K-ELECTRIC

Environmental Impact Assessment
for
Erection of 220 kV KDA/Gulshan Transmission line and addition of Surjani Grid & Angle Tower at Malir Bridge

GEMS

Environmental Impact Assessment

of

Erection of 220 kV KDA/Gulshan Transmission Line and Addition of Surjani Grid & Angle Tower at Malir Bridge

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global environmental management services

2nd Floor, Aiwan-e-Sanat, ST-4/2, Sector 23, Korangi Industrial Area, Karachi

Ph: (92-21) 35113804-5; Fax: (92-21) 35113806; Email: info@gems-intl.com

EXECUTIVE SUMMARY

This report discusses the Environmental and Socio-economic impact assessment of the proposed linked projects for electricity power supply infrastructure. The project is distributed in components which includes transmission line from the KDA Grid Station to the Gulshan Grid Station; Addition of Grid at Gulshan Grid Station; Erection of an angle tower at Malir Bridge; and Installation of grid in Surjani Grid Station.

The first component will comprise of a 220 kV twin bundle circuit power transmission network (Overhead & Underground) of about 14 km from KDA Grid Station to Gulshan Grid Station considering the Right-of-way to be 15 m for Overhead circuit and 3 m for Underground cable respectively and an addition of grid in the already existing Gulshan Grid Station.

The second component is about addition of an angle tower at Malir Bridge in an already existing overhead transmission line.

The third component states the addition of a grid in Surjani Grid Station.

The project is proposed to fulfill the electricity requirements of the city by improvement of transmission networks.

PROPONENT INTRODUCTION

K-Electric Limited formerly known as Karachi Electric Supply Company Limited (KESC) is at present the only vertically-integrated power utility in Pakistan that manages the generation, transmission and distribution of electricity to the city of Karachi. The Company covers a vast area of over 6,500 square kilometers and supplies electricity to all the industrial, commercial, agricultural and residential areas that come under its network, comprising over 2.2 million customers in Karachi and in the nearby towns of Dhabeji and Gharo in Sindh and Hub, Uthal, Vindar and Bela in Balochistan.

K-Electric is also one of the city's largest employers with nearly 11,000 people currently working for it. It was established one hundred years ago on September 13, 1913 and is one of the oldest companies operational in Karachi. It was set up under the Indian Companies Act of 1882 as the Karachi Electric Supply Corporation – KESC. The entity was nationalized in 1952 but re-privatized on November 29, 2005. KESC came under new management in September, 2008 and was renamed as the Karachi Electric Supply Company. At this point, it was transformed into a profitable entity and is today a globally recognized example of an unprecedented turnaround.

Over the last few years, KE has demonstrated a strong ability to bring about a sustainable change. It has pursued a path of visible growth and transformation which has placed it amongst the most dynamic institutions in Pakistan and in the region.

The indicators of KE's operational and financial turnaround have been clearly noticed by its stakeholders, who have reason to believe that the Company is now a renewed entity with a brand new vision and a progressive outlook. Therefore, there is a strong case for its repositioning and rebranding with a refreshing new identity as a manifestation of its aspirations and its current stance as a leader in the energy sector in Pakistan. It is for this reason that KESC has now been rebranded as K-Electric, complete with the renewed hope that it will serve Karachi with more vigour, more energy and a fresh purpose.

NEED OF THE PROJECT

Component A

The purpose of the installation of transmission network from KDA Grid Station to Gulshan Grid Station and addition of a 220kV Gulshan Grid Station is increasing transformation capacity to cater the needs of electricity requirement of the utility consumers of the Gulshan Grid Station. The source of power supply is the Bin Qasim Power Station which provides sufficient power in KDA Grid Station to increase the supply in the networks. In this connection two 220kV line bays will be added at existing KDA Grid Station and a complete 220kV Grid will be established at Gulshan Grid Station premises.

Component B

Addition of an angle tower in the existing line is proposed at Malir Bridge due to a technical correction of the placement of towers. The site at which the angle tower erection is proposed is at the main Malir Bridge where the river is passing and the bridge was constructed, however the towers at that point are at a distance of 532m while according to technical standard it is suggested that the distance must be of 250m, therefore an angle tower will be installed at the interval of 240m which will justify the distance and will also maintain the height of the power cables to improve the Malir Bridge passage.

Component C

A 220kV grid is proposed to be added at the existing 132kV Surjani Grid Station to increase the transformation capacity of the existing grid. The 220kV KDA- Baldia Transmission Lines will be loop in/out at Surjani Grid Station.

PROJECT AREA

Component A (Power Transmission line & Addition of Grid) Underground line is initiated from KDA Grid Station and then it will be converted to Overhead line which is about 1 km inwards from the Super highway and adjacent to Saadi Town till the corner of SUPARCO road. The same network will convert into Underground cable system through PLDP and from there it will lead till University road up to Gulshan Grid Station in Gulshan Town located immediately after the Gulistan e Johar area and addition of a 220kV Gulshan Grid Station with in the KE premises adjacent to the Azm Training Institute.

Component B (Addition of Angle tower) Adjacent to the Malir Bridge in the river bed where the river passes through beside the site.

Component C (Addition of grid) A grid will be added in the Surjani Grid Station which is located in the Surjani Town almost 2 km ahead of 4-K bus stand.

PROJECT DESCRIPTION

The EIA study includes three Components of the transmission Project which are described below in sections in this chapter.

Component A

Erection of 220kV Gulshan Grid & Two 220kV Twin Bundle Circuits of Transmission lines (Overhead & Underground) initiating from KDA Grid Station and ending at Gulshan Grid Station are proposed. The approximate distance of the transmission network line will be about 14 km. Underground line is initiated from KDA Grid Station and then it will be converted to Overhead transmission line diverting at the periphery of Saadi Town and leading towards the backside of SUPARCO headquarters, is estimated to be of about 5.2 km, The Underground cable system will then again be initiated from the same point through a PLDP and divert at Safora Chowk, will run along the path of University road and divert at NIPA flyover leading to Gulshan Grid Station which is situated behind the Federal Urdu University. The Underground cable system distance is estimated to be about 7.5 km. Furthermore a 220kV Grid will be added within the same premises of K-Electric Gulshan Grid Station right adjacent to the Azm Training Institute. The Proposed Transmission line routes are shown in **Exhibit: 2.1**

Component B

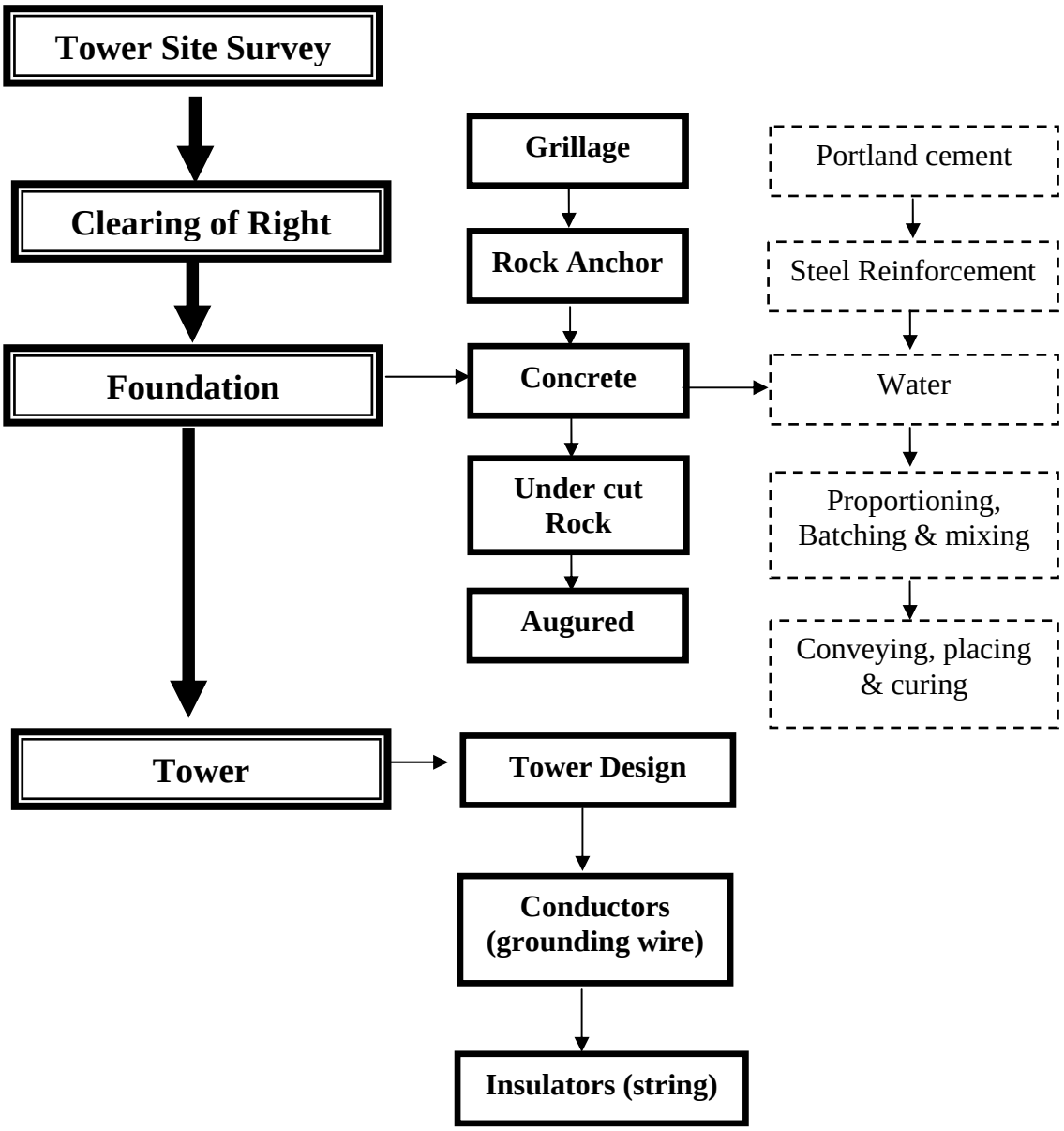
An Angle tower is proposed to be added on the already existing transmission line right adjacent to the Malir Bridge. It will be placed along the bank of Malir River, which at the current situation represents a sewage drainage line. The tower will be placed between the two existing towers about 532 m apart. Addition of the tower will decrease the distance between the towers to an acceptable standard of 240 m and also maintain the height of conductors suspended above the Malir Bridge.

Component C

A Gas Insulated Switchgear grid is proposed to be added in the premises of existing Surjani Grid Station where the capacity will be increased from 132kV to 220kV looped in from the existing 220kV Baldia-KDA Transmission Network.

OVERHEAD TRANSMISSION

Overhead Transmission Line process diagram

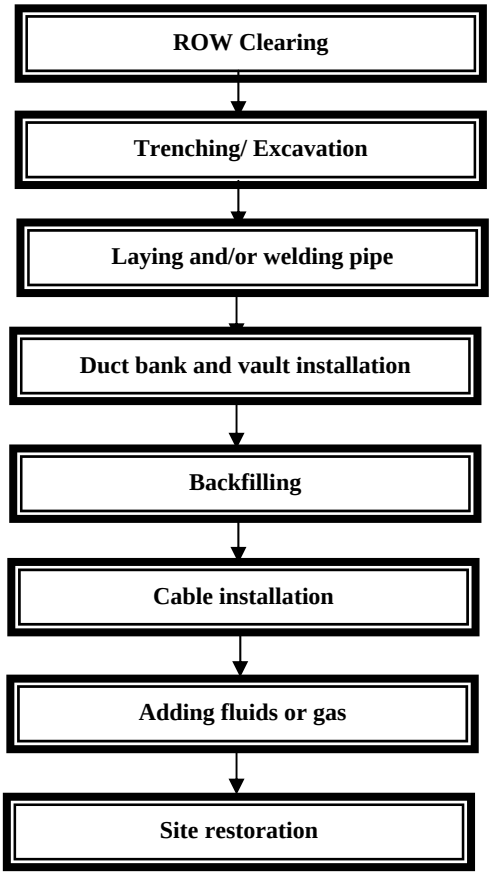


An **overhead power line** is an electric power transmission line suspended by towers or utility poles. Since most of the insulation is provided by air, overhead power lines are generally considered the lowest-cost method of transmission for large quantities of electric energy. Towers for support of the lines are made of steel (either lattice structures or tubular poles). The bare wire conductors on the line are made of aluminum (either plain or reinforced with steel or sometimes composite materials) or copper.

An overhead transmission power line about 5.2km will be installed initiating from KDA Grid Station leading a high power capacity of 220kV transmission till the backside of SUPARCO headquarters. Overhead transmission work will be done according to K-Electric Technical Provisions (TP). TP 9.9 to 9.11.9. Technical Provision are attached as in **Annexure 1**

UNDERGROUND TRANSMISSION

From the PLDP at SUPARCO headquarters the same power will be transmitted through Underground cables to the Gulshan Grid Station, following the route of Safora Chowk, Main University road and diverting before NIPA Bridge and proceeding to the grid station located in Gulshan Town right behind the Federal Urdu University. The approximate distance will be of about 7.5 km. All construction, commissioning and installation of cables will be done according to K-Electric Technical Procedure (TP) 6, 7,8,11,12,1314. Technical Provision can be seen in **Annexure 1**



ADDITION OF GRID

A Grid station (substation) is a part of an electrical generation, transmission, and distribution system. Grid stations transform voltage from high to low, or the reverse, or perform any of several other important functions. Electric power may flow through several grid stations between generating plant and consumer, and its voltage may change in several steps. A substation may include transformers to change voltage levels between high transmission voltages and lower distribution voltages, or at the interconnection of two different transmission voltages.

The 132kV Surjani Grid Station is Gas Insulated Switchgear (GIS) Grid station. In an electric power system, switchgear is the combination of electrical disconnects switches, fuses or circuit breakers used to control, protect and isolate electrical equipment. Switchgear is used to de-energize equipment to allow work to be done and to clear faults downstream. This type of equipment is important because it is directly linked to the reliability of the electricity supply. Gas (SF_6) circuit breakers sometimes stretch the arc using a magnetic field, and then rely upon the dielectric strength of the SF_6 to quench the stretched arc.

LEGISLATIVE REQUIREMENT

The EIA of the proposed K-Electric Project activity will be subjected to the pertinent legislative and regulatory requirements of the Government of Pakistan including State laws. Legislation presents a synopsis of environmental policies, legislation and other guidelines that have relevance to the proposed project.

The proposed project falls under the project category of SCHEDULE II "*Transmission lines (11kV and above) and Grid Stations*" as per the guidelines issued by the Environmental Protection Agency (EPA) under the Pakistan Environmental Protection Act 1997 (PEPA 1997). According to these guidelines, projects under this category require an EIA to be conducted.

The Pakistan Environmental Protection Act, 1997 (PEPA 1997) is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The PEPA 1997 is broadly applicable to air, water, soil, marine and noise pollution. Penalties have been prescribed for those contravening the provisions of the Act. Under the provisions of the Act, federal and provincial EPAs have been formed which ensure enforcement of the Act in their respective areas of power.

The two primary deliberations of the Act are the conduct of projects only after approval of environmental assessments from the relevant EPA and adherence with National Environmental Quality Standards (NEQS).

Under section 12 of PEPA, no project involving construction activities or any change in the physical environment can be taken unless an IEE or EIA as required is conducted and a report submitted to the federal or provincial EPA.

PHYSICAL ENVIRONMENT

The appraised land cover of Karachi city indicated that the major share by area is comprised of mountains/barren land and seawater (79.9%); urban land use (15%) and vegetation canopy (4.9%). However, urban land cover is growing day by day.

The exposed geological material in the area is generally silty sand, sandy gravel and silty clay which is either product of in-situ weathering or deposited by the action of gravity and water. Below this over burden of silty sandy gravel soil, alternating layer of sedimentary rock comprising of sandstone, shell mudstone, siltstone and limestone are present. Preliminary soil investigation will be carried out by the contractor after award of contract at design stage.

The area's climate is broadly classed as hot and arid. The yearly (1992-2012) maximum average temperature in the area remains approximately 32.3°C. Hottest months of the year are May, June and July; coldest, are December, January and February. Humidity levels in the project area are high in the mornings as compared to the evenings Maximum humidity occurs in the month of August whereas minimum occurs in the month of April.

Average annual rainfall in the district is about 166mm. The rain fall is scanty and is un- predictable. The rainy season stretches between July, August & September.

There is no significant ***natural freshwater*** source in the project area. The Indus River about 120km to the east of Karachi city and the Hub River, a perennial stream that originates in Balochistan and marks the boundary between Karachi Division and Balochistan are the sources of fresh water in Karachi.

Groundwater resources in Karachi Division are limited. The aquifers close to the coastal belt are mostly saline and unusable for domestic purposes. The proposed areas didn't have any ground water sources nearby, while it was estimated through local interactions that the depth to access water might go upto 20 to 25ft which is not feasible as the water will be restricted for use in respect of health and accessibility.

BIOLOGICAL ENVIRONMENT

Data for the EIA was gathered from both primary and secondary sources. Baseline field survey was conducted in February 2014. Sampling locations for the identification of floral and faunal assemblages has carefully been selected so that maximum number of species that could be observed within the project area.

No Endangered or threatened species were found to be existent within project areas. Since the area represent urban structure, there is minimal floral habitat found which shall need special attention, the project will be carefully executed to eliminate unnecessary damage to vegetation.

SOCIO ECONOMIC ENVIRONMENT

COMPONENT A

The Proposed Project spreads within three towns of Karachi. Overhead and Underground transmission lines will be constructed from KDA Grid Station KDA Scheme 33 and will proceed towards the outskirts of Saadi Town, leading to University Road adjacent to Gulistan-e-Johar and in Gulshan Town.

The major places which lie within the close proximity of the transmission line are Kiran Hospital, Azer Housing Society, SUPARCO Headquarters, Dow University of Health Sciences OJHA Campus, Main Safora Chowk, University of Karachi, NED University, Samama Shopping Mall, METRO Supermarket, Safari Park, Accountant General Sindh, Major Aziz Bhatti Shaheed Park, and Federal Urdu University.

There is a varying trend of livelihood and business activities from KDA Grid Station to Surjani Grid Station. As it was observed that the KDA Grid Station is at the far end of Gulshan Town and is a bit inwards from the Super Highway, there is almost no establishment of societies or housing schemes nearby, however it was found that there are some illegal inhabitants in the corridor of proposed transmission line who represent the less educated and low cast system. Nevertheless, proceeding towards the University Road, it is found there are huge numbers of markets, educational institutions, and business avenues which are frequently accessed by the inhabitants of Karachi. These areas are composite of both residential and commercial structures. The areas covered are of major contribution to the society and each area has its own identity. Transport is available in all forms in these areas such as cars, bikes, rickshaws, qingqi rickshaws, buses and trucks. The main business and community activities are majorly focused on the University of Karachi, NED University, Kiran Hospital, DOW OJHA Campus, Samama Shopping Mall and Safari Park. Almost 55% public uses local transport to access these places while 45% use private transport means. The main increase in traffic flow occurs in the usual business hours from 9 AM to 8 PM.

COMPONENT B

An angle tower is to be placed under the Malir Bridge which has been recently constructed in Malir Town. The river is no longer in its natural form and represents a sewer drainage outlet. However, the place is not accessed by people.

The major places which lie within the vicinity of the site are Malir Court and Anwar hotel. It is a route which is by-passed from the site.

There are no communities in the surrounding vicinity of the project site; however, the Malir Bridge serves as potential medium for traffic flow. The road is usually busy during business hours from 9 AM to 7 PM. The main attraction in this area is

the Anwar Hotel, where usually people come to enjoy its festivities. All sorts of vehicles are observed accessing the bridge.

COMPONENT C

Surjani Grid Station is situated in Surjani Town, about 2 km ahead of 4-K bus stop roundabout. There are no major establishments within the close vicinity of the Grid station, most societies are under development. However further ahead two main routes are to be found, one leading to Monghopir area while the other leading to the Northern By-pass.

There are no residential or commercial major areas in the close vicinity of the project area. There is only a small residential flat round the corner which does not have much access of traffic nor public movement or activities.

PUBLIC CONSULTATION

The consultants organized meetings with primary and secondary stakeholders of targeted areas including local residents, business community and civil servants. The team visited various prominent places in the project area to meet with the targeted audience.

The public consultation meetings were arranged at shops, outside house / flat or on roads. In a metropolitan city like Karachi and due to current law and order situation none of the residents allowed the team to enter inside their house, neither it was possible to arrange a Focus Group Discussion at some central place with a group of 6-8 people together. Individual meetings were arranged at shops, tea hotels, outside the house or on the street / market, or in the office / working premises individually or in small groups of 3-4 persons.

Participants in general raised some common concerns regarding the project and pointed out few common problems which Karachi people are already facing. Some of them also appreciated the project by saying that this project will be beneficial in catering the load problem in designated areas. Neither Non- governmental organization nor Community Based Organization was found in the area.

IMPACTS AND MITIGATIONS

The transmission line, grid stations and angle tower project is not an air, water polluting and resource intensive sector. However, there can be considerable environmental impacts during the initial construction phase mainly due to civil works such as site preparation, construction of access roads, vehicle movement, RCC foundation, erection of tower etc. Construction phase impacts are usually temporary and localized phenomenon, except the permanent changes they may occur in the local landscape and land use patterns along the Right-of–Way. However, these impacts are given due consideration, wherever applicable.

The operational phase has minor environmental and health impacts. This may include electrical hazards due to meteorological conditions, generation of EMF and leakage of SF_6 gas which is a potential Green House Gas. These can be mitigated by or minimized by proper vigilance. The mitigations for these impacts are summarized in the Environmental Management Plan as shown below.

CONCLUSION

The EIA of the proposed KDA to Gulshan 220kV Transmission Line consisting overhead and underground lines erection, addition of angle tower at Malir Bridge and grid at Surjani Grid Station has achieved the following goals:

- Identification of national environmental regulatory requirements that apply to the proposed project activities;
- Identification of the environmental features of the project area including the physical ,biological and social disturbance and likely impact of the project on the environment;
- Recommendation of appropriate mitigation measures that K-Electric will incorporate and ensure as per this EIA into the project to minimize the adverse environmental impacts.

"If the activities are undertaken as proposed and described in this report, and the recommended mitigation measures and environmental management plan is adopted, the project will not result in any long-term or significant impacts on the local community or the physical and biological environment of the project area rather it will prove to benefit in many ways and bring development in Karachi"

Environmental Management Plan

Aspect	Impact	Mitigation	Monitoring Parameter	Location	Monitoring	Frequency of Monitoring	Responsibility
Construction Phase							
Air	Chronic health affects Reduced visibility on roads	Sprinkling of water Tuning of construction vehicles & machines Dust masks for laborers	Particulate Matter Smoke CO SOx	All project locations	Vehicular emissions Dust Ambient air quality	Monthly for emissions and daily for dust	Contractor K-Electric
Noise	Stress Hypertension Hearing loss Headache	Avoid working at night Lubrication of construction vehicles Ear plugs	Noise levels	Project location close to residential areas	Noise monitoring device	Monthly	Contractor K-Electric
Land and soil	Erosion due to excavation Formation of pits due to improper backfilling	Proper backfilling and stone pitching around the excavated site if required	Surface topography	All project locations	Visual assessment Photographic evidences	From beginning till completion of project	Contractor K-Electric

Aspect	Impact	Mitigation	Monitoring Parameter	Location	Monitoring	Frequency of Monitoring	Responsibility
Vegetation	Cutting of trees	Avoid unnecessary cutting of trees In case of cutting of trees, one plant should be replaced by 6 plants	No of trees cleared or cut Disposal of chopped trees Ensure re-plantation by 1:6 ratio of same species	All project locations	Visual assessment Photographic evidences	From beginning till operational phase	K-Electric
Water	Wastage and misuse of water	Avoid un necessary use of water Prevent leakages	Water supply and use	All project locations	Visual assessment Record log of water usage	From beginning till the end of project	Contractor
Construction debris	Formation of heaps Remaining concrete material results in hardening of ground surface	Avoid wastage of concrete material Reuse remaining construction material	Quantity & quality of construction material	All trenching areas	Visual assessment Photographic evidence	Weekly	Contractor
Social Environment	Disturbance to routine market and local business activities Conflicts between laborers and local communities	Specify time scale for construction activities Discussion with local people regarding conflicts if any	Maintenance of complaint register	All project locations	Review of complaint register Local consultations	Monthly	K-Electric

Aspect	Impact	Mitigation	Monitoring Parameter	Location	Monitoring	Frequency of Monitoring	Responsibility
Roads and networks	Traffic congestion Night time visibility of drivers is reduced	Diversion routes must be allocated to maintain traffic flow Signs and reflectors must be boarded for driver's visibility	Signs and detours are being followed	Intersections of diversions	Observations Local residents consultations and log book	Weekly	Contractor
Health and safety	Lack of awareness to general public about safety may lead to accidents Incompetent and untrained workers might cause harm to themselves and others Construction works may include many risks and hazards that may lead to injuries or even death	Safety symbols and instructions will be boarded at work sites Trained personnel will be appointed for the specific work Appropriate PPEs must be used for technical work	Safety precautions Use of PPEs	On all project sites	Tool box talk Visual assessments Record of PPEs	Daily	Contractor K-Electric

Aspect	Impact	Mitigation	Monitoring Parameter	Location	Monitoring	Frequency of Monitoring	Responsibility
Operational Phase							
Meteorological conditions	Heavy rainfalls may break damaged overhead transmission line which may lead to electrical shock hazards	Ensure good quality of all products used in transmission lines In case of breakage, ensure emergency shutdown of transmission line Immediately repair the damage and ensure Log-Off-Tag-Off (LOTO)	Quality assurance Grid stations loads	All project components Grids	As per technical knowledge	Regularly	K-Electric
Electric Magnetic Field (EMF)	Human health impacts such as, neuropsychological disorders or cardiovascular diseases	Increase depth in case of underground cables to suppress the EMF levels Appropriate cabling with protective shields to suppress electron flux	EMF Intensity	Residency units near the corridor and grids	Electromagnetic meter	Biannually	K-Electric

Aspect	Impact	Mitigation	Monitoring Parameter	Location	Monitoring	Frequency of Monitoring	Responsibility
Sulfur Hexafluoride Gas (SF_6)	Leakage in confined areas presents risk of asphyxia, since it reduces oxygen content SF_6 has a Global Warming Potential of 23900 higher than CO_2	Equipments containing SF_6 will go through constant mechanical damage checks Ventilation of SF_6 containing equipment's compartments will be made mandatory Gas recovery kits will be used when maintenance or filling will be done	Equipment quality SF_6	SF_6 Gas containing equipment's compartments	SF_6 Detectors Ventilation ducts operation	Regularly	K-Electric
Transformer oil spillage	Contamination of soil and water bodies	Regular checking of storage tanks and machines	Soil sampling for oil and grease	Grid station	Visual assessment Soil analysis Equipment maintance record	Bi annually	K-Electric

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Chapter:1 INTRODUCTION

1.1 BACKGROUND

This report discusses the Environmental and Socio-economic impact assessment of the proposed linked projects for electricity power supply infrastructure. The project is distributed in components which includes Erection of 220kV Gulshan Grid & 220kV transmission line from the KDA Grid Station to the Gulshan Grid Station; Erection of an angle tower at Malir Bridge; and Installation of 220kV grid station within Surjani Grid Station.

The first component will comprise of a 220 kV twin bundle circuit power transmission network (Overhead & Underground) of about 14 km from KDA Grid Station to Gulshan Grid Station considering the Right-of-way to be 15 m for Overhead circuit and 3 m for Underground cable respectively and addition of a 220kV Gulshan Grid Station.

The second component is about addition of an angle tower at Malir Bridge in an already existing overhead transmission line.

The third component states the addition of a 220kV grid in Surjani Grid Station.

The project is proposed to fulfill the electricity requirements of the city by improvement of transmission networks.

The proposed project falls under the project category of SCHEDULE II "*Transmission lines (11KV and above) and Grid Stations*" as per the guidelines issued by the Environmental Protection Agency (EPA) under the Pakistan Environmental Protection Act 1997 (PEPA 1997). According to these guidelines, projects under this category require an EIA to be conducted.

1.1.1 Proponent Introduction

K-Electric Limited formerly known as Karachi Electric Supply Company Limited (KESC) is at present the only vertically-integrated power utility in Pakistan that manages the generation, transmission and distribution of electricity to the city of Karachi. The Company covers a vast area of over 6,500 square kilometers and supplies electricity to all the industrial, commercial, agricultural and residential areas that come under its network, comprising over 2.2 million customers in Karachi and in the nearby towns of Dhabeji and Gharo in Sindh and Hub, Uthal, Vindar and Bela in Balochistan.

K-Electric is also one of the city's largest employers with nearly 11,000 people currently working for it. It was established one hundred years ago on September

13, 1913 and is one of the oldest companies operational in Karachi. It was set up under the Indian Companies Act of 1882 as the Karachi Electric Supply Corporation – KESC. The entity was nationalized in 1952 but re-privatized on November 29, 2005. KESC came under new management in September, 2008 and was renamed as the Karachi Electric Supply Company. At this point, it was transformed into a profitable entity and is today a globally recognized example of an unprecedented turnaround.

Over the last few years, KE has demonstrated a strong ability to bring about a sustainable change. It has pursued a path of visible growth and transformation which has placed it amongst the most dynamic institutions in Pakistan and in the region.

The indicators of KE's operational and financial turnaround have been clearly noticed by its stakeholders, who have reason to believe that the Company is now a renewed entity with a brand new vision and a progressive outlook. Therefore, there is a strong case for its repositioning and rebranding with a refreshing new identity as a manifestation of its aspirations and its current stance as a leader in the energy sector in Pakistan. It is for this reason that KESC has now been rebranded as K-Electric, complete with the renewed hope that it will serve Karachi with more vigour, more energy and a fresh purpose.

1.2 NEED OF THE PROJECT

Component A

The purpose of the installation of transmission network from KDA Grid Station to Gulshan Grid Station and addition of a 220kV Gulshan Grid Station is increasing transformation capacity to cater the needs of electricity requirement of the utility consumers of the Gulshan Grid Station. The source of power supply is the Bin Qasim Power Station which provides sufficient power in KDA Grid Station to increase the supply in the networks. In this connection two 220kV line bays will be added at existing KDA Grid Station and a complete 220kV Grid will be established at Gulshan Grid Station premises.

Component B

Addition of an angle tower in the existing line is proposed at Malir Bridge due to a technical correction of the placement of towers. The site at which the angle tower erection is proposed is at the main Malir Bridge where the river is passing and the bridge was constructed, however the towers at that point are at a distance of 532m while according to technical standard it is suggested that the distance must be of 250m, therefore an angle tower will be installed at the interval of 240m which will justify the distance and will also maintain the height of the power cables to improve the Malir Bridge passage.

Component C

A 220kV grid is proposed to be added at the existing 132kV Surjani Grid Station to increase the transformation capacity of the existing grid. The 220kV KDA- Baldia Transmission Lines will be loop In/OUT at Surjani Grid Station.

1.3 PURPOSE OF STUDY

Purpose of this EIA study is to evaluate the proposed extension project activities against Pakistan Environmental Protection Agency (Pak-EPA) standards, and against international environmental guidelines, such as those of the World Bank.

The specific objectives of this EIA are to:

- Assess the existing environmental conditions in the project area, including the identification of environmentally sensitive areas and receptors;
- Assess the various activities (such as construction, process, operational etc) to identify their potential impacts on environment, evaluate these impacts, and determine their significance;
- Propose appropriate mitigation measures that can be incorporated into the design of the proposed activities to minimize damaging effects or lasting negative consequences identified by the environmental assessment;
- Assess the proposed activities and determine whether they comply with the relevant environmental regulations in Pakistan;
- Prepare an EIA report for submittal to the Sindh Environmental Protection Agency (SEPA).

1.4 PROJECT AREA

Component A (Power Transmission line & Addition of Grid) Underground line is initiated from KDA Grid Station and then it will be converted to Overhead which is about 1 km inwards from the Super highway and adjacent to Saadi Town till the corner of SUPARCO road. The same network will convert into Underground cable system through PLDP and from there it will lead till University road up to Gulshan Grid Station in Gulshan Town located immediately after the Gulistan e Johar area and addition of a 220kV Gulshan Grid Station within the KE premises adjacent to the Azm Training Institute.

Component B (Addition of Angle tower) Adjacent to the Malir Bridge in the river bed where the river passes through beside the site.

Component C (Addition of grid) A grid will be added in the Surjani Grid Station which is located in the Surjani Town almost 2km ahead of 4-K bus stand.

1.5 SCOPE OF THE EIA

For the EIA study, the scope of work is as under:

- Description of physical, environmental, socio-economical and cultural conditions in the project area;
- Project impact identification, prediction, and significance based on project activities.
- Identification and assessment of the workability of mitigation measures to offset or minimize negative project impacts on environment.

1.6 APPROACH AND METHODOLOGY

The EIA was performed in five main phases, which are described below.

1.6.1 Scoping

The key activities of this phase included:

Project Data Compilation: A generic description of the proposed activities, within the project area relevant to environmental assessment, was compiled with the help of EPA Guidelines.

Literature Review: Secondary data on weather, soil, water resources, and wildlife vegetation was reviewed and compiled.

Legislative Review: Information on relevant legislation, regulations, guidelines, and standards was reviewed and compiled.

Identification of Potential Impacts: The information collected in the previous steps was reviewed, and potential environmental issues identified.

1.6.2 Baseline Studies

Following the scoping exercise, the project area was surveyed to collect primary data. During the field visits, information was collected on ecologically important areas, ambient air quality, surface and groundwater resources, existing infrastructure, local communities, public services, and sites of archaeological or cultural importance. The following specific studies were conducted as part of the EIA.

Vegetation: A botanist conducted vegetation study, which consisted of a thorough literature review and field data collection. As part of the vegetation study, random sampling was conducted and the area's floral species were documented.

Vegetation communities were identified and vegetation cover determined.

Wildlife Study: A wildlife expert has conducted wildlife study, which consist of a thorough literature review and field data collection. During the fieldwork, the faunal species of the area were documented. The diversity of avian, large and small mammals, and reptile species was determined. Information was collected on the species found in the area.

Physical Environment: Environmental Assessment Specialist conducted physical environmental study including, ambient air, noise, water sampling, surface water resources and the groundwater resources of the areas. It also carried out the impact of project on soil and water resources

Socioeconomic Study: Team of experts including Social Assessment and gender specialist conducted socioeconomic and cultural study in the project area.

The study team through participatory technique collected data from men and women of the project area, consulted communities and local leadership about the project. The profile included livelihood, culture, leadership, gender issues, spiritual and temporal leadership, demographic information based on field data and published sources, the existing use of land resources, community structure, employment, distribution of income, goods and services, public health, local religious and cultural values, and local customs, aspirations, and attitudes.

1.6.3 Public Consultation

The socioeconomic and gender team also conducted a public consultation at various locations of the project areas. Data was collected by conducting of unstructured meetings and interviews with the stakeholders. The scope of work included:

- Provision of basic information on the project to the stakeholders;
- Identification of stakeholders' concerns and apprehensions regarding the project;
- Identification of stakeholders' expectations of the project;
- Summarizing the process and the outcome.

1.6.4 Impact Assessment

The environmental, socioeconomic and cultural, gender and project information collected in previous phases was used to assess the potential impacts of the proposed activities. The issues studied included potential project impacts on:

- Geomorphology;
- Groundwater and surface water quality;
- Ambient air quality;

- Ecology of the area, including flora and fauna;
- Local communities.
- Wherever possible and applicable, the discussion covers the following aspects:
  - The present baseline conditions;
  - The change in environmental parameters likely to be effected by project related activities;
  - Identification of potential impacts;
  - Likelihood and significance of potential impacts;
  - Mitigation measures to reduce impacts to as low as possible;
  - Prediction of impacts, including all long-term and short-term, direct and indirect, and beneficial and adverse impacts;
  - Evaluation of the importance or significance of impacts (The significance of each impact has been judged on the basis of available local, national, and international standards. Where such standards were not available, the best practice elsewhere has been referred to);
    - Implementation of mitigation measures (i.e., environmental management);
    - Determination of residual impacts;
    - Identification of controls and monitoring of residual impacts.

1.6.5 Documentation

At the end of the assessment, a report is prepared according to the relevant guidelines of the Pakistan Environmental Protection Agency. This report includes the findings of the assessment, project impacts, and mitigation measures to be implemented during the execution of the proposed activities.

- Components of this Report will be:

  Chapter: 1 Introduction

  Chapter: 2 Project Description

  Chapter: 3 Institutional, Legislation and policy framework

  Chapter: 4 Physical Environment

  Chapter: 5 Biological Environment

  Chapter: 6 Socio-Economic and Cultural Environment

  Chapter: 7 Alternatives

Chapter: 8 Public Consultation

Chapter: 9 Environmental Impacts Assessment & Environmental Management Plan

Chapter: 10 Conclusion

Chapter: 2 PROJECT DESCRIPTION

Electric power transmission is the bulk transfer of electrical energy between the point of generation and multiple substations near a populated area or load center. Transmission may be via overhead or underground lines, however, most transmission is done with overhead lines because they are less costly to construct and easier to maintain. Underground lines are generally restricted to urban areas.

A power transmission network is referred to as a "grid." Multiple redundant lines between points on the grid are provided so that there are a variety of routes from any power plant to any load center. The specific routing of electricity on the grid at any time is based on the economics of the transmission path and the cost of power.

The EIA study includes three components of the transmission project which are described in following sections.

Component A

Erection of 220kV Gulshan Grid & Two 220kV Twin Bundle Circuits of Transmission lines (Overhead & Underground) initiating from KDA Grid Station and ending at Gulshan Grid Station are proposed. The approximate distance of the transmission network line will be about 14km. Underground line is initiated from KDA Grid Station and then it will be converted to Overhead transmission line diverting at the periphery of Saadi Town and leading towards the backside of SUPARCO headquarters, is estimated to be of about 5.2 km, The Underground cable system will then again be initiated from the same point through a PLDP and divert at Safora Chowk, will run along the path of University road and divert at NIPA flyover leading to Gulshan Grid Station which is situated behind the Federal Urdu University. The Underground cable system distance is estimated to be about 7.5 km. Furthermore a 220kV Grid will be added within the same premises of K-Electric Gulshan Grid Station right adjacent to the Azm Training Institute. The Proposed Transmission line routes are shown in **Exhibit: 2.1**

Component B

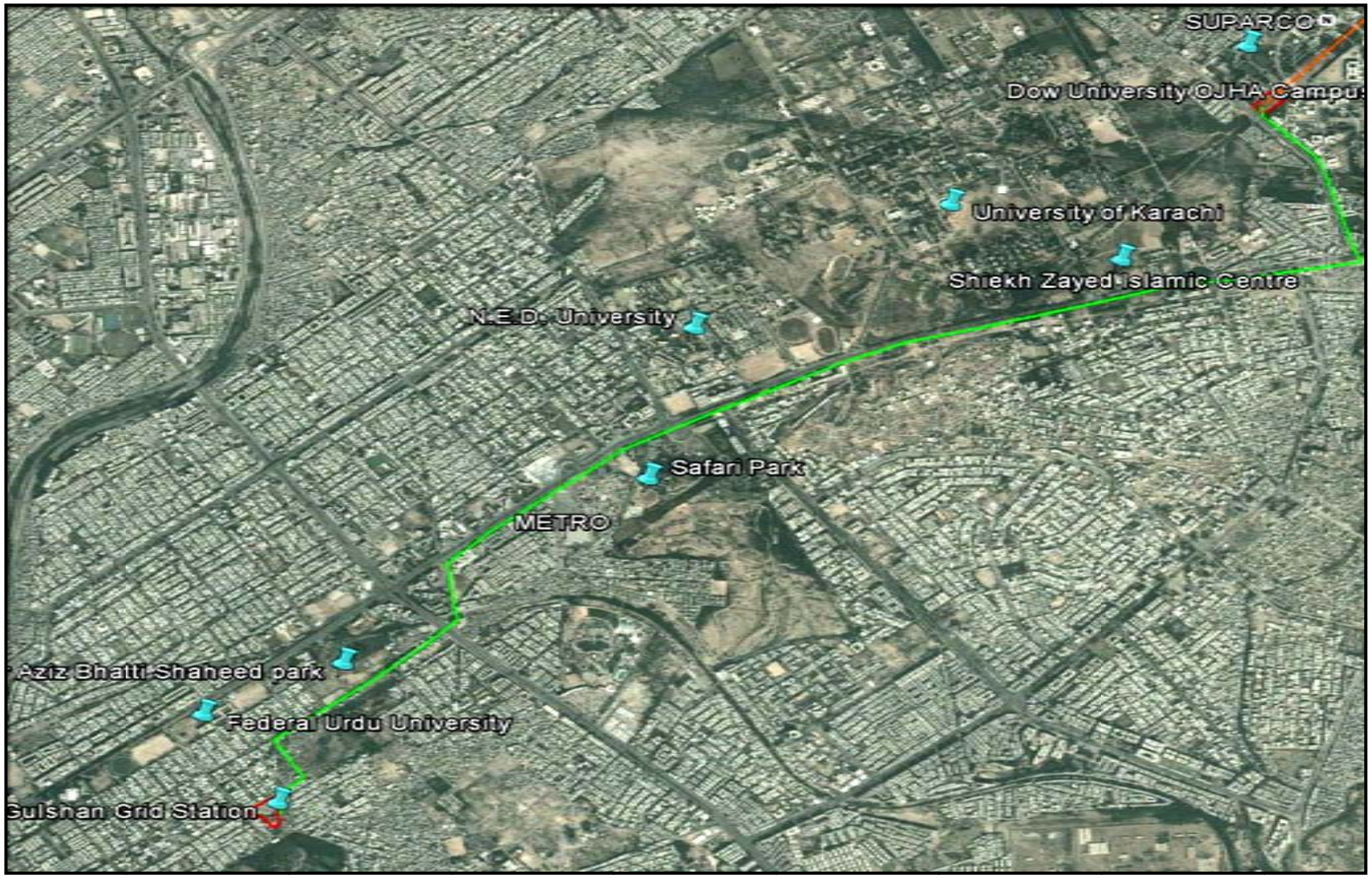
An Angle tower is proposed to be added on the already existing transmission line right adjacent to the Malir Bridge. It will be placed along the bank of Malir River, which at the current situation represents a sewage drainage line. The tower will be placed between the two existing towers about 532 m apart. Addition of the tower will decrease the distance between the towers to an acceptable standard of 240 m and also maintain the height of conductors suspended above the Malir Bridge.

Component C

A Gas Insulated Switchgear grid is proposed to be added in the premises of existing Surjani Grid Station where the capacity will be increased from 132kV to 220kV looped in from the existing 220KV Baldia-KDA transmission network.

Exhibit 2.1: Transmission Line Network maps

Overhead transmission line from KDA Grid Station



Underground cable network end to Gulshan Grid Station

2.1 PROJECT SITE LOCATIONS

Component	Subject	Description	Coordinates	View of Location
A-I	KDA Grid Station	At the Outskirts of Saadi Town and approx 2km inward from Super Highway	N 24°58'38.6" E 67°09'31.9"	
A-II	Gulshan Grid Station	Approx 2 km ahead of NIPA Bridge in Gulshan Town, right behind Federal Urdu University	N 24°54'21.4" E 67°12'13.8"	

Component	Subject	Description	Coordinates	View of Location
A-III	Malir Bridge Angle Tower	Adjacent to the Malir Bridge	N 24O51'55.3" E 67°12'13.8"	
A-IV	Surjani Grid Station	Approx 2 km ahead of 4-K Bus stop in Surjani Town	N 25°01'30.8" E 67°03'45.2"	

2.2 PROJECT SCHEDULE

The project is at development stage and will be finalized when the contract is awarded after due permits.

2.3 OVERHEAD POWER LINE

An **overhead power line** is an electric power transmission line suspended by towers or utility poles. Since most of the insulation is provided by air, overhead power lines are generally considered the lowest-cost method of transmission for large quantities of electric energy. Towers for support of the lines are made of steel (either lattice structures or tubular poles). The bare wire conductors on the line are made of aluminum (either plain or reinforced with steel or sometimes composite materials) or Copper.,

An overhead transmission power line about 5.2km will be installed initiating from KDA Grid Station leading a high power capacity of 220kV transmission till the backside of SUPARCO headquarters. Overhead transmission work will be done according to K-Electric Technical Provisions (TP). TP 9.9 to 9.11.9. Technical Provision are attached as in **Annexure 1**

2.3.1 Clearing Right-of-Way

Initially, the right-of-way is cleared of trees and bush to provide the necessary access for construction equipment and a safe work area for crews. Clearing the right-of-way ensures an environment with safety and reliably supports the construction and ongoing operation of the transmission lines. No herbicides will be used for clearing vegetation during construction. The K-Electric specification of clearing a right way is attached as **Annexure 1.**

MINIMUM CLEARANCES

Following are the minimum clearances distances between live conductors and other objects, which correspond to the maximum conductor sag conditions.

Item	Description of clearances	Minimum (in meters)
a.	Normal ground for pedestrians only	8
b.	Residential areas	10.5
c.	Roads and streets	10.5
d.	Highways	10.5
e.	Over railways-from top of rail (without electric line system)	15.0
f.	Over pipelines-from top of pipe	10.5
g.	To metal clad or roofed buildings or buildings or structures upon which a man may stand	5.4
h.	Power lines (above or below)	5.4
i.	Telecommunication lines	5.4

Ref: Beuth Standards

For other objects not listed in the Schedule the requirements for minimum clearances shall comply also with VDE 0210. Approximately 0.5 m has been added to the clearance values above to allow for survey and drawing errors.

The area where the Overhead transmission is planned is a clear route, however there are some illegal minor establishments which might be compensated to other areas. There are patches of vegetation of minor ecological importance which will be cleared according to the technical standards.

2.3.2 Retaining Walls:

Retaining walls are built to hold back earth which would otherwise move downwards. The purpose is to stabilize slopes and provide useful areas at different elevations.

At locations where earth moving by landslides, boulders, water etc. is likely to occur, the tower leg structure/poles be protected against this effect by means of retaining walls, without any extra cost.

Figure: 7 Retaining Walls

2.3.3 Construction of Foundation Wall

The construction process consists of drilling foundations for the new transmission structures. This involves drilling large holes, which are then typically filled with concrete for the steel structure foundation.

a) Excavation

Excavation in construction refers to any operation in which earth, rock, or other material in or on the ground is moved or otherwise displaced by means of tools, equipment, or explosives, and includes earthwork, trenching, wall shafts, tunneling and underground work.

b) Setting

All foundations will be assembled, placed, and set to the levels, measurements and batters shown on the approved setting diagrams.

c) Back Fill & Clear up

Refill (an excavated hole) with the material dug out of it. On cultivated land, the tower side shall be promptly cleaned and leveled. The original top soil shall be replaced at the surface. All surplus excavated materials, debris, construction materials and foreign matter shall be removed and disposed of from the tower site

2.4 ERECTION OF TOWER

Structures for overhead lines take a variety of shapes depending on the type of line. Tubular steel poles are typically used in urban areas. High-voltage lines are often carried on lattice-type steel towers or pylons.

At Malir Bridge, there is a part of Malir River flowing, but it represents an absolute sewage drainage system. The tower will be erected at that place after considering the bank water flux which might intrude in the foundations of tower.

a) Lattice steel

A lattice steel tower is a steel framework construction. Lattice steel towers are used for power lines of all voltages, and are the most common type for high-voltage transmission lines.

A lattice tower is usually assembled at the location where it is to be erected. This makes very tall towers possible. Assembly of lattice steel towers will be done using a crane.

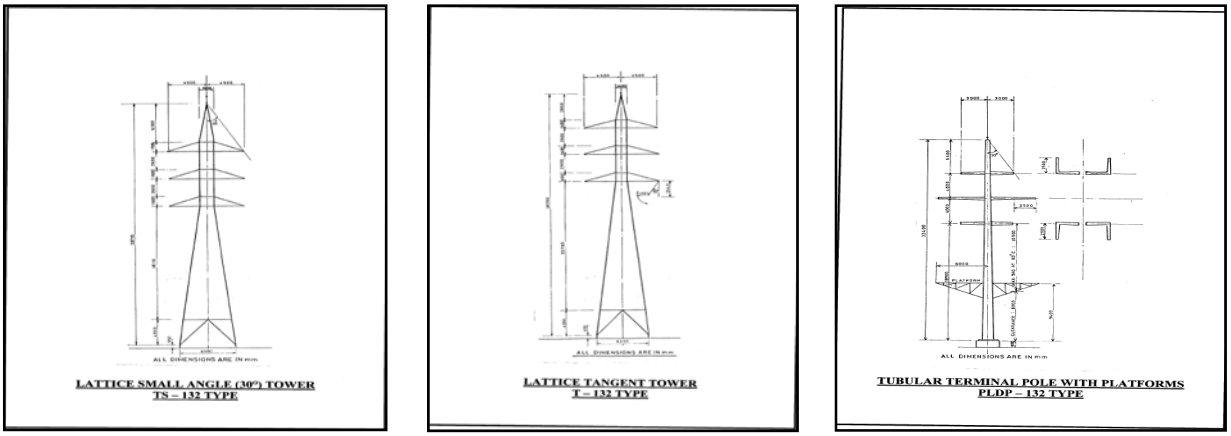


Figure: 8 Types of tower

The towers shall be designed such that their heights may be extended or reduced at suitable intervals (preferably in accordance with already practiced system in KE). The different types of towers will be used as per the route profile survey, which is carried out after the award of contract. T-type, TS-Type towers and PLDP are proposed for this project, and will be finalized after detailed route profile and survey by contractor.

2.4.1 Conductors

Suspension towers will have brackets (hangers) suitable for the attachment of insulator strings associated with suspension conductor support assemblies and shall be flexible on the direction of the line and rigid transverse to the line. The angle tension and terminal towers shall have brackets suitable for the attachment of insulator strings associated of an overhead earth wire clamp to the tower, holes shall be provided on the earth wire peak.

2.4.2 Grounding Wire

Optical Power Ground Wire (OPGW) is an earthing wire having fiber optic cable inside it. OPGW is primarily used by the electric utility industry, placed in the secure topmost position of the transmission line where it “shields” the all-important conductors from lightning. OPGW is capable of withstanding the mechanical stresses applied to overhead cables by environmental factors such as wind and ice. OPGW is also capable of handling electrical faults on the transmission line by providing a path to ground without damaging the sensitive optical fibers inside the cable.

2.4.3 Insulators

Insulators must support the conductors and withstand both the normal operating voltage and surges due to switching and lightning. Insulators are broadly classified as either pin-type, which support the conductor above the structure, or suspension type, where the conductor hangs below the structure

All insulator strings shall be equipped with appropriate protective devices, such as arcing rings. The design of these protective devices shall be such as to support loadings during the installation of insulator strings and stringing of conductors and to reduce as far as possible damage to the conductors, clamps, insulator strings and arcing horns or rings themselves under all flashover conditions.

2.4.4 PLDP (Power Line Drop Point)

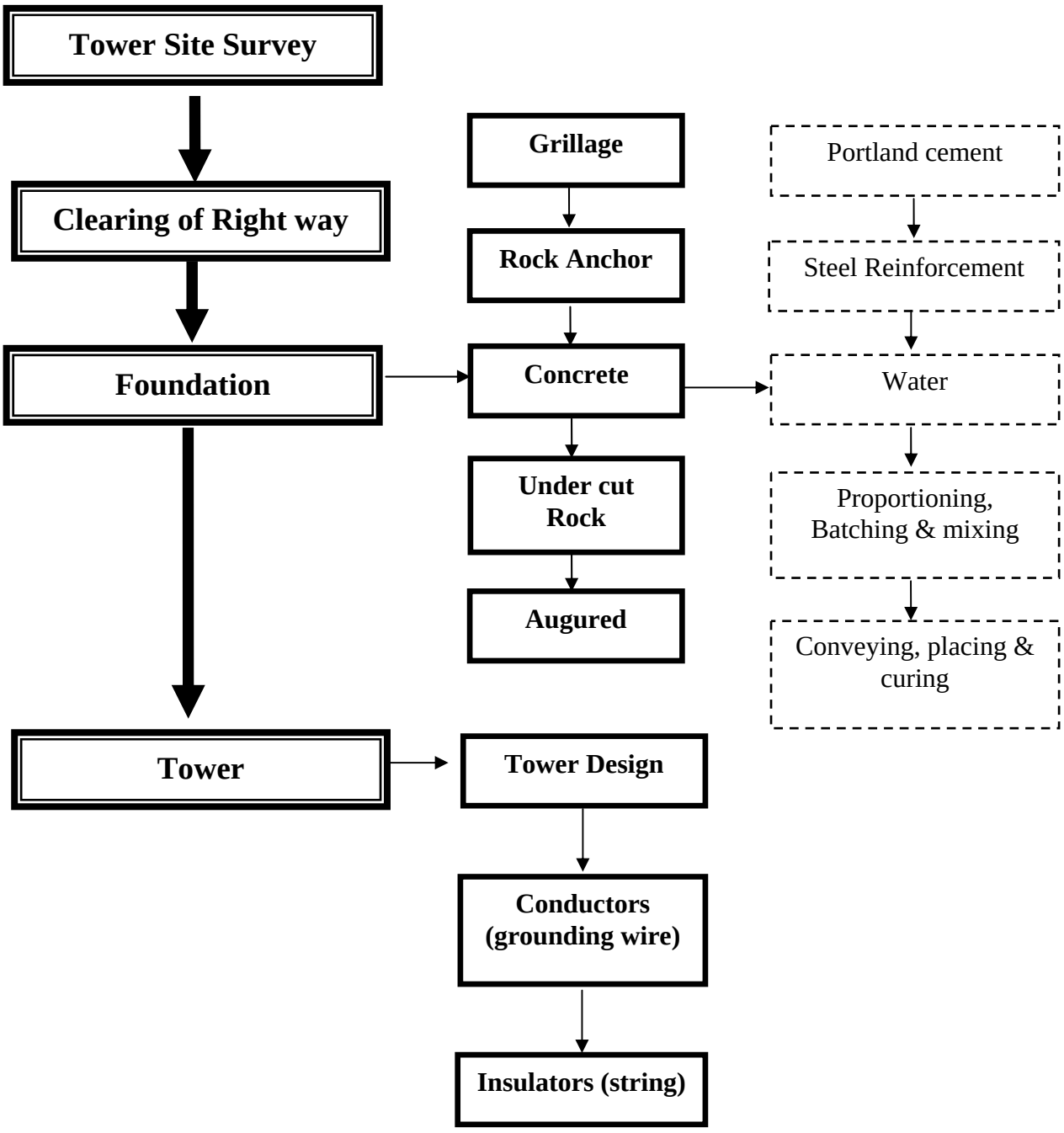
The underground and overhead transmission lines are connected through cable sealing end at power line drop pole (PLDP).

The cable terminations would be suitable for application to single-core XLPE underground cables as described in "Specific Works Data". The terminal of the

cable sealing end will be suitable to accommodate 300 mm² or above copper conductors from the overhead transmission line. They would be designed to withstand the specified short circuit current.

The outdoor type cable sealing end bases will be insulated from the structural steel work and the cable glands of gas-immersed and oil-immersed type sealing ends shall be insulated from the SF6 switchgear, and transformers. They will also be suitably protected by Metal reinforced glass fibre sheet towards the lightning arresters side against the damage due to explosion of lightning arrestor & consequent fire.

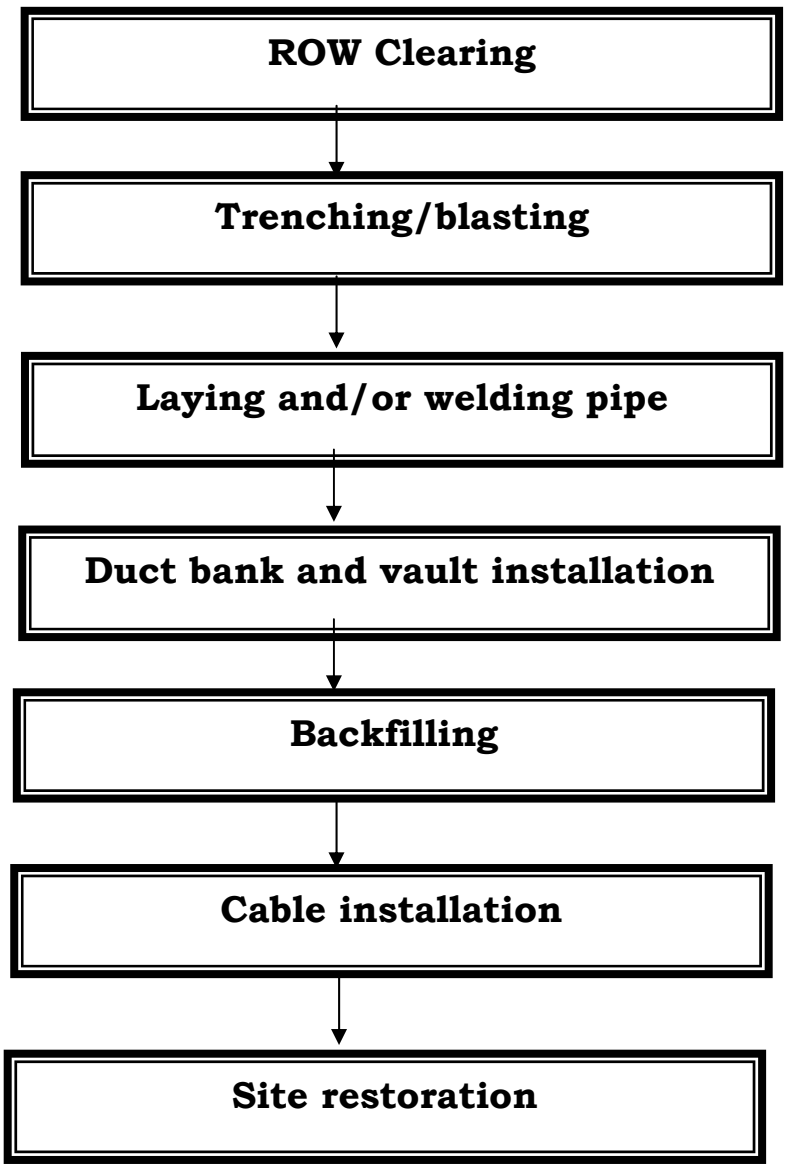
Overhead Transmission Line process diagram



2.5 UNDERGROUND TRANSMISSION

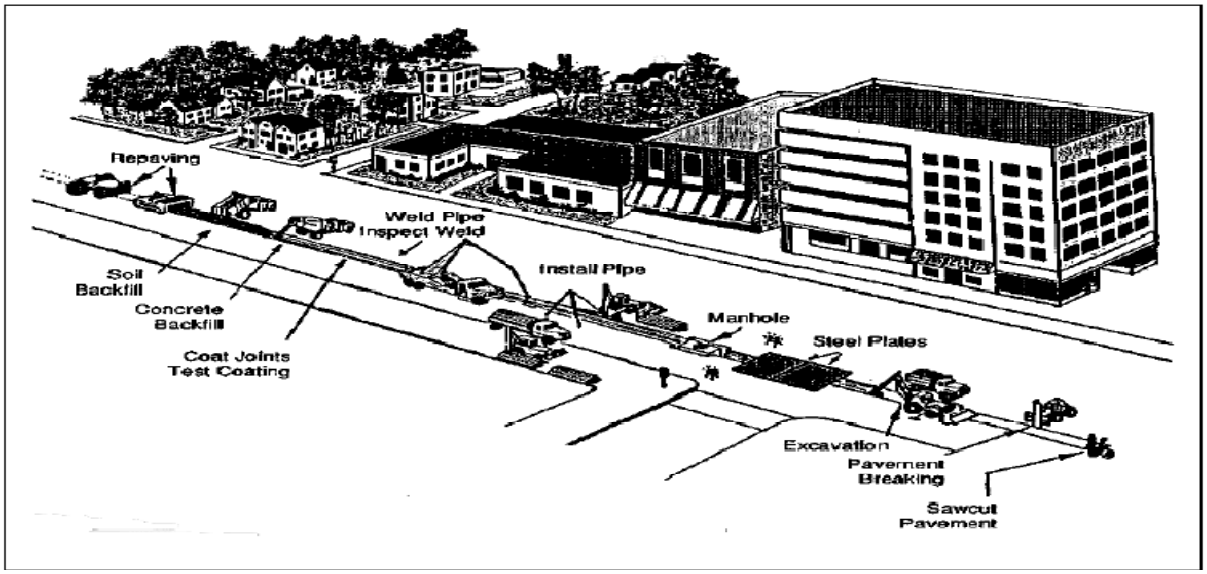
From the PLDP at SUPARCO headquarters the same power will be transmitted through Underground cables to the Gulshan Grid Station, following the route of Safora Chowk, Main University Road and diverting before NIPA Bridge proceeding to the grid station located in Gulshan Town right behind the Federal Urdu University. The approximate distance will be of about 7.5km. All construction, commissioning and installation of cables will be done according to K-Electric Technical provisions (TP) 6, 7,8,11,12,1314. Technical Provision are attached as **Annexure 1**

Underground Transmission Line process diagram



2.5.1 Right-Of-Way Construction Zone

Underground construction will begin by staking the ROW boundaries and marking sensitive resources. Existing underground utilities are identified and marked prior to the start of construction.



2.5.2 Trenching

Excavation will start with the removal of the top soil in unpaved areas or the concrete/asphalt in paved areas. Large trucks will haul away excavated subsoil materials to approved off-site location for disposal, or if appropriate, re-use. Trenches will only be installed inside the grid station, according to geological survey or safety measure the proposed trench size will be 1.4 m x 2 m (height * Width). Generally the three single-core 132kV power cable of each circuit will be laid in trefoil formation when installed on cable trays within the grid station.

2.5.3 Cable Laying and Routing

Power transmission cable line will be buried directly in the ground, the trench for single circuit underground cable transmission line is approximately 2m (wide) and 1.5m (deep) and the soil removed is back filled after installation of the cable. However the leftover soil (if any) is dump at land fill site as designated by civic agencies.

2.5.4 Pipe Installation

Plastic pipe will be used to house the cables beneath the roads and footpaths. Pipe protects cable from the damages which may occur due to repaving of roads and footpaths.

2.5.5 Cable Installation

The cable is pulled from the transition structure to the nearest vault. Direction of pull between vaults is based on the direction that results in the lowest pulling and sidewall tensions. Cable lengths are spliced within the vaults.

2.5.6 Backfilling

Heat will be carried away from the conductors to operate efficiently. The air performs this function for overhead lines and the soil in underground lines. All of the heat generated from direct buried cables will be dissipated through the soil. Excavated soil will be backfilled after installation of the cable.

2.5.7 Site Restoration

When construction is completed, roadways, landscaped areas, and undeveloped areas will be restored to their original condition and topography. Highway lands and shoulders are re-constructed so as to support road traffic. Any infrastructure impacted by the construction project such as driveways, curbs, and private utilities will be restored to their previous function, and yards and pastures are vegetated as specified in landowner easements

2.6 GRID STATION

A Grid station (substation) is part of an electrical generation, transmission, and distribution system. Grid stations transform voltage from high to low, or the reverse, or perform any of several other important functions. Electric power may flow through several grid stations between generating plant and consumer, and its voltage may change in several steps. A substation may include transformers to change voltage levels between high transmission voltages and lower distribution voltages, or at the interconnection of two different transmission voltages.

a) Surjani and Gulshan Grid

The 132kV Surjani & Gulshan Grid Station are Air Insulated Switchgear (AIS) Grid stations. The addition of 220kV Gulshan and Surjani Grid Stations will be GIS (Gas Insulated Switchgear) which will be connected to existing 132kV grid stations after stepping down the voltage through auto transformers. In an electric power system, switchgear is the combination of electrical disconnects switches, circuit breakers used to control, protect and isolate electrical equipment. Switchgear is used to de-energize equipment to allow work to be done and to clear faults downstream. This type of equipment is important because it is directly linked to the reliability of the electricity supply. Gas (SF_6) circuit breakers sometimes stretch the arc using a magnetic field, and then rely upon the dielectric strength of the SF_6 to quench the stretched arc.

2.7 CONSTRUCTION MACHINERY/INSTRUMENTS

The trenching will be carried out generally with machinery like excavator and jack hammer is used for rocky soil. Trench is made manually by using a spade or shovel.

2.8 CONSTRUCTION WASTE MANAGEMENT

Miscellaneous types of waste will be generated from construction activities including excavated soil, construction material, iron scrape, broken wires and electronics items which will be stored at designated place and later dispose off to EPA certified waste contractor.

2.9 SAFETY MEASURE DURING GROUND WORK

SOP for implementation of corporate HSEQ Plan during civil activities for Grid Station and Transmission Line with or without shutdown and Health Safety and Environment Policy is given in **Annexure-2.**

2.9.1 Electric & Magnetic Field

Electric and magnetic fields are produced by any wiring or equipment that carry electric current. This includes overhead and underground power lines carrying electricity, wiring in buildings, and electrical appliances. The strengths of the fields decrease rapidly with increasing distance from the source. Electric and magnetic fields are fundamentally different, in their physical nature and in the way they interact with the body, from true electromagnetic radiation such as radio waves and microwaves. Typical magnetic field levels found in various locations are presented in table.

S/no	Source	Electric Field	Magnetic Field	
			μT	mG
1	High Voltage Transmission line (Direct beneath line)	0.3–3 kV/m	0.5–5	5–50
2	High Voltage Transmission line (40 metres from line)	0.01–0.1 kV/m	0.1–1	1–10
3	Near street distribution lines	0.01–0.1 kV/m	0.05–2	0.5–20
4	Substations Electric fields: generally less than 0.1 kV/m except near	generally less than 0.1 kV/m except near (Where overhead supply lines enter or leave the station.)	generally decrease to around 0.1μT within 5 metres of equipment except near where supply lines enter or leave the station.	generally decrease to around 1 within 5 metres of equipment except near where supply lines enter or leave the

Generally, magnetic fields decrease to around 0.1 μT (1 mG) within 50–100 metres of the line.

Basic Restriction and reference level of occupational and public exposure to50 Hz ELF electric and Magnetic field

Exposure characteristics	Basic restriction	Reference levels		
	Induced current density (mA/m^2)	Electric field strength (kV/m)	Magnetic flux density	
			µT	mG
Occupational	10	10	500	5000
General public	2	5	100	1000

Note: All values are rms (root-mean-square, a kind of average)

Ref. National Radiation laboratory Manatu Haura
(http://www.who.int/peh-emf/project/mapnatreps/nznrl_emfbooklet2008.pdf

Chapter:3 INSTITUTIONAL, LEGISLATION AND POLICY FRAMEWORK

The EIA of the proposed K-Electric Project activity will be subjected to the pertinent legislative and regulatory requirements of the Government of Pakistan including State laws. This chapter presents a synopsis of environmental policies, legislation and other guidelines that have relevance to the proposed project.

3.1 NATIONAL ENVIRONMENTAL POLICY, LEGISLATION AND GUIDELINES

The enactment of comprehensive legislation on the environment, covering multiple areas of concern, is a relatively new and ongoing phenomenon in Pakistan. Whereas, a basic policy and legislative framework for the protection of the environment and overall biodiversity in the country is now in place, detailed rules, regulations and guidelines required for the implementation of the policies and enforcement of legislation are still in various stages of formulation and discussion. The following section presents a brief overview of the existing national policies, legislation and guidelines.

3.1.1 National Conservation Strategy (NCS)

The National Conservation Strategy (NCS) is the primary Policy document of the Government of Pakistan on national environmental issues. The Policy was approved by the Federal Cabinet in March 1992. The Strategy also attained recognition by international donor agencies, principally the World Bank. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage and recommends immediate attention to these core areas in order to preserve the country's environment.

A midterm review of the achievements of the NCS in 2000 concluded that achievements under the NCS have been primarily awareness raising and institutional building rather than actual improvement to environment and natural resources and that the NCS was not designed and is not adequately focused as a national sustainable development strategy (GoP, November 2000). The need therefore arose for a more focused National Environmental Action Plan (NEAP) required to bring about actual improvements in the state of the national environment with greater emphasis on poverty reduction and economic development in addition to environmental sustainability.

The National Environmental Action Plan was approved by the Pakistan Environmental Protection Council under the chairmanship of the President/Chief

Executive of Pakistan in February 2001. NEAP now constitutes the national environmental agenda and its core objective is to initiate actions that safeguard public health, promote sustainable livelihoods, and enhance the quality of life of the people of Pakistan.

A National Environmental Policy has been approved by the Federal Cabinet in its meeting held during June 2005. This policy has already been endorsed by the Pakistan Environmental Protection Council during 2004. The new policy has total 171 guidelines on sectoral and cross-sectoral issues. The objectives of new policy include assurance of sustainable development and safeguard of the natural wealth of country. The following are the approved Sectoral Guidelines;

- Water Supply and Management;
- Air Quality and Noise;
- Waste Management;
- Forestry;
- Biodiversity and Protected Areas;
- Climate Change and Ozone Depletion;
- Energy Efficiency and Renewable;
- Agriculture and Livestock;
- Multilateral Environmental Agreements.

3.1.2 National Environmental Action Plan-Support Programme (NEAP-SP)

The Government of Pakistan and United Nations Development Program (UNDP) have jointly initiated an umbrella support program called the National Environmental Action Plan-Support Program (NEAP-SP) signed in October 2001 and implemented in 2002. The development objective supported by NEAP-SP is environmental sustainability and poverty reduction in the context of economic growth.

3.1.3 Pakistan Environmental Protection Act 1997

The Pakistan Environmental Protection Act, 1997 (PEPA 1997) is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The PEPA 1997 is broadly applicable to air, water, soil, marine and noise pollution. Penalties have been prescribed for those contravening the provisions of the Act. Under the provisions of the Act, federal and provincial EPAs have been formed which ensure enforcement of the Act in their respective areas of power.

The two primary deliberations of the Act are the conduct of projects only after approval of environmental assessments from the relevant EPA and adherence with National Environmental Quality Standards (NEQS).

Under section 12 of PEPA, no project involving construction activities or any change in the physical environment can be taken unless an IEE or EIA as required is conducted and a report submitted to the federal or provincial EPA.

3.1.4 Approval from Sindh Environment Protection Agency

As per the Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000, K-Electric will submit an EIA report for their project activities to EPA Sindh (Environment Protection Agency Sindh), and seek approval on the same from the agency. 10hard copies and 2 soft copies of the EIA report will be submitted to Sindh Environmental Protection Agency. It will then grant its decision on the EIA as per the rules and procedures set out in the Pakistan Environmental Protection Agency review of IEE and EIA Regulation, 2000 Regulations; the following rules will apply:

- A fee is payable to SEPA for review of the EIA;
- The EIA submittal is to be accompanied by an application in the format prescribed in Schedule IV of the Pakistan Environmental Protection Agency review of IEE and EIA Regulation, 2000 Regulations;
- SEPA is bound to conduct a preliminary scrutiny and reply within 10 days of the submittal of the report a) confirming completeness, or b) asking for additional information, if needed;
- K-Electric will publish a public notice in any English or Urdu national newspaper and in a local newspaper of general circulation in the area affected by the project. The public notice will mention the following:
  - The type of project;
  - The location of the project;
  - The name and address of the proponent;
  - The places at which the EIA can be accessed;
  - The date, time and place for public hearing of any comments on the project or its EIA;
- The date set for public hearing will not be earlier than 30 days from the date of publication of the public notice;
- In the review process, SEPA may consult a Committee of Experts, which maybe constituted on the request of the DG SEPA;

- On completion of the review process and the public hearing, the decision of SEPA will be communicated to the proponent in the form prescribed in Schedule VI;

- Where an EIA is approved, SEPA can impose additional controls as part of the conditions of approval;

- SEPA is required to make every effort to complete the EIA review process within 90 days of the issue of confirmation of completeness. However, SEPA can take up to 4 months for communication of final decision;

- The approval will remain valid for the project duration mentioned in the EIA but on the condition that the project commences within a period of three years from the date of approval. If the project is initiated after three years from approval date, the proponent will have to apply for an extension in the validity period. The SEPA on receiving such request grant extension (not exceeding 3 years at a time) or require the proponent to submit a fresh EIA if in the opinion of SEPA changes in baseline conditions or the project so warrant;

- After receiving approval from SEPA the proponent will acknowledge acceptance of the conditions of approval by executing an undertaking in the form prescribed in Schedule VII of the Pakistan Environmental Protection Agency review of IEE and EIA Regulation, 2000;

- The Pakistan Environmental Protection Agency review of IEE and EIA Regulation, 2000;also require proponents to obtain from SEPA, after completion of the project, a confirmation that the requirements of the EIA and the conditions of approval have been duly complied with;

- The SEPA in granting the confirmation of compliance may impose any additional control regarding the environmental management of the project or the operation, as it deems necessary.

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

The Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000 (The 2000 Regulations) promulgated under PEPA 1997 was enforced on 15 June, 2000. The 2000 Regulations define the applicability and procedures for preparation, submission and review of IEEs and EIAs. These Regulations also give legal status to the Pakistan Environmental Assessment Procedures prepared by the Federal EPA in 1997.

The Regulation classifies projects on the basis of expected degree of adverse environmental impacts and lists them in two separate schedules. Schedule I lists projects that may not have significant environmental impacts and therefore require

an IEE. Schedule II lists projects of potentially significant environmental impacts requiring preparation of an EIA. The Regulations also require that all projects located in environmentally sensitive areas require preparation of an EIA.

The relevant categories are as follows:

Schedule II (EIA)

1. Transmission lines (11kV and above) and grid station

The proposed project is classified under this category as it involves transmission network improvement by upgrading supply from 132kV to 220kV. Therefore, it requires an EIA to be conducted.

3.1.6 The National Environmental Quality Standards

The NEQS promulgated under the PEPA 1997 and last revised in 2000 specify standards for industrial and municipal effluents, gaseous emissions, vehicular emissions, and noise levels. The PEPA 1997 empowers the EPAs to impose pollution charges in case of non-compliance to the NEQS.

During the construction and post development phase of the project, NEQS will apply to all effluents and emissions. NEQS for municipal and industrial effluents, selected gaseous pollutants from industrial sources and motor vehicle exhaust and noise are provided in **Exhibit 3.1**, **Exhibit 3.2**, **Exhibit 3.3 & Exhibit 3.4**. NEQS Standards for disposal of solid waste have as yet not been promulgated.

3.1.7 Land Acquisition Act, 1894

The Land Acquisition Act (LAA) of 1894 amended from time to time has been the defacto policy governing land acquisition, resettlement 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.

3.1.8 Pakistan Penal Code (1860)

The Pakistan Penal Code (1860) authorizes fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs so as to make them less fit for ordinary use.

3.1.9 The Antiquities Act, 1975

The Antiquities Act of 1975 ensures the protection of cultural resources of 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 archaeological significance.

Under the Act, the project proponents are obligated to:

- Ensure that no activity is undertaken in the proximity of a protected antiquity;
- Report to the Department of Archeology, Government of Pakistan, any archeological discovery made during the course of a project.

3.1.10 The Factories Act, 1934

The clauses relevant to the project are those that concern to health, safety and welfare of workers, disposal of solid waste and effluent and damage to private and public property. The Factories Act also provides regulation for handling and disposal of toxic and hazardous materials.

3.1.11 Electricity Act, 1910

The Act provides a legal base for power distribution. A licensee under this Act is enabled to operate supply of electricity. This Act obligate licensee to pay compensation for any damages caused during the constructions and maintenance of any power distribution facilities

3.2 NATIONAL AND INTERNATIONAL GUIDELINES OR STANDARDS

3.2.1 The Pakistan Environmental Assessment Procedures, 1997

The Pakistan Environmental Protection Agency prepared the Pakistan Environmental Assessment Procedures in 1997. They are based on much of the existing work done by international donor agencies and Non Governmental Organizations (NGO's). The package of regulations prepared by PEPA includes:

- Policy and Procedures for Filing, Review and Approval of Environmental Assessments;
- Guidelines for the Preparation and Review of Environmental Reports;
- Guidelines for Public Consultation;
- Guidelines for Sensitive and Critical Areas; and
- Sectoral Guidelines for various types of projects.

3.2.2 World Bank Guidelines on Environment

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

- Environmental Assessment-Operational Policy 4.01. Washington, DC, USA. World Bank 1999.
- Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues. World Bank Technical Paper Number 139, Environment Department, the World Bank, 1991,

The first two publications provide general guidelines for the conduct of EIAs, and address the EIA practitioners themselves as well as project designers. While the Sourcebook in particular has been designed with Bank projects in mind, and is especially relevant for the impact assessment of large-scale infrastructure projects, it contains a wealth of useful information, for environmentalists and project proponents.

The Sourcebook identifies a number of areas of concern, which should be addressed during impact assessment. It sets out guidelines for the determination of impacts, provides a checklist of tools to identify possible biodiversity issues and suggests possible mitigation measures. Possible development project impacts on wild lands, wetlands, forests etc. are also identified and mitigation measures suggested.

The World Bank Guidelines for noise are provided in **Exhibit 3.5**. The indicative IFC guideline values applicable to sanitary wastewater discharges are shown in **Exhibit 3.6**.

3.2.3 IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution

The following guidelines are applicable to electric power transmission systems and wire line installations, including receiving and transmitting stations, switches, related equipment:

- The sponsors must provide information regarding rights-of-way, their lengths, general locations and the sponsor's policies regarding alignment of these rights of way.
- Noise abatement measures should achieve the following level or a maximum increase of background levels of 3 dB(A).
- Feasible administrative and engineering controls, including sound-insulated equipments and PPEs.

- Periodic monitoring of workplace air quality should be conducted for air contaminants and masks should be used.

- Project sponsors should recycle or reclaim materials where possible, otherwise disposed off in environmentally acceptable manner

- All hazardous (reactive, flammable, radioactive, corrosive and toxic) materials must be stored in clearly labeled containers or vessels.

- Strict procedures for de energizing and checking of electrical equipment must be in place before any maintenance work is conducted.

- Shield guards or guard railings should be installed at all belts, pulleys, gears and other moving parts. Personnel should use special footwear, masks and clothing.

- Employees should be trained on the hazards, precautions and procedures for the safe storage, handling and use of all potentially harmful materials relevant to each employee's task and work area.

Exhibit 3.1: NEQS for Municipal and Industrial Effluents[a]

Parameters	***Into Inland Water(mg/l)***	***Into Sewage Treatment(mg/l)***
Temperature or temperature increase[c]	≤3°C	≤3°C
pH	6-9	6-9
Biochemical Oxygen Demand (BOD5) at 20°C[d]	80	250
Chemical Oxygen Demand (COD)[d]	150	400
Total Suspended Solids (TSS)	200	400
Total Dissolved Solids (TDS)	3,500	3,500
Grease and oil	10	10
Phenolic compounds (as phenol)	0.1	0.3
Chloride (as Cl^-)	1,000	1,000
Fluoride (as F)	10	10
Total cyanide (as CN-)	1.0	1.0
An-ionic detergents (as MBAS)[e]	20	20
Sulphate (SO_4)	600	1000
Sulphide (S-)	1.0	1.0
Ammonia (NH_3)	40	40
Pesticides[f]	0.15	0.15
Cadmium[g]	0.1	0.1
Chromium (trivalent & hexavalent)[g]	1.0	1.0
Copper[g]	1.0	1.0
Lead[g]	0.5	0.5
Mercury[g]	0.01	0.01
Selenium[g]	0.5	0.5

Parameters	*Into Inland Water(mg/l)*	*Into Sewage Treatment(mg/l)*
Nickel[g]	1.0	1.0
Silver[g]	1.0	1.0
Total Toxic metals	2.0	2.0
Zinc	5.0	5.0
Arsenic[g]	1.0	1.0
Barium[g]	1.5	1.5
Iron	8.0	8.0
Manganese	1.5	1.5
Boron[g]	6.0	6.0
Chlorine	1.0	1.0

Notes

a. All values are in mg/l, unless otherwise defined

b. Applicable only when and where sewage treatment is operational and BOD5=80 mg/L is achieved by the sewage treatment system

c. The effluent should not result in temperature increase of more than 3°C at the edge of zone where initial mixing and dilution take place in the receiving body. In case zone is defined, use 100 meters from the point of discharge

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

e. Modified Benzene Alkyl Sulphate; assuming surfactant as biodegradable

f. Pesticides include herbicide, fungicides and insecticides

g. Subject to the total toxic metals discharge should not exceed level of total toxic metals

Exhibit 3.2: NEQS for Selected Gaseous Pollutants from Industrial Sources [a]

Parameter	***Source of emission***	***Standard(mg/Nm³)***
Smoke	Any	40% or 2 Ringlemann scale or equivalent smoke number
Particulate matter[b]	Boilers and furnaces:	
	Oil fired	300
	Coal fired	500
	Cement kilns	300
	Grinding, crushing, clinker coolers and related processes, metallurgical processes, converter blast furnaces and cupolas	500
Hydrogen chloride	Any	400
Chlorine	Any	150
Hydrogen fluoride	Any	150
Hydrogen sulfide	Any	10
Sulfur oxides[c]	Sulfuric acid/Sulfonic 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

Parameter	*Source of emission*	*Standard(mg/Nm³)*
Antimony	Any	20
Zinc	Any	200
Oxides of nitrogen[d]	Nitric acid manufacturing unit	3,000
	Other plants except power plants operating on oil or coal:	
	Oil Fired	400
	Coal fired	600
	Cement kilns	1,200

Notes:

a. All values are in mg/Nm3, unless otherwise defined

b. Based on the assumption that the size of the particulates is 10 micron or more

c. Based on 1% sulphur content in fuel oil. Higher content of sulphur will cause standards to be pro-rated

d. In respect of the emissions of the sulfur dioxide and nitrogen oxides, the power plants operating on oil or coal as fuel shall, in addition to NEQS specified above, comply with the following standards

Exhibit 3.3: NEQS for Motor Vehicle Exhaust and Noise

Parameter	*Standard*	*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 vehicles: 4.5% Used vehicles: 6%	Under idling conditions, non-dispersive infrared detection through gas analyzer
Noise	85 dB (A)	Sound-meter at 7.5 meters from the source

Exhibit 3.4: NEQS for Noise

S. no	Category of Area/Zone	Effective from 1st July, 2012	
		Limits in dB	
		Day Time	Night Time
1	Residential Area	55	45
2	Commercial Area	65	55
3	Industrial Area	75	65
4	Silence Area	50	45

Note:

1. Day Time hours: 6.00am to 10.00pm
2. Night Time hours: 10.00pm to 6.00am
3. Silence Zone: zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts.
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

dB: Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

Exhibit 3.5: World Bank Guidelines for Noise Levels [a]

No	*Receptor*	*Day (07:00-22:00)*	*Night (22:00-07:00)*
1.	Residential, institutional educational	55	45
2.	Industrial,commercial	70	70

Source: Pollution Prevention and Abatement Handbook World Bank Group (1998).

Notes:

a. Maximum allowable log equivalent (hourly measurements,) in dB (A)

Exhibit 3.6: Indicative IFC Values of Treated Sanitary Sewage Discharges [a]

Pollutants	***Units***	***Guideline Value***
pH	*pH*	*6-9*
Biochemical oxygen demand (BOD)	*mg/L*	*30*
Chemical oxygen demand (COD)	*mg/L*	*125*
Total nitrogen	*mg/L*	*10*
Total phosphorus	*mg/L*	*2*
Oil and grease	*mg/L*	*10*
Total suspended solid (TSS)	*mg/L*	*50*
Total coliform bacteria	*MPN[b]/100ml*	*400*

Notes

a. Not applicable to centralized, municipal, wastewater treatment systems which are included in EHS Guidelines for Water and Sanitation.

b. MPN= Most Probable Number

Chapter:4 ENVIRONMENTAL BASELINE: PHYSICAL ENVIRONMENT

The existing physical environmental conditions of the project area are described in this section. Information for this section was collected from a variety of sources, including published literature, surveys conducted for other studies in the area, and those that were conducted specifically for this study.

Much of the information on topography and land use, geophysical, climate and water resources were collected from published literature and previously conducted studies. The information given in the sections on air, sound and water quality is the result of detailed field surveys conducted specifically for this EIA.

4.1 TOPOGRAPHY AND LAND USE

Karachi city may be classified in to 11 land masses/covers. The appraised land cover of Karachi city indicated that the major share by area is comprised of mountains/barren land and seawater (79.9%); urban land use (15%) and vegetation canopy (4.9%). However, urban land cover is growing day by day. Spread of land cover clusters of Karachi division is shown in **Exhibit 4.1.**

Exhibit 4.1: Spread of Land Cover Clusters of Karachi Division

Sr. No	Area (Sq. Km)	Cluster	Cumulative Land Cover	Share of Aggregate Land Cover	
				(Sq. Km)	Percentage
1	80.3	Dense Vegetation	Vegetation Cover	166	4.9
2	22.3	Sparse Vegetation			
3	63.4	Mangrove			
4	144.2	Urban Vegetation	Built up Land	5	15.0
5	112.9	Dense Urban Built up			
6	86.2	Medium Urban Built up			
7	156.9	Sparse Urban Built up			
8	1,500.6	OpenLand	Unused Land	2,663.9	79.9

Source: hec.gov.pk

4.2 GEOLOGY

Geology of the local area is underlain a lower Indus basin described as Indus river alluvial early Eoicene early deposition of sediments includes silt, sand stone, conglomerate, limestone with low compact and cementing materials. Surface feature describe as syncline delta and valley region and anticline ridges exposed. As stratigraphic description there are two formations Gazij and Manchar formation dip gently northeast to southeast in offshore.

The coastal region is found to be of tertiary and post-tertiary origin. Blatter et al (1929) dates it as recent as Eocene. The region has been formed by the upheaval of land from the Tethys Sea, which once extended up to the northern border of Pakistan but, gradually withdrew with the rising of the Himalayas. The underlying rocks are mostly of marine origin, highly folded, faulted and fissured everywhere.

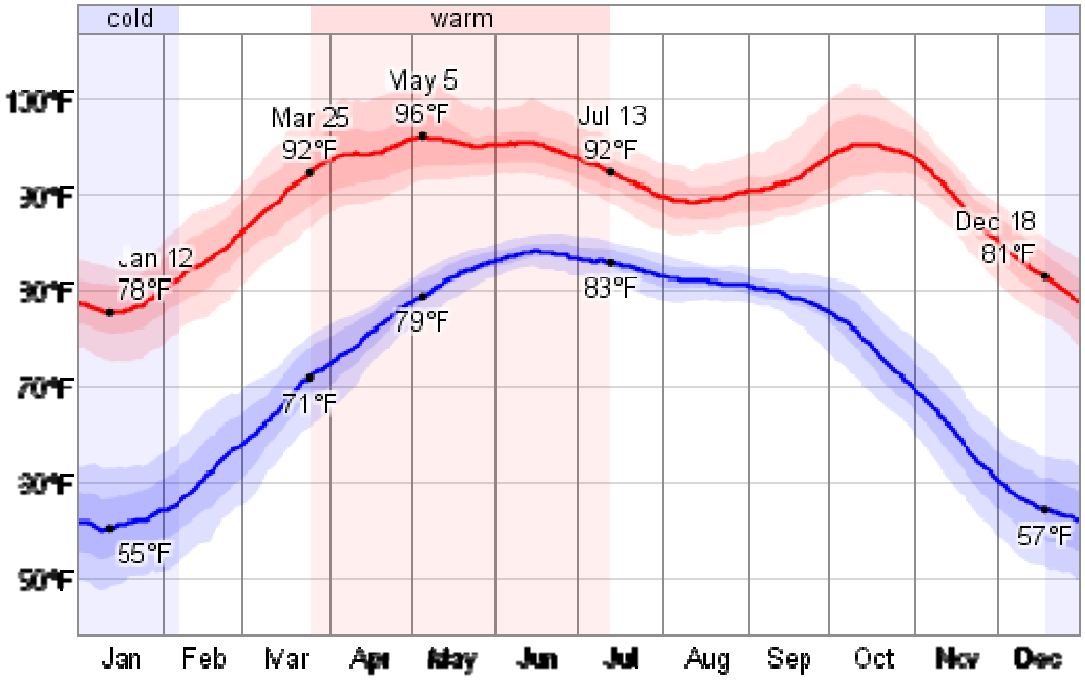
The exposed geological material in the area is generally silty sand, sandy gravel and silty clay which is either product of in-situ weathering or deposited by the action of gravity and water. Below this over burden of silty sandy gravel soil, alternating layer of sedimentary rock comprising of sandstone, shell mudstone, siltstone and limestone are present. The rock formation of this area is from Nari Formation of Oligocene age and partially from Gaj Formation of Miocene age. The Nari Formation consists mainly of sandstone, siltstone and shale with subordinate limestone while the Gaj Formation consists of shale with subordinate limestone.

4.3 CLIMATE

The climate of the country is characterized by extreme variations of temperature, both daily as well as seasonally; the data regarding weather was obtained from the Jinnah International Airport weather station over the course of an average year. All of the meteorological data presented below has been obtained from the same source. It is based on the historical records from 1992 to 2012. Earlier records are either unavailable or unreliable. Karachi has a mild hot dry climate. Yearly mean maximum and minimum temperatures are provided in **Exhibit 4.2**.

Exhibit 4.2: Yearly mean and minimum temperature

Over the course of a year, the temperature typically varies from 55°F to 96°F and is rarely below 49°for above 102°F, the data obtained is average from 1992 to 2012



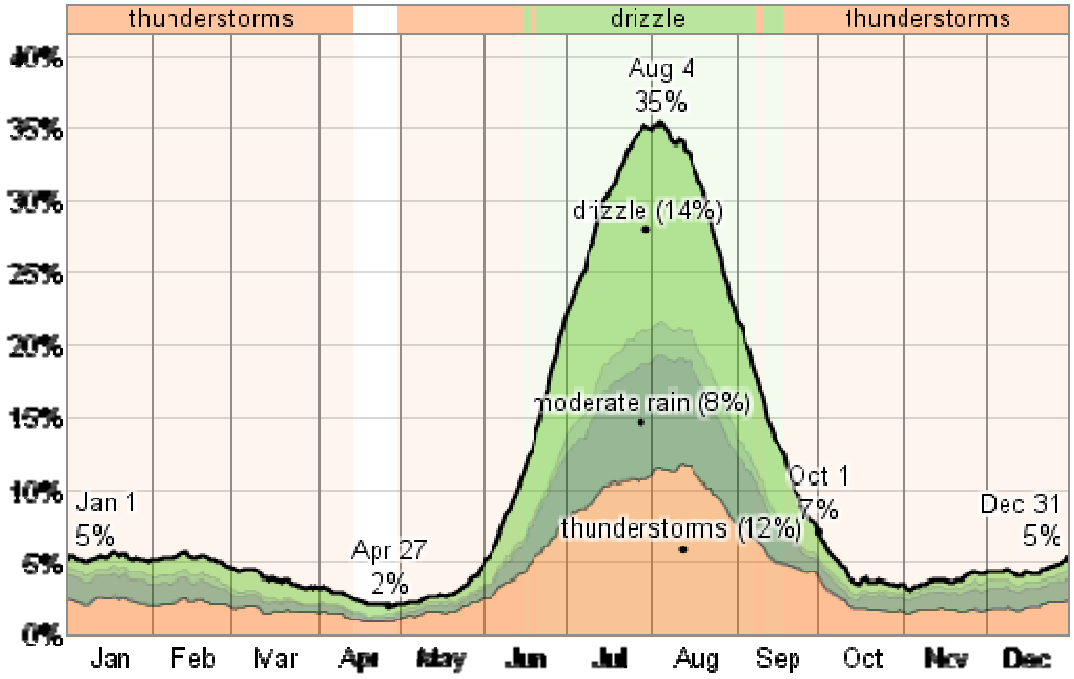
Source; Jinnah International Airport meteorological station

4.4 RAINFALL

There is a variation in the probability of rain throughout the year; however it has been observed that there is probability of precipitation between the month of July and August according to statistical data, it has been estimated that specifically during the month of August precipitation is more likely occurring in 35% of the days. On the other hand Precipitation is least likely around April 27, occurring in 2% of days. Over the entire year, the most common forms of precipitation are thunderstorms, drizzle, and moderate rain. Thunderstorms are the most severe precipitation observed during 38% of those days with precipitation. They are most likely around August 12, when it is observed during 12% of all days.

The mean monthly precipitation average value of the year 1992 to 2012 for Karachi South District is shown graphically in **Exhibit 4.3**.

Exhibit 4.3: Mean monthly precipitation for Karachi south District

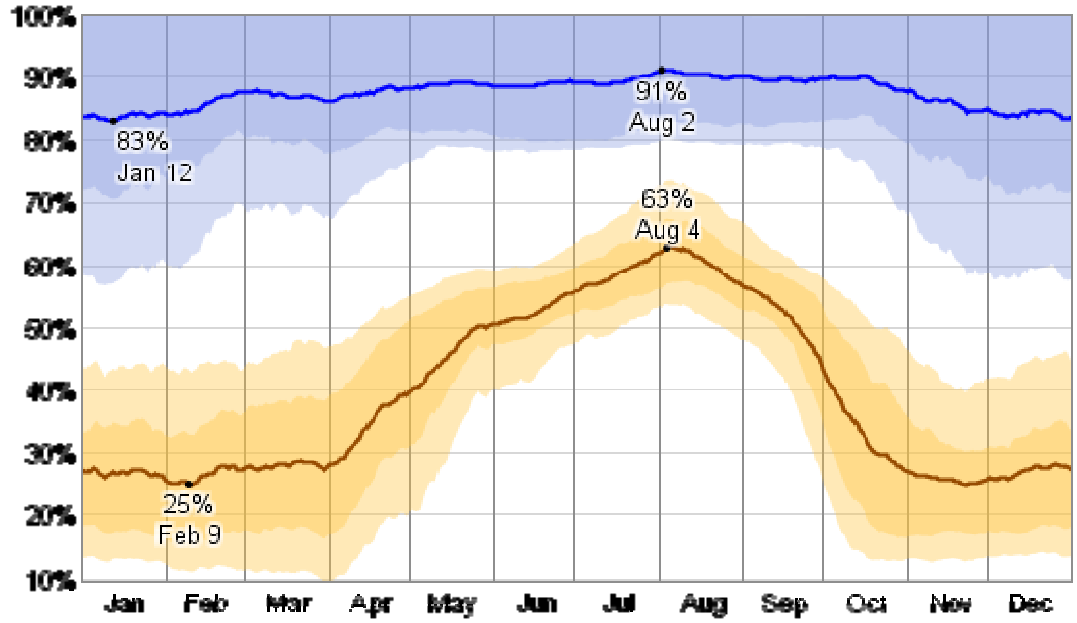


4.5 RELATIVE HUMIDITY

The relative humidity typically ranges from 25% (dry) to 91% (very humid) over the course of the year, rarely dropping below 10% (very dry) and reaching as high as 100% (very humid).

The air is *driest* around February 9, at which time the relative humidity drops below 33% (comfortable) three days out of four; it is *most humid* around August 2, exceeding 83% (humid) three days out of four. The mean monthly relative humidity average value of the year 1992 to 2012 Karachi South district is shown graphically in **Exhibit 4.4**.

Exhibit 4.4: Relative humidity for Karachi south district



Source; Jinnah International Airport meteorological station

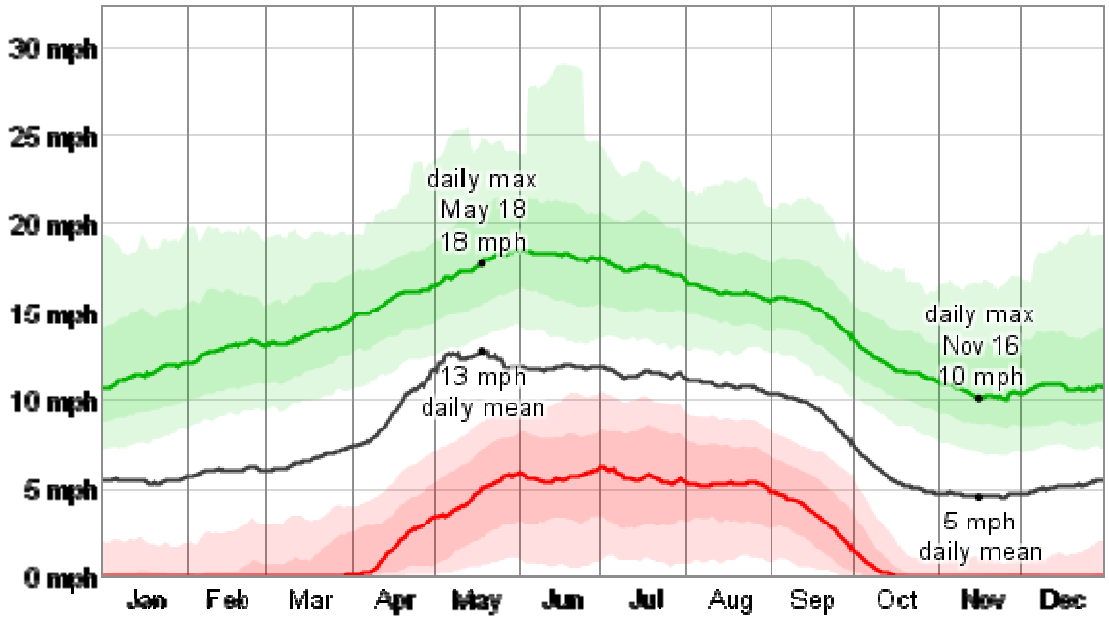
4.6 WIND SPEED AND DIRECTION

The project area lies in region where wind blows throughout the year with highest velocities during the summer months, when the direction is south-west to west. During winter the wind blows from north to northeast, shifting southwest to west in the evening hours. The wind usually carries sand and salt resulting in severe corrosion and erosion. The wind direction and speed between the two monsoon seasons viz. summer and winter are rather unsettled and large variations are noted both with respect to speed and direction. Winds too, are dry and have a desiccating effect during May & June. In July and August winds contain moisture and have a beneficial effect on the plant life.

Over the course of the year typical wind speeds vary from 0 mph to 19 mph (calm to fresh breeze), rarely exceeding 29 mph (strong breeze).The *highest* average wind speed of 13 mph (moderate breeze) occurs around May 18, at which time the average daily maximum wind speed is 18 mph (fresh breeze).The *lowest* average wind speed of 5 mph (light breeze) occurs around November 16, at which time the average daily maximum wind speed is 10 mph (gentle breeze).

The wind is most often out of the *west* (31% of the time) and *south west* (23% of the time). The wind is least often out of the south east (1% of the time), south (2% of the time), east (3% of the time), north west (5% of the time), and north (5% of the time). **Exhibit 4.5** shows the wind speed and direction of the project area. The data obtained is average from 1992 to 2012.

Exhibit 4.5: Wind speed and direction of the project area



Source; Jinnah International Airport meteorological station

4.7 WATER RESOURCES

This section details the water resources of the proposed Transmission line lies and grid stations in south, and west districts of Karachi. Both, surface and ground water resources have been summarized in this section of the report. Data was obtained from secondary sources and through field observation and data collection.

4.7.1 Surface Water Resources

There is no significant natural freshwater source in the project area. The Indus River about 120km to the east of Karachi city and the Hub River, a perennial stream that originates in Balochistan and marks the boundary between Karachi Division and Balochistan are the sources of fresh water in Karachi.

The Lyari and Malir Rivers that passes through the city do not have any natural flow, except during the monsoons. The Lyari River falls in Kemari and Malir River falls in Gizri Creek. Malir River is ephemeral and is constituted from two major tributaries, i.e. Mol and Khadeji as well as some minor tributaries. Khadeji is a perennial stream that originates at Khadeji falls and gains flow as it travels across the Malir Basin.

The Malir and Khadeji River basins include dry hill torrents and flow depends upon precipitation during rains.

According to Karachi water and sewerage board, the total estimated water supply of Karachi is 500 MGD. Approximately 445 MGD, amounting to 89% of the total supply to Karachi, is transported to the city from the Kotri Barrage on the Indus River through a system of canals and conduits. The second source of surface water to Karachi is the dam on the Hub River located north of Karachi, which supplies about 29 MGD of water to the city. Except for a few Karachi Water and Sewerage Board's (KWSB) wells, all of which are connected to the piped supply system, the water from the groundwater wells is distributed through water tankers to various parts of the city.

4.7.2 Groundwater Resources

Groundwater resources in Karachi Division are limited. The aquifers close to the coastal belt are mostly saline and unusable for domestic purposes. The aquifers near the Hub River bed are well developed and are source of water for agriculture and other domestic purposes. Generally the aquifers in Karachi are estimated to lie at depths of 50 m to 100 m. However, there is no groundwater source found at any site of the transmission line route and grid stations area.

4.8 AMBIENT AIR QUALITY

Karachi is one of the most developed city of Pakistan as well as the largest metropolitan city. According to a research of Urban Resource Centre, The city of Karachi has experienced large population growth over the years, especially in mid-20th century since then; the population has grown to exceed 20 million which is an increase of about 39% from the end of the 20th century and is still increasing today.

It also houses a sizeable industrial base with the entire city surrounded by clusters of small industries. In addition, an unprecedented increase has also been witnessed in the vehicular traffic as the number of registered vehicles in the city had increased to over 2614580 by the year 2011. Increasing emissions from vehicular emissions, industries, refuse burning and construction activity pose serious risk to the ambient air quality in general in Karachi city. The widespread use of low quality fuel coupled with a dramatic increase in the number of vehicles plying on roads has led to a significant deterioration of ambient air quality.

The data on the ambient air quality in Pakistan is scarce in general. Very few studies have been conducted that bring into light the deteriorating air quality in major cities of Pakistan. An ambient air quality survey was conducted, the results are shown in **Exhibit 4.6**

Exhibit 4.6: Ambient Air quality

S. No	LOCATION	CO_2 ppm	PM_{10} ug/m^3
1	KDA Grid Station	403	141
2	Gulshan Grid Station	402	258
3	Surjani Grid Station	410	178
4	Malir Bridge	402	153

4.9 NOISE LEVELS

Along the route initiating from KDA Grid Station till the end point of Gulshan Grid Station, Noise was monitored at different stations. The activity for monitoring of noise was carried out by Environmental monitoring specialists; results of noise monitoring can be seen in **Exhibit 4.7**

Exhibit 4.7: Noise monitoring results

S. No	Project Location	Noise Level (dB)	NEQS
1	KDA Grid Station	55	85
2	Sherkhan Goth	62	85
3	SUPARCO HQ	73	85
4	Safora Chowk	84	85
5	University of Karachi	76	85
6	Samama Shopping Mall	86	85
7	Accountant General Sind	79	85
8	Gulshan Grid Station	82	85
9	Surjani Grid Station	53	85
10	Malir Angle tower site	67	85

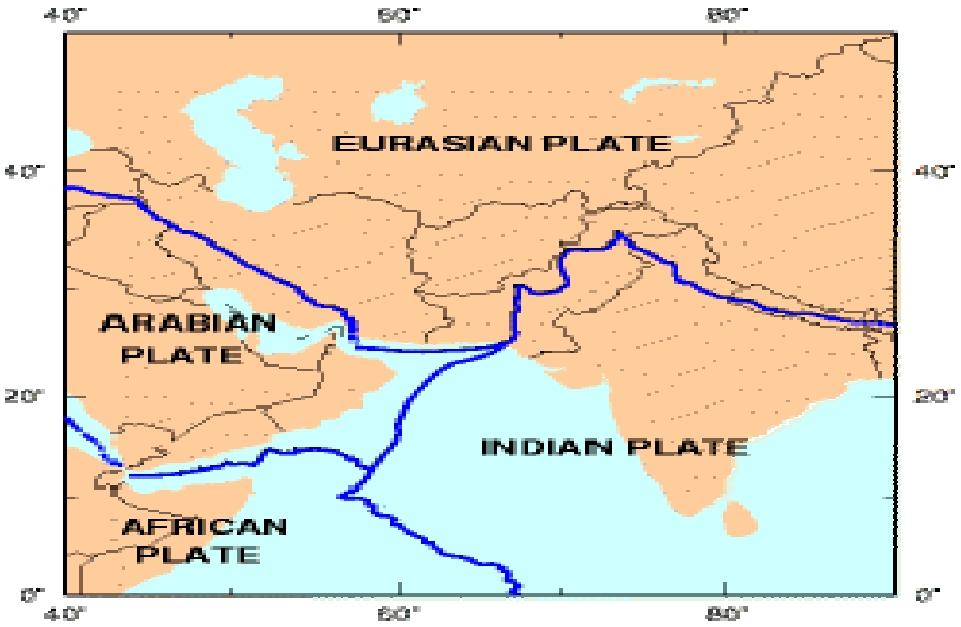
4.10 EARTH QUAKES

The Indo-Australian plate upon which Pakistan, India and Nepal lie, is continuously moving northward, colliding with and sub-ducting under the Eurasian plate, thus forming the Himalayan mountains, and triggering earthquakes in the process. The city of Karachi is located on the edge of the high hazard zone 2B. **Exhibits 4.8** shows seismic zoning map of Pakistan. The history reveals that:

- The areas comprising Pakistan have suffered four major earthquakes in the 20th century including the great Quetta earthquake of 1935, the 1945 earthquake off the coast of Makran, the 1976 earthquake in the Northern areas, and the October 2005 Kashmir earthquake. In between these major events, the Northern areas and Kashmir have experienced many small quakes with localized impact. No appreciable earthquakes have been recorded in Karachi during the recent past.

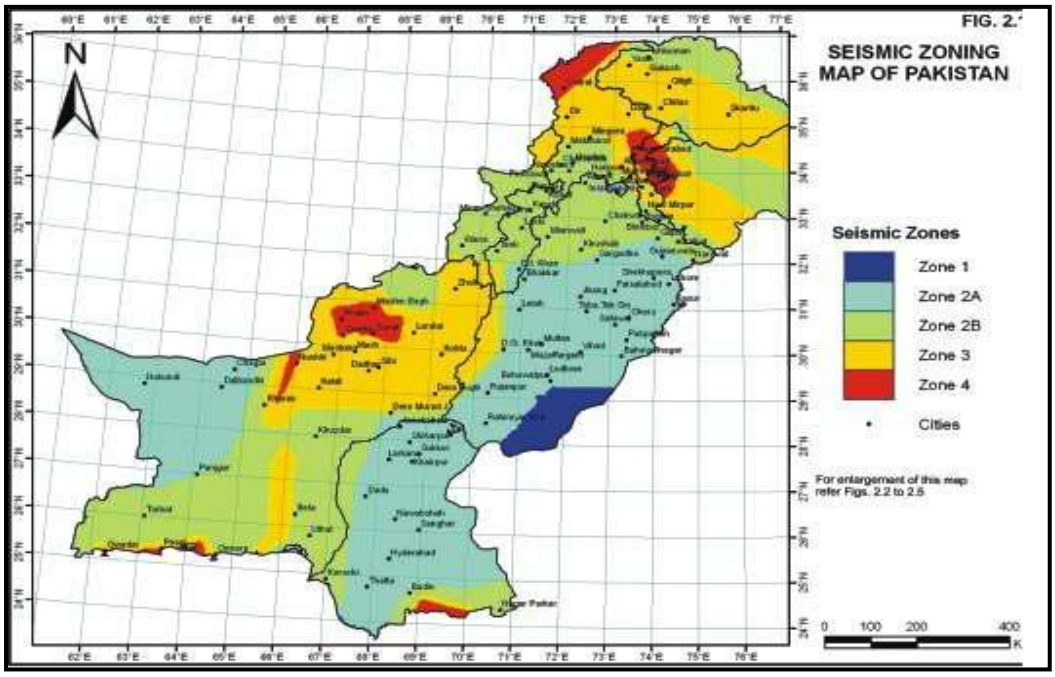
- The recently developed (after the October 2005 earthquake) seismic zone map of Pakistan has divided the country into four seismic zones ranging in term of major, moderate, minor and negligible zones with respect to ground acceleration values. Under this zoning Karachi Division has been identified on the edge of moderate to high hazard zone. This zone has minor to moderate damaging affect.

Exhibit 4.8: Tectonics Plates/Seismic Zoning Map of Pakistan



- The proposed project is located in the seismic tectonic region of the Kirthar Ranges, where a moderate level of seismic activity is believed to exist, but large magnitude earthquakes are rare. Tectonic Plates/Seismic Zoning Map of Pakistan can be seen in **Exhibit 4.9**.

Exhibit 4.9: Karachi lies on 2B Seismic Zone



4.10.1 Tsunamis

The coastal areas of Karachi might experience the affect of Tsunamis as the coast line of Pakistan has had this natural hazard in the recent past. An earthquake of magnitude 8.3 generated a destructive tsunami wave in the Northern Arabian Sea and the Indian Ocean on 28th November 1945, producing 12 m to15 m high sea waves that killed at least 4,000 people in Pasni and adjoining areas. The tsunami hit as far as Mumbai in India. Karachi, about 450 km from the epicenter, experienced 2 m high sea waves which affected harbor facilities. Hence, the occurrence of another tsunami in the future cannot be ruled out.

4.10.2 Tropical Storms and Cyclones

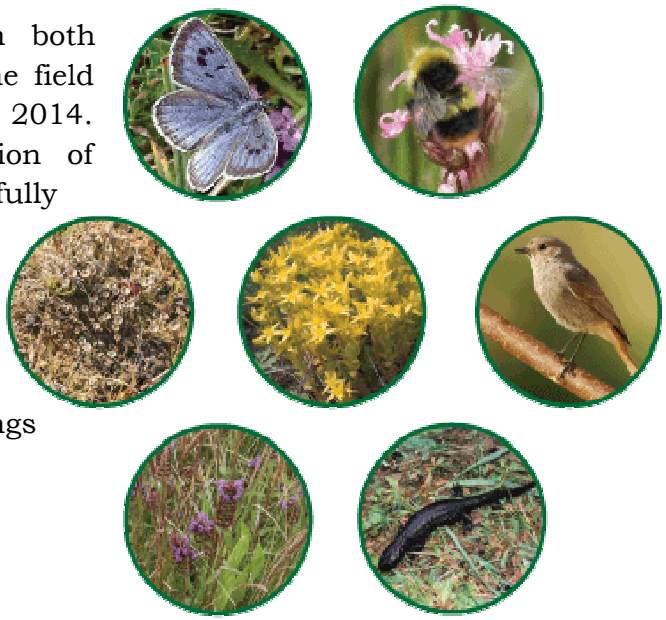
Tropical cyclones also occur periodically in the coastal areas. Seldom, these cyclones have high intensities. A total of 14 cyclones approached the coastal areas of Pakistan from 1971 to 2001. More recently the cyclone of 1999 hit the Sindh coast near Coastal Gharo with wind speeds in excess of 170 miles/hour, generating tidal waves and caused serious damage in terms of lives and property in Thatta and Badin districts. This particular cyclone wiped out 73 settlements, killed 11,000 cattle and affected nearly 0.6 million people. The losses to infrastructure were estimated at US$20 million.

However, except for the above mentioned cyclone, severe storms and cyclones seldom cross the coast of Pakistan. The main cyclonic activity generally takes place in the month of June. All the cyclonic storms that emerge in the Arabian Sea either curve sharply into the Gulf of Kutch or cross the Arabian Sea from east to west and

end up at the coast of the Arabian Peninsula. When the cyclones cross the coast they are accompanied by storm surges, generally known as storm tides. The cyclones that cross the coast in the month of June generate winds of approximately 15 m/s to 18 m/s.

Hence the possible occurrence of a future cyclone with severe consequences is quite rare but cannot be ruled out.

Chapter:5 ENVIRONMENTAL BASELINE: BIOLOGICAL ENVIRONMENT



Data for the EIA was gathered from both primary and secondary sources. Baseline field survey was conducted in February 2014. Sampling locations for the identification of floral and faunal assemblages has carefully been selected so that maximum number of species could be observed within the project area.

The faunal field data were collected through line transects, incidental sightings and plot searches for:

- Birds
- Mammals
- Reptiles

The collected secondary data has provided detailed insight of the biological environment of the area. The studies were consulted including the work of Roberts (1967) and Schaller (1977). Primary data for flora and fauna was collected at different sampling locations within the project area.

Two major habitat types have been observed within the study area during the field survey. Habitats include the terrestrial or land (including residential area, gardens, amusement parks etc) and coastal area. Classifications of these habitats have been based on the floral attributes and land use in the project area.

5.1 FLORA

The flora is typical of an arid area and depends upon the summer, and winter rainfall. The vegetation on mountains, dry streambeds, and stony and sandy plains vary is terms of species, habitat diversities and community structures. The harsh climate, minimal rainfall, and poor soil condition do not allow for dense vegetation and over grazing is also a major issue of the project area. Livestock totally depend on natural vegetation as a fodder.

Flora of Karachi is also facing another development. Due to the developmental activities, the natural flora of the city is replaced by the planted flora. Most of the

species that had been reported earlier by ecologists are now extinct from the urban settlements however, in rural areas they are found in their natural habitats.

5.1.1 Natural vegetation of Project Site:

The ecological characteristic of project site and surrounding area is xerophytic due to low availability of water. Project area is barren and bears arid characteristics. Mostly plants species have economical benefits like medicinal plant species. Most common species, present in project site include *Aerva javanica, Suaeda fruiticosa, Tribulus terrestris, Prosopis juliflora, Parkinsonia aceulata, and Calotropis procera.*

Most of the project area's land is covered with herbs, shrubs and grass which contribute as fodder for livestock of the project site. Most common grass species found in the area are *Dactyloctenium aegyptium*, *Panicum antidotale* etc. The trees found at project and adjacent KDA grid station site are *Acacia nilotica*, *Prosopis cineraria*.

Most common species present in project site include *Aerva javanica, Dactyloctenium aegyptium, Suaeda fruiticosa, Abuitlon indicum and Solanum surratense.*

Halophytes were found in almost all of the project areas. The upper layer of soil is generally less porous which leads to improper distribution of rain water and the hot climate dries up the water. This makes the condition of soil to attain more salinity, therefore the halophytes prosper more well in this condition.

Herb:

Herbs are plants used for flavoring, food, medicine, or perfume. Culinary use typically distinguishes herbs as referring to the leafy green parts of a plant (either fresh or dried), from a "spice", a product from another part of the plant usually dried, including seeds, berries, bark, roots and fruits.

Shrub:

A **shrub** is distinguished from a tree by its multiple stems and shorter height, usually less than 6 m. Plants of many species may grow either into shrubs or trees, depending on their growing conditions.

Trees:

A tree typically has many secondary branches supported clear of the ground by the trunk. This trunk typically contains woody tissue for strength, and vascular tissue to carry materials from one part of the tree to another. For most trees it is surrounded by a layer of bark which serves as a protective barrier.

Grasses:

Usually herbaceous plants with narrow leaves grow from the base that directly sprouts from the ground. They include the "true grasses", of the family Poaceae as well as the sedges Cyperaceae and the rushes Juncaceae. The true grasses include cereals, bamboo and the grasses of lawns and grassland.

Many species present at the project site are used for medicinal purposes plants such as *Calotropis procera, Datura fistuosa, Withania sominifera, Tribulus terrestris, Zygophyllum simplex*.

1. *Calotropis procera*

2. *Aerva jevanica*

There is another specie *conocarpus erectus* present on both sides of road within project corridor, which needs to be removed.

Conocarpus erectus is also called button wood. It is an introduced species i.e. it was not naturally present, however it developed well under the current conditions. It is easily available in local nurseries and can be replanted when feasible.

Exhibit 5.1: Vegetation Identified in the project area:

S. #	Family	species	herb	shrub	tree	grass	No of plant observed	No of plants to be removed	% Of species
1	Aizoaceae	*Zaleya pentandra*	✓				O8	02	25
2	Amaranthaceae	*Amaranthus viridis*	✓				10	05	50
3	Asteraceae	*Launaea procumbens*	✓				12	06	50
4		*Vernonia cinerascens*	✓				20	05	25
5	Asclepiadaceae	*Calotropis procera*		✓			15	07	50
6	Boraginaceae	*Heliotropium ophioglossum*	✓				06	01	20
7		*Trichodesma indicum*	✓				14	07	50
8	Caesalpiniaceae	*Senna holosericea*	✓				24	18	75
9	Capparidaceae	*Cadaba fruticosa*		✓			04	01	25
10		*Capparis decidua*		✓			12	09	75
11	Chenopodiaceae	*Salsolaim bricata*		✓			06	03	50
12	Chenopodiaceae	*Suaeda fruticosa*		✓			18	15	80
13	Fabaceae	*Crotalaria burhia*		✓			04	01	25
14	Malvaceae	*Abutilon fruticosum*		✓					
15		*Abutilon indicum*	✓				30	23	75
16	Mimosaceae	*Prosopis juliflora*			✓		40	20	50
17	Mimosaceae	*Acacia nilotica*			✓		04	02	50
18	Mimosaceae	*Prosopis cineraria*			✓		08	02	25
19	Salvadoraceae	*Salvadora persica*			✓		06	04	60
20	Poaceae	*Aeluropus lagopoides*				✓	08	06	75
21		*Cenchrus ciliaris*				✓	02	01	50
22		*Cenchrus penniseti formis*				✓	10	04	40
23		*Chloris barbata*				✓	12	03	25

S. #	Family	species	herb	shrub	tree	grass	No of plant observed	No of plants to be removed	% Of species
24		*Chrysopogon aucheri*				✓	06	03	50
25		*Cynodon dactylon*				✓	02	02	100
26		*Dactyloctenium aegyptium*				✓	06	05	90
27		*Dactyloctenium aristatum*				✓	12	08	70
28		*Desmostachya bipinnata*				✓	02	01	50
29		*Dichanthium annulatum*				✓	18	12	60
30		*Panicum antidotale*				✓	04	01	25
31		*Phragmites karka*				✓	12	03	25
32		*Saccharum benghalense*				✓	04	01	25
33		*Saccharum spontaneum*				✓	08	02	25
34	Convolvulaceae	*Convolvulus glomeratus*	✓				04	02	50
35		*Convolvulus arvensis*	✓				12	03	25
36	Cyperaceae	*Cyperus pygmaeus*	✓				16	08	50
37	Typhaceae	*Typha angustata*		✓			02	01	50
38	Solanaceae	*Datura fastuosa*		✓			16	04	25
39		*Lycium edgeworthii*		✓			12	03	25
40		*Solanum cordatum*	✓				08	02	25
41		*Withania somnifera*		✓			08	04	50
42	Zygophyllaceae	*Fagonia indica*	✓				12	08	75
43		*Tribulus terrestris*	✓				08	02	25

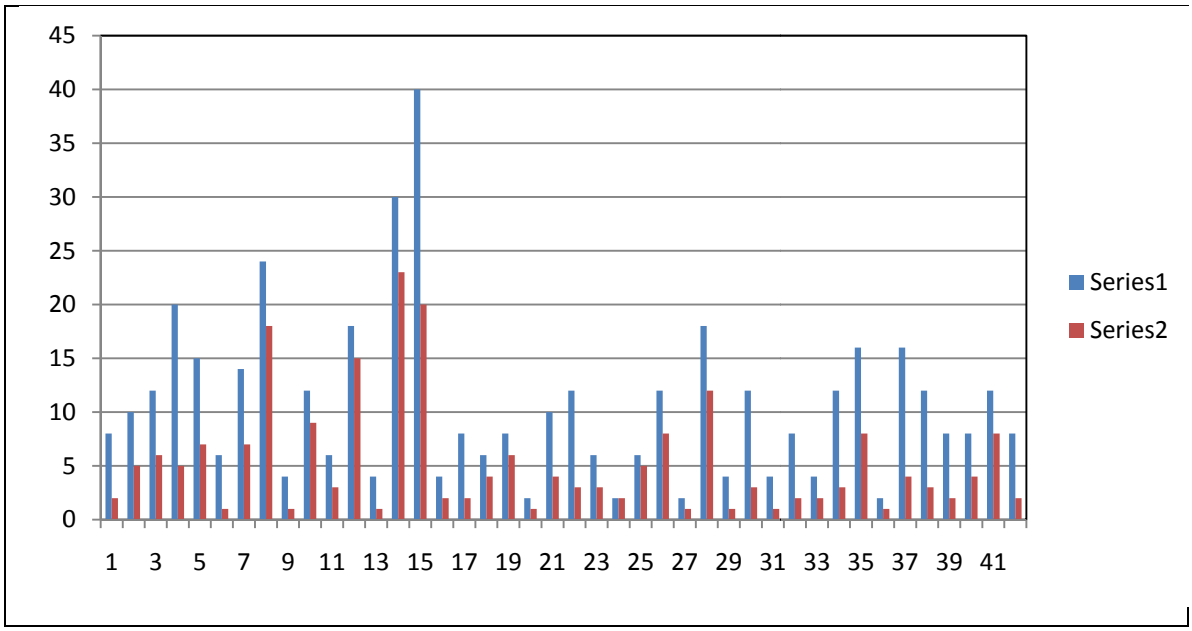
Conculsion:

For removal of 1 specie of a plant, 6 individuals of the same specie shall be planted to avoid degeneration of habitat. A total number of 100 individuals of plant species were identified that might cover the corridor, with the above said ratio, a total of 600 individuals of plant species are estimated to be replanted.

Bar graph showing the presence and removed species at the projec site :

Series 1 Red line showing species present at project site

Series 2 Blue line showing species that will be removed from project site



5.2 FAUNA

A limited number of birds, mammals and reptiles were recorded from the project site during the field visit for EIA study.

No key natural occurring species or species of special concern were found at the project site. All the species of birds, mammals and reptiles (except for Indian monitor lizard) are not protected under the Sindh Wildlife Protection Ordinance 1972(SWPO).

5.2.1 Birds

According to the Bird Club Pakistan which compiled a checklist in 2005 lists about 714 species of birds of both migratory and local. Out of which only a limited number of species were recorded during the survey as it is being

thoroughly monitored that most birds find their habitat to be in less disturbed areas rather than urban cities. The reason of fewer occurrences is the disturbance of high magnitude by the industries and transport. However, there are some species that have adapted to the surroundings and prosper well.

The avian species, which are quite abundant and common in the project area, include House crow, House sparrow, Jungle babbler, White Heron and Bee-eater.

Out of recorded birds, none of the species are protected under the Sindh Wildlife Protection Ordinance (SWPO) and IUCN Red List 2006 as Near Threatened (NT).

Figure: 1 Outskirts of Saadi Town

5.2.2 Mammals

Due to urban environment of the project site and its surroundings, there is hardly any opportunity for mammals to survive. However, rodent species which have adopted such conditions are well established using hollow structures or even buildings as their nesting places. Presence of 6 mammal species was ascertained in the project site and its surroundings. These include 3 rodents and 1 tree dwelling species, (i.e. five striped palm squirrel (*Funambulus pennanti*). None of these species is of ecological or economic importance however *Indian grey mongoose* in the project area has been

included in Appendix III of CITES. **Exhibit 5.3** shows the species of mammals recorded in the project area including their status and listing.

5.2.3 Reptile

Six species were recorded during field visit of the project site. Most of the reptiles require an undisturbed habitat with ample amount of moisture and land to survive and breed in. As Karachi is an urban settlement, it is not considered a favorable condition for the reptiles to exist. A complete List of reptile can be seen in **Exhibit 5.4**

Figure: 3 Reptiles of Project area

Exhibit 5.2: List of Bird Species in the Project Area

S. No	English Name	Scientific Name
1	Grey Partridge	*Pondicerianus mecranesis*
2	Grey Quail	*Coturnix coturnix*
3	Red wattled Lapwing	*Vanellus indicus*
4	Painted Sandgrouse	*Pterocles indicus*
5	Indian Ring dove	*Streptopelia decaocto*
6	Blue Rock Pigeon	*Columbia livia*
7	Indian red turtle dove	*Streptopelia tranquebarica*
8	Rose ringed parakeet	*Psittacula krameri*

S. No	English Name	Scientific Name
9	Cuckoo	*Cuculus canorus*
10	Sind-tailed Bee-eater	*Merops orientalis*
11	Hoopoe	*Upupa epops*
12	Indian crested Lark	*Galerida cristata*
13	Indian grey Shrike	*Lanius excubator*
14	Indian Golden Oriole	*Oriolus oriolus*
15	Rosy Starling	*Sturnus roseus*
16	Indian Myna	*Acridotheres tristis*
17	Sindh House Crow	*Corvus splendens*
18	White eared Bulbul	*Pycnonotus leucogenys*
19	Red vented Bulbul	*Pycnonotus cafer*
20	Common babbler	*Turdoides caudatus*
21	Sindh Jungle babbler	*Turdoides striatus*
22	Pied chat	*Oenanthe picata*
23	Pond Heron	*Ardeola grayii*
24	House Crow	*Corvus splendens*

Exhibit 5.3: List of Mammals in the Project Area

S.No	Common Name	Scientific Name	Occurrence				Listing		
			Common	Abundant	L. Common	Rare	SWPO	Red list	Appendix/CITES
1	Five striped palm squirrel	*Funambulus pennantii*	x						
2	House mouse	*Mus musculus*	x						
3	House rat	*Rattus rattus*	x						
4	Long eared desert hedgehog	*Hemiechinus collaris*			x				
5	Indian grey mongoose	*Herpestes edwardsi*			x				III
6	Indian bush rat	*Golunda ellioti*			x				

Exhibit 5.4: List of Reptiles in the Project Area.

S. No	Common Name	Scientific Name	Occurrence				Listing		
			Common	Abundant	L. Common	Rare	SWPO	Red list	Appendix/CITES
1	*Muggar*	*Crocodylus palustris*							
2	*Bengal Monitor*	*Varanus bengalensis*	x				x		
3	*Garden lizard*	*Calotes versicolor*	x						
4	*Glossy –bellied Racer*	*Coluber ventromaculatus*	x						
5	*Indian spiny tailed lizard*	*Uromastyx hardwickii*	x						
6	*Saw Scaled Viper*	Echis carinatus	x						

Chapter:6 SOCIO-ECONOMIC & CULTURAL ENVIRONMENT

6.1 SCOPE AND METHODOLOGY

A team of experts comprising gender specialist and environmental assessment specialist carried out the study of socio economic and cultural environment of the project area. The approach and methodology was a combination of qualitative and quantitative data gathering techniques. The data collection addresses the primary requirements of an Environmental Impact Assessment (EIA), incorporating the Pakistan Environmental Assessment Procedures 2000.

A Participatory Urban Assessment was combined with the extensive qualitative data collection of socio-economic and cultural data through short structured questionnaires and focus group interviews with communities including men, women and key male informants in the key places of the project area. The relevant and accurate information was obtained efficiently in terms of time and project area coverage by rapid cycles of interaction among team members, communities and project site elders. The specific tools used for collection of data includes, direct observation, short questionnaire, focus groups and semi-structured interviews. **Exhibit: 6.1** shows the socioeconomic features of the project area.

6.2 PROJECT LOCATION AND ADMINISTRATIVE SETUP

COMPONENT A

The Proposed Project spreads within three towns of Karachi. Overhead and Underground transmission lines will be constructed from KDA Grid Station KDA Scheme 33 and will proceed towards the outskirts of Saadi Town, leading to University Road adjacent to Gulistan-e-Johar and in Gulshan Town.

The major places which lie within the close proximity of the transmission line are Kiran Hospital, Azer Housing Society, SUPARCO headquarters, Dow University of Health Sciences OJHA Campus, Main Safora Chowk, University of Karachi, NED University, Samama Shopping Mall, METRO Supermarket, Safari Park, Accountant General Sindh, Major Aziz Bhatti Shaheed Park, and Federal Urdu University.

Figure: 1 University of Karachi

Figure: 2 DOW University OJHA Campus

COMPONENT B

An angle tower is to be placed under the Malir Bridge which has been recently constructed in Malir Town. The river is no longer in its natural form and represents a sewer drainage outlet. However, the place is not accessed by people.

The major places which lie within the vicinity of the site are Malir Court and Anwar hotel. It is a route which is by-passed from the site.

Figure: 3 Malir Court

COMPONENT C

Surjani Grid Station is situated in Surjani Town, about 2 km ahead of 4-K bus stop roundabout. There are no major establishments within the close vicinity of the Grid station, most societies are under development. However further ahead two main

routes are found, one leads to Monghopir area while the other leads to the Northern By-pass.

6.3 ENTRY AND EXIT POINT

COMPONENT A

The project areas if considered from KDA Grid Station to Gulshan Grid Station will have the first access points from the M-9 (Super Highway) and the entrance point of Saadi Town. While the main roads are parallel to the proposed Right-of-Way, the sites are directly accessed from Kiran Hospital area to SUPARCO headquarters, Safora Chowk, Main University road till the Accountant General Sindh office. Whereas the access point for Gulshan Grid Station is directly after the Federal Urdu University.

COMPONENT B

The Site is not easily accessible to all people; however a rough access-route is made by the water tankers to fill water from an illegal water extraction pump from a water supply line. The access route can be found at the left side of the new bridge which is towards the Malir Court road.

COMPONENT C

The Surjani Grid Station is easily accessible as it is located on the main road, It can be accessed from 4-K bus stop roundabout and Monghopir road.

6.4 NETWORKING AND BUSINESS ACTIVITIES

COMPONENT A

There is a varying trend of livelihood and business activities from KDA Grid Station to Surjani Grid Station. As it was observed that the KDA Grid Station is at the far end of Gulshan Town and is a bit inwards from the Super Highway, there is almost no establishment of societies or housing schemes nearby, however it was found that there are some illegal inhabitants in the corridor of proposed transmission line who represent the less educated and low cast system. Nevertheless, proceeding towards the University Road, it is found there are huge numbers of markets, educational institutions, and business avenues which are frequently accessed by the inhabitants of Karachi. These areas are composite of both Residential and commercial structures. The areas covered are of major contribution to the society and each area has its own identity. Transport is available in all forms in these areas such as cars, bikes, rickshaws, qingqi rickshaws, buses and trucks. The main business and community activities are majorly focused on the University of

Karachi, NED University, Kiran Hospital, DOW OJHA Campus, Samama Shopping Mall and Safari Park. Almost 55% public uses local transport to access these places while 45% use private transport means. The main increase in traffic flow occurs in the usual business hours from 9 AM to 8 PM.

COMPONENT B

There are no communities in the surrounding vicinity of the project site; however, the Malir Bridge serves as potential medium for traffic flow. The road is usually busy during business hours from 9 AM to 7 PM. The main attraction in this area is the Anwar Hotel, where usually people come to enjoy its festivities. All sorts of vehicles are observed accessing the bridge.

COMPONENT C

There are no residential or major commercial areas in the close vicinity of the project area. There is only a small residential flat around the corner which does not have much access of traffic nor public movement or activities.

6.5 LEADERSHIP DYNAMICS

There is no strong system of leadership observed in the project areas. People living in this area are independent and follow solitary lives without any leader. There is a system of forming committees of people living in a block offlats/ Residential Project / colonies. They normally meet and discuss the issues of their respective flat / colony. However people living in banglows are totally disconnected from the joint social activities and they only have limited circle of their personal contacts.

6.6 LIVELIHOOD

The livelihood of the people in the project area is mixture of upper, middle and lower class population, hence very diverse. The livelihood of upper class people mainly depends on business, private and Government jobs, however medium and lower class people depend on shops, jobs and labor. Liberalization and the communications revolution have brought the corporate culture to Karachi, including Saddar. Around 40% people of the project area are affiliated with jobs, 10% with small business, 35% with labor and 5% with large business. The people working in low profile jobs and labor mostly belong to slum areas and colonies. For residents of this area who belong to lower and middle class, the family system mainly consists of joint family system with large families.

6.7 DRINKING WATER

The major source of providing drinking water in the project area is KWSB. People of this area also use water supply line and underground water for drinking purpose but mostly for gardening, sanitary or cleaning purposes. According to the people of this area, there is shortage of water. The water through KWSB in most of the areas comes daily or on alternative days for around one hour. If there is load shedding at that time, people cannot store the water. In this case people have to purchase water through tankers. The underground water of the area is brackish and hard in nature.

6.8 EDUCATION

The transmission line route as mentioned earlier is hosted by major educational institutions such as University of Karachi, DOW OJHA Campus, NED University and Federal Urdu University. There are also numerous schools both private and government located on either sides of the transmission line route.

6.9 HEALTH

Most of the transmission line route is under one of the busiest streets of Karachi. There are numerous health facilities adjacent to the route such as Ibn-E-Seena Hospital, Kiran Hospital, DOW OJHA Campus, Nadeem Medical Centre and many more. However, the KDA Grid Station area lacks any such facility since there are no major housing establishments.

6.10 CULTURE

The people of project area mainly adopt an urban culture. Karachi is home to many cultural sects such as Sindhi, Punjabi, Saraiki, Pathan, Baloch, Urdu-speaking, Gilgiti etc. People of the project area have however established small communities according to their livelihood. For example, KDA Grid Station area is almost vacant and does not have any residential setups; however there is a group of Baloch, Pathan who have started living by the outskirts of Saadi Town. A whole new level of urban setup can be found along the University Road, where a composite system of livelihood and cultures is observed.

6.11 GENDER

Data regarding gender aspect of socio economic study was collected by interviewing local females in the project area. A questionnaire was filled by Focus Group Discussions (FDGs) to collect information with regard to demographic and economic indicators and individual interviews were carried out in different places e.g. houses, institutes, markets, and clinics etc.

6.11.1 Daily Routine of Women

Life in Gulshan Town area is a blend of busy working style. Women of this area are professional, mostly related to the professions of teaching, medical officers, lawyer, private jobs and government often, etc and other fields of life. Some women look after household task e.g. washing clothes, cooking, and also pick and drop their children from school. Females of this area regularly go out of their homes mainly for shopping. As males leave early for the work and return late, so females are responsible for purchasing daily use stuff. There are few small shops of vegetable, fruits and other kitchen items in this area otherwise every necessary item can be purchased from Super Markets. Women of this area visit the different shopping malls for shopping which area situated in the area. e.g. Samama Shopping Mall area, METRO supermarket, local bazaars etc. They visit main shopping malls of the city as well.

Most of women wear simple shalwar kamiz and dupatta, some also opt western wears like jeans, T-shirts etc. Most women are active for shopping activities and are independent of any restrictions to move about according to their will. There are few small shops of vegetable, fruits and other kitchen items in these areas.

Exhibit 6.1: Project Area Surrounding Environment

Well Being Indicator	*Name of Town / Area*			
	KDA Grid Station	**Sherkhan Goth**	**DOW OJHA Campus**	**Samama Bridge**
GPS Coordinates	**N 24º58'38.6" E67º09'31.9"**	**N 24º57'55.0" E67º09'36.0"**	**N 24º56'32.6" E67º08'17.0"**	**N 24º55'39.4" E67º06'43.0**
Major Communities	Pakhton, Baloch, hazara	Pakhton, Baloch, hazara	Urdu-speaking, Punjabi, Sindhi, Pakhton	Urdu-speaking, Sindhi, Baloch
No. of Houses	50	25	6000	15000
Population	250	150	12500	120000
Livelihood	Labor, driver, shops transporter	Labor, driver, shops transporter	Labor, businessmen, employed men	Labor, driver, shops transporter, businessmen, employed men
Electricity	Yes	Yes	Yes	Yes
Fueling Source	Yes	Yes	Yes	Yes
No. of Schools	No schools found	No schools found	3 Govt. Schools,10 Private Schools	3 Govt. Schools, 20 Private Schools
Literacy Rate	12%	15%	75%	85%
Drinking Water	Tankers system	Water board supply line and tanker system	Water board supply line	Water board supply line

Well Being Indicator	*Name of Town / Area*			
	KDA Grid Station	**Sherkhan Goth**	**DOW OJHA Campus**	**Samama Bridge**
Major Health Problems	Malaria, fever, normal flu	Malaria, fever, normal flu	Normal flu, heart problems	Normal flu, heart diseases
Health Facilities	No	No	Yes	Yes
Major Hospital	Kiran Hospital	Kiran Hospital	Kiran Hospital, DOW Hospital	Ibn-E-Seena Hospital
Major Needs	Govt. hospital. Road and continuous water and electricity supply	Govt. hospital. Road and continuous water and electricity supply, employment	Proper roads, eradication of Kunda system	Paved Streets Sewage system and continuous water supply
Visit Places /Market	None	None	Safari park, Samama Shopping Mall	METRO supermarket, Samama Shopping Mall, Continental Bakery
Transport	Public Transport, Motorcycle, pickups	Public Transport, Motorcycle, pickups	Public Transport, Motorcycle, cars, buses	Public Transport, Motorcycle, Private cars, bikes

Chapter:7 ALTERNATIVES

Analysis of alternatives is part of the EIA process to select the best among all possible project options. The assessments and recommendations made by the EIA team are presented below**:**

7.1 NO PROJECT ALTERNATIVES

While not developing the power line would avert negative impacts commonly associated with power lines such as visual intrusion especially in residential areas, impact on road, street infrastructure, utilities services and land take. It will not balance the need of development in the city for fulfilling the electricity demands.

Since there is increasing demand of electricity at local and national scale, the "No-Development" Alternative is not considered as a feasible option.

7.2 ALTERNATIVE ROUTES

The proposed project route was finalized from many alternate routes. The final route was planned considering primary factors:

The key considerations in selecting the corridor route included clustered settlements, common access routes and pathways, markets, community structures, private land (by avoiding it to extent possible). The shortest possible route was identified after considering all above factors.

Technically the route identified for transmission line is as follows:

- While selecting the route, due weightage was given to the accessibility of the line for construction as well as for maintenance for its total life span;
- The line is sited in areas which are accessible by slight deviations and marginal increase in the route length;
- In most part of the route it is possible to transport materials and tools quickly in case of breakdowns;
- Wherever roads are existing the line and stations are approachable from such roads; KDA scheme area, where there are some illegal settlements and outgrowth of local plant species, proper planned system is designed
- Crossing of orchards and gardens has been kept to the minimum; such as the KDA scheme area and Saadi Town outskirts.

- It would be possible for the personnel patrolling the line to be able to reach every location, careful inspection of the towers, insulators and the accessories without any obstruction from the land owners;
- Prior consultations were held with the concerned departments.
- Minimizing the transmission line exposure over residents/houses.
- Proper compensation to the affected people would be given.

7.3 ALTERNATIVE TECHNOLOGIES

Trenching is carried out generally with machinery like excavator and jack hammer for rocky soil but in streets/narrow paths where machineries are unable to reach the project area trench is made manually by using a spade or shovel and not a fork or pick-axe, in areas where utility services exist.

Chapter: 8 PUBLIC CONSULTATION

8.1 OBJECTIVES OF PUBLIC CONSULTATION

The main objective of the public consultation process was to disseminate information on the project and its expected impact among primary and secondary stakeholders. Another important objective was to determine the extent of the impact of different project activities and suggest appropriate mitigation measures. The overall objectives of the process were as follows:

- To inform and acquire feedback from primary and secondary stakeholders on project activities;
- To gain the consent of all the primary and secondary stakeholders for carrying out project activities;
- To identify potential issues and mitigation measures;
- To incorporate stakeholders concerns in the project documents.

8.2 PROCESS

The consultants organised meetings with primary and secondary stakeholders of targeted areas including local residents, business community, civil servants and representatives of other institutions. The team visited various prominent places in the project area to meet the targeted audience. During these meetings a simple, non-technical description of the project was given, along with an overview of the project's likely human and environmental impact. Following the project description, a discussion was held so that the participants could voice their concerns and opinions. These concerns and suggestions were recorded in field notes. Participants were also asked to suggest alternatives in case of their particular concerns.

Public consultation meetings were held at prominent locations, with major stakeholders engaged in various activities e.g. jobs, business, labor, households. The meetings with local businessmen, shopkeepers, local residents, civil servants, representatives of civil society and senior citizens in the project area were arranged. Project description was explained in simple language. All the stakeholders were encouraged to ask questions and share their concerns related to the project.

8.3 PUBLIC CONSULTATION OUTCOME

The public consultation meetings were arranged at shops, outside house / flat or on roads. In a metropolitan city like Karachi and due to current law and order situation none of the residents allowed the team to enter inside their house, neither it was possible to arrange a Focus Group Discussion at some central place with a group of 6-8 people together. Individual meetings were arranged at shops, tea hotels, outside the house or on the street / market, or in the office / working premises individually or in small groups of 3-4 persons.

Participants in general raised some common concerns regarding the project and pointed out few common problems which Karachi people are already facing. Some of them also appreciated the project by saying that this will be beneficial in catering the load problem in designated areas. No Non-Governmental Organization (NGO)or Community Based Organization (CBO)was found in the area.

The views of the participants of the meeting are summarized below:

8.3.1 Community Views

- In general, the participants agreed with the project and were of the opinion that the area will be benefitted from the project activities to overcome the problem of load shedding;
- The participants raised concern related to roads and street disturbance due to the excavation work in the project area and wanted to complete the project as quick as possible;
- The participants emphasized to compensate in case of any damage by project activates;
- The participants emphasized that route of transmission line should be designed to minimize disturbance in residential areas:
- The participants emphasized to complete earth work on priority bases with safety. Indication must be put up for alerting general public to avoid accidents mainly in night time when visibility is very low.
- The participants emphasized to take measure and action in order to avoid environmental pollution.

- Some of the participants asked for employment in project works as for them it sounded a good opportunity to help the city develop and increase quality of life.

8.4 OTHER STAKEHOLDERS

In addition to holding consultation meetings with the communities, meetings with members of local and Provincial Government were also deemed essential. All the stakeholders were given maximum project information verbally and were shown map of the area in detail. Their concerns and suggestions were heard which are reproduced below.

8.4.1 University of Karachi

- The students, teachers and almost everybody who are associated with the University activities use the main road for access. If there is excessive work for installation, the movement will be greatly affected.
- By-pass or diversions and indications must be notified to the University admin prior to execution of project works.
- Almost everybody is positive about the development and wants K-Electric to proceed for more such projects.
- There have been tragic traffic accidents in front of the University, it is to be noted that extreme care must be given to safety of people accessing the areas and indications must be put up.

8.4.2 DOW University OJHA Campus

- Prior notice should be given before commencing project works.
- A safe route must be allowed for ambulance arrivals and emergency cases
- Safe access way must be given at entrance as it is one of the busiest hospitals in the area.

8.4.3 Accountant General Sindh

- K-electric must improvise their lapses in power distribution, Kunda system must be eradicated
- Increasing power supply is helpful but the solution is to first recover the power from misuse
- University road is a very busy road and traffic is always full. Management of traffic will be a challenge for everybody

8.4.4 General Public

- Public is much concerned about the state of load shedding in their areas
- Public demands that new project of K-Electric should reduce load shedding and voltage fluctuation in their areas
- Public in general is appreciating the prospect that the capacity will increase
- In rainy season there have been many tragic deaths due to breakage of transmission wires. It is requested to take all precautions for erection.
- Refilling must be done effectively as incomplete backfilling or improper use of materials for filling the underground corridor might develop voids which develop into ditches will create problem for public
- The cross sections of road where the lines will pass such as Safora Chowk and Samama Shopping Mall, must be properly planned as there is huge traffic problems in these areas and construction works will make it worse

Exhibit 8.1: Photographs: Public Consultation

Rickshaw drivers at Samama Shopping Mall

Vendor of Car Oil and spare parts at Safora Chowk

Shopkeeper in Gulshan

Community people of Saadi Town

Chapter:9 ENVIRONMENTAL IMPACT ASSESSMENT & ENVIRONMENTAL MANAGEMENT PLAN

After a thorough assessment of the existing environmental and socio-economic conditions and review of technical data, a team of environmental professionals analyzed the impacts and how to mitigate if these are significant. This Chapter presents the impact assessment of the proposed project as a whole including all the components.

The transmission line, grid stations and angle tower project is not an air, water polluting and resource intensive sector. However, there can be considerable environmental impacts during the initial construction phase mainly due to civil works such as site preparation, construction of access roads, vehicle movement, RCC foundation, erection of tower etc. Construction phase impacts are usually temporary and localized phenomenon, except the permanent changes they may occur in the local landscape and land use patterns along the Right-of–Way. However, these impacts are given due consideration, wherever applicable.

The transmission line, grid stations and angle tower projects may also cause significant impacts on socio-economic environment, if the project is passing through the populated area. The activities such as clearing of land for transmission line RoW and associated facilities can result in the displacement of local people. Moreover, if the route is selected through forest area, concerns such as impacts on biodiversity or changes in land use patterns also become significant. The impacts of transmission line projects on a hilly terrain vary as compared to a plain area. Therefore, magnitude of impact on forest, wildlife and water resources in a hilly area is much higher as compared to plain areas. The auxiliary activities such as construction of approach roads, cutting, filling etc. may lead to slope destabilization and thus causes landslides.

Sometimes, the transmission line, grid stations and angle tower projects can also affect the sensitive sites such as areas of archeological, historical or religious significance, if these sites fall along the RoW. The overall aesthetic effect of a transmission line is likely to be negative to most people, especially when proposed lines would cross natural landscapes and private properties.

9.1 ENVIRONMENTAL IMPACTS ASSESSMENT

The project activities during construction phase will involve clearing of trees along the route alignment wherever required, excavation for installation of towers, erection of towers, civil works related to transmission line and line stringing. For

Grid station, it will involve excavation for building and equipment foundations, civil works and erection of equipment. During the operation phase, most of the construction phase impacts will get stabilized and the impacts will be restricted only to the operation and maintenance of the project.

The impacts on the environment from various activities of the project can be categorised as follows:

- Impact on Physical Resources
    - Impact on Topography
- Impact on Environmental Resources
    - Impact on Air Quality
    - Impact on Noise Levels
    - Impact on Surface Water Quality
    - Impact on Ground Water Quality
    - Impact on Soils and Geology
- Impact on Ecological Resources
    - Terrestrial Ecology
    - Wild Life
    - Aquatic Ecology
- Impact on Human Environment
    - Health and Safety
    - Agriculture
    - Socio-economics
    - Resettlement and Rehabilitation
    - Cultural sites
    - Traffic and Transport
    - Interference with other utilises and traffic
- Waste Disposal
    - Solid waste disposal
    - Liquid waste disposal

9.1.1 Impact On Physical Resources

Impact on Topography

During the construction of the transmission line and substation, the topography will change due to excavation and erection of tower, fill and cut for leveling the tower erection place. The most prominent impact on the surface topography will be due to the removing of the trees at the tower erection site and all along the Right of Way for construction facilitation which are estimated to be about 100 species. This will lead to change in the surface features only. The impact will be irreversible as the present features along the 15 m RoW will be changed due to presence of the transmission line.

No topographical changes are envisaged during the operation phase of the transmission line and the substation. The existing access routes will be utilised during the operation and maintenance of the transmission lines.

9.1.2 Impact on Environmental Resources

Impact on Air Quality

During the construction phase, the activity would involve excavation for the tower erection, movement of transporting vehicles carrying the construction materials etc. along the haul road (through un-built roads, but are not maintained). At majority of locations, movement of heavy vehicles may not be possible; from approach road to construction site material will be head loaded. All these activities would give rise to emission of dust particles thereby affecting air quality marginally at the site which will be transitory in nature.

Mitigation Measures

Sprinkling of water during excavation will reduce the dust emission to a great extent.

The operation of transmission line and the Grid station will not have any negative impact on the air quality of the region.

Impact on Noise Levels

During the construction phase, the major sources of noise pollution are movement of vehicles transporting the construction material and equipment to the site. Most of the access roads along the alignment are feasible for motor vehicles. The major work of the construction is expected to be carried out during the day time. Except for the area of KDA Grid Station, all other areas have heavy load of traffic and public access. People shall be fairly warned about the severity of the works.

Mitigation Measures:

Following measures will help to keep noise and vibration in acceptable level during construction phase:

- Contractor shall equip their heavy construction equipment and plants with exhaust silencers to limit the engine noise so as not to exceed 75 dB (compacters, loaders, vibrators and cranes) and regularly maintain all construction vehicles and machinery that should meet the National Environmental Quality Standards.

- Contractor shall limit working time for activities that create noise only from 7.00 am to 8.00 pm except for construction site near public sensitive receptors. Construction related activities closer to sensitive receptors have to be scheduled in coordination with the relevant authorities.

During the operation phase of the project, there will be corona noise from the conductors which will be felt only up to 15 to 30 m area; hence the ambient noise level shall meet the 85dB limit of NEQS.

Impact on Surface Water Quality

The construction and operation of the transmission lines will not have any significant impact on the surface water quality in the area since no surface water body was found. Proposed activities will create temporary impacts to the existing drainage system in the area. Stagnation of water will also create temporary breeding sites to mosquitoes, which will have direct impact on public health.

Mitigation Measures:

Ensure that minimum water is lost during construction activities and no water remains stagnant at any place.

Impact on Ground Water Quality

Ground water contamination might take place during construction activities. In case of an accidental spill or maintenance works of vehicles, machineries and different components of the transmission line and grid station; chemical substances and oily wastes, which are often used in the construction vehicles and machineries, may leach into the soil and percolate to the ground water. In rainy seasons, the quality of soil is vulnerable since the porosity increase and leachate formation is escalated which may eventually bring an impact on the ground water resources.

Mitigation Measures:

Thus following measures will be required in order to prevent deterioration of water from the construction and construction related activities:

- All construction vehicles and equipment should be maintained in proper conditions to avoid any leakage
- Contractors shall use silt traps and erosion control measures where the construction is carried out in close proximity to the water bodies to avoid cement particles, rock, rubbles and waste water entering the surrounding water bodies
- Construction activities should be restricted to dry season
- All liquid raw materials and semi-liquid components must be kept at impermeable floorings and covered properly with appropriate labeling which shall avoid any leakage that might occur due to accidental spill or rain water runoff

Impact on Soil and Geology

Project activities including excavation, cut and fill operations, removal of trees and green cover vegetation etc., will enhance the soil erosion during the rainy season. Removal of trees and green cover vegetation will reduce infiltration rate of rainwater. The impact on soils will be due to the soil erosion at the tower construction site and along the access routes. Excavation activity and land clearance in the erosion prone areas have to be minimised while conducting site selection for towers. Leveling and stabilisation of tower construction sites will be done after completion of construction activity which will avoid surface runoff and damage to the topsoil.

Mitigation Measures:

The impact associated with landslides due to excessive erosion and other civil works can be avoided or minimised by following mitigation measures:

- Maximum effort should be taken to minimise removal of trees and green cover vegetation
- Minimise obstruction or destruction to natural drainage pattern of the surrounding area
- Proper treatment of clearing and filling areas against flow acceleration
- Turfing work should be taken prior to rainy season around the Grid station

- Contractors shall restrict cut and fill operation around sharp/deep slope areas

- Piling activities will be restricted to non-rainy season, unless piled materials will spread all over the area and contaminate close by water bodies

- Top soil (2-3 cm from the top of the soil), which is removed during construction from the cultivated lands must be stored separately for future utilisation of cultivated lands near tower leg locations

9.1.3 Impact on Ecological Resources

There is no national wildlife park, bird sanctuary, wetland in the route alignment of the proposed transmission line. The study area for route alignment has sparse plantations area. The ecological impacts are briefly described in the following sections

Effect on Flora and Fauna

An estimated number of 100 species of trees will be removed from the project area for RoW. None of the declared environmentally sensitive areas is located within the project-affected area since it is an urban settlement. Migratory paths of small mammals and reptiles may be affected due to construction activities. However, noise, vibration and emission from construction vehicles, equipment will occur during construction and pre-construction stages in temporary manner.

Mitigation Measures:

The impacts related to above activities are temporary and can be mitigated through following measures:

- Strict attention on worker force regarding disturbance to surrounding habitats, flora and fauna including hunting of animals and unnecessary cutting of plants

- Construction activities must begin with low intensity which may serve as an early warning system for the fauna to leave the area and go to safer areas

- Ensure habitat conservation by avoiding dumping of construction and sanitary waste like debris, bricks, gravel, litter, food leftovers in open areas and seek a place with the municipal office to extricate a place to release them

Impact on Terrestrial Ecology

There is no sensitive ecological area / protected forest area such as national wildlife park, or bird sanctuary crossing the proposed route alignment. The removal of

herbaceous vegetation from the soil and loosening of the top soil generally causes soil erosion. However, such impacts would be primarily confined to the project site during initial periods of the construction phase.

Mitigation Measures:

These would be minimised through adoption of mitigation measures like paving and surface treatment and water sprinkling.

Removal of Trees

Approximately 100 plant species will be removed from the RoW of the transmission line. The initial construction works along the alignment involving land clearance, cutting, filling, and leveling may cause loss of vegetation. This will be irreversible impact.

Mitigation Measures:

Care has been taken to avoid the thick plantations/vegetation as far as possible and tower locations are selected at plain paddy fields where the vegetation is thin. This will minimise the tree loss

Replanting of similar species with the ratio of 6 against 1 will be implemented

Effect on Local Road Network

Transformers, tower material, substation equipment, iron bars, concrete materials, equipment etc. will be transported through the provincial and local road network to the project site. Heavy transportation vehicles might disturb the local traffic specially at peak working hours. Excavation at roads will bring impact on traffic flow and also lead to traffic jams. Visibility is usually minimum during night time where there are less street lights, this will pose as a hazard for the local traffic travelling in night time.

Mitigation Measures:

- Contractor should properly maintain all road sections, which will be utilised for the construction related activities
- Construction vehicles will only be allowed to operate at times when there is minimum traffic load
- The site that has to be excavated will be barricaded by means of safety signs and symbols, such as using reflectors to improve indication of excavated sites in night time
- Diversion routes must be allocated for normal and construction vehicular traffic to maintain normal traffic flow

- Emergency routes must be kept clear and ensure that they are easily accessible.

9.1.4 Impact on Human Environment

Health and Safety

Health and safety is one of the major concerns during the construction and operational phase, almost all activities are having potential to cause harm, this includes; Manual lifting of construction material resulting in severe body pains as well as work related stress. The activities like manual lifting, lifter operation as well as operations of other construction vehicles and other activities associated with construction and operation phase will enhance the work related stress. The accidents may be caused due to electrocution, lightening, fires and explosions. The local people living nearby the site where excavation and erection has to be done are more susceptible to road side accidents and noise. Improper lifting of extra tools and storage, while erecting towers is a potential hazard. The accidents may be caused due to electrocution, lightening, fires and explosions.

Mitigation Measures:

- Organise awareness programmes relevant to personal safety of the workers and public in the area

- Installation of warning signs to particular locations such as transverse points of local road network by transmission lines, additional workers and general people specifically children will not be entertained for accessing the work place especially during erection

- Necessary training regarding safety aspects to the personnel working at the line will be provided by the contractor

- Ensure that hazards associated with manual lifting are controlled by proper lifting techniques, work rotation system will reduce the chances of being exposed to work related stress associated with construction activities

- All the workers involved in construction, operational and maintenance activities will be provided with proper PPEs including; safety belts, footwear, helmets, goggles, eye-shields, and clothes to workers depending on their nature of work

- During operational phase it will be ensured that the site having high electrical voltage will be barricaded by means of impermeable walls, this would reduce the probability of being exposed to severe electrical shocks

- Only trained operators will be allowed to access high voltage area

Socio-Economics

Social services like road, traffic, utility lines as well as routine market activities and general business may be affected, however the impact is only limited to the constructional phase. The positive impact during construction of transmission line will generate local employment, as number of unskilled labors (men/women) will be required at the time of construction activities, in summary there is no major impact on social environment, rather it is a developmental activity for the benefit of community.

Mitigation Measures:

The following measures will have to be taken:

- Advance notice to the public as well as major utility providers like, KWSB, SSGS, and PTCL about the time and the duration of the utility disruption, and restore the utilities immediately to overcome public inconvenience
- Alternate routes should be planned and will be kept clear to keep the traffic and general public services in flow and momentum

9.1.5 Electro Magnetic Fields (EMF)

EMFs are generated only at the operational phase when the current is passed from the lines. There are no significant impacts on the environment but there are some aspects of minor concerns. EMF causes changes in flight directions of migratory birds. Moreover, referenced from WHO research archives, it is found that EMF has some effects on human health, such as neuropsychological disorders or cardiovascular diseases, but the data is not sufficient to confirm the risks, however more research is being done in this regard.

Mitigation Measures:

There are no mitigations to consider, however the following steps can be taken to minimize any possible risks:

- Appropriate cabling with protective shields to suppress electron flux
- Health-based exposure limits must be mandated to protect public health
- A labeled zone shall be highlighted to indicate EMF in the area
- Telecommunication service providers must be alerted about the activities and the level of EMF in the corridors and around stations to minimize exceeding levels in other communication devices

- ICNIRP guidelines will be taken into consideration from commissioning to corridor ranges

9.1.6 Sulfur Hexafluoride Gas (SF_6)

Sulfur Hexafluoride (SF_6) will be used as a gas insulator for electrical switching equipments. Commercially available SF_6 is not dangerous, and is not specifically subjected to the local environmental regulations. The use of SF_6, a heavy gas in a confined area presents the risk of asphyxia, since it reduces oxygen content. SF_6 is a stable gas, heavier than air, not harmful to humans, non-toxic and non–corrosive. It is also non-explosive and non-inflammable.

According to United Nations Framework Convention on Climate Change (UNFCCC) SF_6 released into the atmosphere is considered a greenhouse gas with a significantly higher global warming potential (GWP) of 23900 than that of CO_2 in 100 years. SF_6 is used in enclosed systems which are extremely safe and unlikely to leak under normal circumstances. SF_6 is collected and recycled if a piece of equipment or a substation needs to be opened. Despite the fact that SF_6 gas is very stable, it will partly decompose in association with electric discharges and arcs, producing gaseous and solid decomposition products. Normally the level of gaseous decomposition products is kept low through the use of absorbers built into the switchgear. In large concentrations, the decomposition products are corrosive and poisonous.

Mitigation Measures:

The following mitigation measure must be taken into consideration:

- Ventilation of the areas concerned, in addition to permanent surveillance of the gas volumes, will help to eliminate the risk of SF_6 accumulation outside the compartments
- Ensure it is provided in sealed containers
- SF_6 handling and operational procedures shall be in accordance with IEC 61634 requirements
- Leakage checks must be carried out at grids and ensure it does not go beyond 0.1% per annum

9.1.7 Construction Waste

Construction waste management

Almost all the activities from excavation to erection will generate waste, however the waste will be of inert nature, in addition the waste will mainly comprise of cement and concrete waste, the concrete material resulting from batching and

mixing will harden the ground surface resulting in growth inhibition of plant growth. This would also result in unaesthetic environment of the site

Mitigation Measures:

Thus following measures are needed to protect and enhance the quality of environment during the construction stage:

- It is strongly recommended that waste should be reduced at source and by reusing the residual waste
- It will be ensured that waste will be segregated and collected, however recyclable waste will be sent to the recycling industry to generate revenue
- The waste which cannot be reused or recycled will be dumped to the proper and allocated containment facility

9.1.8 Other Environmental impacts

Electric shock

This may lead to death or injury to the workers and public in the area.

Mitigation Measures:

This can be minimized or avoided by:

- Security fences around Grid station and looping areas
- Display of warning signs

Noise Generation

Nuisance to the community around the site can occur during the project implementation stage.

Mitigation Measures:

Provision of appropriate noise barriers will be essential in this regard

Workers and operators, working in close proximity to the grid station will be provided with adequate PPEs

General public will be restricted to stay away from those areas to a safe zone

Construction activities must be limited to day time and avoided at night

Oil Spillage

Contamination of water on land/nearby water bodies by the transformer oil can occur during operation due to leakage or accident.

Mitigation Measures:

Substation transformers will be located within secure and impervious areas with a storage capacity of 100% spare oil. Also proper drainage facilities will be constructed to avoid overflow or contamination with natural flow paths.

9.2 ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Plan (EMP) is a framework for the implementation and execution of mitigation measures and alternatives. It usually covers all phases of the project, right from pre-construction to the operation and maintenance phases of the transmission line project. The plan outlines mitigation measures that will be undertaken to ensure compliance with environmental laws and regulations and to eliminate adverse impacts. The objectives of an EMP, thus, are:

- To ensure that mitigation measures are implemented;
- To establish systems and procedures for this purpose;
- To monitor the effectiveness of mitigation measures;
- To ensure compliance with environmental laws and regulations;
- To take any necessary action when unforeseen impacts occur;

Exhibit 9.1: Environmental Impact Mitigation Plan

S/No	Aspect	Impacts
Construction phase		
1	**Land Disturbance**	
	Underground Transmission Line The potential problems that can arise from the installation of underground cable is the land disturbance. Overhead Transmission Line The potential problems that can arise from the installation of Overhead Transmission are the excavation for foundation construction activities.	There is possibility of land disturbance at project area. It is expected that there are small chances of change in land at project area. The only change in land use for overhead transmission towers installation will be due to earth works and excavation activities which may damage paved road and foot path
	Mitigation Measure	• Earth work should be technically designed according to geological feature of project site. • Obtain all the exact approved routes and locations which have been selected for tower foundation and shall issue "Notices of intent" to all concerned authorities at least four weeks prior to commencement of the work, such as the employer, Municipality, Telecommunication Department, Traffic police, etc. Also excavate the material with care to avoid damaging the existing services and electric cables.

S/No	Aspect	Impacts
		• Excavation operations shall be confined to a minimum working area consistent with efficient operations • Damage to road, footpaths, ditches, etc caused by the project activities should be repaired during completion of earth work on immediate bases. • The trenches (excavated area) shall be located exactly within the approved reservation and no more than two adjacent sections of excavated trench shall be open at a time. • If the transmission line is constructed within roadways, lane closures will be required and traffic control signs be installed. • Restore the paved and unpaved roads. Road need to be paved and backfilled rapidly and properly where cable transmission line is installed. At some sites cable diversion place is at the one side of roadway, lane closures will be required and traffic control signs be installed.
2	**Ambient air quality**	
	Underground & Overhead Transmission Line The potential problems that can arise from the dust emissions from the excavated material and Gaseous emissions from the construction equipments/vehicles.	Fugitive dust emission from construction activities like excavation, trench foundations, backfilling or road leveling. Gaseous emission from the construction and erection machinery.

S/No	Aspect	Impacts
	Mitigation Measure	• Use dust abatement. techniques on unpaved, un vegetated surfaces to minimize airborne dust and during earthmoving activities, prior to clearing, excavating, backfilling, compacting and grading. • Excavated material need to be disposed off away (which is not in use) from the construction area to prevent dust emission. • Sprinkling of water frequently in the area where earth filling and excavation is being carried out. • Post and enforce speed limits to reduce airborne fugitive dust caused by vehicular traffic. • Cover construction materials and stockpiled soils if they are a source of fugitive dust.
3	**Noise Pollution**	
	Underground & Overhead Transmission Line The potential problems that can arise from the noise from the construction equipments/vehicles. Noise produces by transportation and erection of material as well as during construction and installation of cable or overhead transmission line.	While construction noise can be unwelcome during night time in residential areas when people are trying to sleep, sometimes it may be too loud, be impulsive, and interrupt people's activities. Contain annoying pure tones; occur unexpectedly and at undesirable times of day In Overhead Transmission line noise in the form of buzzing or humming can often be heard around transformers or high voltage power lines producing corona.

S/No	Aspect	Impacts
	Mitigation Measure	• If the right-of-way is in a residential area, construction hours and the amount of equipment operating simultaneously may need to be limited to reduce noise levels. • Noise pollution due to construction works should be controlled by completing this task in a short period of time and also be confining it to day time hours. • Use of noise barriers or noise canceling acoustic devices should be considered as necessary.
4	**Ground Water contamination**	
	Underground & Overhead Transmission Line Sewage water line leakages/damage, grey water (used in construction) by project activities.	sewage water leakages or sewage pipe damages during excavation work of trenches which can contaminate ground water quality
	Mitigation Measure	• In case of incidental leakages from sewage line, it is recommended that leakage line should be replaced to reduce the ground water contamination and leachate formation. Also use municipal tankers to collect water filled in excavated/trench area. • Before any earth work consult with cornered department

S/No	Aspect	Impacts
5	**Water Supply line**	
	Underground & Overhead Transmission Line Sewage water line leakages/damage, grey water (used in construction) by project activities.	Sewage water leakages or sewage pipe damages during foundation excavation and grey water may contaminate water supply from KWSB. Improper excavation may cause deteriorate water quality.
	Mitigation Measure	• Before any excavation work take inform the concerned Departments. • Excavation techniques should be efficient to avoid water utility damage Avoid any damage of sewage and other utilities which may cause water contamination
6	**Soil and land contamination**	
	Underground & Overhead Transmission Line Oil, lubricant chemical spillage, construction debris and damages of sewage line may cause land contamination.	Spillage of Oil, lubricant and spillage may cause soil contamination, slippery surface and Soil contaminated with over spill of sewage water by damaging sewage line. At some sites soil may contaminated by leakage of dielectric oil from oil filled cable
	Mitigation Measure	• The secondary containment facility should be available to avoid any spillage or fire hazard and material should be stock according to the inventory requirement.

S/No	Aspect	Impacts
		• Oil filled single core lines must have a spill control plan • Construction debris should be collected and dispose off properly • Avoid any damage to sewage and other utilities which may cause land and soil contamination • Vegetation and debris removed from the tower side shall not be disposed off with in 15m of the centre of the tower.
7	**Solid Waste**	
	Underground & Overhead Transmission Line lubricants and chemicals, construction debris and other waste installation material (metal, wooden, plastic & cable pieces or tower assembling defect or useless pieces), excavated (dredging) material and packaging material	Waste may cause land contamination, slippery site surface and harm natural environment, Excavated material with trench may slide on workers, choking of drains, etc.
	Mitigation Measure	• Use waste minimization techniques to reduce, reuse & recycle waste material. • Excavated materials should be segregated from other wastes to avoid contamination thereby ensuring acceptability at KACHRA KUNDI areas and avoiding the need for disposal at landfill. • Arrival of materials and products should be planned, according to designated place on site and to production requirement • Raw material inventory records should be maintain and avoid excessive stocks.

S/No	Aspect	Impacts
		• Stockpiles of sand, gravel, soil and other similar material should be managed properly so that they do not spread and cannot be washed in the adjacent drain/street • Integrated waste management plan should be prepared to minimize a waste generation • Hazardous waste should be stored in identified mark with air tight lid container. Waste disposal should be according to nature of the waste with approved EPA certified contractor.
8	**Ecological Impact**	
	Underground & Overhead Transmission Line Ecological disturbance from project activities.	No major vegetation clearing will be carried out during the excavation, foundation and line installation phase except for common vegetation which is also in negligible quantities. The plants species within the vicinity of the proposed site are of minor ecological importance.
	Mitigation Measure	• Construction techniques should be environment friendly to minimized local vegetation clearance of the project site. • Clearance of vegetation to be kept minimum. • In case of cutting each tree will be planted with the ratio of 1:6. • Grow invasive species of trees but height of trees in right of area should not be exceeding more than 10 to 15m.

S/No	Aspect	Impacts
		• Avoiding night construction whenever possible to minimize fauna disturbance. • The trenches should be properly covered to avoid any incidents of live stock and other animals. • Bird nest should not be disturbed from project activities. Wild life should not be harmed from project activities
9	**Health and Safety**	
	Underground & Overhead Transmission Line Incident may occur in case of improper management and work practices	Overhead transmission line excavation way may interfere by numerous public utilities and service systems including water, sewer, electric, Sui gas and telecommunication lines which may cause incidents and fire hazard by electrocution, fractures gas and dust emissions may harm far community, Structure collapse, accidents during transportation, handling, installation of high transmission line (falling from high altitude) and land (excavated material sliding may cause serious injury).
	Mitigation Measure	• Establish and maintain a safety and health program for the worksite • Provide adequate systematic policies, procedures, practices • Health and safety Impact assessment should be prepared before starting project activity to prevent hazards to workers or nearby community. • Contractor should be aware of health hazards from project activities. • Contact with concerned department before starting excavation

S/No	Aspect	Impacts
		• Surface encumbrances that create hazards must be removed/supported • Employees must be trained to operate heavy equipment • Use barricades, hand or mechanical signals, stop logs to keep operators safe • Barricades should be used at excavated site • Appropriate PPE's should be providing to workers. • Safety sign boards should be placed for construction work and traffic safety purpose at project site. • Preliminary safety precautions should be taken before earth work • Workers are prohibited from entering excavation sites with accumulated water unless adequate protection has been provided • Keep surface materials at least 2 feet away from the edge of excavation sites. • Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others. • Understand the minimum approach distances outlined for specific live line voltages • Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system

S/No	Aspect	Impacts
		• Retrofitting existing transmission or distribution systems by installing elevated perches, insulating jumper loops, placing obstructive perch deterrents, changing the location of conductors, and / or using raptor hoods The worker is properly isolated and insulated from any other conductive object (live-line work).
10	**Traffic**	
	Underground & Overhead Transmission Line Vehicle movement disturbance on main road of project site	Construction proposed activities would temporarily affect transportation facilities within the project area. Construction is likely to cause temporary traffic delays.
	Mitigation Measure	• During construction stage, the contractors/K-Electric should organize detailed temporary traffic management schemes using updated traffic counts and on-site trial runs for the works. Use temporary traffic management schemes to be approved by the relevant authorities prior to its implementation. • Minimize disruptions to traffic patterns while maximizing the directness of detoured routes, thereby minimizing short-term impacts on emergency services (police, fire, rescue, and hospital access) and transit services throughout the project area. Wide and oversized loads would be restricted to barges, where possible.

S/No	Aspect	Impacts
11	**Social Impacts**	
	Underground & Overhead Transmission Line Blocking of Right of ways in streets, property damage (shops & houses) Incidents by opening the trenches or by the construction vehicular movements	visual and auditory disturbance due to the presence of machinery, construction workers, transmission towers, and associated equipment
	Mitigation Measure	• People to be informed about the construction activities and surveys. • Impacted people to be given Preference for local employment as labor. • Compensation to be paid on time and based on the prevailing market rates. • Community should involve during all project activities. • Contractor should inform before any earth work to residents of project sites. • Incidents should be avoided and construction vehicles should be placed at designated areas to avoid any incident.
12	**Geo hazards –Earthquake**	
	Overhead Transmission Line Could cause towers to fall.	Limited potential for harm unless people were very close to tower or line.

S/No	Aspect	Impacts
	Mitigation Measure	• Maintenance of 30-meter buffer zone for houses. • Foundation/maintenance should be inspected periodically. • SCADA emergency system should be efficient in working condition
13	**Meteorological impacts**	
	Underground & Overhead Transmission Line Damages of towers, equipments and construction structure caused by heavy rainfall, flooding & wind storms.	Damage lines may fall on the residents which may cause any serious conditions. Excavated material in wind storms may harm the environment. Improper back filling may cause serious incidents in rainy season Rainfall may affect the construction work. Heavy rain have tendency to collapse foundation or trench structure.
	Mitigation Measure	• Safety measures should be efficient incase of any natural hazards. • Clear right of way area of 30 by 30m around a tower. • Prohibit the construction work during heavy rainfall, flooding and windstorms. • Tower holding capacity should be according to the wind speed of the project area

S/No	Aspect	Impacts
Post Development Phase		
1	**Meteorological impacts**	
	Underground & Overhead Transmission Line Damages of towers, equipments and construction structure caused by heavy rainfall, flooding & wind storms.	Damage lines may fall on the residents which may cause any serious conditions. Improper back filling may cause serious incidents in rainy season Heavy rain have tendency to collapse foundation or trench structure. These hazards may work as a medium between ground objects and energized conductors. This may cause any serious incident. Dust or water drops can affect a conductor's electrical surface gradient and its corona & induced current performance (Corona is the physical manifestation of energy loss, and can transform discharge energy into very small amounts of sound, radio noise, heat, and chemical reactions of the air components)
	Mitigation Measure	• Safety measures should be efficient incase of any natural hazards. • Clear right of way area of 30 by 30m around a tower. • Prohibit the maintenance work during heavy rainfall, flooding and windstorms. • Tower holding capacity should be according to the wind speed of the project area

S/No	Aspect	Impacts
2	**Sulfur Hexafluoride Gas (SF_6)**	
	Grid Station SF_6 leakage in confined space	SF_6 is a heavy gas and presents risk of asphyxia, since it reduces oxygen content. SF_6 is a green house gas
	Mitigation Measure	• Ventilation of the areas concerned, in addition to permanent surveillance of the gas volumes, will help to eliminate the risk of SF_6 accumulation outside the compartments • Ensure it is provided in sealed containers • SF_6 handling and operational procedures shall be in accordance with IEC 61634 requirements • Leakage checks must be carried out at grids and ensure it does not go beyond 0.1% per annum
3	**Electric and Magnetic field**	
	Underground and Overhead Transmission Line There is public and scientific concern over the potential health effects associated with exposure to EMF	There is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines and equipment. However, while the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern
	Mitigation Measure	• Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities. • Training of workers in the identification of occupational EMF levels and

S/No	Aspect	Impacts
		hazards. • Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers. • Considering sitting new facilities so as to avoid or minimize exposure to the public. Installation of transmission lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g. schools or offices), should be avoided. • EMF can be reduced by Shielding with specific metal alloys, Increasing height of transmission towers and modifications to size, spacing, and configuration of conductors • Since Pakistan does not have NEQS for EMF levels, it is suggested to follow international standards of WHO, IFC etc.
4	**Oil Spillage**	
	Transformer oil spillage can occur during operation due to leakage or accident.	Contamination of land and soil of the facility Leaching into water bodies located nearby grid station
	Mitigation Measure	• Substation transformers will be located within secure and impervious areas with a storage capacity of 100% spare oil. • Proper drainage facilities will be constructed to avoid overflow or contamination with natural flow paths.

S/No	Aspect	Impacts
5	**Health and Safety**	
	Underground & Overhead Transmission Line Incident may occur in case of improper management and work practices	• Overhead transmission line may interfere by numerous public utilities, fire hazard by electrocution and Structure collapse maintenance of high transmission line.
	Mitigation Measure	• Establish and maintain a safety and health program for the worksite • Provide adequate systematic policies, procedures, practices • Health and safety Impact assessment should be prepared before starting project activity to prevent any incident hazards to workers or nearby community. • Contractor should be aware of health hazards from project activities. • Employees must be trained before working with heavy voltage lines during maintenance. • Use barricades, hand or mechanical signals, illuminants painted towers for traffic safety in night hours, stop logs to keep operators safe • Appropriate PPE's should be providing to workers during maintenance work. • Implementation of a fall protection program that includes training in

S/No	Aspect	Impacts
		climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others. • Understand the minimum approach distances outlined for specific live line voltages • Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system • Retrofitting existing transmission or distribution systems by installing elevated perches, insulating jumper loops, placing obstructive perch deterrents, changing the location of conductors, and / or using raptor hoods • The worker is properly isolated and insulated from any other conductive object (live-line work).

Exhibit 9.2: Environmental Management Plan

Aspect	Impact	Mitigation	Monitoring Parameter	Location	Monitoring	Frequency of Monitoring	Responsibility
Construction Phase							
Air	Chronic health affects Reduced visibility on roads	Sprinkling of water Tuning of construction vehicles & machines Dust masks for laborers	Particulate Matter Smoke CO SOx	All project locations	Vehicular emissions Dust Ambient air quality	Monthly for emissions and daily for dust	Contractor K-Electric
Noise	Stress Hypertension Hearing loss Headache	Avoid working at night Lubrication of construction vehicles Ear plugs	Noise levels	Project location close to residential areas	Noise monitoring device	Monthly	Contractor K-Electric
Land and soil	Erosion due to excavation Formation of pits due to improper backfilling	Proper backfilling and stone pitching around the excavated site if required	Surface topography	All project locations	Visual assessment Photographic evidences	From beginning till completion of project	Contractor K-Electric

Aspect	Impact	Mitigation	Monitoring Parameter	Location	Monitoring	Frequency of Monitoring	Responsibility
Vegetation	Cutting of trees	Avoid unnecessary cutting of trees In case of cutting of trees, one plant should be replaced by 6 plants	No of trees cleared or cut Disposal of chopped trees Ensure re-plantation by 1:6 ratio of same species	All project locations	Visual assessment Photographic evidences	From beginning till operational phase	K-Electric
Water	Wastage and misuse of water	Avoid un necessary use of water Prevent leakages	Water supply and use	All project locations	Visual assessment Record log of water usage	From beginning till the end of project	Contractor
Construction debris	Formation of heaps Remaining concrete material results in hardening of ground surface	Avoid wastage of concrete material Reuse remaining construction material	Quantity & quality of construction material	All trenching areas	Visual assessment Photographic evidence	Weekly	Contractor
Social Environment	Disturbance to routine market and local business activities Conflicts between laborers and local communities	Specify time scale for construction activities Discussion with local people regarding conflicts if any	Maintenance of complaint register	All project locations	Review of complaint register Local consultations	Monthly	K-Electric

Aspect	Impact	Mitigation	Monitoring Parameter	Location	Monitoring	Frequency of Monitoring	Responsibility
Roads and networks	Traffic congestion Night time visibility of drivers is reduced	Diversion routes must be allocated to maintain traffic flow Signs and reflectors must be boarded for driver's visibility	Signs and detours are being followed	Intersections of diversions	Observations Local residents consultations and log book	Weekly	Contractor
Health and safety	Lack of awareness to general public about safety may lead to accidents Incompetent and untrained workers might cause harm to themselves and others Construction works may include many risks and hazards that may lead to injuries or even death	Safety symbols and instructions will be boarded at work sites Trained personnel will be appointed for the specific work Appropriate PPEs must be used for technical work	Safety precautions Use of PPEs	On all project sites	Tool box talk Visual assessments Record of PPEs	Daily	Contractor K-Electric

Aspect	Impact	Mitigation	Monitoring Parameter	Location	Monitoring	Frequency of Monitoring	Responsibility
Operational Phase							
Meteorological conditions	Heavy rainfalls may break damaged overhead transmission line which may lead to electrical shock hazards	Ensure good quality of all products used in transmission lines In case of breakage, ensure emergency shutdown of transmission line Immediately repair the damage and ensure Log-Off-Tag-Off (LOTO)	Quality assurance Grid stations loads	All project components Grids	As per technical knowledge	Regularly	K-Electric
Electric Magnetic Field (EMF)	Human health impacts such as, neuropsychological disorders or cardiovascular diseases	Increase depth in case of underground cables to suppress the EMF levels Appropriate cabling with protective shields to suppress electron flux	EMF Intensity	Residency units near the corridor and grids	Electromagnetic meter	Biannually	K-Electric

Aspect	Impact	Mitigation	Monitoring Parameter	Location	Monitoring	Frequency of Monitoring	Responsibility
Sulfur Hexafluoride Gas (SF_6)	Leakage in confined areas presents risk of asphyxia, since it reduces oxygen content SF_6 has a Global Warming Potential of 23900 higher than CO_2	Equipments containing SF_6 will go through constant mechanical damage checks Ventilation of SF_6 containing equipment's compartments will be made mandatory Gas recovery kits will be used when maintenance or filling will be done	Equipment quality SF_6	SF_6 Gas containing equipment's compartments	SF_6 Detectors Ventilation ducts operation	Regularly	K-Electric
Transformer oil spillage	Contamination of soil and water bodies	Regular checking of storage tanks and machines	Soil sampling for oil and grease	Grid station	Visual assessment Soil analysis Equipment maintance record	Bi annually	K-Electric

Chapter:10 CONCLUSION

The EIA of the proposed 220kv Gulshan Grid Station and KDA to Gulshan 220kV transmission line consisting Overhead and Underground lines erection, addition of angle tower at Malir Bridge and 220kv Surjani Grid Station has achieved the following goals:

- Identification of national environmental regulatory requirements that apply to the proposed project activities;
- Identification of the environmental features of the project area including the physical, biological and social disturbance and likely impact of the project on the environment;
- Recommendation of appropriate mitigation measures that K-Electric will incorporate and ensure as per this EIA into the project to minimize the adverse environmental impacts.

Baseline physical, biological and socio-economic and cultural data and information was collected from a variety of primary and secondary sources, including field surveys, review of relevant literature and online publications. The collected data was used to organize profiles of the physical, biological and socio-economic environments, likely to be affected by the project. Communities were consulted as per public consultation processes including women, men and institutional stakeholders. The aim of public consultation was to assure the quality, comprehensiveness and effectiveness of the EIA; as well as to ensure that the views and opinions of the local people were adequately taken into account in the decision making process.

Further an Environmental Impact Assessment Report was made to highlight the potential impacts of the described project on the area's physical, biological and socio-economic, gender and cultural environments.

It is concluded that the potential impacts of the proposed K-Electric Project (Transmission line and Grid addition) will be insignificant on most of the environmental receptors, provided that the EMP and its mitigation measures proposed in this report are implemented in true spirit. However, some area will need special care with regards to the disturbance to the community of the area. K-Electric must be constituted to ensure minimum impacts.

After assessing the proposed project activities and investigating the project area, the environmental consultants, GEMS have concluded that:

"If the activities are undertaken as proposed and described in this report, and the recommended mitigation measures and environmental management plan is adopted, the project will not result in any long-term or significant impacts on the local community or the physical and biological environment of the project area rather it will prove to benefit in many ways and bring development in Karachi. ”

ANNEXURE:

A: Technical Provisions

TS-9 ERECTION WORK

9.1 GENERAL

The Contractor shall be responsible for the true and proper setting out of the erection work in relation to the survey lines and reference bench-marks and for the correctness of the position, levels, dimensions, and alignment of all parts of the lines.

All erection work shall be done in the presence of and under the supervision of the Owner. All erection drawings, setting diagrams and other relevant information shall be approved.

Erection work shall not commence before all such drawings, etc. are approved by the Owner. The Contractor shall also provide, when required, reasonable use of his facilities and equipment to enable inspection, measurement and testing of erection work by the Owner.

The Contractor shall keep damage within the right-of-way to a minimum consistent with the successful execution of the erection work. The Contractor shall exercise all precautions to avoid damage to crops and other property. The Contractor shall comply with all national and local regulations regarding barricades, detour arrangements and warning signs. Damage to roads, footpaths, bridges, ditches, etc., caused by the Contractor shall be repaired at his expense.

9.2 ACCESS

The Contractor shall provide and maintain all access from the main roads to the transmission line routes during erection. No separate payment shall be made to the Contractor on account of building or repairing access roads.

9.3 TOWER SITE SURVEY

The Contractor shall make all necessary site surveys, prepare longitudinal profiles of the transmission line, locate ground positions of the towers, stake out tower footings and determine leg extension requirements.

The Contractor shall locate the bench marks, and reference point already existing and where these do not exist shall provide for them as required. All stakes or other marks shall be preserved until their removal is authorized by the Owner.

Each tower shall be located and centred within 15 cm of the centre line transversely and within a 0.5% deviation of its back span length longitudinally of its specified position on the plan and profiles. Relocation of a tower exceeding the longitudinal and transversal deviation limit will be allowed only if approved by the Owner and for purposes of improving soil conditions for foundation work. Such relocation shall in any case not exceed more than 10 m in either longitudinal direction and will be allowed provided ground clearance is not impaired and specific loading of the particular tower is not exceeded.

Towers in tangent positions shall be oriented with the transverse faces at right angles to the transmission line centre line, and towers in angle positions shall be oriented with the transverse face at right angles to the bisector of the deviation angle.

The Contractor shall assess the soil bearing capacity and weight at each tower location and finalize during the tower site survey the requirements of types of foundations to be applied. The Owner may require the Contractor to make soil tests to verify and/or justify the type of foundation proposed, which will be done at no extra cost to the Owner.

9.4 RETAINING WALLS

At locations where earth moving by land slides, boulders, water etc. is likely to occur, the tower leg structure/poles shall be protected against this effect by means of retaining walls, without any extra cost.

The retaining wall may be built of prefabricated concrete beams arranged in horizontal layers and fixed with their ends in vertically mounted double U-shaped steel beams.

Appropriate alternative solutions may be indicated by the Contractor.

The tower location where the retaining walls are needed shall be decided by the Owner at Site.

9.5 CLEARING OF RIGHT-OF-WAY

The Contractor shall clear the transmission line right-of-way, fell any vegetation and dispose of waste material along the entire length of a transmission line. All trees, stumps, shrubbery and undergrowth exceeding 2 m in height shall be cut to a maximum stump of 50 cm all along the right-of-way.

All trees adjacent to the right-of-way which could fall across the conductors or against the towers shall be cut.

In addition to the clearing required on the rights-of-way all trees, bush stumps and snags at each tower location, shall be cut regardless of height and clearance to conductor to a maximum stump of 25 cm, in an area of 30 by 30 m around a tower.

In the case where plantations are to be crossed by the transmission line, towers with leg extension shall be used. Cutting of trees shall be avoided if possible. Prior to cutting any plant a written confirmation from the Owner or from the relevant authority or department or from land owner (as the case may be) must be available with the Contractor.

The Owner will help the Contractor to make the necessary arrangements/settlements with property owners so as to permit the Contractor the cutting or trimming of trees located both inside and outside the right-of-way where such cutting or trimming is necessary.

Clearing operations shall be conducted so as to prevent damage to existing structures and installations and to those under construction and so as to provide for the safety of employees and the public.

All timber, logs, large stumps and useable material shall be available to the land owner.

All roots, bushes, rotten wood and other refuse from the cleaning operation shall be disposed by the methods directed by the Owner.

9.6 INSTALLATION OF FOUNDATION

9.6.1 General

The tower foundation installation shall include tower site preparation, excavation, foundation placement measurements, assembly and placement of the approved foundation, backfill and clean-up.

The Contractor shall remove all vegetation and other debris from the tower site which will interfere with his operation. Tower preparation shall be done in a manner which will prevent revision of the footing designs of requirements of leg or body extensions.

Vegetation and debris removed from the tower side shall not be disposed of within 15 meters of the centre of the tower.

The ground levels existing before the installation of foundations have been considered in determining tower heights. The Contractor shall dispose of material and regulate the movement of equipment so that grades shall not be exposed, and slopes necessary to develop required loading characteristics shall be maintained, especially in side hill locations.

The depth of the footing shall be measured from the lowest ground elevation in the area occupied by the footing.

9.6.2 Excavation

a) The Contractor shall make the excavation necessary for the approved foundation type.
b) Excavation operations shall be confined to a minimum working area consistent with efficient operations.
c) The Contractor shall perform all pumping of water required to construct the foundations and to keep the foundation base dry. Excavation in areas of unstable soil conditions shall be adequately protected by adequate shoring or soil stabilization.
d) All excavations shall be made according to the specified grade and depth. The foundation bearing area shall be free of all vegetable matter and projecting rock and boulders and shall conform to the size and shape of the footings.

9.6.3 Setting

a) All foundations shall be assembled, placed, and set to the levels, measurements and batters shown on the approved setting diagrams.
b) For all settings a maximum tolerance of 6 mm will be allowed on any dimension.
c) Care shall be taken to ensure that all stub-angles are held in place as required to maintain their correct positions during backfilling or placing of concrete for a period of 48 hours thereafter.
d) The Contractor shall provide rigid steel templates or other means for accurately positioning the stub-angles to the specified dimensional tolerance. The templates shall be of a design approved by the Owner.
e) In addition to stubs of normal length, short stubs may be used with approval, provided that provision is made for the bolting of cleats. Stubs shall not be bent or cranked.

9.6.4 Back-fill and Clear-up

a) All backfill material shall be clean and free from organic material and other deleterious substances. Any excavated material not acceptable for backfill shall be wasted and disposed of in a place and manner satisfactory to the Owner. All timber shoring and other construction materials shall be removed from the excavation before backfilling. The backfill of tower foundations and correction of unsatisfactory backfill shall be completed before tower erection.
b) All backfill shall be thoroughly compacted to minimum compactness of 90% by tamping in 15 cm layers. Mechanical ramming device shall be used for compaction.
c) The top of the concrete footings shall be at least 25 cm above approved ground or backfill line. Backfill for concrete foundations shall be of fine material for the first

a) 30 cm. Before using coarser materials, backfill shall not be placed for at least 3 days after concrete placement. Backfill shall be placed as in b) above. Backfilling from one side or corner only shall not be allowed.
d) On cultivated land, the tower side shall be promptly cleaned and levelled. The original top soil shall be replaced at the surface. All surplus excavated materials, debris, construction materials and foreign matter shall be removed and disposed of from the tower site to the satisfaction of the Owner.

9.6.5 Concrete Foundation

9.6.5.1 General

a) The Contractor shall provide all materials and facilities, machinery and equipment to install foundations, and design, transport, place, finish, protect a cure concrete.
e) He shall also construct, erect and dismantle forms.
b) Non-reinforced or reinforced concrete shall be provided as required. Reinforced concrete shall be used at locations where foundations of non-reinforced concrete are inadequate to meet loading requirements and ground conditions.

9.6.5.2 Concrete Quality

Concrete shall be composed of Sulphate Resisting Portland cement, water, fine and coarse aggregate, and, when approved or directed by the Owner, set-accelerating admixtures. The design of concrete mixtures will be based on securing a plastic, workable mixture suitable for the specific conditions at placement and when properly cured, a product having durability, impermeability and strength in accordance with foundation requirements. Minimum concrete quality requirements B25 according to

DIN 1045 (1978) or equivalent standards.

The Contractor shall engage an independent testing laboratory to determine the prior design mix for the concrete strength and shall submit the Owner the proportions selected and the test results for his approval.

9.6.5.3 Portland Cement

All cement shall be Sulphate Resisting Portland composition obtained from an approved maker. Portland cement shall conform in all respects to Standards DIN 1164 (1978) or ASTM C-150-66 or BS 12 or equivalent standards. Where Portland cement concrete may be liable to chemical attack, higher resistant cement concrete may be used when approved by the Owner.

9.6.5.4 Aggregate

General

All aggregates shall consist of hard, tough, durable and uncoated particles. The Contractor shall select the sources of aggregates, and the aggregate sources shall be approved by the Owner. The aggregates shall be clean and free of clay, earth, organic matter, salt or other impurities and shall comply generally with the requirements of Standard DIN 1045 (1978).

Fine Aggregate

Fine aggregate, washed and free of clay, shall be either well graded natural sand (from an approved source) or well graded manufactured sand conforming to ASTM C-33 latest edition

with fineness modulus of not less than 2.3 and not more than 3.1. No seashore sand shall be used.

Coarse Aggregate

Coarse aggregate, washed and free of clay, shall consist of crushed stone, or other approved inert materials with similar characteristics or a combination thereof conforming to ASTM C-33 and shall pass a mesh of not more than 3 cm.

9.6.5.5 Steel Reinforcement

Reinforcing bars shall be structural grade steel and shall comply with the concerning standard. They shall be free of loose, flaky rust and scale and of oil, grease, mud, concrete or other coating which might destroy or reduce its bond with concrete. Bends, cranks and overlapping on reinforcing bars shall be carefully formed in exact accordance with the appropriate standard, and as shown on the approved drawings.

Deformed bars of high tensile steel may be used if approved by the Owner or if shown on the approved drawings.

9.6.5.6 Water

Water used in mixing concrete shall be clean and free from harmful amounts of rock flour, sewage, oil, acid, alkalis, salts, organic matter or other detritus substances.

9.6.5.7 Forms

The Contractor shall construct, erect, and maintain all appropriate forms necessary to confine the concrete within the lines and grades shown on the drawings. Form surfaces shall be thoroughly cleaned before erection to be left smooth and free from sawdust, dirt, rust, and foreign matter.

Forms shall be left in place until the concrete has gained sufficient strength to support its own weight and any loads imposed thereon, but form removal shall be made as soon as practicable to avoid delay incurring and repairs of surface imperfections.

9.6.5.8 Foundation Preparation

The preparation of all base surfaces shall be properly completed before concrete is placed. Rock surfaces shall be worked clean of all loose particles, mud, debris, and other material not an integral part of the base rock, using water jets, air and water jets, sand blast or other means. Surfaces shall be thoroughly moistened before concreting.

Surfaces of parts to be embedded shall be free from dirt, dried mortar, grout, grease, oil or other substance which would interfere with the bond.

9.6.5.9 Proportioning of Concrete

The quantities of cement, aggregates and water shall be proportioned that when combined and mixed, they will produce concrete of uniform consistency and characteristics to meet adequately the strength and finish requirements. The proportions shall be adjusted whenever such change is necessary in order to maintain the standard quality required by these Specifications.

9.6.5.10 Batching and Mixing

All concrete shall be thoroughly mixed in a mechanical batch mixer of approved type and size, and one so designed as to ensure a positively uniform distribution of all the component materials throughout the mass during the mixing operation. Cement shall be measured by weight and fine and coarse aggregate in gauge boxes to be approved by the Owner.

9.6.5.11 Conveying, Placing and Curing

a) Only methods of transporting and placing which will prevent segregation or loss of ingredients and deliver concrete of the proper consistency will be permitted.
b) Concrete shall be placed before the cement takes its initial set or within 30 minutes from the original mixing times, whichever is sooner.
c) There shall be no vertical drop of concrete mix greater than 1.5 m, except where suitable equipment is provided to prevent segregation and where this is specifically authorized.
d) Concrete shall be worked readily into the corners and angles of the forms and around all reinforcement and embedded items without permitting the component concrete materials to segregate.
e) Concrete shall be placed with the aid of mechanical vibrating equipment and supplemented by hand spading and tamping.
f) All concrete shall be cured by use of a membrane curing compound or by keeping the concrete continuously wet for a period of not less than 7 days by methods approved by the 0wner. After curing the foundations shall be air-dried for a period of 7 days.

9.6.5.12 Concreting under Extreme Weather Conditions

Concreting in Hot Weather

For the purpose of these Specifications, hot weather shall be defined as any combination of high air temperature, low relative humidity and wind velocity which tends to impair the quality of new or hardened concrete, or otherwise result in abnormal properties.

In hot weather and in places where the ambient shade temperature exceeds 30^{o}C, the

Contractor shall take special measures in mixing, placing and curing of concrete. These shall be such as to ensure that the temperature of the concrete during mixing, transporting, placing, setting and curing shall not exceed 30^{o}C.

Care shall be taken to protect all stored materials from the harmful effects of hot weather. Silos, mixers and water tanks being painted white. Cement shall be stored in watertight silos free from internal condensation, or as otherwise approved by the

Engineer, and shall have a temperature not higher than 77^{o}C. Aggregate stockpiles shall be shaded, carefully sprinkled or fog sprayed to maintain constant surface moisture content.

Additional water shall not be added to the mix to improve workability without the Owner's permission.

9.6.6 Grillage Foundation

Where grillage foundations are used, the grillage members and those parts of the towers which are under the ground surface shall be provided with a triple bitumen coating before installation and backfill. This protective coating shall be extended on the tower up to a height of 50 cm above ground level.

9.6.7 Rock Anchor Foundation

Where rock anchor foundations are used the following has to be applied:

a) Rock anchor holes shall be drilled at the locations and to the depths and diameter specified on the approved Contractor's foundation design drawings. Immediately before placing grouting mortar, the drilled holes shall be washed and blown out with an air jet until no water or dirt remains in the holes. If rock anchors are not to be grouted in place immediately, the holes shall be tightly plugged and again washed and cleaned immediately before placing and grouting of bars. At the time of placing, the hole shall be partially filled with a thoroughly mixed thick sand-cement grout, having a water-cement ratio of less than 0.5 and a sand cement ratio of 3 by weight. The rock anchor bar shall be forced into place while being vibrated by a concrete vibrating machine after which any remaining void shall be filled with grout. Holes into which water is seeping or running shall be grouted upward from the bottom by means of tremie pipe to prevent dilution of the grout.
b) The embedment shall be adequate to develop the full yield strength of the anchor rods. Grout shall be allowed to set for at least 7 days before bending rock anchors into position and placing concrete. Any bars which are found to be loose after the grout has set up shall be removed and reset at the expense of the Contractor.
c) The entire grouting procedure shall be subject to approval.

9.6.8 Undercut Foundations in Rock

Undercut foundations may be used where the rock is sound, homogeneous and free from fissures. These foundations will either comprise a concrete block at or below ground level, with the base undercut into the rock with ultimate compression and uplift forces on the foundation resisted by the skin friction/bond developed at the concrete-rock interface: or a concrete block at or below ground level and suitably designed rods grouted into holes previously drilled into the rock. Care shall be taken during excavation to ensure that the surrounding rock is not cracked. The top of pads shall be sloped at not less than 1:10 in order to shed water.

9.6.9 Augured Foundations

Augured foundations may be used provided satisfactory type tests are carried out to the owner's approval. These foundations will comprise either a single shaft with a minimum diameter of 800 mm suitably under reamed at the bottom, or multiple augers with a minimum diameter of 400 mm suitably connected at or below ground level by a concrete cap.

The shear strength of the soil shall be determined from the soil properties measured on undisturbed samples in undrained triaxial compression test. The mean value of the shear strength taken over the effective length of the foundation shall be used in the calculations.

The Contractor's design method shall be submitted for approval, together with the appropriate values of friction/adhesion coefficient and end bearing coefficient prior to any foundation test being undertaken. Where shear forces are resisted by the cap, an appropriate reduction in the mean value of the shear strength shall be taken for the determination of the cap friction/adhesion coefficient.

For single large diameter augured foundations the main reinforcement shall be adequate to carry the total load for the full length of the foundation.

The minimum concrete cover to all reinforcement, including stirrups, shall be 100 mm.

For small diameter augers the concrete cover shall not be less than 50 mm.

9.6.10 Augured or Driven Piles

Ultimate uplift loads shall be obtained assuming the actual dead-weight of pile caps (and tie-beams, etc.) plus the guaranteed ultimate uplift resistance of piles. Allowance shall be made for buoyancy effects.

Ultimate compressive loads shall include the superimposed weight of earth, pile caps (and tie-beams, etc.) multiplied by the appropriate withstand factor and shall be obtained by the guaranteed ultimate resistance of the piles.

The ultimate resistance of piles shall be resistance at which the movement does not exceed 25 mm. Piles will be subjected to uplift or compression tests at the discretion of the Owner.

9.7 SITE TESTS AND TEST LABORATORY

In order to carry out specified tests the Contractor shall provide a site laboratory which shall be available for the use of the Owner as required and shall be properly staffed and equipped in accordance with the standards indicated in Schedule.

General tests or rare tests can be commissioned to an experienced external laboratory.

The whole cost of such tests, relevant to construction including the provision and use of equipment, shall be included in the Contract.

9.8 ERECTION OF TOWERS

9.8.1 General

The Contractor shall ascertain that all concrete foundations or rock anchor grouting are cured and that all backfill is compacted to its approved level before placing or erecting tower steel on the foundations. Concrete in tower foundations shall be allowed to set a minimum of 10 days before erection of the tower and a minimum of 28 days before conductor installation on the tower.

The Contractor shall erect the types of towers specified at the locations indicated on the Contract Drawings.

Towers shall be assembled in accordance with the approved Contractor's drawings and erected by any suitable method approved by the Owner which will not overstrain structural members or their foundations.

All tools and equipment required for tower erection shall be supplied by the Contractor.

9.8.2 Handling and Storage

a) Steel in storage shall be blocked off the ground and all necessary measures shall be taken to prevent structural injury to members or damage to galvanized coatings.
b) Members shall not be dragged on the ground nor will the practice of throwing tower steel into piles on conveyances or from conveyances onto the ground and of skidding steel members over each other be permitted.
c) Tower material damaged shall be replaced by the Contractor at no cost to the Owner.

d) Where galvanizing is broken by any cause, the bare metal shall be painted or regalvanized by the Contractor in accordance with the relevant clause of these Specifications.
e) All galvanized structures shall be painted partly before and partly after erection in accordance with attached painting specification.

9.8.3 Erection

a) After conductors have been installed and sagged, all towers shall be plumb with a tolerance on vertical deviation not exceeding 3 mm/m.
b) During the erection, no tools shall be taken up to the towers except structure wrenches. Only such wrenches will be allowed which do neither deform nor injure the galvanized coating of the nuts.
c) Each bolt shall be securely tightened with adequate but non-excessive torque.
a) Proper tightness shall be spot checked by the Contractor with an accurately calibrated torque wrench. The Contractor shall specify the maximum torque that can be applied for each bolt size.
d) In order to prevent pilfering all bolts and nuts below a minimum height of 3 m above ground shall be secured by means of punching the bolt thread. All towers shall be completely tightened immediately after they are erected and left in workmanlike condition, complete and safe in every respect.
e) A reasonable amount of drifting will be allowed in assembly of towers, but reaming for correction of mismatched holes due to shop errors will not be tolerated. Any drifting used shall not distort the metal or enlarge the hole.
f) Danger signs shall be installed on each longitudinal side of each tower, approximately 2 m above the top of tower footing. A tower number sign and 2 circuit number signs shall be provided for each tower. The phase signs are not required. Anti-bird devices shall be installed on the crossarms as specified.
g) Towers must be completely erected with all members in place and bolts securely tightened before any stringing of conductors or earthwires may be started. All towers shall be inspected by the Owner accompanied by the Contractor before the stringing operation.
h) The Contractor shall assemble and erect the towers completely and carefully. If the stubs are installed separately, they shall be installed by means of rigid frames, which must be supplied by the Contractor for each tower type. The setting templates shall remain in position until the concrete foundations have cured for a period of 24 hours. If possible, the stubs shall be installed together with the lower parts of the tower.

The stubs shall be aligned exactly by means of theodolite or level instruments. The difference in elevation between identical parts of any stub angles shall not exceed 1/1000 of the horizontal distance between the stubs. The actual elevation of any stub angle shall not differ from the calculated elevation by more than 5 mm. The stub angles shall be located horizontally so that each is within 5 mm of its correct position and the batter of the stub angles shall not differ from the correct batter by more than 5 mm per meter of exposed stub.

The Contractor's erection method shall be approved by the Owner.

The concrete foundations can be loaded at the earliest ten days after casting.

Before commencement of erection back-filling and compaction have to be completed.

Angle tension towers and terminal tension towers must be erected out of plumb.

The direction of the deviation from the vertical shall be against the resulting tension. The extent of the deviation has to be determined by the Contractor according to the value of the resulting tension and depending on the specific tower design after stringing of conductors a max. Tolerance of 10 cm from the designed deviation is allowed, but only in the direction of the deviation.

If the Contractor's proposed tower erection method is to assemble the tower or portions thereof on the ground and raise this to the vertical position, this shall be taken into account during detail planning of towers and foundation. If the towers are erected by assembling in sections, initial bolting shall be adequate for all loads and erection stresses, but also to allow alignment.

The earthing system must satisfy the requirements of VDE 0141 or an equivalent standard. It is left to the Contractor to determine the equipment, nature, scope and extent of the particular tower earthing system subject to the requirement that other areas (sites, owners property etc.) are not adversely affected by it. If consequential costs arise in this connection, associated with the construction of the earthing installation, these costs shall be born by the Contractor.

9.9 INSTALLATION OF GROUNDING

a) For lattice towers an armco steel grounding conductor, looped with 200 cm diameter around each leg, buried 150 cm depth shall be used. The grounding conductor (armco steel) shall have a diameter of 2 cm and visibly connected to tower leg by a steel clamp without passing through the foundation concrete.

a) For tubular poles, ground rods shall be installed for grounding and armco steel shall be used for connection to tower. It is also possible to drill 6-7 m deep vertical holes and install armco steel directly in place of rods. A grounding resistance of max. 3 ohms is required for any tower.

c) For tower locations where the rods cannot be used due to soil conditions the

b) Contractor shall at least install two ground strips each 20 m long, connected to the stubs inside the concrete foundations.

c) After the erection of the towers and ground rods or strips, the ground resistance of each tower shall be measured by means of a "Megger" type instrument.

d) Where the value of such resistance is greater than 3 Ohm the Contractor shall install further ground electrodes until the tower ground resistance is lowered to the specified values. If it will be necessary to add a counterpoise type of grounding system, the Contractor will design, furnish and install such a counterpoise system.

f) All contact surfaces on the tower stubs, connectors, rods, strips and wire leads shall be thoroughly cleaned and covered with a liberal coating of appropriate compound.

g) All wire leads shall be properly sealed in the connectors and all bolts shall be firmly tightened to ensure that a good electrical connection is obtained. All wires and strips shall be handed over and installed in a workmanlike manner, free from kinks and damage of any kind. Backfill for strip trenches shall be thoroughly compacted.

h) After final installation, measurement of the earth resistance at each tower structure shall be made before stringing and the results of such measurement submitted to the Owner for approval.

i) Detailed records of the location of all electrodes together with the length of the driven rods, individual earth readings and the routes of all conductors buried in the ground shall be prepared and kept on site and final records produced on completion of the Contract and handed over to the Owner. Earth resistance values of each earth electrode or electrode group shall be measured as under.

-during initial installation;

-28 days after installation;

-immediately before commissioning.

9.10 INSTALLATION OF INSULATOR STRINGS

a) Insulators shall be clean when hung. Steel wool and clean rags shall be used to remove mud, grease, dirt and other foreign matter. Porcelain surfaces shall be wiped to a bright finish and metal surface shall be free from any noticeable contamination.

b) The bending or straining of insulator ball pins, which occurs when insulator strings are picked up by a rope sling placed near the centre of the string, must be avoided.

The rope sling shall always be attached near the top unit of the insulator string.

c) Workmen shall not climb upon insulator strings after installation.

d) Hardware and accessories shall be handled to prevent contact with the ground. All items shall be clean and inspected for missing parts or visual defects before installation. All connections shall be made in accordance with the Contractor's drawings or as recommended by the manufacturer, bolts firmly tightened, split pins inserted where required, all in a good workmanlike manner according to the best practice of transmission line construction.

e) All split pins in each insulator string shall be carefully checked to ensure that they are properly seated to avoid accidental uncoupling of insulator units. All split pins shall be faced towards the stepped leg of the tower to facilitate inspection.

f) Damaged insulator string, hardware and imperfectly or poorly galvanized hardware as determined by the Owner shall not be used. Such pieces shall be replaced with new insulator strings/hardware at no cost to the Owner.

9.11 INSTALLATION OF CONDUCTORS AND ACCESSORIES

9.11.1 Requirements

The Contractor shall sag the conductors in accordance with the initial sag and tension tables to be prepared by him.

9.11.2 Clearances

Requirements for the minimum clearances between live conductors and other objects, which correspond to the maximum conductor sag conditions, are stated in the bid document. For other objects, not listed in this Schedule, the requirements for minimum clearances shall comply with Standard VDE 0210.

9.11.3 Crossing of Public Services

When the Contractor is about to carry out erection of the conductors along or across power lines or telecommunication circuits, public roads, waterways or railways, he shall be responsible for giving requisite notice to the appropriate authorities of the date and time at which he proposes to carry out the work and shall obtain a written acknowledgement of such notice, before stringing of such span is started.

The Contractor shall supply and install all guard structures required for crossings over electric supply and communication lines, railways, roads, highways, obstructions and for the protection of the conductor. All guard structures shall be of adequate strength to withstand the stresses to which they may be subjected. The erection and removal of guard structures is subject to the approval of the Owner.

The Contractor shall provide, erect and maintain all necessary barricades, suitable and sufficient red lights, danger signals and signs and take all necessary precautions for the protection of the work and safety of public. Roads and highways closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning and detour signs. All barricades and obstructions shall be illuminated at night and all lights shall be kept burning from sunset until sunrise.

The cost of providing all such measures and providing necessary repairs and if required by relevant authorities, providing indemnity or other bonds shall be paid by the Contractor and to be included in the Bid Price.

9.11.4 Stringing

a) The Contractor shall take special care that the conductors do not at any time during erection come into contact with the ground or any obstacles such as walls, fences or buildings etc., nor shall they be overstrained during erection. Under no circumstances shall the conductor be dragged on the ground during stringing operation. The conductors shall be strung under tension through stringing sheaves by means of pilot cables. Approved means shall be provided to prevent any damage to conductors where these are run over temporary supports or sheaves.
b) Drum battens shall not be removed until conductor drums are properly mounted at the drum station on the line, and battens shall be immediately refitted to the drum if any surplus conductor is left therein.
c) The conductors, joints and clamps shall be erected in such a manner that no
a) birdcaging over tensioning of individual wires or layers or other deformation damage to the conductors shall occur. Clamps or hauling devices shall, under erection conditions, allow no relative movement of strands or layers of the conductors, if required by the Owner , this property shall be demonstrated by actual tests.
d) If the conductors are damaged, the Contractor shall repair or replace the damaged section in approved manner, and at no additional cost to the owner. All sections of conductors damaged by the application of gripping attachments shall be repaired or replaced before the conductors are sagged in place. The Contractor shall at his own expenses make suitable arrangements for temporary guying of towers, where necessary suitable plates (detachable or otherwise) shall be provided on the towers for the attachment of temporary guys. The additional loads imposed on specific towers during erection by the use of temporary guys shall be calculated and approved prior to conductor stringing commencing. The stringing equipment and operation shall be such as to avoid overstressing tower structures or foundations. Any damage to towers or foundations occurring in such an operation shall be made good at the expense of the Contractor.

Conductors shall be strung carefully to avoid kinking, loosening of strands, scraping, nicksor other damage. Bends of less than the minimum bending radius of 18 times the conductor diameter will not be permitted. Jumper loops shall be made up between terminal fittings and formed into such a shape as will afford the minimum clearances specified on the tower outline drawings and so that the jumper insulator string, if any supplied, is not deflected from a plumb alignment.

Appropriate stringing sheaves or travellers shall be used which will not damage the conductor. Stringing sheaves shall have a minimum diameter measured at the bottom of the groove of 16 times conductor's diameter. Stringing sheaves may be hung on the insulator strings or from hangers of suitable length and design to properly distribute loads to the crossarm. They shall be installed at such height as to support the conductor or earthwire at its permanent elevation when clipped in. The stringing operation shall be executed with due regard to the safety of erection, of personnel and the public. While conductors are being run out, and when being tensioned and finally clipped in, all conductors shall be earthed by the Contractor at points approved by the Owner.

The Contractor shall supply and install all guard structures required for crossings over electric supply and communication lines, railways, roads, highways, obstructions and for the protection of the conductor. All guard structures shall be of adequate strength to withstand the stresses to which they may be subjected.

After being sagged, the conductors shall be allowed to hang in the stringing sheaves for not less than 2 hours before being clamped in, to permit the conductor tension to equalize. The conductors shall be sagged in accordance with sag tables approved by the Owner.

The length of conductor sagged in one operation shall be limited to the length that can be sagged satisfactorily. In sagging one reel length, the sag of 2 spans shall be checked. In sagging lengths of more than one reel, the sag of 3 or more spans near each end and the middle of the length being sagged shall be checked. The length of the spans used for checking shall be approximately equal to the ruling span.

All spans which exceed the ruling span by 60 m or more shall be inspected for sag.

At sharp vertical angles, the sag shall be verified on both sides of the angle. The sag of spans on both sides of all horizontal angles of more than 10 degrees shall be verified. After the conductors have been pulled to the required sag, the intermediate spans shall be inspected to determine whether the sags are uniform and correct. Sagging operation shall not be carried out when, in the opinion of the

Owner, wind, extremely low temperature, or other adverse weather conditions prevents satisfactory sagging.

A tolerance of plus or minus 4 cm of sag per 100 m of span length, but not to exceed 15 cm in any one span, will be permitted, provided the following conditions occur:

-All conductors in the span assume the same sag and the necessary ground clearance is obtained.

-That the conductor tension between successive sagging operation is equalized so that the suspension insulator assemblies will assume the proper position when the conductor is clipped in.

The tension in the ground conductor must be such that the sag is less than that of the conductors.

The Owner will check the sag at all points to be checked and the Contractor shall furnish the necessary personnel for signalling and climbing purposes.

At all suspension or tension structures, the conductors shall be attached to the insulator assemblies by suspension clamps or dead end fittings as shown and all nuts shall be tightened adequately but not excessively. Spans attached to gridstation shall be "Slack Spans". The conductor shall be coated with an approved grease immediately before final assembly in any fitting.

9.11.5 Splices

a) Full tension splices shall be made with strain compression joints.
b) When damage to a conductor does not exceed three strands, either broken or nicked deeper than one third of their diameter a repair sleeve shall be installed and where this limit is exceeded the damaged section of the conductor shall be cut out and spliced with strain compression joint.
c) A maximum of one splice per conductor will be allowed in any phase in any span. No splices shall be located in any span crossing main roads, railways, major canals, rivers, major communication or power lines and in sections between towers of less than three spans.
d) All joints or splices and repair sleeves shall be located at least 10 meters away from the structure.

9.11.6 Sagging

a) Sags and tension tables for the conductor in still air for basic span shall be supplied by the Contractor. While calculating final sag and tensions creep factor shall also be considered.
b) The "equivalent span" method shall be used for the line conductors according to which the tension in any line section, i.e. between two tension towers is the one which would apply to a single span equal to the square root of the figure arrived at by dividing the sum of the cubes of the individual span lengths, in the section considered, by their sum.
c) The Contractor shall submit to the Owner for approval tables showing the initial sags and tensions of the conductor for various temperatures and spans. The initial sag should include allowances for such permanent stretch as may take place in service.
d) The length of conductors or sagged on one operation shall be limited to the length that can be sagged satisfactorily.
e) In order to dissipate the initial torsion energy conductor shall be left in the sheaves for at least 48 hours after sagging before clipping in.
f) Before sagging the choice of control spans and the target setting calculations shall be submitted for approval. The tension prescribed in the sag and tension tables shall not be exceeded by more than 10 % at any time during stringing and sagging operations.
g) Conductor temperature at the moment of sagging shall be checked by an accurate thermometer. The core shall be pulled from a one meter length of conductor, the thermometer inserted into the space vacated by the core, and the length of conductor shall be hung fully exposed to the sun at least 3.5 meters above ground. The temperature reading after reaching its final value shall be used as the sagging temperature.
h) The sag shall preferably be measured with a theodolite subject to the approval of the Owner, the Contractor may employ other methods of checking sag. Sag control measurements will be done for every 5 towers and for all spans exceeding 250 m.
i) As soon as possible after completion of clipping in, the Contractor shall recheck the sags for correctness and shall then turn over his initial and check sagging results to the Owner.
j) Sagging operations shall not be carried out when, in the opinion of the Owner, wind, extremely low temperature or other adverse weather conditions prevent satisfactory sagging.

9.11.7 Vibration Dampers

Vibration dampers shall be installed on both ends of all spans and in positions calculated and proposed by the Contractor and approved by the Owner. The Contractor shall obtain from the vibration damper manufacturer the spacings which the manufacturer has determined from tests to be the most effective in reducing vibrations under wind velocities 0 to 25 km/h.

9.11.8 Conductor Spacers

Spacer dampers shall be installed on all spans and in positions calculated and proposed by the contractor and approved by the Owner. The contractor shall obtain from the spacer damper manufacturer the spacings which the manufacturer has determined from tests to be the most effective whatever service conditions may be prevailing.

9.11.9 Counter Weights

For suspension strings counter weights (hold down weights) may be used to counter uplift, provided the counter weight assembly does not interfere with movement of the suspension clamp. The iron hold down weights shall be composed of 50 kg units. The

Contractor shall submit a detailed calculation of hold down weights.

9.12 Connections to Substations

The tensions of the conductors in the slack span between the terminal tower and gantry shall not exceed the tensions for loading diagrams.

The Contractor shall carry out all connections between transmission line and relevant substation in order to complete the work in every respect to enable the Owner to start operation of the new line(s).

Around the terminal structures and terminal equipment a 2.5 m high fence shall be constructed taking into account the minimum clearances between the fence and the live parts. Inside the fenced area an earthing mat in accordance with VDE 0141/7.76 is required to which all supporting structures and equipment must be connected.

ANNEXURE:

B: Health, Safety and Quality Policy

1.0 Purpose:

The purpose of this procedure is to describe the process required to be adopted with respect to Health, Safety, Environment and Quality (HSEQ) management during implementation of Contracts and Procurement process for acquisition of goods and/or services. The main objectives are to;

- Define the minimum HSEQ objectives to be met at each stage of a contract.
- Develop a strategy for proactive management of Contractor & Supplier HSEQ.
- Highlight the benefit of effective proactive approaches, particularly prior to tendering and mobilization.
- Describe a planned approach to Management of Contractor and Supplier HSEQ that will ensure a continuing improvement in HSEQ performance for all contractor activities.
- Describe the role and responsibilities of key personnel in contractor and supplier HSEQ management.

2.0 Scope:

This procedure applies to KESC employees, contractors and suppliers.

3.0 Distribution:

All employees at KESC, Contractors and Suppliers.

4.0 Definitions:

Company: Karachi Electric Supply Company.

Contract: A formal business agreement detailing the terms and conditions for the supply of products or the provision of services.

HSEQ Plan: A formal document showing how it is intended to manage the hazards determined. It should be recognized that in many situations, particularly for larger contracts, this HSEQ Plan will effectively form a significant part of the contract.

Contractor: A Supplier holding a Contract with Company for the supply of goods or services.

Contract Sponsor: The department, BU or function that has budget and management authority to execute the Contract.

Contract Manager: The person named in the contract to represent the Contractor in respect of the contract and to be responsible for the management of the contract or supplies.

Contractor Representative: The person appointed in writing by the Contract Manager to supervise the execution of the contract activities or supplies.

Scope of Work: The objective and extent of work to be accomplished by a Contractor or Supplier.

Services: Reflect work done in which people play a prominent role in delivery. A service is an intangible product. Work performed for pay.

5.0 HSEQ Requirements:

5.1 Corporate HSEQ Policy:

- Embedding the Health, Safety, Environment and Quality requirements in our routine and non-routine activities.
- Preventing injuries and ill health to personnel affected by our activities through a proactive system of risk management.
- Improving competence and skill through training and awareness.
- Ensuring continual improvement through a system of performance planning, measurement and reviews.

5.2 ISO 14001:2004 Specifications (Section 4.4.2) - Training Awareness and Competence:

The organization shall ensure that any person(s) performing tasks for it or on its behalf that have the potential to cause a significant environmental impact(s) identified by the organization is (are) competent on the basis of appropriate education, training or experience, and shall retain associated records.

5.3 OHSAS 18001 Specifications (Section 4.4.2) - Training Awareness and Competence:

Personnel shall be competent to perform task that may impact on OH & S in the work place. Competence shall be defined in terms of appropriate education, training and or experience.

6.0 Objectives:

The overall objectives of this procedure are:

- Ensure that contractors / supplier meet or exceed KESC HSEQ standards.

6.1 Adherence to Hazards and Effects Management Process:

All hazards to contractor's personnel, KESC staff, public and to the environment shall be:

- Identified, assessed systematically and eliminated where possible
- Controlled through formal procedures and planning methods
- Covered by contingency plans in place to deal with identified consequences of potential loss of control.

6.2 Mutual HSEQ awareness:

The contractor / supplier and the Contract Sponsor shall be mutually aware of both parties' minimum obligations to manage HSEQ and these obligations shall be within mutually agreed contractual terms.

6.3 Means to monitor the contract HSEQ management:

The means to monitor the contract HSEQ management system (HSEQMS) shall be mutually defined, understood, accepted and agreed by both parties as contractually binding.

6.4 Equal attention to Health, Safety, Environment and Quality:

6.5 Controls in place for hazards and effects management

The controls necessary for the management of hazards and effects shall be in place and working. Where they are not, this shall be speedily remedied or in extreme cases, work should be stopped.

6.6 Ensure clarity between Contract Sponsor and Contractor regarding responsibilities:

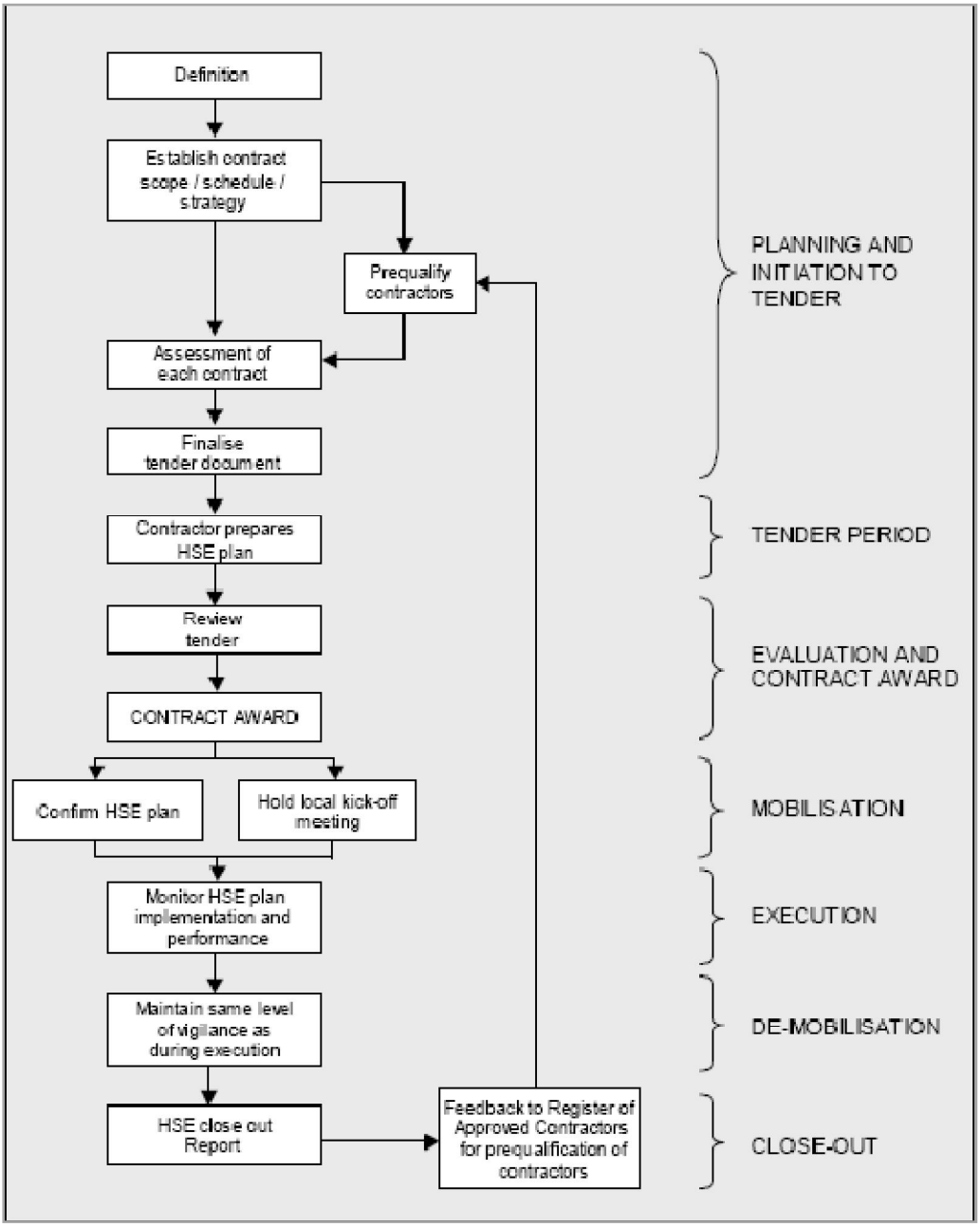
7.0 Procedure:

7.1 Contract Phases and HSEQ Planning:

The influence and inclusion of HSEQ issues in the preparation of tender and contract documents and the subsequent HSEQ management of a contractor shall be described within the context of an identifiable series of phases:

- Planning and invitation to tender.
- Tender period.
- Bid evaluation and contract award.
- Mobilization.
- Execution
- Demobilization
- Close-out.

More details are in the below table



7.2 Pre-Qualification and Tender Process:

Pre-Qualification is a process that shall be conducted preferably in advance of, but may be in parallel with, Tendering, to determine if a Contractor has the capacity to deliver a specific service. In all cases, pre-qualification shall include an HSEQ assessment component.

HSEQ prequalification pack shall include but not be limited to the requirement for potential Tenderers to submit the following:

- Contractor Self Evaluation Form (KESC-SP-022-F01).
- HSEQ policy.
- Contractor HSEQ Management plan.
- HSEQ Organizational structure.
- Details of Contractor HSEQ training and audit systems.
- Overview of the Contractor's recent HSEQ performance.

In addition, any specific HSEQ requirements of the Contractor/Supplier should be defined based on the control measure outcomes of identified in the Risk Evaluation process and included in the Pre-Qualification package.

7.3 HSEQ Tender Package:

The Tender package shall clearly present all HSEQ requirements applicable to the Scope of Work. HSEQ documentation to be included in the HSEQ Tender package and must include but not be limited to the following HSEQ documentation:

- KESC Corporate HSEQ Policy.
- KESC Corporate HSEQ Manual.
- KESC-SP-022 – Contractor / Supplier HSEQ Management Procedure.
- All relevant KESC Corporate HSEQ Procedures (If required by the contractor).

These requirements are mandatory for all Contracts with the Company – irrespective of their jurisdiction. The applicability of all Company HSEQ requirements must be assessed on a case by case basis for each contract.

7.4 Tender Schedule:

A specific HSEQ Tender Schedule shall be prepared that lists all HSEQ related information to be provided by the Tenderer in their submission. It is used as a formal basis for evaluation of the Tender.

The Tender Schedule should require a response to be submitted by the Tenderer for all key HSEQ issues that must be addressed by the Contractor in performing the Scope of Work.

For simple procurement contracts, the HSEQ Tender Schedule may be limited to a request for basic information repeating to the Tenderers internal HSEQ policies and systems. However, for controlled Site based activities, more detailed information shall be requested of the Tenderer including specific responses to HSEQ related issues pertinent to the Scope of Work (e.g. outline of method statements, etc.).

7.5 HSEQ Evaluation of Tender Submissions:

A weighted evaluation of Tenderers final submissions shall be prepared as a basis determining a preferred Tenderer from an HSEQ perspective. The relative weighting assigned to each component of the Tender Schedule shall be based on the risk exposure associated with each aspect of the Scope of Work.

8.0 Contract Award:

8.1 Pre-award HSEQ alignment meeting:

A Pre-Award HSEQ alignment meeting is mandatory for all high risk contracts. The Contract Sponsor shall arrange a pre-award HSEQ alignment meeting with the preferred Tenderer to ensure that the Tenderer is fully cognizant and aligned with all HSEQ requirements applicable to the Scope of Work. Any discrepancies shall be identified at this meeting, if possible resolved, and outcomes minuted by the Contract Sponsor.

8.2 Finalize HSEQ Contract Documentation:

Should any HSEQ amendments to the Tender documentation be necessary as identified in the Pre-Award HSEQ alignment process, these amendments shall be translated into a revision of Contract documentation prior to Contract award.

Any additions, changes or deletions to the standard HSEQ pro-forma clauses shall be approved by the HSEQ and/or Legal functions.

9.0 Contract Pre-Execution:

9.1 Contractor / Supplier HSEQ Plan:

The purpose of the Contractor/Suppliers HSEQ Plan is to define how the Scope of Work shall be implemented by the Contractor/Supplier in accordance with Company (Contractual) HSEQ requirements.

Although a specific Contractors/Suppliers HSEQ Plan shall be required for all Contracts, the content and format of the plan shall be commensurate with the risk associated with executing each aspect of the Scope of Work as determined by risk assessment as well as the necessary control measures.

The Contractors HSEQ Plan shall address any bridging or interfacing requirements necessary to ensure the effective management of HSEQ related issues.

The Plan shall be approved by the Company prior to commencing execution of the Scope of Work.

9.2 Establish Specific HSEQ Systems and Processes:

Specific HSEQ systems and processes shall be established prior to commencing the Scope of Work shall be defined in the HSEQ Plan for the activity and/or the Contractors HSEQ Plan. Following presents a guide to Company expectations regarding HSEQ processes and systems to be established across a range of activities.

The level of inspection and assessment required will be a function of the Scope of Work, work environment and jurisdiction classification of planned activities.

Process	Controlled site activities	Supply/Procurement contract only
Plan	Equipment (Inspections, Checklists, Certifications, Tagging) as per KESC-SP-022-F02	Inspections
	Procedures (Permit systems and certificates)	
	Personnel (Induction, training, certifications)	
Do	Maintain hazard register	
	Inspections	
	Actions register maintenance	
	Contractor coordination meetings	Contractor coordination meetings
	Workforce communications meetings Tool Box Talk	
	Behavioral observation systems	
	Incentive scheme implementation	
	Knowledge sharing initiatives	Knowledge sharing initiatives
Check	Compliance auditing	Compliance auditing
Act	Monthly HSE Reporting	
	Incident and event	

9.3 Complete Pre-Start HSEQ Inspections and Review:

Assessment of key plant, equipment and personnel should be undertaken prior to site mobilization. For example, equipment to be evaluated may include the following:

Fixed and mobile plant (cranes, elevated work platforms, generators, air compressors, etc.). Other specific equipment (scaffolding, ladders, harnesses, rigging, tools, PPE, etc.)

Inspections, audits and third party compliances are mandatory for all activities.

All Personnel working in activities shall have the minimum training, competency and qualifications:

Certificates verifying competency, training and qualifications shall be up to date and made available to upon request.

In addition, short service personnel shall complete a minimum of:

- Site specific HSEQ Induction.

All other personnel shall complete;

- Site specific HSEQ Induction.
- Specific training and competency topics as identified by the site.

10.0 Contract Execution:

10.1 Implement HSEQ Systems and Processes:

The Contract Sponsor and HSEQ Support shall be responsible for monitoring and review of Contractor compliance with all HSEQ requirements defined in the Contract.

A process of continuous review shall be maintained to track HSEQ performance throughout Contract execution. Opportunities for improvement and enhancement of HSEQ systems and processes shall also be identified and implemented. Tools to assist in this process include the following:

- Regular reviews and inspections
- Audit compliance with the HSEQ Plan
- Audit HSEQ performance against the KESC requirements
- Contractor coordination meetings.
- Other feedback mechanisms.

HSEQ performance reviews shall be conducted on a quarterly basis for all high risk contracts.

An HSEQ Action Register shall be established to ensure HSEQ issues are followed up in a timely manner.

10.2 Reporting and Auditing:

Reporting: The Contractor shall be responsible for providing monthly HSEQ performance data to the Company as defined in the Contract and aligned with Company reporting requirements.

Reporting shall be done of the following as minimum;

- HSEQ Incidents / Accidents

- Near-misses
- Tool Box Talk
- Manning Statistics

Auditing: Auditing shall be undertaken by the Contractor, Contract Sponsor and HSEQ as defined in the Contract and the Contractors HSEQ Plan.

A process of corrective action tracking shall be in place in the event that areas of non-compliance are identified. Depending on the Scope of Work, formal audits and audit reporting may also be required.

10.3 Contract Closeout:

After completion, a Contract HSEQ review shall be prepared that provides a formal record and a concise history of the contractor's HSEQ performance and capture learning's that can be applied to future contracts. The review should derive the majority of its content from factual documentation collected during the duration of the contract and lodged with Supply and Chain for future reference.

11.0 Responsibilities:

11.1 Contract Sponsor:

- Shall be responsible for ensuring that this Procedure is implemented for their assigned contract.
- Shall be responsible to conduct regular audit, inspections in conjunction with Corporate HSEQ Department.
- Shall gather the relevant HSEQ documents from the contractor as mentioned in the procedure or as and when required basis.

11.2 Corporate HSEQ Department:

- Shall assist the contract sponsor to conduct the inspections, audits.
- Shall analyze the HSEQ Data received from the contract sponsor for the continuous improvement in the HSEQ System.
- Shall analyze the contracts / tenders with respect to HSEQ Management System prior to the award of contracts.

11.3 Contractor:

- Shall be responsible to conduct regular internal audit, inspections, tool box talks, etc as per company policy.
- Shall provide the HSEQ Data on regular basis as mentioned in the procedure.
- Shall be responsible to provide the HSEQ Resources (PPEs, SPEs, training) to all staff involved in the activity.

12.0 APPLICABILITY

- All Management and non-management staff – KESC.
- 3rd Party contractual.

13.0 FORMS / DOCUMENTS

KESC-SP-022-F01 ---------- Contractor Self Evaluation Form.

KESC-SP-022-F02 ---------- Equipment Inspection Checklist.

10.8.18
AMIR ZAFAR
Director-Corporate HSEQ
KESC Ltd.

Prepared By;

HSEQ Department

Tabish Gauhar
Chief Executive Officer
KESC Ltd.

Approved By;

CEO

Contract Sponsor TO FILL THIS SECTION OUT

Name of Contracting Organization:

Contract Sponsor:

Contractor Scope of Work:

(Provide a brief description of the work the contractor is to undertake, including any specific HSEQ critical tasks).

_____

_____

_____

KESC Contact: _____ _____ Date Issued: _____/_____/_____

CONTRACTOR INSTRUCTIONS:

Review each of the items below and circle the option which best represents your Company's performance. Where appropriate attach examples to demonstrate that choice such as a policy document or a procedure. You can add qualifying comments in the box provided beneath each item.

1. Health, Safety, Environmental and Quality (HSEQ) Policy Statement:

A: No written policy exists

B: A policy statement exists but it has no specific commitments and is not issued for all employees to see.

C: A policy exists and is distributed but there is no definitive commitment to performance targets.

D: Policy clearly establishes commitment to specific performance targets, is signed by a responsible company officer and is issued for all employees to see.

COMMENTS:

2. Health, Safety, Environmental & Quality (HSEQ) Management Manual:

A: Doesn't exist

B: A few basic HSEQ procedures exist but they are not controlled or collated in a manual.

C: A manual exists with some procedures that may or may not be controlled but are not widely available.

D: A comprehensive manual exists with controlled procedures that are available for employees to use.

COMMENTS:

3. Health, Safety, Environmental and Quality Rules:

A. No written rules.

B. Some HSEQ rules have been developed in memo/document form but have not been widely distributed.

C. HSEQ rules developed and issued but no follow up for enforcement.

D. Comprehensive HSEQ rules developed and issued to employees. Disciplinary action established for infraction of HSEQ rules.

COMMENTS:

4. Organisational Roles and Responsibilities for HSEQ:

A. No assignment to any specific person. No responsibility devolved to front line supervisors.

B. Responsibility is assigned to a specific person (non HSEQ specialist). Front line supervisors not responsible for HSEQ

C. Professional(s) on staff or responsibility is part of another position. Responsibilities not well defined. Front line supervisors are responsible for HSEQ.

D. Professional(s) on staff with well defined role and responsibilities. Front line supervisors exercise responsibilities for HSEQ.

COMMENTS:

5. Personnel Sourcing:

A. Basic labour hire service, adhoc hire.

B. Few core staff, with adhoc labour hire as required. Less than 50% of staff are permanent.

C. Core staff with peaks covered by sub contractor hire.

D. Majority core staff or long-term contractors. Low staff turnover.

COMMENTS:

6. Recruitment and Personnel Records:

A. None.

B. Basic details only including name and addresses.

C. Basic personnel details plus employment health testing in accordance with legal requirements of permanent staff; qualifications of all staff on record.

D. For all staff there exists employment health checks, in accordance with legal requirements; record of training, reference checks, drivers licence, next of kin personal details, etc.

COMMENTS:

7. New Employee Orientation Program

A. No formal program.

B. Verbal instructions on Company procedures only.

C. Orientation booklet provided for new employee, but no on-the-job orientation by the Supervisor.

D. Employee handbook provided and Supervisor outlines, explains and demonstrates new employee's job Follow up.

COMMENTS:

8. Health, Safety and Environmental Training Program:

A. No HSEQ training established.

B. On site basic training conducted occasionally.

C. Training is given for specialised operations but no routine training conducted.

D. Formal training programs have been developed and are conducted on a regular basis. Retraining periods are established. Records maintained.

COMMENTS:

9. Personal Protective Equipment:

A. Not used unless prompted.

B. Staff use some PPE some of the time.

C. Staff use appropriate PPE most of the time.

D. Correct PPE is always available and used.

COMMENTS:

10. HSEQ Meeting Program:

A. None, or on rare occasions.

B. Periodic HSEQ meetings for special operations only.

C. HSEQ meetings held on a routine basis but are mainly attended by supervisors with little employee involvement or insufficient records exist.

D. HSEQ meetings performed on regularly scheduled basis by Supervisor or HSEQ rep and include employee representatives. Records kept & actions followed up.

COMMENTS:

11. HSEQ Inspection Program (relevant to Contractors premises only):

A. No program to identify and evaluate workplace hazardous practices and/or conditions.

B. Ad hoc, informal inspections take place from time to time. No records kept.

C. Periodic inspections are conducted but mainly by management with insufficient recording and follow up.

D. Periodic inspections are conducted by management and employees with records kept and hazards eliminated.

COMMENTS:

12. Inspection of Equipment:

A. None or informal.

B. Basic inspection, electrical equipment in date and tagged. Hand tools in good condition.

C. As for previous plus an inspection procedure is in place for hire equipment.

D. Routine inspections done, records available and corrective actions closed out.

COMMENTS:

13. Hazard Identification Systems:

A. Not used.

B. Basic hazard identification systems exist but not documented or formalised.

C. Hazard identification systems such as job HSEQ analysis, task analysis, tool box meetings exist and are sometimes used and not well documented.

D. Hazard identification systems such as job HSEQ analysis, task analysis exist in documented form and are regularly used. Tool box meetings are held on contract sites.

COMMENTS:

14. Accident/Incident Reporting Procedure:

A. No procedure exists.

B. Written procedure requiring basic reporting of personal injuries only.

C. Written procedure requiring reports on all accidents/incidents but no database to track actions and insufficient root cause analysis.

D. Procedure exists with database to track outstanding actions. Copies of reports sent to relevant companies (eg. KESC). Supervisory investigation required to determine and correct root causes of all incidents and near misses.

COMMENTS:

15. HSEQ Performance and Records:

A. No records.

B. A basic understanding of injury reporting is evident and some records kept.

C. Some statistics are recorded and tracked but not made available to employees.

D. Statistics such as Incident frequency rates and injuries are recorded and performance is graphed for employees to see.

COMMENTS:

16. International Certification **Yes** **No**

A. Is your company certified against?

B. ISO 14001 specifications?

C. OHSAS 18001 specifications?

D. SA 8000 specifications?

COMMENTS:

Date completed: _____/_____/_____

Name of Contractor's Representative: _____

Please return this form with all relevant information and evidence documents to the KESC contact Office. That person will arrange with you a suitable date to have an evaluation meeting.

CRANE CHECKLIST

Equipment / Tag No. _____ Capacity / Rating : _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. CERTIFICATES			
VALIDITY / TRACEABILITY OF EQUIPMENT / THIRD PARTY CERTIFICATION			
OPERATOR / DRIVER CERTIFICATION *(Validity of card / License / Competency with regards to load chart, operating procedures, safety devices)*			
2. STATIC			
HOOKS *(No deformation / cracks & safety latch / catch is must, swivel moves freely)*			
WIRE ROPE *(See for kinks, corrosion, broken strands, lubrication)*			
PHYSICAL LOCKING SYSTEM *(Disables and isolate free fall)*			
POWER SUPPLY ISOLATION POINT *(In case of electrical crane)*			
FALL PROTECTION SYSTEM *(Ergonomically acceptable)*			
PULLEYS *(Sheave deformation, any visible cracks, deformation)*			
SLINGS, SHACKLES, TACKLES *(SWL Marked, condition)*			
LIMIT SWITCHES *(Also called Anti Two block device & is a must item)*			
DUTY CHART *(Load / Radius Chart / Crane Manual)*			
TYRE CONDITION *(Condition and inflation, 1/6" Tread @ least)*			

	ACCEPTABLE		REMARKS
	YES	NO	
BOOM *(Structure, straightness, any local welding, repair evidence)*			
BOOM ANGEL INDICATOR *(Accuracy / Condition)*			
BOOM LIMIT SWITCH ALARM			
SWING ALARM *(Must for the counter weight those protrude crane's body)*			
REVERSING ALARM *(Horn should be working)*			
SPARK FLAME ARRESTOR*			
SEAT BELTS *(Mandatory while driving and not while load lifting)*			
OUT RIGGERS ***(Any leakage, damage, cylinders, rod seals or bolting valves, valves for proper operation, feet, hydraulic hoses condition)***			
BASE PLATE FOR OUT RIGGER *(Size and outlook)*			
BATTERY *(Installation fixing)*			
WARNING SIGN AGAINST INTERRUPTION OF THE OPERATOR.			
SWL SAFE WORKING LOAD (Clearly marked and visible)			
ENGINE / DIFFERENTIAL (Leakages)			
Fire Extinguisher *(Seal, marking, gauge, body, fixing)*			
RUNNING			
ABNORMAL SOUND			
VIBRATION			
EXHAUST PIPE *(Engine smoke)*			
BRAKES			
VISIBLE HYDRAULIC HOSES			
EXTERNAL LIHTING *(Load cells, load moment indicator, External rated capacity lighting, brake, reverse and side indicators)*			

	ACCEPTABLE		REMARKS
	YES	NO	
LEVERS *(Operational, function tested)*			
BOOM HYDRAULIC JACK *(Seepage, fully open and close)*			
OBSERVATIONS (IF ENTRY REFUSED)			

CHECKED BY (Contractor Representative) Name / Sign:_____	**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

LEGEND

* FOR HAZARDEOUS AREA

** NECESSARY FOR DRIVERS CABIN

TRUCK / FLAT BED TRUCK / LOW BED TRAILER / DUMPER / VEHICLE CHECKLIST

Equipment / Tag No. _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. STATIC			
LIGHTS			
HOOKS FOR SECURING LOAD / SIDE SUPPORTS / CARGO BARRIERS**			
REAR VIEW MIRROR			
REVERSE LIGHT INDICATOR / ALARM (AUTO WORKING)			
BRAKE LIGHTS			
DIESEL DRIVEN			
TYRE CONDITION			
TOW HOOKS & CHOKE BLOCKS			
LOOSE PARTS (SECURE)			
INDICATORS			
FLAME ARRESTOR*			
VALIDITY OF LICENSE			
SEAT BELTS *(for all passengers)*			
FIRE EXTINGUISHER			
FIRST AID KIT			
COMMUNICATION *(Radio / Mobile phone)*			
TOOL BOX KIT			
TOP PLATE (FIFTH WHEEL / KING PIN) **			
LEAF SPRING			
EXHAUST EMISSION MONITORING			
2. RUNNING			
EXHAUST PIPE WITH SPARK ARRESTOR*			
BRAKES			
ABNORMAL SOUNDS			
OIL & WATER LEAKS			
HYDRAULIC SYSTEM CONDITIONS			
BATTERY *(Installation fixing, damaged or corrosive terminals, terminal covers)*			

	ACCEPTABLE		REMARKS
	YES	NO	
OBSERVATIONS (IF ENTRY REFUSED)			

CHECKED BY (Contractor Representative) Name / Sign:_____	**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

LEGEND

* REQUIRED FOR HAZARDEOUS AREA

** NOT APPLICABLE FOR TOYATA PICK UP & DUMPER

WELDING MACHINE CHECKLIST

Equipment / Tag No. _____ Capacity / Rating: _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. STATIC			
POLARITY MARKED			
AMMETER			
VOLT METER			
WELDING CABLE CONDITION			
HOLDER			
EARTH CLAMP			
EARTH CABLE CONDITION			
SAFETY GAURDS ON ROTARY PARTS / BELTS / PULLEYS			
WIRING			
BATTERY WITH TERMINAL COVERS			
FLAME ARRESTOR*			
TYRES CONDITION			
TOW HOOKS CONDITION			
GROUNDING RODS			
VRD (Voltage Reducing Device)			
OVERALL CONDITION			
ANY OTHER HAZARD IDENTIFIED			
2. RUNNING			
LEAKS OIL / WATER			
ABNORMAL SOUND			
VIBRATION			
ON / OFF SWITCH			
SAFET STARTING SYSTEM			
OBSERVATIONS (IF ENTRY REFUSED)			

	ACCEPTABLE		REMARKS
	YES	**NO**	
CHECKED BY (Contractor Representative) Name / Sign:_____			**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

LEGEND

* REQUIRED FOR HAZARDEOUS AREA

CUTTING TORCH CHECKLIST

Equipment / Tag No. _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. STATIC			
PRESSURE GAUGE AND REGULATOR ON CYLINDER			
CUTTING TORCH CONDITION			
HOSE CONDITION			
CYLINDER TROLLEY AND CHAIN			
HOSE CLAMPING (JUBILEE CLAMPING NOT ACCEPTABLE) – HYDRAULIC PUNCHING			
CUTTING TORCH TIPS			
FLASH BACK ARRESTOR (OXYGEN / ACCETELENE) BOTH ENDS			
CYLINDER KEY / FIXED SPANNER / LIGHTER & TIP CLEANER			
CONDITION OF CYLINDER			
CONDITION OF CYLINDER THREADS / LEAKAGE			
SPARK LIGHTER FOR IGNITION.			
OBSERVATIONS (IF ENTRY REFUSED)			

	ACCEPTABLE		REMARKS
	YES	NO	
CHECKED BY (Contractor Representative) Name / Sign:_____			**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

POWER GENERATORS CHECKLIST

Equipment / Tag No. _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. STATIC MECHANICAL			
DIESEL DRIVEN			
BATTERY TERMINAL WITH COVER			
GUARDS ON MOVING PARTS			
FLAME ARRESTOR / EXHAUST SILENSOR PERSONAL PROTECTED			
TYRE-TROLLEY CONDITION			
2. ELECTRICAL			
ELECTRIC WIRING CONDITION			
AMMETER			
VOLT METER			
BREAKER *(Required Amperage)*			
BATTERY TERMINAL WITH COVER			
PROTECTION *(Overload / short-circuit)*			
PROTECTION *(Reverse power / earth fault for heavy duty only)*			
WEATHER PROTECTED TERMINAL BOX & ELECTRICAL PANEL			
CABLE GLANDS FOR CABLE ENTRY			
ANY OTHER HAZARD IDENTIFIED & EVALUTED			

	ACCEPTABLE		REMARKS
	YES	NO	
3. RUNNING			
ABNORMAL SOUND			
VIBRATION			
OIL AND WATER LEAKS			
EXHAUST EMISSION MONITORING			
OBSERVATIONS (IF ENTRY REFUSED)			

CHECKED BY (Contractor Representative) Name / Sign:_____	**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

GRINDERS / DRILL MACHINE CHECKLIST

Equipment / Tag No. _____

	ACCEPTABLE		REMARKS
	YES	NO	
GENERAL			
CABLE CONDITION			
NO JOINT / PROPER INSULATED LEAK PROOF			
SOCKETS (THREE PIN RECEPTACLE TYPE)			
PLUGS (THREE PIN RECEPTACLE TYPE)			
SPANNER KEYS			
FAIL TO SAFET MODE			
GRINDING DISC FIT FOR PUPOSE AND COMPATABLE WITH MACHINE SPEED			
GUARDS IN GOOD CONDITION AND IN PLACE			
EARTHING ARRANGEMENT			
CARBON BUSHES (SPARK GENERATION NOT ALLOWED)			
ANY OTHER HAZARD IDENTIFIED & EVALUATED			
OBSERVATIONS (IF ENTRY REFUSED)			

	ACCEPTABLE		REMARKS
	YES	NO	
CHECKED BY (Contractor Representative) Name / Sign:_____			**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

HYDRO TEST PRESSURE PUMP CHECKLIST

Equipment / Tag No. _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. STATIC			
DIESEL DRIVEN / MOTOR			
ELECTRIC WIRING CONDITION (NO JOINS / INSULATED / LEAK PROOF)			
BATTERY TERMINALS WITH COVERS			
GAURDS ON MOVING PARTS			
CALIBRATED PSV INSTALLED ON DISCHARGE LINE *(Certificates for PSV)*			
FLAME ARRESTOR*			
ELCB (EARTH LEAKAGE CIRCUIT BREAKER)			
RATED FITTINGS & HOSE CONDITION			
EARTHING ARRANGEMENTS			
MOTOR / ENGINE (WEATHER PROOF / CABLE GLAND)			
TYRES TROLLEY CONDITION			
ANY OTHER HAZARD IDENTIFIED & EVALUATED			
2. RUNNING			
VIBRATION			
PLUNGER BOX (STUFFING BOX) LEAKS			
ABNORMAL SOUND			

	ACCEPTABLE		REMARKS
	YES	NO	
OIL LEAKAGE			
OBSERVATIONS (IF ENTRY REFUSED)			

CHECKED BY (Contractor Representative) Name / Sign:_____	**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

LEGEND

* REQUIRED FOR HAZARDEOUS AREA

FIRE EXTINGUISHER CHECKLIST

Equipment / Tag No. _____ **Type:** CO_2 DRY POWDERE OTHER

	ACCEPTABLE		REMARKS
	YES	NO	
GENERAL			
GENERAL CONDITION (DENTS / COOROSION OR PITTING)			
GAUGE PRESSURE			
OPERATING INSTRUCTION LABEL			
HOSE CONDITION			
DISCHARGE NOZZEL CONTROLLER			
SEAL ON LOCKING PIN			
LOCKING PIN			
FOR C02 FIRE EXTINGUISHER, CHECK WEIGHT			
THE WEIGHT SHOULD BE MARKED ON THE FIRE EXTINGUISHER BY THE MANUFACTURER			
ANY OTHER HAZARD IDENTIFIED & EVALUATED			
OBSERVATIONS (IF ENTRY REFUSED)			

	ACCEPTABLE		REMARKS
	YES	NO	
CHECKED BY (Contractor Representative) Name / Sign:_____			**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

MIXER MACHINE CHECKLIST

Equipment / Tag No. _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. STATIC			
DIESEL DRIVEN / MOTOR			
BUCKET & SLING CONDITION			
CHAIN TIGHTNESS			
TOW HOOKS			
TYRE CONDITION			
LOOSE PARTS			
FLAME ARRESTOR*			
GUARDS ON MOVING PARTS			
GEAR SHAFT CONDITION			
ELECTRICAL WIRING CONDITION			
ANY OTHER HAZARD IDENTIFIED & EVALUATED			
2. RUNNING			
ABNORMAL SOUND			
VIBRATION			
EXHAUST PIPE CONDITION			
OIL & WATER LEAKS			
BATTERY TERMINAL COVER			
OBSERVATIONS (IF ENTRY REFUSED)			

	ACCEPTABLE		REMARKS
	YES	NO	
CHECKED BY (Contractor Representative) Name / Sign:_____			**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

LEGEND

* REQUIRED FOR HAZARDEOUS AREA

LOADER / DOZER / GRADER / BACKHOE CHECKLIST

Equipment / Tag No. _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. STATIC			
CHAIN TRACK TIGHTNESS & CONDITION			
TOW HOOKS			
REVERSING ALARM (AUTO) / INDICATION LIGHTS			
REAR VIEW MIRROR			
TYRE CONDITION			
TIE ROD			
LOOSE PARTS (SECURE)			
FLAME ARRESTOR			
VALIDITY OF LICENSE			
SEAT BELTS			
BUCKET / BLADE & PLOUGH CONDITION			
FIRE EXTINGUISHER			
BATTERY CONDITION			
ELECTRICAL WIRING			
ANY OTHER HAZARDS IDENTIFIED & EVALUATED			
2. RUNNING			
ABNORMAL SOUND			
LIGHTS / INDICATORS			
HYDRAULIC SYTEM CONDITION			
BRAKES			
EXHAUST PIPE			
OIL AND WATER LEAKS			
VIBRATION			

	ACCEPTABLE		REMARKS
	YES	NO	
OBSERVATIONS (IF ENTRY REFUSED)			

CHECKED BY (Contractor Representative) Name / Sign:_____	**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

COMPRESSOR CHECKLIST

Equipment / Tag No. _____ Capacity / Rating: _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. STATIC MECHANICAL			
PRESSURE GAUGE			
PSV ON DISCHARGE LINE			
HOSE CONDITION			
EXTERNAL CONDITION FOR PRESSURE TANK CORROSION / DENTS			
TYRE CONDITION			
DRAIN VALVE ON PRESSURE TANK			
FLAME ARRESTOR (VISIBLE)			
GUARDS ON MOVING PARTS			
QUICK OPEN & CLOSE HOSE CLAMP WITH LOCK PIN / WHIP CHICK			
TOW HOOKS			
OVERALL CONDITION			
2. ELECTRICAL			
BATTERY WITH TERMINAL COVER			
CABLE CONDITION			
TERMINATION (LOOSE PARTS)			
PRESSURE SWITCH / UNLOADER			
MOTOR WITH OVERLOAD PROTECTION (IN CASE OF ELECTRICAL DRIVEN)			
MOTOR (WEATHER PROOF / CABLE GLAND)			

	ACCEPTABLE		REMARKS
	YES	NO	
3. RUNNING			
ABNORMAL SOUND			
VIBRATION			
OIL AND WATER LEAKS			
EXHAUST PIPE			
VERIFY LOADING & UNLOADING OF COMPRESSOR			
EMERGENCY SHUTDOWN SWITCHES			
OBSERVATIONS (IF ENTRY REFUSED)			

CHECKED BY (Contractor Representative) Name / Sign:_____	**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

TRACTOR / TROLLEY CHECKLIST

Equipment / Tag No. _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. STATIC			
TROLLEY / BLADE / PLOUGH CONDITION			
LINKS WITH TRACTOR ATTACHEMENTS (LOCK PIN)			
REAR VIEW MIRRIOR			
INDICATORS & LIGHTS			

	ACCEPTABLE		REMARKS
	YES	NO	
REVERSING ALARM (AUTO WORKING)			
TIE ROD (TOW) / AXLES			
TYRE CONDITION			
WIRING			
LOOSE PARTS (SECURED)			
HOOKS FOR SECURING LOAD			
BRAKES AND LIGHTS			
FLAME ARRESTOR			
VALIDITY OF LICENSE			
BATTERY TERMINAL WITH COVERS			
ANY OTHER HAZARD IDENTIFIED & EVALUATED			
2. RUNNING			
ABNORMAL SOUND			
STARTING SYSTEM			
OIL AND WATER LEAKS			
BRAKES			
HYDRAULIC SYSTEM			

OBSERVATIONS (IF ENTRY REFUSED)

CHECKED BY (Contractor Representative)

Name / Sign:_____

Approved By (KESC Representative)

Name / Sign:
_____

Approval Date:
_____

Valid up to:
_____

ELECTRICAL CONNECTION BOARDS / PANELS

Equipment / Tag No. _____

	ACCEPTABLE		REMARKS
	YES	NO	
GENERAL			
ELECTRIC BOARD CLOSABLE			
CABLE CONDITION (CABLE GLAND FOR CABLE ENTRY)			
NO JOINT / PROPER INSULATED LEAK PROOF			
SOCKET (THREE PIN / RECEPTACLE TYPE)			
LIGHTS FIXTURE (SHOULD BE ENCLOSED)			
EQUIPMENT GROUNDING			
BREAKER (REQUIRED AMPERAGE)			
ELCB (EARTH LEAKAGE CIRCUIT BREAKER)			
DOUBLE INSULATED			
COVERED WITH WOODEN BOX			
ANY OTHER HAZARD IDENTIFIED & EVALUATED			
OBSERVATIONS (IF ENTRY REFUSED)			

	ACCEPTABLE		REMARKS
	YES	NO	
CHECKED BY (Contractor Representative) Name / Sign:_____			**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

SIDE BOOM CHECKLIST

Equipment / Tag No. _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. STATIC			
THIRD PARTY CERTIFICATION OF EQUIPMENT / LOAD CHARTS			
HOOKS WITH SAFETY LATCH			
WIRE ROPE			
PULLEYS AND DRUMS			
AXLES			
TOW HOOKS			
SLING / SHACKLE & BELTS CONDITION / CERTIFICATION			
CHAIN TRACK CONDITION			
FLAME ARRESTOR			
COUNTER WEIGHT (DEAD WEIGHT)			
BOOM CONDITION			
BOOM LIMIT SWITH (ALARM)			
ROLLER (PIPE CRADLE)			
HYDRAULIC LEVER (FUNCTION & TESTING)ROLLER (PIPE CRADLE)			
BATTERY TERMINAL WITH COVERS			
LIGHTS & INDICATORS			
2. RUNNING			
ABNORMAL SOUND			
STARTING SYSTEM			
OIL AND WATER LEAKS			
EXHAUST PIPE			
HYDRAULIC SYSTEM / BRAKES / HOSE CONDITION			

	ACCEPTABLE		REMARKS
	YES	NO	
OBSERVATIONS (IF ENTRY REFUSED)			

CHECKED BY (Contractor Representative) Name / Sign:_____	**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

FORKLIFT CHECKLIST

Equipment / Tag No. _____

	ACCEPTABLE		REMARKS
	YES	NO	
1. STATIC			
THIRD PARTY CERTIFICATION OF EQUIPMENT / LOAD CHARTS			
SWL or WLL *(Clearly Marked and Visible)*			
FORK *(Condition, wear tear, deformation, cracks)*			
FORK SLIDING *(Condition)*			
CHAIN *(Condition of links)*			
FLAME ARRESTOR			
HYDRAULIC SYSTEM / JACK *(Condition, leakage, seepage)*			
LEVER *(Function testing)*			
TOW HOOKS / HITCH			
SEAT BELTS			
BRAKE SYSTEM			
TYRE CONDITION			
BATTERY TERMINAL WITH COVERS			
LIGHTS & INDICATORS			
2. RUNNING			
ABNORMAL SOUND			
STARTING SYSTEM			
OIL AND WATER LEAKS			
EXHAUST PIPE			
HYDRAULIC SYSTEM / BRAKES / HOSE CONDITION			

	ACCEPTABLE		REMARKS
	YES	NO	
OBSERVATIONS (IF ENTRY REFUSED)			

CHECKED BY (Contractor Representative) Name / Sign:_____	**Approved By** (KESC Representative) Name / Sign: _____ Approval Date: _____ Valid up to: _____

Environmental Impact Assessment

of

Erection of 220 kV KDA/Gulshan Transmission Line and Addition of Surjani Grid & Angle Tower at Malir Bridge

Final Report

July, 2014

global environmental management services

2nd Floor, Aiwan-e-Sanat, ST-4/2, Sector 23, Korangi Industrial Area, Karachi

Ph: (92-21) 35113804-5; Fax: (92-21) 35113806; Email: info@gems-intl.com