Power Plant
Shadow Times on House 7, Window 1 from all turbines



MCPL Wind Power Plant
Shadow Times on House 7, Window 2 from all turbines



MCPL Wind Power Plant
Shadow Times on House 8, Window 1 from all turbines



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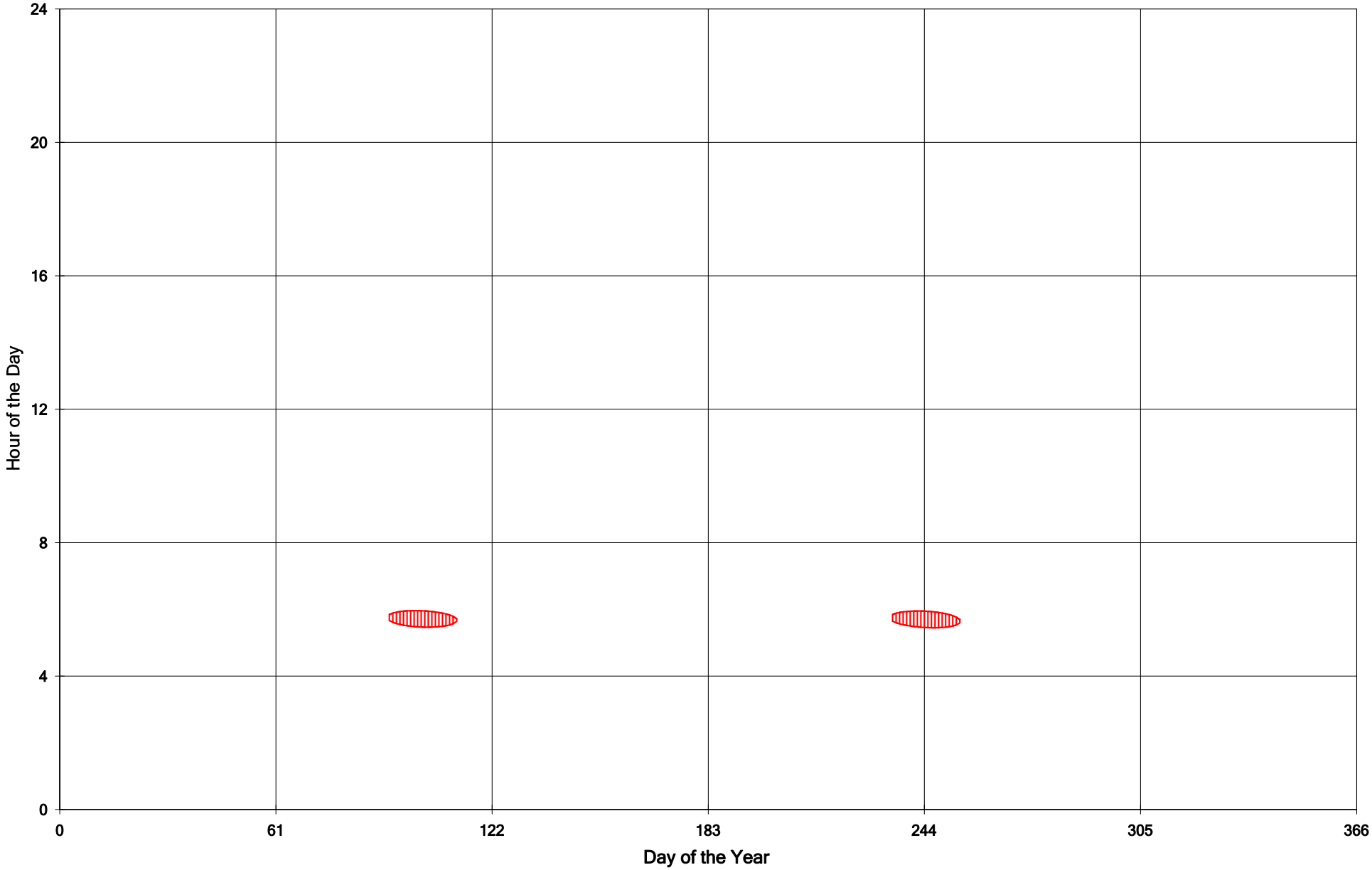

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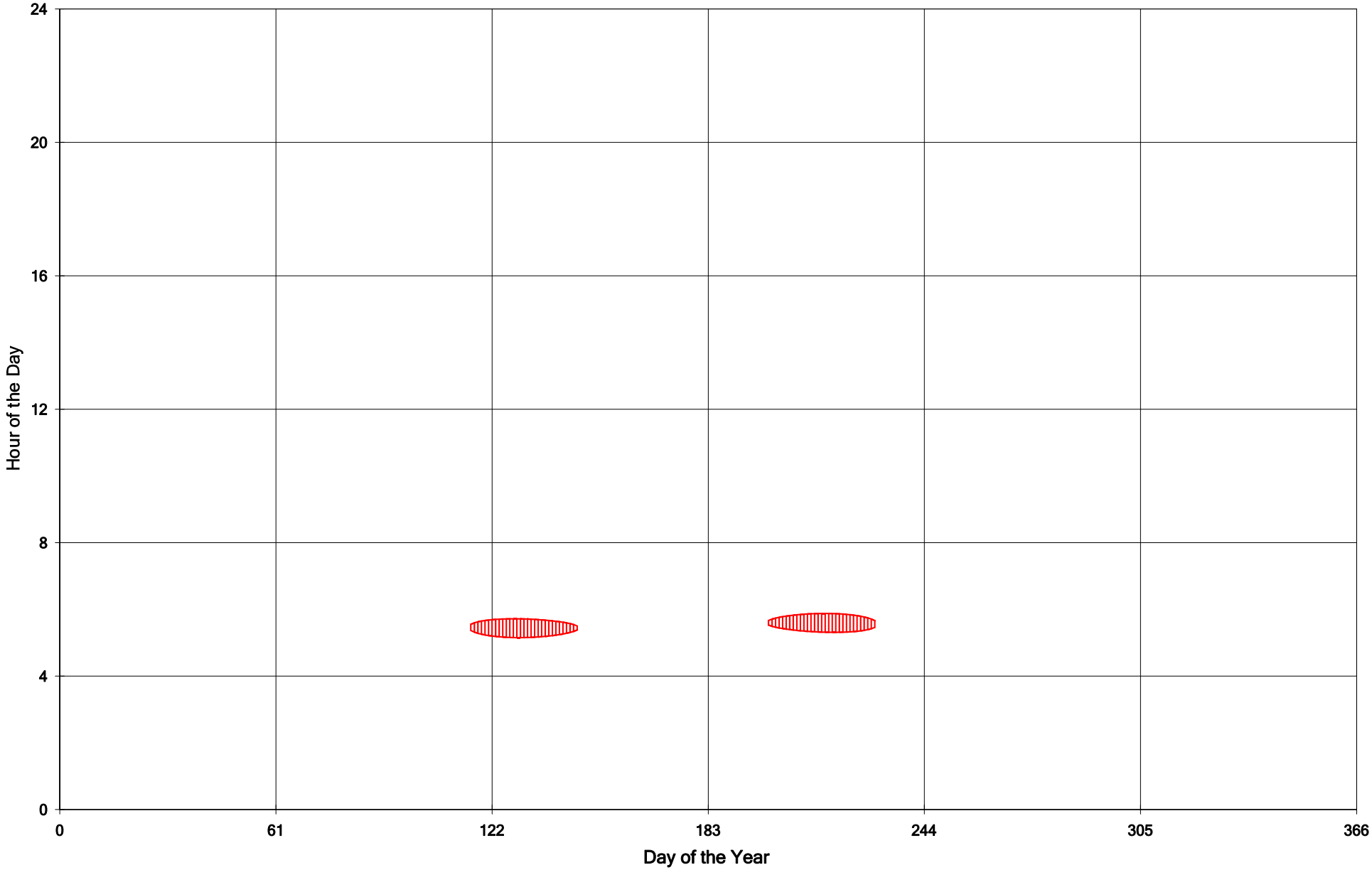

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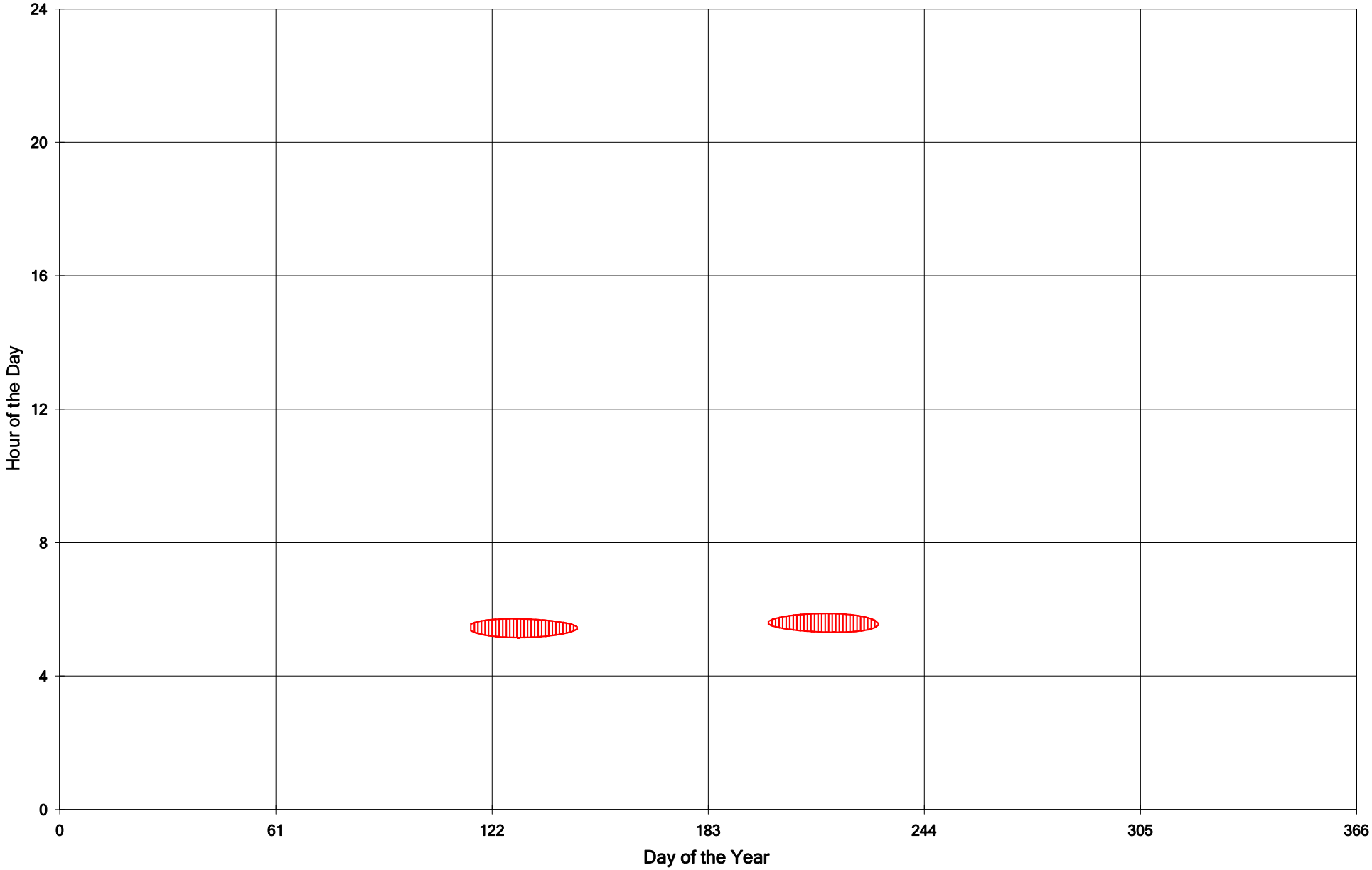

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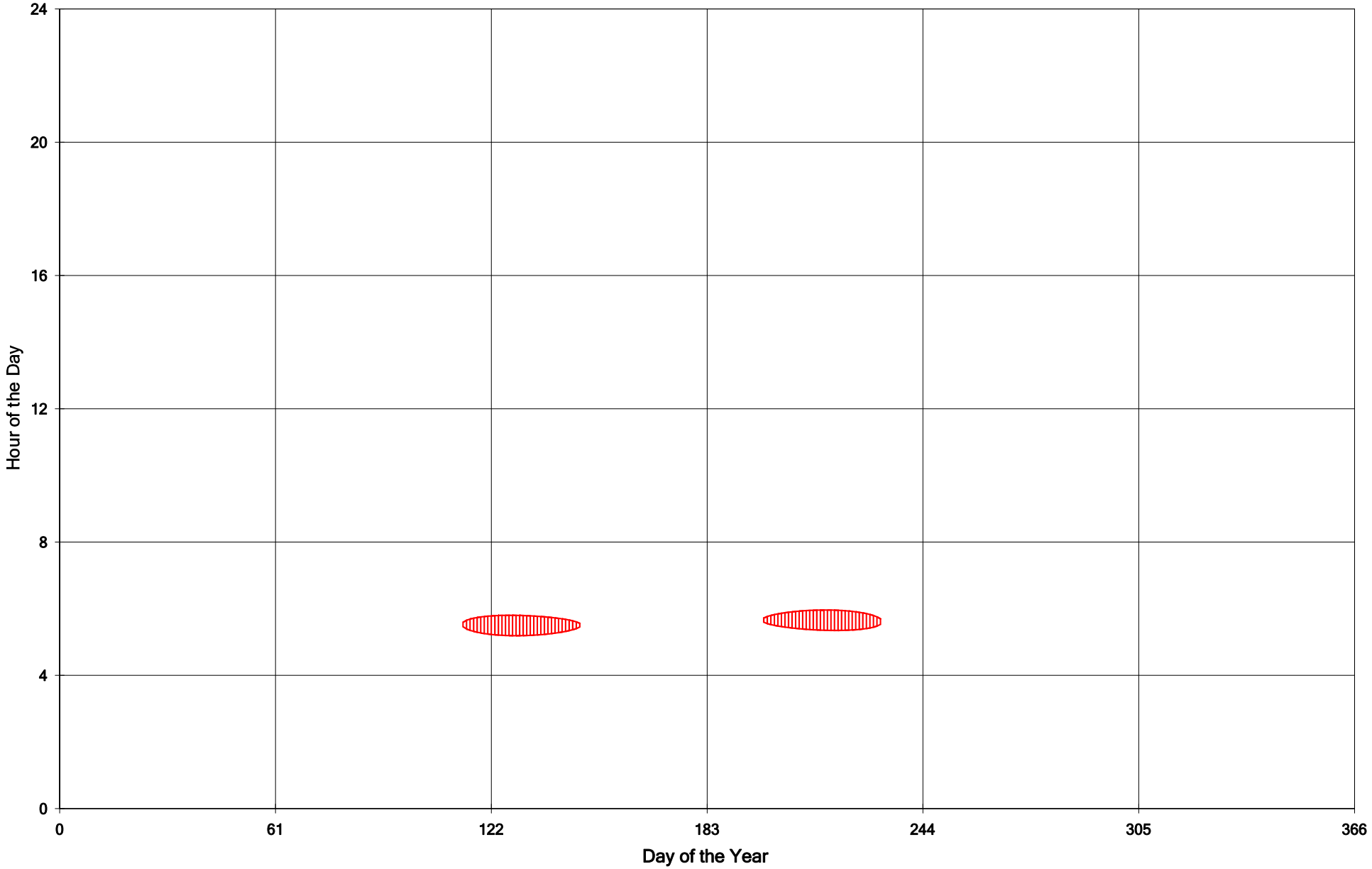

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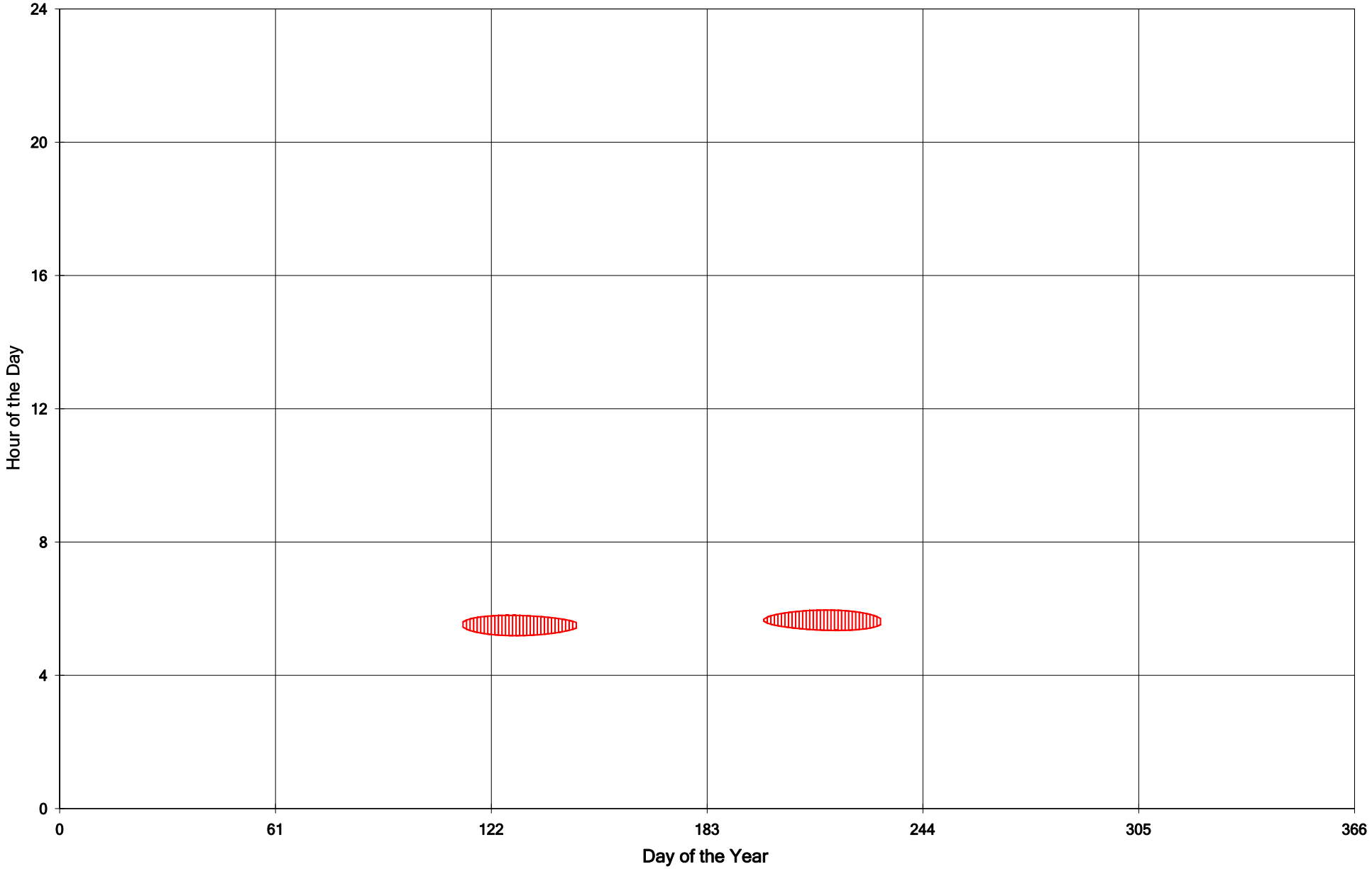

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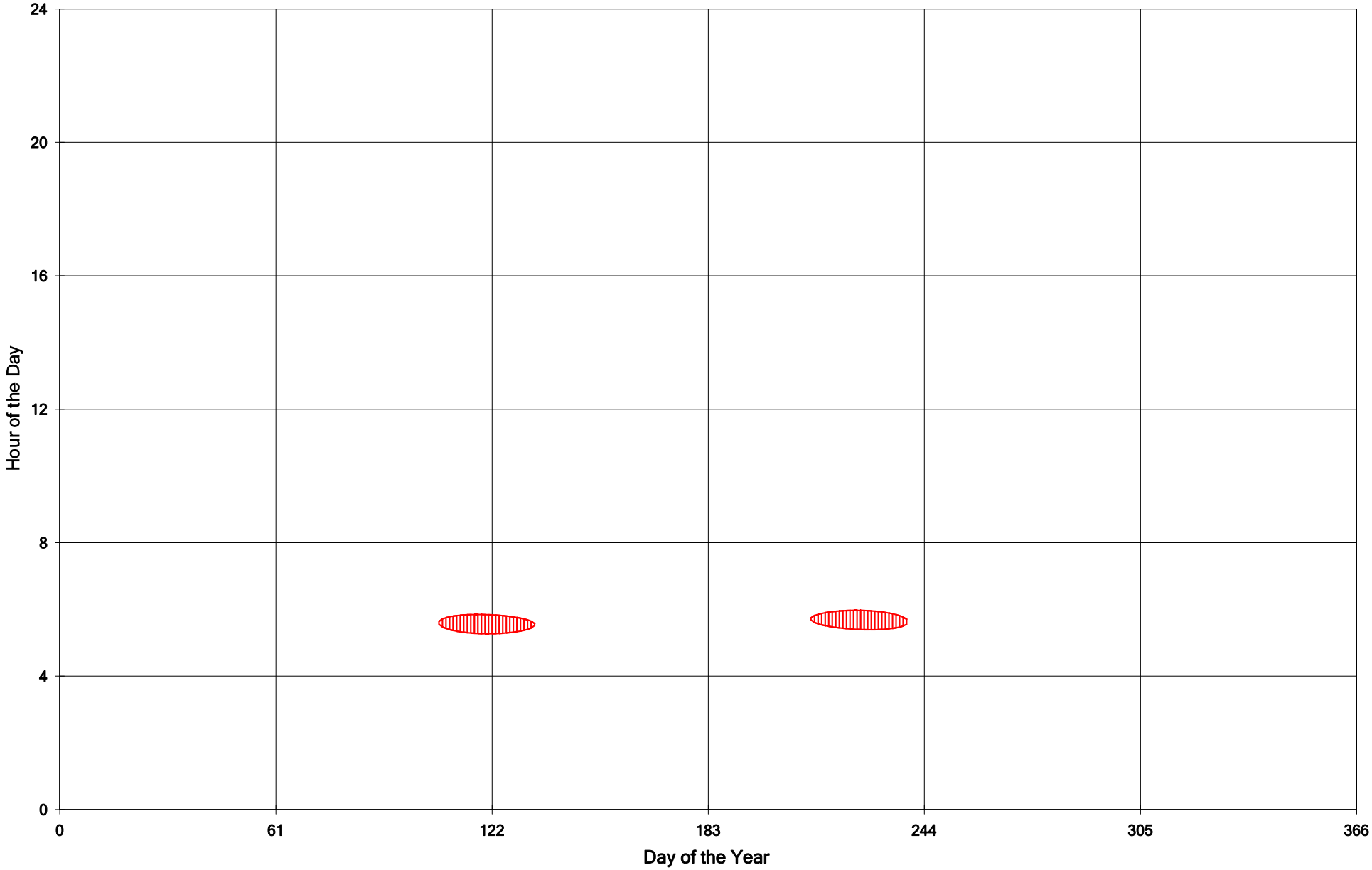
Shadow Times on House 12, Window 1 from all turbines



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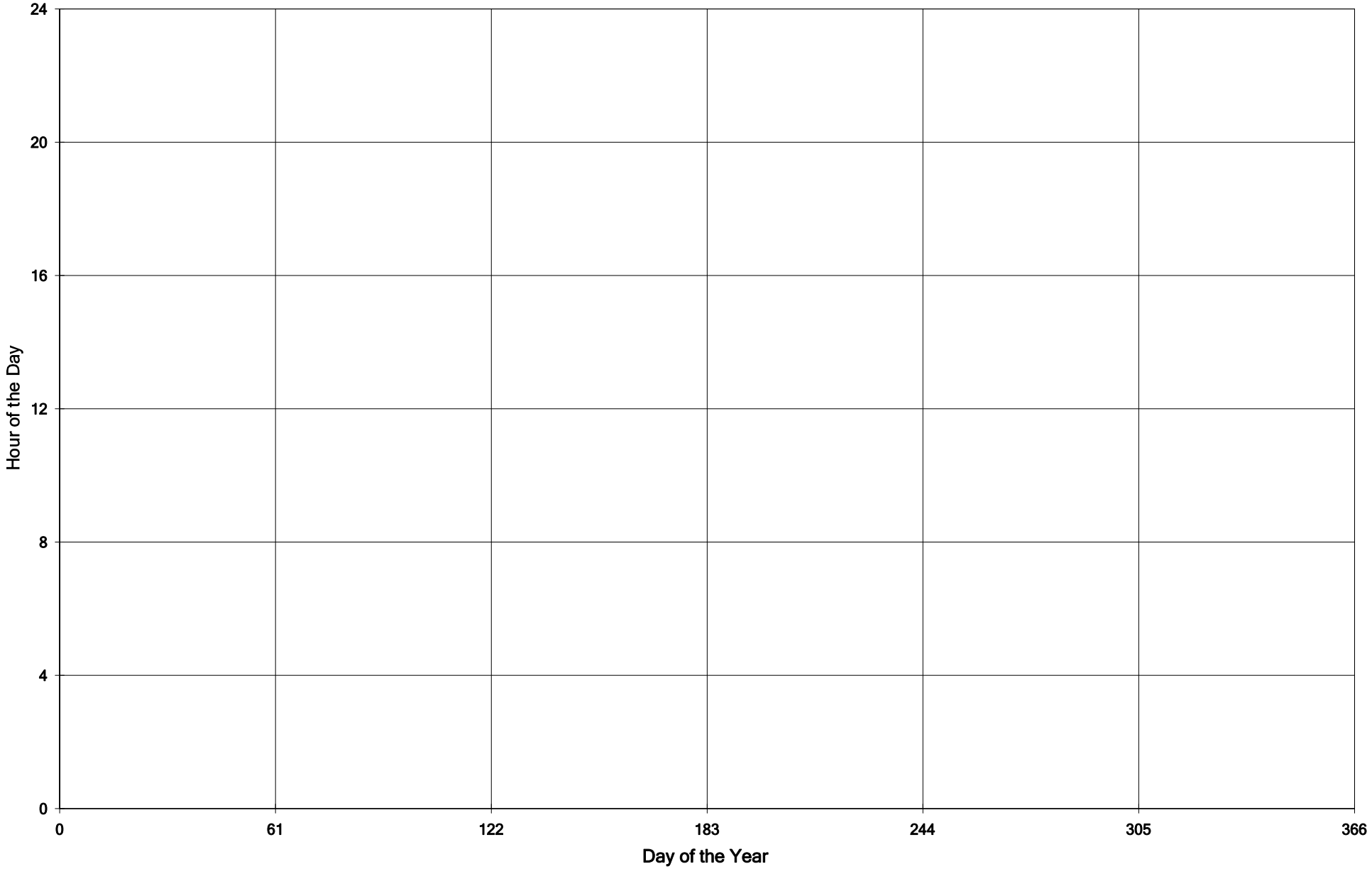

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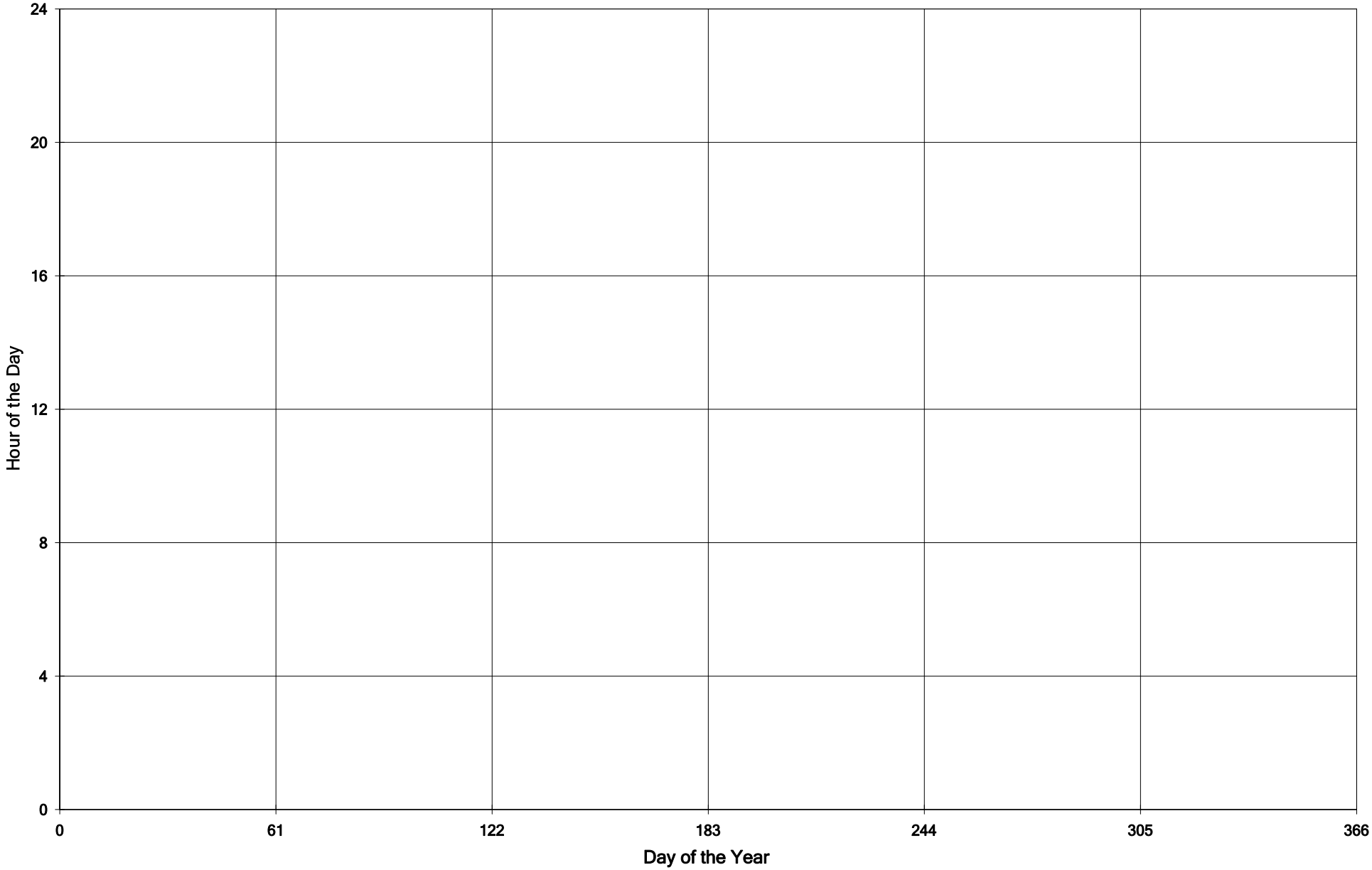
Shadow Times on House 14, Window 1 from all turbines



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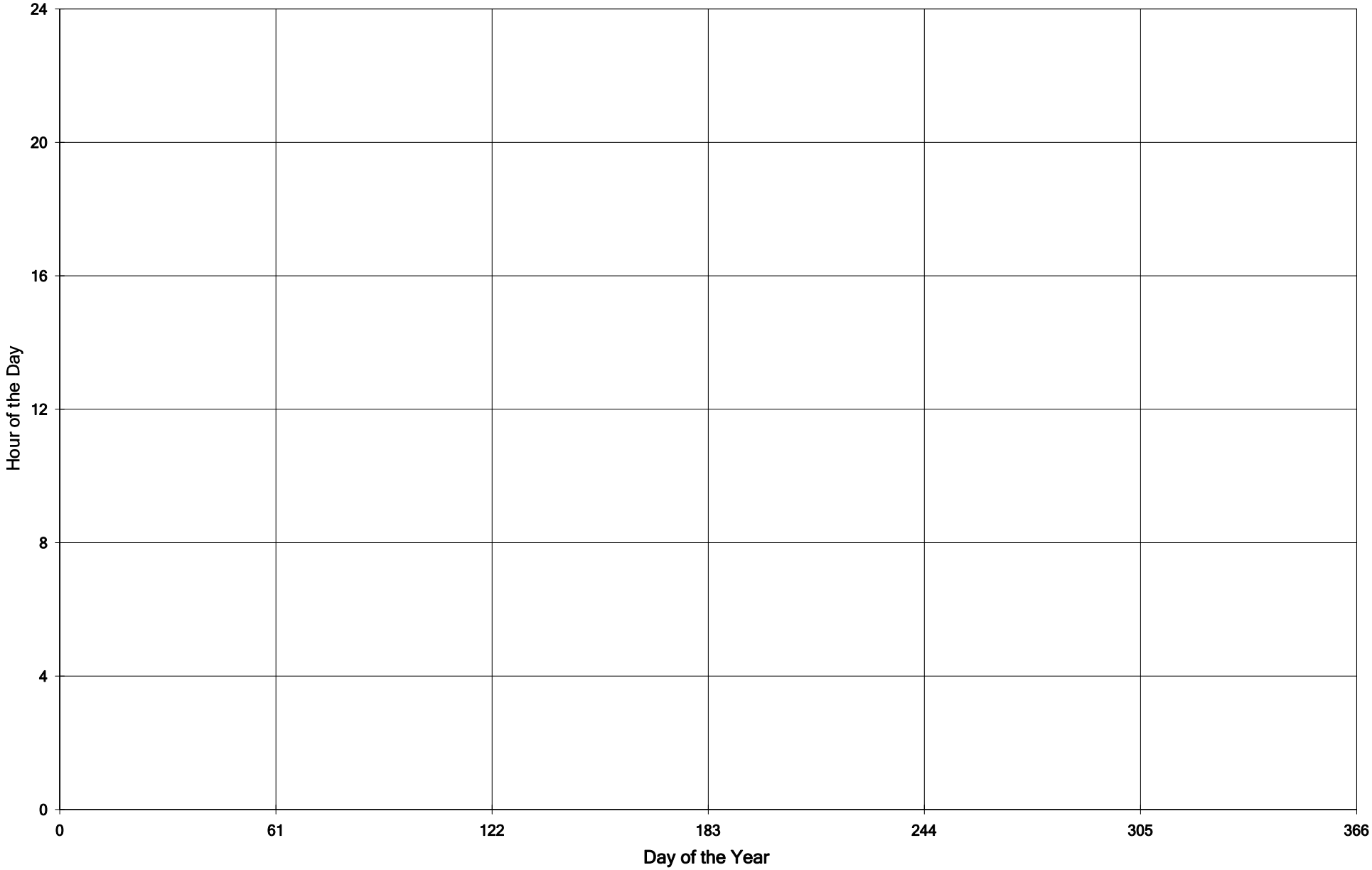

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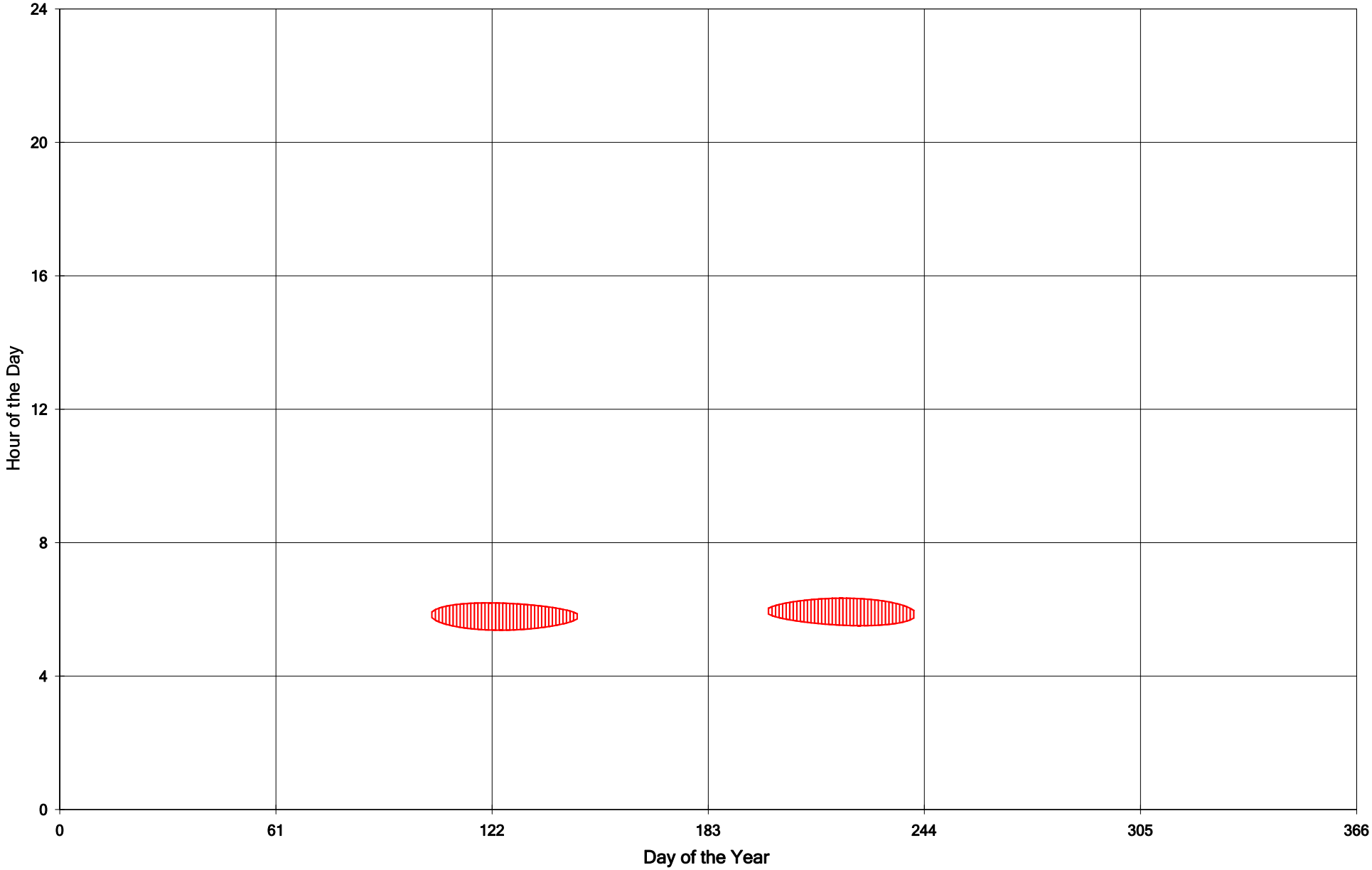

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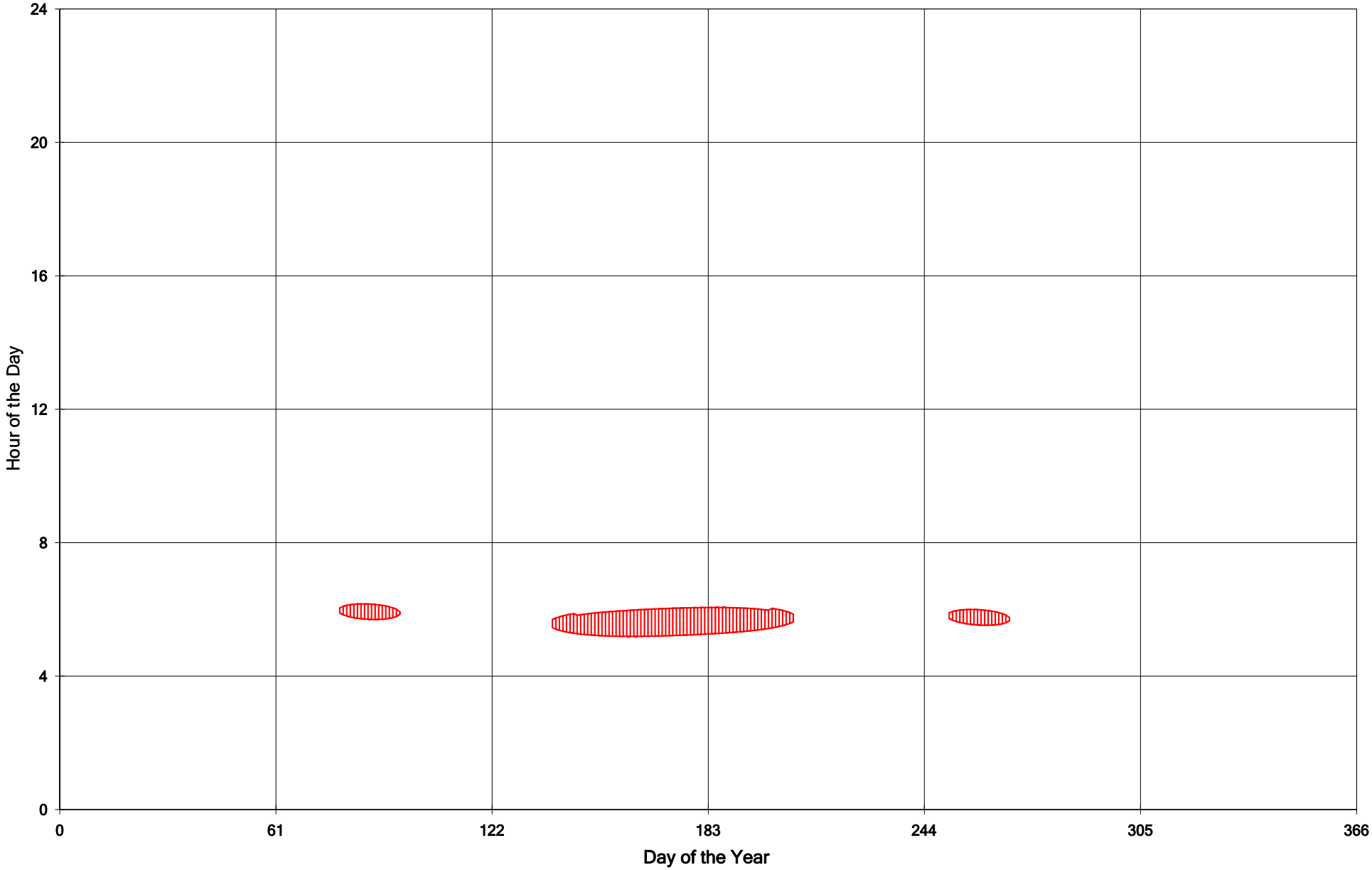

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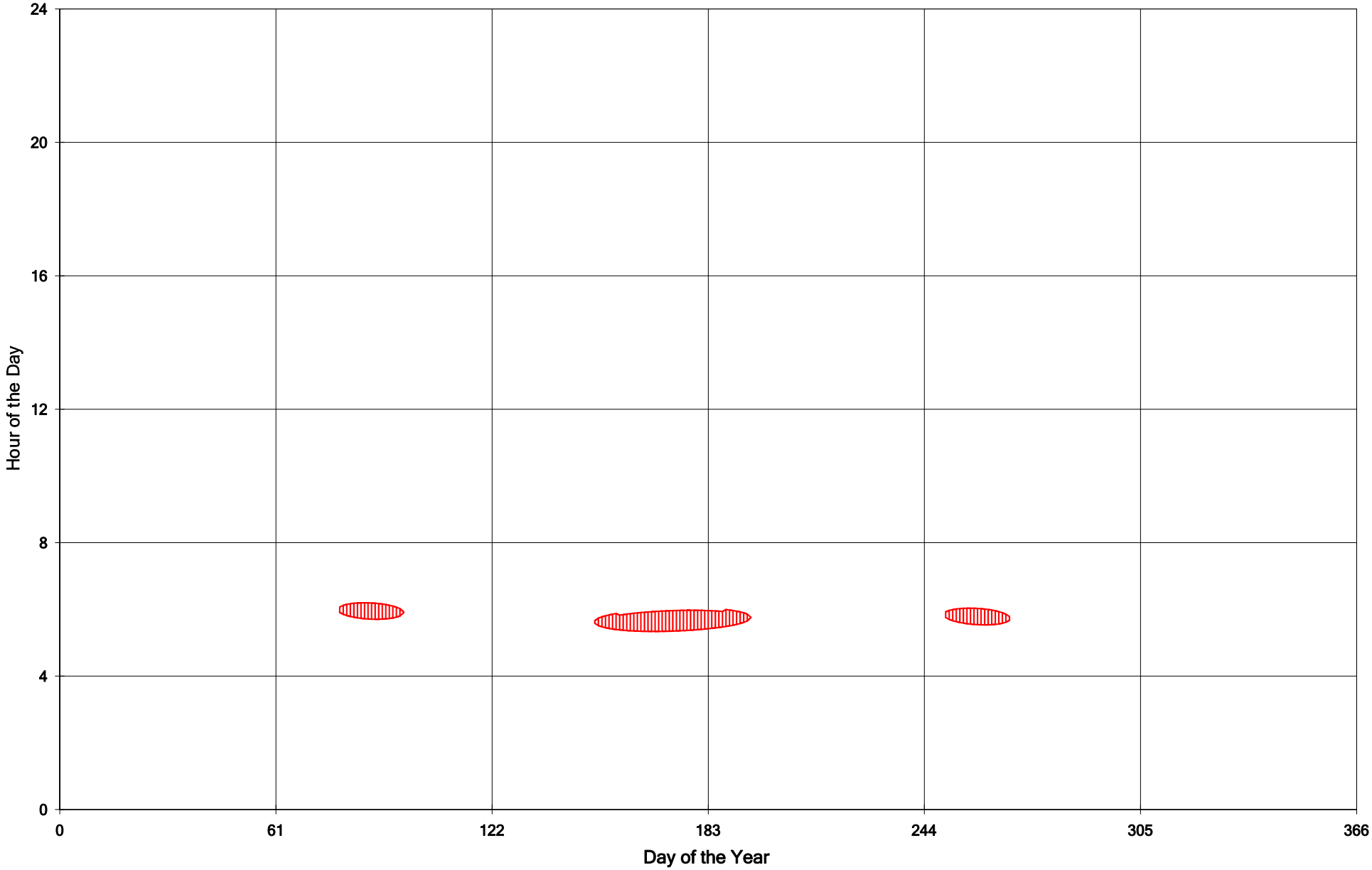

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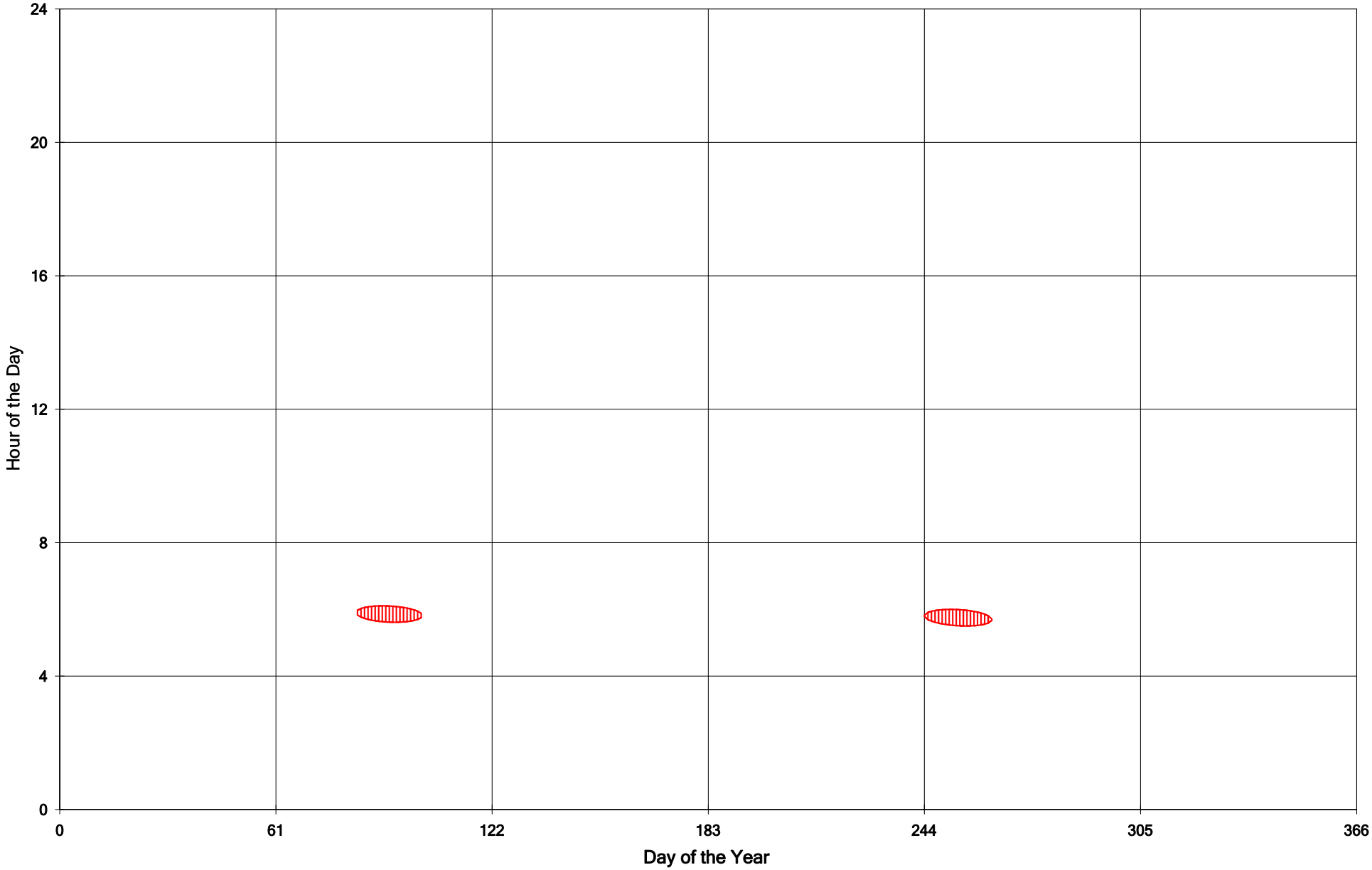

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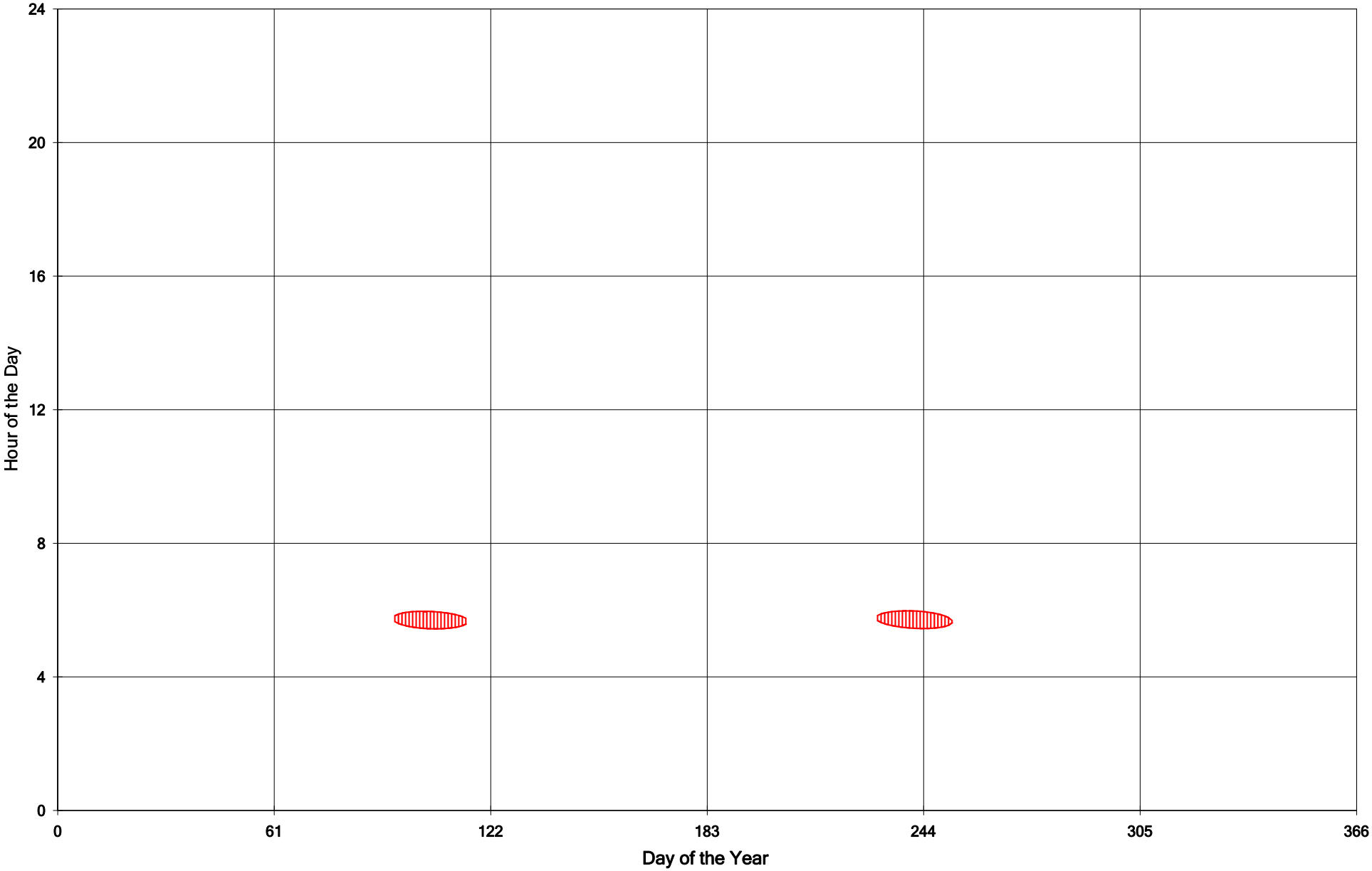

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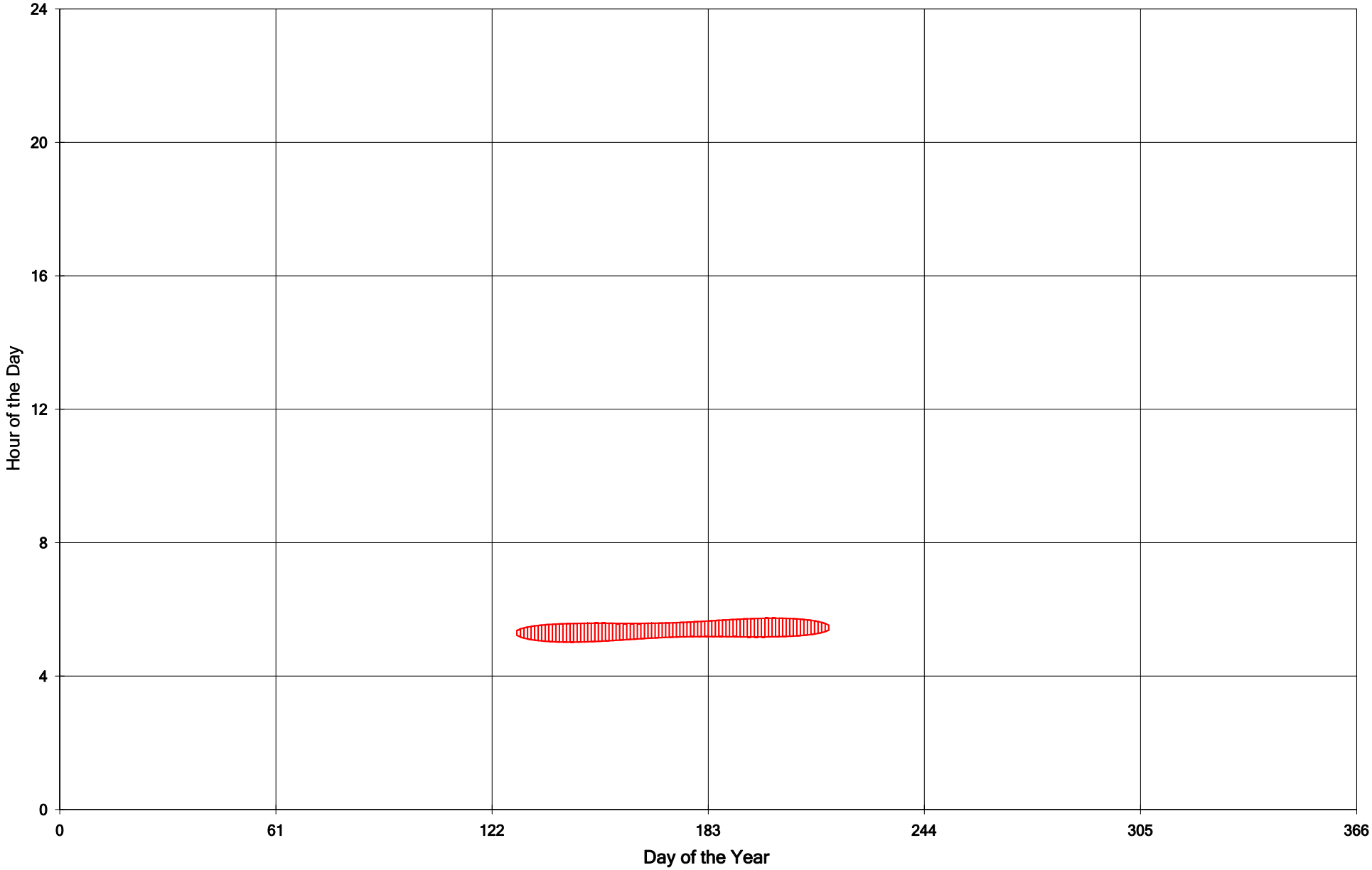

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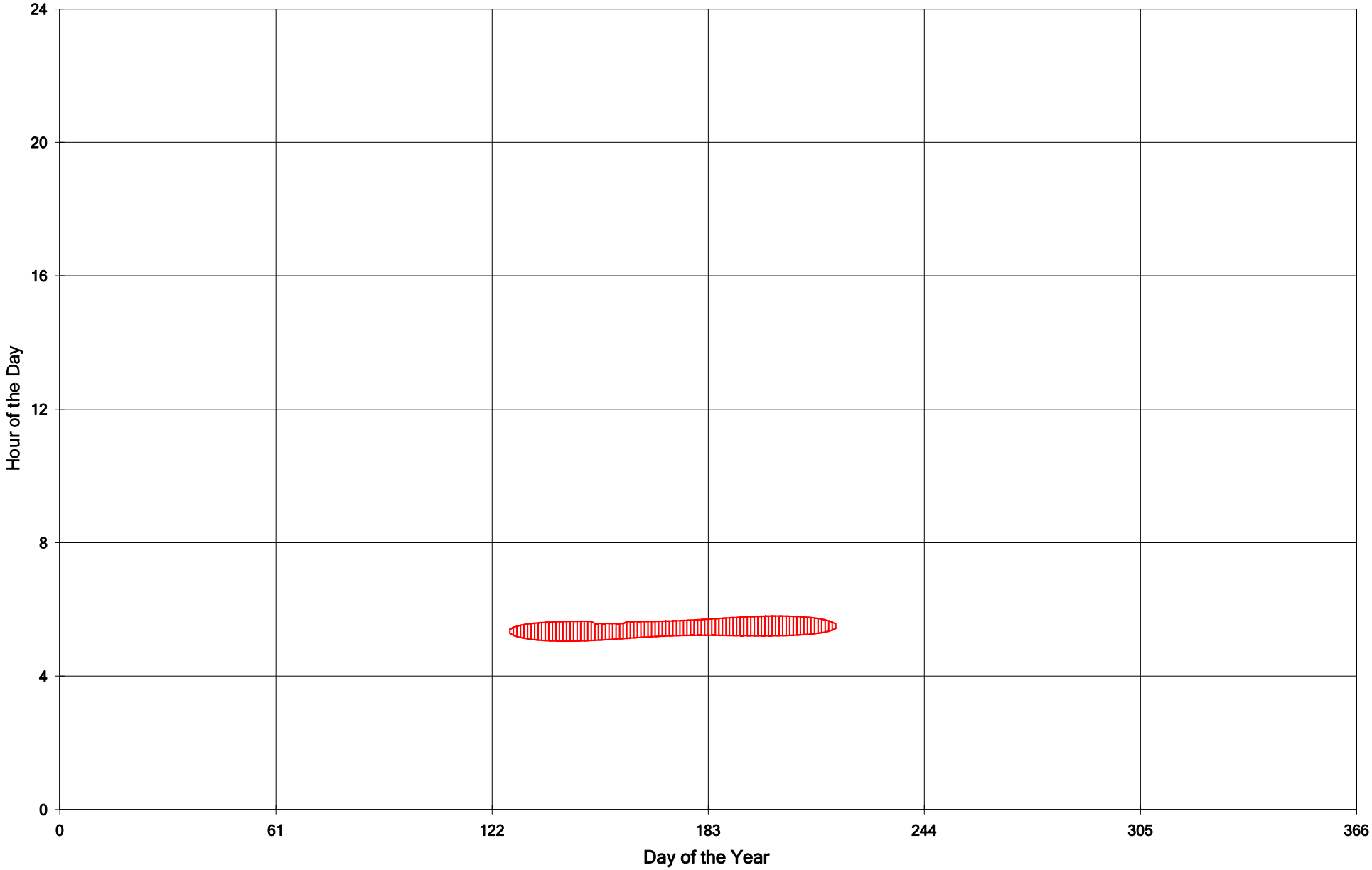

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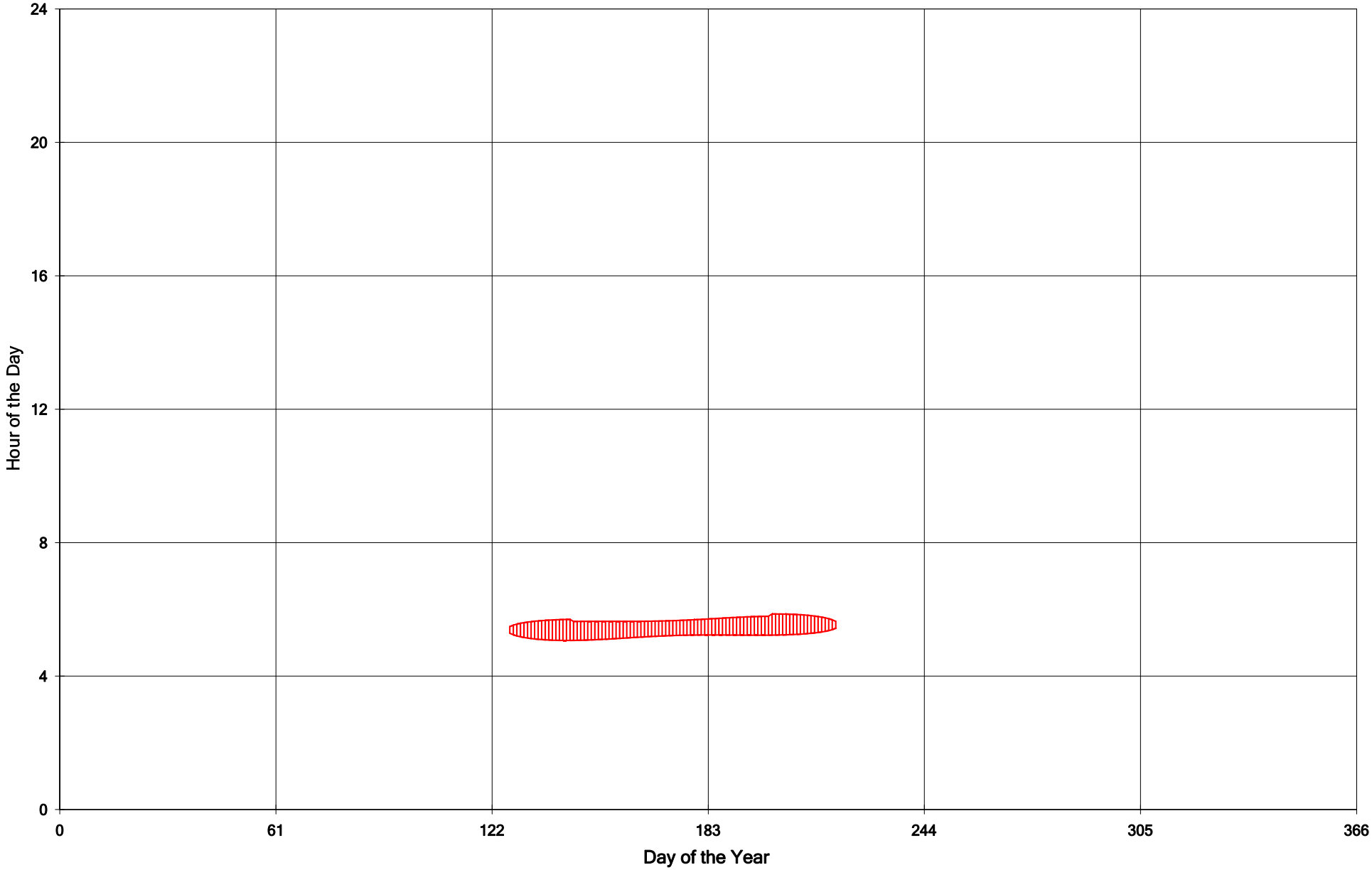

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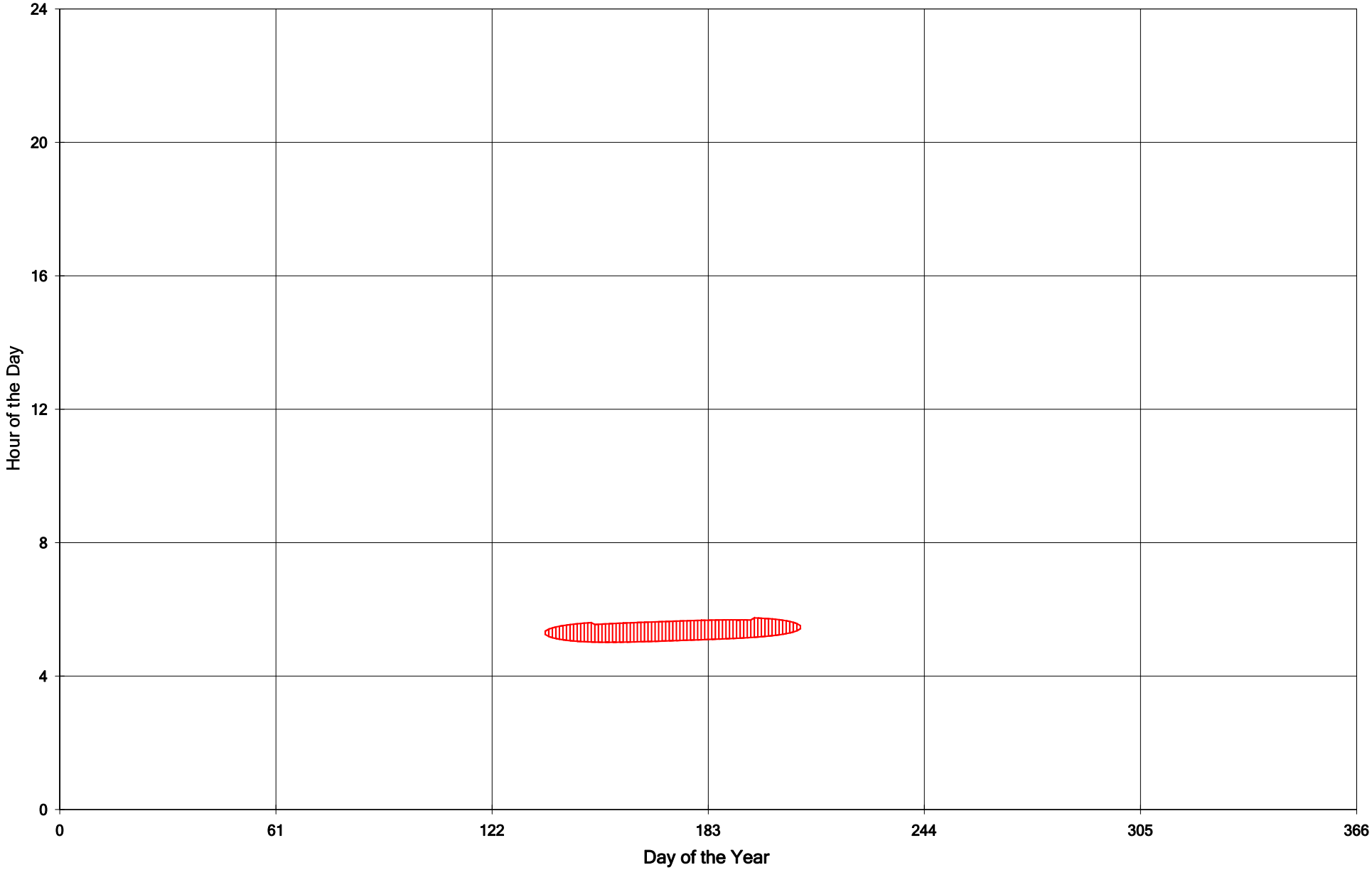

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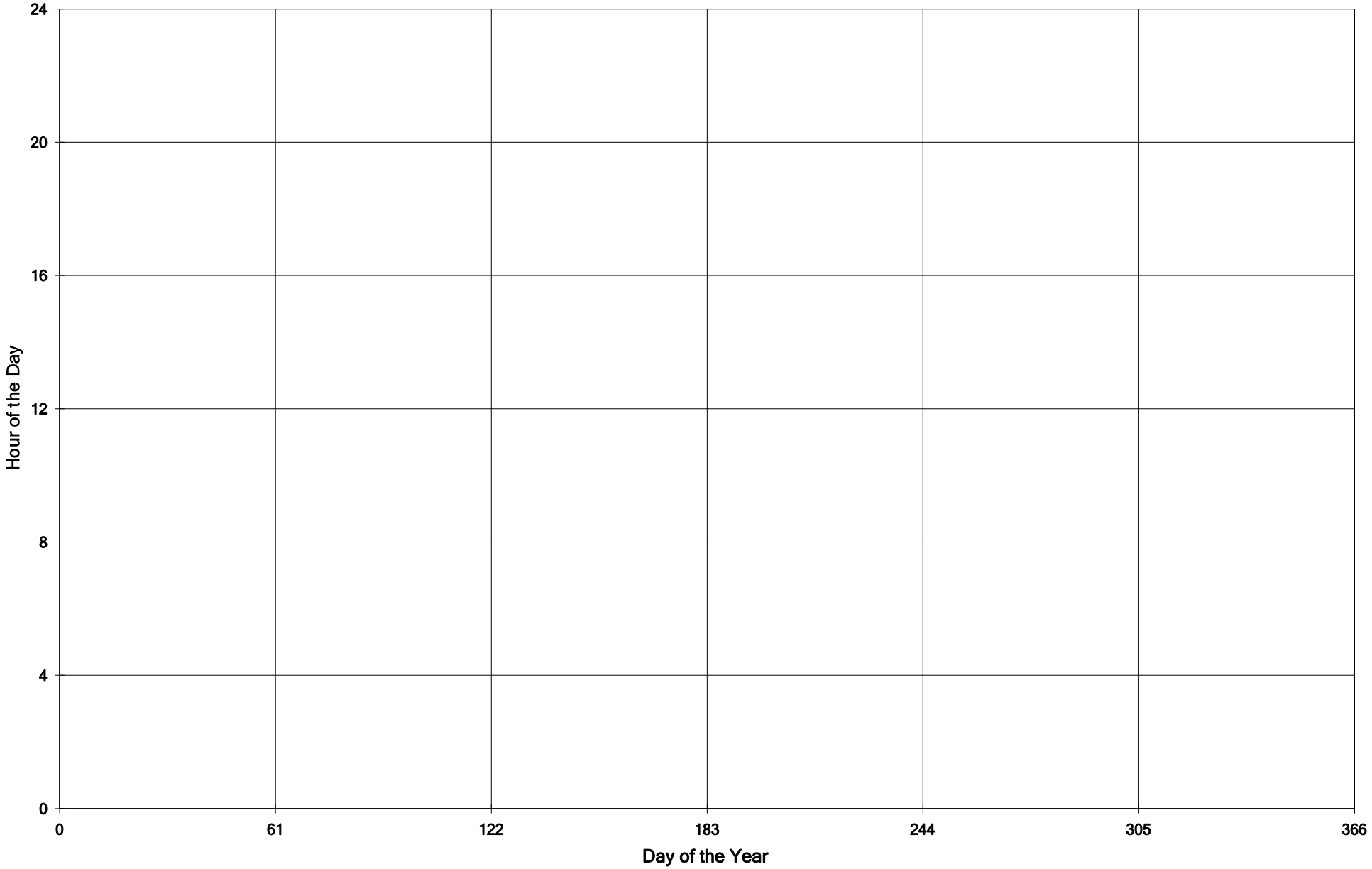
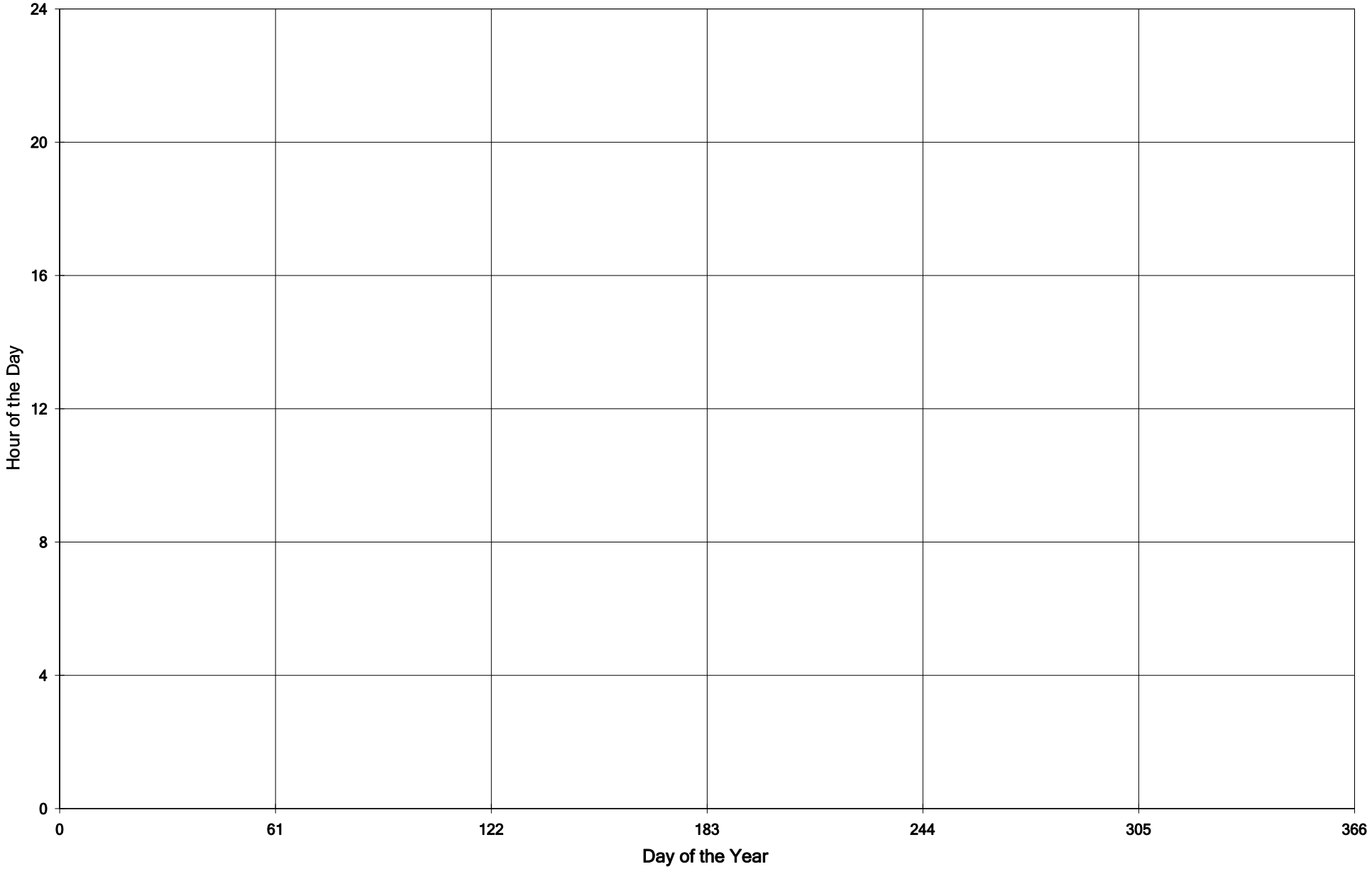


MCPL Wind Power Plant
Shadow Times on House 26, Window 1 from all turbines



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Annex K

MPCL Corporate Policies (EHS, Code of Conduct and Human Resources)

SOCIAL, ENVIRONMENTAL, HEALTH & SAFETY POLICY

APRIL 2013

1.1 SOCIAL, ENVIRONMENTAL, HEALTH AND SAFETY POLICY

We, **Metro Power Company Limited** ("**MPCL**"), are in the business of developing, operating and maintaining a wind power project with a view to provide Clean and Green energy to the service of the populace.

We at MPCL shall ensure to safeguard our commitment and strive to achieve and sustain excellence in Environment, Social, Occupational Health and Safety performance by ensuring the goals that construct our corporate Social Environmental Health and Safety (**SEHS**) policy. We will aspire to achieve the following:

1. We, including our contractors, sub-contractors and other stakeholders comply with all the applicable Environmental, Health & Safety laws and regulations.

2. Conducting and carrying out all our operations in an environmentally and socially acceptable and sustainable manner with minimal residual or negative impact on the associated components be it People, Property or Nature.

3. Conducting all our operations in compliance to the applicable laws, regulations and international guidelines and best practices in order to meet our social and environmental contractual obligations to investors, lenders, customers and other relevant stakeholders.

4. Assessing and addressing in the complete life cycle of the project and at all stages of project starting from Planning to decommissioning, key social, environmental, health and safety related impacts associated with our project.

5. Developing mutual trust and respect with the neighbouring communities around our project site through continuous engagement throughout the complete life cycle of the project.

6. Using the most efficient, safest and environment friendly technology in our work processes and systems.

7. Ensuring minimal waste generation from the company's operations and in case of waste generation, either proper disposal of the same through authorized channels or reuse and recycling of the same.

8. Developing a work culture of continuous improvement in all our operational and management procedures and processes and monitoring the progress in the same;

9. Prioritising above everything, Health and Safety of our personnel as well as our subcontractor personnel directly contracted by us.

10. Maintaining a tradition of appreciation and respect for Social Environment, Health and Safety concerns as imbibed in the SEHS policy and enabling the same among the employees, contract workers, business partners, subcontractors or any stakeholder attached with the company.

We shall communicate and make this policy available to all our employees, stakeholders and interested public. The policy shall be reviewed periodically and modified to incorporate changes as arising from change and progress of business plan.

Signed by:

Danish Iqbal
Chief Executive Officer
Metro Power Company Limited
Date:

1.2 SIGNING AUTHORITY AND DISPLAY

The corporate policy shall be signed by the Chief Executive Officer of MPCL who holds the authority to advocate and implement the commitments made through the policy at each and every stage of project implementation.

The signed policy shall be displayed at the corporate office, the project operation site and at the website of the company.

The SEHS management will be managed by EHS Manager at the corporate level.

CODE OF BUSINESS CONDUCT AND ETHICS

April 2013

About the Code of Business Conduct and Ethics

This Code of Business Conduct and Ethics ("**Code**") has been adopted by our Board of Directors. The Code is intended to govern as a requirement of employment the actions of everyone who works at Metro Power Company Limited ("**MPCL**" or "**Company**"). The Code addresses the following topics:

Compliance with Laws, Rules, Regulations and this Code
Conflicts of Interest and Corporate Opportunities
Protection and Proper Use of Company Assets
Protection of Confidential Proprietary Information
Fair Dealing
Interacting With Government
Compliance with Antitrust Laws
Safety and Environmental Standards
Respecting One Another
Record Retention
Implementation of the Code

At times, this Code requires ethical conduct higher than that required by the law. MPCL employees, officers and directors are expected and required to conduct themselves according to the language and spirit of this Code and seek to avoid even the appearance of improper behavior. Compliance with this Code must come before other business considerations. Even well- intentioned actions that violate the law or this Code may result in negative consequences for the Company and for the individuals involved.

While the standards set forth in this Code cover a wide range of business practices and procedures, this Code cannot and does not cover every issue or law that may arise, or every situation where ethical decisions must be made. The fact that a law, rule or regulation is not specifically covered by a section of this Code does not remove the requirement that all MPCL people are expected to comply with all laws, rules or regulations applicable to their MPCL business.

This Code will be strictly enforced throughout the Company.

Compliance with Laws, Rules, Regulations and This Code

MPCL people are expected to be always in full compliance with applicable laws, rules, regulations and this Code. MPCL operations are subject therefore to the laws of Pakistan and of Sindh Province and other local laws and regulations, as applicable. MPCL people are expected to refrain from any conduct or activity that may be illegal or unethical or that otherwise raises questions regarding the Company's honesty and integrity or causes embarrassment to the Company.

Conflicts of Interest and Corporate Opportunities

MPCL employees, officers and directors have an obligation to act in the best interest of the Company. MPCL people are expected to avoid any activity or situation that creates or appears to create a conflict between their interest and the interest of MPCL. Similarly, MPCL people are prohibited from taking for themselves business opportunities that arise through the use of Company property, information or position for personal gain, and no employee, officer or director may compete with the Company. Although it is not possible for MPCL to list every conceivable impermissible conflict or competition, following are some common examples of situations that should be avoided:

- Working, in any capacity, for a competitor, customer or supplier while employed by the Company without explicit written permission given by the Company.
- Accepting gifts of more than token value or receiving personal discounts or other benefits from a competitor, customer or supplier as a result of one's position with the Company.
- Competing with the Company for the purchase or sale of property, services or other interests.
- Having an interest (other than routine investments in publicly traded companies) in a transaction involving the Company, a competitor, a customer or supplier.
- Receiving a loan or guarantee of an obligation from a competitor, customer or supplier as a result of one's position with the Company.
- Directing business to a supplier owned or managed by an MPCL person, or which employs, a relative or friend.

Situations involving a conflict of interest may not always be obvious or easy to resolve. Therefore, if there is any doubt as to whether a conflict of interest or a potential conflict of interest exists, or whether there may be the appearance of such a conflict of interest, the immediate supervisor and human resources manager must be consulted. In order to avoid conflicts of interests, all directors, Chief Financial Officer and senior officers, as identified by the Board of Directors or Chief Executive Officer, must disclose to the Company, in writing, any material transaction or relationship that reasonably could be expected to give rise to such a conflict.

Protection and Proper Use of Company Assets

MPCL people have the responsibility to protect Company assets against loss, theft or other misuse. Loss, theft and misuse of Company assets including MPCL physical premises and equipment, records, customer information and MPCL names and trademarks directly impact the Company's profitability. Without

specific authorization, no MPCL person should take, loan, sell, damage, or otherwise dispose of any MPCL property, or use MPCL property for any non-company purpose.

Protection of Confidential Proprietary Information

MPCL people must maintain in strict confidence all confidential and proprietary information of the Company, except where disclosure is authorized by the Company or required by law. Confidential and proprietary information generated and/or gathered by the Company is a valuable Company asset. Protecting this information plays a vital role in the Company's continued growth and ability to compete.

MPCL people also are required to respect and observe the property rights of other companies and their proprietary information as MPCL people would with the Company's own proprietary information. The unauthorized use or distribution of such proprietary information of others violates Company policy and may also be illegal.

The obligation to protect the Company's proprietary and confidential information continues even after leaving employment with the Company. Upon the termination of employment, MPCL people are required to return everything that belongs to MPCL, including all documents and other materials containing MPCL and third-party confidential information, and must not disclose confidential information to a new employer or to others after ceasing to be an MPCL employee.

Fair Dealing

MPCL seeks to maintain the trust of its customers, competitors and suppliers by conducting business in a fair and ethical manner. MPCL people must never take unfair advantage of others through manipulation, concealment, abuse of privileged information, misrepresentation of material facts or any other unfair dealing practice. MPCL people also must not offer anything of value to others to obtain an improper advantage in obtaining or retaining business or obtaining other favorable action.

Interacting with Government

MPCL policy, the laws of Pakistan and/or laws of countries where MPCL shareholders are based prohibit MPCL and its officers, employees and agents from giving or offering to give money or anything of value to a local or foreign government official, political party, a party official or a candidate for political office in order to influence official acts or decisions of that person or entity, to obtain or retain business, or to secure any improper advantage. To ensure compliance with such laws, no gifts or business entertainment of any kind, which is not of token value, may be given by any MPCL person to any employee of a government without the prior written approval of the Chief Executive Officer.

Payments of corporate funds to any political party, candidate or campaign may be made only if permitted under applicable law and after prior written approval from the Chief Executive Officer.

Compliance with Antitrust Laws

MPCL people are required to conduct their actions in the marketplace in accordance with the letter and spirit of applicable antitrust and competition laws. The antitrust laws prohibit agreements among competitors on such matters as prices, terms of sale to customers and allocating markets or customers.

Safety and Environmental Standards

MPCL is committed to conducting its business in compliance with all applicable environmental and workplace health and safety laws and regulations and MPCL Social Environment Health & Safety Policy.

MPCL people are expected to provide a safe and healthy work environment for all employees, and they should also act so as to avoid adverse impact and injury to the environment and the communities in which MPCL conducts business. MPCL people are therefore responsible for maintaining MPCL facilities free from recognized hazards, obeying all MPCL safety rules, and complying with all applicable environmental laws and MPCL Social Environment Health & Safety Policy. MPCL people are expected to report any known violation of an environmental or safety law or regulation by a third party to their supervisor.

Respecting One Another

MPCL policies are designed to ensure that employees are treated, and treat each other, fairly and with respect and dignity. MPCL recognizes that all employees want and deserve a workplace where they are respected and appreciated. MPCL people must contribute to the creation and maintenance of such an environment, and supervisors and managers have a special responsibility to foster a workplace that supports honesty, integrity, respect and trust.

MPCL will not discriminate against any person on the basis of race, religion, gender, age, marital status, disability, or any other basis prohibited by law in recruiting, hiring, placement, promotion, or any other condition of employment.

MPCL also strictly prohibits any form of harassment in the workplace, including sexual harassment. MPCL encourages the prompt reporting of all incidents of harassment, regardless of who the offender may be, or the offender's relationship to MPCL. Any MPCL person who is found to be responsible for harassment, or for retaliating against any individual for reporting a claim of harassment or cooperating in an investigation, will be subject to disciplinary action, up to and including discharge.

Record Retention

MPCL is committed to compliance with all laws and regulations relating to the preservation of records. MPCL's policy is to identify, maintain, safeguard and destroy or retain all records in its possession on a systematic and regular basis. MPCL people are expected to comply with this policy.

Implementation of the Code

All MPCL People Must Comply with the Code

MPCL people are responsible for knowing and understanding the policies and guidelines contained in this Code. MPCL people must sign a statement of compliance with the Code as per the Acknowledgement Form attached at the end of this document.

Reporting Possible Violations of the Code

The Company encourages all MPCL people to promptly report any suspected or actual violation of this Code. The Company also encourages MPCL people to seek guidance if uncertain as to the appropriate course of conduct to follow. Any violation or suspected violation of laws, rules, regulations or this Code should be reported to the Administration Department. The Chief Executive Officer, with the advice of the Company's Administration Department, will have the primary authority and responsibility for the enforcement of this Policy, subject to the supervision of the Board of Directors and its appropriate Committees. If an MPCL person prefers, they may report any such concern, question or violation to their supervisor or the Administration Department or directly to the Chief Executive Officer.

The Company intends to thoroughly investigate any genuine report. Any violation will be dealt with immediately and shall subject the violator to corrective and/or disciplinary action, including possible dismissal from employment or office.

Open communication of any concern by an MPCL person without fear of retribution or retaliation is vital to the successful implementation of this Policy. The Company will not tolerate any retaliation against any MPCL person making a good faith or genuine report or concern.
Violations of this Code that involve illegal conduct will be reported to the appropriate governmental authorities. All MPCL people must cooperate in any internal investigation conducted by the Company.

Copies of the Code

Copies of this Code are available from the Administration Department.

Waivers and Amendments of the Code

Waiver of any application of a policy set forth in this Code may be granted only where circumstances warrant, and then only in conjunction with an appropriate monitoring of the particular situation. Any waiver of a policy in this Code for directors, Chief Financial Officer or senior officials may only be granted by the Board of Directors and shall be promptly disclosed to the Company's shareholders. The Board of Directors can approve any amendment to this Code. Any amendment of a provision in this Code shall also be promptly disclosed to the Company's shareholders.

ACKNOWLEDGEMENT FORM

I have received and read the MPCL Code of Business Conduct and Ethics, and I understand its contents. I agree to comply fully with the standards, policies and procedures contained in the Code and MPCL's related policies and procedures. I understand that I have an obligation to report to the Company any suspected violations of the Code that I am aware of. I acknowledge that the Code is a statement of policies for business conduct and does not, in any way, constitute an employment contract or an assurance of continued employment.

Printed Name _____

Signature _____

Date _____

MPCL Department _____

Annex L

Proposed Framework Management Plans

1 STAKEHOLDER ENGAGEMENT PLAN FRAMEWORK

1.1 OBJECTIVES AND PRINCIPLES

MPCL will establish a Stakeholder Engagement Plan (SEP) that will be applicable for the entire project lifecycle. The Stakeholder Engagement Plan will consider the analysis, mapping and feedback of consultations that have been undertaken for the project thus far, as summarized in Section 5 of the IEE report.

The SEP will take into consideration both the applicable legal framework for public disclosure in Pakistan and the IFC requirements. The main objective of the SEP will be to increase the effectiveness of MPCL's relationships with all their stakeholders.

This framework provides details on the general principles for MPCL's stakeholder engagement as well as suggestions on the mechanisms and tools which can be used.

1.1.1 *Principles of Stakeholder Engagement*

MPCL should commit to the following principles for effective and long-term engagement:

- Providing meaningful information in a format and language that is readily understandable and tailored to the needs of the target stakeholder group(s);
- Providing information in advance of consultation activities and decision-making;
- Providing information in ways and locations that make it easy for stakeholders to access it and that are culturally appropriate;
- Respect for local traditions, languages, gender sensitivities, timeframes, and decision-making processes;
- Two-way dialogue that gives both sides the opportunity to exchange views and information, to listen, and to have their issues heard and addressed;
- Inclusiveness in representation of views, including ages, women and men, vulnerable and/or minority groups;
- Processes free of intimidation or coercion or incentives;
- Clear and simple mechanisms for responding to people's concerns, suggestions, and grievances; and
- Incorporating, where appropriate and feasible, feedback into project or program design, and reporting back to stakeholders.

1.2 TOOLS AND MECHANISMS

1.2.1 *Implementation Plan*

Based on the Framework for stakeholder engagement planning, MPCL should develop a detailed implementation plan with the following suggested information:

- Identification of key stakeholders that MPCL considers most relevant on the basis of those provided in the ESIA and developing mechanisms to engage with the same;
- Structure a stakeholder engagement program that will describe the most culturally appropriate mechanisms to consult the prioritized stakeholders;
- Provide a schedule outlining dates and locations when various stakeholder engagement activities will be conducted;
- Indicate what staff and resources will be devoted to managing and implementing the company's Stakeholder Engagement Program;
- Describe in detail the Grievance Mechanism that has been finalized by the senior management in consultation with local communities;
- Describe any plans to involve project stakeholders (including affected communities) or third-party monitors in the monitoring of project impacts and mitigation programs.

The Implementation Plan should include a clear plan of actions with deadlines and responsibilities in order to assure the maximum engagement level for all relevant stakeholders.

1.2.2 Information Disclosure

MPCL is in the process of developing communication procedures to disclose information on the proposed 50 MW wind energy project as required by the Pakistan regulatory agencies. In the context of the IEE, MPCL will need to disclose:

- Key results/impacts/risks of the project as identified in the report;
- Key mitigation measures and systems that are to be put in place by MPCL to minimize any adverse impacts;
- Proposed community interventions and engagement activities that are planned;
- Proposed changes in project design, schedule of events, potential activities associated with any road diversions, labour camp sites etc.

MPCL will need to clearly identify the formal public consultation methods that may vary depending upon the stakeholder, for example:

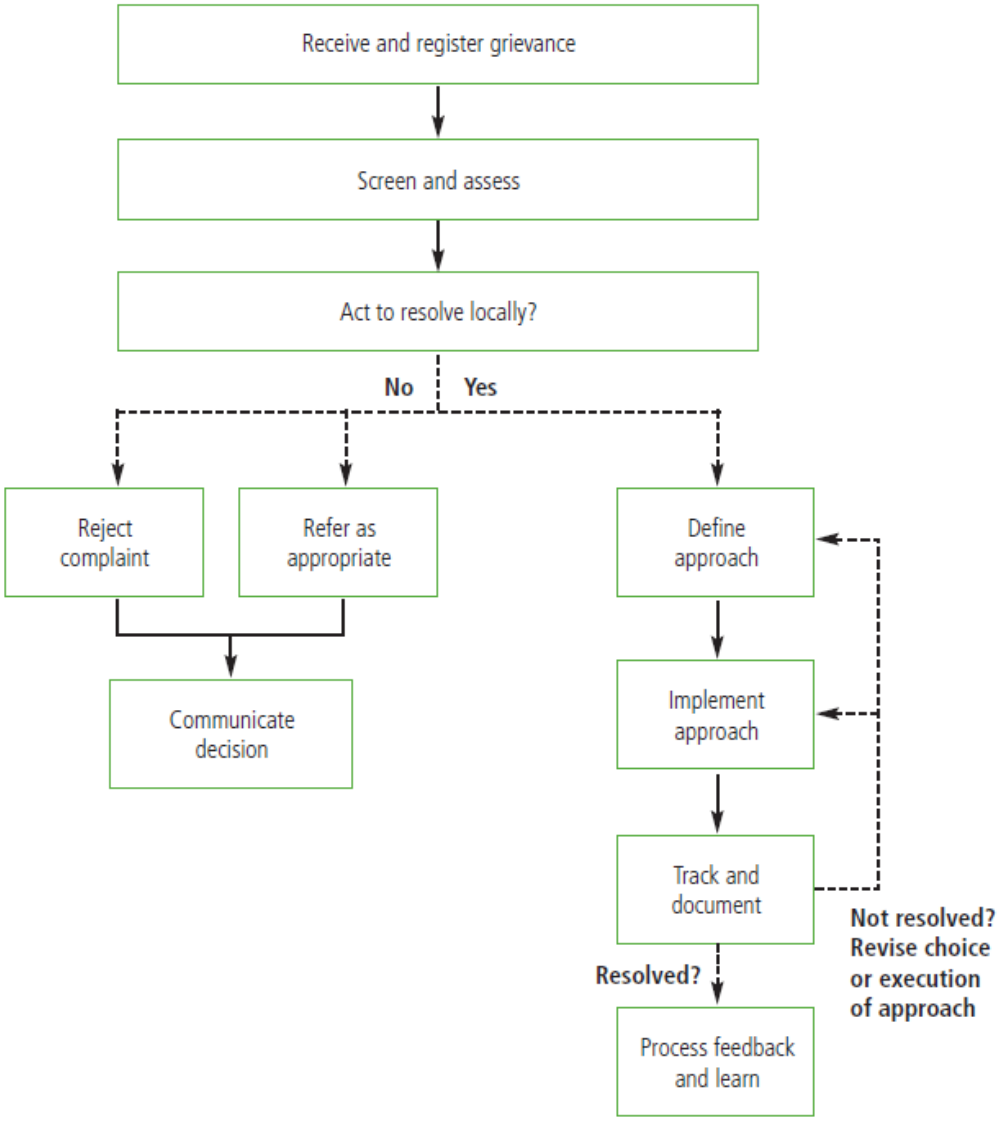
- Regular local and regional media articles, with special focus on the project implementation and EHS and CSR initiatives;
- Brochure on the profile of the company, including contact information on how to raise complaints or grievances;
- Disclosure of the Executive Summary at the local administrator's office in the language predominant in the project area;
- Annual report on environment, health and safety, and social initiatives provided to local municipal authorities.

Some stakeholder groups may require different or additional means of communication. The more directly impacted a stakeholder group is, the more efforts need to be made to ensure that they have been informed about the project and its impacts, and can communicate their questions and concerns.

1.2.3 Grievance Redressal and Management

MPCL will constitute a Grievance Redressal Mechanism (see footnote [1]) managed by 1-2 personnel that records, directs and redresses grievances of stakeholders, especially the local community. For disputes that cannot be internally resolved, the project will set up an independent mechanism with representation from community, local union councils and key informants of the area to sort these conflicts. In case of any legal implication, the district administration is to be approached.

Figure 1.1 Typical Steps of Grievance Management



The project will share information about these mechanisms to the local community. The grievance procedure will need to be simple, transparent and readily accessible at the project site and immediate vicinity. The Grievance Redressal procedure should outline the process and steps to be taken, the key people responsible, and the upper limit to the time taken to resolve a conflict

(1) www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/p_GrievanceMechanisms/$FILE/IFC+Grievance+Mechanisms.pdf

to the satisfaction of the complainant. In case there are grievances that have reached a stalemate, a third party mediation may be considered.

The Grievance Redressal procedure will also outline the process and steps to be taken and the time limit within which the issue would need to be resolved to the satisfaction of the complainant. If not then the next steps and actions will be communicated to them. The project will endeavour to get all complaints recorded and addressed in a uniform and consistent manner.

1.2.4 Commitment Register

MPCL should develop a commitment register to record, implement and track any public commitment or request that is made to the project's stakeholders. This includes any requests of direct development interventions, expectations on employment, petty procurement etc.

1.3 ROLES AND RESPONSIBILITIES

Stakeholder Engagement will be on going throughout the entire project lifecycle and will be coordinated across project activities and contractors by designated personnel the Community Relations team. As discussed in the IEE report, the Community Relations team will support the EHS Coordinator in implementing the Environmental and Social Management and Monitoring Plan and will also lead the stakeholder engagement process which will have the following tasks:

- Interface between MPCL, contractors, sub-contractors and the local community;
- Disclosure of project specific information for all components to village settlements within the footprint area and other external groups as required;
- Establish a mechanism to obtain, report, redress and monitor all grievances from the local community;
- Regular engagement with key informants and local leaders to ensure a transparent feedback process in to the project; and
- To plan, implement and evaluate community development programs.

The Community Relations Team will consist of 2 personnel who would coordinate with the overall Environmental and Social Manager. This will include the Community Relations Officer and the Human Resources Officer.

1.4 COMMUNITY DEVELOPMENT

MPCL's personnel have already commenced the process of early identification of community support projects, such as drinking water and sanitation, and providing investment for the same. These activities will be streamlined under the framework of stakeholder engagement to develop a detailed Community Development Plan which looks into options of CSR activities and social

investments and suggests models of interventions to suit the needs of the community.

To the extent possible the CSR activities should be relevant to the needs of the locality and in no case should be detrimental to the E&S sensitivities of the project area. These plans and activities are to be implemented in consultation with the community, local administration in Jhimpir and Thatta. The plan will also include indicators for regular monitoring of these development activities in order to assess their impacts and to suggest changes in the approach.

1.5 MONITORING AND EVALUATION

MPCL will monitor the principles and commitments of the stakeholder engagement process and will need to report on the status of implementation of different aspects, such as information disclosure, grievance redressal, etc. Engagement levels can be monitored by developing a set of indicators which will include:

- Number and Type of Communications and Issues discussed;
- Frequency of communications;
- Type, subject and number of grievances;
- Sources of complaints;
- Average time taken to resolve and close grievances;
- Number of presentations and frequency on EHS and economic status of the company;
- Number and diversity of stakeholders involved per action;
- Comments on any disclosed documents/presentations;
- Level/degree of involvement for stakeholders;
- Partnerships with stakeholders;
- Number of mass media articles/announcements.

The subsequent table suggests an on-going stakeholder engagement framework for the MPCL project for some of the key stakeholders that have been identified:

Table 1.1 On-going Stakeholder Engagement Guidance

Stakeholder Group	Stakeholder	Activity of Concern	Degree of Influence	Engagement Methodology (*All formal and informal contacts, meetings and discussions with any and all stakeholders should be duly documented. Proceedings to be conducted in local dialects*)	Timing	Responsibility	
						Execution	Monitoring
Community	Local Villages on project site	Project activities on village land	High	Meeting with all villagers or at least heads of households and women representatives (together or separately as per custom) on the site • Explanation of project and activities before during and after construction • Eliciting of concerns • Establishment of communication methods for concerns, issues and grievances and identification of responsible coordinating persons from village and proponents • Establish schedule and frequency of the formal meetings A common meeting near the project site is considered suitable.	Before Construction	MPCL	Proponent HSSE Supervisor
				Quarterly meeting during construction and semi-annual meeting during operations coupled with grievance redressal mechanism. Meetings should include contractor representatives • Ensure presence of village coordinators and concerned or affected people • Provide updated schedule of activities for following fortnight • Elicit concerns • Discuss and finalize acceptable and feasible mitigation measures	During construction	MPCL	Proponent Community Relations Team
				Monthly meetings : During operation phase once a month meeting with the nominated coordinators from the villages on site will be held to review any issues or grievances registered in the grievance register	After construction	MPCL	Proponent HSSE Supervisor
Community	Villages in 500 m surroundings	Project activities in vicinity	High	Quarterly meeting during construction and semi-annual meeting during operations coupled with grievance redressal mechanism. Supervisor in these communities; identify and resolve their concerns.	During and after construction	MPCL	Contractor HSSE Supervisor
Community	Settlements around access roads	Project activities (road construction, transportation) in vicinity	Medium	Meeting with all villagers or at least heads of households and women representatives (together or separately as per custom) in the villages along the access route • Explanation of project and activities before during and after construction • Eliciting of concerns	Before construction	MPCL	Contractor HSSE Supervisor

Stakeholder Group	Stakeholder	Activity of Concern	Degree of Influence	Engagement Methodology (*All formal and informal contacts, meetings and discussions with any and all stakeholders should be duly documented. Proceedings to be conducted in local dialects*)	Timing	Responsibility	
						Execution	**Monitoring**
				• Establishment of communication methods for concerns, issues and grievances and identification of responsible coordinating persons from village and proponents • Establish schedule and frequency of the formal meetings			
Government Departments	City District Government Thatta, Tehsil Thatta, Union Council Jhimpir, Deh Kohistan 7/1	Provision of security, maintenance of law and order	High	**Group Meeting** • All the concerned Government Department Officials to be gathered at a single meeting and present the project description and its development stages (timeline); • This is important due to gap between 2009 and 2013.	Before construction	MPCL	MPCL Project Management
	Education Department	Disturbance to any schools in the project area	Medium	**Case to case meeting:** In case there is likelihood of disturbance to any Government schools and religious study centers, the department will be contacted to affect suitable mitigation measures.	Before and during construction	MPCL	MPCL Project Management
	Health Departments	Provision of Health facilities	Low			MPCL	
External Agencies	Social and Welfare Organisations – Local and International NGOs working for social development	Provision of basic facilities like education, health etc.	Medium	Feedback and Contact: Acquire feedback from influential NGOs that are prominent in framing up the social guidelines of the project; Contact can be maintained through emails, letters, phone calls, fax and other forms of electronic and print media to inform them about project developments. Group Meeting: Presenting the project information to the NGOs; A follow up meeting with the NGOs can take place during the middle of the project construction phase	Before and during construction	MPCL	MPCL Project Management
	Local Media	Vigilance of project information	Medium	Information Availability: The public needs to be informed about the project description, its locality and areas of influence through the use of electronic and print media; such as newspapers and magazines.	Before and during construction	MPCL	MPCL Project Management
	Future Wind Farm Operators	Installation in the vicinity	High	Group Meeting: Future wind farm operators can be presented of the challenges and hindrances that arise during the setup of a wind farm. Consultation can be made with them regarding the construction of the access road.	Ongoing	MPCL	MPCL Project Management

2 CONSTRUCTION LABOUR MANAGEMENT PLAN FRAMEWORK

It is understood that approximately 200 workers and 100 technical staff will be deployed for the construction, erection and commissioning of the proposed 50 MW MPCL wind energy project. It is estimated that the labour requirement during the peak construction phase can increase up to 200 workers. The environmental and social baseline has indicated certain sensitivities, such as the existing community settlements, degraded land resources and constraint of availability of water. Hence, this construction labour management plan framework has been formulated to assist MPCL in managing adverse impacts during the construction phase.

This framework management plan has been developed taking into cognizance the following applicable standards:

- Requirements of the Sindh EPA in establishing labour camps;
- IFC Performance Standards (2012);
- IFC Guidelines on Worker Accommodation; and
- Applicable laws on labour and working conditions in Pakistan.

The construction labour management plan has been formulated with the following objectives:

- To avoid or mitigate the adverse impacts of influx of labour in the construction phase;
- To avoid or minimize the strain on local resources that may be required to support construction labour.

This section discusses the following elements for MPCL to take into account to implement a robust construction labour management plan:

- Resource Requirements;
- Labour Camp Facilities;
- Recommended Measures; and
- Monitoring and inspection of labour camps.

2.1 RESOURCE REQUIREMENTS AND WASTE MANAGEMENT

2.1.1 Water Supply

Average fresh water requirement will be 40-60 m^3/day. The required water will be obtained from Kalri Baghar Feeder from the distributary at Jherruck through water tanker and Potable water from the Nooriabad/Jhimpir Pumping Station will be used for the camps.

No groundwater abstraction wells should be constructed for fulfilling water requirements.

2.1.2 Waste Generation

The total domestic waste generation expected from the construction labour camp will be 40-50 kg per day. The waste will be collected on daily basis from construction labour camps. About 70% of the domestic waste is expected to be bio-degradable waste from kitchen/food waste. Food waste will be disposed to composting at nearby landfill. Remaining domestic waste will be disposed of at a site as approved by local authority.

2.1.3 Sewage Generation and Treatment

Approximately 20 to 30 m^3/day of sewage is expected to be generated during construction phase (by engaging 200 construction labour onsite). The domestic waste generated onsite will be disposed of in septic tanks and soak pits provided. No untreated domestic waste water or sewage should be discharged into any common drains around the site.

2.1.4 Fuel Arrangement for Construction Labour

It is understood that the project site does not have dense vegetation other than shrubs and scattered growth of flora. However, MPCL should ensure that the influx of labour in the project area does not lead to widespread usage of local species for fuel wood. Necessary arrangement for supply of coal/fuel wood and kerosene to the labour will be made by MPCL in association with its contractors and with the help of local government

In order to reduce pressure on locally available fuel wood on site, the following is recommended:

- Undertake a purchase agreement with Government agencies to provide regular kerosene oil at the Project site for distribution to the labour engaged for work at site.
- Similarly purchase orders for fuel wood/charcoal, to be placed on to State Forest Department for regular fuel supply to the labourers from authorised fuel/wood/charcoal depots of the district.

2.2 LABOUR CAMP FACILITIES

It is understood that none of the proposed labour camps will be within 1 km from any existing settlements or rural communities. MPCL will ensure that all camps are provided with basic amenities and sanitation facilities to avoid pressure on local natural resources (water bodies, fire wood) and infrastructure (drinking water, health care etc.).

The layout and facilities of the labour camp will need to be aligned to the extent practical and feasible with the IFC Guidelines on Worker Accommodation. MPCL will need to agree on a minimum set of standards that will be applicable to each and every contractor for their individual labour camp arrangements. MPCL, as the principle employer, will be overall

responsible for the facilities and arrangements made available at the worker camps.

MPCL may also decide on a strategy of allowing workers to find accommodation in the local community. However, the contractors will need to manage and monitor this process.

2.2.1 *Layout of Accommodation*

General layout and management of the accommodation would include the following as required under the IFC Guidelines on Worker Accommodation:

- The site for the camp facilities shall be appropriately aesthetically landscaped;
- A separate fence of sufficient structure shall be erected to protect the camp;
- Electricity shall be provided for 24 hours a day for lighting, refrigeration, ceiling fans, air-conditioning, where applicable. Where necessary back-up generators shall be installed;
- Fire precautions shall be taken, including safe distances between buildings, access for fire tenders, fire extinguishers, muster points and practices;
- The grounds and open areas surrounding the shelters and the whole camp shall be maintained in a clean and sanitary condition free from rubbish, debris, waste paper, garbage, or other refuse;
- A supervisor shall be appointed to supervise camp hygiene, and to carry out regular inspections of the camps and work sites to ensure that sanitary facilities are maintained. A sanitary squad shall be employed to operate the storage, collection and disposal of garbage, and for cleaning of roads, buildings, living quarters and sanitary facilities;
- Keeping pets or other animals in the camp shall be prohibited;
- Laundry facilities shall be provided in the camp;
- Clinic shall be provided in the camp;
- Recreational facilities shall be provided that are appropriate to the size and the needs of the workforce;
- All sites used for camps shall be adequately drained. They shall not be subject to periodic flooding, nor located within 75 metres of swamps, pools, or other surface collections of water unless such quiescent water surfaces can be subjected to mosquito control measures. The camp shall be located so the drainage from and through the camp will not endanger any domestic or public waters supply. All sites shall be graded, ditched, and rendered free from depressions in which water may become a nuisance.

2.2.2 *Details on the Worker Sheds*

- The accommodation shall be constructed in such a manner as to provide protection against the moisture, wind and sand/dust, and shall be adequately screened against insects. The accommodation shall be provided with a finish that can be cleaned easily and shall be maintained in a clean condition. The floor shall be concrete if constructed on ground level. A cement plinth of at least 30 cm height shall be constructed to prevent ingress of insects and pests;
- Purpose built caravans; portable cabins, etc. may be used for accommodation;
- Whenever tents are used, the floor should be covered with linoleum;.
- The sleeping space shall have a minimum floor area of 4 sq.m. per person, with a typical length of 2 m and a minimum distance of 1 m. between beds (both laterally and end to end). Bunk beds will not normally be allowed;

- A secure lockable cupboard shall be provided to each occupant for them to keep their clothes and belongings. Hanging of clothes on the wall should be avoided.
- Beds shall be fitted with a mattress of at least 10 cm thick, a blanket, two sheets, pillow and pillowcase. The linen shall be washed at least once a week and mattresses and blankets aired outside once a week.
- Window space shall be at least 10% of the floor area.
- Each room shall be fitted with a door and movable windows of reasonable dimensions. Windows shall, as far as possible, be fixed on opposite sides to provide through-ventilation. Sufficient natural and artificial lighting shall be provided.
- Ceiling or self-standing fans shall be provided, unless air-conditioning is necessary.

2.2.3 Sanitation Facilities

- Where both males and females are residing at the camps or worksites separate shower and sanitary facilities with sufficient privacy shall be provided. At least one in three closets should be provided with a sanitary disposal unit.
- Sufficient lights and ventilation shall be provided.
- All toilet and washing facilities shall be cleaned at least daily and be in working order.
- The floors, walls and ceilings and fittings in toilet and washing facilities shall be of a finish that can be cleaned easily.
- All toilet and washing facilities shall have window openings to the outside air, or be provided with ventilation systems.
- The window surface area shall be not less than 10% of the floor area.
- Showers, hand basins and toilets shall be provided with a supply of soap and water.
- The floor of shower cubicles shall be fitted with wooden or plastic slats to give adequate drainage and to prevent fungus infections of the feet. The slats shall be washed and air-dried daily.
- Shower cubicles shall be provided with doors or curtains.
- All wastewater including floor-washing water shall be connected to a disposal drain. No wastewater shall be allowed to discharge on outside ground or beneath portable cabins.
- Floors shall slope towards an integrated floor drain.
- Toilets shall be located within reasonable distance from the living quarters but not closer then 30 metres to any sleeping room, dining room, lunch area or kitchen.
- The minimum numbers of toilets and washing facilities will meet local regulations.

2.2.4 Monitoring of Labour Camps

Labour camps will be inspected on fortnightly basis. The inspection will focus on the following:

- General observations on cleanliness;
- Drinking water availability with respect to source, cleanliness of storage tanks and quality to be consumed;
- Provision of sanitation facilities to water availability in toilets their cleanliness and drainage;
- Provision garbage segregation and disposal facilities;

- Review of any health & safety incidents as well as grievance register that is to be maintained by the security personnel.

A format of inspection of labour camps is as shown in ***Figure 2.1***.

Figure 2.2.1 Sample Labour Camp Inspection Checklist

Inspection Report of Labour Camps

Date: _____ **Name of Contractor :_____**
Location: _____ **Nos. of Huts. :_____**
Colony Type: Main/ Temporary **Total Nos. of labour :_____**
Contact phone Nos.: _____ **Name site in charge :_____**
Sr.No: _____ **Nos. of toilets : _____**

GENERAL OBSERVATION		Remarks
Cleanliness in the camp	Good/Satisfactory /Unsatisfactory	
DRINKING WATER		
Water Source	IPH/Borewell	
Cleanliness of Storage tank	Good/Satisfactory /Unsatisfactory	
Visual Quality of Drinking water	Good/Satisfactory /Unsatisfactory	
SANITATION		
Toilets Condition	Good / Satisfactory /Unsatisfactory	
Water Availability	Sufficient /Unsufficient	
Cleanliness	Good / Satisfactory /Unsatisfactory	
Drainage	Good / Satisfactory /Unsatisfactory	
Garbage disposal system	Good / Satisfactory /Unsatisfactory	

Name & Signature of Investigation Team **Environment & Social Manager (Verified by)**

2.3 *RECOMMENDED MEASURES*

MPCL should develop a "Code of Conduct" for the workers engaged in construction and operations phase that will take into account:

- predominantly rural community in the vicinity;
- occupational health & safety aspects;
- restrictions on activities – Dos and Donts and labour camps regulations;

- zero tolerance of illegal activities by construction personnel including: unlicensed prostitution;
- illegal sale or purchase of alcohol; sale, purchase or consumption of drugs;
- illegal gambling or fighting which will be shared with all contractors for induction of their employees/supervisors/workers.

Social interactions between migrant labour and the host community will be closely monitored by the project. The community will be consulted at regular intervals and any complaints or concerns with respect to labour should be addressed without delay.

The project will conduct routine medical check-ups, health and safety training and sensitization programmes to raise awareness about STDs, and HIV amongst the labourers. These trainings will also have sessions on maintaining behaviour standards while moving in the community, knowing and respecting prevalent socio- cultural systems of host community etc.

The project will, where possible, maximise procurement of goods and supplies catering to the labour camps from the local markets. This will ensure that the project catalyses the local economy.

3 EMERGENCY RESPONSE AND PREPAREDNESS PLAN

3.1 OBJECTIVES

The emergency response plan sets out procedures and measures to be taken to deal with an on-site and off-site emergency such as fire, explosion, gas or other incident threatening the safety and integrity of the company. The basic concept of the plan is to allow for smooth coordination of activities during an emergency. All employees of MPCL, contractors and surrounding villages in the close vicinity shall be familiar with the plan. This plan will be reviewed and amended when needed to ensure that all parties concerned are furnished with up-to-date information. The facility manager shall carry out exercises of part of the emergency plan at a regular interval as deemed necessary with all the employees, contract labourer and villagers in the close vicinity of the MPCL Project site. The lesson learnt from these exercises shall be documented and used during the updating of this emergency response plan.

3.2 ROLES AND RESPONSIBILITIES

The various duties and responsibilities assigned at all levels are presented in ***Table 3.1*** below:

Table 3.1 Roles and Responsibilities at Various levels

S.N	Level	Responsibility
1	MPCL Project site Manager (or his designee)	• Communication to company officials of any Health and Safety incidents. • No employee shall give a statement to non-company agents. • Coordination with MPCL emergency commander
2	HSSE coordinator	• Reviewing and updating the written procedure at least annually, when a new type of hazard is introduced into the workplace, when program job duties are changed, when locations mentioned in the program are changed or when there are other changes that affect the safety of employees and contractors. • Ensure that all MPCL employees, EPC, operation and maintenance contractors and villagers in the close vicinity of the project are trained in all aspects of the emergency program. • Being the contact person for further information or explanation of duties.
3	Fire Warden	• Checking specific areas during an emergency. • Perform headcount at the assembly point.
4	Fire Aider	• Render first aid to casualties prior to the arrival of ambulance. • Set up first aid post during an emergency.

3.3 PROCEDURE FOR EMERGENCY RESPONSE

Emergency Escape

When an emergency alarm sounds, all employees, visitors, EPC and O& M contract personal and villagers in the close vicinity will immediately evacuate their respective occupational or working area by the nearest safe exit and gather at the assembly area. Everyone is required to stay at the assembly area until it can be verified that it is safe to return to their respective places. Exit signs/routes will be posted throughout their respective occupational or working area.

Shutdown during emergency evacuation

MPCL should ensure that, no employee, EPC and O& M contract personal is required to remain and operate or shutdown critical operations before they evacuate.

Accounting for all personnel after an evacuation

All personnel will be accounted for at the assembly area. Procedures that can be used include, but are not limited to, use of the simple attendance sheet, visitors registration book, knowledge of car ownership, supervisor knowledge of employee presence, employee knowledge of fellow employee presence etc.

Rescue and medical duties for employees

Employees are not required to perform any rescue duties. For medical emergencies call 0298-920165. Please note: if an employee has been trained and does not put him/herself at risk, first aid should be rendered.

Procedures for reporting other exigency

The steps to be followed for various other exigencies are listed below:

Table 3.2 Other Emergency Reporting Procedures

S.N	Type of Emergency	Method
1.	Fires	Employees are not required to fight fires. A trained employee (trained within the last 12 months) may try to put out an incipient fire but it is not required that they attempt this. An employee discovering a fire should leave the area and manually actuate the fire alarm system or Exit the occupational and working area using a safe exit and assemble at the assembly area.
2.	Explosions	The probability of an explosion is highly remote. However, if one does occur: Leave the area and manually actuate the fire alarm system. Exit the occupational and working area using a safe exit and assemble at the assembly area.

S.N	Type of Emergency	Method
3.	Bomb Threats	Bomb threats are commonly received over the phone. If this occurs: If a person makes a threat and stays on the line, try and obtain as much information as possible, such as: When is it set to go off? Where is it located? Why is this being done? What kind of bomb is it? Did you or someone else place the bomb? What does it look like? Contact the Site Manager (or his designee) present on site who will decide whether to evacuate the occupational and working area. Try to remember and put in writing exactly what the person making the threat said.
4.	Written Threats or Suspicious Packages	Do not touch the item. Contact the Site Manager (or his designee) present on site who will decide whether to evacuate the occupational& working area and nearby villages in the close vicinity.
5.	Medical Emergencies	Medical emergencies can be classified as life threatening or non-life threatening. If you are in doubt, assume that the emergency is life threatening. For life threatening medical 0298-920165 Please note: If an employee has been trained and does not put him/herself at risk, first aid should be rendered.
6.	Electrical Outage	During an electrical outage, emergency lighting should illuminate the facility. All employees should carefully walk to the assemble area for further instructions.
7.	Site Evacuations	Site evacuations, other than detailed above, may be necessary. Reasons include, but are not limited to unplanned discharges, off-site emergencies at nearby locations, etc. In these cases, the telephone lines should be used to evacuate the building. In extreme cases, the fire alarm may be used to signal a site evacuation.

Training procedures

The training procedure should be carried out in the following stages:

- When the plan is first developed.
- Whenever an employee's responsibilities or actions under the plan change.
- Whenever the plan is changed.
- Upon initially being hired. Drills and evacuation exercises will be held regularly.
- All contractor, their employees and villagers in the close vicinity of MPCL site need undergo drills and evacuation exercise.

Risk Mitigation Measures

Various risk mitigation measures for proposed MPCL are as given below:

- Detailed Risk Assessment study shall be carried on finalisation of design and operating parameters for various component;
- The Safety Management Systems (SMS) shall be introduced and followed.
- All the personnel at the MPCL site shall be made aware about the hazardous substance stored and risk associated with them.
- Safe work practices shall be developed to provide for the control of hazards during operation and maintenance
- In the material storage area, hazardous materials shall be stored based on their compatibility characteristics.

- Near miss and accident reporting system shall be followed and corrective measures shall be taken to avoid / minimize near miss incidents.
- Safety measures in the form of DO and Don't Do shall be displayed at strategic locations.
- Safety audits shall be conducted regularly.
- Electrical earthing pit shall be checked regularly.
- Water sprinkler system shall be provided in flammable gas storage area and it shall be checked regularly.
- Fire fighting system shall be tested periodically for proper functioning.
- All hydrants, monitors and valves shall visually inspect every month.
- Smoke and heat detectors shall be provided and these shall be tested and calibrated as per schedule.
- Adequate earthing and bonding shall be provided to tanks and machineries and structures, electrical motors and other facilities.
- Flameproof electrical fitting shall be provided flammable gas and liquids handling areas, HSD/FO storage area.
- Only authorised persons shall be allowed to enter inside the flammable storage area.
- Adequate lighting in the work place shall be provided with due flame proof lighting (FLP) fitting wherever required.
- It is ensured that all safety devices provided are in good condition and functional.

Table 3.3 Emergency Contact Details

S.No	Facility	Contact Number
	Civil Hospital Thatta	0298-920165
		0298-620166
2	Monsoon contingency, Thatta Taluka	0298-550515
3	DCO Thatta	03332150888
		0298-920061
		0298-770359

Source: Disaster Contingency Plan, district Thatta

4 HEALTH & SAFETY MANAGEMENT PLAN FRAMEWORK

4.1 OCCUPATIONAL HEALTH & SAFETY

The Contractor shall carry out a Health Risk Assessment (HRA) of all construction activities for all chemical, physical, biological, ergonomic and psychological health hazards associated with work at the WTGs construction site and associated activities having risks assessed as Medium or High on the Risk Assessment Matrix based on which control measures should be selected, implemented and documented. The selection of controls should take account of the control hierarchy, i.e. Elimination, Substitution, Engineering, Procedural and lastly Personal Protective Equipment.

Construction staff shall be trained in the nature of the health hazards and specified controls.

Chemical Hazards

The Contractor shall identify, assess and control all hazardous chemicals involved in the construction, including building materials, proprietary chemical products, fumes, dusts and gases emitted as a result of cutting and welding and sanding/grinding.

Physical Hazards

The EPC and O&M Contractor shall assess the risks associated with physical hazards and eliminate them or control them to as low as reasonably practicable, applying the principles outlined below:

Noise

For operations under noisy conditions, the Contractor shall establish procedures in compliance with the Noise Guide. The Contractor shall reduce noise from construction equipment by measures such as:

- Selecting machinery that has inherent noise reduction features;
- Periodic monitoring of sound levels and regular maintenance of equipment;
- Contractor shall conduct periodic monitoring of sound pressure at least once each quarter.

Vibration

Where exposure to vibration may affect part or all of the body, for example in the use of pneumatic drills, the Contractor shall ensure that exposures are assessed and eliminated or controlled.

Climatic Stress

For operations under extreme climatic conditions, the Contractor shall establish procedures in compliance with the relevant standards.

Biological Hazards

Where insects, mites and animals, moulds, yeasts, fungi, bacteria and viruses are present in the working environment, exposures to pathogenic biological agents shall be controlled such that diseases and ill health effects are prevented.

Malaria

When construction takes place in areas where malaria occurs, a comprehensive risk based malaria control program shall be in place encompassing all aspects of malaria prevention programs. Use of malaria prophylaxis is a must, comparable with wearing safety shoes and hard hats. The four components of malaria prophylaxis are:

- Awareness
  - Be aware of the risk of malaria in the work locations or sites visited;
  - Be aware of the signs and symptoms and know how long it takes to develop the illness after being bitten.
- Bite Prevention - Avoid being bitten by mosquitoes by:
  - Wearing long sleeved shirts and trousers when outdoors;
  - Using insect repellent (preferably containing the active ingredient DEET) and;
  - Using air conditioning whenever available or mosquito nets at bedtime in the absence of air-conditioning.
- Chemoprophylaxis - comply when advised by a competent health professional:
  - Take anti-malarial drugs (chemoprophylaxis) when appropriate, to prevent infection from developing into clinical disease. Although highly effective, note that anti-malarial drugs do not guarantee 100% protection;
  - Medications are safe to use if taken according to medical advice.
- Diagnosis and Treatment
  - Early diagnosis and treatment can prevent fatalities. Seek immediate diagnosis and treatment if a fever and/or flu-like symptoms develop one week or more after entering and up to 3 months after departure from a risk area;
  - Inform your doctor of recent travel to a malaria risk area;
  - Owner should closely monitor performance of these Malaria control programs.

Legionella bacteria

Water systems may support the growth of legionella bacteria. These bacteria can enter the human body when contaminated water is inhaled as a spray, and may cause infection in the form of Pontiac Fever or Legionnaires' Disease. Known sources of legionella-contaminated water on construction sites, which may lead to infection, include:

- Domestic water storage tanks;
- Pipe work including dead legs and intermittently used water services;
- Personal and safety showers, pipe work and heads;
- Fire water and other water storage tanks;
- Water supplies used for suppressing road dust etc.;
- Water cooling systems for air conditioners;
- Water jetting equipment

The Contractor shall appoint a competent person to assess the risk of legionella and to implement the control measures.

Pest and Insect Control

Typical pests are flies, mosquitoes, rats and snakes. Effective cleaning and good housekeeping of worksite and workers camps is the basis of any pest control programme.

The Contractor shall employ a specialist Subcontractor to provide a pest control service for the worksite and workers camp, to the Contractor's specification.

Where the pest control is not subcontracted; the Contractor shall provide proper equipment and pesticides and shall train one or two employees in the operation of spraying equipment and on safe handling of pesticides. The Contractor shall carry out a risk assessment of the pesticides to be used and implement controls to minimise risks. This may require provision of appropriate personal protective equipment, e.g. coveralls, impervious gloves, eye and respiratory protection. The Contractor shall monitor the pest control service.

Ergonomic Hazards

The use of good manual handling and lifting techniques for construction materials minimises back and other related injuries. The Contractor shall therefore instruct workers in correct posture and lifting techniques.

Psychological Hazards

Work Plan and Organisation

The Contractor needs to be assured that all relevant and appropriate good working practices are being followed. To plan the work so as to maximise

efficiency and so as to optimise human efforts the following shall be considered:

- Work cycles/shift work, taking account of local legislation
- Circadian (daily) rhythms of the working population

Working Hours and Working Cycles

Regular long working hours and shift work can promote fatigue. Fatigue can lead to reduced mental function and vigilance. As a result there will be an increased likelihood of accidents and ill health. Most construction activities carry a safety risk and this shall not be aggravated by serious fatigue because of excessive overtime. As a minimum the Contractor shall follow local legislation and ILO/UN recommendations on maximum working hours. The Contractor shall assess all the risks associated with the extended working hours and shift cycles and shall agree with the Owner the working hours and working cycles to be applied on the specific project.

The Contractor shall set up a system to monitor that Subcontractors are also following the agreed working cycles.

Monitoring of health performance and incident reporting & investigation

The Contractor shall have health monitoring systems in place. A medical file shall be kept for each employee. This file should include details of the pre-employment fitness to work assessment, details of any subsequent first aid treatments or clinic visits, and details of any medical surveillance that may be undertaken. The Contractor shall monitor:

- Occupational illness cases and frequency;
- First aid treatment cases;
- Number of individuals' undergoing medical surveillance;
- Number of health audits;
- Number of health related training courses;
- There may be a requirement to monitor and report specific illnesses, if required by the specific health management plan.

Contractors shall investigate health incidents and non-accidental deaths, involving their staff in the same way as they are expected to investigate and report safety incidents.

Fitness to Work

The Contractor shall identify all worker groups whose specific work or working conditions require a minimum fitness for duty standard.

Local Health Facilities and Medical Emergency Response

The Contractor shall provide access to suitably equipped and staffed hospitals.

The Contractor shall provide medical centre and first aid arrangements that comply with the Medical Emergency Guidelines. Particular attention shall be paid to ensuring that the required first aid response times are achieved and should be verified by drills.

The Contractor shall develop a site-specific plan based on the health risk assessment, which describes the response to various medical emergency scenarios and medical evacuation procedures. The Contractor shall arrange for regular drills to practice and learn from the various emergency scenarios.

Working at Height

Working at heights is necessary during installation and assembly of wind tower components and general maintenance activities during operations. Prevention and control of hazards associated with working at heights include:

- Prior to undertaking work, test structure for integrity;
- Implementation of a fall protection program;
- Ensure all the personal involved in working at the heights are trained on working at height and
- Install fixtures on tower components to facilitate the use of fall protection systems;
- All the labourer working at height shall be provided with an adequate work-positioning system; Connectors on positioning systems must be compatible with the tower components to which they are attached;
- Ensure that hoisting equipment is properly rated and maintained and that hoist operators are properly trained;
- When operating power tools at height, workers should use a second (backup) safety strap;
- Signs and other obstructions should be removed from poles or structures prior to undertaking work;
- An approved tool bag should be used for raising or lowering tools or materials to workers on elevated structures; and
- MPCL and Subcontractor EHS and site manager should ensure that no tower installation or maintenance work during poor weather conditions and especially where there is a risk of lightning strikes.

4.2 COMMUNITY HEALTH & SAFETY

MPCL and the contractors will need to integrate the following measures on ensuring community health and safety with their project activities:

- Cordon off the construction site (be it WTG location, transmission line, substation, yards, access roads) from free public access such that local community is not exposed to H&S risks.
- Follow the mitigation measures suggested for transporting WTG parts and other materials, transmission line construction to prevent community H&S risks.
- Do not allow free access to roadside temporary storage areas created as transit points for WTG parts and crane equipments.
- Do not leave heavy equipments, vehicles and other such hazardous machinery unattended allowing free access to public. Even roadside parked vehicles carrying WTG parts should be guarded all the time for safety reasons.

- Wherever possible, post information boards about public safety hazards in the work area (in the local language) and emergency contact information.
- Follow electrical safety regulations before charging the transformer and transmission line.
- Record all incidents and accidents involving community stakeholders;
- Standing instruction will be issued to all labour contractors and adequate facilities will be provided within the camp area to restrict the interaction with general community
- Local administration and police will be made aware about the details of outside labourers as also a list will be provided to the Panchayat /block office.
- To the extent possible, labour will be housed in camps, with good living conditions and access to amenities. Outside labour living in the local community will be discouraged;
- Health and safety training of the labour, raising awareness about STDs, and HIV, and maintaining behaviour standards while moving in the community will be a priority; and
- Water-logging or collection of water in and around the project site will be prevented to avoid malaria and other diseases.

4.3 TRAFFIC AND ROAD SAFETY MANAGEMENT

The framework management plan for traffic and road safety will need to cover the following aspects that are detailed subsequently:

- Management of access and approach roads;
- Training of vehicle operators;
- Vehicle management and maintenance;
- Community liaison and safety; and
- Key mitigation measures.

4.3.1 Management of Access and Approach Roads

The MPCL project site can be accessed from the Karachi - Hyderabad Super Highway M-9 at 55 km to Hyderabad. The project plans to construct a proposed access road from the M9 Super Highway up to the site. This road is likely to be approximately 12 km in length and 6 m in width. The project will also require road construction of by lanes for the movement of specialised heavy transport vehicles to carry WTG equipment in the construction phase. This movement is likely to reduce during the operations phase.

MPCL should undertake an integrity testing of all roads in the project area to ensure that proposed access and approach roads will be enough to bear the truck loads of specialised trailers and heavy vehicles.

Overall, traffic management is to be monitored on a daily basis to evenly spread traffic flow during a day so as to avoid congestion and minimise chances of road accidents. All the contractors will be required to comply with statutory vehicle and speed limits with respect to width, height, loading etc.

4.3.2 Access Road Maintenance

Contractors will be responsible for monitoring the condition of access roads used for project traffic to ensure good condition and satisfaction of any external road maintenance authorities. Appropriate measures need to be put in place to keep access roads free from mud, dust and debris.

4.3.3 Training of Vehicle Operators

All operators for heavy vehicles and low moving vehicles will need to be trained by MPCL and their contractors. Unauthorised passengers in project related vehicles will be strictly prohibited. MPCL can engage a local driving school to ensure that all contractors in the construction and operations phase are consistently trained specifically on health and safety requirements.

Vehicle operator's qualifications, skills etc. will need to be checked by the contractors and MPCL. The training requirements should at a minimum cover the following:

- Awareness of traffic impacts and mitigation measures as provided in the IEE report;
- National and local legal requirements for driving/vehicle operations;
- Project-specific rules, safety limits, protocols and documentation to be maintained.

4.3.4 Vehicle Management and Maintenance

In order to ensure that accident rates and the overall transport fuel consumption is minimised, MPCL will ensure that the vehicle fleet working on the project (whether directly for the contractor or for the contractor's subcontractors) is maintained according to the manufacturers' specifications.

MPCL will ensure the following in respect of vehicle maintenance, noise and emission standards:

- An up to date database of all vehicles and construction equipment deployed across various project component locations to be maintained. The database to contain details about the periodical maintenance, schedule of maintenance, vehicular emission and noise emission testing etc;
- Transportation routes to be selected so as to minimise nuisance to local residents from noise and emissions;
- Avoidance of passage through and near settlements during night time hours;
- All vehicles to be maintained so that their noise and emissions do not cause nuisance to workers or local people;
- New vehicles/equipment purchased 'as new' after contract award to comply with emission standards in force on the purchase date;
- Older vehicles/equipment not purchased 'as new' after contract award to be maintained so that noise and emissions levels are no greater than when the vehicle/ equipment was new;
- Oil and fuel leaks to be addressed within 24 hrs of observation or reporting on any vehicle or construction equipment;

- All heavy vehicles like JCE, cranes, battery operated trolleys etc. to be provided with reversing siren.

MPCL should ensure a laydown area within their site to avoid parking on any community roads. Each Contractor personnel will report to vehicle maintenance team and the driver concerned about any oil and fuel spillage and leakage for immediate rectification.

4.3.5 Recommended Measures

MPCL's detailed Traffic Management Plan should also include the following mitigation measures while transporting WTG parts, BOP materials, erection equipment, EHV line materials and substation materials:

- Accord high priority to local community's health and safety aspects more than anything else;
- Control fugitive dust generation by restricting the vehicle speed to 15km/hr or less on unpaved roads.
- Record incidents and accidents involving project vehicles, equipment transport vehicles etc
- Mobilise local teams to support the vehicle fleet movement especially in crowded stretches such as at Malharpet, Nade, Patan, Morgiri and Diskhi etc.
- Plan traffic movement through: dense semi-urban areas; narrow roads; near sensitive receptors and congested market stretches during off-peak hours in consultation with local community.
- All vehicles including trailers should have light reflective strips pasted all along the edges and corners of the vehicle, brake lights in working condition; protruding WTG parts and equipments should have red flags and red light beacons to highlight the safety hazard.
- If these vehicles are parked along road side, ensure that they are parked well away from main carriageway and in night time red reflectors are working with beacon lights switched on.
- Along horizontal and vertical curves in the plain and hill road segments, at least 2-4 ground staff should guide the drivers to negotiate them safely.
- Before allowing the vehicle to enter into external hill access road, check the ropes and chains used for tying the load for their integrity. Any worn out, loosened or slackened ropes/chains should be rectified before moving the vehicles.
- Along external hill access road slopes and curves, overturning of vehicles or loaded parts falling off its place should be assessed before allowing the vehicle to move
- When the trailer vehicles enter or exit a major road junction, 2-4 helpers should warn and guide the mainstream traffic about trailer movement.
- Where there is the potential for cumulative impacts from congestion and related impacts from construction traffic to settlements near or en route to the project component locations, transport movement will be carefully considered in order to minimise disturbance impacts.

4.3.6 Community Liaison and Safety

Traffic safety in the local communities will be a high priority for MPCL and their contractors. Each of the contractors will ensure communities are advised in advance of project progress and near term activities where transport issues have the potential to impact local communities. Special attention will be given

to any local religious fares, market days or during movements associated with village processions.

Annex M

Photo-documentation

Fig1: View of M9 (Karachi – Hyderabad Motorway)

Fig 2: View of MPCL Wind Mast B-5

Fig 3: View of other wind farms.

Fig 4: View of dirt track which proceeds to site

Fig-5: View of rocky outcrop exposed in the area

Fig 6: View of seasonal drain near Metro Power land

Fig7: House Structures in Qasim Burfat Goth

Fig 8: View of Faiz Mosque located in Qasim Burfat Goth

Fig 9: View of hand pump located in Qasim Burfat Goth

Fig 10: View of Autaq located in Qasim Burfat Goth

Fig11: View of water storage tank (for domestic use) located in Qasim Burfat Goth

Fig 12: View of agricultural land located in Haji Usman Jhakro Goth (a nearby village)

Fig13: View of sparse vegetation and cows

Fig 14: View of Keenjhar lake situated 15 km from MPCL Project site

Fig 15: View of Kali Bhagri Feeder

Fig 16: View of agricultural land in the project surroundings

Fig 17: View of agricultural land with bund and trees located in the project surroundings

Fig 18: View of sparse vegetation and rocky outcrop near wind mast B4

Fig19: View of spiny tailed lizard (sandha) in project area

Fig 20: View of birds resting on ground found in Haji Qasim Burfat Goth

Fig 21: View of livestock tethering area found in Haji Walloo Goth

Fig22: View of birds drinking water found in Haji Qasim Burfat Goth

Fig-23: View of Porcupine's lair found in the drain located 60 m Southwest of wind mast B4

Fig 24: View of burrow of spiny tailed lizard or snake (likely)

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