MEPCO 6th STG and ELR Project (2006-07)

Environmental and Social Assessment

Volume 1 of 2 – Main Report

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Prepared for
Multan Electric Power Company (MEPCO)

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Executive Summary

The Multan Electric Power Company (MEPCO) is planning to undertake the 6th Secondary Transmission and Grid (STG) and Energy Loss Reduction (ELR) project in various parts of its territory. MEPCO is seeking financing from the World Bank (WB) for a portion of this 5-year project. In line with the prevailing legislation in the country, and WB safeguard policies, an environmental and social assessment (ESA) of the project has been carried out. This document presents the report of this assessment.

Study Methodology

The present study was conducted using a standard methodology prescribed by national and international agencies. Various phases of the study included screening, scoping, data collection and compilation, stakeholder consultation, impact assessment, and report compilation.

Legislative Framework

The Pakistan Environmental Protection Act, 1997 (PEPA 1997) requires the proponents of every development project in the country to conduct an environmental assessment and submit its report to the relevant environmental protection agency.

In addition, the World Bank Operational Policy 4.01 (OP 4.01) requires that environmental and social assessment be carried out before commencing projects such as the 6th STG and ELR. The OP 4.12 specifies the procedure that needs to be followed to address the involuntary resettlement the project would cause. The WB's other relevant safeguard policies include OP 4.36 (Forestry), OP 4.04 (Natural Habitat), OP 4.10 (Indigenous People), OP 4.11 (Cultural Property) and OP 7.60 (Projects in Disputed Areas). However, the ESA concludes that none of these OPs are triggered.

Project Overview

The overall objective of the MEPCO's 6th STG and ELR project is to help increase the efficiency, reliability, and quality of its electricity supply. The project seeks to decrease technical as well as commercial losses, increase electricity availability, and improve the voltage profile within the MEPCO's electricity network.

In its total span of 5 years, the 6th STG project envisages the establishment of 20 new grid stations, conversion of 8 grid stations, augmentation of 24 grid stations, and extension of 36 grid stations, as well as the laying of 666 km of transmission lines. Similarly, the ELR project activities during the total span of 5 years include installation of 416 km of new high-tension (HT) lines, re-conductoring of 416 km HT lines, installation of 1,563 distribution transformers, installation of 700 km of new low-tension (LT) lines and re-conductoring of 407 km LT lines.

The present ESA addresses the project components that will be undertaken during the Year 2006-07. The STG works for this year include the establishment of 5 new grid stations, in addition to the conversion of 3, extension of 12, and augmentation of 5 existing grid stations. A total of about 272 km of new transmission lines will also be

added to the existing MEPCO system. The ELR works for the Year 2006-07 include installation of 65 km of new HT lines, re-conductoring of 77 km HT lines, installation of 250 distribution transformers, installation of 43 km of new LT lines and re-conductoring of 72 km LT lines.

Description of the Environment

The project area lies in the Upper Indus Plain, which essentially forms the western extension of Indo-Gangetic Plain. The Indus Plain has been made up of the silt brought by the Indus and its numerous tributaries, such as Jhelum, Chenab, Ravi and Sutlej on the east bank, and Kabul, Kurram, Tochi, and others on the west bank. The Indus Plain is known for its agricultural fertility and cultural development throughout history. The Upper Indus Plain consists of four river interfluves, the Bahawalpur plain and the Sulaiman piedmont.

The main rivers that flow through the project area include Indus, Chenab, Ravi and Sutlej. However, under the Indus Basin Treaty, India has rights over the waters of Ravi and Sutlej.

The agriculture is by far the main economic activity in the project area, which lies within the Indus Basin Irrigation system – one of the most extensive canal irrigation systems in the world. The groundwater extraction augments the canal water for irrigation in the area.

Ecologically, the project area can be divided in three broad ecozones: tropical thorn forest ecozone, riverine forest ecozone and desert habitat. However, urban centers, villages and agriculture activities have greatly modified these ecozones in most parts of the project area. Whatever wild species now found in the area are essentially those which have adapted to the modified conditions and presence of human beings.

Administratively, the project area falls under thirteen districts of the Punjab Province — Multan, Sahiwal, Khanewal, Vehari, Pakpattan, Bahawalnagar, Layyah, Muzaffargarh, Dera Ghazi Khan, Rajanpur, Lodhran, Bahawalpur and Rahim Yar Khan.

Stakeholder Consultation

Stakeholder consultations were carried out as part of the ESA study. These consultations were conducted with the institutional as well as the grassroots stakeholders. The main objectives of the consultations were to apprise the stakeholders of the proposed project activities and to obtain their views, concerns, and recommendations so that these could be incorporated into the project design in order to enhance the environmental and social performance of the project.

Impact Assessment and Mitigation

During the present ESA, the project's potential social and environmental impacts were identified. Each identified impact was then characterized with respect to its nature, reversibility, geo-extent, consequence-severity and likelihood. Based upon this characterization, the impacts were then assessed to be of high, medium or low significance.

The ESA revealed that most of the impacts of the proposed project were confined to the construction phase and temporary in nature. Appropriate control and housekeeping measures – recommended in the ESA – would address these issues adequately. The environmental and social monitoring would ensure compliance to and effectiveness of these control measures.

The key social issues identified and assessed as described above included land procurement, damaged crops and safety hazards. The ESA has recommended that the land for the grid stations should be purchased directly from the owners, on the basis of *willing seller – willing buyer*, at mutually acceptable market price. It will be ensured that the seller has the right of refusal. Furthermore the entire process will be documented. The project will purchase a total of about 20 acres of land in this manner. To mitigate the damage crops – caused by the transmission line construction activities – compensation should be paid to the landowners/cultivators. The ESA has estimated that crops would be damaged over a total of 1,339 acres of land belonging to 669 landowners/cultivators. The associated compensation amount has been estimated to be about Rs.9.6 million. Finally, to address the safety concerns associated with the construction activities, and the electrocution risk, precautionary measures have been included in the ESA.

The key environmental impacts of the proposed project as identified in the ESA included soil erosion and degradation and water contamination. The soil erosion would be caused by the grid station and transmission line construction activities, particularly in the hilly terrain of the project area. These concerns will be addressed through appropriate design and construction techniques employed during the proposed project. The soil and water contamination could be caused by the inappropriate waste disposal and leakage/spillage of oils and chemicals. These concerns will be forestalled through waste disposal system recommended in the ESA.

The total cost of the environmental and social management of the project, including implementing the mitigation measures has been estimated to be about Rs. 16 million. This includes the crop compensation of about Rs. 9.6 million mentioned earlier.

Environmental Management Plan

In order to provide an implementation mechanism for the mitigation measures discussed above, a comprehensive environmental management plan (EMP) has been developed. The EMP provides the organization structure for the environmental management system during the project, and defines the roles and responsibilities of various players. The EMP includes a mitigation plan, a monitoring plan, the communication and documentation requirements, and training needs, in the context of the environmental and social management of the project. The EMP also includes a grievance redressal mechanism.

Resettlement Plan

The social assessment of the project has identified the project affectees to be more than 200 in numbers. Therefore a Resettlement Plan (RP) has been developed, in accordance with the OP 4.12. The RP addresses the involuntary resettlement issues likely to arise during the project, and provides the entitlement framework, implementation procedure, institutional arrangement, monitoring requirements and grievance redressal mechanism.

The RP is a stand-alone document, and has been provided under separate cover.

Environmental and Social Guidelines

The present ESA covers the project components to be undertaken during the year 2006-07. The remaining project components – to be undertaken during the years 2007-08 and 2008-09 - have not been finalized yet. Hence their ESA cannot be conducted at this stage. For these project components, the Environmental and Social Guidelines (ESG) have been developed, which provide a framework to address the environmental as well as social issues that may arise during the later phases of the project.

The ESG is also a stand-alone document and provided under separate cover.

Findings and Recommendations

On the basis of the overall impact assessment and, more specifically, the nature and magnitude of the residual environmental and socioeconomic impacts identified during the present ESA, it is concluded that the proposed project is unlikely to cause any significant, lasting impact on the social, physical and biological environment of the area, provided that the proposed activities are carried out as mentioned in this report, and the mitigation measures included in this report are completely and effectively implemented.

The key recommendations pertaining to the environmental and social assessment of the proposed project are as follows:

- The EMP and RP should be made a part of the contracts awarded by MEPCO for the proposed project.
- The Company should follow the RP for addressing the involuntary resettlement issues (primarily pertaining to crops damaged as a result of construction activities), and to compensate the project affected persons (PAPs).
- MEPCO will not purchase transformers having PCB-containing oil. However, old transformers in the MEPCO system may still have PCB-containing oil. Therefore, a program should be developed to eliminate the PCB-containing transformer oil from its entire system. To start with, the grid stations and workshops should be provided with the PCB testing kits.
- In-house environmental and social management capacity should be developed in MEPCO. For this purpose, an Environmental and Social Cell should be established within the company.
- MEPCO should develop its Environmental and Social Policy, which should demonstrate the company's commitment towards sound environmental and social management practices throughout its operations. MEPCO should adhere to the environmental legislation and regulations, particularly for conducting environmental and social assessments for all its future projects.

Acronyms

AEB	Area Electricity Board
AJK	Azad Jammu and Kashmir
Amsl	Above mean sea level
BOD	Biological oxygen demand
Cantt.	Cantonment
CITES	Convention on International Trade in Endangered Species
COD	Chemical oxygen demand
Cusecs	Cubic feet per second
DC	Deputy Commissioner
DCO	District Coordination Officer
DISCO	Distribution Company
DO	Dissolved oxygen
EDO	Executive District Officer
EIA	Environmental Impact Assessment
ELR	Energy loss reduction
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESA	Environmental and Social Assessment
ESG	Environmental and Social Guidelines
ESI	Environmental and Social Inspector
ESO	Environmental and Social Officer
FESCO	Faisalabad Electric Supply Company
GDP	Gross Domestic Product
GENCO	Generating Company
GEPCO	Gujranwala Electric Power Company
GIS	Geographical information system
GoP	Government of Pakistan
GRM	Grievance Redressal Mechanism
GSC	Grid Station Construction (Department)
GSO	Grid Station Operation (Department)
GS	Grid Station
Ha	Hectare
HESCO	Hyderabad Electric Supply Company
HSE	Health safety and environment
HT	High tension
IBIS	Indus Basin Irrigation System
ICT	Islamabad Capital Territory

IEE	Initial Environmental Examination
IESCO	Islamabad Electric Supply Company
IUCN	International Union for Conservation of Nature
KESC	Karachi Electric Supply Company
KM	Kilometer
KV	Kilo volts
KWh	Kilo watt hour
LAA	Land Acquisition Act (of 1894)
LESCO	Lahore Electric Supply Company
LOS	Laws of Seas
LPG	Liquefied petroleum gas
LT	Low tension
MAF	Million acre feet
MARPOL	Marine Pollution (Convention for the Prevention of Pollution from Ships)
MEA	Multilateral Environmental Agreements
MEPCO	Multan Electric Power Company
MVA	Mega volt amperes
MW	Mega watts
M&E	Monitoring and Evaluation
NEQS	National Environmental Quality Standards
NGO	Non Governmental Organization
NOx	Oxides of nitrogen
NTDC	National Transmission and Dispatch Company
NWFP	North Western Frontier Province
OP	Operational Policy
O&M	Operation and Maintenance
PAPs	Project affected persons
PCB	Poly Chlorinated Biphenyl
POF	Pakistan Ordnance Factory
PEPC	Pakistan Encl Protection Council
PESCO	Peshawar Electric Supply Company
PD	Project Director
PEPA	Pakistan Environmental Protection Act
PM	Project Manager
PM	Particulate matter
POP	Persistent Organic Pollutants
P&DD	Planning and Development Department
QESCO	Quetta Electric Supply Company
RP	Resettlement Plan

RPF	Resettlement Policy Framework
SCARP	Salinity Control and Reclamation Project
STG	Secondary transmission and grid
TDS	Total dissolved solids
ToR	Terms of Reference
XEN	Executive Engineer
UNFCCC	United Nations Framework Convention on Climate Change
USEPA	United States Environmental Protection Agency
WAPDA	Water and Power Development Authority
WB	World Bank
WBG	World Bank Group
WWF	World Wide Fund for Nature

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1 Introduction

The Multan Electric Power Company (MEPCO) is planning to undertake the 6th Secondary Transmission and Grid (STG) and Energy Loss Reduction (ELR) project in various parts of its territory (see **Exhibit 1.1** for project location). MEPCO is seeking finances from the World Bank (WB) for a portion of this 5-year project. In line with the prevailing legislation in the country, and WB safeguard policies, an environmental and social assessment (ESA) of the project has been carried out. This document presents the report of this assessment.

1.1 Project Proponent

MEPCO is a public utility company, providing electricity to the southern districts of the Punjab Province (Multan, Sahiwal, Khanewal, Pakpattan, Vehari, Rahim Yar Khan, Muzaffargarh, Dera Ghazi Khan, Layyah, Rajanpur, Bahawalpur, Bahawalnagar and Lodhran). MEPCO was incorporated in 1998 under the Companies Ordinance 1984. Before this, it was one of the eight Area Electricity Boards (AEBs) of the Water and Power Development Authority (WAPDA).

Established in 1958, WAPDA had two wings: Water and Power. The Water Wing was (and still is) responsible for developing and managing large water reservoirs and barrages, while its Power Wing was a vertically integrated utility, responsible for generation, transmission and distribution of electricity throughout Pakistan (except for the City of Karachi, where the Karachi Electric Supply Company – KESC - performs a similar function).

Under its un-bundling and restructuring program, WAPDA's Power Wing has been broken down into eight distribution companies collectively called DISCOs, three generating companies collectively called GENCOs and a transmission company called National Transmission and Dispatch Company (NTDC). MEPCO is one of the eight DISCOs; the other seven DISCOs are:

- Peshawar Electric Supply Company (PESCO), for the entire North Western Frontier Province (NWFP), northern parts of Azad Jammu and Kashmir (AJK) and the Northern Areas.
- Islamabad Electric Supply Company (IESCO), for Islamabad, Rawalpindi, Jhelum, Chakwal and Attock districts. [1]
- Gujranwala Electric Power Company (GEPCO), for Gujranwala, Sialkot, Mandi Bahauddin, Hafizabad, Narowal and Gujrat districts.
- Lahore Electric Supply Company (LESCO), for Lahore, Kasur, Sheikhupura and Okara districts.

[1] In addition, IESCO also supplies bulk electricity to Azad Jammu and Kashmir (AJK).

- Faisalabad Electric Supply Company (FESCO), for Faisalabad, Sargodha, Khushab, Jhang, Toba Tek Singh, Bhalwal, Mianwali and Bhakkar districts.
- Hyderabad Electric Supply Company (HESCO), for the entire Sindh Province except Karachi and parts of Thatta district where KESC is responsible for electricity distribution.
- Quetta Electric Supply Company (QESCO), for the entire Balochistan Province, except Lasbela, which is covered under the KESC network.

1.2 Project Background and Justification

Pakistan as a whole is an energy-deficient country and per capita electricity generation has traditionally been low (581 KWh as against the World average of 2,657 KWh[2]). The electricity demand in the country has grown at a rapid pace since 1985. Consumption of electricity increased from 17,608 GWh in 1985 to 55,507 GWh in 2004, representing an annual average growth rate of 6.2%. The growth in the electricity demand has however been uneven over the years. The consumption grew at a rate of 11% during 1985-99, the growth rate slowed down to 6.9% during 1990-95 and 2.5% during 1996-2000. Since the year 2000 however, the trend has reversed and electricity demand has picked up, mirroring the overall economic growth in the country. During the period 2001-04, the electricity demand grew at a rate of 3.3% (NEPRA 2005).

The electricity demand in the country is projected to grow at an annual compound growth rate of 7.9% during the period 2005-10, and increase from 15,500 MW in 2005 to 21,500 MW in 2010, as shown in **Exhibit 1.2**. This growth has been projected on the basis of increase both in population and per capita income; **Exhibit 1.3** presents the linkage between the increasing population, per capita income and electricity consumption.

MEPCO is also experiencing growth in the electricity demand, as shown in **Exhibit 1.4**. In order to meet the increasing electricity demand, the existing secondary transmission and grid system (132 and 66 kV) has to be expanded, in addition to the increased generation and primary transmission (500 kV and 220 kV) capacity. Towards this end, MEPCO, being responsible for the expansion, operation and maintenance of the secondary transmission and grid (STG) system within its territory, has developed the 6th STG project. The ELR project on the other hand ensures increased system reliability and reduced losses at the HT and LT levels (11 kV and 0.4 kV, respectively).

The project includes establishment of new grid stations, extension / conversion / augmentation of existing grid stations, laying of new transmission line and replacing weaker/undersized transmission lines. The project will ensure supply of electricity in new areas, load reduction on presently overloaded grid stations and transmission lines, and improvement in the voltage profile as well as the system reliability.

[2] Source: World Bank, Medium Term Development Framework 2005-10.

1.3 Project Overview

The overall objective of the 6th STG and ELR project is to help increase the efficiency, reliability and quality of the electricity supply. The project seeks to decrease the technical as well as commercial losses, increase the electricity availability, and improve the voltage profile, within the MEPCO's electricity network.

1.3.1 STG Project

The 6th STG is a 5-year project, from 2005-6 to 2009-10[3], and has been broken down in five distinct year-wise phases. Each phase of the project consists of establishing new grid stations, extending/upgrading/augmenting existing grid stations, and laying transmission lines. The key components of these phases are tabulated below.[4]

	2005-06	2006-07	2007-08	2008-09	2009-10	Total
New Grid Stations (GS)	3	5	5	4	3	20
GS Conversion	3	3	0	0	2	8
GS Augmentation	13	5	4	2	0	24
GS Extension	16	12	5	3	0	36
Transmission Lines (km)	190	272	129	49	26	666

MEPCO is seeking the WB financing for a 3-year slice starting with the 2nd year of the project.

1.3.2 ELR Project

The ELR is also a 5-year project, from 2005-06 to 2009-10. The project consists of rehabilitation of high-tension (HT) feeders and low-tension (LT) lines, replacement of undersized and/or old transformers, replacement of sluggish energy meters, and associated activities. The yearly breakup of the key components of this project is provided below.

Description	Year 1	Year 2	Year 3	Year 4	Year 5
11 kV New Lines (km)	131	65	59	68	93
11 kV Re-conductoring (km)	108	77	72	68	91
Transformers for LT Proposals	526	250	227	260	300
New LT Lines (km)	473	43	43	63	78
LT Lines Re-conductoring (km)	75	72	65	85	110

MEPCO is seeking finances from the WB for the 2nd year of the ELR project, ie, 2006-07.

[3] The original PC1 was prepared for the project duration from 2003-04 to 2007-08.

[4] The original year-wise distribution of work within the total project duration as given in the PC1 has subsequently been revised, based upon changing load demand and priorities.

1.4 ESA Study

1.4.1 Need of the Study

The World Bank Operational Policy 4.01 (OP 4.01) states that "The Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making"[5]. The study also responds to OP 4.12 on involuntary resettlement, and provides the required mitigation measures through a Resettlement Plan (RP).

In addition, the Pakistan Environmental Protection Act, 1997 (PEPA 1997) requires the proponents of every development project in the country to submit either an Initial Environmental Examination (IEE) or "where the project is likely to cause an adverse environmental effect," an Environmental Impact Assessment (EIA) to the concerned environmental protection agency (EPA). The IEE/EIA Regulations 2000 issued under the PEPA 1997 provide separate lists for the projects requiring IEE and EIA.

1.4.2 Study Objectives

The objectives of the present ESA are:

- To assess the existing environmental and socioeconomic conditions of the project area,
- To identify likely impacts of the proposed project on the natural and human environment of the area, to predict and evaluate these impacts, and determine significance of these impacts, in light of the technical and regulatory concerns,
- To propose appropriate mitigation measures that should be incorporated in the design of the project to minimize if not eliminate the adverse impacts,
- To assess the compliance status of the proposed activities with respect to the environmental legislation and WB's OPs,
- To develop an environmental management plan (EMP) to provide an implementation mechanism for the mitigation measures identified during the study.

1.4.3 Study Scope

The present ESA study covers the components of the proposed 6th STG and ELR project which will be carried out during the year 2006-07. These components of the 6th STG and ELR project will be referred to as the proposed project in this report. The study addresses the potential environmental and social impacts that may be encountered during the construction and operation phases of the proposed project, in accordance with the terms of reference (ToR) provided by MEPCO for this purpose. (See **Appendix A** for the ToR of the ESA.)

1.4.4 Study Methodology

The key steps that were followed while conducting the ESA are briefly described below.

[5] Excerpts from OP4.01 – Environmental Assessment. January, 1999.

Scoping

During this phase, key information on the project was collected and reviewed. A 'long list' of the potential environmental as well as social issues likely to arise as a result of the project was developed. The stakeholder analysis was also carried out for the consultation to be carried out subsequently.

Stakeholder Consultation

Stakeholder consultations were carried out during the ESA study. Meetings were held in Islamabad with the institutional stakeholders and key environmental and social issues discussed. Consultations with the grass root stakeholders were carried out at the project sites (grid station locations and transmission line routes).

Data Collection/Compilation

During this phase, data was collected and compiled, in order to develop a baseline of the project area's physical, biological and human environment. For this purpose, both review of secondary sources and field data collection were carried out. Field visits to each of the new grid station site, existing grid stations (which are to be extended/augmented/ upgraded) and transmission line routes, were carried out.

The secondary resources that were consulted included reports of the studies carried out earlier, published books and data, and relevant websites. With the help of these resources a generic profile of the entire project area was developed.

In addition to the above, extensive field visits were carried out in order to collect the primary data specific to the project sites (grid station locations and transmission line routes). During these field visits, key information on environmental and social parameters was collected. During the primary data collection, environmental as well as social hot spots falling at or near the project sites were identified, and most importantly, the project affectees were determined.

During the field investigations, detailed information was collected on the cultivated area falling under the transmission line routes, since damage to the crops would be the primary asset loss during the proposed project. Information was also collected on the owners/tenants of the cultivated land under the transmission line.

Impact Assessment

During the impact assessment, the environmental, socioeconomic, and project information collected in previous steps was used to determine the potential impacts of the proposed project. Subsequent to this, the potential impacts were characterized in order to determine their significance. Mitigation measures were identified where required to minimize the significant environmental impacts. A management framework was also developed in the form of an EMP for the implementation of the mitigation measures identified during the study. The social screening checklist, provided in the terms of reference (ToR), was also used as one of the tolls to conduct the social impact assessment.

The impact assessment has been carried out and the associated mitigation measures recommended on the basis of the surveyed transmission line routes and other project locations. Variations in the impacts and associated mitigation measures are expected if the project components are moved outside the surveyed corridor.

Report Compilation

Report compilation was the last step of the study. The report includes a brief description of the proposed project, a review of environmental legislation and policy framework relevant to the project, a description of baseline environmental and socioeconomic conditions in the project area, and potential project impacts and mitigation measures. (Complete structure of the report is provided in **Section 1.5** below.)

1.4.5 Environmental and Social Guidelines

As described in **Section 1.4.3** above, the present ESA study covers the project components to be carried out during the year 2006-07, which is the first year of the 3-year project slice for which the WB financing is being sought. For the project components to be carried out during the remainder of the 3-year slice (ie, 2007-08 and 2008-09), details such as grid station locations and transmission lines routes are not known, and hence a detailed ESA cannot be conducted for this portion of the project at this stage.

In order to provide a broad framework to address the environmental as well as social aspects during this phase of the project (ie, 2007-08 and 2008-09), a set of environmental and social guidelines (ESG) has been prepared.

The ESG is a stand-alone document and has been provided under separate cover.

1.4.6 Resettlement Plan

Since the total number of the project affectees is expected to be more than 200, a Resettlement Plan (RP) has been developed, in accordance with the WB OP 4.12. The RP provides entitlement framework, compensation assessment and disbursement procedure, grievance redressal mechanism, monitoring requirements, resettlement budget and disclosure procedure for the proposed project.

The RP is a stand alone document and has been provided under separate cover.

1.4.7 Study Team

The ESA team consisted of environmental and socioeconomic experts having considerable experience in their respective field of expertise. The list of the experts is provided in **Appendix B**.

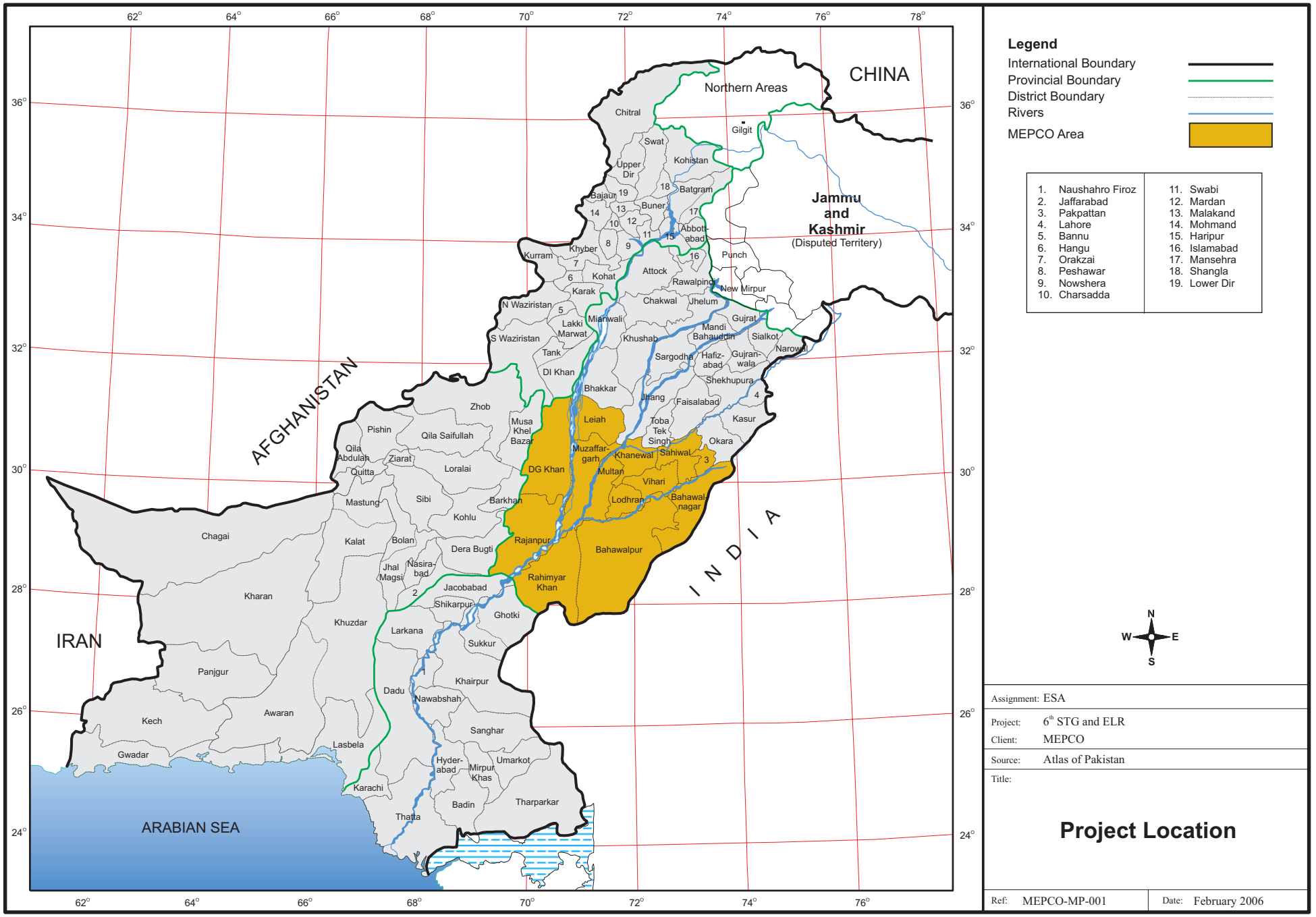
1.5 Document Structure

Chapter 2 discusses the World Bank's safeguard policies, as well as the regulatory, legislative and institutional setup in the country, relevant to the environmental and social assessment. The Chapter also outlines the international environmental agreements to

which the country is a party. **Chapter 3** provides a simplified description of the project and its components. The environmental baseline conditions are presented in **Chapter 4**, whereas the existing socioeconomic conditions of the project area are described in **Chapter 5**. Project alternatives are evaluated in **Chapter 6**. The stakeholder consultation has been covered in **Chapter 7**. The environmental as well as the socioeconomic impacts are assessed and their respective mitigations recommended in **Chapters 8** and **9**, respectively. **Chapter 10** outlines the implementation mechanism for the mitigation measures, in the form of an environmental management plan. Finally, **Chapter 11** presents the findings and conclusion of the study.

Exhibit 1.1: Project Location

(Please see the following page)



Legend

- International Boundary
- Provincial Boundary
- District Boundary
- Rivers
- MEPCO Area

1. Naushahro Firoz	11. Swabi
2. Jaffarabad	12. Mardan
3. Pakpattan	13. Malakand
4. Lahore	14. Mohmand
5. Bannu	15. Haripur
6. Hangu	16. Islamabad
7. Orakzai	17. Mansehra
8. Peshawar	18. Shangla
9. Nowshera	19. Lower Dir
10. Charsadda	

N
W E
S

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Atlas of Pakistan

Title:

Project Location

Ref: MEPCO-MP-001

Date: February 2006

Exhibit 1.2: Projection of Power Demand Growth - Pakistan

Year	Total Demand (MW)
2005-06	15,500
2006-07	16,600
2007-08	17,900
2008-09	19,600
2009-10	21,500

Table borrowed from NEPRA's State of the Industry Report – 2005
(Source: Mid Term Development Framework).

Exhibit 1.3: Population, Income and Electricity Consumption - Pakistan

Year	Population (Million)	Per Capita Income (Rs)	Energy Sale (GWh)	Per Capita Energy Consumption (kWh)
2000-01	138.87	5,697	59,770	430
2001-02	143.32	5,840	64,853	453
2002-03	147.32	5,986	70,234	477
2003-04	151.73	6,136	76,320	503
2004-05	156.29	6,289	82,990	531
2005-06	160.98	6,446	90,149	560
2006-07	165.80	6,607	97,988	591
2007-08	170.78	6,773	106,396	623
2008-09	175.90	6,942	115,566	657
2009-10	181.17	7,116	125,732	694

Source: Table-3. Proforma PC1 (6th STG), MEPCO 2003.

Exhibit 1.4: Historical and Projected Electricity Demand- MEPCO

Year	Total Demand (MW)
2002-03	1,528
2003-04	1,620
2004-05	1,788
2005-06	1,906
2006-07	2,045
2007-08	2,205
2008-09	2,396
2009-10	2,616

Source: Data provided by MEPCO.

2 Policy, Legal and Administrative Framework

This Chapter discusses the policy, legal and administrative framework and institutional set-up relevant to the environmental as well as social assessment of the proposed project. Also included in the Chapter are the environmental and social guidelines from the national agencies as well as international donors and other organizations.

2.1 The World Bank Operational Policies

Applicability of the WB Operational Policies (OPs) with respect to the environmental and social issues associated with the proposed project is tabulated below.

Operational Policy	Triggered
Environmental Assessment (OP 4.01)	Yes
Involuntary Resettlement (OP 4.12)	Yes
Forestry (OP 4.36)	No
Natural Habitat (OP 4.04)	No
Pest Management (OP 4.09)	No
Safety of Dams (OP 4.37)	No
Projects in International Waters (OP 7.50)	No
Cultural Property (OP 4.11)	No
Indigenous People (OP 4.10)	No
Projects in Disputed Area (7.60)	No

These policies are discussed in the following sections.

2.1.1 Environmental Assessment (OP 4.01)

The World Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making.[1] The OP defines the EA process and various types of the EA instruments.

The proposed project consists of activities which have environmental and social consequences, including:

- Damage to assets (such as crops),
- Loss of land,
- Deterioration of air quality,

[1] Excerpts from WB OP 4.12. WB Operational Manual. January 1999.

- Water contamination and consumption,
- Damage to top soil, land erosion,
- Safety hazard.

To identify the extent and consequences of these impacts, and to develop an EMP for their mitigation, an ESA is being carried out, in accordance with this OP.

2.1.2 Involuntary Resettlement (OP 4.12)

The WB's experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks: production systems are dismantled; people face impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost. This policy includes safeguards to address and mitigate these impoverishment risks.[2]

The overall objectives of the Policy are given below.

- Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.
- Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.
- Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

The Policy defines the requirement of preparing a resettlement plan or a resettlement policy framework, in order to address the involuntary resettlement.

For the proposed project, land will need to be acquired for the establishment of the new grid stations. During the site/route selection, settlements are generally avoided, however at some places acquisition of cultivable land – though temporary - cannot be avoided.

Similarly, crops along the proposed transmission lines may be damaged during the construction and operation phases of the proposed project.

[2] Excerpts from WB OP 4.12. WB Operational Manual. December 2001.

In view of the above, the OP 4.12 will be triggered, and since the number of affectees is more than 200, a Resettlement Plan has been developed in accordance with this OP.

2.1.3 Forestry (OP 4.36)

The objective of this Policy is to assist the WB's borrowers to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests.

None of the project components would be located inside any forested areas. Hence the OP 4.36 is not triggered.

2.1.4 Natural Habitat (OP 4.04)

The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions … [3]

Most parts of the proposed project are located in areas where the natural habitat has already been significantly modified, as a result of human habitation, cultivation and associated activities. Therefore the OP 4.04 is not triggered for the proposed project.

2.1.5 Pest Management (OP 4.09)

Through this OP, the WB supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides.

This OP is not triggered since the proposed project does not involve usage of pesticides. (Usage of the chemical herbicides to clear vegetation under the transmission lines will not be allowed during the proposed project.)

2.1.6 Safety of Dams (OP 4.37)

The Policy seeks to ensure that appropriate measures are taken and sufficient resources provided for the safety of dams the WB finances. However this OP is not relevant since the proposed project does not involve construction of dams.

2.1.7 Projects on International Waterways (OP 7.50)

This OP defines the procedure to be followed for projects the WB finances that are located on any water body that forms a boundary between, or flows through two or more states. However, no project components will be located on any such waterways, hence this OP is not triggered.

[3] Excerpts from WB OP 4.04. WB Operational Manual. June 2001.

2.1.8 Cultural Property (OP 4.11)

The World Bank's general policy regarding cultural properties is to assist in their preservation, and to seek to avoid their elimination. The specific aspects of the Policy are given below. [4]

- The Bank normally declines to finance projects that will significantly damage non-replicable cultural property, and will assist only those projects that are sited or designed so as to prevent such damage.
- The Bank will assist in the protection and enhancement of cultural properties encountered in Bank-financed projects, rather than leaving that protection to chance. In some cases, the project is best relocated in order that sites and structures can be preserved, studied, and restored intact in situ. In other cases, structures can be relocated, preserved, studied, and restored on alternate sites. Often, scientific study, selective salvage, and museum preservation before destruction is all that is necessary. Most such projects should include the training and strengthening of institutions entrusted with safeguarding a nation's cultural patrimony. Such activities should be directly included in the scope of the project, rather than being postponed for some possible future action, and the costs are to be internalized in computing overall project costs.
- Deviations from this policy may be justified only where expected project benefits are great, and the loss of or damage to cultural property is judged by competent authorities to be unavoidable, minor, or otherwise acceptable. Specific details of the justification should be discussed in project documents.
- This policy pertains to any project in which the Bank is involved, irrespective of whether the Bank is itself financing the part of the project that may affect cultural property.

During the present ESA, no site of historical, cultural or archaeological importance was found to be affected by the project. Hence OP 4.11 is not triggered.

However, in case of discovery of any sites or artifacts of historical, cultural, archeological or religious significance during the project execution, the work will be stopped at that site. The provisions of this Policy will be followed. Additionally, the provincial and federal archeological departments will be notified immediately, and their advice sought before resumption of the construction activities at such sites.

2.1.9 Indigenous People (OP 4.10)

For purposes of this policy, the term "Indigenous Peoples" is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees:[5]

[4] Excerpts from the OPN 11.03. WB Operational Manual. September 1986.
[5] Excerpts from the OP 4.10. WB Operational Manual. July 2005.

- self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;
- collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
- customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and
- an indigenous language, often different from the official language of the country or region.

The OP defines the process to be followed if the project affects the indigenous people.

During the ESA, no indigenous people - with a social and cultural identity distinct from the dominant society that makes them vulnerable to being disadvantaged in the development process - were found in the areas where different project components are planned to be located. Therefore this OP is not triggered.

However if such groups are identified during the project implementation, the proponents will develop an Indigenous People Development Plan, in compliance with the OP and get it approved by the Bank.

2.1.10 Projects in Disputed Areas (OP 7.60)

Projects in disputed areas may raise a number of delicate problems affecting relations not only between the Bank and its member countries, but also between the borrower and one or more neighboring countries. In order not to prejudice the position of either the Bank or the countries concerned, any dispute over an area in which a proposed project is located is dealt with at the earliest possible stage.

The Bank may proceed with a project in a disputed area if the governments concerned agree that, pending the settlement of the dispute, the project proposed for country A should go forward without prejudice to the claims of country B. [6]

MEPCO territory does not fall in any of the disputed areas. Hence this OP is not triggered.

2.2 Laws and Regulations

Pakistan's statute books contain a number of laws concerned with the regulation and control of the environmental and social aspects. However, the enactment of comprehensive legislation on the environment, in the form of an act of parliament, is a relatively new phenomenon. Most of the existing laws on environmental and social issues have been enforced over an extended period of time, and are context-specific. The laws relevant to the developmental projects are briefly reviewed below.

[6] Excerpts from the OP 7.60. WB Operational Manual. November 1994.

2.2.1 Pakistan Environmental Protection Act, 1997

The Pakistan Environmental Protection Act, 1997 (the Act) is the basic legislative tool empowering the government to frame regulations for the protection of the environment (*the 'environment' has been defined in the Act as: (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the inter-relationships between any of the factors specified in sub-clauses 'a' to 'f'*). The Act is applicable to a broad range of issues and extends to socioeconomic aspects, land acquisition, air, water, soil, marine and noise pollution, as well as the handling of hazardous waste. The discharge or emission of any effluent, waste, air pollutant or noise in an amount, concentration or level in excess of the National Environmental Quality Standards (NEQS) specified by the Pakistan Environmental Protection Agency (Pak-EPA) has been prohibited under the Act, and penalties have been prescribed for those contravening the provisions of the Act. The powers of the federal and provincial Environmental Protection Agencies (EPAs), established under the Pakistan Environmental Protection Ordinance 1983,[7] have also been considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental law either of their own accord, or upon the registration of a complaint.

The requirement for environmental assessment is laid out in Section 12 (1) of the Act. Under this section, no project involving construction activities or any change in the physical environment can be undertaken unless an initial environmental examination (IEE) or an environmental impact assessment (EIA) is conducted, and approval is received from the federal or relevant provincial EPA. Section 12 (6) of the Act states that this provision is applicable only to such categories of projects as may be prescribed. The categories are defined in the Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000 and are discussed in **Section 2.2.2** below.

The requirement of conducting an environmental assessment of the proposed project emanates from this Act.

2.2.2 Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000

The Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000 (the 'Regulations'), developed by the Pak-EPA under the powers conferred upon it by the Act, provide the necessary details on preparation, submission and review of the initial environmental examination (IEE) and the EIA. Categorization of projects for IEE and EIA is one of the main components of the Regulations. Projects have been classified on the basis of expected degree of adverse environmental impacts. Project types listed in Schedule I are designated as potentially less damaging to the environment, and those listed in Schedule II as having potentially serious adverse effects. Schedule I projects

[7] Superseded by the Pakistan environmental Protection Act, 1997.

require an IEE to be conducted, provided they are not located in environmentally sensitive areas. For the Schedule II projects, conducting an EIA is necessary.

The proposed project falls under the Schedule II of the Regulations, hence an EIA has to be conducted for it.

2.2.3 National and International Environmental Standards

National Standards

The National Environmental Quality Standards (NEQS), promulgated under the PEPA 1997, specify the following standards:

- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources,
- For power plants operating on oil and coal:
  - Maximum allowable emission of sulfur dioxide,
  - Maximum allowable increment in concentration of sulfur dioxide in ambient air,
  - Maximum allowable concentration of nitrogen oxides in ambient air, and
  - Maximum allowable emission of nitrogen oxide for steam generators as function of heat input.
- Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment and sea (three separate set of numbers).

Selected NEQS for liquid effluents discharged to inland waters, gaseous emission from industrial sources and emissions from motor vehicles are provided in **Exhibits 2.1**, **2.2** and **2.3**, respectively. These standards will be applicable to the gaseous emissions and liquid effluents discharged to the environment from the proposed project.

International Standards

The NEQS do not cover the ambient air quality or water quality standards. The international standards for ambient air quality and drinking water quality are presented in **Exhibits 2.4** and **2.5**.

For noise, the NEQS are limited to the vehicular noise. For noise generated by other sources, the WB standards are usually applied. The allowable noise limits per these standards are 55 dB(A) for daytime and 45 dB(A) for nighttime, measured at the receptor.

2.2.4 Land Acquisition Act, 1894

The Land Acquisition Act (LAA) of 1894 amended from time to time has been the de-facto policy governing land acquisition and compensation in the country. The LAA is the most commonly used law for acquisition of land and other properties for development projects. It comprises of 55 sections pertaining to area notifications and surveys,

acquisition, compensation and apportionment awards and disputes resolution, penalties and exemptions.

WAPDA has been acquiring land for the grid stations under the provisions of this Act. However, for the proposed project, the grid station sites will be procured directly from the owners, after paying the mutually agreed market price. And in case some parts of the land required for the proposed project is acquired under this Act, the Urgency/Emergency Clause (Section 17) will not be used, in the absence of an urgency or emergency. This Clause does not allow appeals or recourse in case of dispute on the land price.

2.2.5 National Resettlement Policy / Ordinance

The Ministry of Environment, Local Government and Rural Development formulated a draft policy in 2004 on involuntary resettlement with technical assistance from ADB. The policy aims to compensate for the loss of income to those who suffer loss of communal property including common assets, productive assets, structures, other fixed assets, income and employment, loss of community networks and services, pasture, water rights, public infrastructure like mosques, shrines, schools and graveyards.

The government has also developed a document entitled "*Project Implementation and Resettlement of the Affected Persons Ordinance, 2002*", later referred to as the "*Resettlement Ordinance*", for enactment by provincial and local governments, after incorporating local requirements. The Ordinance, being a new law, shall be supplementary to the LAA as well as other laws of Pakistan, and wherever applicable under this policy. However, if necessary, appropriate amendments to the LAA 1894 will also be proposed to facilitate the application of the Resettlement Ordinance.

There has not been much progress on the enactment of the Resettlement Ordinance; hence this is not relevant for the proposed project.

2.2.6 Telegraph Act, 1885

This law was enacted to define the authority and responsibility of the Telegraph authority. The law covers, among other activities, installation and maintenance of telegraph lines and posts (poles). The Act defines the mechanism to determine and make payment of compensation associated with the installation of these lines and posts.

Under this Act, the land required for the poles is not acquired (or purchased) from the owner, nor the title of the land transferred. Compensation is paid to the owner for any structure, crop or tree that exists on the land; cost of the land is not paid to the owner. Under this Act, the land under the tower would not be paid for by WAPDA, while this contravenes with the Bank policies.

WAPDA has been installing the transmission lines and towers, and determining the associated compensation, on the basis of this Act. For the proposed project as well, MEPCO will use this Act. However the land under the towers will be acquired and compensated, if there is loss of access, and productive use of the land by the landowners/affectees is impacted.

2.2.7 Punjab Wildlife Protection Act, 1974

This law was enacted to protect the province's wildlife resources directly and other natural resources indirectly. It classifies wildlife by degree of protection, ie, animals that

may be hunted on a permit or special license, and species that are protected and cannot be hunted under any circumstances. The Act specifies restrictions on hunting and trade in animals, trophies, or meat. The Act also defines various categories of wildlife protected areas, ie, National Parks, Wildlife Sanctuaries and Game Reserve.

2.2.8 Forest Act, 1927

The Act authorizes Provincial Forest Departments to establish forest reserves and protected forests. The Act prohibits any person to set fire in the forest, quarries stone, removes any forest-produce or cause any damage to the forest by cutting trees or clearing up area for cultivation or any other purpose.

2.2.9 Canal and Drainage Act (1873)

The Canal and Drainage Act (1873) prohibits corruption or fouling of water in canals (defined to include channels, tube wells, reservoirs and watercourses), or obstruction of drainage. This Act will be applicable to the construction works to be carried out during the proposed project.

2.2.10 Provincial Local Government Ordinances, 2001

These ordinances were issued under the devolution process and define the roles of the district governments. These ordinances also address the land use, conservation of natural vegetation, air, water and land pollution, disposal of solid waste and wastewater effluents, as well as matters relating to public health.

2.2.11 Antiquity Act, 1975

The Antiquities Act of 1975 ensures the protection of cultural resources in Pakistan. The Act is designed to protect 'antiquities' from destruction, theft, negligence, unlawful excavation, trade and export. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain articles of archeological significance.

Under this Act, the project proponents are obligated to:

- Ensure that no activity is undertaken in the proximity of a protected antiquity, and
- If during the course of the project an archeological discovery is made, it should be protected and reported to the Department of Archeology, Government of Pakistan, for further action.

2.2.12 Mines, Oil Fields and Mineral Development Act, 1948

This legislation provides procedures for quarrying and mining of construction material from state-owned as well as private land. These procedures will have to be followed during the proposed project.

2.2.13 Factories Act, 1934

The clauses relevant to the MEPCO's proposed project are those that address the health, safety and welfare of the workers, disposal of solid waste and effluents, and damage to private and public property. The Act also provides regulations for handling and disposing toxic and hazardous substances. The Pakistan Environmental Protection Act of 1997 (discussed above), supersedes parts of this Act pertaining to environment and environmental degradation.

2.2.14 Pakistan Explosive Act, 1884

This Act provides regulations for the handling, transportation and use of explosives during quarrying, blasting and other purposes. The transmission line tower installation may need blasting at rocky/mountainous areas, thus these regulations will be applicable for the proposed project.

2.2.15 Employment of Child Act, 1991

Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines or any other hazardous employment. In accordance with this Article, the Employment of Child Act (ECA) 1991 disallows the child labor in the country. The ECA defines a child to mean a person who has not completed his/her fourteenth years of age. The ECA states that no child shall be employed or permitted to work in any of the occupation set forth in the ECA (such as transport sector, railways, construction, and ports) or in any workshop wherein any of the processes defined in the Act is carried out. The processes defined in the Act include carpet weaving, bidi (kind of a cigarette) making, cement manufacturing, textile, construction and others).

MEPCO and its contractors will be bound by the ECA to disallow any child labor at the project sites or campsites.

2.2.16 Pakistan Penal Code, 1860

The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents. Most of the environmental aspects of the Code have been superseded by the Pakistan Environmental Protection Act, 1997.

2.3 Obligations under International Treaties

Pakistan is signatory of several MEAs, including:

- Basel Convention,
- Convention on Biological Diversity, Convention on Wetlands (Ramsar),
- Convention on International Trade in Endangered Species (CITES),
- UN Framework Convention on Climate Change (UNFCCC),

- Kyoto Protocol,
- Montreal Protocol,
- UN Convention to Combat Desertification,
- Convention for the Prevention of Pollution from Ships (MARPOL),
- UN Convention on the Law of Seas (LOS),
- Stockholm Convention on Persistent Organic Pollutants (POPs),
- Cartina Protocol.

These MEAs impose requirements and restrictions of varying degrees upon the member countries, in order to meet the objectives of these agreements. However, the implementation mechanism for most of these MEAs is weak in Pakistan and institutional setup non existent.

In order to address this state of affairs, the GoP has recently approved a PC1 for the establishment of the National MEA Secretariat under the Ministry of Environment in Islamabad. The Secretariat will handle and coordinate activities, and develop action plans for each MEA vis-à-vis the country's obligation under these agreements. The Secretariat will then be responsible to ensure implementation of these action plans. The Secretariat will also evaluate future MEAs and advise the Government for acceding (or otherwise) these agreements.

For the proposed project, the Stockholm Convention has the direct relevance. The Convention addresses the eradication of the persistent organic pollutants (POPs). The transformer oil used to contain poly-chlorinated biphenyl PCB), which is one of the POPs. Though now its usage has been abandoned, old transformers in Pakistan still contain oil containing PCB (this issue is further discussed in **Section 8** of this report).

2.4 Institutional Setup for Environmental Management

The apex environmental body in the country is the Pakistan Environmental Protection Council (PEPC), which is presided by the Chief Executive of the Country. Other bodies include the Pakistan Environmental Protection Agency (Pak-EPA), provincial EPAs (for four provinces, AJK and Northern Areas), and environmental tribunals.

The EPAs were first established under the 1983 Environmental Protection Ordinance; the PEPA 1997 further strengthened their powers. The EPAs have been empowered to receive and review the environmental assessment reports (IEEs and EIAs) of the proposed projects, and provide their approval (or otherwise).

The proposed projects would be located in the Punjab Province. Hence this ESA report will be sent to the Punjab EPA for review.

2.5 Environmental and Social Guidelines

Two sets of guidelines, the Pak-EPA's guidelines and the World Bank Environmental Guidelines are reviewed here. These guidelines address the environmental as well as social aspects.

2.5.1 Environmental Protection Agency's Environmental and Social Guidelines

The Federal EPA has prepared a set of guidelines for conducting environmental assessments. The guidelines derive from much of the existing work done by international donor agencies and NGOs. The package of regulations, of which the guidelines form a part, includes the PEPA 1997 and the NEQS. These guidelines are listed below.

- Guidelines for the Preparation and Review of Environmental Reports,
- Guidelines for Public Consultation,
- Guidelines for Sensitive and Critical Areas,
- Sectoral Guidelines.

It is stated in the Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000 that the EIA or IEE must be prepared, to the extent practicable, in accordance with the Pakistan Environmental Protection Agency Environmental Guidelines.

2.5.2 World Bank Environmental and Social Guidelines

The principal World Bank publications that contain environmental and social guidelines are listed below.

- Pollution Prevention and Abatement Handbook 1998: Towards Cleaner Production
- Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues.
- Social Analysis Sourcebook.
- All environmental and social safeguard operational policies.

Exhibit 2.1: Selected NEQS for Waste Effluents

Parameter	Unit	Standards (maximum allowable limit)
Temperature increase	°C	< 3
pH value (acidity/basicity)	pH	6-9
5-day biochemical oxygen demand (BOD) at 20 °C	mg/l	80
Chemical oxygen demand (COD)	mg/l	150
Total suspended solids	mg/l	200
Total dissolved solids	mg/l	3,500
Grease and oil	mg/l	10
Phenolic compounds (as phenol)	mg/l	0.1
Chloride (as Cl)	mg/l	1,000
Fluoride (as F)	mg/l	10
Sulfate (SO_4)	mg/l	600
Sulfide (S)	mg/l	1.0
Ammonia (NH_3)	mg/l	40
Cadmium	mg/l	0.1
Chromium (trivalent and hexavalent)	mg/l	1.0
Copper	mg/l	1.0
Lead	mg/l	0.5
Mercury	mg/l	0.01
Selenium	mg/l	0.5
Nickel	mg/l	1.0
Silver	mg/l	1.0
Total toxic metals	mg/l	2.0
Zinc	mg/l	5
Arsenic	mg/l	1.0
Barium	mg/l	1.5
Iron	mg/l	8.0
Manganese	mg/l	1.5
Boron	mg/l	6.0
Chlorine	mg/l	1.0

Source: Government of Pakistan (2000).

Notes:

1. The standard assumes that dilution of 1:10 on discharge is available. That is, for each cubic meter of treated effluent, the recipient water body should have 10 m^3 of water for dilution of this effluent.
2. Toxic metals include cadmium, chromium, copper, lead, mercury, selenium, nickel and silver. The effluent should meet the individual standards for these metals as well as the standard for total toxic metal concentration.

Exhibit 2.2: NEQS for Industrial Gaseous Emissions

mg/Nm^3 unless otherwise stated

Parameter	Source of Emission	Standards (maximum allowable limit)
Smoke	Smoke opacity not to exceed	40% or 2 Ringlemann Scale or equivalent smoke number
Particulate matter [1]	(a) Boilers and furnaces: i. Oil fired ii. Coal fired iii. Cement Kilns	 300 500 300
	(b) Grinding, crushing, clinker coolers and related processes, metallurgical processes, converters, blast furnaces and cupolas	500
Hydrogen Chloride	Any	400
Chlorine	Any	150
Hydrogen fluoride	Any	150
Hydrogen sulphide	Any	10
Sulphur Oxides [2, 3]	Sulfuric acid/Sulphonic acid plants	5,000
	Other Plants except power Plants operating on oil and coal	1,700
Carbon Monoxide	Any	800
Lead	Any	50
Mercury	Any	10
Cadmium	Any	20
Arsenic	Any	20
Copper	Any	50
Antimony	Any	20
Zinc	Any	200
Oxides of Nitrogen [3]	Nitric acid manufacturing unit	3,000
	Other plants except power plants operating on oil or coal: i. Gas fired ii. Oil fired iii. Coal fired	 400 600 1,200

Source: Government of Pakistan (2000).

Explanations:

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1% sulphur content in fuel oil. Higher content of sulphur will cause standards to be pro-rated.
3. In respect of emissions of sulphur dioxide and nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to NEQS specified above, comply with the standards provided separately.

Exhibit 2.3: NEQS for Motor Vehicles Exhaust and Noise

Parameter	Standards (maximum permissible limit)	Measuring Method
Smoke	40% or 2 on the Ringlemann Scale during engine acceleration mode.	To be 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 meter at 7.5 meter from the source.

Source: Government of Pakistan (2000).

Exhibit 2.4: WHO Ambient Air Quality Standards

Pollutant	Maximum Allowable Limit	Units	Averaging Time
CO	35	ppm	1 hour
NO_X	106	ppb	1 hour
SO_2	134	ppb	1 hour
PM_{10}	70	$\mu g/m^3$	24 hours

Exhibit 2.5: WHO Drinking Water Quality Standards

Element/ Substance	Symbol/ Formula	Normally Found in Freshwater/Surface Water/Groundwater	Health Based WHO Guideline
Aluminium	Al		0.2 mg/l
Ammonia	NH_4	< 0.2 mg/l (up to 0.3 mg/l in anaerobic waters)	No guideline
Antimony	Sb	< 4 µg/l	0.005 mg/l
Arsenic	As		0.01 mg/l
Asbestos			No guideline
Barium	Ba		0.3 mg/l
Berillium	Be	< 1 µg/l	No guideline
Boron	B	< 1 mg/l	0.3 mg/l
Cadmium	Cd	< 1 µg/l	0.003 mg/l
Chloride	Cl		250 mg/l
Chromium	Cr^{+3}, Cr^{+6}	< 2 µg/l	0.05 mg/l
Colour			Not mentioned
Copper	Cu		2 mg/l
Cyanide	CN^-		0.07 mg/l
Dissolved oxygen	O_2		No guideline
Fluoride	F	< 1.5 mg/l (up to 10)	1.5 mg/l
Hardness	mg/l $CaCO_3$		No guideline
Hydrogen sulfide	H_2S		No guideline
Iron	Fe	0.5 - 50 mg/l	No guideline
Lead	Pb		0.01 mg/l
Manganese	Mn		0.5 mg/l
Mercury	Hg	< 0.5 µg/l	0.001 mg/l
Molybdenum	Mb	< 0.01 mg/l	0.07 mg/l
Nickel	Ni	< 0.02 mg/l	0.02 mg/l
Nitrate and nitrite	NO_3, NO_2		50 mg/l total nitrogen
Turbidity			Not mentioned
pH			No guideline
Selenium	Se	< < 0.01 mg/l	0.01 mg/l
Silver	Ag	5 – 50 µg/l	No guideline
Sodium	Na	< 20 mg/l	200 mg/l
Sulfate	SO_4		500 mg/l
Inorganic tin	Sn		No guideline
TDS			No guideline
Uranium	U		1.4 mg/l
Zinc	Zn		3 mg/l

3 Description of the Project

This Chapter provides a simplified description of various components of the proposed project and their salient features, location, and phases.

3.1 MEPCO's Existing System

MEPCO is one of the eight DISCOs which have been established as a result of WAPDA's restructuring. The key technical data of the MEPCO's system is provided in **Exhibit 3.1**.

3.1.1 MEPCO Area

The area within the MEPCO network comprises the following thirteen districts of the province of Punjab:

- Multan
- Sahiwal
- Khanewal
- Pakpattan
- Vehari
- Bahawalpur
- Bahawalnagar
- Layyah
- Rahim Yar Khan
- Muzaffargarh
- Rajanpur
- Dera Ghazi Khan
- Lodhran.

Exhibit 3.2 presents a map of the MEPCO system.

The total population in this area is about 25.7 million (1998 census). The major urban centers of the area include Multan, Bahawalpur, Sahiwal, Rahim Yar Khan and Dera Ghazi Khan.

3.1.2 Transmission Lines

The MEPCO system comprises of seven 132-kV double circuit, eleven 132-kV single circuit and five 66-kV single circuit transmission lines. A list of these transmission lines is provided in **Exhibit 3.3**.

3.1.3 Grid Stations and HT Feeders

There are seventy-one 132-kV, thirty-one 66 kV and one 33 kV grid stations within the MEPCO system; a list of these grid stations is provided in **Exhibits 3.4** and **3.5**.

A total of 817 HT feeders originate from the above grid stations in the MEPCO system. **Exhibit 3.6** provides a summary of the HT feeders in the MEPCO system.

3.2 Project Objectives

The overarching objective of the 6th STG and ELR project is to increase the efficiency, reliability and quality of the electricity supply. The project aims to achieve:

- Strengthening of electricity transmission network to reduce bottlenecks and improve system reliability and quality
- Strengthening of electricity distribution network to reduce losses and improvement in supply.

This will be achieved by adding new grid stations, upgrading/augmenting/converting the existing ones, adding new transmission lines, bifurcating long distribution feeders and replacing old/undersized conductors as well as transformers.

3.3 Project Components

In its total span of 5 years, the 6th STG project envisages the establishment of 20 new grid stations, conversion of 8 grid stations, augmentation of 30 grid stations, and extension of 30 grid stations, as well as the laying of 666 km of transmission lines. Similarly, the ELR project activities during the total span of 5 years include installation of 416 km of new high-tension (HT) lines, re-conductoring of 416 km HT lines, installation of 1,563 distribution transformers, installation of 700 km of new low-tension (LT) lines and re-conductoring of 407 km LT lines.

The present ESA addresses the project components which will be undertaken during the Year 2006-07. These components and their salient information are tabulated below.

Project Component	Features
New Grid Stations	
Bahawalpur Cantonment (Cantt.)	132 kV grid station; 2 × 26 MVA transformers
Jail Road, Multan	132 kV grid station; 2 × 26 MVA transformers
Suraj Miani, Multan	132 kV grid station; 2 × 26 MVA transformers
Sahiwal III	132 kV grid station; 2 × 26 MVA transformer
Makhdumpur	132 kV grid station; 2 × 13 MVA transformers

Project Component	Features
Conversion of Existing Grid Stations (66 kV to 132 kV)	
Head Sidhnai	132 kV grid station; 2 × 13 MVA transformers
Lal Sohanra	132 kV grid station; 2 × 13 MVA transformers
Khairpur Tamewali	132 kV grid station; 2 × 13 MVA transformers
Extension of Existing Grid Stations	
Chowk Azam	1 × Line Bay
Kot Addu	1 × Line Bay
Daharanwala	1 × 13 MVA transformer
Damarwala	1 × 13 MVA transformer
Jampur	1 × 13 MVA transformer
Karor Lal Essan	1 × 13 MVA transformer
Khan Garh	1 × 13 MVA transformer
Khanewal Road, Multan	2 × 26 MVA transformers
Kot Chutta	1 × 13 MVA transformer
Qabula	1 × 13 MVA transformer
Hasilpur	1 × Line Bay
Kahror Pecca	1 × Line Bay
Augmentation of Existing Grid Stations	
Harappa	1 × 26 MVA transformer
Kacha Khoh	1 × 26 MVA transformer
Mailsi	1 × 26 MVA transformer
Sahiwal New	1 × 26 MVA transformer
Khanpur	1 × 26 MVA transformer
New Transmission Lines [1]	
Feed for Bahawalpur Cantanment grid station	Length: 2 km
Feed for Sahiwal III grid station	Length: 0.3 km
Feed for Jail Road (Multan) grid station	Length: 1 km
Feed for Suraj Miani grid station	Length: 5 km
Feed for Makhdumpur	Length: 18 km
Feed for Head Sidhnai grid station	Length: 15 km
Feed for Lal Sohanra grid station	Length: 2 km
Kahror Pacca – Lal Sohanra	Length: 30 km

[1] The lengths of the new transmission lines are indicative only.

Project Component	Features
Lal Sohanra – Khairpur Tamewali	Length: 25 km
Khairpur Tamewali – Hasilpur	Length: 35 km
Kot Addu – Chowk Azam	Length: 106 km
ELR Works	
New HT lines	65 km
HT Line Re-conductoring	77 km
Transformers	250
New LT Lines	43 km
LT Lines Re-conductoring	72

The above components are shown in **Exhibit 3.7** and described in the following sections.

3.3.1 Bahawalpur Cantt. Grid Station

The southern parts of the Bahawalpur City near the airport and along the Yazman Road are currently being fed from the Bahawalpur grid station. Owing to the fact that this area is far away from the existing grid station, the 11-kV feeders in the area are lengthy and fully loaded. As a result, the distribution network in the area experiences low-voltage and frequent power outages.

In order to address the above problems, and in view of the anticipated load growth, a new 132-kV grid station has been planned, along the Yazman Road, a few kilometers further south of the Bahawalpur airport. This will result in the reduced losses associated with low-voltage on the existing feeders, fewer power outages and improved voltage profile, while also catering to the future load growth in the area.

The grid station will be fed from the Bahawalpur – Khairpur Tamewali transmission line, which is currently under construction.

The new grid station will have two transformers, each having a capacity of 26 MVA. Initially, several of the existing 11 kV feeders from the Bahawalpur grid station will be shifted to the new grid station. Additional feeders will be added as and when new consumers are connected to the system.

About 4 acres of land is usually required for the grid station of this size. The land currently being considered for this purpose is located a few kilometers outside Bahawalpur City, along the Yazman Road. The land is State owned.

MEPCO will need to establish contact with the Civil Aviation Authority for obtaining necessary approvals, since the grid station site is in the vicinity of the Bahawalpur airport.

3.3.2 Jail Road Grid Station[2], Multan

The southern parts of the Multan City are currently being fed by the Qasimpur, MESCO and Industrial Estate grid stations. The electricity demand in the area is rapidly increasing, both because of the increasing population in the area as well as the new industrial units being setup. The 11-kV feeders in the area are lengthy and fully loaded. As a result, the distribution network in the area experiences low-voltage and frequent power outages.

In order to address the above problems, and in view of the anticipated load growth, a new 132-kV grid station in the area close to the Muzaffargarh Bypass, south of the Multan City has been planned. This will result in the reduced losses associated with low-voltage on the existing feeders, fewer power outages and improved voltage profile, while also catering to the future load growth in the area.

The proposed grid station will be fed from the existing 132-kV transmission line from NGPS to Industrial Estate Grid Station.

The new grid station will have two transformers each having a capacity of 26 MVA. Initially, several of the existing 11-kV feeders from the Qasimpur, MESCO and Industrial Estate grid stations will be shifted to the new grid station. Additional feeders will be added as and when new consumers are connected to the system.

About 4 acres of land is usually required for the grid station of this size. MEPCO is looking for a suitable tract of land along or near the Muzaffargarh Bypass. The land will be purchased directly from the buyer on *willing seller – willing buyer* basis at market price. The seller will have the right of refusal and the entire process will be documented.

3.3.3 Suraj Miani Grid Station, Multan

The northwestern parts of the Multan City along the Suraj Miani Road are currently being fed from the MESCO grid station. Owing to the large distances and increasing electricity demand, the 11-kV feeders in the area are lengthy and fully loaded. As a result, the distribution network in the area experiences low-voltage and frequent power outages.

In order to address the above problems, and in view of the anticipated load growth, a new 132-kV grid station in the area has been planned. This will result in the reduced losses associated with low-voltage on the existing feeders, fewer power outages and improved voltage profile, while also catering to the future load growth in the area.

The proposed grid station will be fed from the Multan Industrial Estate – Bosan Road transmission line.

The new grid station will have two transformers each having a capacity of 26 MVA. Initially, several of the existing 11-kV feeders from the MESCO grid station will be shifted to the new grid station. Additional feeders will be added as and when new consumers are connected to the system.

[2] The name of the grid station as 'Jail Road' was selected initially when the grid station was planned at the Jail Road. However, no space is now available along the Jail Road; the new grid station would therefore be located along the southern bypass of the City.

The land currently being considered for this grid station is located along the Suraj Minai Road in the Multan City. The land will be purchased directly from the buyer on *willing seller – willing buyer* basis at market price. The seller will have the right of refusal and the entire process will be documented.

3.3.4 Sahiwal III Grid Station

The western parts of the Sahiwal City and adjacent rural areas are currently being fed from the Sahiwal New grid station. Owing to the large distances and increasing electricity demand, the existing distribution system in the area is already overloaded and can hardly meet the prevailing electricity demand. Long feeders also result in high energy losses and frequent power outages.

In order to address the above problems, and in view of the anticipated load growth, a new 132-kV grid station has been planned, just outside the Sahiwal City. This will result in the reduced losses associated with low-voltage on the existing feeders, fewer power outages and improved voltage profile, while also catering to the future load growth in the area.

The proposed grid station will be fed from the 132-kV Tandlianwala-Sahiwal Old transmission line, which is passing adjacent to the proposed grid station site.

The new grid station will have two transformers each having a capacity of 26 MVA. Initially, several of the existing 11-kV feeders from the Sahiwal New grid station will be shifted to the new grid station. Additional feeders will be added as and when new consumers are connected to the system.

The land currently being considered for this purpose is located near the village 93-6-R just outside the Sahiwal town. The land will be purchased directly from the buyer on *willing seller – willing buyer* basis at market price. The seller will have the right of refusal and the entire process will be documented.

3.3.5 Makhdumpur Grid Station

Currently, the area around Mukhdumpur (located around 20 km east-northeast of Kabirwala) is being fed from the Head Sidhnai and Kabirwala grid stations. As a result, the feeders are lengthy and overloaded. The existing distribution system in the area can hardly meet the prevailing electricity demand. Long feeders also result in high energy losses and frequent power outages.

In order to address the above problems, and in view of the anticipated load growth, a new 132-kV grid station has been planned near Mukhdumpur. This will result in the reduced losses associated with low-voltage on the existing feeders, fewer power outages and improved voltage profile, while also catering to the future load growth in the area.

The proposed grid station will be fed from the 132-kV Kabirwala - Shorkot transmission line, which is passing at a distance of about 13 km from the proposed grid station site.

The new grid station will have two transformers each having a capacity of 13 MVA. Initially, several of the existing 11-kV feeders from the Head Sidhnai and Kabirwala grid stations will be shifted to the new grid station. Additional feeders will be added as and when new consumers are connected to the system.

The land currently being considered for this purpose is located the Kabirwala – Makhdumpur Road. The land will be purchased directly from the buyer on *willing seller – willing buyer* basis at market price. The seller will have the right of refusal and the entire process will be documented.

3.3.6 Conversion of Head Sidhnai Grid Station

The existing Head Sidhnai grid station is currently on 66-kV system. The existing power transformer at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. Most importantly, the 66-kV system is fast becoming obsolete, and obtaining spares and replacements is becoming more and more difficult.

In view of the above situation, conversion of the 66-kV system to the 132-kV system has been envisaged. The conversion will help improve the system parameters, while meeting the growing demand of the electricity in the area. In addition, the grid station will be connected to the national grid.

The upgraded grid station will have two transformers each having a capacity of 13 MVA (replacing two transformers of 13 MVA and 5 MVA capacity). The grid station will be fed through the 132-kV Kabirwala - Shorkot transmission line, which runs about 15 km from the grid station.

Limited space is available in the existing grid station for the proposed conversion, however MEPCO will make efforts to adjust the new equipment within the premises.

3.3.7 Conversion of Lal Sohanra Grid Station

The existing Lal Sohanra grid station is currently on 66-kV system. The existing power transformer at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. Most importantly, the 66-kV system is fast becoming obsolete, and obtaining spares and replacements is becoming more and more difficult.

In view of the above situation, conversion of the 66-kV system to the 132-kV system has been envisaged. The conversion will help improve the system parameters, while meeting the growing demand of the electricity in the area. In addition, the grid station will be connected to the national grid. The upgraded grid station will have two transformers having a capacity of 13 MVA (replacing the existing 5 MVA transformer). The grid station will be fed through the 132-kV Bahawalpur – Khairpur Tamewali transmission line.

The grid station has ample space for the new transformers and associated equipment. Therefore no additional land will need to be acquired for the conversion.

3.3.8 Conversion of Khairpur Tamewali Grid Sattion

The existing Khairpur Tamewali grid station is currently on 66-kV system. The existing power transformer at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired

voltage levels is also a problem. Most importantly, the 66-kV system is fast becoming obsolete, and obtaining spares and replacements is becoming more and more difficult.

In view of the above situation, conversion of the 66-kV system to the 132-kV system has been envisaged. The conversion will help improve the system parameters, while meeting the growing demand of the electricity in the area. In addition, the grid station will be connected to the national grid.

The upgraded grid station will have two transformers having a capacity of 13 MVA. The grid station will be fed through the 132-kV Bahawalpur – Khairpur Tamewali transmission line.

The grid station has ample space for the new transformers and associated equipment. Therefore no additional land will need to be acquired for the conversion.

3.3.9 Extension of Chowk Azam Grid Station

Currently, the Chowk Azam grid station is being fed from the 132-kV single circuit transmission line from Kot Addu. In addition to powering the 11 kV feeders for the surrounding areas, this grid station also provides 132-kV feed to Layya, Bhakkar and Chaubara grid stations. In order to provide a back-up source, another 132-kV circuit is being added between Kot Addu and Chowk Azam grid stations (further discussed later in the Chapter). To accommodate this additional 132-kV circuit, another line bay will need to be added at the Chowk Azam grid station. No transformer will be added at the grid station at this stage.

The grid station has ample space for the new line bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.10 Extension of Kot Addu Grid Station

As described in **Section 3.3.9** above, another 132-KV circuit is being added, as a part of the proposed project, between Kot Addu and Chowk Azam grid stations (further discussed later in the Chapter). To accommodate this additional 132-kV circuit, another line bay will need to be added at the Kot Addu grid station. No transformer will be added at the grid station at this stage.

The grid station has ample space for the new line bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.11 Extension of Daharanwala Grid Station

Currently, the Daharanwala grid station has on 66-kV – 11-kV transformer of 13 MVA capacity. The existing power transformer at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. In order to meet the increasing electricity demand in the area and to improve the voltage profile, a 132-kV – 11-kV transformer of the same capacity is being added at the grid station.

The grid station has ample space for the new transformer bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.12 Extension of Damarwala Grid Station

Currently, the Damarwala grid station has one 132-kV – 11-kV transformer of 13 MVA capacity. The existing power transformer at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. In order to address these problems, another transformer of 13 MVA capacity is proposed to be added at this grid station.

The grid station has ample space for the new transformer bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.13 Extension of Jampur Grid Station

Currently, the Jampur grid station has one 132-kV – 11-kV transformer of 13 MVA capacity. This transformer as well as the 11-KV feeders originating from it are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. In order to address these problems, another transformer of 13 MVA capacity is proposed to be added at this grid station.

The grid station has ample space for the new transformer bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.14 Extension of Karor Lal Essan Grid Station

Currently, the Karor Lal Essan grid station has one 66-kV – 11-kV transformer of 13 MVA capacity. The existing power transformer at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. In order to address these problems, another transformer of 13 MVA capacity is proposed to be added at this grid station.

The grid station has ample space for the new transformer bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.15 Extension of Khan Garh Grid Station

Currently, the Khan Garh grid station has one 132-kV – 11-kV transformer of 13 MVA capacity. The existing power transformer at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. In order to address these problems, another transformer of 13 MVA capacity is proposed to be added at this grid station.

The grid station has ample space for the new transformer bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.16 Extension of Khanewal Road (Multan) Grid Station

Currently, the Khanewal Road grid station in Multan has two 132-kV – 11-kV transformers of 26 MVA capacity each. The existing power transformers at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system

cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. The expanding urban area is expected further increase the electricity demand. In order to address this situation, another transformer of 26 MVA capacity is proposed to be added at this grid station.

The grid station has ample space for the new transformer bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.17 Extension of Kot Chutta Grid Station

Currently, the Kot Chutta grid station has two 132-kV – 11-kV transformers of 13 MVA capacity each. The existing power transformers at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. The expanding urban area is expected further increase the electricity demand. In order to address this situation, another transformer of 13 MVA capacity is proposed to be added at this grid station.

The grid station has ample space for the new transformer bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.18 Extension of Qabula Grid Station

Currently, the Qabula grid station has one 132-kV – 11-kV transformer of 26 MVA capacity. The existing power transformer at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. The expanding urban area is expected further increase the electricity demand. In order to address this situation, another transformer of 13 MVA capacity is proposed to be added at this grid station.

The grid station has ample space for the new transformer bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.19 Extension of Hasilpur Grid Station

A 132-KV transmission line is proposed to be constructed between Khairpur Tamewali and Hasilpur grid stations (discussed later) in order to provide second power source to the Hasilpur grid station and to complete the ring. To cater to this transmission line, a line bay would need to be added at the Hasilpur grid station.

The grid station has ample space for the new line bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.20 Extension of Kahror Pecca Grid Station

A 132-KV transmission line is proposed to be constructed between Kehror Pecca and Lal Sohanra grid stations (discussed later) in order to provide second power source to the Lal Sohanra grid station and to complete the ring. To cater to this transmission line, a line bay would need to be added at the Kahror Pecca grid station.

The grid station has ample space for the new line bay and associated equipment. Therefore no additional land will need to be acquired for the extension of the grid station.

3.3.21 Augmentation of Harappa Grid Station

Currently, the Harappa grid station has two 132-kV – 11-kV transformers of 13 MVA and 10.5 MVA capacity. The existing power transformers at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. In order to address these problems, a 26 MVA transformer is proposed to be installed at this grid station, replacing the existing transformers.

No additional land will need to be acquired for the proposed works art the grid station, since no new line bay or transformer bay will be added, and the new transformer will use the exiting bay.

3.3.22 Augmentation of Kacha Khoh Grid Station

Currently, the Kacha Khoh grid station has two 132-kV – 11-kV transformers of 13 MVA each. These transformers, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. In order to address these problems, a 26 MVA transformer is proposed to be installed at this grid station, replacing one of the existing transformers.

No additional land will need to be acquired for the proposed works art the grid station, since no new line bay or transformer bay will be added, and the new transformer will use the exiting bay.

3.3.23 Augmentation of Mailsi Grid Station

Currently, the Mailsi grid station has two 132-kV – 11-kV transformers of 26 MVA and 13 MVA. The existing power transformers at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. In order to address these problems, a 26 MVA transformer is proposed to be installed at this grid station, replacing the existing 13 MVA transformer.

No additional land will need to be acquired for the proposed works art the grid station, since no new line bay or transformer bay will be added, and the new transformer will use the exiting bay.

3.3.24 Augmentation of Sahiwal New Grid Station

Currently, the Sahiwal New grid station has two 132-kV – 11-kV transformers of 13 MVA capacity each. The existing power transformers at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. In order to address these problems, a 26 MVA transformer is proposed to be installed at this grid station, replacing one of the existing transformers.

No additional land will need to be acquired for the proposed works art the grid station, since no new line bay or transformer bay will be added, and the new transformer will use the exiting bay.

3.3.25 Augmentation of Khanpur Grid Station

Currently, the Khanpur grid station has two 132-kV – 11-kV transformers of 26 MVA and 13 MVA. The existing power transformers at the grid station, as well as the 11-KV feeders originating from it, are fully loaded, and the system cannot cater to any additional load. Maintaining the desired voltage levels is also a problem. In order to address these problems, a 26 MVA transformer is proposed to be installed at this grid station, replacing the existing 13 MVA transformer.

No additional land will need to be acquired for the proposed works art the grid station, since no new line bay or transformer bay will be added, and the new transformer will use the exiting bay.

3.3.26 Transmission Line to Feed Bahawalpur Cantt. Grid Station

The Bahawalpur Cantt. grid station is proposed to be established as part of the 6th STG project (see **Section 3.3.1**). The grid station will be fed from the Bahawalpur – Khairpur Tamewali transmission line. For this purpose, a double circuit transmission line will be constructed for the in-out arrangement from the above mentioned transmission line. The length of the proposed transmission line is expected to be about 2 km.

Double circuit transmission line will be constructed on the double circuit towers (one circuit for incoming and the other for out going). For the line length of about 2 km, approximately 6-7 towers would be required (based on average tower-to-tower span of 330 m), though exact quantity would be determined once the detailed route survey is carried out.

3.3.27 Transmission Line to Feed Sahiwal III Grid Station

The Sahiwal III grid station is proposed to be established as part of the 6th STG project (see **Section 3.3.4**). The grid station will be fed from the Tandlianwala – Sahiwal Old transmission line. For this purpose, a double circuit transmission line will be constructed for the in-out arrangement from the above mentioned transmission line. The length of the proposed transmission line is expected to be less than a kilometer, since the existing line passes quite close to the proposed site for the grid station.

Double circuit transmission line will be constructed on the double circuit towers (one circuit for incoming and the other for out going). In view of the short distance, only one or maximum two towers would be required for the proposed transmission line.

3.3.28 Transmission Line to Feed Jail Road (Multan) Grid Station

The Jail Road grid station is proposed to be established in Multan as part of the 6th STG project (see **Section 3.3.2**). The grid station will be fed from the MESCO – Qasimpur transmission line. For this purpose, a double circuit transmission line will be constructed for the in-out arrangement from the above mentioned transmission line. The length of the proposed transmission line is expected to be less than a kilometer, since the existing line passes quite close to the proposed site for the grid station.

Double circuit transmission line will be constructed on the double circuit towers (one circuit for incoming and the other for out going). In view of the short distance, only one or maximum two towers would be required for the proposed transmission line.

3.3.29 Transmission Line to Feed Suraj Miani Grid Station

The Suraj Minai grid station is proposed to be established in Multan as part of the 6th STG project (see **Section 3.3.3**). The grid station will be fed from the Multan Industrial Estate – Bosan Road transmission line. For this purpose, a double circuit transmission line will be constructed for the in-out arrangement from the above mentioned transmission line. The length of the proposed transmission line is expected to be a few kilometers.

Double circuit transmission line will be constructed on the double circuit towers (one circuit for incoming and the other for out going). Assuming the line length as about 5 km, approximately 15-16 towers would be required (based on average tower-to-tower span of 330 m), though exact quantity would be determined once the detailed route survey is carried out.

3.3.30 Transmission Line to Feed Mukhdumpur Grid Station

The Makhdumpur grid station is proposed to be established as part of the 6th STG project (see **Section 3.3.5**). The grid station will be fed from the Kabirwala – Shorkot transmission line. For this purpose, a double circuit transmission line will be constructed for the in-out arrangement from the above mentioned transmission line. The length of the proposed transmission line is expected to be about 13 km.

Double circuit transmission line will be constructed on the double circuit towers (one circuit for incoming and the other for out going). For the line length of about 13 km, approximately 40-42 towers would be required (based on average tower-to-tower span of 330 m), though exact quantity would be determined once the detailed route survey is carried out.

3.3.31 Transmission Line to Feed Head Sidhnai Grid Station

The Head Sidhnai grid station is proposed to be upgraded as part of the 6th STG project (see **Section 3.3.6**). The grid station will be fed from the Kabirwala – Shorkot transmission line. For this purpose, a double circuit transmission line will be constructed for the in-out arrangement from the above mentioned transmission line. The length of the proposed transmission line is expected to be about 15 km.

Double circuit transmission line will be constructed on the double circuit towers (one circuit for incoming and the other for out going). For the line length of about 15 km, approximately 45-47 towers would be required (based on average tower-to-tower span of 330 m), though exact quantity would be determined once the detailed route survey is carried out.

3.3.32 Transmission Line to Feed Lal Sohanra Grid Station

The Lal Sohanra grid station is proposed to be converted as part of the 6th STG project (see **Section 3.3.7**). The grid station will be fed from the Bahawalpur – Khairpur Tamewali transmission line. For this purpose, a double circuit transmission line will be

constructed for the in-out arrangement from the above mentioned transmission line. The length of the proposed transmission line is expected to be about 2 km.

Double circuit transmission line will be constructed on the double circuit towers (one circuit for incoming and the other for out going). For the line length of about 2 km, approximately 6-7 towers would be required (based on average tower-to-tower span of 330 m), though exact quantity would be determined once the detailed route survey is carried out.

3.3.33 Kahror Pecca – Lal Sohanra Transmission Line

The Lal Sohanra grid station is being converted to 132-KV system during the proposed project, as described in **Section 3.3.7** above. The grid station will be supplied from the Bahawalpur – Khairpur Tamewali transmission line. In order to provide the second source, and to complete the ring, a 132-KV transmission line will be constructed between the 132-KV Kahror Pecca grid station.

Single circuit transmission line will be constructed on double circuit towers. For the proposed line length of about 30 km, about 100 towers would be required (based on average tower-to-tower span of 330 m), though exact quantity would be determined once the detailed route survey is carried out.

3.3.34 Lal Sohanra – Khairpur Tamewali Transmission Line

The Khairpur Tamewali gird station is proposed to be converted to 132-KV system, as described in **Section 3.3.8** above. A 132-KV transmission line will need to be constructed from Lal Sohanra, in order to feed the converted Khairpur Tamewali grid station.

Single circuit transmission line will be constructed on double circuit towers. For the proposed line length of about 25 km, about 75 towers would be required (based on average tower-to-tower span of 330 m), though exact quantity would be determined once the detailed route survey is carried out.

3.3.35 Khairpur Tamewali – Hasilpur Transmission Line

The 132-KV Hasilpur grid station receives power from the existing transmission line. In order to complete the ring, and provide a second power sources, a 132-KV transmission line is proposed to be constructed between Kahirpur Tamewali and Hasilpur grid stations.

Single circuit transmission line will be constructed on double circuit towers. For the proposed line length of about 30 km, about 100 towers would be required (based on average tower-to-tower span of 330 m), though exact quantity would be determined once the detailed route survey is carried out.

3.3.36 Transmission Line between Kot Addu and Chowk Azam

A single circuit 132-kV transmission line exists between the Kot Addu and Chowk Azam grid stations. Another 132-kV circuit is proposed to be constructed between these two grid stations, as mentioned in **Section 3.3.8**. Since double circuit towers have been used

for the existing single circuit line, no additional towers would be required for the proposed second circuit. The length of the line is about 106 km.

3.3.37 ELR Works

The power distribution system in the MEPCO network is generally heavily loaded resulting in low voltage, high distribution losses, and high rate of transformer failure. The quality of the power supply to the consumer particularly at the tail end of the feeders is very poor.

The reasons for high distribution transformer failure include over-loading due to growth in number of consumers and electricity demand. The lengthy feeders particularly in the rural areas are also a reason for high distribution losses and low-voltage. Yet another issue concerning the distribution is the congested HT and LT lines in dense urban centers and narrow streets, posing a serious threat to life and property.

In order to solve the above problems, the following ELR activities have been included in the proposed project to be undertaken during 2006-07:

- New HT lines: 65 km
- Re-conductoring of HT lines: 77 km
- HT capacitors: 30
- HT panels: 12
- Replacement of earthing: 672
- HT cables: 1 km
- Replacement of 'D' fittings: 2,100
- Transformers for LT proposals: 250
- Conversion of LT feeders: 28 km
- Transformer augmentation: 250
- New LT lines: 43 km
- LT line re-conductoring: 72
- Energy meters: 43,900
- PVC cables: 512 km
- Connectors: 32,568.

3.4 Construction Activities

3.4.1 Grid Stations

The sequence of activities which are carried out for the establishment of a new grid station is provided below.[3]

- First of all, the location where the new grid station should be established is identified. This is carried out on the basis of load on the existing feeders, load on the nearby existing grid stations, lengths of the existing feeders, trend of the load growth and future outlook of the area.
- After the broad identification of the required location, availability of land is determined. Usually, 3 candidate sites are identified at this stage.
- In order to make the final selection, a committee of concerned departments (usually GSO, GSC and Planning) is constituted. After conducing the site inspection, the site of the proposed grid station is finalized.
- Land is acquired through the district/city administration (now district government), following the procedure laid down in the Land Acquisition Act. **Exhibit 3.8** provides a summary of the land take for the proposed project. (Land for the proposed project will be purchased directly from the landowners, as discussed later.)
- The site is surveyed and its contour plan developed. This activity is carried out by the GSC department. Soil survey and geo-technical investigations are also carried out at this stage.
- The contour plan and result of the above investigations are sent to the Design Department.
- The Design Department prepares the detailed design of the grid station, including the civil design, construction drawings, general layout plan and equipment details.
- Once the civil design is available, estimates are prepared and approvals obtained from the concerned authority.
- Subsequent to the above, tendering and contract awarding is carried out for the civil construction.
- Parallel to the civil works, the grid station equipment (transformers, breakers, isolators, control panels, feeder panels and allied equipment) is obtained from the central stores.[4]
- The equipment is handed over to GSC Department, who installs it once the civil works are complete.

[3] Because of the on-going re-structuring of WAPDA into the DISCOs and NTDC, some of the existing procedures and responsibilities do need to be redefined. Some of the functions which used to be centralized need to be distributed/replicated in the individual DISCOs.

[4] For all future projects, DISCOs will be responsible for the procurement of all equipment and store.

- Once the installation is complete, the system is tested jointly by the GSO and GSC departments.
- After the testing, the grid station is commissioned and put into operation.

For the proposed project, some of the grid station works can be implemented through turn-key contract, where the contractor is responsible for the supply, installation and commissioning of the entire grid station.

Furthermore, in view of the extent of the works under the proposed project, MEPCO may employ a supervision consultant, in order to ensure quality of the construction, installation and testing works.

3.4.2 Laying of Transmission Line and Feeders

The sequence of activities which are carried out for the laying of transmission lines and 11-kV feeders is provided below.

- First of all a reconnaissance site visit is carried out by the GSC Department in order to determine feasible routes for the transmission line.
- Three candidate routes are marked on the map, and sent to the Design Department.
- The Design Department approves one of the routes.
- The GSC carries out detailed survey (plain tabling as well as profiling) of the approved route.
- The results of the detailed survey are sent to the Design Department.
- The Design Department prepares the detailed design.
- Material is procured after tendering.
- Tendering for the construction works is carried out and contract awarded.
- Construction activities are started by demarcating the tower locations. Compensation is determined and disbursed in accordance with the WAPDA procedures.
- Construction of the tower foundation is taken in hand. Towers are erected subsequent to this.
- Once towers are erected, stringing is carried out and accessories (insulators, etc.) installed.
- Once installation is complete, testing is carried out. After that the line is commissioned and put into operation.

3.5 Operation and Maintenance Activities

The operation and maintenance (O&M) activities of grid stations and transmission lines are briefly described below.

- Operation Activities

- The grid stations are manned round the clock and important parameters (voltage, load, power factor, etc.) monitored. Daily log sheets are filled recording the key data.
- Any abnormality is recorded and concerned departments informed for taking remedial measures.
- Scheduled Maintenance
- Checking/testing of transformers
- Testing of breakers
- Testing of protection system
- Transmission line patrolling
- Washing/replacement of insulators
- Emergency Maintenance
- Locating the fault
- Carrying out repairs or replacements
- Restoring the system to the normal operating conditions.

Maintenance of Transformers

Power transformer repairs: The minor repairs for the power transformers are carried out at the grid stations, however for the major repairs, the transformers are transported to the WAPDA's Power Transformer Reclamation Workshop at Kot Lakhpat, Lahore. MEPCO, much like the other DISCOs, intends to utilize the same facility in the future as well.

Distribution transformer repairs: No field repair is allowed for the distribution transformers. If the transformers are damaged within the warranty period (usually 2 years after delivery), they are returned to the suppliers. If damaged after this period, the transformers are sent to the Distribution Transformer Reclamation Workshops located in Lahore and Multan.

Transformer oil testing: The dielectric strength of the transformer oil filled in the power transformers is tested every year at the gird stations. For this purpose, a simple device called the oil testing set is used. Oil sample is taken out of the transformer and test performed. A record is maintained for these yearly tests. No action is taken if the test results are within the prescribed limits. However, if the dielectric strength of the transformer oil is found to be less than the allowable limits, the oil is replaced.

After every five years, a more comprehensive test is carried out for the transformer oil. Three oil samples are taken from each transformer and sent to the WAPDA's High Voltage and Research Laboratory in Faisalabad. At the Laboratory, the following tests are carried out:

- Flash point;
- Viscosity;

- Moisture;
- Gas content; and
- Dielectric strength.

Currently, no tests are performed to check the presence of poly-chlorinated biphenyl (PCB) in the transformer oil, though the transformer specifications include a clause that the oil should be PCB-free.

Transformer Oil Disposal: The transformer oil is mostly recycled in the transformer workshops. The unusable waste oil is disposed through contractors. WAPDA procedures include a list of approved firms for the disposal of the used transformer oil.

Not much is known about the fate of the waste oil leaving the workshops, however the probable end uses include burning in brick kilns, oil recycling facilities, miscellaneous works in small workshops and even as a massaging oil (thought to be useful for joint pains).[5]

[5] Assessment of the waste disposal practices in the transformer maintenance workshops was not included in the scope of the present study. The information given here is mostly based upon the anecdotal sources.

Exhibit 3.1: MEPCO's Technical Profile

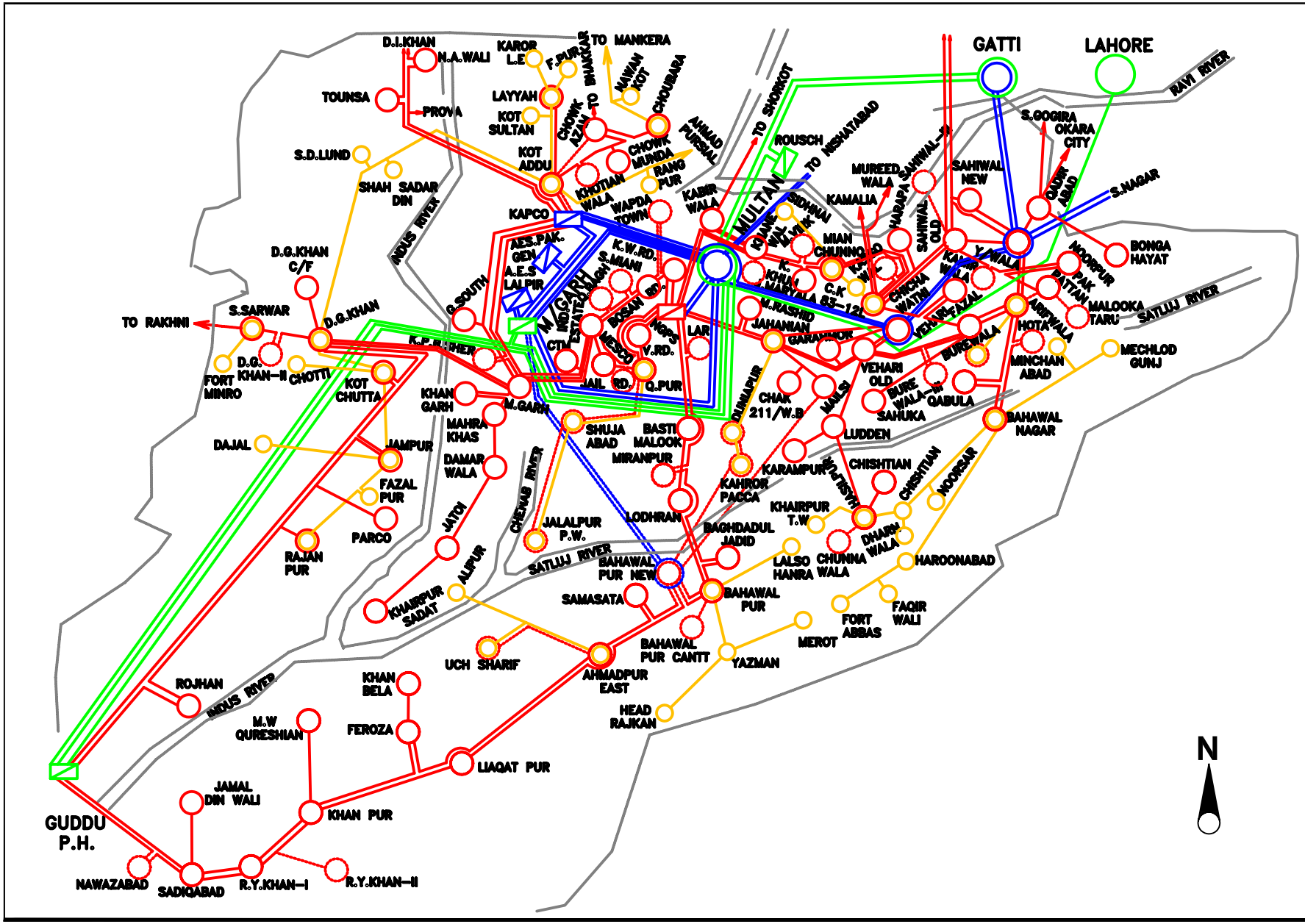
132 kV grid stations (numbers)	71
66 kV grid stations (numbers)	31
33 kV grid stations (numbers)	1
Peak load demand (MW) (2002-03)	1,431
Peak load demand (MW) (2003-04)	1,598
Units purcahsed (GWh) 2003-04	8,728
Units sold (GWh) 2003-04	7,246
Transmission line (km) (132 kV)	2,573
Transmission line (km) (66 kV)	1,479
Transmission line (km) (33 kV) [6]	45
HT lines (km)	45,750
LT lines (km)	31,100
11 kV feeders (numbers)	817
Distribution transformers (numbers)	79,923
Distribution transformation capacity (MVA)	4,211
Domestic consumption (GWh) (2003-04)	3,416
Domestic consumers (numbers) (2003-04)	2,127,360
Commercial consumption (GWh) (2003-04)	372
Commercial consumers (numbers) (2003-04)	306,210
Industrial consumption (GWh) (2003-04)	2,085
Industrial consumers (numbers) (2003-04)	29,775
Agricultural consumption (GWh) (2003-04)	1,221
Agricultural consumers (numbers) (2003-04)	37,986

Source: State of Industry Report 2005. National Electric Power Regulatory Authority.

[6] The transmission line has been designed for 132-kV, however it is being operated at 33 kV.

Exhibit 3.2: MEPCO System

(Please see the following page.)



LEGEND

	EXISTING		PROPOSED	
	GRIDS	LINES	GRIDS	LINES
1–500KV				
2–220KV				
3–132KV				
4–66KV				

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source:

Title:

MEPCO System

Ref: MEPCO-MP-001

Date: February 2006

Exhibit 3.3: Transmission Lines in MEPCO's Area

Transmission Line	Rout Description
Double Circuit 132 kV	■ From Yusufwala to Sahiwal Old Grid Station ■ From NGPS (Multan) to Qasimpur via Vehari Road Grid Station ■ From Sahiwal Old to NGPS (Multan) via Chichawatni, Mian Channu and Khanewal Grid Stations ■ From NGPS (Multan) to Khanewal Road and Bosan Road; and Industrial Estate Grid Stations ■ From Kot Addu to Muzaffargarh, Dera Ghazi Khan and Guddu ■ From NGPS (Multan) to Bahawalpur, Khanpur, Rahim Yar Khan, Sadiqabad and Guddu. ■ From NGPS (Multan) to Jehanian, Vehari New, Vehari Old and Burewala
Single Circuit 132 kV	■ From Jehanian to Chak 211 and Mailsi. ■ From Vehari to Ludden, Hasilpur and Chishtian. ■ From Burewala to Sahuka ■ From Chichawatni to Shaeikh Fazal and Burewala. ■ Form Sahiwal Old to Noor Pur and Pakpattan. ■ From Khanpur to MIanwali Qureshian. ■ From Sadiqabad to Jamaldinwali. ■ From D. G. Khan to Cement Factory and Sakhi Sarwar ■ From Muzaffargarh to Khan Garh, Mehra Khas, Damarwala, Jatoi Janubi and Khairpur Sadat. ■ From NGPS (Multan) to Industrial Estate and Colony Textile Mills ■ From KAPCO to Dera Ismail Khan (NWFP) via Taunsa ■ From Kot Addu Old to Dera Ismail Khan via Noor Ahmad Wali.
Single Circuit 66 kV	■ From Arifwala to Burewala Old ■ From Chichawatni to Chak 83/12L, Minchanabad and Sidhnai. ■ From Bahawalnagar to Haroonabad, Faqirwali and Fort Abbas. ■ From Hasilpur to Minchanabad and Macleod Ganj; Noor Pur, Chishtian. ■ From Qasimpur to Shujabad and Jalapur Pirwala. ■ From Bahawalpur to Lal Sohanra; Yazaman and Marrot.

Exhibit 3.4: Grid Stations in MEPCO's Area

132-kV

- Ahmad pur East
- Arif Wala
- Baghdad-ul-Jadeed
- BahawalNagar
- Bahawalpur
- Basti Malook
- Bonga Hayat
- Bosan Road Multan
- Burewala
- Chak 211/WB
- Chichawatni
- Chishtian
- Choubara
- Chowk Azam
- Chowk Munda
- D.G.Khan
- Dammarwala
- Feroza
- Garha More
- Gujrat South
- Harrapa
- Hasilpur
- Industrial Estate Multan
- Jahanian
- Jamal Din Wali
- Jampur
- Jatoi Janubi
- Kabirwala
- Kacha Khu
- Karam Pur
- Karor Pacca
- Khairpur Sadat
- Khan Bela
- Khan Garh
- Khanpur
- Khanewal
- Khanewal Road Multan
- Kot Addu
- Kot Chutta
- Layyah
- Liaquat pur
- Lodhran
- Luddan
- Mahra Khas
- Mailsi
- Makhdoom Rashid
- MESCO Multan
- Mian Channu
- Mianwali Qureshian
- Muzaffargarh
- Noor Ahmad Wali
- Noor Pur
- Pakpattan
- Qaboola
- Qadir Abad
- Qasimpur Multan
- R.Y.Khan I
- R.Y.Khan-II
- Rajanpur
- Rojhan
- Sadiqabad
- Sahiwal New
- Sahiwal Old
- Sahuka
- Sakhi Sarwar
- Sama Satta
- Sheikh Fazil
- Shujabad
- Taunsa Sharif
- Vehari
- Vehari Road Multan

Exhibit 3.5: Grid Stations in MEPCO's Area

66-kV and 33 kV

66 kV

- Ali Pur
- Burewala
- Chak 83/12L
- Chishtian
- Choti
- Dahranwala
- Dajal
- Dunyapur
- Faqirwali
- Fatehpur
- Fazil Pur
- Fort Abbas
- HaroonAbad
- Head Rajkan
- Head Sidhnai
- Jalalpur Pirwala
- Jampur
- K.P Tame Wali
- Karor Lal Eason
- Kot Sultan
- Lal Sohanra
- Marrot
- Mcload Gunj
- Minchinabad
- Nawan Kot
- Noor Sur
- Rangpur
- Shah Sadar Din
- Shahdan Lund
- Uch Sharif
- Yazman

33 kV

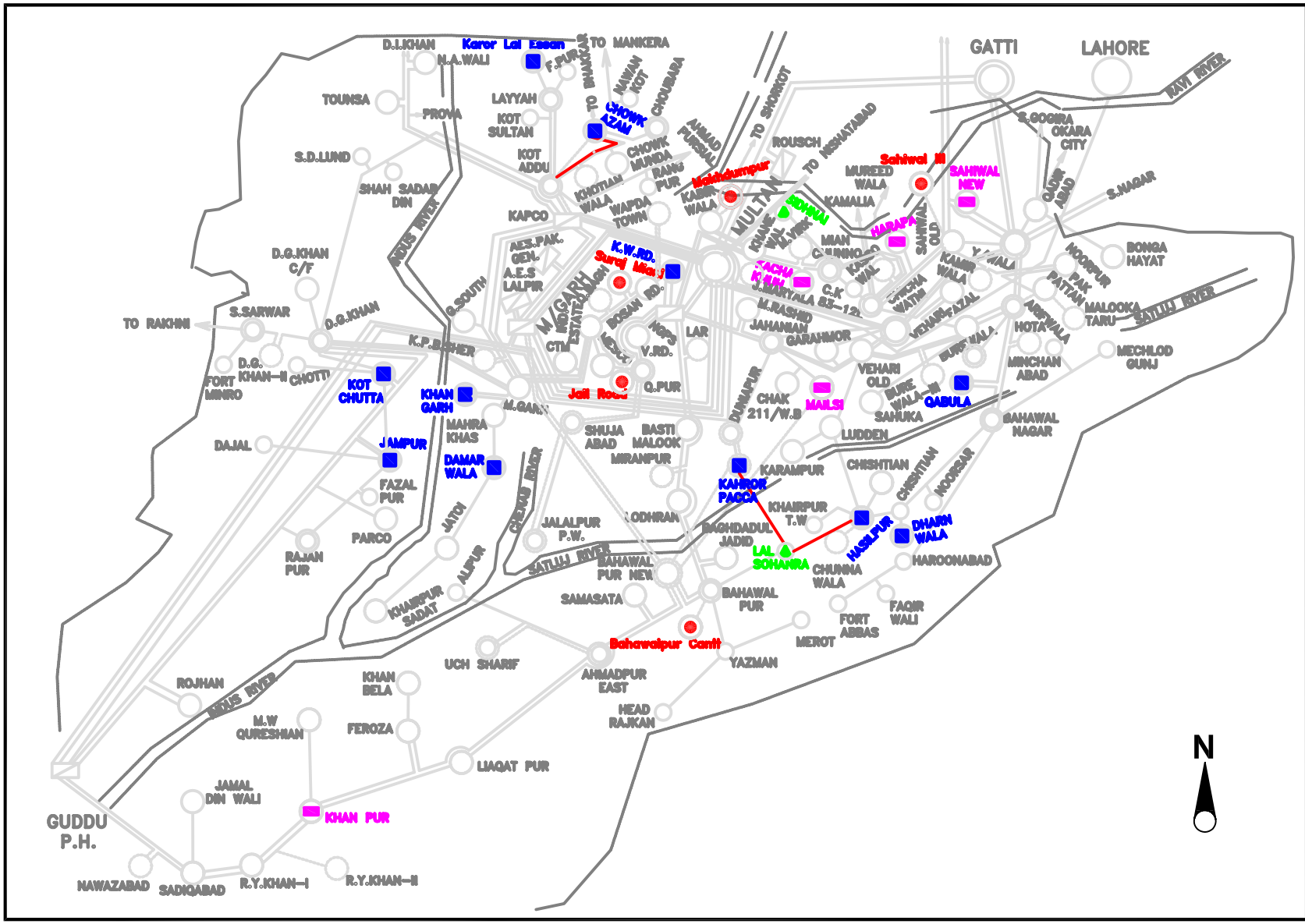
- Fort Munro

Exhibit 3.6: HT (11 kV) Feeders in MEPCO's Area

Circle	Quantity of Feeders
Multan	174
Dera Ghazi Khan	95
Vehari	77
Bahawalpur	108
Sahiwal	100
Rahim Yar Khan	80
Muzaffargarh	121
Bahawalnagar	62
Total	**817**

Exhibit 3.7: Project Components

(Please see the following page.)



LEGEND

- New Grid Station
- Conversion
- Extension
- Augmentation
- New Transmission Line

Assignment:	ESA
Project:	6th STG and ELR
Client:	MEPCO
Source:	Data Provided by MEPCO
Title:	**Project Components**
Ref:	MEPCO-MP-000
Date:	July 2006

Exhibit 3.8: Land to be Acquired for Project

Description	Land Take	Number of Landowners/Affectees
New grid stations (qty: 5)	20 acres (4 acres for each grid station) permanent land take	4 (Bahawalpur grid station is being established on State land)

4 Description of the Environment

This Chapter describes the environmental conditions of the project area before the commencement of the proposed activities. The environmental baseline in this Chapter addresses the physical and biological aspects of the project area.

Since the proposed project components are located in different parts of the MEPCO area (see **Exhibit 3.7** for the location of project components), a generic overview of the environmental conditions of this entire area is presented. A more specific description of the immediate surroundings of various project components is provided separately, where appropriate. This site specific description is augmented by the schematic diagram of the grid station locations as well as transmission line routes - provided at the end of this Chapter, and photographs – provided in **Appendix C** of this report. In view of the absence of any major development activities underway at or around the project sites or any other natural/anthropogenic phenomenon, the environmental conditions of the project sites are unlikely to experience any significant change before the project commencement.

4.1 Physical Environment

4.1.1 Physiography and Geology

On the basis of the physical environment and geology, the project area falls in the Indus Basin (Atlas of Pakistan, 1997), which is briefly described below.

The Indus Plain essentially forms the western extension of Indo-Gangetic Plain, and has been made up of the silt brought by the Indus and its numerous tributaries, such as Jhelum, Chenab, Ravi and Sutlej on the east bank, and Kabul, Kurram, Tochi, and others on the west bank. The Indus Plain is known for its agricultural fertility and cultural development throughout history.

The left bank tributaries of the Indus River al meet at Panjnad and flow as one large stream for about 75 km before joining the Indus at Mithankot, and south of it, the Indus flows almost alone up to the Arabian Sea without receiving any noticeable tributary.

The average annual discharge of the Indus – 92 million acre feet at Attock Khurd – is much higher than the combined discharge of its tributaries. There is a great fluctuation in their seasonal discharge, especially in the hot summer and rainy season. Almost all of its tributaries and the Indus itself have their sources in snow and glaciated areas of Himalayan, Karakoram and Hindukush mountain systems.

On the basis of hydrology and land form, the Indus Plain can be divided into the upper and lower Indus Plains.

The Upper Indus Plain (where the project area is located) differs from the Lower Indus Plain primarily because of the major tributaries (Jhelum, Chenab, Ravi and Sutlej) divide the land surface into several interfluves or ‘doabs’. The two plains are separated by a narrow corridor near Mithankot where the Sulaiman range approaches the Indus River.

The Upper Indus Plain is sub-divided into four interfluves plus the Bahawalpur plain and the Sulaiman piedmont. The major interfluves are:

- the Sindh Sagar Doab or Thal, between Jhelum and Indus rivers
- the Chaj Doab, between Jhelum and Chenab rivers
- the Rachna Doab, between Ravi and Chenab rivers
- the Bari Doab, between Ravi and Sutlej rivers.

The entire project area falls in the Upper Indus Plain.

Geological Setting: The prevailing geologic conditions in the region are the results of extensive inundation, depositions, coastal movements, and erosions over a long period of time in the geological ages. The geology of the region is closely related to the formation process of Himalayan ranges resulting in intense deformation with complex folding, high angle strike-slip faults and crust thickening expressed in a series of thrust faults. The important tectonic changes which have had so much influence in the region are feebly visible particularly in the Indus Plain, and it is only by considering the geology on a broader regional scale, as well as in site specific detail, that the effects can be appreciated.

4.1.2 Meteorology and Climate

Meteorology

The climate of most parts of the Project Area is arid to semi-arid characterized by four district seasons in a year, that is, winter from Mid-November to February, spring during March and April summer from May to Mid-September and autumn from Mid-September to Mid-November. There exist several meteorological stations in the project area; data recorded at some of these stations is provided in the following sections.

Temperatures

June is the hottest month in most parts of the project area, with mean daily maximum temperature recorded as 42.4 °C.[1] January is the coldest month in the area, with the mean daily minimum temperature recorded as 4.4 °C.[2]

Mean daily maximum and mean daily minimum temperatures of various districts in the project area are presented in **Exhibits 4.1** and **4.2**, respectively.[3] In view of the very small differences among these temperatures, this data can be taken as representative for the entire project area.

Rainfall

Average annual rainfall in the project area ranges between 97 mm and 261 mm. Maximum rainfall (about 60% of the total annual) occurs during the Monsoon season

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1 Recorded in Rahim *Yar* Khan.

2 *Recorded in Rahim Yar Khan.*

3 *Temperature Normals* recorded for the period 1961 to 1990. Source: District Census Reports. (*Normals* for the period subsequent to 1990 are not published yet.)

(July, August and September), while the period of minimum rainfall or drier period is October and November.

Mean monthly rainfall data of various locations within the project area is provided in **Exhibit 4.3**.[4]

Humidity

July, August and September are the most humid months in the area, whereas May and June are the least humid months. Average monthly relative humidity (RH) values at various locations in the project area are provided in **Exhibit 4.4**.[5]

Climate

Pakistan's latitudinal and longitudinal extents and its northern rim of lofty mountains, are the two factors, which have a great bearing not only on the temperature and rainfall patterns, but also on the general circulation of the atmosphere on the southern Asia.

Climate of Pakistan according to Koppen's classification[6] falls under the following five types:

Tropical Semi-arid with Dry Winter: This climate type prevails in Karachi, Hyderabad, and southern Khairpur Division. The mean annual temperature is above 18 °C.

Tropical Arid: This is characterized by average annual temperature of about 18 °C with dry winters. This includes southern Kalat and whole of the Indus Plain.

Cold Semi-arid With Dry Summer: This climate type covers central Kashmir, Peshawar, D.I. Khan, Quetta and northern half of Kalat Division.

Snow Forest Climate: This climate type is characterized by average temperature of coldest month below 0 °C. Mean temperature of the warmest month is between 10 and 22 °C. It includes northern mountainous areas and parts of Kashmir.

Extreme Cold: Having average temperature of the warmest months between 10 and 0 °C. It comprises eastern and northern parts of Kashmir, Chitral, Gilgit and Laddakh.

Based upon the above classification, most parts of the proposed project area are included in the Tropical Arid climate zone.

Ambient Air Quality

The project locations where the air pollution is likely to be exceeding the acceptable limits include the following:

- Suraj Miani grid station
- Feed for the above
- Khanewal Road grid station (Multan).

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4 Rainfall *Normals recorded* for the period 1961 to 1990. Source: District Census Reports. (*Normals* for the period subsequent to 1990 are not published yet.)

5 Humidity *Normals* recorded for the period 1961 to 1990. Source: District Census Reports. (*Normals* for the period subsequent to 1990 are not published yet.)

6 *Climatic Regions of West* Pakistan, Pakistan Geographical Review. Kazi, S. A.,1952.

The primary source of air pollution at the above sites is the vehicular emissions, and the key pollutants likely to be found at these locations include carbon monoxide (CO), oxides of nitrogen (NO_X), sulfur dioxide (SO_2), and particulate matter (PM). A typical air quality data for some urban centers in the country is presented in **Exhibit 4.5**, which can be used as a generic ambient air quality baseline for these locations.[7]

The remaining project components (grid stations sites and transmission line routes) are located well outside the metropolitan centers. There does not exist any large industry or any other significant pollution source near these sites/routes either. As a result, the ambient air quality of these sites is expected to be well within the acceptable limits, and no major criteria pollutants are likely to be found in excess of the limits prescribed by national and international standards (see **Section 2.2.3** for the ambient air quality and emission standards).

4.1.3 Surface Water Resources

The River Indus and its tributaries constitute the surface water resources of the area. These are shown in **Exhibit 4.6**, and briefly described below.

Indus River: The Indus River and its tributaries are the main source of surface water in the project area (and in the country). The Indus rises in Tibet, at an altitude of about 18,000 feet (5,486 m) amsl, and has a total catchment area of 654,329 km^2. Length of the Indus River in the country is about 2,750 km. Five main rivers that join the Indus from the eastern side are Jhelum, Chenab, Ravi, Beas and Sutlej. Besides these, two minor rivers - Soan and Harrow also drain into the Indus. On the western side, a number of small rivers join Indus, the biggest of which is River Kabul with its main tributaries i.e. Swat, Panjkora and Kunar. Several small streams such as Kurram, Gomal, Kohat, Tai, Tank, etc also join the Indus on the right side.

The Indus River exhibits great seasonal variations, with more than 80% of the total annual flow occurring during the summer months, peaking in June, July and August. **Exhibit 4.7** presents flow data of the Indus.

The Indus River and its tributaries on an average bring about 154 MAF of water annually. This includes 144.9 MAF from the three western rivers and 9.14 MAF from the eastern rivers. Most of this, about 104.7 MAF is diverted for irrigation, 39.4 MAF flows to the sea and about 9.9 MAF is consumed by the system losses which include evaporation, seepage and spills during floods. The flows of the Indus and its tributaries vary widely from year to year and within the year. As is the case with the water availability there is significant variation in annual flows into sea.

Chenab River: The Chenab River is one of the major left bank tributaries of the Indus River. The River Chenab originates in the Kulu and Kangra districts of the Himachal Pardesh province of India, at an elevation of about 16,000 feet (4,877 m) amsl. The total length of the river is about 1,242 km, of which approximately 729 km flow through Pakistan. The total catchment area of the river is about 67,430 km^2, of which 28,166 km^2 lie in the State of Jammu and Kashmir, 4,494 km^2 in India and 34,885 km^2 in Pakistan.

[7] A site-specific air quality baseline will be established before site mobilization at each grid station site (further discussed in EMP later in the document).

Water discharge of the Chenab starts rising in the later part of May and pass the 50,000 cusecs mark in June. A high flow above 50,000 cusecs continues till the middle of September, the peak discharge months being July and August. **Exhibit 4.7** presents flow data of the Chenab River.

Ravi River: The Ravi River is the smallest of the five main eastern tributaries of the Indus. It rises in the basin of Bangahal, India, and has a total catchment area of about 40,769 km^2. Length of the river in Pakistan is about 679 km. India has the full rights over the Ravi waters in accordance with the Indus Basin Water Treaty of 1960, and diverts all of its base flow for irrigation purposes.

Sutlej River: This Sutlej River originates in Western Tibet in the Kailas mountain range, near the source of the Indus, the Ganges and the Bhramaputra. It flows through the Panjal and Siwalik mountain ranges and then enters the plains of Indian Punjab. The total length of the river is about 1,551 km of which only 529 km runs in Pakistan. The total catchment area of the River is about 106,728 km^2. India has full rights over Sutlej waters as well, according to the Indus Basin Water Treaty.

Hill Torrents: A distinct feature of the hilly areas of the Indus left bank (districts Dera Ghazi Khan and Rajanpur in the MEPCO area; see **Exhibit 1.1**) is the presence of hill torrents, which drain the western hilly areas towards the Indus River in the east. Most of these surface drains experience nominal flow, if any, during the dry weather. However, during the rainy seasons, sudden, high and gushing flows occur, causing flash floods in the downstream areas.

Rivers Water Quality: The water quality of Indus River and its tributaries is generally considered excellent for irrigation purposes. The total dissolved solids (TDS) range from 60 mg/l in the upper reaches to 375 mg/l in the lower reaches of the Indus, which are reasonable levels for irrigated agriculture and also as raw water for domestic use. The disposal of saline drainage from various irrigation projects has been a major factor in the increased TDS in the lower reaches of the rivers in the Punjab. There is progressive deterioration downstream and the salinity is at its maximum at the confluence of the Chenab and Ravi rivers, where the TDS ranges from 207 to 907 mg/l. A slight improvement in water quality is noted further downstream at Panjnad due to dilution from the inflow from Sutlej River. The quality of the Indus water at Guddu, however, is within acceptable limits for agriculture; TDS being in the range of 164-270 mg/l.

In the upper reaches of the Indus River, the Dissolved Oxygen (DO) content remains above 8.5 mg/l which is well above the acceptable levels of 4 mg/l. The Biochemical Oxygen Demand (BOD) downstream of Attock has been recorded as 2.9 mg/l. At Kotri, it has a SS content of 10 to 200 mg/l. Indus River water quality has been studied at the Dadu Moro Bridge and Kotri Barrage, with nitrate levels at 1.1 and 7.5 mg/l, phosphate at 0.02 and 0.3 mg/l, BOD at 2.4 and 4.1 mg/l, faecal coliforms at 50 and 400 per ml, and aluminum at 1.8 and 0.2 mg/l respectively. Due to industrial waste discharges from Punjab and Sindh, a high content of heavy metals such as nickel, lead, zinc and cadmium have also been found in Indus water.

4.1.4 Groundwater Resources

The Indus Basin was formed by alluvial deposits carried by the Indus and its tributaries. It is underlain by an unconfined aquifer covering about 15 million acres (60,700 km^2) in surface area. In the Punjab, about 79% of the area and in Sindh, about 28% of the area is underlain by fresh groundwater. This is mostly used as supplemental irrigation water and pumped through tubewells. Some groundwater is saline. Water from the saline tube wells is generally put into drains and, where this is not possible, it is discharged into large canals for use in irrigation, after diluting with the fresh canal water.

Before the introduction of widespread irrigation, the groundwater table in the Indus Basin varied from about 12 m in depth in Sindh and Bahawalpur areas to about 30 m in Rechna Doab (the area between Ravi and Chenab Rivers). After the introduction of weir-controlled irrigation, the groundwater table started rising due to poor irrigation management, lack of drainage facilities and the resulting additional recharge from the canals, distributaries, minors, water courses and irrigation fields. At some locations, the water table rose to the ground surface or very close to the surface causing water-logging and soil salinity, reducing productivity.

In the late 1950s, the Government of Pakistan embarked upon a program of Salinity Control and Reclamation Project (SCARP) wherein large deep tube wells were installed to control the groundwater table. Over a period of about 30 years, some 13,500 tubewells were installed by the Government to lower the groundwater table. Of these, about 9,800 tube wells were in the Punjab.

The SCARP project initially proved to be quite effective in lowering the water table but with time, the performance of the SCARP tubewells deteriorated. The development of deep public tube wells under the SCARP was soon followed by private investment in shallow tube wells. Particularly in the eighties, the development of private tube wells received a boost, when locally manufactured inexpensive diesel engines became available. Most of these shallow tube wells were individually owned.

In the last 25-30 years, ground water has become a major supplement to canal supplies, especially in the Upper Indus Plain, where ground water quality is good. Large scale tubewell pumpage for irrigation started in the early sixties. There are presently more than 500,000 tubewells in the Indus Basin Irrigation System (IBIS). According to a study, the total groundwater potential in Pakistan is of the order of 55 MAF.

Major part of the groundwater abstraction for irrigation is within the canal commands or in the flood plains of the rivers. However, the amount of abstraction varies throughout the area, reflecting inadequacy/unreliability of surface water supplies and groundwater quality distribution.

The quality of groundwater ranges from fresh (salinity less than 1,000 mg/l TDS) near the major rivers to highly saline farther away, with salinity more than 3,000 mg/l TDS.[8] The general distribution of fresh and saline groundwater in the country is well known and

[8] Site-specific water analyses will be carried out at all the grid station locations and campsites before the mobilization of the contractor/construction crew, in order to establish the baseline conditions.

mapped, as it influences the options for irrigation and drinking water supplies. Generally, the quality and quantity of groundwater in the Indus Basin deteriorate from north to south, and from east to west.

The key water quality parameters of some of the locations in the project area are tabulated in **Exhibit 4.8**.[9]

4.2 Biological Resources

This section provides an overview of the ecozones, wild flora and fauna, and the habitat conditions prevailing in the project area. The description in this section has been prepared on the basis of secondary literature review, and field visits carried out in the area during this ESA and earlier assignments.

4.2.1 Original Ecological Zones of Punjab

At the time of partition three types of ecological zones or habitats prevailed in natural or undeveloped areas of Punjab:

- Tropical thorn forest
- Riverine Tracts
- Tropical Habitat of Thal and Cholistan Deserts

These ecological zones are briefly discussed below.

Tropical Thorn Forest Ecozone

This habitat was the most extensive ecozone of the Indus plain, and currently exists only in places where the land has not been converted for habitation or cultivation. This habitat comprises low forests of thorny and hard-wooded tree species, dominated by *Acacia* spp. The trees of such forests have short boles and low branching crowns. These are usually not close-growth trees hence their canopies touch each other in exceptionally favorable spots. The usual height of the trees is 20-30 feet (6-9 m). Other plants that grow mixed with *Acacia* include *Salvadora, Prosopis, Capparis,* and *Tamarix.* The shrubs of the ecozone included *Calotropis, Zizyphus, Suaed*, while herbs of the area included *Chenopodium, Calligonum, Haloxylon* and various species of grasses.

Mammals usually found in such forest areas included Long-eared Hedgehog, Grey Mongoose, Bengal Fox, Jackal, Wolf, Jungle Cat, Civet Cat, Wild Boar, Desert Jirds and Porcupine.

Birds of the ecozone included Grey Partridge, Peafowl, Common Quail, Ring Dove, Red Turtle Dove, Little Brown Dove, Green Pigeon, Hoopoe, Spotted Owlet, Barn Owl, Dusky Horned Owl, Indian Nightjar, Wryneck, Golden-backed woodpecker, Pied Woodpecker, Wood Shrike, Great Grey Shrike, Rufous-backed shrike, Fantail Flycatcher, Common babbler, Jungle babbler and many other species of passerine birds.

[9] Site-specific water analyses will be carried out at all the grid station locations and campsites before the mobilization of the contractor/construction crew, in order to establish the baseline conditions.

Reptiles of the area included Bengal Monitor Lizard, Garden Lizard, Spiny-tailed Lizard, Cobra, Krait, Vipers and Rat Snake.

Tropical Habitats of Thal and Cholistan Deserts

These deserts are characterized by undulating sand dunes with occasional trees such as *Acacia, Prosopis, Capparis, Tammarix* and small vegetation like *C*alligonum, *Alhagi, Pennisetum* and *Haloxylon.*

The key mammals of these areas include Chinkara Gazelle, Nilgai, Blackbuck, Caracal, Desert Cat, Civet Cat and Desert Fox. Wild birds of the area include Grey Partridge, Houbara Bustard, Great Indian Bustard, Indian Courser, species of Sandgrouse, Little Brown Dove, Shrikes, Larks and Finches.

The key reptiles of the ecozone included Cobra, Krait, Russel's Viper, Saw-scaled Viper, Yellow Varanus and many other small lizard species.

Riverain Tract Habitats

Originally the riverain habitats used to have heavy, seasonal floods. Since forecasting and prior warning were not available to the rural people, these habitats were not occupied for agriculture and habitation. Natural resource exploitation was also not extensive. As a result, this natural flora along the rivers flourished. These included: *Tamarix, Saccharum, populus* and *Acacia. Typha* growth was common wherever the water was stagnant or slow moving.

The mammals of such habitat included Hog Deer, Wild Boar, Fishing Cat, Jungle Cat, Small Indian Civet, Smooth-coated Otter and Indus Blind Dolphin. The wild avifauna of the area included around forty species of Ducks and Geese, Black Partridge, Countless number and species of waders, Purple Moorhen, Common and White-breasted Moorhen, Yellow-eyed Babbler, and several Passerine species. The key reptiles of the area included Monitor Lizard and several species of Turtles.

4.2.2 Modified Nature of Habitat

Major parts of the original habitats described in **Section 4.2.1** above have been modified into new habitats, primarily as a result of extensive cultivation and expanding urban centers as well as rural settlements. These new habitat types are briefly discussed below.

Agricultural Habitats

Most parts of the Punjab are under very intensive irrigated cultivation. In addition, livestock rearing is also practiced extensively, and milk animals are common. The use of the chemical fertilizers and pesticides is very common. Several species of wildlife have adapted to the changed habitat. These include: Jackal; Jungle Cat, Bengal Fox, Small Indian Mongoose, Shrew, Rodent pests including Porcupine, Fruit Bats and Wild Boar. The avifauna which survived the modified habitat include Doves, Black Partridge, Cuckoos, Koel, Woodpeckers, Parakeets, Bulbuls, Babblers, Black Drongo, Bee-eaters, Finches and House Sparrow. The reptilian species of this modified habitat include Krait, Cobra, Saw-scaled Viper, Rat Snake and Monitor Lizard.

In these modified habitats, the winter bird species from Himalayas have reduced due to the extensive use of pesticides in these areas, since these species feed on the insects. These birds play an important role in controlling insects particularly in the forests.

Most of the proposed transmission line routes and some of the grid stations (Makhdumpur and Sahiwal III) are located in this type of habitat.

Rural and Urban Habitats

These include human habitations within agriculture areas, as well as the urban centers. Scavengers like Jackals are attracted to the garbage dumps and human feces for food. House Sparrows breed in the houses. Bank Mynas and Cattle Egrets feed on grasshoppers in the rangelands with cattle and buffalos. Banyan and Peepal trees still grow in villages. Green Pigeons and barbets feed in these trees.

Some of the oldest trees still stand in the old British era colonies. Some rare species of birds such as hornbills, Green Pigeon, Barbets still live on them. Large populations of Pigeons breed in urban houses. Kites, Crows, Mynas, House Sparrows, and Alexandrine Parakeets breed in the urban areas.

Usually Shisham and Acacia trees are planted along side the roads and canals. Mostly Doves breed on such trees.

The grid stations in the Multan City and their feeding transmission lines are located in this type of habitat.

Rakhs and Irrigated Plantations

Rakhs are areas where inundation water reaches and the trees grow in good condition. Usually *Prospis spiciger* may grow with closed canopy. Chichawatni *Rakh* is one such plantation in the project area. Other irrigation plantations in the area are located at Sama Satta and Lal Suhanra. The tree species in such plantations include Shisham, Mulbery, Kikar and Euclayptus. Large number of bird nest in all the plantations. These are also the habitats of Wild Boar, Porcupine, Jackal, Jungle cat, Bengal fox and Monitor Lizard.

No project components are located inside these *rakhs* or plantations.

Wetlands

The wetlands of the region include rivers, canals, ponds and water logged areas. These areas provide great resources for human needs, while providing good habitat for water related species as well. Reeds, water reeds, Typha, Lotus, Water nut and Bladderworts grow in these habitats. These habitats also support a large variety of fish.

Some of the threats these wetlands currently face include: polluted waters in rivers and canals; burning of reed; and cutting of typha for commercial purposes.

4.2.3 Protected Areas

There exist one national park, nineteen wildlife sanctuaries and five game reserves in the project area. A list of these protected areas is provided in **Exhibit 4.9**. However, none of the project components are located inside these areas.

4.3 Environmental Hotspots

In view of the greatly modified nature of the habitats, as described in **Section 4.2.2**, there do not exist any environmental hotspots at or around any of the proposed project components.

4.4 Description of Grid Station Sites and Transmission Line Routes

Salient information of the grid station sites and along different transmission line segments is provided in the following sections

4.4.1 Bahawalpur Cantt. Grid Station Site

The site for the proposed grid station is located along the Yazman Road, a few kilometers south of the Bahawalpur City. The site is lying vacant with no cultivation or habitation over it. The area is generally sandy, with little natural vegetation over it. There exists a small settlement across the Yazman Road. The land is State owned.

See **Section C.1** in **Appendix C** for the photographs of the area.

No significant developmental activities are being undertaken at or around the proposed site.

4.4.2 Feed for Bahawalpur Cantt. Grid Station

The proposed transmission line route runs almost parallel to the Yazman Road. The general land use for most parts of the route is cultivation. The segment adjacent to the proposed site for grid station would pass over the vacant land. There are few structures in the area, and the transmission line will not pass over any settlement.

See **Section C.2** in **Appendix C** for the photographs of the area.

No significant developmental activities are being undertaken along the proposed route.

4.4.3 Jail Road Grid Station Site

The Jail Road grid station is proposed to be built along/near the Muzffargarh Bypass, in the suburbs of the Multan City. The sites[10] considered for the grid station are lying vacant. There exist industrial buildings and cultivation fields in the vicinity of one of the proposed sites. Settlements exist close to the other candidate site. The land is privately owned.

See **Section C.3** in **Appendix C** for the photographs of the area.

No significant developmental activities are being undertaken at or around the proposed site.

4.4.4 Feed for Jail Road Grid Station

The NGPS to Industrial Estate transmission line, which will feed the new grid station, runs at a distance of less than 200 m from the proposed site. The land use along the proposed route of the grid station feed is generally cultivation, though some settlements

[10] MEPCO is considering a couple of *candidate* sites in the same locality.

do exist in the area as well. The feed for the proposed grid station would avoid these settlements.

See **Section C.4** in **Appendix C** for the photographs of the area.

No significant developmental activities are being undertaken along the proposed route.

4.4.5 Makhdumpur Grid Station Site

The site is located about 20 km from Kabirwala, in a rural setup. The general landuse of the area is cultivation. There exist no settlements in the immediate vicinity of the site. No structure is present over the proposed tract of land either.

See **Section C.5** in **Appendix C** for the photographs of the area.

No significant developmental activities are being undertaken at or around the proposed site.

4.4.6 Feed for Mukhdumpur Grid Station

The transmission line feeding the proposed Mukhdumpur grid station would be about 13 km in length, and would pass through the rural area. The general land use in the area is cultivation with scattered settlements. There exist no large towns along the proposed route. The transmission line will be aligned avoiding the settlements.

Exhibit 4.10 presents a schematic diagram of the proposed transmission line route. See photographs of the route in **Section C.6** of **Appendix C**.

No significant developmental activities are being undertaken along the proposed route.

4.4.7 Suraj Miani Grid Station

The proposed site is located along the Suraj Miani Road, in a thickly populated congested area of the Multan City. The general land use in the area is commercial and agricultural. There exist a poultry farm and a few shops adjacent to the site. The land is privately owned.

See **Section C.7** in **Appendix C** for the photographs of the area.

No significant developmental activities are being undertaken at or around the proposed site.

4.4.8 Feed for Suraj Miani Grid Station

The feed for the proposed Suraj Miani grid station would be a few kilometers in length, and would generally pass over the cultivation fields, though there do exist some settlements and other structures in the area as well. Efforts will be made to avoid passing the new transmission line over the settlements.

See **Section C.7** in **Appendix C** for the photographs of the area.

No significant developmental activities are being undertaken along the proposed route.

4.4.9 Sahiwal III Grid Station Site

The proposed site for the Sahiwal III grid station is located just outside the Sahiwal City, in a rural setting. The land use in the area is cultivation; no settlements exist in the immediate vicinity. A brick kiln is located adjacent to the proposed site. The land is privately owned.

See **Section C.8** in **Appendix C** for the photographs of the area.

No significant developmental activities are being undertaken at or around the proposed site.

4.4.10 Feed for Sahiwal III Grid Station

The Tandlianwala to Sahiwal Old transmission line – which will feed the new grid station – runs at a distance of less than 100 m from the proposed site. Therefore, the feed for the proposed grid station will be very short in length, and would pass over the cultivation fields. No settlements or any other structure exists in the area.

See **Section C.8** in **Appendix C** for the photographs of the area.

No significant developmental activities are being undertaken in the area.

4.4.11 Feed for Head Sidhnai Grid Station

The transmission line feeding the Head Sidhnai grid station would be about 15 km in length, and would pass through the rural area. The general land use in the area is cultivation with scattered settlements. There exist no large towns along the proposed route. The transmission line will be aligned avoiding the settlements.

Exhibit 4.11 presents a schematic diagram of the proposed transmission line route. See photographs of the route in **Section C.9** of **Appendix C**.

No significant developmental activities are being undertaken along the proposed route.

4.4.12 Feed for Lal Sohanra Grid Station

The transmission line feeding the Lal Sohanra grid station would be less than 2 km in length. The area has sparse population with few cultivation fields. The new transmission line feeding the Lal Sohanra grid station would cross the railway track and Bahawalpur-Hasilpur road. Due to very sparse population in the area, the transmission line route would be aligned through the vacant land.

See **Section C.10** in **Appendix C** for the photographs of the area.

No significant developmental activities are being undertaken along the proposed route.

4.4.13 Kot Addu – Chowk Azam Transmission Line

The transmission line passes through a settlement in the Kot Addu town, less than a kilometer from the Kot Addu grid station. Beyond this settlement, the general land use is cultivation, with some sparse settlements. The transmission line crosses an irrigation canal between the towers 31 and 32 (about 10 km from the Kot Addu grid station), and the Daira Deen Panah - Chowk Munda Road at tower location 46 (about 15 km from the

grid station). From this point to the tower location 134 (about 44 km from Kot Addu), the transmission line runs roughly parallel to the Daira Deen Panah – Chaowk Munda Road. Beyond this point, the transmission line makes a 90° turn, and runs roughly parallel to the Multan - Mianwali Road. At the tower location 213 (about 70 km from Kot Addu), the transmission line crosses the Multan – Mianwali Road and turns towards northeast. Near the tower location 238 (about 78 km from Kot Addu), the tee-off point for the Chowk Azam grid station exists. From this point, the transmission line runs in the northwestern direction, and reaches the grid station after crossing the Chowk Azam – Jhang and Multan - Mianwali roads.

Except for the initial segment of the transmission line that passes through a settlement, the general land use along the transmission line is cultivation with sparse population.

Exhibit 4.12 presents a schematic diagram of the transmission line route. See **Section C11** in **Appendix C** for the photographs of the area.

No significant developmental activities are being undertaken along the proposed route.

4.4.14 Kahror Pecca – Lal Sohanra Transmission Line Route

The proposed 132-KV transmission line between the Kahror Pecca and Lal Sohanra grid stations would be about 30 km in length, and would pass through the rural area. The general land use in the area is cultivation with scattered settlements. The proposed route would cross the dry bed of Sutlej River. There exist no large towns along the proposed route. The transmission line will be aligned avoiding the settlements.

Exhibit 4.13 presents a schematic diagram of the proposed transmission line route. See photographs of the route in **Section C.12** of **Appendix C**.

No significant developmental activities are being undertaken along the proposed route.

4.4.15 Lal Sohanra – Khairpur Tamewali Transmission Line Route

The proposed 132-KV transmission line between Lal Sohanra and Khairpur Tamewali grid stations would be about 25 km in length, and would pass through the rural area. The general land use in the area is cultivation with scattered settlements, which will be avoided while aligning the route. There exist no large towns along the proposed route.

Exhibit 4.14 presents a schematic diagram of the proposed transmission line route. See photographs of the route in **Section C.13** of **Appendix C**.

No significant developmental activities are being undertaken along the proposed route.

4.4.16 Khairpur Tamewali – Hasilpur Transmission Line Route

The proposed 132-KV transmission line between Khairpur Tamewali and Hasilpur grid stations would be about 35 km in length, and would pass through the rural area. The general land use in the area is cultivation with scattered settlements. There exist no large towns along the proposed route. The transmission line will be aligned avoiding the settlements. **Exhibit 4.15** presents a schematic diagram of the proposed transmission line route. See photographs of the route in **Section C.14** of **Appendix C**. No significant developmental activities are being undertaken along the proposed route.

Exhibit 4.1: Meteorological Data – Mean Monthly Maximum Temperatures

Degrees Celsius

Month	Pakpattan	Bahawalpur	Multan	Sahiwal	R Y Khan
January	20.8	21.6	21.0	19.7	21.8
February	23.3	24.1	23.2	22.8	24.4
March	28.7	29.5	28.5	28.3	30.2
April	35.8	36.1	35.5	35.2	37.0
May	40.6	40.8	40.4	40.4	41.7
June	41.6	42.2	42.3	41.4	42.4
July	38.4	39.5	39.2	38.4	30.9
August	37.3	38.3	38.0	37.8	38.4
September	36.5	37.1	37.2	36.2	37.0
October	34.3	34.8	34.6	34.6	34.8
November	28.6	29.3	28.5	28.6	20.4
December	22.5	23.5	22.7	22.4	23.5
Annual	**32.4**	**33.0**	**32.6**	**32.2**	**33.5**

Source: Data Processing Centre, Pakistan Meteorological Department, Karachi

Exhibit 4.2: Meteorological Data – Mean Monthly Minimum Temperatures

Degrees Celsius

Month	Pakpattan	Bahawalpur	Multan	Sahiwal	R Y Khan
January	4.5	5.6	4.5	5.4	4.4
February	8.3	8.6	7.6	8.4	7.3
March	13.6	13.8	13.4	13.5	12.8
April	19.7	19.6	19.5	19.2	18.5
May	24.2	24.5	24.4	24.4	23.6
June	28.2	28.4	28.6	27.7	27.2
July	27.9	28.5	28.6	28.1	27.3
August	27.4	27.9	28.0	27.2	26.3
September	24.7	24.8	24.9	24.4	23.1
October	18.4	18.3	18.2	18.1	16.3
November	12.0	11.7	10.9	10.8	10.1
December	6.9	6.6	5.5	6.4	5.3
Annual	**18.1**	**18.2**	**17.8**	**17.8**	**17.0**

Source: Data Processing Centre, Pakistan Meteorological Department, Karachi

Exhibit 4.3: Meteorological Data – Precipitation

mm

Month	Pakpattan	Bahawalpur	Multan	Sahiwal	R Y Khan
January	3.9	6.0	7.2	12.0	4.4
February	15.8	11.5	9.5	12.0	5.3
March	15.5	9.4	19.5	17.0	5.5
April	8.9	7.2	12.9	6.0	2.7
May	3.9	6.1	9.7	7.0	5.1
June	15.3	16.9	12.3	23.0	2.8
July	81.2	52.6	61.2	74.0	27.5
August	34.3	43.2	32.6	75.0	23.0
September	9.3	12.1	10.8	25.0	15.5
October	0.8	0.6	1.7	1.0	1.2
November	3.3	4.0	2.3	2.0	0.7
December	4.0	3.0	6.9	7.0	3.3
Annual	**196.2**	**172.6**	**186.6**	**261.0**	**97.0**

Source: Data Processing Centre, Pakistan Meteorological Department, Karachi

Exhibit 4.4: Meteorological Data – Relative Humidity

%

Month	Pakpattan	Multan	R Y Khan
January	60.1	62.3	57.5
February	55.6	56.3	52.0
March	49.9	51.6	46.4
April	37.6	40.0	35.2
May	32.4	33.2	33.4
June	36.6	39.9	41.7
July	57.2	56.0	53.4
August	61.2	59.7	57.7
September	55.7	56.3	56.9
October	48.6	51.6	50.0
November	53.9	61.4	53.7
December	62.5	66.6	59.5
Annual	**50.9**	**52.9**	**49.8**

Source: Data Processing Centre, Pakistan Meteorological Department, Karachi

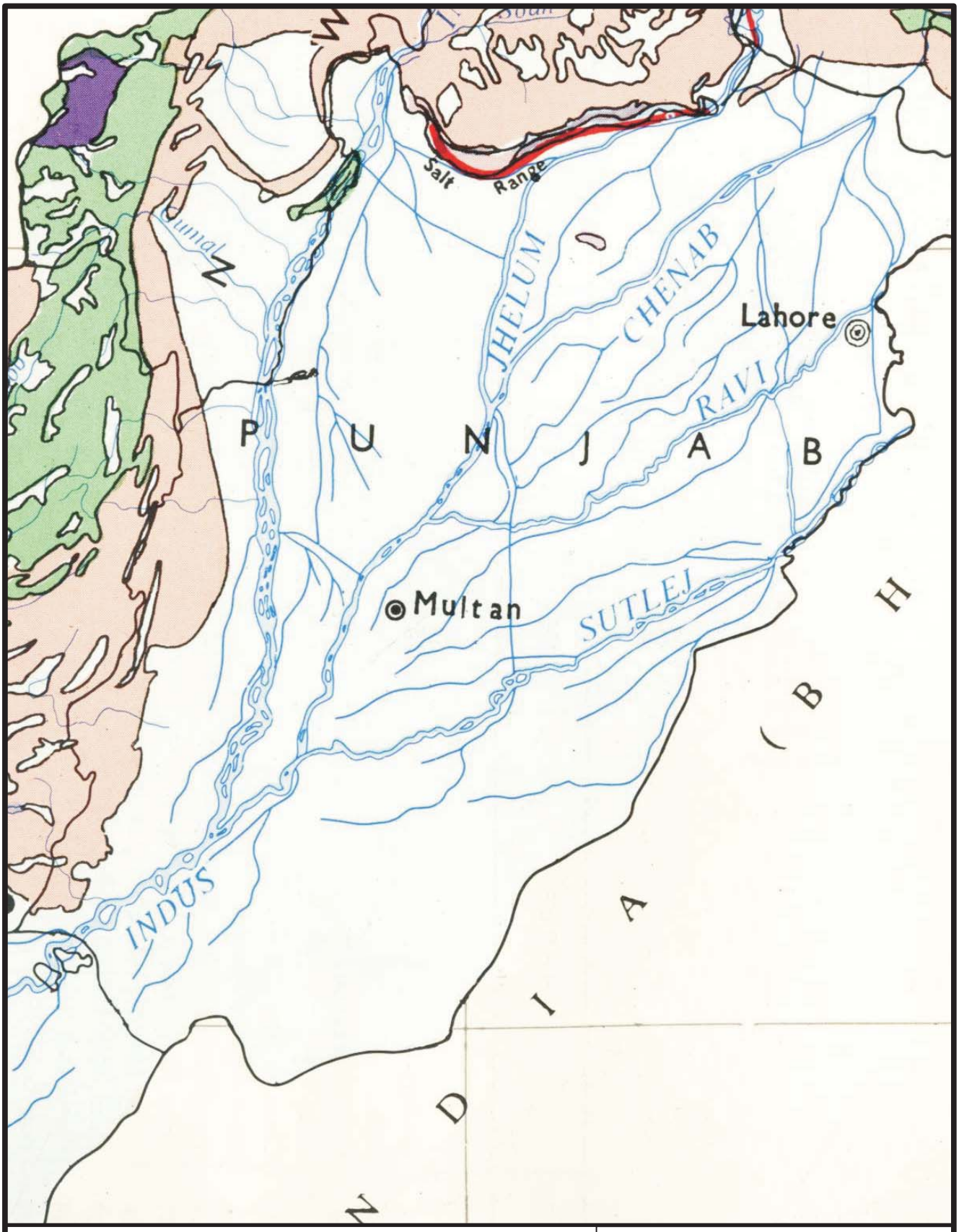
Exhibit 4.5: Ambient Air Quality in Urban Centers

Pollutant	*Units*	*Rawalpindi*	*Lahore*
Total suspended particles (TSP)	$\mu g/m^3$	435.0	886.0
Particulate matter of size less than 10 micron (PM_{10})	$\mu g/m^3$	230.0	300.0
Sulfur dioxide (SO_2)	ppb	37.0	55.7
Carbon monoxide (CO)	ppm	16.5	26.8
Oxides of nitrogen (NO_X)	ppb	40.0	55.0
Ozone	ppb	42.0	51.0

Source: Ambient air quality tests carried out by SUPARCO, 2004.

Exhibit 4.6: Surface Water Resources in the Project Area

(Please see the following page.)



Assignment:	ESA
Project:	6th STG and ELR
Client:	MEPCO
Source:	Atlas of Pakistan
Title:	**Water Resources in Project Area**
Ref:	MEPCO-MP-008
Date:	February 2006

Exhibit 4.7: Water Flow in Major Rivers in the Project Area

River	Average Annual Flow - 1922-61 (MAF)	Average Annual Flow - 1985-95 (MAF)	Average Annual Flow - 2001-02 (MAF)
Chanab [a]	26	27.5	12.38
Indus [b]	93.00	62.70	48.00

Source: Pakistan Water Gateway.

[a] Flow measured at Marala Head Works.

[b] Flow measured at Tarbela.

Exhibit 4.8: Water Quality in Project Area

	Water Quality Parameter	Unit	Bahawalpur			Multan		
			Min.	Max.	Avg.	Min.	Max.	Avg.
1	Alkalinity	m.mol/l	4	9.40	5.84	2.80	6.80	4.59
2	Arsenic	µg/l	0	100	27.40	0	80	39.38
3	Bicarbonate	mg/l	200	470	291.40	140	340	229.69
4	Calcium	mg/l	12	180	84.12	30	108	58.38
5	Carbonate	mg/l	0	0	0	0	0	0
6	Chloride	mg/l	6	256	68.36	5	136	36.13
7	Chromium	Ppb	0	4	0.800	0	5	2.44
8	Conductivity	S/cm	472	4080	1084	424	1124	783
9	Fluoride	mg/l	0	2.80	0.58	0	0.70	0.21
10	Hardness	mg/l	100	820	374.20	200	420	261.25
11	Iron	mg/l	0	5.70	0.83	0.01	1.10	0.29
12	Magnesium	mg/l	16	127	39.32	17	38	27.63
13	Nitrate (N)	mg/l	0	1.40	0.40	0	0.10	0.01
14	pH	-	7	8.10	7.35	6.10	7.90	7.39
15	Phosphate	mg/l	0	1.40	0.23	0	0.18	0.06
16	Potassium	mg/l	5	40	9.50	3.20	9.20	5.29
17	Sodium	mg/l	21	760	116.44	30	140	86.50
18	Sulfate	mg/l	7	1286	180.40	32	184	123.31
19	TDS	mg/l	321	2856	768.44	288	787	547.63
20	Turbidity	NTU	0.40	45	6.03	0.10	9	1.59
21	Total Coliform	MPN/100 ml	0	180	26.80	0	180	44.69

Water quality analyses of multiple test points. Source: National Water Quality Monitoring Programme, PCRWR.

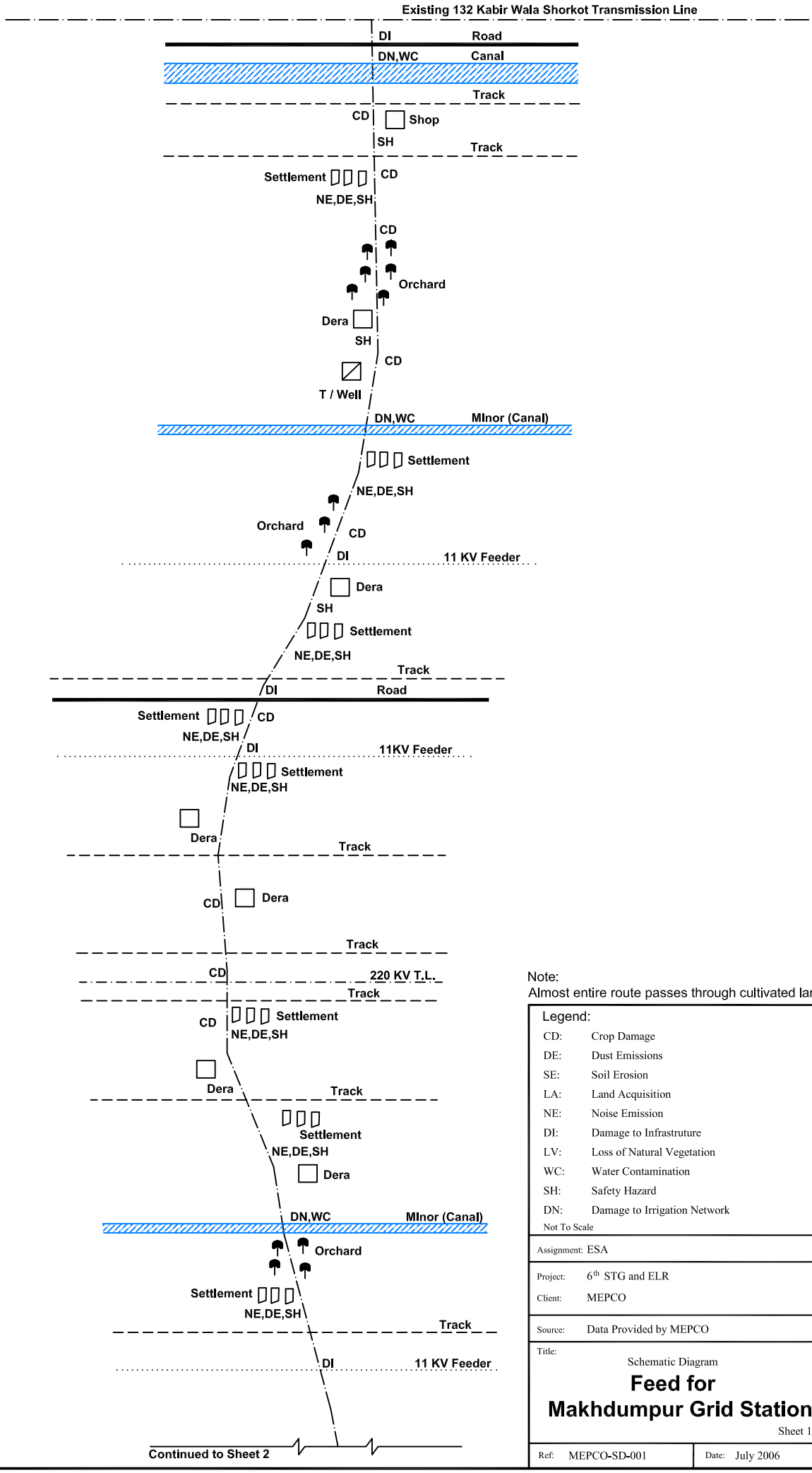
Exhibit 4.9: Wildlife Protected Areas in MEPCO Area

Description	Location	Area (ha)
National Parks		
Lal Sohanra National Park	Bahawalpur	50,992
Wildlife Sanctuaries		
Bahawalnagar Plantation	Bahawalnagar	547
Chak Katora Plantation	Bahawalnagar	536
Chichawatni Plantation	Sahiwal	4,668
Cholistan	Bahawalpur and Bahawalnagar	661,216
Daman Forest Plantation	Rajanpur	2,271
Inayat Foreat Plantation	Layyah	4,213
Khanewal Plantation	Khanewal	7,216
Lal Sohanra	Bahawalpur	5,101
Machu Plantation	Layyah	4,111
Miranpur Plantation	Lodhran	769
Rajan Shah Plantation	Layyah	2,111
Rakh Kharewala	Layyah	5,880
Taunsa Barrage	Muzaffargarh	6,569
Walhar Plantation	Rahim Yar Khan	1,875
Head Panjnad Pond Area	Muzaffargarh	
Rahri Bunglow	Bahawalpur	5,466
Thal	Muzzafargarh	71,277
Khanpur Plantation	Muzaffargarh	13,309
Kotla Issan Forest Plantation	Rajanpur	2,179
Game Reserves		
Abasia Forest Plantation	Rahim Yar Khan	2,732
Cholistan	Bahawalpur, Rahim Yar Khan and Bahawalnagar	
Chopalia	Bahawalnagar	9.861
Head Islam	Vehari	3,132
Kot Sabzal	Rajanpur	10,121

Source: Punjab Wildlife Department

Exhibit 4.10: Feed for Mukhdumpur Grid Station
Schematic Diagram

(Please see the following pages.)



Note:
Almost entire route passes through cultivated land.

Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastruture
LV:	Loss of Natural Vegetation
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

Title:

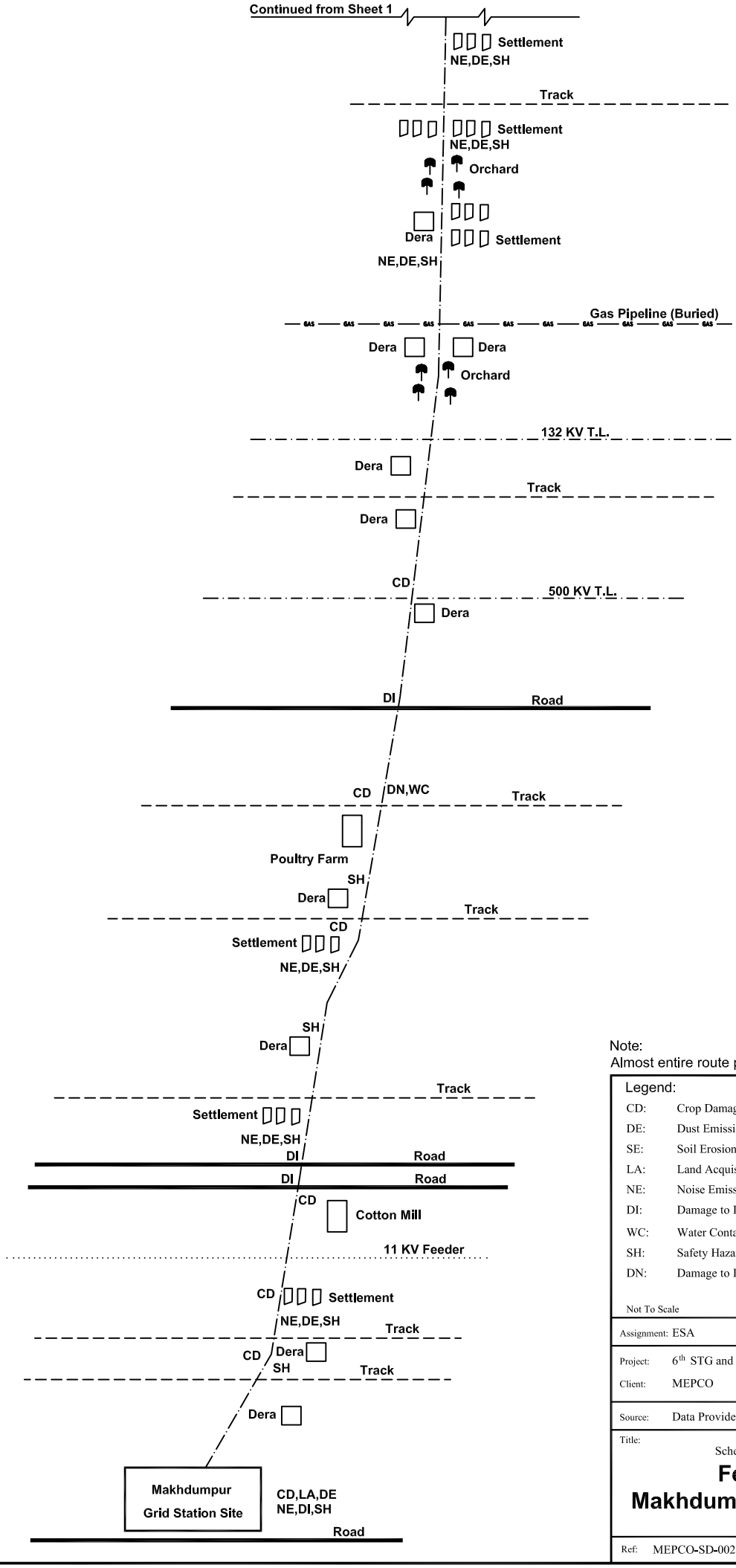
Schematic Diagram

Feed for Makhdumpur Grid Station

Sheet 1 of 2

Ref: MEPCO-SD-001

Date: July 2006



Note:
Almost entire route passes through cultivated land

Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastruture
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

Title:

Schematic Diagram

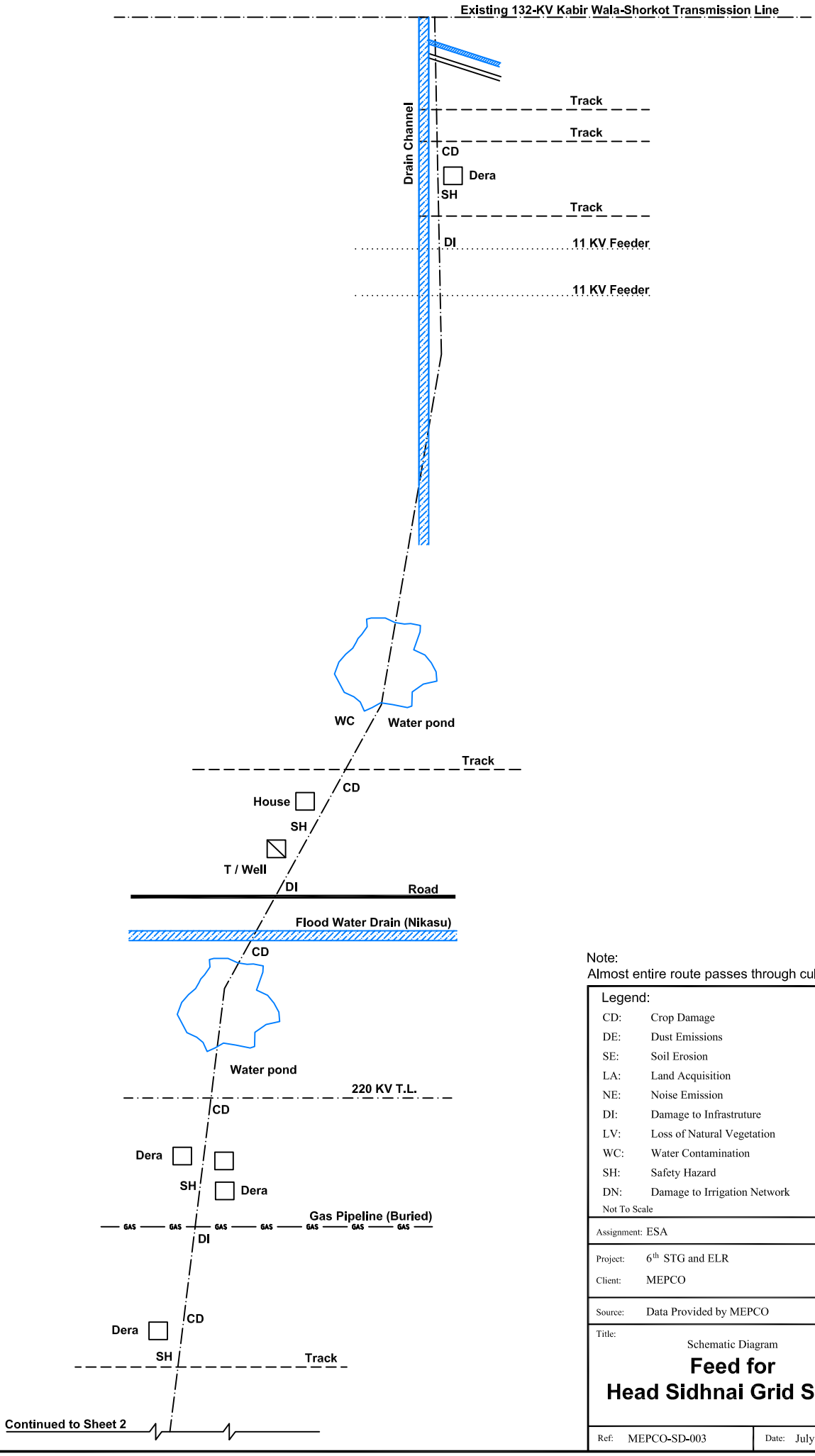
Feed for Makhdumpur Grid Station

Sheet 2 of 2

Ref: MEPCO-SD-002 Date: July 2006

Exhibit 4.11: Feed for Head Sidhnai Grid Station Schematic Diagram

(Please see the following pages.)



Note:
Almost entire route passes through cultivated land

Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastruture
LV:	Loss of Natural Vegetation
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

Title:

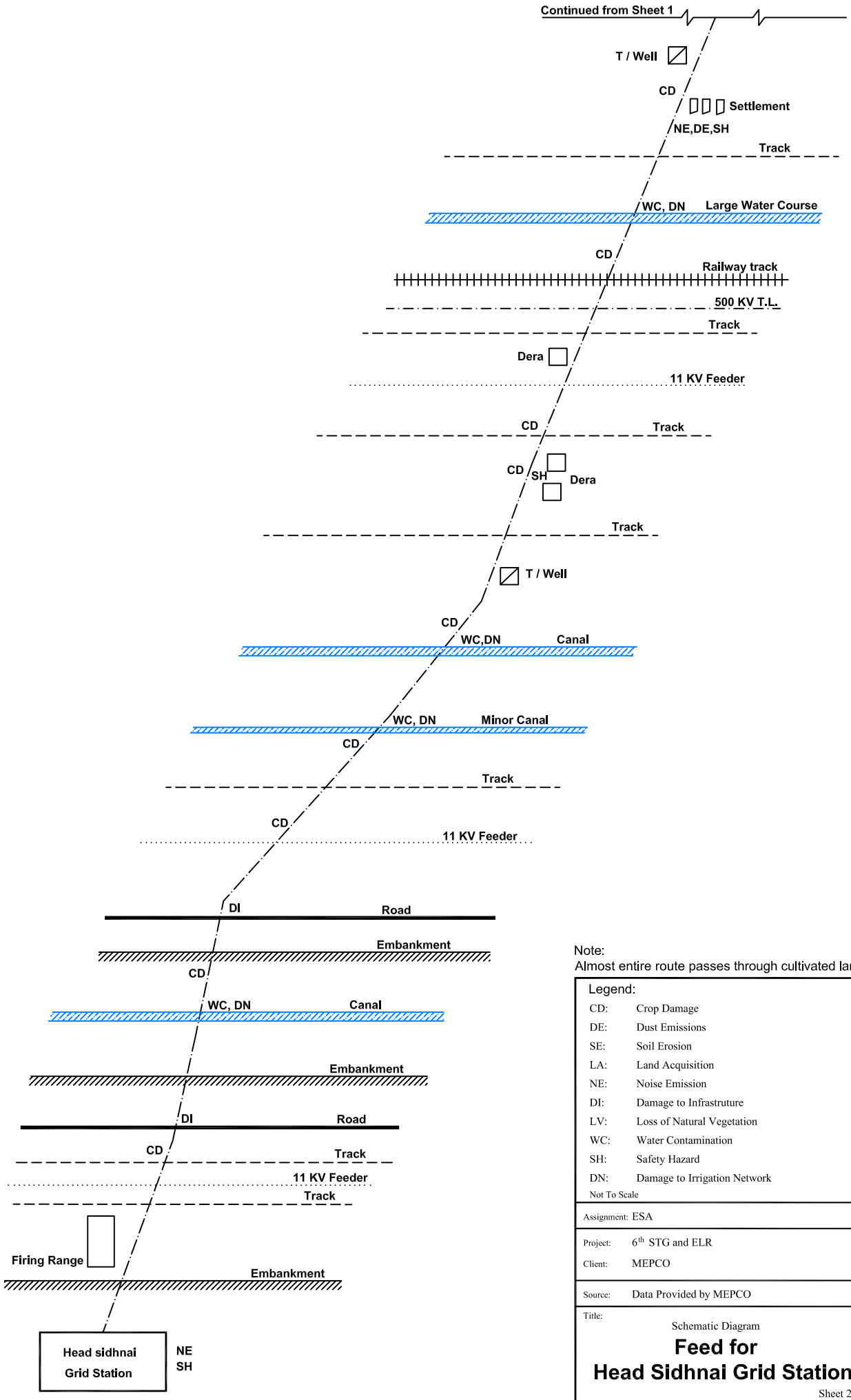
Schematic Diagram

Feed for Head Sidhnai Grid Station

Sheet 1 of 2

Ref: MEPCO-SD-003

Date: July 2006



Note:
Almost entire route passes through cultivated land

Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastruture
LV:	Loss of Natural Vegetation
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

Title:

Schematic Diagram

Feed for Head Sidhnai Grid Station

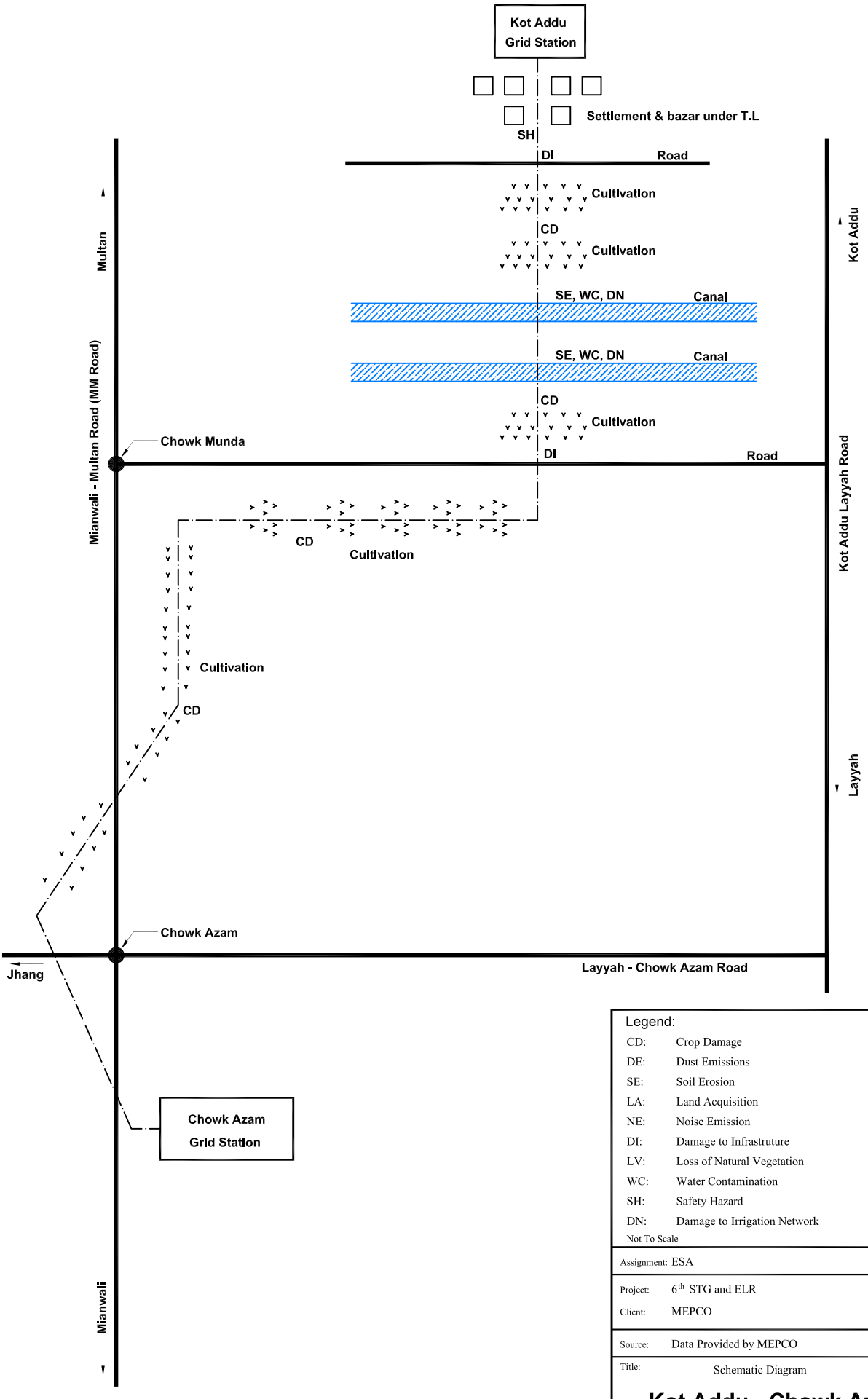
Sheet 2 of 2

Ref: MEPCO-SD-004

Date: July 2006

Exhibit 4.12: Kot Addu – Chowk Azam Transmission Line Schematic Diagram

(Please see the following page.)



Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastruture
LV:	Loss of Natural Vegetation
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

Title: Schematic Diagram

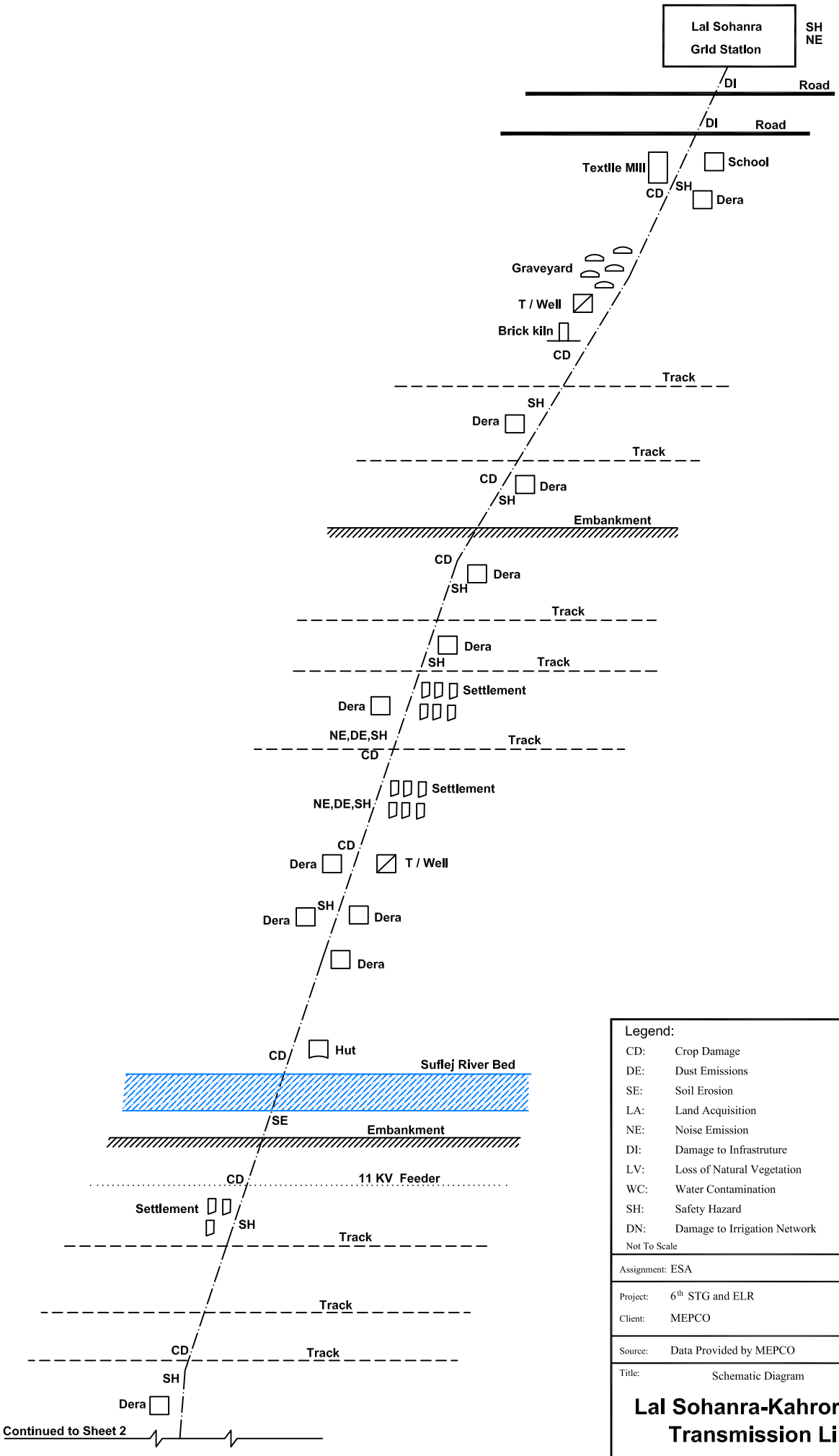
Kot Addu - Chowk Azam Transmission Line

Ref: MEPCO-SD-012

Date: July 2006

Exhibit 4.13: Kahror Pecca – Lal Sohanra Transmission Line Schematic Diagram

(Please see the following pages.)



Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastruture
LV:	Loss of Natural Vegetation
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

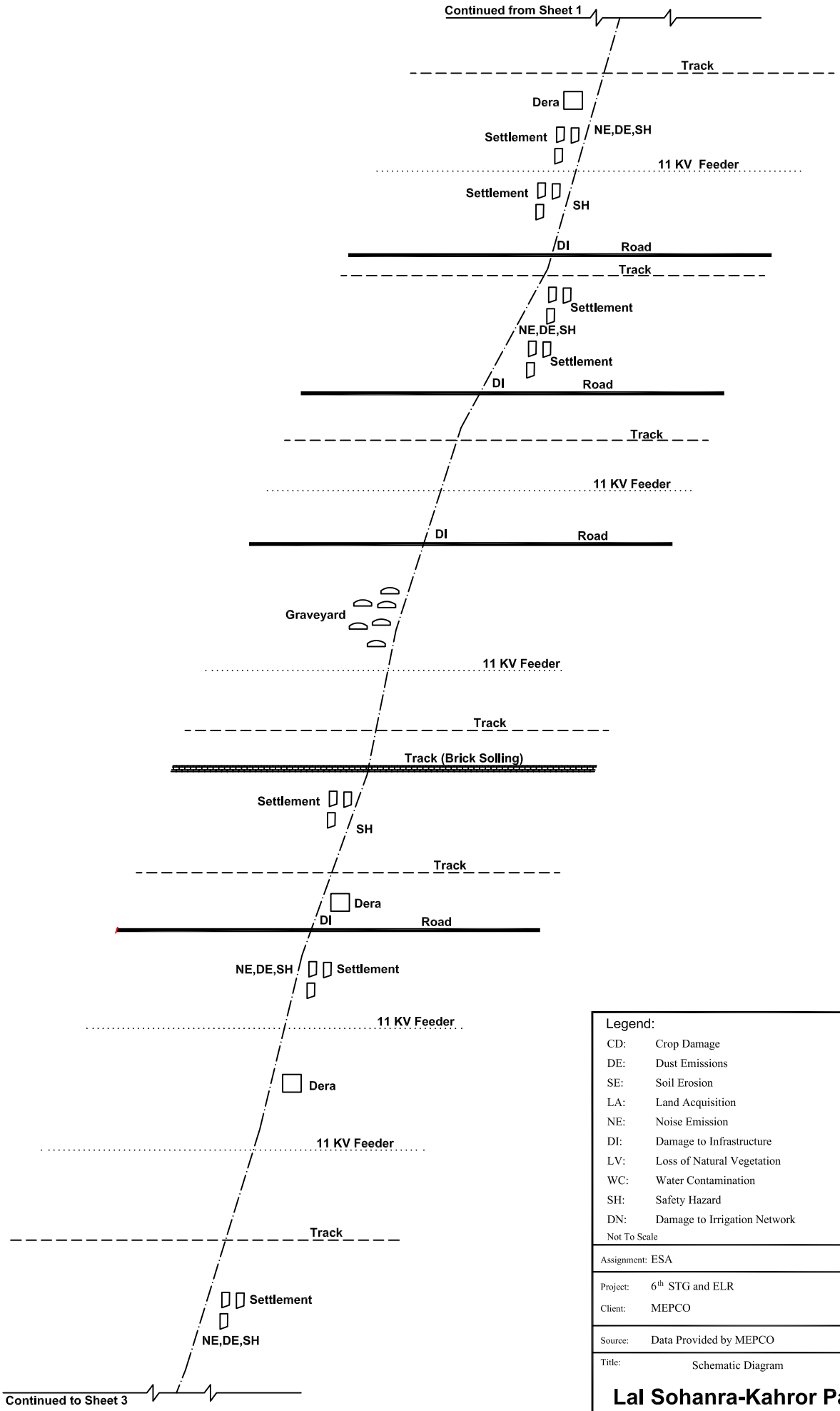
Title: Schematic Diagram

Lal Sohanra-Kahror Pacca Transmission Line

Sheet 1 of 3

Ref: MEPCO-SD-005

Date: July 2006



Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastructure
LV:	Loss of Natural Vegetation
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

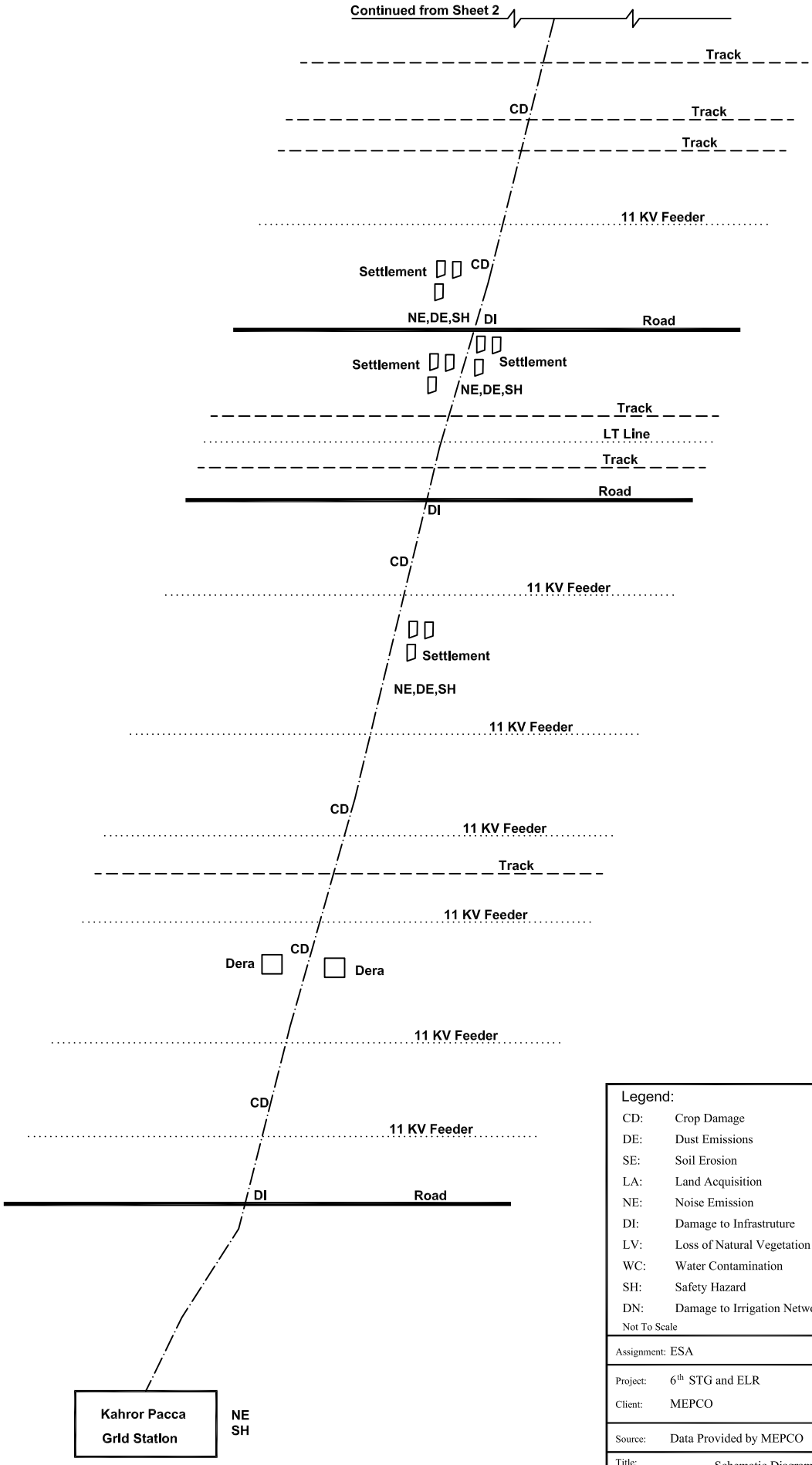
Title: Schematic Diagram

Lal Sohanra-Kahror Pacca Transmission Line

Sheet 2 of 3

Ref: MEPCO-SD-006

Date: July 2006



Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastruture
LV:	Loss of Natural Vegetation
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

Title: Schematic Diagram

Lal Sohanra-Kahror Pacca Transmission Line

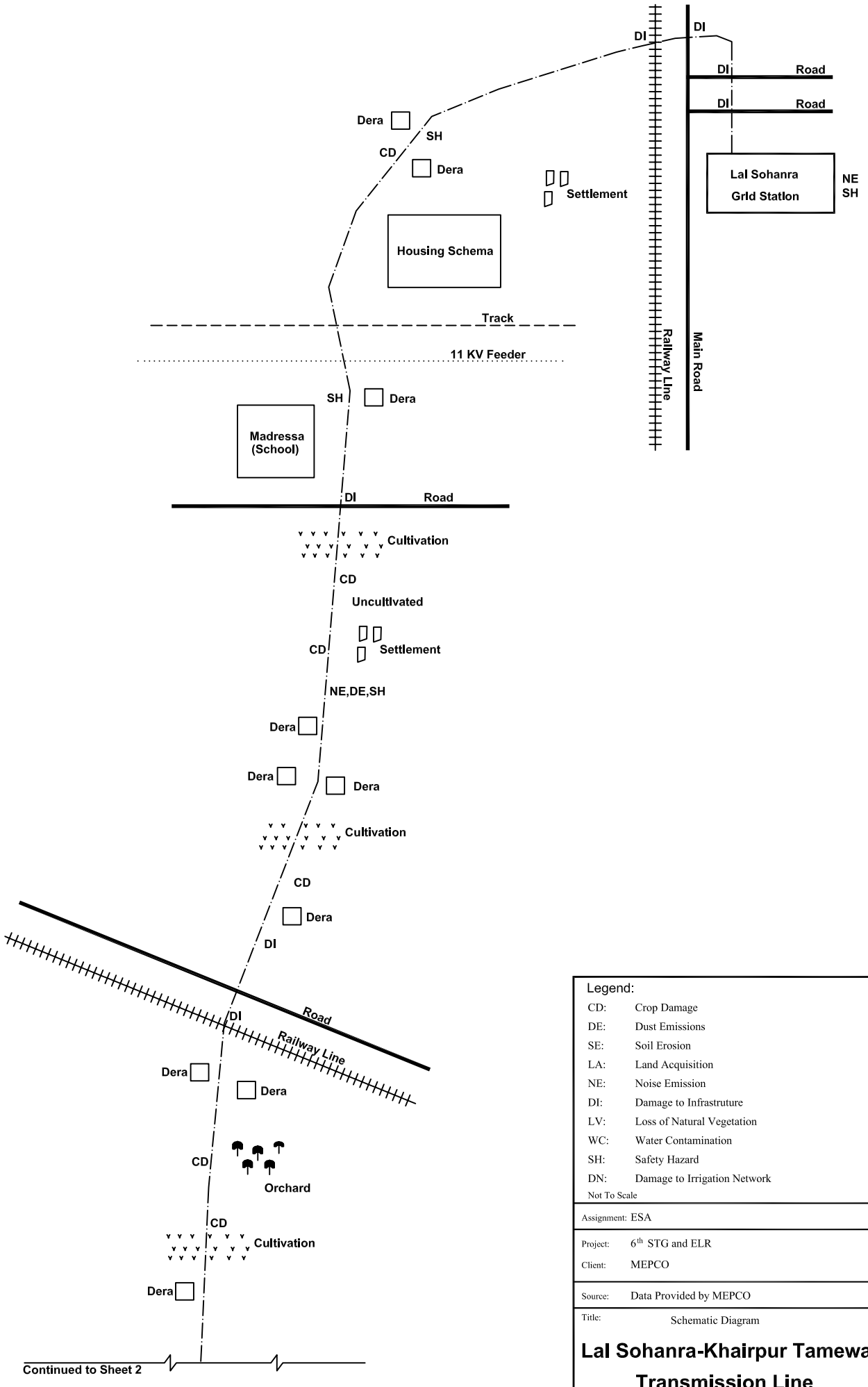
Sheet 3 of 3

Ref: MEPCO-SD-007

Date: July 2006

Exhibit 4.14: Lal Sohanra – Khairpur Tamewali Transmission Line Schematic Diagram

(Please see the following pages.)



Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastruture
LV:	Loss of Natural Vegetation
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

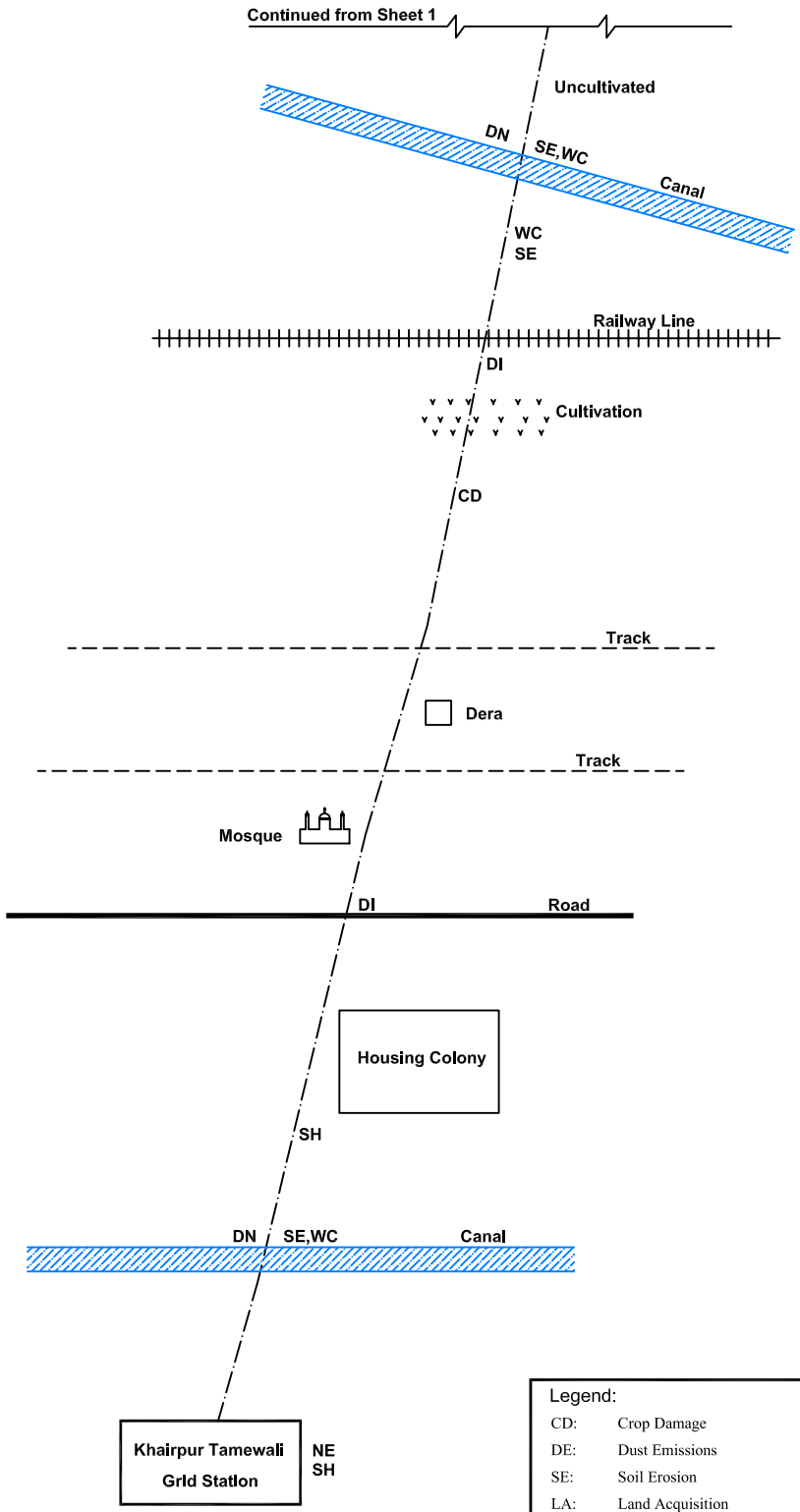
Title: Schematic Diagram

Lal Sohanra-Khairpur Tamewali Transmission Line

Sheet 1 of 2

Ref: MEPCO-SD-008

Date: July 2006



Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastruture
LV:	Loss of Natural Vegetation
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

Title: Schematic Diagram

Lal Sohanra-Khairpur Tamewali Transmission Line

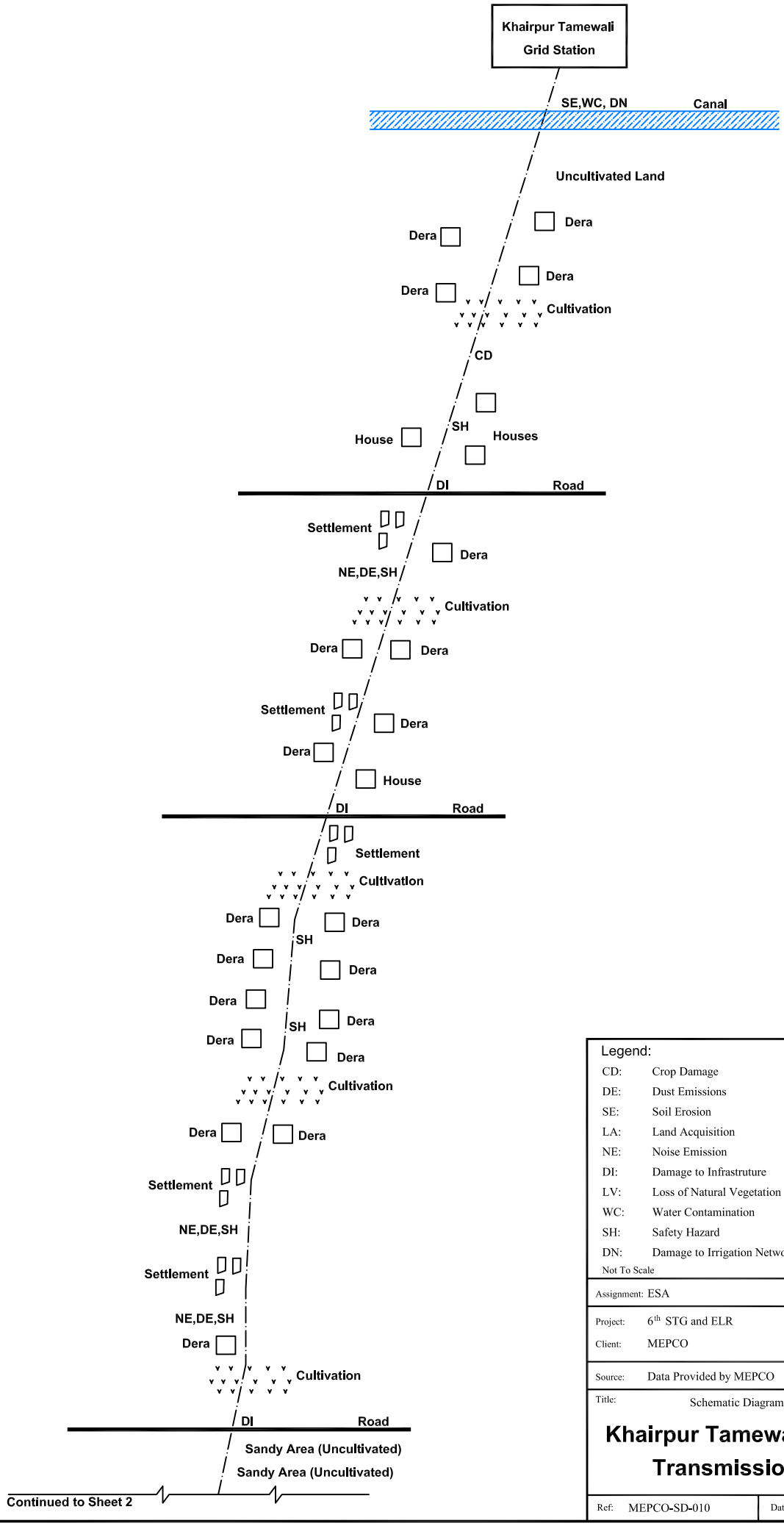
Sheet 2 of 2

Ref: MEPCO-SD-009

Date: July 2006

Exhibit 4.15: Khairpur Tamewali – Hasilpur Transmission Line Schematic Diagram

(Please see the following pages.)



Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastruture
LV:	Loss of Natural Vegetation
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

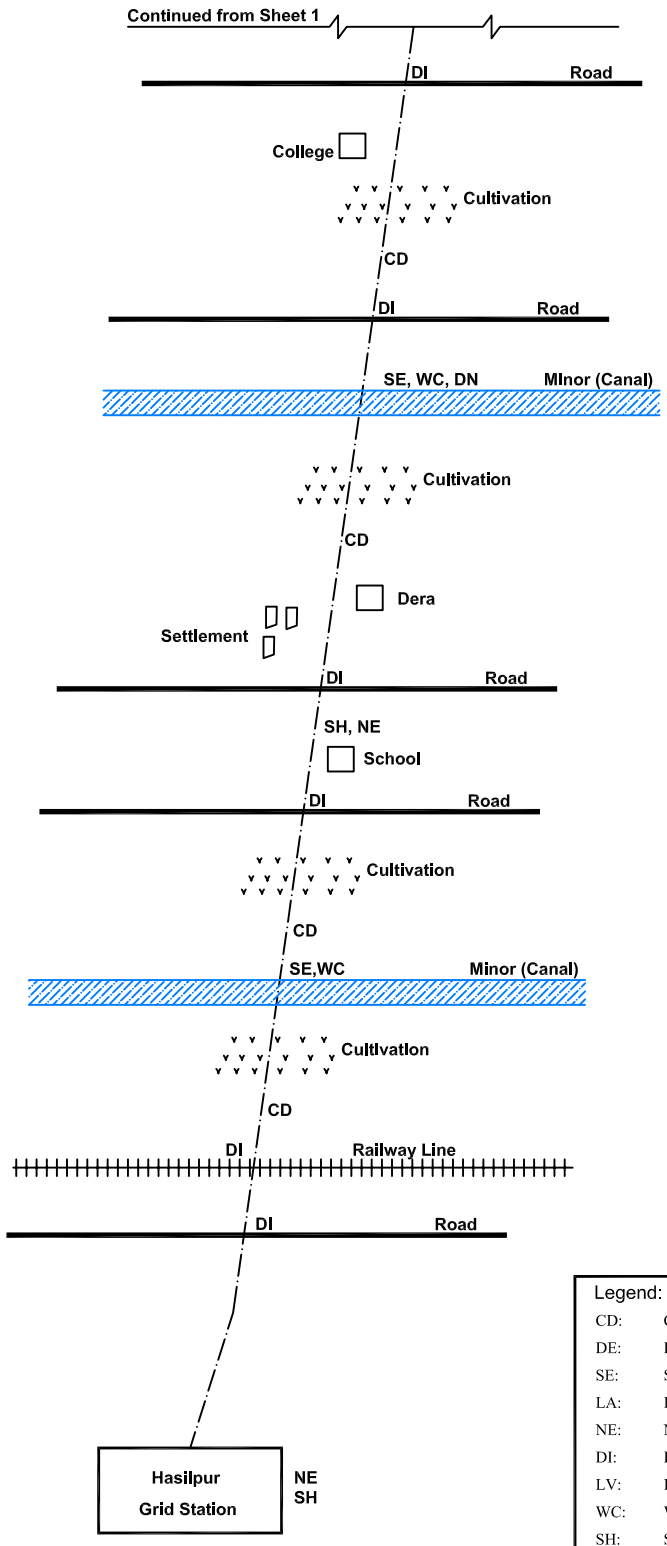
Title: Schematic Diagram

Khairpur Tamewali-Hasilpur Transmission Line

Sheet 1 of 2

Ref: MEPCO-SD-010

Date: July 2006



Legend:

CD:	Crop Damage
DE:	Dust Emissions
SE:	Soil Erosion
LA:	Land Acquisition
NE:	Noise Emission
DI:	Damage to Infrastruture
LV:	Loss of Natural Vegetation
WC:	Water Contamination
SH:	Safety Hazard
DN:	Damage to Irrigation Network

Not To Scale

Assignment: ESA

Project: 6th STG and ELR

Client: MEPCO

Source: Data Provided by MEPCO

Title: Schematic Diagram

Khairpur Tamewali-Hasilpur Transmission Line

Sheet 2 of 2

Ref: MEPCO-SD-011

Date: July 2006

5 Description of the Socioeconomic Conditions

This Chapter describes the general socioeconomic conditions of the MEPCO area before the commencement of the proposed activities. The site-specific socioeconomic description of the area is provided in **Appendix D** of this report. In view of the absence of any major development activities underway at or around the project sites or any other natural/anthropogenic phenomenon, the socioeconomic conditions of the project sites are unlikely to experience any significant change before the project commencement.

5.1 Socioeconomic Description

5.1.1 Overview

The southern part of the Punjab Province is a predominantly Saraiki speaking area. The area was annexed in the Punjab Province in 1818; before then this area was a separate province by itself. In 1971, three districts of Bahawalpur division were also included in the present Punjab, thus expanding the limits of this area to the Punjab-Sindh border in the south.

The Southern Punjab has always remained as an undeveloped area. The economy of southern Punjab mostly depends on agriculture and this area produces the best quality cotton, mangoes and wheat. However unfortunately, due to a host of factors including improper pricing system and lack of efficient marketing network, the farmers of this area could not get proper financial benefits.

The feudals and landlords of the southern Punjab have always played a very important role in the politics of the Punjab and Pakistan. However this fact has not been effective in the development of the area, and despite of producing a lot of very high quality agricultural products, this area remains backward and under-developed.

There exists a huge deficiency of educational facilities in this area, which is reflected by the presence of only two universities there, out of more than twelve universities in the whole Punjab. As a result, the literacy rate in this area is also very low. Similarly, this area also lacks in effective communication systems, proper roads, telephone system and post offices, as compared to the other areas of Punjab.

The people of the southern Punjab are far behind in availing job opportunities, and they have a very minimal share in top-level civil jobs.

5.1.2 Present Situation

In the context of political economy, the southern Punjab presents development challenges. The area had a resilient feudal system, which is now in transition. Patronage links, which bonded peasants to their feudal overlords, have weakened over the past decades, but still local *panchayats* (village council) led by local feudal elite has its significant role in local decisions making, especially resolving disputes on marital and other issues. Usually the women are not represented in these *panchayats*, and as a

result, the weaker gender is most deprived, marginalized and vulnerable in the southern Punjab.

The recent democratic developments in the country, particularly the Local Government Elections–2001, intend to shift the governance to the grass root level, while also creating an enormous opportunity for the disadvantaged sections of the society such as women, workers and religious minorities. The government has also reserved 17% seats for women in the National and Provincial Assemblies as well as the Senate. The multi-gender representation in the governance structures thus created presents an excellent opportunity to strengthen the voices of marginalized communities in the state apparatus.

5.1.3 Economic Situation

The economic activity has traditionally been a domain of the men in the area, much like rest of the country. The prime occupation of the people of the area has been cultivation and the associated activities, a trend which is fast changing now particularly in the urban and sub-urban areas. The male members of the family have traditionally been the breadwinners. Particularly in the backward areas, it used to be considered inappropriate to educate women beyond the school or intermediate level. From the 50% male population, on average 44.96% are economically active, while the remaining 55.4% are inactive.[1] The ratio is highest in the Sahiwal District (49.3%) and lowest in the Rajanpur District (36%). Among the economically-inactive people, on average 35.4% are under the age of 10 (the ratio is lowest in the Sahiwal District and highest in the Rajanpur District), and 9.5% are students (this ratio is highest in the Sahiwal District and lowest in the Rajanpur District). The ratio of domestic workers is 3.4% - the ratio is highest in Multan District (11.9%) and lowest in the Sahiwal District (1.2%). The remaining 7.9% are landlords, property owners, retired persons, disabled - the ratio is highest in the D. G. Khan District (9.8%) and lowest in the Multan District (5.3%). The unemployment ratio in these areas is 21 % (the ratio is highest in D. G. Khan (25.2%) and lowest in Bahawalpur (18.6%).

5.1.4 Ethnicity

The people in the southern Punjab are from different ethnic groups, mostly Saraiki speaking, and have derived from Semitic and Indo-Aryan races. Over the centuries, the region has attracted a large number of immigrants not only from neighboring areas but also from far-off places. Most of the important tribes now inhabiting in these districts have immigrated into the area. The most dominating castes are Syed, Gillani, Qureshi, Gerdazi, Araian, Ansari, Kamboh, Rajpoot, Jat, and Baloch having numerous sub-castes. Arains of these area claim that they came from Hindustan (India). The Jat and Rajput are important tribes involved in agriculture. In D. G. Khan and Rajanpur the inhabitants are predominantly Baloch belonging to different tribal groups: Nutkhani, Buzdar, Qaisirani, Sori, Lund, Khosa, Leghari, Pitafi, Jaskani, Khitran and Shikhani. A considerable number of migrants belonging to Jat, Rajput, Arain and Pathan have also settled there. After independence there has been an influx of Muslim refugees from different parts of India.

[1] Source: District Census Reports, 1999 and 2000.

The immigrants have mainly come from Panipat, Karnal, Rohtak and Hassar districts of India, although a considerable number have come from Amritsar, Jallunder and the former United and Central Provinces of India as well. These immigrants have settled on the lands of the non-Muslims throughout the areas.

People living in Vehari, Sahiwal, Pakpattan are ethnically Punjabis of Aryan origin. The major castes of the area are Rajput and Jat.

The people living in the area are all culturally, socially and economically fully integrated, and no indigenous people exist in the area (see **Section 2.1.9**).

5.1.5 Family Structure

In the villages, joint family system is still prevalent and people prefer to live with their parents, grand parents, uncles and brothers. Independent family units consisting of husband, wife and dependent children is not a common feature. Family system is patriarchal, and the eldest male members of the family mostly make important household decisions. Women generally confine their activities to the kitchen and children, but also assist in farming in the rural areas. However the situation is fast changing particularly in the cities where more and more people are living as an independent, nucleus family unit.

5.1.6 Poverty

The southern Punjab is the irrigated area of the Province. Major source of income is from the agricultural activities including cultivation and livestock. Other sources of income include industrial as well as daily wages labour in the open market, and running of micro and medium enterprises. A small percentage of the workforce is involved in fishing as well, particularly in areas along the rivers. Major crops are cotton, wheat and sugarcane. Among fruits mangoes, white pomegranate and dates are grown. Small landholders also grow grass and fodder. Mango orchards have mix cropping of vegetable and grass, in addition to the fruit trees; cotton and wheat is not grown in these orchards.

Most of the people have small land ownership, and the feudals of south Punjab dominate the area. The poor are bound to maintain good relationship with them due to their strong social, economic and political position. The farm workers are usually paid in kind, at the time of the harvest.

Despite having rich agricultural land, most of the rural communities do not have access to the basic necessities of life. Most village households do not have toilets. Illiteracy and shortage of educational institutes are among the major hurdles in the road to development.

The economic data disaggregated on rural-urban basis show that while the urban poverty declined during 1990-1991 and 1998-1999, the rural poverty increased up to 36 percent exacerbating rural-urban inequities.[2] A review of the past few decades shows that economic growth in Pakistan has not been able to bring equal social improvements to all sections of the populace. The growing inequality, with concentration of resources in a few powerful hands is increasing deprivation among millions of people.

[2] Source: SPDC 2002.

Vulnerability of the poor is compounded by socio-cultural factors that perpetuate the structures of inequity in the society. Among those affected most are the landless belonging to the so-called lower class/caste and minorities. They lack buffers against shocks of crop failures, accidents, deaths and burdened by social conventions – dowry, funerals, and weddings.

5.2 Administrative Setup

The MEPCO area consists of thirteen districts the southern Punjab, as follows:

1. Multan
2. Lodhran
3. Sahiwal
4. Khanewal
5. Bahawalpur
6. Bahawalnagar
7. Pakpattan
8. Layyah
9. Muzaffargarh
10. Rahim Yar Khan
11. Dera Ghazi Khan
12. Rajanpur
13. Vehari.

Exhibit 5.1 provides an administrative map of the area.

The districts in the country now have their respective district governments with the elected representatives as well as government functionaries. The district government is headed by the *Nazim*, who is a public representative elected by the people; while the government functionaries in the district include the District Coordination Officer (DCO) and Executive District Officers (EDOs). The EDO (Revenue) is the officer relevant for land acquisition in the district.

5.3 Demographic Data

5.3.1 Population and Housing

The total population in the MEPCO area falling in the southern Punjab Province is about 25.7 million (1998 census). Multan and Rayim Yar Khan are the most populous, while Rajanpur is the least populous district in the area. **Exhibit 5.2** provides the population data of the MEPCO area.

Household sizes are quite uniform in the area, ranging from 6.4 to 7.8 persons per household. **Exhibit 5.3** presents the household data in the MEPCO area.

Exhibit 5.4 provides the data for the drinking water availability in the area, which indicates the hand pumps being the most prevalent source of drinking water in the region. **Exhibits 5.5** and **5.6** present the information on source of lighting and source of cooking fuel. In most of the areas in the region, electricity is available to about 50% of the population, whereas for majority of the population, wood is still the primary source of cooking fuel.

5.3.2 Education and Literacy

The numbers of the educational institutes in the project area, and their enrollment figures are listed in **Exhibit 5.7**. However, the geographical distribution of these facilities is not even in the area. In general, the cities and towns have more schools and colleges, compared to the rural areas. Consequently, there is a general trend in these areas to go to the cities, particularly for higher education.

Exhibit 5.8 provides the enrollment data for the project area. The highest figures are for Sahiwal, whereas the Rajanpur district has the lowest enrollment. The difference in male and female enrollment is also quite wide for most of the districts.

The literacy figures, presented in **Exhibit 5.9**, show the disparity among various districts of the project area. The Multan and Sahiwal districts have the highest literacy ratios, whereas the Rajanpur district has the lowest. This trend is inline with the school enrollment ratios provided in **Exhibit 5.8**.

5.3.3 Health Facilities

The data on the health facilities that exist in the project area is provided in **Exhibit 5.10**. As can be seen from this data, most large hospitals are primarily limited to Multan and Bahawalpur. Much like the geographical distribution of schools and colleges (**Exhibit 5.7**), most of these facilities are located in cities and towns, and the people from rural areas usually face considerable hardship in coming to the urban centers for the treatment of serious diseases.

5.4 Industry

Most of the industries in the project area are essentially agriculture-based in nature. Some small industries are working like carpet weaving, cotton ginning and pressing, rice husking, ice factories, brick kilns, and flourmills. There is a large fertilizer complex in Multan; one more complex exists at Goth Machi, near Sadiqabad, District Rahim Yar Khan. In addition, there exist several large power plants in the region, particularly in Multan, Kot Addu and Muzaffargarh. The cement factory is the main industry located in Dera Ghazi Khan, which is also well known for lacquered articles such as wooden/electric lamps, frame of looking glass, flowers, vases and bowls. This district also produces several minerals, such as petroleum, natural gas, uranium, gypsum and limestone.

At present more than 130 factories are registered in the area, including textile mills, tanneries, vegetable oil mills, ghee factories, mechanical works, cold storages and ice factories. **Exhibit 5.11** provides the list of these industries.

5.5 Agriculture

As stated above, the agriculture is by far the main economic activity in the southern Punjab. The main crops during *Rabi* are wheat, gram, rape, mustard, barley and oil seeds. In *Kharif*, cotton, jawar, sugarcane, bajra, maize and rice are grown. In addition, there are subsidiary crops known as Zaid Rabi like Kharbooza, tobacco and potatoes and Zaid Kharif like potatoes and chilies. The main fruits grown are mangoes, date, malta, orange, water and musk melon, guava, citrus, falsa, jaman and pomegranate. In the beginning of the cultivation era the inhabitants used to eat Pilu and Bair, the only wild fruits that grows intermittently. With the introduction of canal irrigation mango and other fruits are being grown on commercial basis.

The use of land is governed by several interacting factors, which are physical, biological, social and economic in nature. A clear vision of these factors is essential for increased agricultural production in any given region. The Pakistan Agricultural Research Council in 1980 divided Pakistan in ten agro-ecological zones, based on a survey carried out by FAO and review of the available literature on physiography, climate, soils, land use and other factors affecting agriculture production. These zones are shown in **Exhibit 5.12** and defined in **Exhibit 5.13**. According to this zonation, the project area falls under the Zone IV-B, which is characterized by extensive cultivation, high summer temperatures and moderate to low rainfall.

Wheat, cotton, sugarcane and rice are the major crops, whereas mango and citrus are the major fruits of the area. **Exhibits 5.14** and **5.15** provide the lists of major crops and fruits in the project area, respectively.

The cropping pattern in these areas is provided in **Exhibits 5.16** and **5.17**. As can be seen from this data, wheat and cotton are the highest grown crops in the area.

Livestock

Livestock breading is one of the main pursuits and means of livelihood of rural and urban population. The Sahiwal and Dera Ghazi Khan districts are very famous for livestock production; especially the buffalos of Sahiwal district are renowned in all over country. In the districts of Dera Ghazi Khan and Rajanpur, livestock breading is more important as its land remains uncultivated continuously for years due to paucity of rains and no hill torrent. In the plains camel and horse breading is also an occupation and source of income.

5.6 Irrigation System

The project area falls in the Indus Basin Irrigation System, which is shown in **Exhibit 5.18** and briefly described below.

The Indus Basin Irrigation System comprises of three major reservoirs, 16 barrages, 2 head-works, 2 siphons across major rivers, 12 inter river link canals, 44 canal systems (of which 23 lie in Punjab) and more than 107,000 water courses. The aggregate length of the canals is about 56,073 km. In addition, the watercourses, farm channels and field ditches cover another 1.6 million km.

Typical watercourse commands range between 200 and 800 acres. The system utilizes over 41.6 MAF of groundwater, pumped through more than 550,000 tube wells, in addition to the canal supplies.

Currently the total annual surface water diversions at the canal heads of the Indus Basin irrigation system are about 105 MAF. Irrigated agriculture is the major user of both, surface and groundwater resources of Pakistan. The average annual river diversions for irrigation in the Indus Basin are of the order of 104.7 MAF, to irrigate over 14.6 million hectares. Of this, 67.11 MAF on average are diverted during the *kharif* period, while 37.63 MAF are diverted during the *rabi* period.

During the *kharif* periods of the last ten years, Punjab used 34.3 MAF annually, while Sindh and Balochistan used 31.4 MAF and NWFP used 2.35 MAF. During the *rabi* periods of the last ten years, average withdrawals by Punjab, Sindh and Balochistan and NWFP were 19.87 MAF, 16.06 MAF and 1.46 MAF, respectively. A further 41.6 MAF is pumped annually from the groundwater reservoirs, of which more than 90% is used for irrigation.

The public irrigation infrastructure in the Punjab consists of 13 barrages, 2 siphons across major rivers, 12 link canals and 23 major canal systems over an aggregate length of 34,500 km.

The whole irrigation infrastructure lies within the Indus Basin System. It serves an area of 8.58 million hectares. In addition, there are 135 surface drainage systems including over 670 drains, with an aggregate length of about 6,600 km, which drain an area of about 5.79 million hectares, within the 23 canal commands.

During the year 1999-2000, the total irrigated area, using all sources available in the Punjab, was of the order of 13.8 million hectares. This included 11 million hectares in the canal commands. The private tube-wells and wells irrigated 6.8 million acres during the same period.

Groundwater Irrigation

An estimated 41.6 MAF of groundwater is pumped annually in Pakistan. According to a study, more than 90% of the extracted groundwater is used for irrigation purposes. Groundwater reservoirs are recharged from the rivers as well as the seepage losses from the canals, watercourses, farm channels and the fields.

Most of the ground water abstraction occurs in the Punjab. This was of the order of 34 MAF in the year 1999-2000. In the last 25- 30 years, ground water has become a major supplement to canal supplies, especially in the Upper Indus Plain. In this region, the ground water quality is good. The groundwater resources of Pakistan extend from the Himalayan foothills to the Arabian Sea and are contained in the alluvial deposits of the Indus Plains.

5.7 Sites of Archeological, Cultural, Historical or Religious Significance

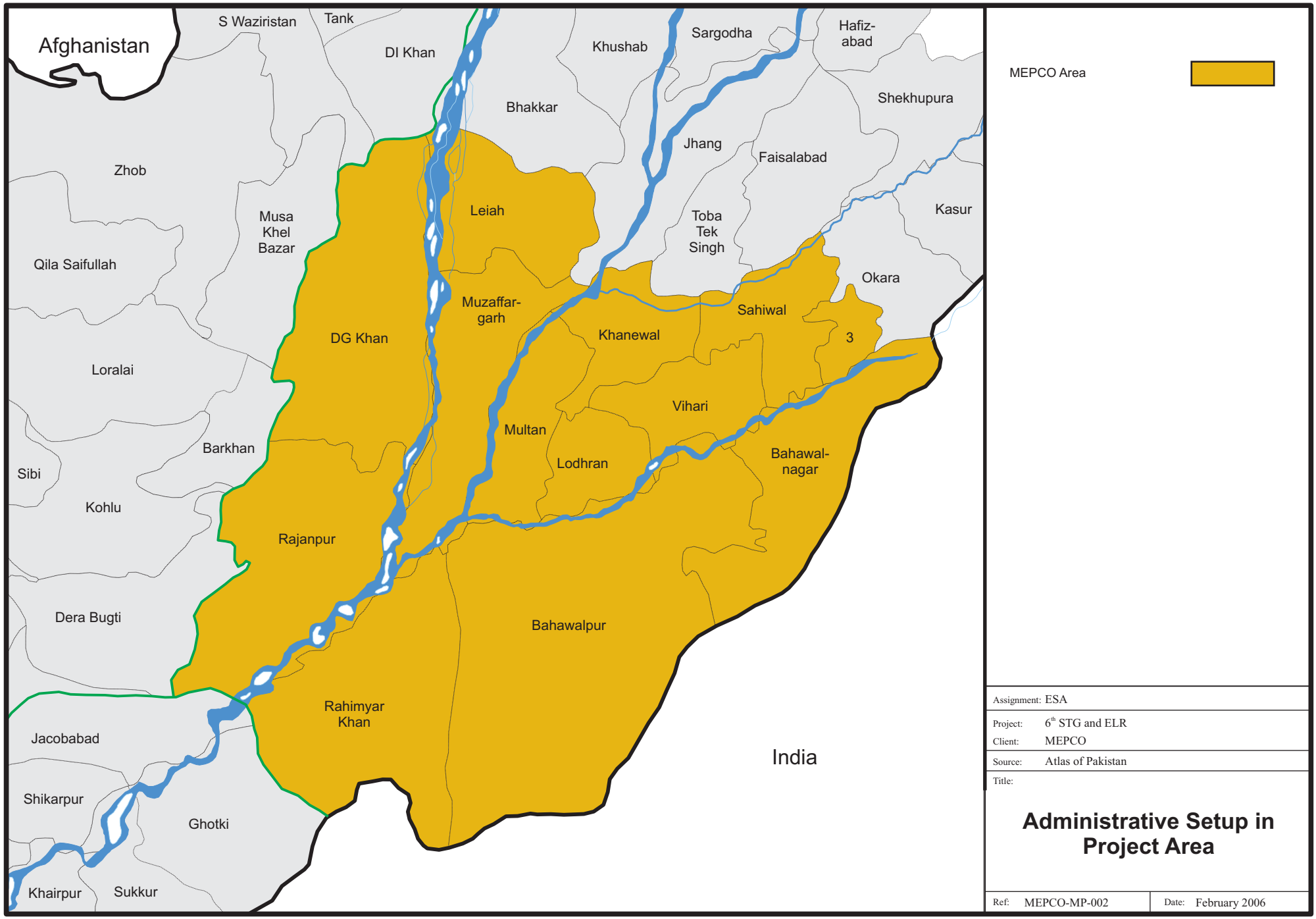
There exist a large number of sites of archeological, cultural, historical and religious significance in the southern Punjab. The major ones include the archeological site at Harappa, which is an Indus Civilization ruins. In addition, a large numbers of shrines in

almost all parts of the project area. A list of these places located in the project area is provided in **Exhibit 5.19**.

However, none of the project components are located at or near any known sites of archeological, cultural, historical and religious significance.

Exhibit 5.1: Administrative Map of the Area

(Please see the following page.)


Afghanistan
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Qila Saifullah
Okara
Muzaffar-
garh
Sahiwal
DG Khan
Khanewal
3
Loralai
Vihari
Multan
Barkhan
Lodhran
Bahawal-
nagar
Sibi
Kohlu
Rajanpur
Dera Bugti
Bahawalpur
Rahimyar
Khan
India
Jacobabad
Shikarpur
Ghotki
Khairpur
Sukkur
MEPCO Area
Assignment: ESA
Project: 6th STG and ELR
Client: MEPCO
Source: Atlas of Pakistan
Title:
Administrative Setup in Project Area
Ref: MEPCO-MP-002
Date: February 2006

Exhibit 5.2: Population in Project Area

District	Population
Pakpattan	1,286,680
Lodhran	1,172,800
Bahawalnagar	2,061,447
Bahawalpur	2,433,091
Multan	3,116,851
Vehari	2,090,416
Khanewal	2,068,493
Sahiwal	1,843,194
Rajanpur	1,103,618
Rahim Yar Khan	3,141,053
Muzaffargarh	2,635,903
Dera Ghazi Khan	1,643,118
Layyah	1,121,951
Total	25,718,615

Source: District Census Reports, 1999 and 2000.

Exhibit 5.3: Indices of Congestion

District	Persons per Housing Unit	Persons per Room	Rooms per Housing Unit
Pakpattan	6.4	3.2	2.0
Lodhran	7.2	3.4	2.1
Bahawalnagar	6.7	3.0	2.2
Bahawalpur	6.8	3.4	2.0
Multan	7.1	3.4	2.1
Vehari	6.9	3.1	2.2
Khanewal	7.0	3.0	2.3
Sahiwal	6.9	3.0	2.3
Rajanpur	7.3	4.1	1.8
Rahimyar Khan	7.5	3.6	2.1
Muzaffargarh	7.3	3.8	1.9
Dera Ghazi Khan	7.8	3.7	2.1
Layyah	7.3	3.2	2.3

Source: District Census Reports, 1999 and 2000.

Exhibit 5.4: Source of Drinking Water

District	Source of Drinking Water (%)							
	Inside			Outside				
	Pipe (Nul)	Hand Pump	Well	Pipe (Nul)	Hand Pump	Well	Pond	Others
Pakpattan	15.0	70.7	0.5	1.2	3.2	0.5	0.1	3.8
Lodhran	13.3	69.7	0.2	1.5	9.4	0.2	1.7	4.0
Bahawalnagar	26.9	47.7	0.3	3.0	10.0	1.3	5.2	5.6
Bahawalpur	16.0	63.5	1.1	1.5	8.6	2.4	3.6	3.3
Multan	21.7	70.4	0.4	1.3	4.5	0.1	0.1	1.5
Vehari	17.2	70.7	0.5	1.4	7.5	0.2	0.1	2.4
Khanewal	12.0	76.3	2.0	0.7	6.2	0.2	0.4	2.2
Sahiwal	17.9	68.4	0.5	1.6	7.9	0.2	-	3.5
Rajanpur	8.5	63.9	1.1	2.9	5.1	1.6	7.9	9.0
Rahimyar Khan	15.3	69.1	0.5	1.2	6.9	0.9	3.0	3.1
Muzaffargarh	6.0	87.6	0.1	0.5	4.8	0.1	-	0.9
Dera Ghazi Khan	19.5	53.2	0.5	6.1	3.7	2.7	5.3	9.0
Layyah	5.2	84.4	0.1	0.3	9.1	-	-	0.6

Source: District Census Reports, 1999 and 2000.

Exhibit 5.5: Source of Lighting

District	Source of Lighting Used (%)		
	Electricity	Kerosene Oil	Others
Pakpattan	54.5	44.3	1.2
Lodhran	52.0	46.9	1.1
Bahawalnagar	53.0	46.1	0.9
Bahawalpur	50.0	49.0	1.0
Multan	69.6	29.4	1.0
Vehari	63.5	35.8	0.7
Khanewal	56.4	42.7	0.9
Sahiwal	66.8	32.4	0.8
Rajanpur	40.4	55.3	4.3
Rahimyar Khan	52.9	45.8	1.3
Muzaffargarh	51.2	47.9	0.9
Dera Ghazi Khan	56.0	43.1	0.9
Layyah	46.6	53.0	0.4

Source: District Census Reports, 1999 and 2000.

Exhibit 5.6: Source of Cooking Fuel

District	Source of Cooking Fuel Used (%)			
	Wood	Kerosene Oil	Gas	Others
Pakpattan	79.1	2.9	1.6	16.4
Lodhran	59.2	1.1	1.2	38.5
Bahawalnagar	68.4	1.6	2.2	27.8
Bahawalpur	69.7	2.0	11.3	17.0
Multan	63.1	2.2	29.0	5.7
Vehari	80.9	1.9	2.5	14.7
Khanewal	70.2	1.5	9.2	19.1
Sahiwal	82.2	4.2	5.1	8.5
Rajanpur	90.1	2.3	0.6	7.0
Rahimyar Khan	83.2	1.5	9.2	6.1
Muzaffargarh	77.8	1.6	4.0	16.6
Dera Ghazi Khan	91.4	1.9	4.9	1.8
Layyah	96.8	1.5	1.1	0.6

Source: District Census Reports, 1999 and 2000.

Exhibit 5.7: Education in Southern Punjab

District	Numbers			Enrollment		
	Schools	Colleges	Others	Schools	Colleges	Others
Pakpattan	837	5	9	108,362	3,646	595
Lodhran	846	5	23	-	-	-
Bahawalnagar	2,464	10	398	240,083	6274	10,122
Bahawalpur	1847	15	443	-	-	-
Multan	1,787	10	376	226,890	-	11,744
Vehari	1,706	6	6	-	-	-
Khanewal	1,456	8	323	199,727	6,197	11,404
Sahiwal	1,325	5	157	255,539	8,684	5,306
Rajanpur	1,093	4	265	-	-	-
Rahimyar Khan	2,866	8	10	-	-	-
Muzaffargarh	1,145	7	0	-	-	-
Dera Ghazi Khan	1,654	5	26	158,347	60,58	2,977

Source: District Census Reports, 1999 and 2000.

Exhibit 5.8: Enrollment Ratio

District	Both Sexes (%)	Males (%)	Females (%)
Pakpattan	28.6	36.5	20.1
Lodhran	26.1	32.4	19.1
Bahawalnagar	31.1	35.3	26.7
Bahawalpur	28.4	32.3	24.0
Multan	34.9	40.8	28.6
Vehari	30.5	36.5	24.0
Khanewal	33.1	39.2	26.5
Sahiwal	43.6	54.4	31.9
Rajanpur	21.6	27.0	15.3
Rahimyar Khan	27.0	31.4	22.2
Muzaffargarh	23.9	30.2	17.4
Dera Ghazi Khan	23.0	28.4	17.1
Layyah	31.2	38.5	23.4

Source: District Census Reports, 1999 and 2000.

Exhibit 5.9: Literacy Ratio

District	Both Sexes (%)	Males (%)	Females (%)
Pakpattan	34.7	47.0	21.3
Lodhran	29.9	42.7	16.0
Bahawalnagar	35.1	45.5	23.8
Bahawalpur	35.0	44.9	24.0
Multan	43.4	53.3	32.3
Vehari	36.8	49.4	23.2
Khanewal	39.9	53.6	25.1
Sahiwal	43.9	54.7	32.3
Rajanpur	20.7	29.0	11.3
Rahimyar Khan	33.1	43.4	21.8
Muzaffargarh	28.4	40.9	14.8
Layyah	38.7	53.0	23.4
Dera Ghazi Khan	30.6	42.1	18.1

Source: District Census Reports, 1999 and 2000.

Exhibit 5.10: Healthcare Facilities in Southern Punjab

District	Number of Healthcare Facilities							
	Hospital (s) (150 beds & above)	District Headquarter(s)	Tehsil Headquarter(s)	Basic Health Unit(s)	Rural Health Centre (s)	Maternity Community Health Centre(s)	T.B Clinic(s)	Others (Sub Health Centres, Dispensaries & Private Facilities)
Pakpattan	-	1	1	74	6	1	1	-
Lodhran	-	1	2	50	4	-	-	-
Bahawalnagar	-	1	4	101	10	7	3	91
Bahawalpur	8	-	-	73	12	2	3	95
Multan	14	-	2	67	8	13	3	91
Vehari	-	1	2	76	6	3	-	4
Khanewal	8	-	-	82	4	11	2	29
Sahiwal	9	1	-	74	9	9	1	47
Rajanpur	-	1	-	32	6	1	-	2
Rahim Yar Khan	4	-	-	102	17	-	-	-
Muzaffargarh	-	1	2	71	20	4	-	3
D G Khan	6	-	-	52	9	6	1	69
Layyah		1	2	42	3	1		10

Source: District Census Reports, 1999 and 2000.

Exhibit 5.11: Major Industries of Southern Punjab

District	Major Industry(s)
Pakpattan	Ittefaq Sugar Mills, Rice Mills, Cotton and Ginning/ Pressing Mills, Brick Kilns
Lodhran	Cotton Ginning Factories, Vegetable Ghee Mill, Flour Mill
Bahawalnagar	Cotton Spinning Textiles, Sugar Mills, Flour Mills, Ghee Mills, Cotton Ginning, Rice Factories, Cottage Industries (hand work embroidery, shoe making, bangle making, wood carving, carpet weaving, iron work, mud pottery and sports goods)
Bahawalpur	Textile (Spinning) Mills, Textile (Weaving) Mills, Power Looms, Vegetable Ghee Mills, Flour Mills, Sugar Mills, Cotton Ginning Mills, Bakery Plants, Rice Sheller, Card Board Industries, Ice Factories, Poultry Feeds, Cold Storage, Solvent Oil Ext, Tannery, Cotton Waste Spinning, Match Box Industries, Marble Cutting, Woolen Press, Ready Made Garments, Fruit Juice, Beverages, Steel Re – Rolling Mill, Pharmaceutical Industries Cottage Industries: brass ware, hand block painting, embroidery, furniture, khais, poultry, printing, pottery work, silver jewelry, plastic leads, attachicase, khussa work, pin work, book binding
Multan	Cotton Textiles (Ginning & Processing), Silk & Silk Art Textiles, Carpet & Rug Woolen Textiles, Edible Oil Mills, Leather Tanneries (Tanning, Finishing, Dying), Bleaching & Finishing Textiles, Fertilizer Factories, Soap Manufacturing Factories, Clay Products Manufacturing Factories, Pharmaceutical Industries, Agriculture Machinery Manufacturing Industries, Cottage Industries (chemical silk/ woolen carpets, colored bricks, household linens)
Vehari	Textile Mills Burewala, Gulshan Spinning Mills, Kohinoor Oil Mills, G.S.S Oil Mills, Chohan Ghee Mills, Ginning Factories, Oil Mills, Textile Factories, Flour Mills.
Khanewal	Punjab Sugar Mills, Mannoo Textiles, Wasim Beverages, Oils Mills in Kabirwala, Cotton Ginning Factories, Flour Mills, Brook Bond Tea Factory, Nestle Milk Plant, Railway Sleeper Factory, Cottage Industry (cotton cloth weaving industries, making of ropes, mats, and baskets)
Sahiwal	Biscuit Factory, Ginning Factories, Textile Mills, Tanneries, Vegetable Oil Mills, Ghee Factory, Mughal Engineering Company, Master Industries, Wasal Mechanical Works, Wan Factory, Saw Mills, Cold Storages, Ice Factories
Rajanpur	Carpet Weaving Factories, Cotton Mills(Ginning & Pressing), Rice Husking Mills, Ice Factories, Brick Kilns, Flour Mills
Rahim Yar Khan	Textile Mills, Cotton Ginning & Pressing Mills, Sugar Mills, Cotton seed oil Mills, Edible Oil Mills, Soap Manufacturing Mills, Beverages Factories, Agriculture Implement Manufacturing Industries, Fertilizer Manufacturing Industries, Flour Mills, Industrial Unit of Lever Brothers, Fauji Fertilizer Plant, Power Looms, Packing Paper Units, Seed Processing Plants, Steel Pipe Industry, Oil & Lubricants Factories, Poultry Feed Industries, Bread Industry, Brick Kilns, Ice Factories
Muzaffargarh	Jute Mills, Sugar Mills, Textile Mills, Cloth Mills, Dying Factories, Packages Factory, Flour Mills, Pak Arab Oil Refinery, Ghee Mills, Gas Turbine Power Station, ARS Lal Pir Thermal Power Station
Dera Ghazi Khan	Cotton Ginning and Pressing, cotton textiles, cement factory, vegetable oil, lacquered wooden/ electric lamps, frames of looking glasses, flower, waxes, bowls, dressing tables, articles of decoration
Layyah	Sugar mill, flour mills.

Source: District Census Reports, 1999 and 2000.

Exhibit 5.12: Agro-ecological Zones of Pakistan

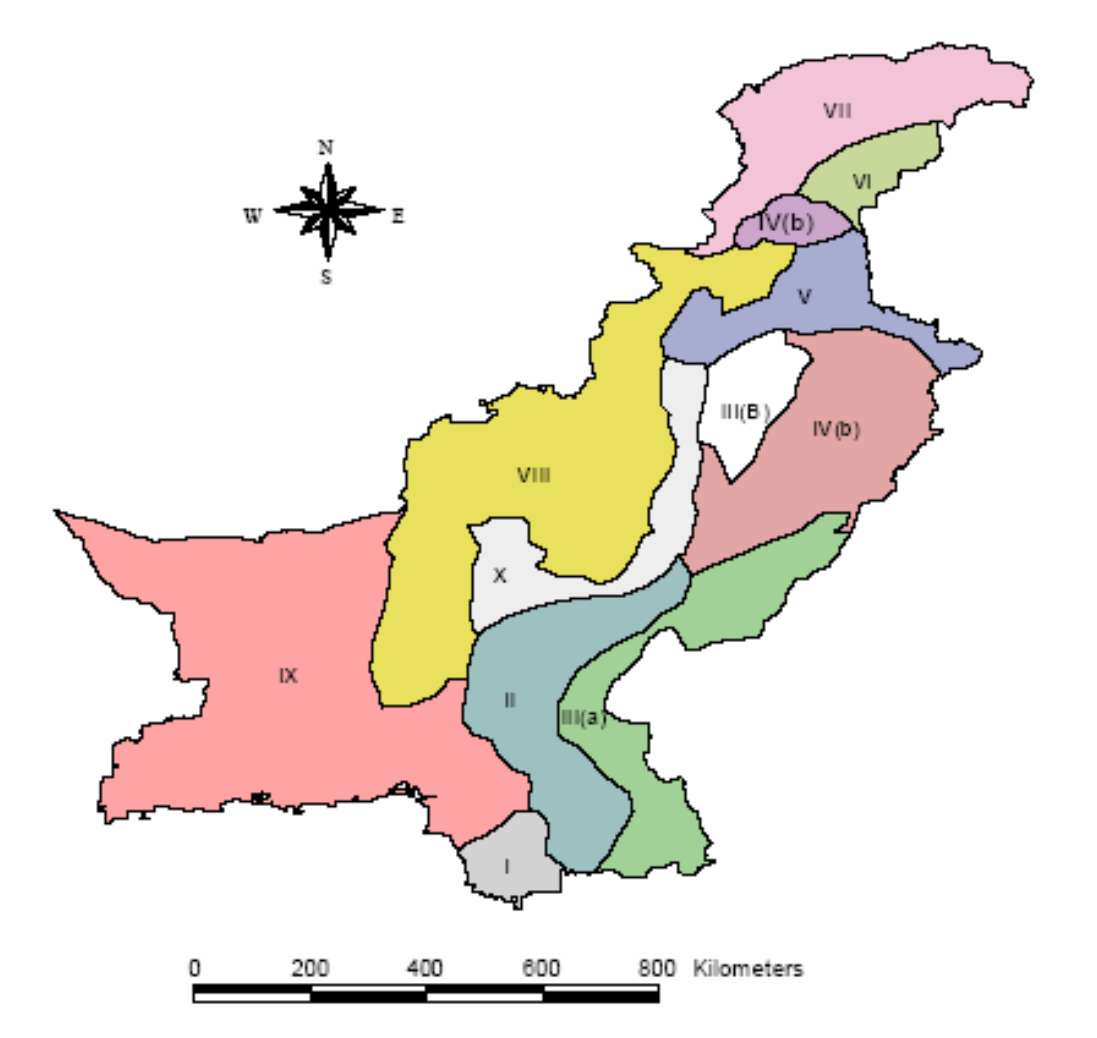

Exhibit 5.13: Characteristics of Agro-ecological Zones of Pakistan

Zone	Region	Temperature (°C)	Rain (mm)	Soil	Crops	Other Features
I	Indus Delta	34-40 19-20	125-250	Clayey Soil Silty Soil	Rice, Sugarcane, Pulses, Berseem, Wheat	Salinity of Soil, Poor Drainage
II	Southern irrigated plain	38-45 8-12	125-250	Silt Loam, Sandy Loam, Silty Clay	Rice, Wheat, Cotton, Sorghum, Mustered, Sugarcane, Gram	20% Salt Affected Area
III(a)	Sandy Desert	39-41 7	125-250	Sandy Soils, Moving Sand Dunes; Clayey Soils	Guar, Millets, Wheat	Dust Storm are Common
III(b)	Sandy Desert	40 5.5	150-350	Stable Sand Ridges (sand and loamy fine sand soils)	Gram, Wheat, Cotton, Sugarcane	Internal Drainage
IV(a)	Northern Irrigated Plain	39.5-42 6-6.2	200-500	Sandy Loam, Clayey Loam	Rice, Wheat, Cotton, Sugarcane, Maize, Oilseeds, Melons	Canal Irrigated Cropping
IV(b)	Northern Irrigated Plain	38 5	500	Clayey	Sugarcane, Maize, Tobacco, Wheat, Berseem	Intensively Cultivated Area
V	Barani Land	38-38.5 3.7	200-1000	Silty Loam, Silty Clayey loam, Clay Loam	Wheat, Millets, Rice, Maize, Oilseeds, Pulses, Fodder	Shallow Soils Unsuitable for Root Growth
VI	Wet mountain	35 0-4	>1000	Silt Loams, Silty Clay	Maize, Wheat, Rice, Deciduous Fruit	Steep Mountain Slopes
VII	Northern Dry Mountains	Varied	300-1000	Deep and Clayey formed of Colluvial material and alluvial deposits	Maize, Wheat, Fodders, Fruit, Apricot	Glaciers and Snow fields

…Continued, Exhibit 5.13

Zone	Region	Temperature (°C)	Rain (mm)	Soil	Crops	Other Features
VIII	Western Dry Mountain	30-39 -3 – 7.7	125-500	Strongly Calcareous Soils; Gravely soils	Fruit, Wheat, Vegetables, fodder, Maize	Numerous Hill Torrents
IX	Dry Western Plateau	33-40.5 3 – 15	50-200	Strongly Calcareous Silt Loams Gravely soils	Tropical Fruits, Wheat Summer Cereals	Sailaba agriculture system
X	Sulaiman Piedmont	40-43.6 5.8 – 7.6	125-250	Loamy, Clayey	Wheat, Gram, Lentils, Oilseeds, Millet Sorghum	Sailaba agriculture system

Exhibit 5.14: Major Crops of Southern Punjab

District	Crops
Pakpattan	Wheat, rice, maize, sugarcane, cotton, gram
Lodhran	Wheat, grain, oil seeds, cotton, sugarcane, rice, til
Bahawalnagar	Cotton, sugarcane, wheat, gram, and oil seeds
Bahawalpur	Wheat, sugarcane, cotton, rice, jowar, bajra, maize, mong, mash, grams, lentil, oil seeds and other pulses
Multan	Wheat, rice, cotton, sugarcane
Vehari	Cotton, wheat, sugarcane, rice, maize, pulses, oil seeds and vegetables
Khanewal	Wheat, cotton, rice, sugarcane
Sahiwal	Wheat, cotton, rice, sugarcane
Rajanpur	Wheat, cotton, rice, sugarcane, peas
Rahimyar Khan	Cotton, sugarcane, rice, wheat, oil seeds, fodders
Muzaffargarh	Wheat, rice, maize, sugarcane, cotton
Dera Ghazi Khan	Wheat, Rice, Sugarcane, Cotton

Source: District Census Reports, 1999 and 2000.

Exhibit 5.15: Major Fruits of Southern Punjab

District	Fruits
Pakpattan	Mango, banana, guava, citrus, water &musk melon
Lodhran	Citrus, mango, banana, guava, pomegranate, water melon, dates
Bahawalnagar	Mangoes, dates, citrus, guava, ber
Bahawalpur	Mangoes, dates, citrus, falsa, pomegranate, jaman, pilu, ber, jambolan, kinno
Multan	Mangoes (anwar ratol, dasehri, langra), malta, orange, sour – lemon, sweet – lemon, pomegranate, guava, dates
Vehari	Mango, citrus
Khanewal	Mango, malta, orange, lemon, pomegranate, guava, dates
Sahiwal	Mango, citrus, banana, orange, mandaroine, lemon, guava, malta
Rajanpur	Mango, water &musk melon, dates, guava, citrus
Rahimyar Khan	Mango, citrus
Muzaffargarh	Citrus, mango, banana, pomegranate, date, guava
Dera Ghazi Khan	Mangoes, Dates, Guava, Pomegranate, Citrus

Source: District Census Reports, 1999 and 2000.

Exhibit 5.16: Cropping Pattern

Crop in District	Area (00 Hectares)	Production (000 Tons)	Yield (kg/ Hectares)
Wheat			
Pakpattan	148.50	425.90	2,868
Lodhran	401.9	12,57.80	1,116
Bahawalpur	6,24,000 acres	553,180	23.7 monds
Multan	178,000	399,000	-
Khanewal	205.0 (acres)	503.0	-
Sahiwal	149.0	427.0	-
Rajanpur	115.3	214.0	1,856
Muzaffargarh	266.7	551.5	2,052
Dera Ghazi Khan	149.3	292.5	1,959
Rice			
Pakpattan	23.10	39.70	1,718
Lodhran	46.0	2,101.0	1,674.0
Bahawalpur	17,000	10,280	16.2 monds
Multan	5,000	6,000	-
Vehari	-	-	-
Khanewal	10.0 (acres)	13.0	-
Sahiwal	14.0	19.0	-
Rajanpur	12.9	18.6	1,441
Muzaffargarh	21.5	31.3	1,455
Dera Ghazi Khan	19.8	28.5	1,439
Maize			
Pakpattan	9.70	16.10	1,659
Muzaffargarh	3.9	5.4	1,384
Bahawalpur	6,500	3,400	14.0 monds
Sugarcane			
Pakpattan	9.30	367.30	39,494
Lodhran	44.0	1,551.4	1,302.37
Bahawalpur	26,900 acres	579,200	576.9 monds
Multan	3,000	96,000	-
Vehari			
Khanewal	7.0 (acres)	286.0	-
Sahiwal	16.0	686.0	-
Rajanpur	1.8	64.4	45,777
Muzaffargarh	11.1	425.3	38,315
Dera Ghazi Khan	1.8	70.7	39,277

…Continued, Exhibit 5.16

Crop in District	Area (00 Hectares)	Production (000 Tons)	Yield (kg/ Hectares)
Cotton			
Pakpattan	117.30	232.80	1,984
Lodhran	472.0	11,807.0	393.94
Bahawalpur	6,19,000	1,053,010	23.2 monds
Multan	172,200	333,000 (bales)	-
Khanewal	189.0 acres	521.0 (bales)	-
Sahiwal	102.0	250.0 (bales)	-
Rajanpur	123.0	366.2	2,977
Muzaffargarh	171.6	440.2	2,565
Dera Ghazi Khan	88.6	264.2	2,981
Jowar			
Bahawalpur	28,000	7,800	7.5 monds
Bajra			
Bahawalpur	12,600	3,700	7.9 monds
Gram			
Pakpattan	1.10	0.90	818
Bahawalpur	2,100	700	8.9 monds
Dera Ghazi Khan			
Grain			
Lodhran	1.3	12.0	-
Bahawalpur	-	-	-
Dera Ghazi Khan			
Mong			
Bahawalpur	610	106	4.5 monds
Mash			
Bahawalpur	476	152	8.5
Lentil			
Bahawalpur	622	200	8.6 monds
Oil seeds			
Bahawalpur	51,700	22,100	11.4 monds
Other Pulses			
Bahawalpur	80	23	11.4 monds

Source: District Census Reports, 1999 and 2000.

Exhibit 5.17: Horticulture Pattern

District	Area (00 Hectares)	Production (000 Tons)	Yield (kg/ Hectares)
Mango			
Pakpattan	98.00	1,088.00	11,102
Lodhran	364.0	4,031.0	11,074
Rajanpur	915.0	9,279	10,140
Muzaffargarh	3,157	32,024	10,143
Dera Ghazi Khan	142.0	1,577.0	11,105
Banana			
Pakpattan	425.00	2,689.00	6,327
Lodhran	4.0	20.0	5,000
Muzaffargarh	14.0	72.0	5,142
Guava			
Pakpattan	522.00	3,848.00	7,371
Lodhran	137.0	1,049.0	7,656
Dera Ghazi Khan	12.0	85.0	7,083
Rajanpur	16.0	110.0	6,875
Muzaffargarh	28.0	193.0	6,892
Citrus			
Pakpattan	1,686.00	16,173.00	9,592
Lodhran	1,446.0	13,753.0	9,511
Rajanpur	302.0	3,105	10,281
Muzaffargarh	967.0	9.007	9,314
Dera Ghazi Khan	323.0	3,008.0	9312
Water & Musk Melon			
Pakpattan	115.00	2,544.00	22,121
Lodhran	178.0	3,941.0	22,140
Rajanpur	53.0	1,067	20,132
Pomegranate			
Lodhran	20.0	140.0	7,000
Muzaffargarh	567.0	3,929	6,911
Dera Ghazi Khan	5.0	35.0	7,000
Dates			
Lodhran	29.0	183.0	6,310
Rajanpur	71.0	462.0	6,507
Muzaffargarh	2,924	20,225	6,916
Dera Ghazi Khan	78.0	502.0	6,435

Source: District Census Reports, 1999 and 2000.

Exhibit 5.18: Irrigation Command Area

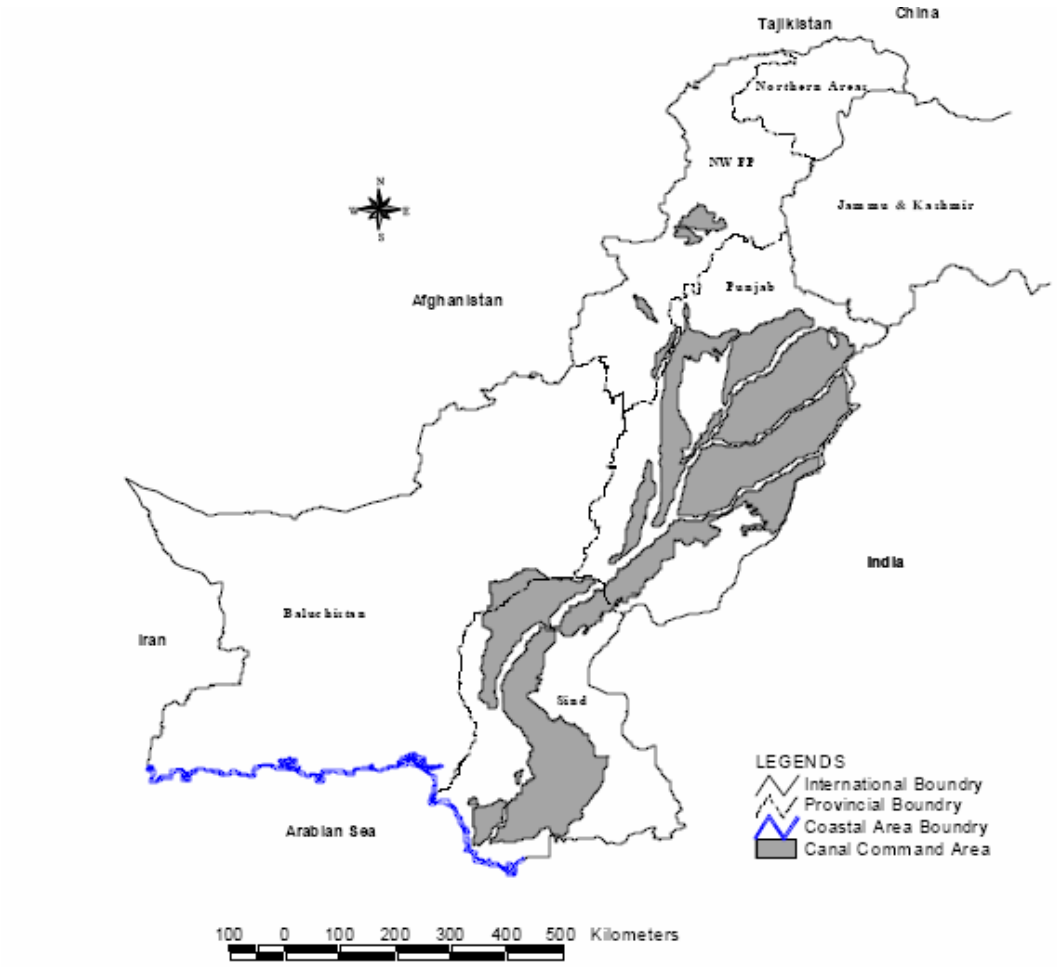

Exhibit 5.19: Places of Archeological, Historical or Religious Significance

Description	Location
Tomb of Abu Hanifa	Uch Sharif, Bahawalpur
Tomb of Bibi Jawidi	Uch Sharif, Bahawalpur
Tomb of Nuria	Uch Sharif, Bahawalpur
Tomb of Bhawal Halee	Uch Sharif, Bahawalpur
Tomb of Musa Pak Shaheed	Uch Sharif, Bahawalpur
Fort Derawar	About 50 km from Bahawalpur
Noor Palace	Bahawalpur
Sadiq Garh Palace	Bahawalpur
Tomb of Ghazi Khan	Village Chirota, Dera Ghazi Khan
Shrine of Sakhi Sarwar	Dera Ghazi Khan
Ther Dallu Roy	Dajal, Dera Ghazi Khan
Shrine of Mohammad Suleman at Taunsa (Taunsa Sharif)	Taunsa, Dera Ghazi Khan
Tomb of Khalid Walid	Kabirwala, Khanewal
Ruins of Indus Civilization	Hrappa, Sahiwal
Tomb of Mir Chakar	Satghara, Sahiwal
Tomb of Syed Daud Kirmani	Shergarh, Sahiwal
Tomb of Sheikh Baha-ud-din Zakaria	Multan
Sawi Masjid and graves	Kotla Tole Khan, Multan
Tombs of Patrick Alexander Vana, Andrew and William Anderson	Old Fort, Multan
Shrine of Shah Rukne Alam	Old Fort, Multan
Tomb of Shah Ali Akbar's mother	Sura Miana, Multan
Tomb of Shams Tabrez	Sura Miana, Multan
Tomb of Shah Ali Akbar	Multan
Tomb of Shah Yusuf Gardezi	Multan
Mound Ratti Khari	Kabirwala
Tomb of Shah Hussain Soozai	Multan
Tomb of Mai Mehraban	Multan
Ruins of a Mosque	Sargana, Multan
Maryala Mound	Multan
Phulra Fort	Fort Abbas, Bahawalnagar
Mir Garh Fort	Fort Abbas, Bahawalnagar
Jam Garh Fort	Fort Abbas, Bahawalnagar
Marrot Fort	Bahawalnagar

…Continued, **Exhibit 5.19**.

Description	Location
Tomb of Thar Khan Nahar	Muzaffargarh
Mosque of Thar Khan Nahar	Muzaffargarh
Tomb of Sheikh Sadan Shaheed	Muzaffargarh
Shrine of Hazrat Din Panah	Daira Din Panah, Muzaffargarh
Shrine of Hazrat Noor Shah	Kot Addu, Muzaffargarh
Shrine of Hazrat Baba Baga Sher	Muzaffargarh
Shrine of Hazrat Alam Shah Bukhari	Shehr Sultan Jatoi, Muzaffargarh
Shrine of Hazrat Pir Jahanian	Muzaffargarh
Shah Garh Fort	Muzaffargarh
Mosque at Bhong	Bhong, about 28 km from Sadiqabad, District Rahim Yar Khan
Pttan Minar	Rahim Yar Khan
Mau Mubarik Fort	Rahim Yar Khan
Khair Garh Fort	About 40 km south of Khanpur, District Rahim Yar Khan
Islam Garh Fort	About 34 km south of Rahim Yar Khan
Bhutta Wahan	About 16 km north of Rahim Yar Khan
Shrine of Hazrat Baba Farid-ud-din Ganj-e-Shakar	Pakpattan

Sources: District Census Reports (1999 and 2000); Guidelines for Sensitive and Critical Areas; Pak-EPA (1997).

Note: None of the above areas are located at or in the immediate vicinity of the proposed project components.

6 Analysis of Project Alternatives

This Chapter discusses various project alternatives that were considered during the design phase. The alternatives in this Chapter have been organized in three broad categories: management, siting and technical alternatives.

6.1 Management Alternatives

6.1.1 No Project Alternative

As described in **Section 1.2**, the electricity demand has been increasing during the past several years, and this trend is expected to continue as a result of the on-going economic uplift in the country. The key factors fueling the increasing power demand include increasing population, rapid urbanization, industrialization, improvement in per capita income and village electrification.

In order to match the increasing trend in the power demand, regular investments in various segments of the power network – generation, transmission, and distribution – is vitally important. Otherwise, the gap between the supply and demand will keep on increasing.

The proposed project seeks to upgrade the secondary transmission and grid network of the MEPCO system, as well as rehabilitate the HT/LT feeders. Establishing new grid stations and augmenting/converting/upgrading the existing ones will provide the much needed relief to the over-loaded system, while also accommodating additional load. The new grid stations and the HT/LT rehabilitation works will also reduce the line losses and power breakdowns.

In case the proposed project is not undertaken, the MEPCO system will not be able to cope with the increasing demand, the existing system will remain over-loaded, line losses will also remain high, and the system reliability will progressively decrease, with increasing pressure on the system. The Utility will also forego the opportunity of increasing its consumers as well as revenue associated with the system expansion.

In view of the above, the 'no project' option is not a preferred alternative.

6.2 Siting Alternatives

6.2.1 Grid Station Sites

MEPCO considered multiple alternative sites for the Jail Road, Suraj Miani, Sahiwal III and Makhdumpur grid stations. However, these alternatives were quite similar with respect to the environmental and social aspects. For the Bahawalpur Cantt. grid station, the Cantonment Authorities have identified the site. Hence for this grid station, no alternative locations were considered.

6.2.2 Routing Alternatives

While selecting the transmission line route, the GSC crew identifies three options. These include the shortest possible route between the two ends of the proposed transmission line. However this may not always be the most feasible route, in view of the settlements that come in the way. Therefore the most preferable route is the one which avoids settlements and other sensitive areas.

For the proposed project, the GSC surveyor team could not identify three alternate routes because of shortage of time. However, while surveying the routes, the GSC team considered multiple routing options, and made efforts to avoid settlements and other sensitive locations as far as possible. The key routing options of the transmission lines are discussed below.

Feed for Head Sidhnai Grid Station: The shortest route for the feed would pass over some settlements. However, deviations have been made in the route to avoid the settlements. There exist no other environmental or social sensitivities along the proposed route.

Feed for Makhdumpur Grid Station: The shortest route for the feed would pass over some settlements. However, the route has been aligned to avoid these settlements. There exist no other environmental or social sensitivities along the proposed route.

Kahror Pecca to Lal Sohanra to Hasilpur Transmission Line: The only sensitivity identified along the possible route was some settlements near Kahror Pecca. The route in this section of the transmission line has been aligned to avoid these settlements. There exist no other environmental or social sensitivities along the proposed route.

6.3 Technical Alternatives

6.3.1 Type of Grid Station

Generally, two types of grid station designs are available: conventional and gas-insulated.

The conventional grid stations have open yards for transformers and their accessories and the control panels and feeder panels are placed indoors. These grid stations require a large area (about 4 acres), which might be a problem in congested urban areas. The environmental and socioeconomic aspects of this type of grid station include safety hazard for the nearby population, particularly in the congested urban areas.

The gas insulated grid stations (GIS) on the other hand employ a very compact design, and most of equipment is fully enclosed and gas insulated. This allows the entire system to be placed indoors in considerably small space compared to the conventional design. However, the cost of these grid stations is several times higher than the conventional ones.

In view of the fact that most of the new grid stations as part of the proposed project are being planned outside the congested urban areas, the availability of land is not a problem. The project does include establishment of two new grid stations inside the Multan City, however here too, the land is expected to be available at a reasonable price. Hence the additional cost associated with the GIS cannot be justified, and the conventional grid station design is the preferred option for the proposed project.

6.3.2 Type of Circuit Breakers

Traditionally, oil-filled circuit breakers used to be installed at the 132-kV and 11-kV levels. However, now SF_6 circuit breakers are available for 132-kV and above, and vacuum

circuit breakers are available for the 11-kV system. These breakers have very effective arc-quenching characteristics, compared to the old oil-type breakers. Therefore, these modern circuit breakers are the preferred option for the proposed project.

The environmental aspects of the oil-filled circuit breakers essentially pertain to the of soil and water contamination caused by the possible oil leakage.

For the MEPCO's proposed 6th STG project, vacuum and SF_6 circuit breakers would be installed at the grid stations.

6.3.3 Type of Transformer Oil

Traditionally, transformer oil – meant for providing insulation and cooling of the transformer windings – used to contain poly-chlorinated biphenyls (PCB), a man-made chemical known for its excellent dielectric properties. However, this chemical was then found to be highly toxic, and more importantly, chemically very stable. Hence this chemical would not decompose or disintegrate naturally. Due to this property of PCB, it was included in a group of chemicals collectively known as persistent organic pollutants (POPs). **Appendix E** provides more information on PCBs.

Although, production and use of the PCB containing transformer oil is not allowed anymore in the West, it is still being used locally. In view of their extremely harmful effects however, use of this oil is not a preferred option for all applications, including the proposed project.

MEPCO's specifications for the procurement of transformers clearly mention that the transformer oil should be PCB-free (though no tests are performed to confirm this). Hence the equipment purchased as part of this project would be PCB-free.

6.3.4 Type of Transmission Line Towers

Single Circuit vs. Double Circuit

For the 132-kV single-circuit transmission lines, there are two possible options for the type of the towers: single circuit and double circuit. The single circuit towers are designed for one circuit of the transmission line only, and there is no room for the second circuit in the future. On the other hand, using the double circuit towers for the single circuit transmission line provides the future expansion capacity on the same towers. The cost of the double circuit towers is slightly higher than the single circuit variants, however, in view of their expansion capacity, these towers are the preferred options for all the single circuit transmission lines which are included in the proposed project.

The environmental and socioeconomic aspects of the double-circuit tower include smaller footprint and lower land acquisition requirements (compared to two single-circuit towers).

Tower vs. Tubular Pole

The base of the transmission line towers is about 10 m × 10 m, and finding this much space in congested urban areas may be a problem. For such applications, WAPDA has been using tubular steel poles which require considerably less space. These poles are quite expensive compared to the conventional towers.

The environmental and socioeconomic aspect of the tubular pole includes smaller footprint, compared to the conventional tower.

Some of the transmission lines as part of the proposed project would need to pass through congested city areas (eg, feed for the Jail Road and Suraj Miani grid stations in Multan City). For such transmission lines, the preferred option would be to use the tubular poles.

6.3.5 Construction Methodology Options

The transmission line towers require foundations to be built to support their weight. To build these foundations, excavation has to be carried out. In the rocky areas, these excavations can be carried out through blasting, or alternatively, by using mechanical means. Usually, blasting is a quicker method, however, in some areas this may not be the preferred option, particularly, in wildlife sensitive areas or within/near communities.

The environmental and socioeconomic aspects associated with the blasting include safety hazard for communities and livestock, noise and vibration, damage to natural vegetation, disturbance to wildlife and soil erosion.

No blasting is expected to be carried out as part of the proposed project, nor are there any sensitive areas in and around the proposed project components.

7 Stakeholder Consultations

This Chapter provides the objectives, process and outcome of the stakeholders consultations conducted as part of the ESA study.

7.1 Objectives

The stakeholder consultation is an integral part of the environmental and social assessment for a project such as the 6th STG and ELR, and aims to provide a two-way communication channel between the stakeholders and the project proponents. In line with this aim, the objectives of the stakeholder consultation conducted as part of the present ESA were to:

- develop and maintain communication links between the project proponents and stakeholders,
- provide key project information to the stakeholders, and to solicit their views on the project and its potential or perceived impacts, and
- ensure that views and concerns of the stakeholders are incorporated into the project design and implementation with the objectives of reducing or offsetting negative impacts and enhancing benefits of the proposed project.

The stakeholder consultation is a continued process, and should be maintained throughout the project. The EMP in **Chapter 10** provides a stakeholder consultation mechanism for the project implementation phase.

7.2 Participation Framework

The stakeholder consultation is a continued process, and should be maintained throughout the project. The consultations carried out during the present ESA and reported in this Chapter are essentially a first step in this process. During the subsequent project phases as well, participation of the project stakeholders need to be ensured.

Exhibit 7.1 charts out the proposed participation framework during different project phases, while **Exhibit 7.2** provides the conceptual framework employed during the stakeholders consultation carried out as part of the present ESA.

7.3 Stakeholder Identification

Stakeholder analysis was carried out to identify relevant stakeholders on the basis of their ability to influence the project or their vulnerability to be negatively impacted from it. This approach ensured that no relevant groups are excluded from the consultation, and appropriate engagement strategies are developed for each stakeholder.

Key stakeholders consulted at various levels include:

- People directly affected by the Project (ie, project affected persons or PAPs).
- Project beneficiaries

- MEPCO officials
- District governments (revenue and other departments)
- Environment Protection Agency
- The broader interested community
- The NGOs, international organizations and other interest groups.

7.4 Consultation Process

Consultations with the project stakeholders were carried out while conducting the present ESA. A participatory and consultative approach was employed for information gathering and data collection.

Meetings were held with a range of key informants as well as government and civil society stakeholders at different levels. The focus group discussions with smaller groups of grassroots stakeholders were held, whereas one-to-one meetings were held with the institutional stakeholders. These discussions were held with project affected people, project beneficiaries and other local communities in Multan, Muzaffargarh, Bahawalpur and Sahiwal districts. This process of public consultation was conceived to interact meaningfully with affected communities and other stakeholders. The consultations also helped better understand local knowledge with respect to the various sets of issues and concerns, and integrate these into the project design and EMP. (Please see **Appendix D** for stakeholder consultation details.)

7.5 Consultations with Institutional Stakeholders

The institutional stakeholder consultations were held with the representatives of the following organizations:

- Environmental Protection Agency (EPA)
- Energy Wing – Planning Commission, Government of Pakistan
- Sustainable Development Policy Institute (SDPI)
- Leadership in Environment and Development (LEAD) fellows
- Lok Parya (a local grass root level NGO)
- National Environmental Action Plan (NEAP)
- International Union for Conservation of Nature (IUCN).

In addition, a meeting was also held with Dr Yusuf Hyat, who was part of the Persistent Organic Pollutants (POPs) Project.

Concerns Raised by Institutional Stakeholder

The institutional stakeholders raised several concerns and provided useful suggestions/recommendations. These are provided below.

- MEPCO should fulfill the regulatory requirement of conducting environmental and social assessment of all of its projects.
- The project proponent should develop organizational capability for the implementation of EMP, and to handle environmental as well as social issues during the project implementation as well as routine operation of the organization.

- The issues related to land acquisition and compensation should be appropriately addressed during the proposed project.
- The construction related issues – such as waste disposal, soil erosion and hazards for the nearby communities – should be adequately addressed during the proposed project.
- The potential environmental issues during the operation and maintenance of the proposed project – such as soil and water contamination caused by the leakage/spillage of the PCB-containing transformer oil – should be adequately mitigated.
- MEPCO should have PCB testing arrangements at its grid stations and workshops.
- The PCB-containing transformer oil should be eliminated from the MEPCO system.
- The effects of electromagnetic radiation caused by the high power transmission lines should be appropriately addressed during the proposed project.

7.6 Grass Root Stakeholders Consultations

The grass root consultations were carried out at the following project locations:

- Site for the Jail Road grid station in Multan
- Site for Suraj Miani grid station in Multan
- Site for Sahiwal III grid station in Sahiwal
- Site for Bahawalpur Cantt. grid station, Bahawalpur
- Site for Makhdumpur grid station
- Kot Addu – Chowk Azam transmission line route
- Kahror Pecca – Lal Sohanra transmission line route
- Lal Sohanra – Khairpur Tamewali transmission line route
- Khairpur Tamewali – Hasilpur transmission line route.

Exhibit 7.3 presents list of the discussants and the key issues raised during the consultations. The questionnaire used during the consultations is provided in **Exhibit 7.4**. A summary of these consultations is presented below; details of the consultations are provided in **Appendix D**.

Jail Road Grid Station Site, Multan

During the consultations, people of the area complained about low voltage, frequent interruptions and voltage fluctuations in the area which was causing a lot of hardship as well as damage to the electric appliances. This situation also affected the livelihood of the local population, as shared by the people interviewed. The interviewee shared their grievance about corruption in WAPDA due to their negligence on issues related with the repair and maintenance of the faulty systems. Another of the common complaint shared by the people of the area was over-billing by the Utility.

The people of the area generally supported the plans for the new grid station, and preferred to have a dedicated feeder for their neighborhood.

The main concerns shared by the consultees regarding the proposed project included the risk of electrocution associated with the transmission lines that would pass through the congested areas.

Consultations were also held with staff from an industrial unit in the area. They also complained about the low voltage and frequent power interruptions, causing production loss as well as damage to the equipment. They welcomed the establishment of the new gird station in the area. in their opinion, the improved power availability will not only solve the above-described problems, but will also enable them and other industries in the area to enhance their production capacity, thus increasing their profits while also providing additional employment opportunities.

Suraj Miani Grid Station Site, Multan

The people of the area complained about low voltage, frequent interruptions and voltage fluctuations in the area which was causing a lot of hardship as well as damage to the electric appliances. Load shedding was cited as one of the problems faced by the people as well. The residents of the area also informed about occurrence of sparking at the existing electricity wires passing through the locality. They also shared their grievance associated with the over-billing by the Utility.

Regarding the establishment of the new grid station as a part of the proposed project, the people were averse to the idea of installing transmission line towers in the cultivation fields of the area. They suggested that the transmission line should generally follow the existing road alignment, thus avoiding any built-up area or the cultivation fields.

Sahiwal III Grid Station Site, Sahiwal

Much like the consultees in Multan, the people interviewed at the proposed site for the Sahiwal III grid station complained about low voltage, frequent power outages, faulty meters and over billing. The area being under cultivation, the crops suffered as a result of power outages and load shedding.

The people were in general supportive of the establishment of the proposed grid station at the site. Their concerns included the privacy and safety issues during the construction activities, since their women worked in the fields.

Some of the respondents suggested that a dedicated feeder be installed for their village.

Bahawalpur Cantt Grid Station Site, Bahawalpur

The residents of the area complained about low voltage, frequent interruptions and voltage fluctuations in the area which was causing a lot of hardship as well as damage to the electric appliances. Load shedding was cited as one of the problems faced by the people as well.

The people were generally supportive of the MEPCO's initiative to establish the new grid station in the area, and expected the Utility to incorporate all standard safety measures in the system.

The officials from the nearby Bahawalpur Airport were however not supportive of the new grid station to be established at the proposed site. Their apprehensions included obstruction caused by the transmission line towers in the flight path, electromagnetic radiation disturbing the navigation of aircrafts, and increased bird activity as a result of improper waste disposal at the proposed grid station. They strongly suggested that MEPCO should inform the Civil Aviation Authority of its plans, and obtain necessary approvals, before the work can be started on the grid station.

Makhdumpur Grid Station Site

The people interviewed at the proposed site for the Makhdumpur grid station complained about low voltage, frequent power outages, faulty meters and over billing. The area being under cultivation, the crops suffered as a result of power outages and load shedding.

The people were in general supportive of the establishment of the proposed grid station at the site. Their concerns included the privacy and safety issues during the construction activities, since their women worked in the fields. The landowners expected fair, market-based price for the land.

Kot Addu – Chowk Azam Transmission Line Route

A settlement exists near the Kot Addu grid station. The transmission line from Kot Addu to Chowk Azam passes over this settlement. This transmission line is proposed to be upgraded from single circuit to double circuit, using the existing towers, as part of the proposed project. The residents of this settlement were consulted as part of the stakeholder consultations.

The respondents were unanimous regarding the danger this transmission line poses while passing over their houses. Their concerns included their inability to construct higher buildings, owing to the low height of the transmission line. While they acknowledged that the transmission line was constructed before the settlement was established, they nonetheless desire the transmission line to be re-routed, avoiding the settlement.

Kahror Pecca – Lal Sohanra Transmission Line Route

The people interviewed along the proposed route complained about low voltage, frequent power outages, faulty meters and over billing. The area being under cultivation, the crops suffered as a result of power outages and load shedding.

The people were in general supportive of the proposed project. Their concerns included compensation for damaged crops during the construction phase.

Lal Sohanra – Khairpur Tamewali Transmission Line Route

The people interviewed along the proposed route complained about low voltage, frequent power outages, faulty meters and over billing. The area being under cultivation, the crops suffered as a result of power outages and load shedding.

The people were in general supportive of the proposed project. Their concerns included compensation for damaged crops during the construction phase.

The wildlife officials interviewed (since the Lal Sohanra National Park is in the vicinity of the route) did not share any concern regarding the proposed project. (They however complained about frequent power failures at the 11-KV feeder passing through the National Park, caused by the tree branches close to the feeder.)

Khairpur Tamewali – Hasilpur Transmission Line Route

The people interviewed along the proposed route complained about low voltage, frequent power outages, faulty meters and over billing. The area being under cultivation, the crops suffered as a result of power outages and load shedding.

The people were in general supportive of the proposed project. Their concerns included compensation for damaged crops during the construction phase. They also expected the transmission line to avoid their homes and settlements.

7.7 Summary of Concerns and Recommendations

A summary of the concerns raised and recommendations provided by the institutional as well as the grass root stakeholders is provided in **Exhibit 7.5**. An attempt has been made, during the present ESA, to address these concerns (discussed in **Chapters 8** and **9**).

Exhibit 7.1: Participation Framework

Project Stage	Proposed Tool	Stakeholders Consulted	Responsibility
Project Design Phase	Meetings with institutional stakeholders (carried out during the present ESA); Meetings with grass root stakeholders (carried out during the present ESA) (See **Section 7.3** for a list of key stakeholders.)	Institutional stakeholders; Grass root stakeholders, including the communities to be affected during the project implementation.	ESA consultant.
Project Construction Phase	Sharing of the project objectives, project components, major benefits, potential impacts, mitigation measures and Resettlement Plan with the affected communities (and other stakeholders).	Institutional stakeholders; Grass root stakeholders, including the communities to be affected during the project implementation.	Environmental and Social Inspector (ESI); Environmental and Social Monitor (ESM) (See **Section 10** for the definition and roles of ESI and ESM).
	Grievance Redressal Mechanism and Social Complaint Register (discussed in **Chapter 10**).	The affected communities.	ESI; ESM.
	Consultations with the communities during Compliance Monitoring and Effects Monitoring (discussed in **Section 10**).	Affected communities.	ESI; ESM.
	Fortnightly meetings at the site.	MEPCO site staff; Contractors.	ESI; ESM.
	Consultations with the project affectees / communities during the external monitoring (discussed in **Chapter 10**).	Affected communities.	External monitoring consultant.
	Consultations with the project affectees / communities during the site visits by the WB monitoring mission.	MEPCO site staff; Contractors; The affected communities.	WB monitoring mission.

….Cont'd., **Exhibit 7.1**.

Project Stage	Proposed Tool	Stakeholders Consulted	Responsibility
Project Operation Phase	Liaison with the communities around the grid stations; Liaison with the communities along the transmission line routes.	The communities around the grid stations and along the transmission line routes.	MEPCO O&M staff; MEPCO Environmental Cell (discussed in **Chapter 10**).
ESAs of subsequent phases of the 6th STG Project.	Meetings with institutional stakeholders; Meetings with grass root stakeholders.	Institutional stakeholders; Grass root stakeholders, including the communities to be affected during the project implementation; Affectees of the previous phase of the project (ie, 6th STG Project, 2006-07).	ESA Consultant.

Exhibit 7.2: Conceptual Framework

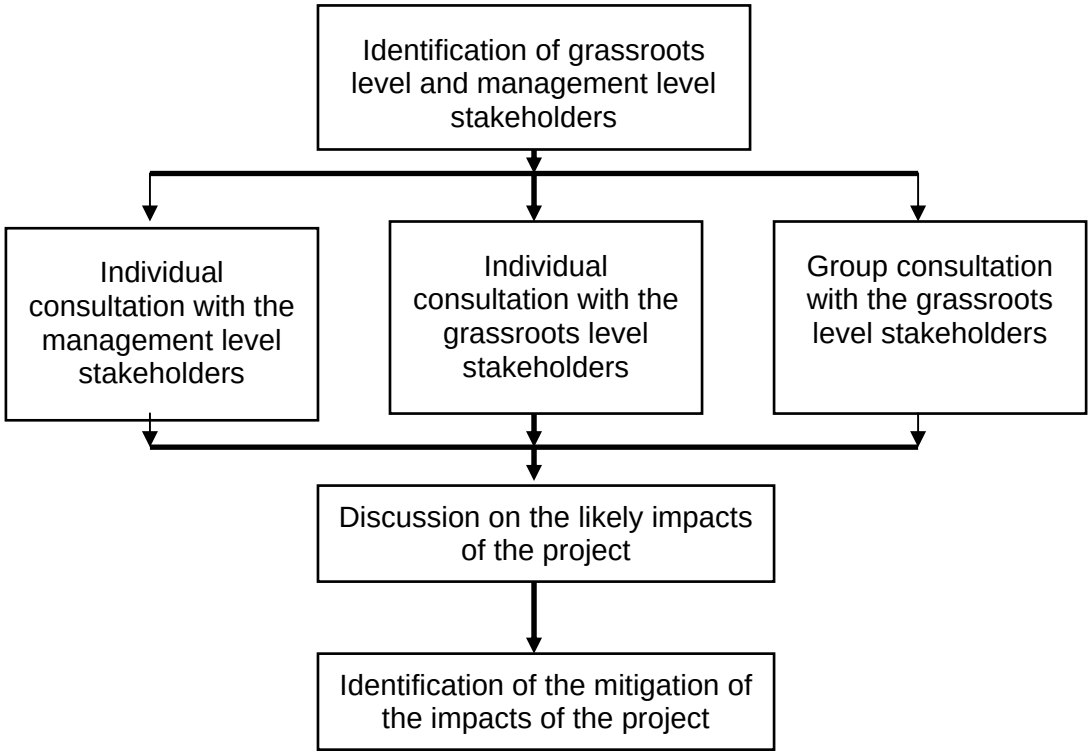

Exhibit 7.3: List of Participants during Grass Root Consultations

Location	Number of Participants	Key Issue Discussed
Multan (near Jail Road grid station site)	15 Residents of the area; Shopkeepers; Staff of two industrial units	Inadequacy of the existing power supply in the area; Safety hazard caused by the transmission line and feeders, for the people of the area. Demand of separate feeders for the area.
Multan (near Suraj Miani grid station site)	12 Residents of the areas; Farmers; Shopkeepers.	Frequent power failures and voltage fluctuation; Safety hazard caused by the transmission line and feeders, for the people of the area. The farmers of the area were averse of the possibility of transmission line towers to be installed in the cultivation fields, during the proposed project.
Sahiwal grid station site and adjoining areas	30 Residents of a nearby villages; Farmers; Staff at the nearby brick kiln.	Frequent power failures and voltage fluctuation; Possibility of dedicated feeder for the area. No apprehensions on the proposed project.
Bahawalpur Cantt, Grid Station	20 Residents of the nearby village; Staff at the nearby grain storage; Staff at the Bahawalpur airport.	Frequent power failures and voltage fluctuation; Over billing; Safety precautions to be taken during the project works; Apprehensions regarding the site in the vicinity of the airport, thus possibly causing hazards for the air traffic.
Lal Sohanra National Park	5 Staff of the National park	The officials confirmed that the transmission line route (or any other project component) was well outside the National park; No apprehension on the proposed project.

…Continued **Exhibit 7.3**.

Location	Number of Participants	Key Issue Discussed
Bahawalgarh Village (near Kehror Pecca)	12 (farmers, teacher, workers at the shops and daily wage earners)	Low voltage, persistent load shedding and frequent power shut down; No apprehensions on the proposed project. The damage to crops should be minimized during the project. The transmission line towers should avoid the cultivation fields. Tower design should allow cultivation underneath them.
Hameedabad Village (near Khairpur Tamewali	7 Patwari and farmers of the village.	No electricity in the village; No apprehension on the proposed project.
Kot Addu – Chowk Azam Transmission Line	25 Residents of the settlement under the transmission line; Farmers along the transmission line; School teachers.	Safety hazards caused by transmission line. Low voltage, persistent load shedding and frequent power shut downs. Complaints of noise from the transmission line (chattering), corona and interference with the electrical appliances. Low height of the transmission line, thus not allowing the residents to construct higher buildings. Harmful effects of the electromagnetic radiation.
Makhdumpur Grid Station Site	7 Farmers and residents of the nearby village	Low voltage, load shedding and frequent power shut down; No apprehensions on the proposed project.
Along the route for the Makhdumpur grid station feed	10 Farmers and residents of the nearby villages/deras	Low voltage, load shedding and frequent power shut down; Damage to the crops caused by the construction activities.
Along the route for the Head Sidhnai grid station feed.	12 Farmers and residents of the nearby villages/deras	Minimize the damage to the crops caused by the construction activities. Towers should avoid the cultivation fields. Tower design should allow the cultivation underneath them.

Exhibit 7.4: Checklist used for Stakeholder Consultations

1. Overview of basic necessities of livelihood available in the area other than the proposed project (e.g sources of water supply, availability of electricity, sources of fuel wood, means of communication, availability of health and educational facilities, technical and vocational training centers, sources of information)?
2. Does the proposed project strengthen the social network already existing in the area or affect it?
3. Who are the people affected by the project with categories of persons and intensity of impacts?
4. What is the poverty level of affected persons?
5. Are directly affected stakeholders agreeable to allow the project?
6. What are the social benefits of the proposed project like provision of electricity to majority of the people, if not all, and stability of electricity in the area at large?
7. What social issues/ losses will be triggered as a result of the project intervention (e.g loss of land, loss of livelihood, bifurcation of land, any risks associated with human and animal health etc)
8. Any commercial activities affected in the visited area due to this project?
9. Apprehensions of the visited communities and their suggestions for the improvement of the proposed project.

Exhibit 7.5: Summary of Communities' Concerns and Expectations

Institutional Stakeholders	**Concerns Raised**
	Land acquisition issues.
	Possibility of soil and water contamination caused by the PCB-containing transformer oil.
	Construction-related issues, such as waste disposal, soil erosion and hazard for communities.
	Effects of electromagnetic radiation caused by the high power transmission lines.
	Recommendations Provided
	MEPCO should conduct environmental and social assessment of all of its projects.
	MEPCO should develop organizational capacity for managing the environmental as well as social issues during its operations.
	The PCB elimination program should be developed and implemented.
Grass Root Stakeholders	**Concerns Raised**
	Safety hazards for people caused by the transmission lines.
	Possibility of transmission line passing over the settlements and through the cultivation fields.
	Low height of the transmission line (Kot Addu – Chowk Azam) thus not allowing the residents to construct taller buildings/install antenna, etc.
	Electromagnetic radiation caused by the transmission line.
	Corona and chattering (noise) caused by the transmission line.
	Obstruction in the flight path of the aircrafts (Bahawalpur Grid Station)
	Expectations Shared
	MEPCO should take all safety precautions to minimize safety hazards associated with the transmission lines.
	The transmission line should avoid passing over the settlements or through the cultivation fields.
	MEPCO should contact the Civil Aviation Authority and follow its procedures in connection with the establishment of the Bahawalpur Cantt. Grid station.
	The transmission line construction should minimize crop damage. The tower design should allow cultivation underneath them.

8 Environmental Impacts and Mitigation

This Chapter assesses the potential impacts of the proposed project (ie, components of the 6th STG and ELR project to be undertaken during 2006-07) on the physical and biological environment of the project area. Also provided in the Chapter are the significance of the potential impacts, the recommended mitigation measures to minimize if not eliminate the potentially adverse impacts, and the residual impacts.

8.1 Environmental Assessment Process

This section provides the environmental assessment process that was employed during the present ESA.

8.1.1 Screening of the Environmental Impacts

As part of the environmental impact assessment process, a screening matrix was developed tailored specifically to the proposed project, focusing the potential environmental impacts during the design, construction and operation phases. The matrix examined the interaction of project activities with various components of the environment. The impacts were broadly classified as physical, biological and social, and then each of these broad categories further divided into different aspects. The potential impacts thus predicted were characterized as follows:

- High negative (adverse) impact,
- Low negative impact,
- Insignificant impact,
- High positive (beneficial) impact,
- Low positive impact, and
- No impact.

The matrix is provided in **Exhibit 8.1**.

The negative impacts predicted in this manner were the 'unmitigated' impacts. Appropriate mitigation measures were recommended as part of this ESA, thus reducing the occurrence possibility and severity of the potentially adverse impacts.

The negative impacts identified through this process are discussed later in the Chapter.

8.1.2 Impact Characterization

Once the potentially adverse impacts were identified as discussed above (and shown in **Exhibit 8.1**), these impacts were characterized. Various aspects of the impact characterization included:

- Nature (direct/indirect)
- Duration of impact (short term, medium term, long term)

- Geographical extent (local, regional)
- Timing (project phase: before, during and after construction)
- Reversibility of impact (reversible/irreversible)
- Likelihood of the impact (certain, likely, unlikely, rare)
- Impact consequence severity (severe, moderate, mild)
- Significance of impact (High, medium, low).

The above aspects of environmental and social impact characterization are defined in **Exhibit 8.2**. The impact characterization during the design, construction and operation phases of the proposed project is provided in **Exhibits 8.3**, **8.4** and **8.5**, respectively.

Subsequent to the impact characterization, appropriate mitigation measures were identified, in order to minimize if not completely eliminate the adverse impacts associated with project activities. Finally, the residual impacts were identified.

The environmental impact characterization, mitigation measures and residual impacts are discussed in the following sections (the socioeconomic impacts and their mitigation are covered in the next Chapter).

8.2 Design Phase Considerations

The decisions made at the design phase of any project can be quite far reaching. For the proposed project, the aspects which can be significant with respect to the environmental impacts include:

- Site selection for grid stations
- Route selection for transmission lines
- Type of equipment.

The design phase impacts are characterized in **Exhibit 8.3** and can be readily preempted and avoided. These concerns and the measures to avoid/minimize them are tabularized below.

Impacts	Likely Causes for Proposed Project	Measures to be Incorporated in Project Design
Soil erosion	Poor site selection; unstable soils.	■ Areas having unstable soil will be avoided for the grid station sites and transmission line/HT feeder routes. ■ Canal and river banks will be avoided while placing the transmission line towers.
Soil and water contamination	Absence of appropriate waste (solid and liquid) disposal.	■ Appropriate waste disposal systems will be included in the design of the grid stations and associated facilities.

Impacts	Likely Causes for Proposed Project	Measures to be Incorporated in Project Design
	Using transformers with PCB-containing oil.	■ The transformer procured during the proposed project will be PCB-free. ■ Leaked oil collection arrangement (such as a channel and a drain pit below the transformers) will be incorporated in the design of the transformer foundations at the grid stations.
Loss of natural vegetation and threat to wildlife	Routing the transmission lines through forested and wildlife-sensitive areas	■ Areas having precious/sensitive natural vegetation and wildlife resources will be avoided for the grid station sites and transmission line routes, where possible. ■ Protected areas (national parks, wildlife sanctuaries and game reserves) will be avoided while selecting the grid station sites and transmission line routes.

8.3 Construction Phase Impacts

The construction phase will be by far the most significant part of the proposed project with respect to environmental considerations, since most of the impacts are likely to take place during this period.

Various construction activities will invariably create environmental disturbances, which may have impacts on the physical and biological resources of the area (see **Exhibit 8.1**). Such impacts include the following:

- Physical Environment
  - Soil erosion, degradation
  - Air quality deterioration
  - Water contamination
- Biological Environment
  - Loss of/damage to the floral resources (natural vegetation) of the area
  - Loss of/damage to faunal resources (wildlife) of the area.

These impacts are characterized in **Exhibit 8.4** and can be readily preempted and mitigated. The mitigation measures recommended in this section will need to be incorporated in the execution of the project.

These impacts and their respective mitigation measures are discussed below.

8.3.1 Soil Erosion and Degradation

The soil-related issues include soil erosion, slope stability, and soil contamination. Soil erosion is likely to be caused by the vehicular traffic on unpaved roads, land clearing for construction camp, grid stations and transmission line towers, and the subsequent construction activities.

Soil may be contaminated as a result of fuel/oils/chemicals spillage and leakage, and inappropriate waste (solid as well as liquid) disposal. This is a potential impact at all of the project sites.

Exhibits 4.10 to **4.15** show the key locations of these impacts in various parts of the project area.

The unmitigated impacts related to soil erosion and contamination are characterized below.

- Nature: Direct
- Duration: Long term
- Geo extent: Local
- Reversibility: Mostly irreversible
- Likelihood: Likely
- Consequence: Major
- Impact significance: High.

Mitigation Measures

The following mitigation measures will minimize the soil erosion and contamination:

- Soil Erosion
  - Cut and fill at the proposed grid station site will be carefully designed, and ideally should balance each other. The surplus soil, if any, will be disposed at places approved by MEPCO (the organizational arrangements for the environmental management during the project construction phase are defined in **Section 10** of this report). Such sites will be selected after surveying the area and ensuring that soil deposition will not have any significant impacts, such as loss of productive land, blocked access, natural vegetation and disturbance to drainage.
  - If necessary, fill material for grid station sites will be obtained from appropriate locations approved by MEPCO. Such locations will be selected after surveying the area and ensuring that soil extraction will not have any significant impacts, such as soil erosion, loss of natural vegetation and disturbance to drainage.
  - Where the use of cultivated land is unavoidable for obtaining the fill material, the top 30 cm soil layer will be removed and stockpiled for redressing the land after removal of the borrow material. The excavation in such areas will be limited to 50 cm depth.
  - The fill material will not be obtained from any cultivation fields or orchards, except where the land owner allows doing so.
  - Areas from where the fill material is obtained or surplus soil deposited, will be landscaped to minimize erosion and hazard for people and livestock.

- Construction camp will be located in a stable and flat area, requiring minimal devegetation and leveling. The contractor(s) will obtain approval from the MEPCO for this purpose.
- Embankments and excavated slopes will not be left untreated/unattended for long durations. Appropriate slope stabilization measures will be taken per the design (eg, stone pitching).
- Vehicular traffic on unpaved roads will be avoided as far as possible. Operation of vehicles and machinery close to the water channels, water reservoir will be minimized.
- After the completion of the construction works, the transmission line routes, campsites and other construction sites will be completely restored. No debris, surplus construction material or any garbage will be left behind.
- Photographic record will be maintained for pre-project, during-construction and post-construction condition of the sites (grid station, transmission line/feeder routes, camps and access roads).

- Soil Contamination
  - Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to avoid soil and water contamination.
  - For the domestic sewage from the construction camps, appropriate treatment and disposal system, such as septic tanks and soaking pits, will be constructed having adequate capacity. The contractor(s) will submit to the MEPCO the plans for the camp layout and waste disposal system, and obtain approval.
  - Waste oils will be collected in drums and sold to the recycling contractors.
  - The inert recyclable waste from the site (such as card board, drums, broken/used parts, etc.) will be sold to recycling contractors. The hazardous waste will be kept separate and handled according to the nature of the waste.
  - Domestic solid waste from the construction camp will be disposed in a manner that does not cause soil contamination. The waste disposal plan submitted by the contractor(s) will also address the solid waste.

Residual Impacts

Appropriate construction practices and management actions as listed above will greatly minimize the soil erosion and contamination. The significance of the residual impacts is therefore expected to be 'low'.

The environmental monitoring (discussed in **Chapter 10**) will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

8.3.2 Air Quality Deterioration

Construction machinery and project vehicles will release exhaust emissions, containing carbon monoxide (CO), sulfur dioxide (SO_2), oxides of nitrogen (NO_X), and particulate matter (PM). These emissions can deteriorate the ambient air quality in the immediate vicinity of the project sites. Furthermore, construction activities such as excavation, leveling, filling and vehicular movement on unpaved tracks may also cause fugitive dust emissions.

The project components that are located close to the communities, and may cause air quality deterioration include:

- Jail Road Grid Station and its feed
- Suraj Miani Grid Station and its feed
- Sections of the Kot Addu – Chowk Azam transmission line,
- Sections of the transmission line feeding Mukhdumpur Grid Station
- Sections of the transmission line feeding Head Sidhnai Grid Station
- 11-KV feeders and LT lines in the above areas.

Exhibits 4.10 to **4.15** show the key locations of these impacts in various parts of the project area.

Rest of the project sites are well away from the communities, hence no air quality issues are expected to arise.

The unmitigated impacts related to air quality deterioration are characterized below.

- Nature: Direct
- Duration: Short term
- Geo extent: Local
- Reversibility: Reversible
- Likelihood: Likely
- Consequence: Minor
- Impact significance: Medium.

Mitigation Measures

The following mitigation measures will minimize the emissions and their impacts:

- Air quality analysis at each of the grid station sites will be conducted before mobilization of the construction crew, in order to establish baseline conditions of the ambient air quality at these locations.
- Construction camps will be established at least 500 m from communities (except when such camps are established inside the grid stations). The contractor(s) will obtain MEPCO's approval for this purpose, as mentioned earlier.
- Construction machinery, generators and vehicles will be kept in good working condition and properly tunned, in order to minimize the exhaust emissions.
- Fugitive dust emissions will be minimized by appropriate methods, such as spraying water on soil, where required and appropriate. The waste water from kitchen and washing area of the construction camp may be used for water spraying.
- Project vehicles will avoid passing through the communities and cultivation fields as far as possible. If unavoidable, speed will be reduced to 15 km/h to avoid excessive dust emissions.

- While working within the communities for works such as transmission line laying, coordination with the communities will be maintained to minimize any detrimental impacts on the crops and settlements.
- Ambient air quality analysis will be carried out at the grid station sites once every two months during the construction phase.

Residual Impacts

The above measures will reduce the magnitude of the adverse impacts of the project on the ambient air quality, but will not eliminate them completely. However, the significance of the residual impacts on the air quality is expected to be low.

The environmental monitoring (discussed in **Chapter 10**) will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

8.3.3 Surface Water and Groundwater Contamination

The project activities that can contaminate soil, may also contaminate the surface water and groundwater. These include:

- Disposal of construction waste
- Solid waste disposal from construction camps
- Waste effluents disposal
- Equipment/vehicle maintenance
- Spillage/leakage of fuels, oils and chemicals.

In addition, vehicles and construction machinery operation near water bodies/water courses can potentially contaminate the surface water.

These impacts may be encountered at all of the sites during the construction phase of the project. However, at the project locations which are near the settlements (such as those listed in **Section 8.3.2** above), the consequence of these impacts will be more severe.

Exhibits 4.10 to **4.15** show the key locations of these impacts in various parts of the project area.

The unmitigated impacts of the proposed construction activities on the water quality of the area are characterized below.

- Nature: Direct and indirect
- Duration: Short to medium term
- Geo extent: Local
- Reversibility: Reversible
- Likelihood: Likely
- Consequence: Major
- Impact significance: High.

Mitigation Measures

The mitigation measures recommended to forestall soil contamination will also prevent water surface and groundwater contamination. Additional mitigation measures are given below.

- The groundwater quality analysis at each of the grid station sites (and campsites if established outside the grid stations) will be conducted before mobilization of the construction crew, in order to establish baseline conditions of the water quality at these locations.
- Construction camp will not be located within 500 m of rivers and major canals (unless it is placed inside the grid station). Location will be finalized after obtaining MEPCO's approval.
- The contractor(s) will submit to the MEPCO the plans for the camp layout and waste disposal system, and obtain approval.
- Groundwater quality analysis will be carried out at the grid station sites and campsites once a month during the construction phase.

Residual Measures

If the recommended mitigation measures are effectively employed, the project activities are unlikely to contaminate the water resources of the area in any significant manner. The residual impacts of the project on the water quality will therefore be negligible.

The environmental monitoring (discussed in **Chapter 10**) will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

8.3.4 Loss of Natural Vegetation

Land will have to be cleared for the grid stations, transmission line towers and parts of the transmission line routes. However most of the project sites are located in areas where the natural habitat has long been modified for habitation or cultivation. The sites selected/identified for the grid stations are either located within the city limits (Suraj Miani grid stations), or in cultivated areas (Sahiwal III grid station). Hence establishment of these grid stations will not cause any damage to the natural vegetation of the area. Similarly none of the transmission line routes would be located in areas where any sensitive or significant natural vegetation now exists.

For clearing the vegetation under the transmission lines, chemical herbicides are also sometimes used. Indiscriminate usage of this method can cause significant loss of biodiversity.

Construction crew can also indulge in tree/shrub cutting to obtain fuel wood.

The unmitigated impacts of the proposed activities on the floral resources of the area are characterized below.

- Nature: Direct
- Duration: Medium to long term

- Geo extent: Local
- Reversibility: Irreversible (reversible in medium to long term)
- Likelihood: Unlikely to Possibly
- Consequence: Mild to Moderate
- Impact significance: Low to Medium.

Mitigation Measures

The following mitigation measures will further minimize negative impacts on the floral resource of the area:

- Clearing of natural vegetation will be minimized as far as possible during the transmission line works.
- Herbicides will not be used to clear vegetation along the transmission line route (or at other project locations).
- For each transmission line route, a tree cutting plan will be prepared and submitted to MEPCO for approval. The plan will include for each tree to be cut/trimmed: the number, species, type, size, age and condition – factors which will determine the associated compensation. (The compensation for the fruit trees is discussed in **Section 9.3.1**).
- The construction crew will be provided with LPG as cooking (and heating, if required) fuel. Use of fuel wood will not be allowed.
- No fires will be allowed inside the forest.
- Construction camps will not be established inside the forested area.
- Tree plantation plan will be developed and implemented at each of the grid stations included in the proposed project. Provisions will be made for tree plantation while designing the layout of the grid stations. This will compensate any tree cutting in the non forest area along the transmission lines. Indigenous tree species will be selected for plantation; Eucalyptus trees will not be used in any case.

Residual Impact

The potential impacts of the proposed project on the natural vegetation are expected to be mild in nature. With the help of the above mentioned mitigation measures, these impacts are expected to reduce further. Significance of the residual impacts on the floral resources of the area is therefore expected to be 'low'.

The environmental monitoring (discussed in **Chapter 10**) will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

8.3.5 Damage to Wildlife

As stated in **Section 8.3.4** above, most parts of the project area do not support any natural vegetation. Similarly, most of the native faunal species have long disappeared from the area, as a result of the expanding settlements and extensive cultivation. Whatever species currently exist in the area have adapted to the presence of human

beings. None of the project activities are therefore expected to adversely affect whatever faunal resources are left in the area.

The unmitigated impacts of the proposed activities on the faunal resources of the area are characterized below.

- Nature: Direct
- Duration: Medium to long term
- Geo extent: Local
- Reversibility: Reversible
- Likelihood: Unlikely to Possibly
- Consequence: Mild to Moderate
- Impact significance: Low to Medium.

Mitigation Measures

- Measures to protect and rehabilitate floral resources of the area discussed in **Section 8.3.4** above will also protect the wildlife resources of the area.
- The measures to prevent soil and water contamination will forestall any adverse impact on the faunal resources of the area.
- Garbage will not be left in the open.
- The project staff will not be allowed to indulge in any hunting or trapping activities.

Residual Impact

The potential impacts of the proposed project on the wildlife of the area are expected to be mild in nature. With the help of the above mentioned mitigation measures, these impacts are expected to reduce further. Significance of the residual impacts on the faunal resources of the area is therefore expected to be 'low'.

8.4 Operation Phase Impacts

The operation and maintenance (O&M) activities of the electricity network are environmentally benign by nature, and result in very few impacts, which are listed below.

- Contamination of soil and water as a result of inappropriate waste disposal (domestic solid waste, sewage, repair and maintenance waste, waste oils and chemicals, etc.)
- Contamination of soil and water as a result of leakage of transformer oil.

These negative impacts are characterized in **Exhibit 8.5**, and discussed below.

8.4.1 Soil Contamination

The O&M activities of the grid stations generate several types of wastes, which can cause soil contamination. These are listed below.

- Domestic solid waste from the offices and residences in the grid stations
- Sewage from the offices and residences in the grid stations

- Wastes from the repair and maintenance activities (discarded equipment and parts, packing materials, used oils and chemicals, cotton rags and the likes).

In addition, leakage and spillage of transformer oil can contaminate soil. Of particular concern is the possible soil contamination with PCB, since the old transformers and circuit breakers in the MEPCO system are still likely to contain PCB-containing transformer oil (see **Section 6.3.3**).

These impacts can potentially occur at the grid stations included in the proposed project.

These unmitigated impacts are characterized below.

- Nature: Direct and indirect
- Duration: Short to medium term
- Geo extent: Local
- Reversibility: Reversible
- Likelihood: Likely
- Consequence: Major
- Impact significance: High.

Mitigation Measures

The following mitigation measures will greatly minimize if not prevent the impacts of the proposed project's O&M activities on the soil of the area:

- The grid stations will have appropriate solid waste collection and disposal arrangements. Since all the grid stations are inside or near cities, the domestic solid waste will be handed over to the Municipality.
- The grid stations will have appropriate sewage handling system. The grid stations' sewage collection system will be connected to the Municipality operated sewerage system, if available. Otherwise, grid stations will have their own septic tanks and soakage pits.
- Waste oils and chemicals will be disposed in accordance with their respective Material Safety Data Sheet (MSDS). MSDS will be made available at the grid stations and maintenance workshops.
- Non-toxic recyclable waste (such as cardboard) will be given away for recycling.
- Toxic waste will be stored separately, and incinerated at an appropriate double chamber incinerator.
- Grid stations will have channels and drainage pits to collect any leaked oil from the transformers in the grid stations. This oil will be sent back to the workshop for recycling.
- MEPCO's Environmental and Social Cell (ESC) will develop (or have it developed) a comprehensive plan for PCB testing and its complete elimination from all the transformers and circuit breakers from the entire network (an outline ToR of the PCB Elimination Plan development is provided in **Exhibit 8.6**). As a first step in this regard, the PCB test kits will be made available with the MEPCO maintenance staff.

Residual Impact

With the help of the mitigation measures described above, the O&M activities will not have any significant impact on the soils of the area.

8.4.2 Water Contamination

The O&M activities which can contaminate soil can also adversely affect the surface as well as groundwater of the area. These include:

- Improper disposal of domestic solid waste from the offices and residences in the grid stations
- Improper disposal of sewage from the offices and residences in the grid stations
- Improper waste disposal from the repair and maintenance activities (discarded equipment and parts, packing materials, used oils and chemicals, cotton rags and the likes).

In addition, leakage and spillage of transformer oil can contaminate soil.

These impacts can potentially occur at all of the grid stations included in the proposed project.

These unmitigated impacts are characterized below.

- Nature: Direct and indirect
- Duration: Short to medium term
- Geo extent: Local
- Reversibility: Reversible
- Likelihood: Likely
- Consequence: Major
- Impact significance: High.

Mitigation Measures

The mitigation measures recommended in **Section 8.4.1** will also forestall any water contamination that could be caused by the project's O&M activities as well.

Exhibit 8.1: Environmental and Social Screening Matrix (Unmitigated)

	Physical					***Biological***		***Social and Socioeconomic***											
	Soil Erosion / Contamination	*Air Quality*	*Surface Water Quality*	*Groundwater Quality*	*Water Availability and Consumption*	*Natural Vegetation*	*Wildlife*	*Blocked Access Routes*	*Noise and Vibration*	*Impacts on Agriculture*	*Impacts on Irrigation Network*	*Livestock Grazing*	*Compensation Issues*	*Safety Hazard*	*Infrastructure*	*Public Health and Nuisance*	*Aesthetic Value*	*Cultural Issues*	*Gender Issues*
Design Phase																			
Site Selection for Grid Stations	-1	0	0	0	0	-1	-1	-1	0	-1	-1	0	-2	-2	N	-1	-1	0	0
Route Selection for Transmission Lines/Feeders	-1	0	0	0	0	-1	-1	0	0	-1	-1	0	-2	-2	N	0	-1	0	0
Design of Grid Station	-2	0	-2	-2	0	0	0	0	0	0	0	0	0	0	0	-2	-1	0	0
Equipment Selection	-2	0	-2	-2	0	0	0	0	0	0	0	0	0	0	N	-2	0	0	0
Construction Phase-Grid Stations																			
Land Acquisition	N	N	N	N	N	N	N	-1	N	-2	-2	-1	-2	N	N	N	N	N	N
Mobilization of Contractors	-1	-1	-1	0	0	-1	-1	0	-1	-2	-2	-1	0	-1	-1	-1	0	0	-1
Construction Camp Establishment	-1	-1	-1	-1	0	-1	-1	-1	-1	-2	-2	-1	-1	-1	-1	-1	-1	-1	-1
Construction Camp Operation	-2	-1	-2	-2	-1	-1	-1	0	-1	0	0	0	0	-1	-1	-1	0	-1	-1
Transportation of Construction Materials and Supplies	-1	-1	-1	0	0	-1	-1	0	-1	-2	-2	-1	0	-1	-1	-1	0	0	-1
Excavation for Foundations	-2	-1	-1	-1	0	-1	-1	0	-1	0	0	0	0	-1	0	-1	0	0	0
Construction Works	-2	-1	-1	-1	-1	0	0	0	-1	0	0	-1	0	-1	0	-1	0	0	0
Equipment Installation	0	-1	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	0
Testing and Commissioning	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0

…. Contd. **Exhibit 8.1**

	Physical					***Biological***		***Social and Socioeconomic***											
	Soil Erosion / Contamination	*Air Quality*	*Surface Water Quality*	*Groundwater Quality*	*Water Availability and Consumption*	*Natural Vegetation*	*Wildlife*	*Blocked Access Routes*	*Noise and Vibration*	*Impacts on Agriculture*	*Impacts on Irrigation Network*	*Livestock Grazing*	*Compensation Issues*	*Safety Hazard*	*Infrastructure*	*Public Health and Nuisance*	*Aesthetic Value*	*Cultural Issues*	*Gender Issues*
Construction Phase-Transmission Lines/Feeders																			
Land Acquisition	N	N	N	N	N	N	N	-1	N	-2	-2	-1	-2	N	N	N	N	N	N
Mobilization of Contractors	-1	-1	-1	0	0	-1	-1	0	-1	-2	-2	-1	0	-1	-1	-1	0	0	-1
Construction Camp Establishment	-1	-1	-1	-1	0	-1	-1	-1	-1	-2	-2	-1	-1	-1	-1	-1	-1	-1	-1
Construction Camp Operation	-2	-1	-2	-2	-1	-1	-1	0	-1	0	0	0	0	-1	-1	-1	0	-1	-1
Transportation of Construction Materials	-1	-1	-1	0	0	-1	-1	0	-1	-2	-2	-1	0	-1	-1	-1	0	0	-1
Excavation for Foundations	-2	-1	-1	-1	0	-1	-1	0	-1	-2	-2	0	-1	-1	0	-1	0	0	0
Construction of Foundations	-2	-1	-1	-1	-1	0	0	0	-1	-1	-1	0	0	-1	0	-1	0	0	0
Erection of Towers / Poles	0	-1	0	0	0	0	0	0	-1	-1	-1	0	0	-1	0	-1	0	0	0
Stringing	0	-1	0	0	0	0	0	0	-1	-1	-1	0	0	-1	0	-1	0	0	0
Testing and Commissioning	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0
Contractor Demobilization	-1	-1	-1	0	0	-1	-1	0	-1	-1	-1	-1	0	-1	-1	-1	0	0	-1
Operation and Maintenance Phase																			
Grid Station O&M	-2	0	-2	-2	-1	0	0	0	0	0	0	0	0	-2	0	-2	0	0	0
Transmission Line/Feeders O&M	0	0	0	0	0	0	0	0	0	-1	-1	-1	0	-2	0	0	0	0	0

Key: -2: High negative impact; -1: Low negative impact; 0: insignificant/negligible impact; +1: low positive impact; +2: High positive impact, N: no impact.

Exhibit 8.2: Impact Characterization

Categories	Characteristics
Nature	**Direct:** The environmental parameter is directly changed by the project. **Indirect:** The environmental parameter changes as a result of change in another parameter
Duration of impact	**Short-term**: lasting only for the duration of the project such as noise from the construction activities. **Medium-term**: lasting for a period of few months to a year after the project before naturally reverting to the original condition such as loss of vegetation due to clearing of campsite, contamination of soil or water by fuels or oil. **Long-term**: lasting for a period much greater than medium term impact before naturally reverting to the original condition such as loss of soil due to soil erosion.
Geographical extent	**Local, regional (spatial dimension)**
Timing	**Construction** and **Operation**
Reversibility of impact	**Reversible**: when a receptor resumes its pre-project condition **Irreversible**: when a receptor does not or cannot resume its pre-project condition
Likelihood of the impact	**Almost Certain:** Impact expected to occur under most circumstances **Likely:** Impact will probably occur under most circumstances **Possibly:** Impact may possibly occur at some time **Unlikely:** Impact could occur at some time **Rare:** Impact may occur but only under exceptional circumstances
Impact consequence severity	**Major**: When an activity causes irreversible damage to a unique environmental feature; causes a decline in abundance or change in distribution over more than one generation of an entire population of species of flora or fauna; has long-term effects (period of years) on socioeconomic activities of significance on regional level. **Moderate**: When an activity causes long-term (period of years), reversible damage to a unique environmental feature; causes reversible damage or change in abundance or distribution over one generation of a population of flora or fauna; has short-term effects (period of months) on socioeconomic activities of significance on regional level. **Minor**: When an activity causes short-term (period of a few months) reversible damage to an environmental feature; slight reversible damage to a few species of flora or fauna within a population over a short period; has short term (period of months) effects on socioeconomic activities of local significance. **Negligible**: When no measurable damage to physical, socioeconomic, or biological environment above the existing level of impact occurs.
Significance of impact	Categorized as **High, Medium**, or **Low** Based on the consequence, likelihood, reversibility, geographical extent, and duration; level of public concern; and conformance with legislative of statutory requirements.

Exhibit 8.3: Impact Characterization for Project Design Phase (Unmitigated)

Impact	Nature	Duration	Geo Extent	Reversibility	Likelihood	Consequence Severity	Impact Significance
Soil Erosion, Degradation	Direct	Long term	Local	Irreversible	Likely	Major	**High**
Surface Water Contamination	Indirect	Short term	Local	Reversible	Likely	Major	**High**
Groundwater Contamination	Indirect	Medium term	Local	Reversible	Likely	Major	**High**
Loss of/Damage to Natural Vegetation	Direct	Medium to Long term	Local	Irreversible	Possibly	Moderate	**Medium**
Loss of/Damage to Wildlife	Direct	Medium term	Local	Reversible	Possibly	Moderate	**Medium**

Exhibit 8.4: Impact Characterization for Project Construction Phase (Unmitigated)

Impact	Nature	Duration	Geo Extent	Reversibility	Likelihood	Consequence Severity	Impact Significance
Physical Environment							
Soil Erosion, Degradation	Direct	Long term	Local	Irreversible	Likely	Major	**High**
Air Quality Deterioration	Direct	Short term	Local	Reversible	Likely	Minor	**Medium**
Surface water Contamination	Direct	Short term	Local	Reversible	Likely	Major	**High**
Groundwater Contamination	Indirect	Medium term	Local	Reversible	Likely	Major	**High**
Water Consumption; Availability	Direct and Indirect	Short term	Local; Regional	Reversible	Likely	Moderate	**Medium**
Biological Resources							
Loss of/Damage to Natural Vegetation	Direct	Medium to Long term	Local	Irreversible	Unlikely to Possibly	Mild to Moderate	**Low to Medium**
Loss of/Damage to Wildlife	Direct	Medium term	Local	Reversible	Unlikely to Possibly	Mild to Moderate	**Low to Medium**

Exhibit 8.5: Impact Characterization for Project Operation Phase (Unmitigated)

Impact	Nature	Duration	Geo Extent	Reversibility	Likelihood	Consequence Severity	Impact Significance
Soil Contamination	Indirect	Short to medium term	Local	Reversible	Likely	Major	High
Water Contamination	Indirect	Short to medium term	Local	Reversible	Likely	Major	High

Exhibit 8.6: Outline ToR for Developing PCB Elimination Plan

- Review of the MEPCO system to handle transformers and transformer oil
- Review of the past practices in WAPDA to handle transformers and transformer oil
- Review of the systems and practices at the WAPDA's and MEPCO's transformer maintenance work shops
- Study similar practices prevailing in other countries
- Developing action plan to identify PCB-containing transformers
- Developing action plan to segregate the PCB-free and PCB-containing transformers
- Developing action plan to isolate the PCB-free and PCB-containing transformers at the maintenance workshops
- Developing testing and monitoring procedures and systems
- Developing the documentation system
- Determining the capacity building needs and developing training program
- Consultations with the key stakeholders (such as the EPAs and relevant professionals)
- Report compiling.

9 Socioeconomic Impacts and Mitigation

This Chapter assesses the potential socioeconomic impacts of the proposed project (components of the 6th STG and ELR project to be undertaken during 2006-07). The chapter also includes the significance of the potential impacts, recommends mitigation measures to minimize if not eliminate the potentially adverse impacts, and identifies the residual impacts.

9.1 Socioeconomic Impact Assessment Process

9.1.1 Social Screening Checklist

The social screening checklist provided in the ToR (see **Appendix A** for the ToR) was used to identify the key social issues associated with the proposed project and type of mitigation measures required to address them. **Exhibit 9.1** summarizes the social issues given in the checklist.

9.1.2 Screening of Socioeconomic Impacts

Screening of the socioeconomic impacts of the proposed project was carried out during this ESA, using the same framework as described in **Section 8.1**. The screening matrix provided in **Exhibit 8.1** addresses the socioeconomic impacts as well.

9.1.3 Impact Characterization

The impact characterization has been defined in **Section 8.2**. Much like the environmental concerns, the socioeconomic impacts were also characterized using the same method.

9.2 Design Phase Considerations

Much like the environmental considerations during the design of the proposed project (discussed in **Section 8.2**), the following aspects of the project can have bearing on its socioeconomic performance:

- Site selection for grid stations
- Route selection for transmission lines
- Equipment selection.

The design phase considerations are characterized in **Exhibit 9.2** and can be readily preempted and avoided. These concerns and the measures to avoid/minimize them are tabularized below.

Impacts	Likely Causes for Proposed Project	Measures to be Incorporated in Project Design
Resettlement Issues	Poor site selection; Poor route alignment	■ The grid stations to be established during the proposed project will be located in open areas, free of any existing structure. ■ The transmission line routes included in the proposed project will be selected avoiding settlements, buildings, other structures and cultivation, as far as possible, thus minimizing the resettlement issues.
Safety hazards and public health concerns	Poor site selection; Poor route alignment; Inappropriate equipment selection (such as PCB-containing transformers)	■ All safety precautions will be taken to minimize the safety hazards and risk of accidental electrocution. These will include double periphery walls at the grid stations and appropriate clearance (between the live wires/connectors and the buildings/structures/trees). ■ Transmission lines will not be routed through the settlements as far as possible. Appropriate clearance will be maintained all along the transmission lines and feeders. ■ Appropriate waste disposal systems will be included in the design of the grid stations. These include sewage disposal, and if required, treatment system (eg, septic tank). ■ PCB-free transformers will be selected for the project. (This aspect is already included in the MEPCO's transformer specifications.) ■ The transmission line routes will avoid passing over the buildings.
Aesthetic value	Intrusion in the natural landscape	■ Tree plantation will be carried inside and at the periphery of the grid stations, without compromising the safety aspects (ie, required clearances will be maintained). For this purpose, provision will be made in the site layout of the grid stations. ■ Transmission lines and feeders through the cities will be constructed after astute planning, in order to avoid dense concentration of electrical lines.

9.3 Construction Phase Impacts

Much like the environmental impacts described in **Section 8.3**, most of the socioeconomic concerns will also arise during the construction phase of the proposed project.

The key socioeconomic concerns of the construction phase as identified with the help of the screening process (**Section 8.1.1** and **Exhibit 8.1**) are as follows:

- Land acquisition and damage to crops
- Damage to infrastructure
- Damage to irrigation network
- Blocked access
- Noise and vibration
- Safety hazard
- Public health
- Gender issues
- Impacts on archeological, cultural, historical or religious significance.

These impacts are characterized in **Exhibit 9.3**, and assessed in the following sections.

9.3.1 Land Acquisition and Asset Loss

A total of 20 acres of land will need to be acquired for the five new grid stations envisaged during the proposed project. MEPCO plans to purchase this land directly from the owners, on the basis of *willing seller – willing buyer*, at mutually acceptable market price. The seller will have the right of refusal and the entire process will be documented.

In addition, about 2,040 acres of land would be used as temporary right of way (RoW) along the transmission line routes during the construction phase (272 km long × 30 m wide), and about 70-80 acres of land for accessing the transmission line route during the construction phase (one route every 5 km; 500 m long, 10 m wide).

For the towers of the transmission lines passing through the urban areas, considerable land will be required, which may not be available in the existing RoW (such as road sides). This aspect is likely to arise for the transmission lines feeding the proposed Jail Road and Suraj Miani gird stations.

Parts of the transmission lines would pass over the cultivated land, thus causing damage to crops during the construction phase of the project. This crop damage would take place over a total area of about 1,339 acres; the total number of affectees would be about 669. **Exhibit 9.4** provides a summary of the cultivated land that would fall under the proposed transmission lines (detailed list of the affected land and project affectees (ie, PAPs) is provided in **Section D.6** of **Appendix D**).

The project sites where this issue may be encountered include:

- Jail Road grid station and associated transmission line

- Suraj Miani grid station and associated transmission line
- Sahiwal III grid station and associated transmission line
- Feed for the Bahawalpur Cantt. grid station
- Mukhdumpur grid station and its feed
- Feed for the Head Sidhnai grid station
- Sections of the Kot Addu – Chowk Azam transmission line
- Transmission line between Kehror Pecca and Lal Sohanra
- Transmission line between Lal Sohanra and Khairpur Tamewali
- Transmission line between Khairpur Tamewali and Hasilpur
- 11-KV feeders and LT lines in the above areas.

The proposed project is not likely to cause any other asset loss (please see **Exhibits 4.10** to **4.15** for the route maps of the transmission lines and key environmental/socioeconomic features along them).

Each 11-KV feeder poles will take about 0.25 m^2 of land. Most of these poles will be erected on the existing right of way/along roads, avoiding cultivated areas or any existing structure. Hence their impact will be minimal.

The unmitigated impacts related to the land acquisition and damaged crops are characterized as 'high', as shown in **Exhibit 9.3**.

Mitigation Measures

The following mitigation measures are proposed to avoid potential losses due to land take and involuntary resettlement.

- A Resettlement Plan (RP) has been prepared to address the involuntary resettlement, including the damaged crops, caused by the project activities. The RP provides the entitlement framework, which is provided in **Exhibit 9.5**. Other aspects covered in the RP include institutional and implementation framework, the monitoring and documentation systems and the grievance redressal mechanism. (The RP is a stand-alone document and provided under separate cover.)
- Compensation will be paid for the crops damaged during the construction activities (see **Exhibit 9.4** for cultivated lands falling under the transmission lines). The compensation will be paid to the cultivator, and absence of the land title will not be a bar to receiving the compensation.
- Complete record will be maintained for the determination and payment of the compensation.
- It will be ensured that the land under the 132-KV transmission line tower remains available for cultivation (see **Exhibit 9.6** for a typical tower with cultivation underneath).
- In case the above is not possible, the land under the tower will be acquired in accordance with the LAA procedures (Section 17.4 of the LAA will not be used).

- The 11-KV feeders will be routed along the existing right of ways or roads, avoiding any existing structures. The cultivated fields will also be avoided as far as possible. In case, it is not possible, damage to crops will be compensated.
- Operation of project vehicles and construction machinery outside the RoW will be avoided. Attempts will be made to use existing tracks/roads to access the transmission line corridor/tower locations. In case new access routes are necessary, the cultivated land will be avoided as far as possible. Damage to crops will be compensated.
- Tubular poles will be used where necessary, instead of conventional transmission line towers, for the feed for the Suraj Miani grid station. The transmission line route will be aligned along the existing roads/RoW as far as possible.
- Grievance redressal mechanism will be put in place to address the community complaints.

Residual Impacts

The expectations of some of the affected landowners may not be completely fulfilled regardless of the compensation. However, with the help of above measures, the issue is likely to be adequately addressed. The residual impacts associated with the involuntary resettlement are therefore expected to be low to medium.

The social monitoring will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

9.3.2 Damage to Irrigation Network

The project activities can potentially damage the irrigation network in and around the project sites. Operation of project vehicles and construction machinery in the cultivation fields can damage the water courses.

The project sites where this issue may be encountered include:

- Jail Road grid station and associated transmission line
- Suraj Miani grid station and associated transmission line
- Sahiwal III grid station and associated transmission line
- Feed for the Bahawalpur Cantt. grid station
- Mukhdumpur grid station and its feed
- Feed for the Head Sidhnai grid station
- Sections of the Kot Addu – Chowk Azam transmission line
- Transmission line between Kehror Pecca and Lal Sohanra
- Transmission line between Lal Sohanra and Khairpur Tamewali
- Transmission line between Khairpur Tamewali and Hasilpur
- 11-KV feeders and LT lines in the above areas.

The unmitigated impacts related to the irrigation network are characterized as 'high', as shown in **Exhibit 9.3**.

Mitigation Measures

The following mitigation measures are proposed to avoid potential loss due to agriculture.

- Operation of construction machinery and project vehicles will be avoided close to the canals and water courses.
- Any damage caused by the project activities will be completely repaired.

Residual Impacts

With the help of the above measures, impacts associated with the irrigation network will be reasonably mitigated, and the residual impacts will be quite negligible.

The social monitoring will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

9.3.3 Blocked Access

This issue can arise during the construction phase, particularly as a result of establishment of the construction camp or construction activities along the transmission line routes.

The unmitigated impacts related to the blocked access routes are characterized as 'medium' (see **Exhibit 9.3**).

Mitigation Measures

- In case of the blockage of the existing routes, alternate routes will be identified in consultation with affected communities.

Residual Impact

Following the availability of alternative routes, significance of the residual impact is expected to be quite negligible.

The social monitoring will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

9.3.4 Noise and Vibration

The construction activities and project vehicle movement close to the communities can cause noise and vibration.

The project components that will be undertaken close to the communities, and may cause noise and vibration include:

- Jail Road grid station and associated transmission line
- Suraj Miani grid station and associated transmission line
- Sections of the feed for the Mukhdumpur grid station
- Sections of the feed for the Head Sidhnai grid station

- Sections of the Kot Addu – Chowk Azam transmission line
- Sections of the transmission line between Kehror Pecca and Lal Sohanra
- Sections of the transmission line between Lal Sohanra and Khairpur Tamewali
- Sections of transmission line between Khairpur Tamewali and Hasilpur
- Conversion/augmentation/extension of the Head Sidhnai, Lal Sohanra, Jampur, Chowk Azam, Daharanwala, Damarwala, Harappa, Kacha Khoh, Karor Lal Essan, Khan Garh, Khanewal Road (Multan), Mailsi, Kot Chutta, Qaula and Sahiwal New grid stations
- Installation/modification of 11-KV feeders and LT lines in the above areas.

The unmitigated impacts related to the noise caused by the project construction activities are characterized as 'medium' (see **Exhibit 9.3**).

Mitigation Measures

- Vehicular traffic through the communities will be avoided as far as possible. Project routes will be authorized by the MEPCO.
- Vehicle speeds will be kept low, and horns will not be used while passing through or near the communities.
- Vehicles will have exhaust silencers to minimize noise generation.
- Nighttime traffic will be avoided near the communities, as far as possible.
- Movement of all project vehicles and personnel will be restricted to within work areas, to avoid noise disturbance.
- Working hours for construction activities within the communities will be limited to between 8 am and 6 pm (between 6 am and 8 pm during the summers).
- Liaison with the community will be maintained. Grievance redressal mechanism will be put in place to address the community complaints, as stated earlier.

Residual Impact

With the implementation of above measures, the significance of the residual noise impacts will be low.

The social monitoring will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

9.3.5 Safety Hazards

The construction activities will involve operation of heavy construction machinery, vehicular traffic, excavation and filling operations. These activities may pose some safety hazards to the local population.

During the testing and commissioning of the grid stations and transmission lines, the nearby population will be exposed to the electrocution risk.

As described in **Section 9.3.4** above, the following components of the project will be located close to the communities:

- Jail Road grid station and associated transmission line
- Suraj Miani grid station and associated transmission line
- Sections of the feed for the Mukhdumpur grid station
- Sections of the feed for the Head Sidhnai grid station
- Sections of the Kot Addu – Chowk Azam transmission line
- Sections of the transmission line between Kehror Pecca and Lal Sohanra
- Sections of the transmission line between Lal Sohanra and Khairpur Tamewali
- Sections of transmission line between Khairpur Tamewali and Hasilpur
- Installation/modification of 11-KV feeders and LT lines in the above areas.

The safety hazards will be more acute for the above project components, though a certain level of these risks would still exist for rest of the project sites as well. **Exhibits 4.10** to **4.15** show the key locations of these impacts in the project area.

A small section of the Kot Addu – Chowk Azam transmission line passes through a settlement near the Kot Addu town (see **Section 4.4.13**). The existing transmission line passes over several houses, and the proposed works to install another circuit on the existing towers would cause safety hazards for the residents of these houses.

The unmitigated impacts related to the safety hazards are characterized as 'high' (see **Exhibit 9.3**).

Mitigation Measures

- The construction sites will have protective fencing to avoid any unauthorized entry.
- The project drivers will be trained for defensive driving skills (environmental and social trainings are described in **Chapter 10**).
- Vehicular speeds near/within communities will be kept low to minimize safety hazards.
- Construction camp sites will be located at least 500 m away from the nearest community. Camp site will be selected with MEPCO's approval, as mentioned in **Section 8.3.1**.
- Firefighting equipment will be made available at the camps.
- The camp staff will be provided fire fighting training.
- All safety precautions will be taken to transport, handle and store hazardous substances, such as fuel.
- Liaison with the community will be maintained. In particular, the nearby communities will be informed before commencing the testing commissioning of the system. Protective fencing will be used where appropriate/possible. Awareness raising program will be implemented to educate the communities regarding the hazards

associated with the transmission lines, feeders and other electrical systems/equipment. Warning signs will be used at the appropriate locations.

- For the segment of the Kot Addu – Chowk Azam transmission line passing through the settlement, GSC/contractor will prepare a work plan and submit to MEPCO for approval. The construction works will not commence before the approval. The work plan will include measures to address the safety hazards for the houses / other structures that exist under the transmission line.

Residual Impact

There will be a low level of residual impact of safety hazards associated with the vehicular traffic. The safety hazard issue with the construction activities will be negligible. The safety hazard during the testing and commissioning of the system will be from low to medium.

The social monitoring will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

9.3.6 Public Health Issues

The public health concerns to be addressed during the design phase of the proposed project have been discussed in **Section 9.2** above. There will be some similar concerns during the construction phase as well, primarily associated with the operation of the construction camps.

The public health issues can potentially arise at all of the project sites.

The unmitigated impacts related to the public health are characterized as 'high', as shown in **Exhibit 9.3**.

Mitigation Measures

The following mitigation measures will minimize the public health concerns during the construction phase of the project:

- The construction camps will have septic tanks and soaking pits of adequate size.
- Camps will be at least 500 m from any groundwater wells used by the community.
- The construction camps will have appropriate solid waste disposal mechanism (see **Section 8.3.1**).
- The construction camps and site offices will have first-aid kits.
- The construction crew will be provided awareness for the transmissible diseases (such as HIV/AIDS, hepatitis B and C).

Residual Impacts

With the help of the above measures, the public health concerns during the project construction phase can be reasonably addressed. The significance of the residual impacts is therefore expected to be negligible.

The social monitoring will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

9.3.7 Damage to Infrastructure

The construction activities and associated vehicular traffic may damage the existing infrastructure in the areas such as roads, water channels and other structures.

The infrastructure may be damaged at all of the project sites.

The unmitigated impacts related to the infrastructure are characterized as 'medium' (see **Exhibit 9.3**).

Mitigation Measures

- All damaged infrastructure will be restored to original or better condition.

Residual Impact

Following the implementation of the above-recommended measure, there will be negligible level of residual impact.

The social monitoring will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

9.3.8 Gender Issues

The project works to be carried out within the rural communities may cause disturbance to the womenfolk. Similarly, the construction camp operation and vehicular traffic may also cause some hindrance to women mobility.

In particular, these issues can potentially arise at the following locations:

- Jail Road grid station and associated transmission line
- Suraj Miani grid station and associated transmission line
- Bahawalpur Cantt. grid station and its feed
- Sections of the feed for the Mukhdumpur grid station
- Sections of the feed for the Head Sidhnai grid station
- Sections of the Kot Addu – Chowk Azam transmission line
- Sections of the transmission line between Kehror Pecca and Lal Sohanra
- Sections of the transmission line between Lal Sohanra and Khairpur Tamewali
- Sections of transmission line between Khairpur Tamewali and Hasilpur
- Extension/conversion/augmentation of the Head Sidhnai, Lal Sohanra, Jampur, Chowk Azam, Daharanwala, Damarwala, Harappa, Kacha Khoh, Karor Lal Essan, Khan Garh, Khanewal Road (Multan), Mailsi, Kot Chutta, Qaula and Sahiwal New grid stations
- Installation/modification of 11-KV feeders and LT lines in the above areas.

The unmitigated gender issues are characterized as 'medium' (see **Exhibit 9.3**).

Mitigation Measures

- The routes used by the women will be avoided as far as possible. If unavoidable, alternate routes to be identified for the communities, if required, especially along routes frequented by women folk, such as route to the local well or water source.
- Camp sites for construction will be 500 m away from the nearest community, as recommended earlier.
- Construction crew will avoid in entering villages and settlements.
- Communities will be informed and consulted before commencing works inside or near the communities.
- Strict code of conduct will be maintained by the construction crew. Local norms will be respected.

Residual Impact

Despite the implementation of the above mitigation measures, there will be a low to moderate level of residual impact associated with the gender issues.

The social monitoring will ensure compliance to the above mitigation measures and their adequacy, as well as significance of the residual impacts.

9.3.9 Child Labor

Although the use of child labor is not prevalent in the construction works such as those involved in the proposed project, however, the provisions of the Child Labor Act will still be made part of the construction contracts, in order to ensure that no child labor is employed at the project sites or campsites.

9.3.10 Impacts on Sites of Historical, Cultural, Archeological or Religious Significance

As mentioned in **Section 5.7**, no sites of historical, cultural, archeological or religious significance are known to exist at or in the immediate of the project components that are known at this stage. However, during the construction works of the project, particularly, excavation, such sites or artifacts may be discovered.

There are a few graveyards along the transmission line routes (see **Exhibits 4.10** to **4.15** for the schematic diagram and description of key features along the transmission line routes).

The unmitigated impacts on sites of historical, cultural, archeological or religious significance are characterized as ‘medium’ (see **Exhibit 9.3**).

Mitigation Measures

- In case of discovery of any sites or artifacts of historical, cultural, archeological or religious significance, the work will be stopped at that site.
- The provincial and federal archeological departments will be notified immediately, and their advice will be sought before resumption of the construction activities at such sites.

- The existing graveyards will not be damaged. The construction work close to the graveyards will be carried out after informing/consulting the relevant communities.

9.4 Operation Phase

Much like the environmental issues associated with the O&M activities, there are very few socioeconomic concerns which are expected during the operation phase of the proposed project. These concerns are listed below.

- Safety hazards
- Public health
- Loss of agricultures

These impacts are characterized in **Exhibit 9.7** and discussed below.

9.4.1 Safety Hazard

The grid stations, transmission lines and HT/LT lines will pose electrocution risk to the MEPCO staff as well as the nearby population and livestock. In particular, the following project components can cause safety concerns for the population of the area:

- Jail Road grid station and associated transmission line
- Suraj Miani grid station and associated transmission line
- Sections of the feed for the Mukhdumpur grid station
- Sections of the feed for the Head Sidhnai grid station
- Sections of the Kot Addu – Chowk Azam transmission line
- Sections of the transmission line between Kehror Pecca and Lal Sohanra
- Sections of the transmission line between Lal Sohanra and Khairpur Tamewali
- Sections of transmission line between Khairpur Tamewali and Hasilpur
- The 11-KV feeders and LT lines in the above areas.

In particular, a segment of the Kot Addu – Chowk Azam transmission line passes over a settlement, as described in **Section 9.3.5**. Operation of this proposed line will cause significant safety hazard particularly for the population living underneath the wires.

The safety hazard issues have been characterized as 'high' (see **Exhibit 9.7**).

Mitigation measures

Design aspects of this issue have been discussed in **Section 9.2**, which will forestall major causes of electrocution. Additional measures are provided below.

- MEPCO's O&M staff will be provided essential protective gears and equipment.
- MEPCO's O&M staff will be provided safety training. Refresher courses will be arranged on regular basis.
- Firefighting equipment will be made available at the grid stations.

- The Emergency Response Plan (ERP), prepared by MEPCO, will be made available at each grid station. Its salient points will be displayed at prominent places within each grid station. The O&M staff will be given training on the ERP. The Environmental and Social Cell (ESC) (discussed in **Chapter 10**) will review the ERP and with respect to the environmental and social considerations, and recommend changes if needed. The ERP will include procedure to inform the nearby communities in case of fire in the grid stations (particularly in the congested urban areas, such as Adyala Road grid station).
- The communities near the grid stations and transmission lines will be educated on the risk of electrocution, and how to avoid accidents.
- Appropriate signage on safety precautions will be installed at the key locations.
- The trees under the transmission lines will be regularly trimmed in order to maintain 8 m clearance.

Residual Impacts

Despite the implementation of the above measures, there will be some residual safety hazards associated with the operation of the system. The significance of this impact is expected to be medium.

9.4.2 Public Health Concerns

There are the following three distinct types of public health concerns associated with the operation of the proposed project:

- Inappropriate solid waste and sewage disposal from grid stations and their residential areas
- Leakage of PCB-containing transformer oil
- Electromagnetic (EM) radiation caused by the high tension transmission lines.

The public health issues have been characterized as 'high' (see **Exhibit 9.7**).

Mitigation Measures

- The concerns associated with the waste disposal and PCB-containing transformer oil have been adequately discussed and addressed in **Sections 8.4.1** and **9.2**.
- Studies have shown that there is a weak evidence of health risk associated with the exposure to power frequency fields (excerpts from a document 'Power Lines and Cancer FAQ' are provided in **Appendix F**). However, since the proposed transmission line routes will be selected avoiding the settlements, there will not be any significant risk of EM radiation exposure.

9.4.3 Loss of Agriculture

During the repair and maintenance activities on the transmission lines, the nearby crops can potentially be damaged.

The project sites where this issue may be encountered include:

- Transmission line feeding the Jail Road grid station
- Transmission line feeding the Suraj Miani grid station
- Transmission line feeding the Mukhdumpur grid station
- Transmission line feeding the Head Sidhnai grid station
- Transmission line feeding the Sahiwal III grid station
- Transmission line feeding the Bahawalpur Cantt. grid station
- Sections of the Kot Addu – Chowk Azam transmission line
- Sections of the transmission line between Kehror Pecca and Lal Sohanra
- Sections of the transmission line between Lal Sohanra and Khairpur Tamewali
- Sections of transmission line between Khairpur Tamewali and Hasilpur
- 11-KV feeders and LT lines in the above areas.

The impacts on cultivation have been characterized as 'medium' (see **Exhibit 9.7**).

Mitigation Measures

The following mitigation measures will address the concerns associated with the loss of agriculture during the O&M phase of the project:

- Damage to the crops will be avoided during the transmission line patrolling.
- Any damage during repair the repair and maintenance activities will be compensated.
- Liaison with the nearby communities will be maintained in this regard.
- The grievance redressal mechanism will be maintained on continuous basis.

Residual Impacts

With the help of the above mitigation measures, the concerns associated with the loss of agriculture will be reasonably addressed and there will be negligible residual impacts.

Exhibit 9.1: Social Screening Checklist

People affected by the project	People living close to the grid stations and transmission line routes. For intensity of impacts, see **Exhibit 8.1**. The social impacts are discussed in **Sections 9.2** to **9.4**. Most of the PAPs are the farmers whose crops will be damaged during the construction and O&M of the transmission lines (discussed in **Sections 9.3.1**, **9.3.2** and **9.4.3**.
Poverty level of affected persons	Varies greatly, mostly associated with the locality. Most of the PAPs – farmers whose crops would be damaged - belong to middle and lower middle class.
Are the directly affected people agreeable to allow the project?	Yes (see **Section 7** for stakeholders consultation).
Social issues, impacts of the project.	Key impacts: damage to crops, safety hazards, public health, noise. **Sections 9.2** to **9.4** discuss all of the social issues.
Does the project require land?	The project will require about 16 acres of land, which will be procured directly from the owners after paying mutually acceptable price, on the basis of *willing seller – willing buyer* (see **Exhibit 3.8** for a summary of land requirement)..
Is there any involuntary land acquisition?	No involuntary land acquisition is expected for the proposed project. Temporary land acquisition will need to be carried out during the construction phase; crop compensation will be paid where such temporary acquisition involves cultivated land (see **Section 9.3.1**).
Are there any affected structures?	No structures are expected to be affected by the project.
Will there be any loss of livelihood of title and non title holders?	The loss of livelihood during the project is associated with the damaged crops discussed above.
Is there any social conflict resolution mechanism in the communities?	The rural communities usually have '*panchayat*' system for conflict resolution.
Are the social safeguards triggered?	OP 4.12 is triggered (see **Section 2.1**).
Any commercial activities affected in urban/rural areas?	No.

Exhibit 9.2: Impact Characterization for Project Design Phase (Unmitigated)

Impact	Nature	Duration	Geo Extent	Reversibility	Likelihood	Consequence Severity	Impact Significance
Land acquisition (including loss of asset, loss of livelihood, damage to infrastructure)	Direct	Long term	Local	Irreversible	Likely	Major	High
Blocked access	Indirect	Long term	Local	Reversible	Possibly	Moderate	Medium
Safety hazards	Indirect	Long term	Local	Reversible	Likely	Major	High
Public health	Indirect	Medium to Long term	Local	Reversible	Likely	Major	High
Aesthetic value	Indirect	Long term	Local	Reversible	Possibly	Moderate	Medium

Exhibit 9.3: Characterization of Construction Phase Socioeconomic Impacts (Unmitigated)

Impact	Nature	Duration	Geo Extent	Reversibility	Likelihood	Consequence Severity	Impact Significance
Land acquisition (including loss of asset, loss of livelihood, damage to infrastructure)	Direct	Long term	Local	Irreversible	Certainly	Major	High
Loss of agriculture	Direct	Long term	Local	Reversible	Likely	Major	High
Damage to Irrigation Network	Direct	Long term	Local	Reversible	Likely	Major	High
Blocked Access	Direct	Short term	Local	Reversible	Possibly	Moderate	Medium
Noise	Direct	Short term	Local	Reversible	Possibly	Moderate	Medium
Safety Hazard	Direct and Indirect	Short to Medium term	Local	Reversible	Likely	Major	High
Public health	Direct and Indirect	Short to Medium term	Local	Reversible	Likely	Major	High
Damage to Infrastructure	Direct and Indirect	Short term	Local; Regional	Reversible	Possibly	Moderate	Medium
Gender Issues	Indirect	Short term	Local	Reversible	Possibly	Moderate	Medium
Impacts on Sites of Archeological, Cultural, Historical or Religious Significance	Indirect	Long term	Local	Irreversible	Unlikely	Moderate	Medium

Exhibit 9.4: Cultivated Land Affected by the Project

	Project Component	Cultivated Area to be Affected (Acres)	Number of Affectees
1	Khairpur Tamewali – Hasilpur Transmission Line	217	57
2	Lal Sohanra - Khairpur Tamewali Transmission Line	198	40
3	Lal Sohanra - Kehror Pacca Transmission Line	147	150
4	Feed for Head Sidhnai Grid Station	55	43
5	Feed for Makhdumpur Grid Station	83	109
6	Kot Addu – Chowk Azam Transmission Line	639	270
	Total	**1,339**	**669**

Exhibit 9.5: Entitlement Framework

Type of Loss	Definition of Entitled Persons	Entitlement Policy	Responsibility
Loss of agriculture land[1]	Legal users with valid title, customary or usufruct rights.	PAPs will be entitled to cash compensation for acquired land at market value, on '*willing buyer – willing seller*' basis. If LAA is used, an amount of 15% will be added to the market price, in accordance with the LAA. [2]	Tehsildar; Environmental and Social Inspector (ESI) (these are defined later in the document)
	Tenant, leaseholder and sharecropper	PAPs will be entitled to reimbursement for un-expired lease.	Tehsildar; ESI
	PAPs without valid title (vulnerable encroachers or squatters)	PAPs will be entitled to cash compensation for affected structures at replacement value.	Tehsildar; ESI
Loss of residential, commercial, industrial or institutional land	Legal users with valid title, customary or usufruct rights.	PAPs will be entitled to cash compensation for affected portion of land at replacement value, on '*willing buyer – willing seller*' basis.	Tehsildar; ESI
	Tenant, leaseholder and sharecropper	PAPs will be entitled to reimbursement for un-expired lease.	Tehsildar; ESI
	PAPs without valid title (vulnerable encroachers or squatters)	PAPs will be entitled to cash compensation for affected structures at replacement value.	Tehsildar; ESI
Structures (residential, commercial, industrial or institutional)	Owners of affected structure, with or without legal title, customary or usufruct rights	PAPs will be entitled to: o Cash compensation for affected structures, or portion of the structure, at replacement value. o Allowance to cover the repair cost of the remaining structure.	Tehsildar; ESI

[1] In case of land acquisition, Section 17 of the LAA will not be used, in the absence of the emergency/urgency.

[2] This would be equivalent to the replacement cost.

Contd. **Exhibit 9.5**.

Type of Loss	Definition of Entitled Persons	Entitlement Policy	Responsibility
Loss of common resources and facilities	Communities/households	o Replacement of the common property resources/facilities, in consultation with the affectees. o Access to equivalent resources/facilities.	Contractors; Environmental and Social Monitor (ESM); ESI.
Loss of standing crops	Households who cultivate the land	PAPs will be entitled to: o Cash compensation equivalent to the market value of damaged crops.	Tehsildar; ESI
Loss of trees	Owners of the affected trees (irrespective of the land title)	PAPs will be entitled to: o Cash compensation equivalent to the market value of trees on the basis of type, age and productivity.	Tehsildar; ESI
Loss of public infrastructure	Relevant agencies	Compensation in cash at replacement cost to respective agencies, or Restoration/repair of the damaged infrastructure in a similar or better condition as before.	Contractors; ESM; ESI.
Loss of or damage to religious sites (eg, mosques, graveyards, shrines)	Community and affected households	Replacement cost for religious sites. Cost of removal of graves and all related costs for its relocation.	Contractors; ESM; ESI.

Notes:

- Compensation for the affected structure will be calculated on the basis of the replacement cost at market prices, without taking salvage value into consideration.
- All compensations will be paid before commencement of the construction activities.

Exhibit 9.6: Typical Tower Design Allowing Cultivation Underneath

Exhibit 9.7: Characterization of Operation Phase Socioeconomic Impacts (Unmitigated)

Impact	Nature	Duration	Geo Extent	Reversibility	Likelihood	Consequence Severity	Impact Significance
Impacts on Cultivation	Indirect	Short to medium term	Local	Reversible	Possibly	Moderate	Medium
Public health	Direct and Indirect	Short to Medium term	Local	Reversible	Likely	Major	High
Safety Hazards	Indirect	Medium to long term	Local	Reversible	Likely	Major	High

10 Environmental Management Plan

This Chapter presents the implementation mechanism – in the form of an environmental management plan (EMP) - for the environmental and social mitigation measures identified during the present ESA, and reported in **Chapters 8** and **9** of this document, respectively. A resettlement plan has also been prepared and provided under separate cover, to address the involuntary resettlement caused by the proposed project.

10.1 Purpose and Objectives of EMP

This EMP provides the delivery mechanism to address the adverse environmental as well as social impacts of the proposed project during its execution, to enhance project benefits, and to introduce standards of good practice to be adopted for all project works.

The specific objectives of the EMP are to:

- Facilitate the implementation of the environmental and social mitigation measures identified in **Chapters 8** and **9** of this document, respectively;
- Define the responsibilities of the project proponents, contractors, and environmental monitors, and provide a means of effectively communicating environmental and social issues among them,
- Define a monitoring mechanism and identify monitoring parameters in order to:
  - Ensure the complete implementation of all mitigation measures, and
  - Ensure the effectiveness of the mitigation measures.
- Provide a mechanism for taking timely action in the face of unanticipated environmental or social situations,
- Identify environmental as well as social training requirements at various levels.

10.2 Components of the EMP

The EMP consists of the following:

- Organizational structure; roles and responsibilities
- Mitigation plan
- Monitoring plan
- Change management plan
- Communication and documentation
- Environmental and social trainings,

These are discussed in **Sections 10.3** to **10.8** below.

10.3 Organizational Structure, Roles and Responsibilities

This section describes the organizational structure required for managing the environmental as well as social aspects of the proposed project. Also defined in this section are the roles and responsibilities of the various role players during the project.

10.3.1 Management Approach

MEPCO will establish an Environmental and Social Cell (ESC) within the Organization, in order to handle the environmental and socioeconomic matters during the proposed project, other future projects as well as its routine operations.[1] The ESC will not be part of the proposed project organization, and will provide advisory services to the project and other MEPCO departments. Initially, the ESC will have one environmental and one socioeconomic expert of relevant qualification and experience; the strength can be increased in the future as required.

The role of the ESC and other key entities for the proposed project is described below.

Construction Phase

The organizational roles and responsibilities are summarized below:

***MEPCO*:** The overall responsibility for compliance with the environmental management plan rests with the project proponents (MEPCO).

***MEPCO's Environmental and Social Cell (ESC)*:** The ESC will provide overall supervision and advisory services during the construction phase of the project. The ESC will supervise the MEPCO's environmental monitors (discussed below). The ESC will also advise GSC and other MEPCO departments on environmental and social matters during the project.

***Contractor(s)*:** The contractor(s) will be responsible for the construction activities of the project. The contractor(s) will be responsible for the complete implementation of the EMP and the mitigation measures detailed in the EMP and ESA. The contractors will also ensure that the project is not put out of compliance with the Bank policies through their actions. The contractor(s) will also be subject to certain liabilities under the environmental laws of the country, and under its contract with MEPCO.

Other essential features of the institutional arrangement proposed for the project are:

- MEPCO will appoint Environmental and Social Inspectors (ESIs) for overseeing and monitoring the entire implementation of the EMP and ESA.
- In case MEPCO appoints Supervision Consultant, the ESIs will be appointed by the Consultant (instead of MEPCO).
- The EMP as well as environmental management requirements and specifications will be included in all contracts MEPCO and its contractors/consultants execute.
- Each contractor will be required to appoint a dedicated field Environmental and Social Monitor (ESM) at the project site.

[1] The cost of ESC will not be included in the proposed project.

- MEPCO, through the ESC, will cooperate with regulatory agencies (such as the Pak-EPA) and other stakeholders who may want to send their own teams to monitor the project activities.

Operation Phase

During the operation phase of the proposed project, environmental and socioeconomic management will become a routine function, as an integral part of the O&M activities. The ESC will be the focal point for all matters relating to environmental and socioeconomic issues during the routine operations of the Organization. The ESC will advise various departments within MEPCO for environmental and socioeconomic issues. The ESC will develop an environmental and socioeconomic management system for the Company, defining roles and responsibilities of various departments and their respective staff.

10.3.2 Organizational Structure and Responsibilities

Construction Phase

The organizational structure for the construction phase EMP is shown in **Exhibit 10.1**, and its salient features described below.

1. Primary responsibilities:
   - The GSC Department through its Project Director (PD) will be responsible for the project's compliance with the ESA and EMP throughout the project. The ESC will assist GSC Department and will provide policy support in all environment and socioeconomic matters.
   - The Supervision Consultant (if MEPCO chooses to employ one) through its Resident Engineer (RE) will be responsible for ensuring that the contractors adhere to the quality requirements and other commitments including implementation of the EMP and ESA.
   - The contractors' Chief Executive Officer or Country Manager will assume the main responsibility for all environmental matters pertaining to their work.
   - The PD will coordinate with relevant government departments (Pak-EPA) and other stakeholders through the ESI.
2. Field management and quality control:
   - Carrying out construction activities in an environmentally and socially sound manner during the construction phase will be the responsibility of the site managers of the contractor(s).
   - The GSC's site incharge (or RE, if the Supervision Consultant is employed) will be responsible for the environmental and social soundness of all construction activities.
3. On-the-job supervision and monitoring:
   - The ESM of each contractor will be responsible for the implementation of the EMP during construction works. He will also be responsible for communication

with and the training of their respective construction and camp crews in all aspects of the EMP.

- The ESI will ensure implementation of the EMP in the field. He will also coordinate with the PD, the contractor's project management and ESM of each contractor. ESI will be part of MEPCO's site organization if no Supervision Consultant is employed. Otherwise, the ESI will be part of the Supervision Consultant's site staff.
- If any monitoring teams from government departments or from NGOs visit the field during the field activities, the ESI will be responsible for coordinating their visits.

The responsibilities of various role players are summarized in **Exhibit 10.2**.

Operation Phase

As stated in **Section 10.3.1** above, the environmental and social management will be integrated in the MEPCO's O&M system. Expertise will be instituted in the ESC to support the O&M staff for the environmental and social management of their respective activities.

10.4 Mitigation Plan

The mitigation plan is a key component of the EMP. It lists all the potential effects of each activity of the project and their associated mitigation measures identified in the ESA. For each project activity, the following information is presented in the plan:

- A listing of the potential impact associated with that project activity,
- A comprehensive listing of mitigation measures (actions),
- The person(s) responsible for ensuring the full implementation of the action,
- The person(s) responsible for monitoring the action,
- The timing of the implementation of the action to ensure that the objectives of mitigation are fully met.

The mitigation plan for the construction phase of the proposed project is presented in **Exhibit 10.3**.

It should be emphasized that the mitigation measures will have to be translated into environmental as well as social requirements and specifications to be made part of the contracts for the construction activities, with legal binding.

10.5 Monitoring Plan

The objective of environmental and social monitoring during the various phases of the proposed project will be as follows:

- Ensuring that the mitigation measures included in the ESA are being implemented completely.

- Ensuring the effectiveness of the mitigation measures in minimizing the project's impacts on social and environmental resources.

To achieve these objectives the following monitoring program will be implemented.

10.5.1 Compliance Monitoring

The compliance monitoring of the project activities is principally a tool to ensure that the environmental and social control measures required in the ESA are strictly adhered to during the project activities.

Various aspects of the ESA compliance monitoring will be to:

- Systematically observe the activities undertaken by the contractors (and sub-contractors) or any other person associated with the project.
- Verify that the activities are undertaken in compliance with the ESA, EMP and RP (RP is provided under separate cover).
- Document and communicate the observations to the concerned person(s) of the contractors, GSC Department and ESC, so that any corrective measures, if required, can be taken in a timely fashion.
- Maintain a record of all incidents of environmental and social significance and related actions and corrective measures.
- Maintain contact with the communities, solicit their views and concerns, and discuss them during the fortnightly meetings.
- Prepare periodic reports of the environmental and social performance of project.

The mitigation plan discussed in **Section 10.4** will be used as a management and monitoring tool for compliance monitoring. Inspection will be done using checklists prepared by the respective contractors, on the basis of the **Exhibit 10.3**, during the construction phase.

Compliance monitoring will be the responsibility of all organizations involved in the field activities, ie, GSC Department and the contractors. It will be carried out by the following:

- ESI
- ESM.

10.5.2 Effects Monitoring

The ESA predicts the impacts of the proposed project on the basis of information available at the time of conducting the assessment and the natural processes that link various environmental and social parameters. Based on this prediction, mitigation measures are introduced such that the predicted residual effects do not exceed acceptable levels. However, there is always an element of uncertainty in such predictions due to an insufficient grasp of the processes, limitations in prediction techniques, or inadequate data on the environment. This is true for the physical, biological, as well as socioeconomic environment. Consequently, it is possible that even

if the mitigation measures are implemented fully, the negative impacts of the project will exceed acceptable limits.

In order to address the above concerns, effects monitoring will be undertaken during the project activities, with the overall objective of proper management of environmental and social risks and uncertainties. Broadly, effects monitoring has the following objectives:

- To verify that the impacts of the proposed project are within acceptable limits, thus establishing credibility (public assurance)
- To immediately warn the project proponents (and the regulatory agencies, if required) of unanticipated adverse impact or sudden changes in impact trends so that corrective actions can be undertaken, which may include modifications in the proposed activities, or the inclusion of modified or additional mitigation measures
- To provide information to plan and control the timing, location, and level of certain project activities so that the effects are minimized.
- To facilitate research and development by documenting the effects of the proposed project that can be used to validate impact-prediction techniques and provide a basis for more accurate predictions of future projects.

The effects monitoring plan is provided in **Exhibit 10.4**. The detailed methodologies will be developed during the detailed design phase of the project, when the specific information on field activities will be known. The effects monitoring will comprise the following:

- Soil erosion
- Water quality
- Water consumption and availability
- Air quality
- Noise
- Socioeconomic aspects
- Grievance monitoring.

In addition, contact will be maintained with the communities, their views and concerns solicited. The outcome of these consultations will be discussed during the fortnightly meetings at the site.

10.5.3 External Monitoring

In addition to the compliance and effects monitoring discussed above, MEPCO will engage an independent consultants to carry out external monitoring on periodical basis. The objectives of this external monitoring will be to ensure that:

- the EMP is being adequately implemented,
- mitigation measures are being implemented,
- the RP is being implemented

- the compliance and effects monitoring are being conducted,
- environmental and social trainings are being conducted, and
- complete documentation is being maintained.

The external monitoring consultants will periodically visit the sites (grid stations as well as the transmission line routes), examine the documentation maintained at the site, interview key site staff, make spot checks, take photographs where necessary, interview the PAPs, and meet with the communities. After each external monitoring visit, the consultant will prepare a monitoring report and submit to MEPCO. The report will include the observations made during the visits, highlight non-compliances observed, if any, salient information obtained from PAPs/communities, and make recommendations.

10.6 Communication and Documentation

An effective mechanism for storing and communicating environmental and social information during the project is an essential requirement of an EMP. The key features of such a mechanism are:

- Recording and maintenance of all information generated during the monitoring in a predetermined format.
- Communicating the information to a central location.
- Storing raw information in a central database.
- Processing the information to produce periodic reports.

A description of the various components of the communication and documentation system is given below.

10.6.1 Data Recording and Maintenance

The forms to be used for recording information during the environmental and social monitoring will be developed by the ESI, under the supervision of ESC. These forms will follow a standard format, which will correspond to the database into which all the information gathered will be placed. All common fields will have identical formats in the database and on the forms. Check boxes will be used as much as possible for ease in filling out the forms and to facilitate data entry.

All forms will be numbered and a tracking system will be developed for each. Whenever a form is released for use in the field, its number will be recorded. The field staff will be required to account for each form after completion. In this manner, it will be ensured that all forms are returned to the office.

10.6.2 Meetings

The following environmental meetings will take place during the project:

- Project initiation meetings (one each for each of the contractors).

- Fortnightly meetings.[2]

The purpose of the project initiation meetings will be to discuss the EMP, and ensure full commitment from concerned parties for its implementation.

A periodic meeting will be held at site during the construction phase. The purpose of the meetings will be to discuss the conduct of the operation, non-compliances noted by the ESI or Contractors' ESMs. The remedial measures will also be discussed and agreed during these meetings. The meeting will be recorded in the form of an environmental report (ER) prepared by the ESI.

10.6.3 Grievance Redressal Mechanism

An attempt has been made during the present ESA to identify all potential impacts of the proposed project, to identify all PAPs, to provide mitigation measures to address the potential impacts, and to chart out a mechanism to implement these mitigation measures (including payment of compensation).

However during the project implementation, the stakeholders (mostly the communities in the vicinity of the project sites/transmission line routes) may still have some grievances with respect to the project activities, their impacts, compensation and other mitigation measures. The key reasons of these grievances are listed below:

- PAPs not enlisted,
- Losses (such as damaged crops) not identified correctly,
- Compensation inadequate or inappropriate,
- Dispute about ownership,
- Delay in disbursement of compensation,
- Improper distribution of compensation in case of joint ownership.

In order to address the above eventualities, the Grievance Redressal Mechanism (GRM) has been devised. The main objective of the GRM will be to provide a mechanism to mediate conflict and cut down on lengthy litigation, which often delays the infrastructure projects such as the 6th STG. It will also facilitate people who might have objections or concerns about their assistance, a public forum to raise their objections and through conflict resolution, address these issues adequately. The main functions of the GRM will be as follows:

- Provide a mechanism to the PAPs on problems arising as a result of project activities,
- Record the grievance of the PAPs, categorize and prioritize the grievances that need to be resolved, and
- Report to the aggrieved parties about the developments regarding their grievances and the decision of the project authorities.

[2] Frequency of meetings may be adjusted per the situation.

Under the GRM, the ESI will maintain the Social Complaint Register (SCR) at the sites to document all complaints received from the local communities. The information recorded in the SCR will include date of the complaint, particulars of the complainant, description of the grievance, actions to be taken, the person responsible to take the action, follow up requirements and the target date for the implementation of the mitigation measure. The register will also record the actual measures taken to mitigate these concerns.

As soon as a complaint is received, the ESI will discuss it with the ESMs, and determine the remedial action. If required, consultations will also be undertaken with the contractor's site managers and GSC's PD. Once the remedial action is decided, implementation responsibility as well as schedule will be determined.

The proposed remedial action will be documented in the SCR, with complete details (by whom and by when). The proposed remedial action will be shared with the complainant. Similarly, the actual action taken will also be documented in the Register and shared with the complainant. The complainant's views on the remedial action taken will also be documented in the Register.

The SCR will be reviewed during the fortnightly meetings at the site during the project, and the action items discussed. The progress on the remedial actions will also be reviewed during the meetings. The Register will also be shared with the PD and ESC, on regular basis, for information and further action, if any.

In order to address any unresolved grievances, a Grievance Redressal Committee (GRC) will be constituted. The Committee will be headed by the PD, with ESI and the ESC social expert its other members. A non-project person acceptable to all parties will also be part of the Committee. Any un-resolved issue will be sent to the Committee for determining the remedial action.

The GRM's roles, responsibilities and implementation mechanism are explained in **Exhibit 10.5**.

10.6.4 Reports

The ESI will produce periodic reports based on the information collected. These will include reports for:

- Project initiation meetings with each contractor,
- Fortnightly meetings,
- Non-compliances,
- Effects monitoring.

At the end of the construction phase, a final report will also be prepared.

10.7 Environmental and Social Trainings

Environmental and social trainings will help to ensure that the requirements of the ESA and EMP are clearly understood and followed by all project personnel throughout the project period. The primary responsibility for providing training to all project personnel will be that of the ESI. The environmental and social training program will be finalized before the commencement of the project, during the detailed design phase. The training will be provided to the MEPCO staff, the construction contractors, and other staff engaged for the project. Training will cover all staff levels, ranging from the management

and supervisory to the skilled and unskilled categories. The scope of the training will cover general environmental awareness and the requirements of the ESA and the EMP, with special emphasis on sensitizing the project staff to the environmental and social aspects of the area. **Exhibit 10.6** provides a summary of various aspects of the environmental social trainings.

During the O&M phase of the project, these trainings will continue to be conducted by ESC for all relevant staff of the Company, particularly from GSC, GSO and Planning departments.

10.8 Change Management

The present ESA has been carried out on the basis of the project information available at this stage. This is however possible that changes are made in some components of the project, during the design and construction phases. In order to address the environmental and social implications of these changes, a simple framework has been devised, which is described in this section.

The change management framework recognizes the following three broad categories of the changes in the project:

- Category A changes,
- Category B changes, and
- Category C changes.

These categories are defined below.

10.8.1 Category 'A' Change

The 'Category A' change is one that leads to a significant departure from the project described in the ESA and consequently requires a reassessment of the environmental and socioeconomic impacts associated with the change. In such an instance, MEPCO will be required to conduct a fresh ESA of the changed portion of the project, and send the report of this assessment to the relevant agencies for approval (Pak-EPA). Examples of such changes are provided below.

- Change in the transmission line route by more than 2 km of the original alignment. Or change in the route by less than 2 km, but the changed route has environmental and/or social sensitivity more than the original route.
- Increase in the transmission line length exceeding 20 % of the original design. Or increase in length by less than 20% but involving areas which are more sensitive – environmentally and/or socially – than the original route.
- Change in the grid station site by more than 2 km of the location studied during the ESA. Or change in the site by less than 2 km but the new location has a higher environmental and/or social sensitivity.
- Increasing the number of grid stations to be established.

10.8.2 Category 'B' Change

The category 'B' change is one that may entail project activities not significantly different from those described in the ESA, which may result in project effects whose overall magnitude would be similar to the assessment made in this report. In case of such changes, the ESI (with assistance from the ESC) will be required to reassess the environmental and socioeconomic impacts of the activity, specify additional mitigation measures, if necessary, and report the changes to the relevant agencies (Contractors, ESC, Pak EPA). Examples of such changes are provided below.

- Changes in the transmission line route by more than 500 m of the original alignment, but not exceeding 2 km, provided that the changed route does not have environmental or social sensitivity more than the original area.
- Increase in the transmission line length exceeding 10 % of the original design, but not exceeding 20%, provided that the extended route does not have environmental or social sensitivity more than the original area.
- Change in the grid station site by more than 500 m of the location studied during the ESA, but not exceeding 2 km, provided that the new location does not have environmental or social sensitivity more than the original area.

Such changes will necessitate site surveys for the transmission line routes or grid station sites, by the environmental and socioeconomic experts. A site specific assessment for any additional environmental as well as socioeconomic issues will need to be carried out. Complete record of the surveys and assessment will be maintained.

10.8.3 Category 'C' Change

A Category-C change is one that is of little consequence to the ESA findings. This type of change does not result in effects beyond those already assessed in the ESA, rather it may be made onsite to minimize the impact of an activity, such as re-aligning a particular section of the transmission line to avoid cutting a tree, or relocating construction campsites to minimize clearing vegetation. The only action required for such changes will be to record the change in the Change Record Register.

10.9 Public Disclosure

MEPCO will disclose this ESA and EMP to all the stakeholders at the commencement of the proposed project. The ESA report will be made available to the stakeholders at the sites designated by the EPA, in accordance with the national legislation (PEPA 1997). In addition, the executive summary of the ESA will be translated into Urdu language, and made available to the affected communities (and also kept at the project sites). This will ensure that the local communities are aware of the project, its key impacts, the mitigation measures and the implementation mechanism. In addition, the Executive Summary will be disclosed through the MEPCO's official website.

10.10 Cost of Environmental and Social Management

The primary component of the environmental and social management cost pertains to the personnel dedicated for EMP implementation. The other component relates to the

environmental effects monitoring as discussed in **Section 10.5.2** and tabulated in **Exhibit 10.4**. The cost of mitigation measures detailed in **Exhibit 10.3** is completely integrated with the construction costs, and cannot be separated. The mitigation measures should be made part of the project design and hence included in the overall project cost. **Exhibit 10.7** provides the cost estimates for the environmental and social management of the proposed project.

Exhibit 10.1: Organizational Structure for Environmental and Social Management

(Please see the following page.)

Organizational Structure for Environmental and Social Management

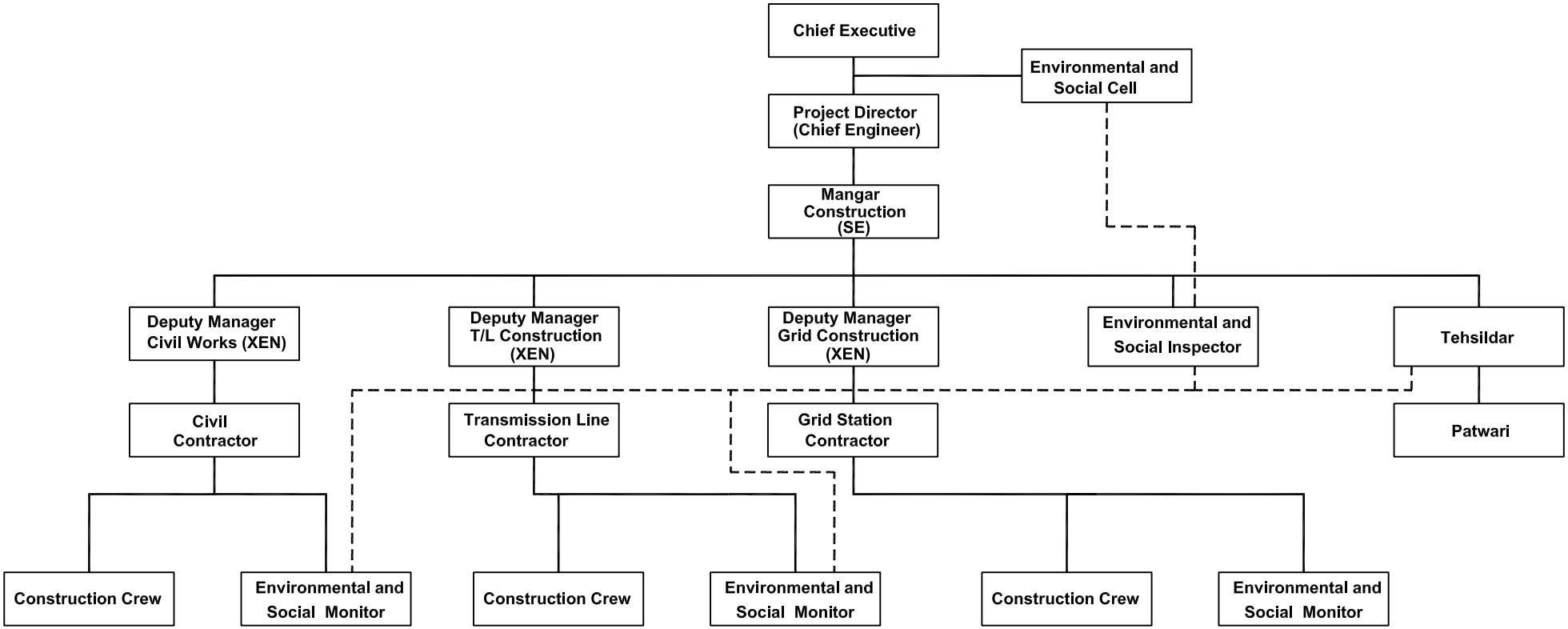

Exhibit 10.2: Roles and Responsibilities

Organization	Designation	Responsibilities
Environmental and Social Cell	Environmental and Socioeconomic Experts	Advise GSC and other MEPCO departments on matters relating to environment and social aspects of the project. Advise and support ESI for the implementation of ESA and EMP.
GSC Department	PD	Fulfill MEPCO's and GSC's obligations as laid out various project documents. Ensure that the construction is carried out within the agreed timeframe according to satisfactory HSE and technical standards.
GSC Department (or Superviision Consultant)	Site Incharge (or RE if Supervision Consultant is employed)	Facilitate field management of contractors; Report regularly to the Project Manager and PD.
	Environmental and Social Inspector (ESI)	Ensure that the entire project is conducted in an environmentally friendly manner. Ensure compliance with all relevant environmental laws. Facilitate full implementation of EMP and ESA requirements during the project. Assist the PD and Project Manager in fulfilling MEPCO's and GSC's environmental responsibilities and keep them updated on environmental matters relating to the construction. Review environmental reports (ER), and ensure implementation of corrective measures, if any. Coordinate with other stakeholders, including relevant EPAs.
Contractors	Site Manager	Manage construction activities, manage construction crew, camp crew and other site personnel, in an environmentally responsible manner; Liaise with GSC's Project Manager; Liaise with GSC's Site Incharge.
	Environment and Social Monitoros (ESM)	Manage the implementation of mitigation measures given in the ESA and EMP; Manage implementation of entire EMP; Report regularly to Site Manager; Liaise with ESI; Provide environmental training to construction crew.

Exhibit 10.3: Mitigation Plan

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
1	PCB Elimination Plan	1.1	Soil and water contamination	• The PCB Elimination Plan will be developed (**Exhibit 8.6** provides outline ToR of the Plan).	Environmental and Social Cell (ESC)	Chief Executive	Before the physical implementation of the project.
2	Contractor Mobilization and Demobilization	2.1	Soil Erosion and Contamination	• Vehicular traffic on unpaved roads will be avoided as far as possible. Operation of vehicles and machinery close to the water channels, water reservoir will be minimized. • Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to avoid soil and water contamination.	Contractors	Environmental and Social Monitor (ESM)	Before construction (BC); After construction (AC)
		2.2	Air Quality Deterioration	• Construction machinery and vehicles will be kept in good working condition and properly tunned, in order to minimize the exhaust emissions. • Fugitive dust emissions will be minimized by appropriate methods, such as spraying water on soil, where required and appropriate. • Project vehicles will avoid passing through the communities, farms and orchards as far as possible. If unavoidable, speed will be reduced to	Contractors	ESM	BC; AC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				15 km/h to avoid excessive dust emissions.			
		2.3	Noise	• Vehicles will have exhaust mufflers (silencers) to minimize noise generation. • Nighttime traffic will be avoided near the communities. Local population will be taken in confidence if such work is unavoidable. • Vehicular traffic through the communities will be avoided as far as possible. Vehicle speeds will be kept low, and horns will not be used while passing through or near the communities.	Contractors	ESM	BC; AC
		2.4	Safety Hazards	• Road signage will be fixed at appropriate locations to reduce safety hazard associated with project-related vehicular traffic. • Project drivers will be trained on defensive driving. • Vehicle speeds near / within the communities will be kept low, to avoid safety hazard and dust emissions.	Contractors	ESM	BC; AC
		2.5	Damage to Infrastructure	• All damaged infrastructure will be restored to original or better condition.	Contractors	ESM	DC; AC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
3	Construction Camp Establishment and Operation	3.1	Soil Erosion / Contamination	• The construction camps will preferably be established in the nearby grid stations. • Photographs will be taken to record the site conditions prior to the establishment of the camp. • Construction camp will be located in a stable and flat area, requiring minimal devegetation and leveling. ESI's approval will be obtained for camp location. • Land clearing, leveling and grading will be minimized, and carried out in a manner to minimize soil erosion. • Vehicular traffic on unpaved roads will be avoided as far as possible. Operation of vehicles close to the water channels, water reservoirs will be minimized. • Contractors will prepare a waste disposal plan and submit to ESI for his approval. • For the domestic sewage, appropriate treatment and disposal system will be constructed having adequate capacity. • Waste oils will be collected in drums	Contractors	ESM	BC; DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				and sold to the recycling contractors. • The inert recyclable waste from the site (such as card board, drums, broken/used parts, etc.) will be sold to recycling contractors. The hazardous waste will be kept separate and handled according to the nature of the waste. • Domestic solid waste from the construction camp will be disposed in a manner that does not cause soil contamination. • The camp sites will be completely restored after the completion of the construction works. All temporary structures will be demolished, land leveled and re-contoured to the original condition or better. All debris and any other material will be removed from the site. The photographs taken prior to the camp establishment will be used to restore the area.			
		3.2	Air Quality Deterioration	• Construction camps, if located outside the grid stations, will be established about 500 m from communities. • Generators and vehicles will be kept in good working condition and properly	Contractors	ESM	BC; DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				tunned, in order to minimize the exhaust emissions. • Fugitive dust emissions will be minimized by appropriate methods, such as spraying water on soil, where required and appropriate. Waste water from kitchen and washing area of the construction camp may be used for water spraying. • Project vehicles will avoid passing through communities, farms and orchards. If unavoidable, max speed of 15 km/h will be observed to avoid excessive dust emissions.			
		3.3	Surface Water Contamination	• For the domestic sewage, appropriate treatment and disposal system will be constructed having adequate capacity. Waste oils will be collected in drums and sold to the recycling contractors. • The inert recyclable waste from the site (such as card board, drums, broken/used parts, etc.) will be sold to recycling contractors. The hazardous waste will be kept separate and handled according to the nature of the waste. • Domestic solid waste from the	Contractors	ESM	BC; DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				construction camp will be disposed in a manner that does not cause soil contamination.			
		3.4	Water Consumption	• Water will be obtained from the source approved by the ESI. • Astute planning will be employed to conserve water at the construction sites and camp. Water will be procured in a manner that least affects the local communities. Waste water recycling will be carried out for sprinkling and gardening purposes.	Contractors	Environmental and Social Inspector (ESI)	DC
		3.5	Loss of Vegetation	• Clearing natural vegetation will be avoided as far as possible. • The camp will be established in a natural clearing, outside forested areas. • Complete record will be maintained for any tree cutting. • The construction crew will be provided with LPG as cooking (and heating, if required) fuel. Use of fuel wood will not be allowed.	ESM	ESI	BC; DC
		3.6	Noise	• Generators and vehicles will have exhaust mufflers (silencers) to minimize noise generation.	Contractors	ESM	BC; DC
		3.7	Safety Hazards	• Protective fencing to be installed	Contractors	ESM	BC;

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				around the Camp to avoid any accidents. • Firefighting equipment will be made available at the camps. • The camp staff will be provided fire fighting training. • All safety precautions will be taken to transport, handle and store hazardous substances, such as fuel.			DC
		3.8	Public Health	• Camps will be at least 500 m from any groundwater wells used by the community. • The construction camps and site offices will have first-aid kits. • The construction crew will be provided awareness for the transmissible diseases (such as HIV/AIDS, hepatitis B and C).	Contractors	ESM	BC; DC
		3.9	Social and Gender Issues	• Construction crew will avoid entering the villages and settlements. • No child labor will be employed.	ESM	ESI	BC DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
4	Transportation of Equipment and Construction Materials	4.1	Soil Erosion and Contamination	• Vehicular traffic on unpaved roads will be avoided as far as possible. Operation of vehicles and machinery close to the water channels, water reservoir will be minimized. • Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to avoid soil and water contamination.	Contractors	ESM	DC
		4.2	Air Quality Deterioration	• Vehicular traffic on unpaved roads will be avoided as far as possible. Operation of vehicles and machinery close to the water channels, water reservoir will be minimized. • Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to avoid soil and water contamination.	Contractors	ESM	BC; DC
		4.3	Noise	• Vehicles will have exhaust mufflers (silencers) to minimize noise generation. • Nighttime traffic will be avoided near the communities. Local population will be taken in confidence if such work is unavoidable. • Vehicular traffic through the	Contractors	ESM	BC; DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				communities will be avoided as far as possible. Vehicle speeds will be kept low, and horns will not be used while passing through or near the communities.			
		4.4	Safety Hazards	• Road signage will be fixed at appropriate locations to reduce safety hazard associated with project-related vehicular traffic. • Project drivers will be trained on defensive driving. • Vehicle speeds near / within the communities will be kept low, to avoid safety hazard and dust emissions.	Contractors	ESM	BC; DC
		4.5	Damage to Infrastructure	• All damaged infrastructure will be restored to original or better condition.	Contractors	ESM	BC; DC
5	Grid Station Construction	5.1	Land Acquisition	• Land for the grid stations will be purchased directly from the owners, on the basis of *willing seller – willing buyer*, at mutually acceptable market price. The seller will have right of refusal. • The agreement between MEPCO and the sellers will be properly documented. • Grievance redressal mechanism will be put in place to address the community complaints.	GSC Department	ESI	BC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
		5.2	Loss of Agriculture	• The land price will include any existing crops at the time of the agreement. • Compensation will also be paid for damaged crops, if any, outside the acquired land. • Complete record will be maintained for the compensation determination and payment.	GSC Department	ESI	BC; DC
		5.3	Blocked Access	• In case of the blockage of the existing routes, alternate routes will be identified in consultation with affected communities.	Contractor	ESM	BC; DC
		5.4	Noise and Vibration	• Working hours for construction activities within the communities will be limited to between 8 am and 6 pm.	Contractor	ESM	DC
		5.5	Safety Hazards	• The construction sites will have protective fencing to avoid any unauthorized entry. • Before commencing the testing commissioning of the system, the nearby communities will be informed. Protective fencing will be used where appropriate/possible.	Contractor	ESM	DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
		5.6	Damage to Infrastructure	• All damaged infrastructure will be restored to original or better condition.	Contractor	ESM	DC
		5.7	Gender Issues	• Bypass routes will be identified, if required, especially those frequented by women folk, such as route to the local well or water source.	GSC Department	ESI	BC; DC
		5.8	Social Issues	• Construction crew will avoid entering villages and settlements. • Local social norms and practices will be respected. • No child labor will be employed at sites.			
		5.9	Sites of Historical, Cultural, Archeological or Religious Significance	• In case of discovery of any sites or artifacts of historical, cultural, archeological or religious significance, the work will be stopped at that site. The provincial and federal archeological departments will be notified immediately, and their advice will be sought before resumption of the construction activities at such sites.	GSC Department	ESI	BC; DC
		5.10	Soil Erosion	• Cut and fill at the proposed grid station site will be carefully designed, and ideally should balance each other. The surplus soil, if any, will be disposed at places approved by ESI. Such sites will be selected after surveying the area	Contractors	ESM; ESI	DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				and ensuring that soil deposition will not have any significant impacts, such as loss of productive land, blocked access, natural vegetation and disturbance to drainage. • If necessary, fill material for grid station sites will be obtained from appropriate locations approved by ESI. Such locations will be selected after surveying the area and ensuring that soil extraction will not have any significant impacts, such as soil erosion, loss of natural vegetation and disturbance to drainage. • The fill material will not be obtained from any cultivation fields, unless allowed by the landowner/cultivator. • Where the use of cultivated land is unavoidable for obtaining the fill material, the top 30 cm soil layer will be removed and stockpiled for redressing the land after removal of the borrow material. The excavation in such areas will be limited to 50 cm depth. • Areas from where the fill material is obtained or surplus soil deposited, will be landscaped to minimize erosion and			

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				hazard for people and livestock. • Embankments and excavated slopes will not be left untreated/unattended for long durations. • After the completion of the construction works, campsites and other construction sites will be completely restored. No debris, surplus construction material or any garbage will be left behind. • Photographic record will be maintained for pre-project, during-construction and post-construction condition of the sites.			
		5.11	Soil Contamination	• Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to avoid soil and water contamination. • For the domestic sewage, appropriate treatment and disposal system, such as septic tanks and soaking pits, will be constructed having adequate capacity. The contractor(s) will submit to ESI the plans for the camp layout and waste disposal system, and obtain approval. • Waste oils will be collected in drums and sold to the recycling contractors.	Contractors	ESM, ESI	DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				• The inert recyclable waste from the site (such as card board, drums, broken/used parts, etc.) will be sold to recycling contractors. The hazardous waste will be kept separate and handled according to the nature of the waste. • Domestic solid waste from the construction camp will be disposed in a manner that does not cause soil contamination. The waste disposal plan submitted by the contractor(s) will also address the solid waste. • Leaked oil collection arrangement (such as a channel and a drain pit below the transformers) will be incorporated in the design of the transformer foundations at the grid stations.			
		5.12	Air Quality Deterioration	• Construction machinery, generators and vehicles will be kept in good working condition and properly tunned, in order to minimize the exhaust emissions. • Fugitive dust emissions will be minimized by appropriate methods, such as spraying water on soil, where	Contractors	ESM	DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				required and appropriate. Since water availability is an issue in some of the areas, it is recommended that the waste water from kitchen and washing area of the construction camp may be used for water spraying. • While working within the communities for works such as transmission line laying, coordination with the communities will be maintained to minimize any detrimental impacts on the crops and settlements.			
		5.13	Aesthetic Value	• Tree plantation will be carried inside and at the periphery of the grid stations, without compromising the safety aspects (ie, required clearances will be maintained). For this purpose, provisions will be made in the site layout of the grid stations.	GSC Department	ESI	AC
6	Construction of Transmission Lines, Feeders and LT Lines	6.1	Loss of Agriculture	• Temporary RoW will be used along the proposed transmission lines, and for access routes to the transmission line corridor. • Compensation will be paid for the crops damaged as a result of the construction activities. The compensation will be paid to the cultivator, and absence of	GSC Department	ESI	BC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				the land title will not be a bar to receiving the compensation. The **Resettlement Plan** (provided under separate cover) presents detailed procedure for the compensation determination and payment. • Complete record will be maintained for the determination and payment of the compensation. • It will be ensured that the land under the 132-KV transmission line tower remains available for cultivation. • In case the above is not possible, the land under the tower will be acquired in accordance with the LAA procedures (Section 17.4 of the LAA will not be used). • The 11-KV feeders will be routed along the existing right of ways or roads, avoiding any existing structures. The cultivated fields will also be avoided as far as possible. In case, it is not possible, damage to crops will be compensated. • Operation of project vehicles and construction machinery outside the RoW will be avoided. Attempts will be			

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				made to use existing tracks/roads to access the transmission line corridor/tower locations. In case new access routes are necessary, the cultivated land will be avoided as far as possible. Damage to crops will be compensated. • Grievance redressal mechanism will be put in place to address the community complaints.			
		6.2	Damage to irrigation network	• Operation of construction machinery or project vehicles near the water courses/canals will be avoided. • All damages to the water courses or canals caused by the project activities will be completely repaired.	Contractor	ESM	DC
		6.3	Blocked Access	• In case of the blockage of the existing routes, alternate routes will be identified in consultation with affected communities.	Contractor	ESM	BC; DC
		6.4	Noise and Vibration	• Vehicular traffic through the communities will be avoided as far as possible. Project routes will be authorized by ESI. • Vehicle speeds will be kept low, and horns will not be used while passing	Contractor	ESM	DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				through or near the communities. • Vehicles will have exhaust silencers to minimize noise generation. • Nighttime traffic will be avoided near the communities. • Movement of all project vehicles and personnel will be restricted to within work areas, to avoid noise disturbance. • Working hours for construction activities within the communities will be limited to between 8 am and 6 pm.			
		6.5	Safety Hazards	• The communities near the transmission line routes will be informed about the construction activities. Protective fencing will be installed where required. • Before commencing the testing commissioning of the system, the nearby communities will be informed. Protective fencing will be used where appropriate/possible. • For the Kot Addu – Chowk Azam transmission line works, the GSC/contractor will prepare a work plan, highlighting the safety measures for the settlements under the transmission line. The plan will be	Contractor	ESM	DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				submitted to MEPCO for approval. No works will be commenced before the approval.			
		6.6	Damage to Infrastructure	• All damaged infrastructure will be restored to original or better condition.	Contractor	ESM	DC
		6.7	Gender Issues	• Bypass routes to be identified, if required, especially along routes frequented by women, such as route to the local well or water source.	GSC Department	ESI	BC; DC
		6.8	Social Issues	• Construction crew will avoid entering villages and settlements. • No chills labor will be employed at the project sites.			
		6.9	Sites of Historical, Cultural, Archeological or Religious Significance	• Extreme care will be employed while working through the graveyards that exist on the transmission line routes. No graves will be damaged. Construction activities will be carried out after consultation with the nearby/relevant community.	Contractor	ESM	DC
				• In case of discovery of any sites or artifacts of historical, cultural, archeological or religious significance, the work will be stopped at that site. The provincial and federal archeological departments will be notified	GSC Department	ESI	DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				immediately, and their advice will be sought before resumption of the construction activities at such sites.			
		6.10	Soil Erosion	• Embankments and excavated slopes will not be left untreated/unattended for long durations. • Vehicular traffic on unpaved roads will be avoided as far as possible. Operation of vehicles and machinery close to the water bodies will be minimized. • After the completion of the construction works, the transmission line routes and other construction sites will be completely restored. No debris, surplus construction material or any garbage will be left behind. • Photographic record will be maintained for pre-project, during-construction and post-construction condition of the sites.	Contractor	ESM	DC
		6.11	Soil Contamination	• Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to avoid soil and water contamination.	Contractor	ESM	DC
		6.12	Air Quality Deterioration	• Construction machinery, generators and vehicles will be kept in good	Contractor	ESM	DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				working condition and properly tunned, in order to minimize the exhaust emissions. • Fugitive dust emissions will be minimized by appropriate methods, such as spraying water on soil, where required and appropriate. • Project vehicles will avoid passing through the communities and cultivation fields as far as possible. If unavoidable, speed will be reduced to 15 km/h to avoid excessive dust emissions. • While working within the communities for works such as transmission line laying, coordination with the communities will be maintained to minimize any detrimental impacts on the crops and settlements.			
		6.13	Loss of Natural Vegetation	• Clearing of natural vegetation will be minimized as far as possible during the transmission line works. • Herbicides will not be used to clear vegetation along the transmission line route (or at other project locations). • For each transmission line route, a tree cutting plan will be prepared and submitted to MEPCO for approval. A	Contractor	ESM	DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				complete record will be maintained for any tree cutting or trimming. The record will include: the number, species, type, size, age, condition and photograph of the trees to be cut/trimmed. The compensation for non-fruit trees will be determined on the basis of these factors. • The construction crew will be provided with LPG as cooking (and heating, if required) fuel. Use of fuel wood will not be allowed. • Tree plantation plan will be developed and implemented at each of the grid stations included in the proposed project. Provisions will be made for tree plantation while designing the layout of the grid stations. Indigenous tree species will be selected for plantation; Eucalyptus trees will not be used in any case.			
		6.14	Damage to Wildlife	• Garbage will not be left in the open. • The project staff will not be allowed to indulge in any hunting or trapping activities.	Contractor	ESM	DC

ESI: Environmental and Social Inspector;
ESM: Environment and Social Monitor;
PM: Project Manager;
GSC: Grid Station Construction.

BC: Before Construction;
DC: During Construction;
AC: After Construction;

Exhibit 10.4: Effects Monitoring Plan for Construction Period

No.	Monitoring Parameter	Monitoring Locations	Frequency [a]	Responsibility	Resource Requirement	Documentation
1	Visual observation of soil erosion	Construction sites, campsites	During routine monitoring	ESI	-	Record of observations.
2	Water quality	At wells and surface waetr bodies near grid station and construction campsites	Before mobilization	Contractor/ESM	Sampling bottles	Complete record of sampling and analyses.
		Selected local wells	Monthly	Contractor/ESM	Sampling bottles	Complete record of sampling and analyses.
		Selected locations at nearby surface water bodies	Monthly	Contractor/ESM	Sampling bottles	Complete record of sampling and analyses.
4	Water consumption	Construction sites, campsite	Daily	Contractor/ESM	-	Complete record
5	Visual checks for any damage to water course, groundwater wells	Construction sites	During routine monitoring	ESI	-	Record of observations.
6	Ambient air quality	Construction sites, camp sites	Before mobilization	Contractor/ESM	Ambient air quality monitoring equipment	Complete record of sampling and analyses.
		Construction sites, camp sites	Once every two months	Contractor/ESM	Ambient air quality monitoring equipment	Complete record of sampling and analyses.
7	Visual checks for exhaust emissions	Construction sites, camp site	During routine monitoring	Contractor/ESM	-	Record of observations.
	Visual checks for dust emissions	Construction sites, camp site, project roads	During routine monitoring	Contractor/ESM	-	Record of observations.

…Cont'd. **Exhibit 10.4**.

No.	Monitoring Parameter	Monitoring Locations	Frequency [a]	Responsibility	Resource Requirement	Documentation
8	Noise	At nearby communities	Fortnightly or during the construction activities causing noise.	Contractor/ESM	Noise meter	Complete record of noise measurements, locations, etc.
9	Public Grievances	At nearby communities	Throughout the field activities.	ESI	Social Complaint Register	Complete record to be maintained in the form of the Social Complaint Register.

[a] Frequency may be adjusted in the field according to the situation and results of the monitoring.

Exhibit 10.5: Grievance Redressal Mechanism

Stage	*Action*	*Action By*	*By When*	*Monitoring By*	*Notes*
Mobilization at site	Placement of Social Complaint Register (SCR) at the site office	ESM	At the time of site mobilization.	ESI	The SCR will have separate columns for: i) date of complaint; ii) description of complaint; iii) particulars of complainant; iv) details of action required/decided; v) person(s) responsible to take action; vi) person(s) responsible to monitor the action; vii) details of action taken (when, by whom, where); viii) comments of the complainant after the action taken. A separate SCR will be placed at each grid station included in the proposed project, and any other project site offices.
Complaint raised by any complainant	The complaint is recorded in the SCR.	ESM	-	ESI	The relevant columns of the SCR are filled.
Identification of remedial action	A meeting is held between ESM and ESI, and if required with PM and Site Incharge. The redial action is identified. The PD and ESC are informed regarding the grievance and the remedial action identified.	ESI	Within 2 days of the new complaint.	ESC	The relevant columns of the SCR are filled.
Implementation of remedial action	The remedial action is implemented	Contractors or MEPCO, depending upon the nature of the remedial measure	To be decided for each remedial action.	ESI	The relevant columns of the SCR are filled.
Feed back to the complainant	Information is provided to the complainant regarding the remedial action taken. The comments/observations of the complainant are obtained and documented.	ESM	Within 1 week of the action taken.	ESI	The relevant columns of the SCR are filled.

…Cont'd. **Exhibit 10.5**.

Stage	*Action*	*Action By*	*By When*	*Monitoring By*	*Notes*
Fortnightly site meetings	The SCR will be discussed.	ESI	Fortnightly.	PM	The discussion will be documented in the minutes of meeting.
On monthly basis	The summary of SCR will be sent to PD and ESC.	ESI	Monthly.	PM	-

Exhibit 10.6: Environmental and Social Trainings

Contents	Participants	Responsibility	Schedule
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project area; Key findings of the ESA; Mitigation measures; EMP; Social and cultural values of the area.	Design team; Selected MEPCO management staff	ESC	Prior to the start of the project activities. (To be repeated as needed.)
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project area; Mitigation measures; Community issues; Awareness of transmissible diseases Social and cultural values.	All site personnel	ESI and ESM	Prior to the start of the field activities. (To be repeated as needed.)
EMP; Waste disposal	Construction crew	ESM	Prior to the start of the construction activities. (To be repeated as needed.)
Road safety; Defensive driving; Waste disposal; Cultural values and social sensitivity.	Drivers	ESM	Before and during the field operations. (To be repeated as needed.)
Camp operation; Waste disposal; Natural resource conservation; Housekeeping.	Camp staff	ESM	Before and during the field operations. (To be repeated as needed.)
Restoration requirements; Waste disposal	Restoration teams	ESM	Before the start of the restoration activities.

Exhibit 10.7: Cost of Environmental and Social Management

	Description	Cost (Pak Rs.)	Basis
1	Environmental Personnel		
	ESI (3)	2,160,000	18 months × 40,000 PM [a]
	ESM (6)	0	To be included in the Contractor's cost
2	Environmental Monitoring	25,000	Initial water analysis to determine baseline conditions (5 locations; 5,000 per sample).
		540,000	6 water samples per month; Rs. 5,000 per sample; 18 months. [b]
		100,000	Initial air quality analysis to determine baseline conditions (5 locations; 20,000 per location)
		480,000	4 air quality analysis every three months; 20,000 per analysis; 18 months. [b, c]
3	External Monitoring	900,000	3 × 1-day visits; 5 locations (GS): (15 days). 3 × 2 day visits; 5 TL locations (30 days). 45 days × !0,000 per day × 2 experts
4	Environmental Trainings	440,000	11 training sessions × one-day duration; Rs 40,000 per training. [d]
5	Tree Plantation	100,000	About 500 trees
6	Development of PCBs Elimination Plan	520,000	26 days × 20,000 per day.
7	Crop/tree compensation	9,626,145	See **Section 5.3** in Resettlemetn Plan.
8	Miscellaneous Expenses	500,000	Lump sum
9	Contingencies	462,000	3 % of the above
	Total	**15,853,145**	

[a] The duration of the proposed project has been assumed as 18 months.

[b] Frequency of analysis may be adjusted by ESI on the basis of the previous results or sensitivity of area.

[c] Parameters for air quality monitoring to be determined by ESI, depending upon the area sensitivity/expected pollutants.

[d] Frequency of the trainings may be altered per the requirements.

11 Conclusions and Recommendations

This ESA has been conducted in line with the relevant guidelines of the WB and GoP. The objective of the ESA is to identify and assess the potential environmental and social impacts of the MEPCO's proposed 6th STG and ELR project (2006-07). The ESA also includes public consultation with the institutional as well as grass root stakeholders, in order to apprise them of the project activities and to obtain their views and concerns.

This Chapter presents the conclusions of the key findings and recommendations for further actions.

11.1 Conclusions

The major conclusions of the ESA are:

- For the electricity transmission and grid station projects such as the 6th STG and ELR, environmental and social impacts are experienced primarily during the construction phase. The operation phase will have mostly insignificant impacts on the social, physical and biological environment of the area. This has been confirmed during the environmental and social assessment as part of this ESA. Furthermore, some of the impacts can be forestalled at the design stage as well.
- The potential impacts during the construction phase of the proposed project include land acquisition (resulting in loss of assets and/or loss of livelihood), loss of agriculture, damage to the irrigation network, soil erosion and contamination, water contamination, deterioration of ambient air quality caused by exhaust emissions and kicked-up dust, noise pollution, damaged infrastructure, safety hazards and public health concerns for the nearby communities.
- The environmental and social management issues during the operation phase of the proposed project include waste disposal at the grid stations, safety hazards for the MEPCO staff as well as the nearby communities, and loss of agriculture caused during the transmission line maintenance activities.
- All the recommended mitigation measures are contained in the EMP, which will need to be made part of the construction contract(s). The EMP provides the organization structure for the environmental and social management system during the project implementation, and defines roles and responsibilities of various role players. The EMP includes a mitigation plan, which precisely defines the mitigation actions, executing persons, monitoring persons and timing of these actions. An environmental and social monitoring plan is also included in the EMP, in addition to communication and documentation requirements, and training needs, in the context of environmental and social management.
- An RP has also been developed to provide framework and procedure to address the involuntary resettlement issues and to guide through the compensation assessment

and disbursement process during the proposed project. (The RP is provided under a separate cover.) The RP will also be made part of the construction contracts.

- The mitigation measures proposed in this ESA adequately address all the concerns raised by the stakeholders, as summarized in **Exhibit 11.1**.
- Based on the recommended mitigation measures provided in **Chapters 8** and **9**, the impacts identified in **Exhibit 8.1** will be sufficiently mitigated, and the residual impacts are expected to be within the acceptable limits. **Exhibit 11.2** presents the assessment of the residual impacts.
- On the basis of the overall impact assessment, more specifically, nature and magnitude of the residual environmental and socioeconomic impacts identified during the present ESA, it is concluded that the proposed project is unlikely to cause any significant, lasting impact on the social, physical and biological environment of the area, provided that the proposed activities are carried out as mentioned in this report, and the mitigation measures included in this report are completely and effectively implemented.

11.2 Recommendations

On the basis of the environmental and social impact assessment discussed in **Chapters 8** and **9**, and the conclusions provided in **Section 11.1** above, it is recommended that:

- The EMP should be made a part of the contracts awarded by MEPCO for the proposed project.
- The Company should follow the RP for addressing the involuntary resettlement issues (primarily pertaining to crops damaged as a result of construction activities), and to compensate the project affected persons (PAPs).
- MEPCO will not purchase transformers having PCB-containing oil. However, old transformers in the MEPCO system may still have PCB-containing oil. Therefore, a program should be developed to eliminate the PCB-containing transformer oil from its entire system. To start with, the grid stations and workshops should be provided with the PCB testing kits.
- In-house environmental and social management capacity should be developed in MEPCO. For this purpose, an Environmental and Social Cell should be established within the company.
- MEPCO should develop its Environmental and Social Policy, which should demonstrate the company's commitment towards sound environmental and social management practices throughout its operations. MEPCO should adhere to the environmental legislation and regulations, particularly for conducting environmental and social assessments for all its future projects.

Exhibit 11.1: Summary of Concern Raised by Stakeholders and their Mitigation

Concerns / Recommendations	Mitigation Measures
Land acquisition issues.	See **Section 9.3.1**.
Possibility of soil and water contamination caused by the PCB-containing transformer oil.	See **Sections 8.2** and **8.4.1**.
Construction-related issues, such as waste disposal, soil erosion and hazard for communities.	See **Sections 8.3.1**, **9.3.5** and **9.4.1**.
Effects of electromagnetic radiation caused by the high power transmission lines.	See **Section 9.2**.
Safety hazards for people caused by the transmission lines	See **Sections 9.2**, **9.3.5** and **9.4.1**.
Safety hazard for livestock caused by the transmission lines	See **Sections 9.2**, **9.3.5** and **9.4.1**.
Possibility of transmission line passing over the settlements	See **Section 9.2**.
MEPCO should conduct environmental assessment of all of its projects.	See **Section 11.2**.
MEPCO should develop organizational capacity for managing the environmental issues during its operations.	See **Section 10.3.1**.
Development of PCB elimination program.	See **Section 8.4.1**.
MEPCO should take all safety precautions to minimize safety hazards associated with the transmission lines	See **Sections 9.2**, **9.3.5** and **9.4.1**.
MEPCO should contact the Civil Aviation Authority in order to obtain approval for the Bahawalpur Cantt. Grid station	See **Section 3.3.1**.
Tower design should allow cultivation under it.	See **Section 9.3.1**
Payment of full compensation for the cost of land/damaged crops.	See **Section 9.3.1**.

Exhibit 11.2: Environmental Screening Matrix (Mitigated)

	Physical					***Biological***		***Social and Socioeconomic***											
	Soil Erosion / Contamination	*Air Quality*	*Surface Water Quality*	*Groundwater Quality*	*Water Availability and Consumption*	*Natural Vegetation*	*Wildlife*	*Blocked Access Routes*	*Noise and Vibration*	*Impacts on Agriculture*	*Impacts on Irrigation Network*	*Livestock Grazing*	*Compensation Issues*	*Safety Hazard*	*Infrastructure*	*Public Health and Nuisance*	*Aesthetic Value*	*Cultural Issues*	*Gender Issues*
Design Phase																			
Site Selection for Grid Stations	0	0	0	0	0	0	0	0	0	0	0	0	-1	-1	N	0	0	0	0
Route Selection for Transmission Lines/Feeders	0	0	0	0	0	0	0	0	0	0	0	0	-1	-1	N	0	0	0	0
Design of Grid Station	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-1	0	0
Equipment Selection	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N	0	0	0	0
Construction Phase-Grid Stations																			
Land Acquisition	N	N	N	N	N	N	N	0	N	0	0	0	-1	N	N	N	N	N	N
Mobilization of Contractors	0	0	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	-1
Construction Camp Establishment	0	0	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	-1
Construction Camp Operation	0	0	0	0	-1	0	0	0	-1	0	0	0	0	-1	0	0	0	0	-1
Transportation of Construction Materials and Supplies	0	0	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	-1
Excavation for Foundations	-1	-1	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	0
Construction Works	-1	-1	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	0
Equipment Installation	0	-1	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	0
Testing and Commissioning	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0

…Contd. **Exhibit 11.2**.

	Physical					***Biological***		***Social and Socioeconomic***											
	Soil Erosion / Contamination	*Air Quality*	*Surface Water Quality*	*Groundwater Quality*	*Water Availability and Consumption*	*Natural Vegetation*	*Wildlife*	*Blocked Access Routes*	*Noise and Vibration*	*Impacts on Agriculture*	*Impacts on Irrigation Network*	*Livestock Grazing*	*Compensation Issues*	*Safety Hazard*	*Infrastructure*	*Public Health and Nuisance*	*Aesthetic Value*	*Cultural Issues*	*Gender Issues*
Construction Phase-Transmission Lines/Feeders																			
Land Acquisition	N	N	N	N	N	N	N	0	N	0	0	0	-1	N	N	N	N	N	N
Mobilization of Contractors	0	0	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	-1
Construction Camp Establishment	0	0	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	-1
Construction Camp Operation	0	0	0	0	-1	0	0	0	-1	0	0	0	0	-1	0	0	0	0	-1
Transportation of Construction Materials	0	0	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	-1
Excavation for Foundations	-1	-1	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	0
Construction of Foundations	-1	-1	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	0
Erection of Towers / Poles	0	-1	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	0
Stringing	0	-1	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	0
Testing and Commissioning	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0
Contractor Demobilization	0	0	0	0	0	0	0	0	-1	0	0	0	0	-1	0	0	0	0	-1
Operation and Maintenance Phase																			
Grid Station O&M	0	0	0	0	-1	0	0	0	0	0	0	0	0	-1	0	0	0	0	0
Transmission Line/Feeders O&M	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0

Key: -2: High negative impact; -1: Low negative impact; 0: insignificant/negligible impact; +1: low positive impact; +2: High positive impact, N: no impact.

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