K-ELECTRIC
Energy That Moves Life

Final Report
July 2017

Environmental Impact Assessment (EIA)

220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station

EMC Pakistan Private Limited

Environmental Impact Assessment

220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station

Final Report
July 2017
Ref: EIA/04/07/17

EMC PAKISTAN PVT. LTD.
503, Anum Estate, Opp. Duty Free Shop, Main Shahrah-e-Faisal, Karachi.
Phones: 9221-34311466, 34324680, Fax: 9221-34311467.
E-mail: mail@emc.com.pk, info@emc.com.pk
Website: www.emc.com.pk

Disclaimer:

This report has Attorney – Client Privilege. EMC Pakistan Pvt. Ltd has prepared this report in accordance with the information provided by K-Electric for their sole and specific use. Any other person(s) who use any information contained herein do so at their own risk. This report cannot be used in the court of law for any negotiation or standardization.

Executive Summary

Environmental Impact Assessment is a tool for environmental conservation and has been identified as a key component in implementation of any new project. The relevant rules which support this statement are: Section 17 of Sindh Environmental Protection Act 2014 and other regulatory documents such as Sindh Environmental Protection Agency (Review of IEE/EIA) Regulations 2014. These regulations require that every new development project has to be preceded by an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) depending upon the magnitude of the severity of impacts anticipated at the time of commissioning and operations of the project.

In compliance of above laws, this EIA has been prepared; which presents the findings of the Environmental Impact Assessment (EIA) study carried out by EMC Pakistan Pvt. Limited for the proposed 220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station. The project has been studied and analyzed in detail.

New generated electric power from 450 MWs Engro Power Plant will be transmitted through proposed overhead & underground transmission line of about 38.25 km in length which terminates to a new Port Qasim Grid Station proposed under this project. The line route is planned keeping in mind the less possible right-of-way. All construction, commissioning and installation will be done according to KE Technical Provisions.

Total 95 lattice steel towers, 48 poles and 2 PLDPs will be erected to support the conductor wires. 2500mm2 Underground XLPE Cable (0.75km route length) and 2 x AAAC Greely Conductor (35.5km route length) are being used for Transmission Line.

Moreover, the addition of this circuit in Extra High Tension network will ensure the required degree of reliability for power system and enables the shift engineers and grid operators in easy and efficient management of load. The K-Electric consumers and especially the development in Malir will benefit after the energization of this Grid Station.

Underground transmission line will initiate from proposed Engro Power Plant, initially run along Port Qasim road and Lotte Chemicals Pakistan and transformed into overhead after 2km. The overhead transmission line will run along the Eastern industrial zone of PQA (UC Ghaghar) and intersect National highway N5 near Ghaghar Phattak and enter UC Gulshan-e-Hadeed. After covering a distance, it will turn right and intersect New Malir Housing Scheme-1 and Eastern Bypass. It will then enter agriculture areas located at the right bank of Malir River and end near Goth Haji Sheedi and connect via underground line to new Port Qasim Grid Station.

Objectives of the Project

Main objectives of the project are as follows:

- To transmit newly produced electricity from Engro Power Plant to New PQA GS; and
- To distribute this electricity to Malir and nearby newly developed and demanding areas.

Other Approvals

For underground TL, the start and end point 6.5ft. wide ROW will be obtained from PQA and Malir Development Authority (MDA) and for tower base, land acquisition will be done as per Telegraph Act, 1885.

Categorization of the Project

The Sindh Environmental Protection Agency (Review of IEE/EIA) Regulations, 2014 categorizes the project on the basis of nature and scope of the project. The project "220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station" falls in Schedule II requiring an EIA to be submitted to relevant Environmental Protection Agency, which in this case is Sindh Environmental Protection Agency (SEPA) and is given as:

- ✓ A. Energy
- ✓ Transmission Lines(11 kV and above) and Distribution projects

Collection of Data

To further study the project features, primary and secondary data is collected. Primary data is obtained through field data collection which includes observational surveys, monitoring and analysis of various environmental parameters, consultations and meetings for data collection from the neighboring communities etc. And, secondary data is collected from various sources such as internet, studies previously conducted in the project area and its neighborhood, in-house sources, Government Departments and NGO's etc. Furthermore, applicable international guidelines, conventions and environmental assessment procedures prepared by the SEPA have been consulted frequently while preparing this document.

Baseline

The physical, ecological and socio-economic environmental conditions of the microenvironment and macro environment of the project area have been studied in detail. Previous published and unpublished literature and other information were collected in order to gain a complete understanding of existing environmental and socioeconomic conditions in the area including the topography, geology, soils, water resources, ambient air, climate, flora and fauna, habitats within the proposed site and its surroundings, socio-economic conditions, infrastructure and land use; and any heritage aspects such as sites of cultural, archaeological or historical significance.

Physical Environment

The Ambient air quality was conducted at five locations in the macroenvironment by EMC Pakistan Pvt. Limited. Based on the result of the survey, the average values of NO2, NO and SO2 monitored in 5 locations exceeded the SEQS standards. It is due to the fact that a number of heavy vehicles such as large transport trailers and tank lorries passes the target section (as indicated also in the traffic survey) boosted the values. Exhaust fumes emitted by factories in the industrial areas also has an effect on boosting the values. On the other hand, values of CO, SPM, PM10 and PM2.5 were within the standards.

The noise level at the proposed project alignment at different locations on the average is 66 dB (A), shows that the average noise measurements of the survey is exceeding the limits of SEQS for residential areas due to the heavy wind blowing and heavy mass of traffic flow at National Highway.

Ecological Environment

Ecological surveys were conducted in and around the project alignment to check the current ecological status of the project site and its immediate surroundings. Few tree species found along the proposed route of TL which includes *Conocarpus erectus, Euphorbia caudicifolia Calotropis procera and Propis Juliflora. Conocarpus erectus* species are mainly found along the road islands.

Socio Economic Environment

The socio economic situations prevailing in the microenvironment of the project area, based on primary and secondary information were studied. The primary data was gathered through extensive field surveys, while various relevant sources were used for secondary data. 220kV double circuit transmission line is located in Malir District of Karachi Division. Moreover, as per the old administrative structure, the project site falls in Bin Qasim Town.

Impacts and Mitigation Measures

Potential environmental impacts that would result due to various activities performed in project area for 220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station during different phases such as design, construction, operation and maintenance are identified and mitigation measures have been suggested to reduce those impacts. The potential impacts expected to arise during construction phase are temporary and localized and last during construction phase. Some of the significant impacts of construction activities are i) Intrusion to sensitive receptors and Existing Infrastructure, ii) obstruction to movement of people/traffic, iii) deterioration of air & water quality due to temporary construction camp area, vii) construction waste handling and disposal, viii) deterioration of local air quality due to dust and vehicular emissions, ix) noise and vibration near the construction activity site, x) removal of trees/ plants during ROW clearance, xi) occupational health and safety, xii) traffic movement, congestion and diversion due to construction along the roads, xiii) impact on migratory bird flyway, and xiv) community health & safety. The potential impacts in operation phase will be minor in nature and will arise only during maintenance of the proposed transmission line project e.g. noise pollution, EMF, wind, fire and earthquake hazards, SF_6 release and vehicular emissions. The mitigation measures for these impacts are summarized in the Environmental Management Plan.

Conclusions and Recommendations

On the basis of the findings of the EIA Study, it is possible to conclude that:

- Construction and Operation of Transmission line will, on adoption of the mitigation measures, have no significant impact on the physical as well as socio-economic composition of the microenvironment and macro-environment of the project area;
- The likely impact of construction and operation of the Transmission line will be appropriately mitigated through proven technologies, careful planning and landscaping;
- The project is not likely to cause displacement of population, loss of business and annoyance to the living environment, or disturb the peace and tranquility of its surroundings;
- The project will meet the forecasted demand for energy due to extension of the project;
- The proposed 220 kV Supply Line after commissioning will become an integral part of the microenvironment and a friendly component of its macro environment.

Mitigation will be assured by a program of environmental monitoring conducted to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged. This will include observations on and off site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the EPA Sindh.

The study recommends and confirms that the proponent shall adopt all environmental management processes in full, as prescribed by the national and international laws and guidelines and given in the EIA document.

The study therefore recommends that the EIA report should be approved with the provision that the suggested mitigation measures will be adopted and the Environmental Management Plan will be followed in letter and spirit.

Environmental Management & Monitoring Plan (EMP)

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
Designing Phase							
Migratory bird flyways / Birds	Chance of Collision of Birds with the conductor string	• All suspension poles shall have detachable bird protection devices, over each suspension insulator string. • Bird flappers and deflectors will be installed on conductors to avoid collision of birds on strings.	CC	Check the bird protection devices are installed	Monthly / reported quarterly basis	CC/KE	Bird protection devices = Rs.400-500 per set
Temporary Construction Camps	Deterioration of air & water quality, and social impacts	• Camps are to be located away from residents/commercial activities to minimize nuisance; • Sanitation facilities in the camps if provided should be mobile and collect its wastewater or connected to the local sewerage system; • Bathing of construction crew should be prohibited at the camp as it will require large quantity of water as well as wastage.	CC	Consumption in liters / Construction sites/camps	Measured on daily basis / reported quarterly basis	CC/KE	Cost Sanitation facilities = Rs.3 lacs to 4 lacs per cabin
Excavation & backfilling of underground transmission line ROW may result in obstruction	Movement of People/Traffic	• Cables that cross main roads will be achieved through thrust boring under the road; and • The excavation and backfilling activities should be scheduled (skipping peak hours) to minimize the impact of obstruction to the movement of people and traffic.	CC	Traffic diversion sites, check access routes of pedestrians and construction sites / At ROW along the roads and footpaths	Monthly / reported quarterly basis	CC/KE	Cost of thrust boring will be evaluated and borne by CC
Contract clauses	Contractor may not perform the work in environmental friendly manner	• Construction Contractor/Waste Contractor shall be made responsible through contract documents for proper disposal of the spoil / excavated earth and not to dump these spoils/ earth near open plots / open spaces / open storm water drains / in front of residents or left unattended along the construction site. It should be disposed in KMC designated landfill site. • A proper site rehabilitation plan shall be made by the contractor include the spoil / excavated earth disposal arrangements • Contractors shall also be made responsible through contract documents to follow Sindh Environmental Quality Standards (SEQS) and applicable standards during all the construction operations and ensure compliance of the same through periodic environmental monitoring reports. • Contractors shall be made responsible through contract documents to follow Standard Practices and Standard Operating	KE				

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
		Procedures (SOPs) to ensure health & safety of workers at the site and public during all construction operations. • As the work is usually completed by contractors and sub-contractors, K-Electric should monitor their works to ensure proper task completion.					
Construction Phase							
Excavation, storage of soil and waste, generation of waste	Soil Erosion	• Construction activities should be scheduled to avoid runoff due to rain; • The dredged soil must be contained in an enclosure to reduce the chances of runoff during the seasons of precipitation; • Stock piles of fine material should be wetted or covered with tarpaulin especially during windy weather conditions; • Cut and fill should be balanced to the extent practical at each site in order to minimize the need for fill and for spoil disposal. Cut material should be used to level the site area or be disposed at designated spoil disposal sites; • Excess spoil should only be directed to designated disposal areas and temporary quarries; no disposal in waterways is allowed.	CC	Check any obstruction in existing drains due to construction, check lifting of waste material, check waste management plan / At construction site	Monthly / reported quarterly basis	CC/KE	Water Sprinkling Cost = Rs.3.0/gallon/ km Cost of enclosure and tarpaulin will be evaluated and borne by CC
Water Resources	Impact on Surface and ground water sources	• All excavated soil left after backfilling should be completely removed; • Debris and vegetation clogging culverts and drains should be regularly cleared; and • Soil runoff from the site leading to off-site contamination (particularly during rainy season) should not be allowed.	CC	Check drainage infrastructure / Construction sites near drainage infrastructure	Monthly / reported quarterly basis	CC/KE	Mitigation cost will be evaluated and borne by CC
Fuel, Oil & Chemical handling, storage and disposal	Soil contamination	• Spillage of oil and grease from the vehicles should be avoided. • Chemicals and oils should be stored in secure designated areas with temporary impermeable bunds at distance of at least 100 m from any water course; • Refueling, oil changing and engine maintenance of machinery, equipment and vehicles should be avoided at construction site; • Oil contaminated materials should be disposed at designated waste disposal facilities.	CC	Check contamination on the ground, check waste disposal / Vehicles/ machinery in working areas	Monthly / reported quarterly basis	CC/KE	Cost of preparing temporary bunds will be evaluated and borne by CC
Construction Waste Disposal	This waste has the potential to cause negative impact on	• A Comprehensive Waste management Plan for Construction phase should be developed;	CC	Domestic waste, Hazardous waste – Chemical waste,	Measured on daily basis and	CC/KE	Waste disposal cost will be

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
	the surroundings if not properly managed and disposed of. Irregular storage of this waste is hazardous to the workers at the site as well	• Construction sites should be equipped with temporary refuse bins, and construction wastes should be collected on a daily basis and contained in a temporary designated waste storage area on each site; • Designated waste storage areas should not be within 50 m of water ways; • Any hazardous waste should be separated and stored in areas clearly designated and labeled, and disposal in environmental friendly manner. • All type of waste should be routinely collected from the designated area and disposed at licensed waste disposal facilities approved by SEPA; and • Upon completion of activities at a construction site all solid wastes should be completely removed and the site should be re-contoured or prepared for natural re-vegetation.		electro waste, Paper and Polythene material waste and Wood / Collection, handling, storage areas and disposal	reported quarterly		evaluated by CC after selecting waste management contractor
Dust Emissions	Deterioration of local Air Quality	• Dust emissions from soil piles and aggregate storage stockpiles should be reduced by keeping the material wet by sprinkling water at appropriate frequency and erecting windshield walls on three sides of the piles; • It should be mandated by KE to Contractor to backfill the trenches/excavations after laying of the pipeline/tower foundations and rehabilitate the excavated area to its original position. If it is a road, the backfilling will be followed by levelling and carpeting of road with bitumen; • Vehicular movement should be restricted to a specific time for dumping of supplies and construction materials; and • Workers should wear dust masks and safety goggles, especially during dry and windy weather conditions to avoid health risk.	CC	SPM, PM_{10}, $PM_{2.5}$, SOx, NO, NO_2 and CO / Near Construction site (if several construction sites with a buffer distance of 5 km working consecutively or together, each site will be monitored at in a month)	Measured monthly for 12 working hours / reported quarterly basis	CC/KE	Rs.20,000 per site per month
Exhaust Emissions	Deterioration of local Air Quality	• All vehicles, generators and other equipment used during the construction will be properly tuned and maintained in good working condition in order to minimize emission of pollutants; • Emissions from the machinery and vehicles will be monitored on regular basis to ensure compliance of SEQS; • Excessive engine idling will be discouraged and machinery causing excessive pollution (i.e. visible clouds of smoke) will be banned from sites;	CC	Smoke, CO, Noise, NOx, PM, SO_2 / All construction vehicles	Measured monthly/ reported quarterly basis	CC/KE	Rs.15,000 per vehicle per month

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
		• Standby generators for power supply will be kept away from pathways and will be placed at locations where probabilities of human intervention are limited; and • The stack height of the generators used will be at least 3 m above the ground.					
Noise and Vibration	Construction activities are expected to produce noise levels in the range of 80 – 95 dB and may cause discomfort to local residents	• Machinery operation and high noise activities should be carefully planned and scheduled; • To the extent practical batching plants and construction areas should not be located within 500 meters of a settlement; • Where that is not possible, high noise activities should cease between 20:00 and 06:00 hrs at any construction site within 500 meters of a settlement, or if noise complaints are received from settlement residents. • Vehicles and machinery will be equipped with silencers. Contractors will be required to fit noise shields on high noise construction machinery; • Site labor working in high noise area such as where noise level exceeds 80 dB (A), will wear earplugs; • The stationary sources of noise such as concrete mixers, batching plant, power generators and pumps will be selected and segregated from work areas and residents; and • Occupational health, safety and environmental procedures and Environmental management plan for proposed project would be followed.	CC	Noise Intensity (dB) / Near Construction site (if several construction sites with a buffer distance of 5 km working consecutively or together, each site will be monitored at in a month)	Monthly / reported quarterly basis	CC/KE	Rs.5,000 per site per month
ROW Clearance	Impacts on Ecology (Flora and Fauna), cutting of trees	• Compensatory plantation shall be provided at a ratio of 1:3; • Selection of plants for landscaping should consider the habitat suitability, trees of national interest, flowering trees and shrubs; and • By using the best practice for vegetation clearing and disposal practices; will minimize the environmental risk associated with clearing and disturbance of vegetation communities.	CC	Check tree cutting, compensatory plantation, inventory of cleared trees / plants / At construction alignment	Monthly / reported quarterly basis	CC/KE	Rs.5,000 per tree planting
Safety Precautions for the Workers	The construction of civil works poses an inherent risk of injury to workers from accidents and	• Preventive and protective measures including modification, substitution, or elimination of hazardous conditions, with particular attention to live power lines, working at height, working above water, high noise levels, and exposure to chemicals will be made;	CC	Accidents, PPEs, Annoyance, Fire Hazards, Safety Protocols, Spill on	Continuous / reported quarterly basis	CC/KE	PPE cost will be borne by CC

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
	hazardous working environments. There may be either minor or major accidents due to different activities of construction phase	• Measures for the management and appropriate disposal of hazardous wastes will be undertaken to ensure protection of the workforce and the prevention and control of releases and accidents; • Appropriate fire extinguishers and fire response plans will be available at the site; • Appropriately stocked first-aid equipment and stations at both work sites and temporary construction camps, including appropriately trained first aid staff on site and adequate transport facilities for moving injured persons to the nearest hospital will be available; • Training for workers and appropriate incentives to use and comply with health and safety procedures and PPEs will be provided; • Procedures for documenting and reporting occupational accidents, diseases, and incidents; • Emergency prevention, preparedness, and response arrangements will be in place; • There will be strict safety requirements for personnel assigned to construction work; • To maintain safe conditions for the general public, all substations will be fenced and gated, that must be locked at all times; and • Appropriate signage will be posted that shows the owner of the substation, the hazardous nature of the substation and contact information.		Land and Spill on Water / All construction areas			Rs.12,000 per set of PPE
Traffic Movement near construction site	Traffic flow in the locality of project will slightly increase during construction activities of the project, which directly impact the traffic flow along the right of way of transmission lines and in the vicinity of grid station. This	• Traffic management plan will be developed and implemented during the construction phase; • Excavation near industries should be done during non-peak hours and the construction should be done in pieces near residential areas; • Construction activities will be scheduled to reduce the chances of traffic jams; • Adequate and appropriate road signs will be erected to warn road users along the ROW of transmission lines; • The movement of equipment (trucks) during the construction of the proposed project will be limited to 9:30 am - 4:30 pm per day;	CC	Traffic flow, timing of activities, near misses and injuries records and reporting / At crossroads and along transmission line Right of Way	Continuous / reported quarterly basis	CC/KE	Mitigation cost will be evaluated and borne by CC

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
	increase in traffic may congest the flow of traffic on eastern bypass, Dumlotee Road, National Highway (N5) and roads in Eastern Industrial Zone of PQA; and may cause some accidental injuries and deteriorate the air quality of ambient air.	• Raw materials for construction work will be adequately covered within the trucks to prevent any escaping into the air and along the roadway; • Vehicles will be maintained regularly to reduce the exhaust emissions; and • Any complain launched by community member will be responded and appropriate action will be taken to avoid it in future.					
Social Impacts	Community health & safety issues	• Emergency response plan should be prepared and implemented during entire phase of construction; • Procedures for interaction with local and regional emergency and health authorities should be made; • In order to minimize traffic congestion (if applicable), deliveries of materials and equipment should avoid peak traffic hours between 6:30-8:30 am and 3:30-4:30 pm; • Erection of towers and poles for the overhead TLs should be barricaded and crane movement should be assessed prior to the operation near the residential areas and communities; • It should be mandated by KE to Contractor to backfill the trenches in case of UG TLs after laying of the pipeline and rehabilitate the excavated area to its original position. If it is a road, the backfilling will be followed by levelling and carpeting of road with bitumen; • Proper lighting at night near trenches will be ensured; and • Diversions, danger points and works at culverts, bridges and construction sites will have appropriate warning signs; this is particularly important at night to avoid accidents	CC	Review of complaint register Local Consultations / Near Construction site	Monthly / reported quarterly basis	CC/KE	Mitigation cost will be evaluated and borne by CC
				Surface topography, Proper backfilling and carpeting / All excavated areas	Continuous / reported quarterly basis	CC/KE	Backfilling and carpeting cost will be evaluated and borne by CC
Operational and Maintenance Phase							
Wind, fire and earthquakes	Electricity arcing, poles and towers dislodgment	• Transmission support structures such as tower foundations have also been designed to withstand different combinations of	KE/CC	Regular maintenance of the protection system including	Monthly / reported quarterly basis	KE	Mitigation cost will be evaluated

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
		loading conditions including extreme winds that generally exceed earthquake loads • System protection features designed to safeguard the public and line protection systems will consist of Transmission Line relays and circuit breakers that are designed to rapidly detect faults and cut-off power to avoid shocks and fire hazards.		conductors and circuit breakers will be undertaken			and borne by KE
Human Exposure to Electromagnetic Fields (EMF)	Adverse health effects	• Undertake EMF monitoring as per KE predefined procedures.	KE	Electromagnetic Field (EMF) / Transmission line Corridor	Conducted and reported annually	KE	Rs.8,000 per site per year
Gaseous Emissions	Air pollution	• All vehicles, power generators and other equipment used during the maintenance work will be properly tuned and maintained in good working conditions in order to minimize emission of pollutants; and • Emissions from the machinery and vehicles will be monitored on regular basis to ensure compliance with SEQS.	KE	Smoke, CO, Noise, NOx, PM, SO_2 / All maintenance vehicles	During maintenance activities	KE	Rs.15,000 per vehicle
Solid Waste	The maintenance activities may generate some hazardous and non-hazardous waste such as wires and wild vegetation etc.	• Ensure that all solid waste collected during operational or maintenance work is disposed of in an appropriate disposal site in the locality.	KE	Waste collection and disposal records / Maintenance areas	During maintenance activities	KE	Waste disposal cost will be evaluated by KE based in the quantity and type
Sulfur Hexafluoride Gas (SF6)	GHG emissions, asphyxia in confined areas	• Ventilation of the areas concerned, in addition to permanent surveillance of the gas volumes, will help to eliminate the risk of SF6 accumulation outside the compartments • Ensure it is provided in sealed containers • SF6 handling and operational procedures shall be in accordance with KE SF6 Monitoring & Management procedure and in line with **IEC 60376**	KE	Check ventilation requirements in confined spaces where risk of SF6 leakage is there / Grid station site	Conducted and reported annually	KE	
Notes KE = K-Electric; CC = Construction Contractor; SEQS = Sindh Environmental Quality Standards; PM = Particulate Matter.							

TABLE OF CONTENTS

ANNEXURES

Chapter 1 Introduction

K-Electric intends to transmit the newly generated electricity from proposed 450 MW Engro Power Plant and connect it with proposed Port Qasim Grid Station and laying a combination of 220kV Double Circuit Overhead and underground transmission lines.

EMC Pakistan Pvt. Limited has been engaged by K-Electric to conduct the Environmental Impact Assessment of proposed 220 kV Double Circuit Transmission Line From 450 MW Engro Power Plant to New Port Qasim Grid Station, Karachi in order to comply with the provisions of Sindh Environmental Protection Act, 2014 and the Sindh EPA Review of IEE and EIA Regulations, 2014.

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

1.1 Project Developer Introduction

K- Electric Limited came under new management in 2008 and has gone on to bring about sustainable change throughout its organizational structure and compliance of HSEQ in all areas of its operations.

1.1.1 Vision

To restore and maintain pride in KE, Karachi and Pakistan.

1.1.2 Mission

Brightening lives by building the capacity to deliver uninterrupted, safe and affordable power to Karachiites.

1.1.3 Corporate Health, Safety, Environment and Quality

The company aims to maintain a high international standard to ensure quality, safety and reliability in its operations. . Training courses are conducted on a regular basis and staff is also provided training and networking opportunities within its five power plants in Karachi.

The Company's commitment to Environmental Sustainability is indicated by the Environmental Health & Safety Awards it has received over the years:

- 13th Award 2016 for 8th consecutive year.
- Runner up in ACCA WWF Best Environmental Performance Report Writing 2015 (latest).
- Winner of International EHS Award for category "Environmental Impact Assessment" 2015 and 2016.
- 3rd Position for Best Safety Practices, awarded by Employers Federation of Pakistan in collaboration with ILO, in the category of Oil, Gas and Energy held in 2014.
- "Fire & Safety Award 2013" for the 3rd consecutive year, awarded by NFEH and FPAP.
- OHSAS certification 18001-2007 for all generating stations.

1.1.4 Environmental Stewardship

K-Electric's Environmental Management System is ISO-14001 compliant, the international standard for environmental management. It complies with the Sindh Environmental Quality Standards of Pakistan for stack emissions and effluent discharge.

K-Electric is compliant with the IFC/ADB guidelines and also by the Sindh Environmental Quality Standards of Pakistan for Noise Pollution.

K-Electric has been recognized by Association of Chartered Certified Accountants (ACCA) ACCA- World Wildlife Fund (WWF) for its HSE practices.

1.1.5 Energy Conservation

K Electric has been recognized for the energy conservation measures undertaken at its plants and offices. K Electric received the Energy Leaders Award 2014 for Best Practices in Energy Conservation.

1.1.6 Corporate Social Responsibility

K Electric's commitment to CSR is demonstrated by the awards it has received over the years:

- 3rd consecutive CSR Business Excellence Award by the National Forum for Environment and Health (NFEH) in collaboration with Islamabad Chamber of Commerce and Industry (ICCI) and Federation of Pakistan Chambers of Commerce and Industry (FPCCI) at the 7th International CSR Summit.
- CSR Award for 2014 from NFEH in recognition of the utility's support to the education and youth platforms.
- Recognized for its 'Outstanding Corporate Volunteerism' by INJAZ Pakistan, over KE's involvement in the professional skills based mentoring programs.
- Level 'A' rating awarded for Sustainability Report by the Global Reporting Initiative.
- CSR Association of Pakistan – CSR Excellence Award 2012 for 'Innovation' and 'Sustainability Reporting'.
- International CSR Excellence Award 2012 organized by NFEH and UNEP for 'Community Service'.
- Certificates of Appreciation from Fatimid Foundation for overwhelming participation by K-Electric employees in blood donation drive.

1.2 Project Overview

The proposed project is of overhead & underground transmission line network of K-Electric of about 0.75km underground from Engro power plant, 35.5km overhead and 2km underground transmission lines to New port Qasim will be constructed in between above mentioned two locations.

The project is proposed to execute the transmission newly build electricity via new transmission line in order to transmit it from source of 450 MWs Engro Power Plant to demand side of the consumer at New port Qasim.

1.3 Project Location

Underground transmission line will initiate from proposed Engro Power Plant, initially run along port qasim road and Lotte Chemicals Pakistan and transformed into overhead after 2km. The overhead transmission line will run along the Eastern industrial zone of PQA (UC Ghaghar) and intersect National highway N5 near Ghaghar Phattak and enter UC Gulshan-e-Hadeed. After covering a distance, it will turn right and intersect New Malir Housing Scheme-1 and Eastern Bypass. It will then enter agriculture areas located at the right bank of Malir River and ends near Goth haji Sheedi and connects via underground line to new Port Qasim Grid Station. **Fig.1.1** shows the location map of proposed line route.

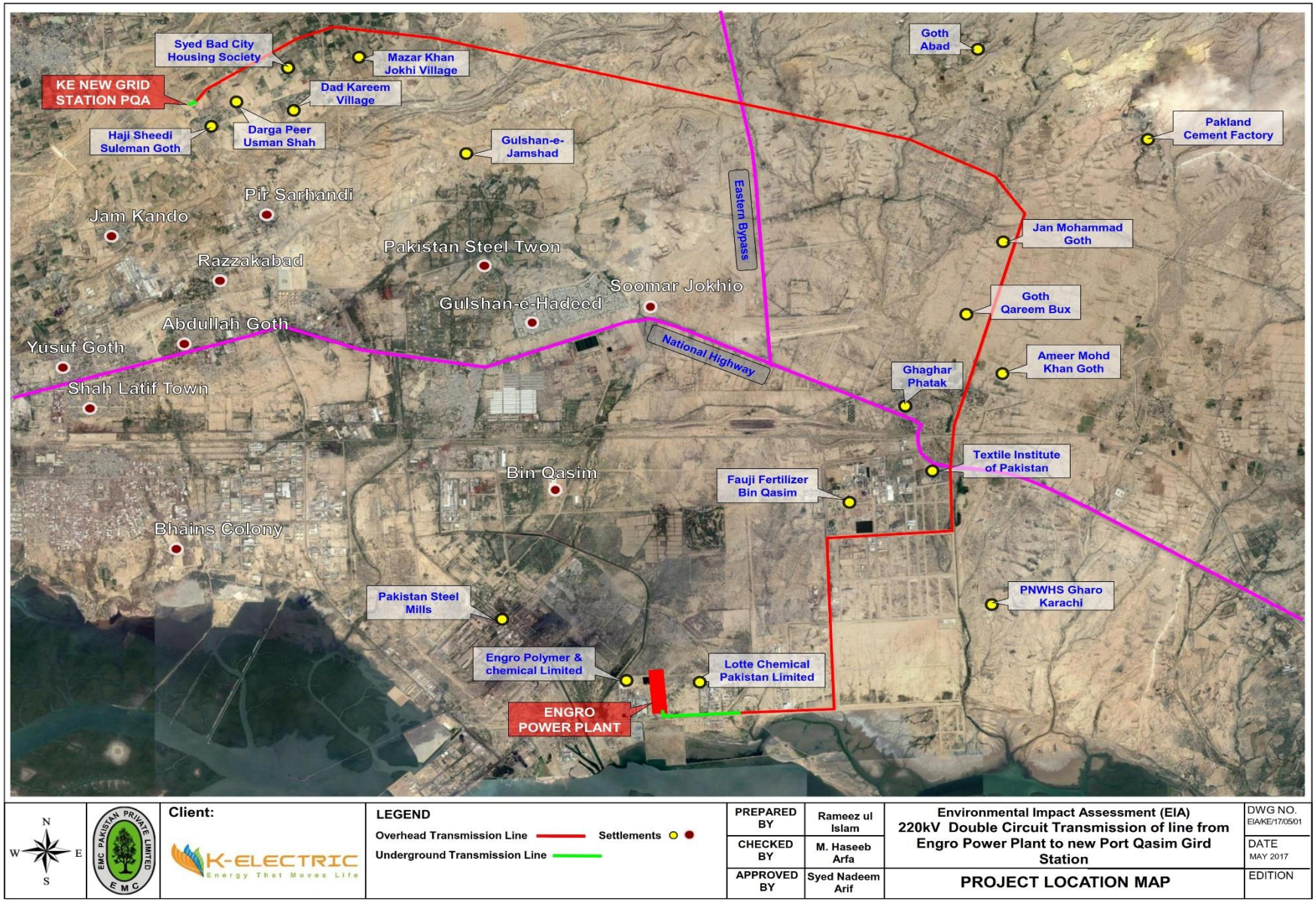


Fig. 1.1: Location map of the 220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station

1.4 Categorization of the Project

Sindh Environmental Protection Agency (Review of EIA/IEE) Regulations, 2014 notified under section 37 of SEPA, 2014 categorizes projects in two separate schedules which requires either an IEE (Schedule-I) or an EIA (Schedule-II) and according to this the proposed project falls in **Schedule II: A(4)** requiring an EIA.

✓ Transmission Lines(11 kV and above) and Distribution projects

1.5 Objectives of EIA

As stated by the United Nations Environment Programme's Division of Technology, Industry and Economics, an EIA is a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning and design, finding ways and means to reduce the adverse impacts, shaping projects to suit the local environment, and presenting options to decision-makers.

An EIA can bring about both environmental and economic benefits, such as reduction in costs and time taken for implementation and design of a project and lesser intervention of legalities and regulations. A properly conducted EIA lessens conflicts by promoting community participation, informs decision-makers, and helps lay the base for environmentally sound projects.

The main purpose of this EIA Study is to provide and analyze information on the nature and severity of environmental aspects and propose mitigation measures in case of negative impacts arising from the construction and operation of the project and related activities that would take place concurrently or subsequently. The EIA study will in fact respond to the provision of Sindh Environmental Protection Act 2014 and Guidelines for the Preparation and Review of Environmental Reports. The Study will:

- Identify all major and minor impacts, negative as well as positive, on the environment (physical and ecological) during its different stages viz. pre-construction, construction and operation of Project;
- Identify Socioeconomic aspects, and
- Devise Environmental Management& Monitoring Plan (EMMP) for sustainable operation of the Project.

1.6 Methodology Adopted for EIA

This environmental impact assessment was conducted in the following manner:

1.6.1 Scoping

A scoping exercise was undertaken to identify the potential issues that are to be considered in the environmental impact assessment. The scoping exercise included the following tasks:

- **Data Compilation**: A generic description of the proposed activities relevant to this environmental assessment was compiled with the help of the Project proponent.
- **Review of Published literature**: All available published and unpublished information pertaining to the micro and macro environment of the study area was obtained and reviewed. It included the earlier studies conducted in the study area, environmental and social baselines and impact assessment studies conducted by different consultants in past. Secondary data was very helpful in understanding the issues that were identified by other consultants.
- **Review of applicable Legislation**: Information on relevant legislations, regulations, guidelines, and standards was reviewed and compiled.

- **Identification of potential impacts**: The information collected in the above procedures was reviewed and potential environmental impactswere identified.
- **Initial site visit**: An initial site visit was conducted to get an overview of site conditions and the surrounding areas.
- **Stakeholder consultation**: A stakeholder consultation was undertaken to document the concerns of the local community and other stakeholders, and to identify issues that may require additional assessment in order to address these concerns.

1.6.2 Review of Legislation and Guidelines

National legislations, international agreements and environmental guidelines were reviewed to set environmental standards that The KE will be required to follow during construction & operation phase of the project. Sindh Environmental Protection Act 2014, SEPA (Review of IEE/EIA) regulations 2014, Guidelines for the Preparation and Review of Environmental Reports and IFC EHS Guidelines for Electric Power Transmission & Distribution were the basic guiding documents used during the study.

1.6.3 Baseline Data Collection

Baseline Data was collected from different sources including electronic and print media, studies previously conducted by EMC Pakistan Pvt. Limited and archives of the experts, consultations with institutions, Non-government Organizations (NGOs) and field surveys conducted for this study by the team of EMC Pakistan Pvt. Limited etc.

Primary Data Collection

The team comprising of environment specialists, ecologist and sociologist collected area specific primary data during site visits of the proposed project. A description of baseline data (physical, biological and socioeconomic conditions) of the proposed project is provided in this report.

Secondary Data Collection

Previous published and unpublished literature and other information were collected in order to gain a complete understanding of existing environmental conditions in the area including the following:

- **Physical environment**: Topography, geology, soil, water resources, ambient air, noise and climate;
- **Biological environment**: Flora and fauna within the proposed site and its surroundings;
- **Socio-economic environment**: Settlements, socio-economic conditions, infrastructure and land use; and
- **Heritage aspects**: Sites of cultural, archaeological or historical significance.

1.6.4 Identification of Aspects

Identification of environmental aspects and their significance is fundamentally important for determination of severity of incidence of impacts at different stages of the project. This step is aimed at obtaining an inventory of the aspects. The aspects identified during this step cover all activities like construction, installation and operation, in order to determine those which have or can have significant impact on the environment.

1.6.5 Impact Assessment & EMMP

Environmental experts at EMC Pakistan Pvt. Limited analyzed and assessed the anticipated impacts that are likely to arise due to the identified aspects. Potential impacts were evaluated using the environmental, ecological, socioeconomic, and project information collected. The impact assessment covers the following aspects:

- Potential change in environmental parameters likely to be affected by Project related activities;

- Prediction of potential impacts;
- Evaluation of the likelihood and significance of potential impacts;
- Defining of mitigation measures to reduce impacts to as low as reasonably practicable;
- Prediction of any residual impacts, including all long-term and short-term, direct and indirect, and beneficial and adverse impacts; and
- Monitoring of residual impacts.

An environmental management & monitoring plan (EMMP) was developed to oversee the environmental performance of the project, adoption of proposed mitigation measures, to monitor impacts of all activities and performance of mitigation measures and to identify the residual impact, and also the positive/negative changes in the physical, ecological, and socioeconomic environment.

1.6.6 Documentation & Review

This is the final step of the EIA study. The data generated during and for the study was compiled and examined by experts. Sections of this report were prepared as the study progressed, by consultation with experts. The report was finally reviewed by Team Leader, who analyzed the information, assessed the potential environmental impacts in the light of national and international guidelines, and examined the alternatives in the light of observations on the field as well as meetings with the stakeholders.

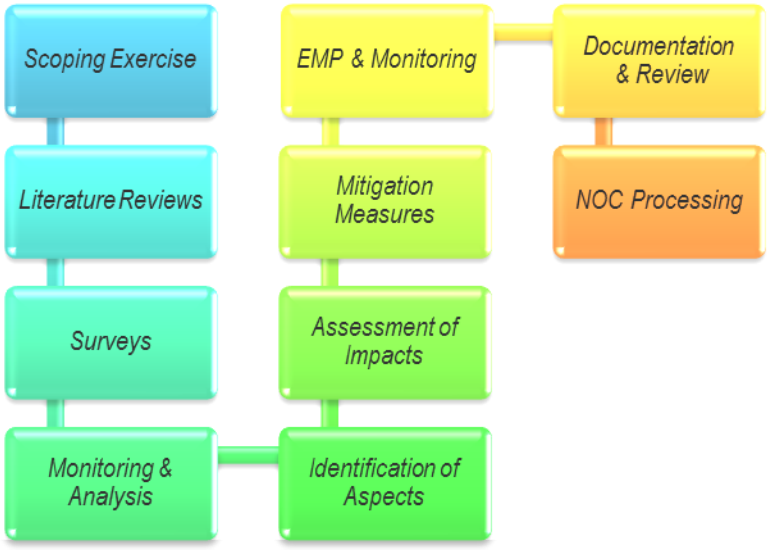


Fig. 1.2: EIA Methodology

1.7 Structure of the Report

This document is structured as follows:

- **Chapter 1:** Presents the background, objectives, scope and methodology adopted for the study;
- **Chapter 2:** Provides an overall description of project;
- **Chapter 3:** Describes the legislative and policy framework governing the project;
- **Chapter 4:** Provides environmental (Physical & Biological) and Social baseline conditions of the macro and microenvironment of the project area;
- **Chapter 5:** Summarizes the main concerns raised by stakeholders during consultations;

- **Chapter 6:** Provides analysis of different alternatives;
- **Chapter 7:** Screening of environmental impacts of the project and appropriate mitigation measures;
- **Chapter 8:** Provides an environmental management and monitoring plan (EMMP); and
- **Chapter 9:** Provides conclusions and recommendations.

The main text of the report is supported by a series of Annexure which provide supplementary information including respective sections of prominent provincial and national laws and guidelines.

1.8 EIA Study Team

EMC Pakistan Pvt. Limited has coordinated the following team for conducting the Environmental Impact Assessment (EIA) of the proposed 220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station.

Table 1.1: List of EIA Study Team

S. No.	Name of Experts	Position in EIA Team
1.	Mr. Syed Nadeem Arif	Project Manager
2.	Dr. Ali Ghalib	Flora and Fauna Expert
3.	Mr. Saquib Ejaz Hussain	Environmental Specialist
4.	Mr. Muhammad Haseeb	Environmental Specialist
5.	Ms. Zulekha Soorma	HSE Expert
6.	Mr. Khurram Shams	Sociologist
7.	Mr. Waqas Khan	HSE Coordinator
8.	Mr. Irfan Ali	Environmentalist
9.	Mr. Rameez ul Islam	AutoCAD Specialist

Chapter 2 Project description

2.1 Introduction

This chapter of EIA presents a brief overview of the project including objectives, location, scope, need, schedule and cost of the project. This chapter gives a clear picture of the project, its context and operations.

2.2 Overview of the project

New generated electric power from 450 MWs Engro Power Plant will be transmitted through proposed overhead & underground transmission line of about 38.25 km in length which terminates to a new Port Qasim Grid Station proposed under this project. The line route is planned keeping in mind the less possible right-of-way. All construction, commissioning and installation will be done according to KE Technical Provisions.

Total 95 lattice steel towers, 48 poles and 2 PLDPs will be erected to support the conductor wires. 2500mm^2 Underground XLPE Cable (0.75km route length) and 2 x AAAC Greely Conductor (35.5km route length) are being used for Transmission Line.

Moreover, the addition of this circuit in Extra High Tension network will ensure the required degree of reliability for power system and enables the shift engineers and grid operators in easy and efficient management of load. The K-Electric consumers and especially the development in Malir will benefit after the energization of this Grid Station.

2.3 Objectives of the project

Main objectives of the project are as follows:

- To transmit newly produced electricity from Engro Power Plant to New PQA GS; and
- To distribute this electricity to Malir and nearby newly developed and demanding areas.

2.4 Scope and need of the project

The scope of the project is to supply, laying, testing and commissioning of 220 kV, 2500mm^2 XLPE, double circuit line from 450 MWs Engro Power Plant to new PQA Grid Station.

Karachi has a wide network of power transmission but the standards and conditions of the power transmission system are inadequate to meet rapidly growing demand of electrical power. This situation limits the national development and economic growth. To cope with the constraints, the existing power transmission infrastructure has been proposed to be improved and upgraded in proposed System Stabilization, Rehabilitation and Loss Reduction Programme. This program will enhance the customer service, improve power supply reliability, and strengthen health, safety and environmental management system. Nowadays power systems are complicated networks. They have several generating stations and load centers that are interconnected through power transmission lines. Generation facilities should have the capacity to produce required power to meet the customer demand. Bulk power generated must be transported through best transmission systems over a long distance without overheating or jeopardizing system stability.

2.5 Project Location

Underground transmission line will initiate from proposed Engro Power Plant, initially run along Port Qasim road and Lotte Chemicals Pakistan and transformed into overhead after 2km. The overhead transmission line will run along the Eastern industrial zone of PQA (UC Ghaghar) and intersect National highway N5 near Ghaghar Phattak and enter UC Gulshan-e-Hadeed. After covering a distance, it will turn right and intersect New Malir Housing Scheme-1 and Eastern Bypass. It will then enter agriculture areas located at the right bank of Malir River and ends near Goth haji Sheedi and connects via underground line to new Port Qasim Grid Station. The proposed route plan of the 220kV Supply line is as shown in **Fig. 2.1**.

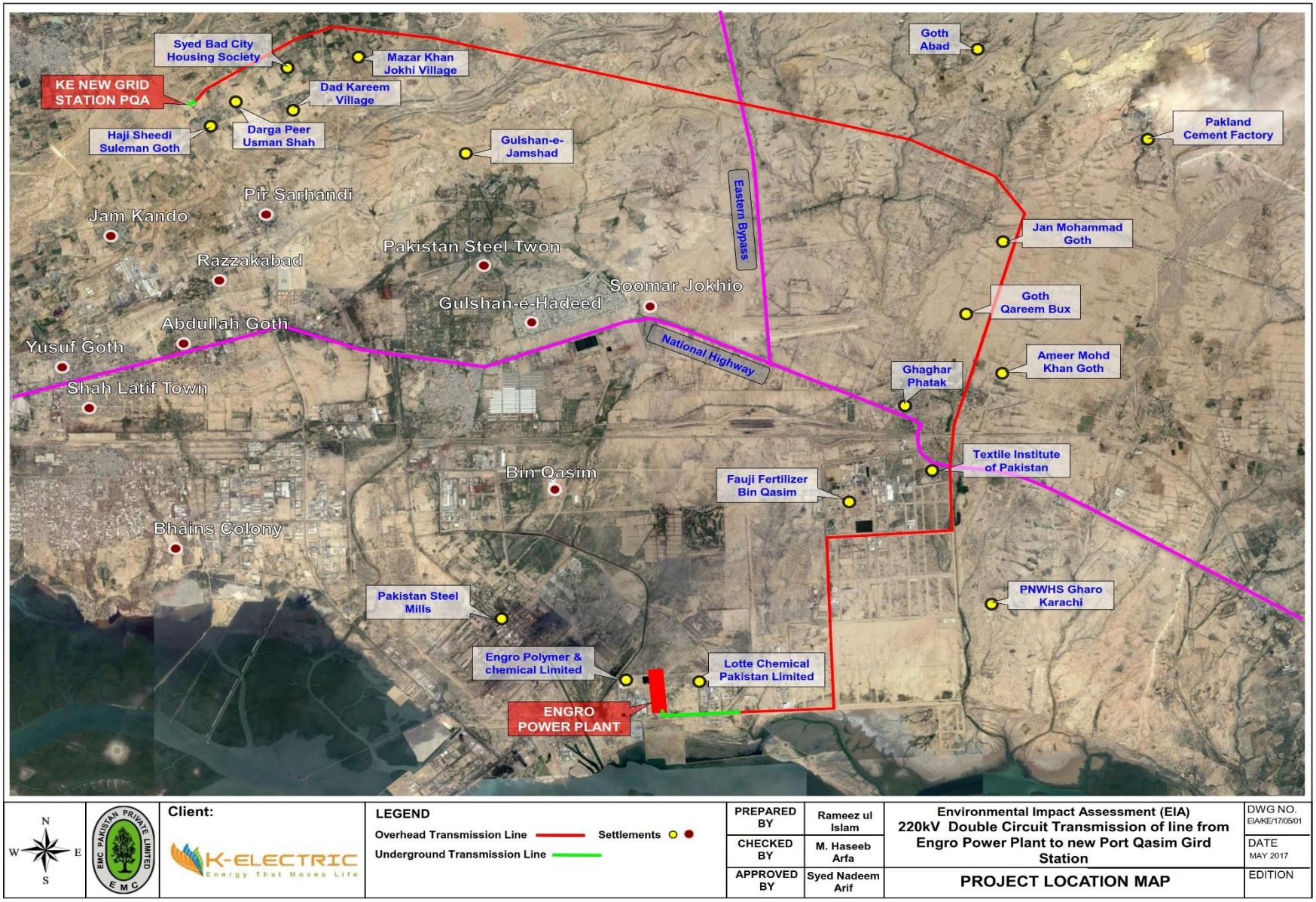


Fig. 2.1: Location map of the 220 kV Double Circuit TL from 450 MW Engro Power Plant to New Port Qasim GS

2.6 Technical Details of Project

An overhead transmission line is a traditional method of supplying electricity from one end to another, in which line is suspended by means of towers and poles. Since large portion of transmission line is overhead so this type of transmitting method is low-cost method for transmission sector as compared to underground transmission, therefore large quantities of electric energy is being supplied using this method where air plays an important role in providing most of the insulation to overhead power line. Mostly two types of towers (lattice structure or tubular poles) are used to support the line. Commonly Aluminum made (either plain or reinforced with steel or sometimes composite materials) bare wire conductors are used in the overhead line, but sometimes copper material is also used in the overhead line depending upon the voltage distribution, voltage connections and customer premises.

Electric power will be generated and transmitted through newly build overhead & underground transmission line of about 38.25 km from 450 MWs Engro Power Plant to New port Qasim Gird Station Karachi. The line route is planned keeping in mind the less possible right-of-way section for the line. All construction, commissioning and installation will be done according to K.E Technical Procedure (TP).Technical Provision can be seen in in the following sections.

The Transmission Line Process Diagram is as follows;

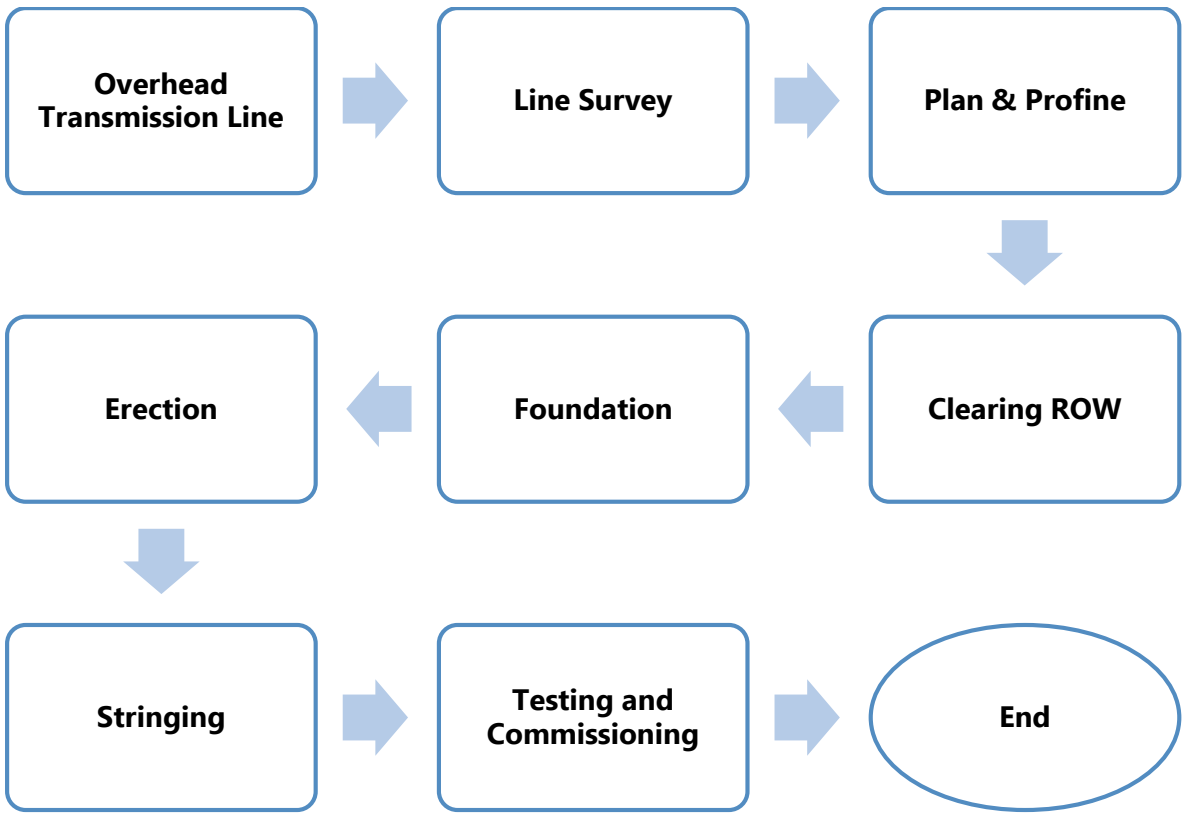


Fig. 2.1: Overhead Transmission Line Process Diagram

2.6.1 Line Survey

It has been clearly mentioned in the Bill of Quantity (BOQ) mentioning the person responsible for the line survey. Initially a line survey is carried out to have a clear picture about the road map of the transmission line. Preliminary survey is done to understand the terrain and direction of the line from start point to end point.

As the survey is carried of preliminary stage no quality standards are required. Follow up of safety precautions are necessary to avoid any incident. While carrying out the line survey it is to be clearly taken in mind that the route is to be selected carrying minimum right of way.

2.6.2 Plan & Profile

Responsibility of Plan & Profile is clearly mentioned in the BOQ. It is the second stage of the survey of the proposed line. This survey carries out all the detail information about the line; including terrain of the land, tower types, number of towers, wind speed, span distance, tower height, etc.

The important thing to remember while doing survey for plan and profile is that minor changes in the initial line are acceptable but a person responsible for profile should not totally alter the line at any cost. But if the matter cannot be resolved preemptive measures are to be taken and client has to be taken in to full confidence before taking any decisions.

All the quality standards are to be followed and safety of the equipment and personnel is to be given prime importance. Personal Protective Equipment (PPE) should be used necessary for the desired locations. Due to suburb area away from the main facilities basic necessities are to be carried in order to face the hazards in case of emergency (ICE) situation. The basic facilities include; drinking water, first aid box.

2.6.3 Technical Specification Overhead Transmission line

Design

This section of the Specification shall cover the design and design parameters for the construction of the overhead lines.

1. Design Spans

The design of all towers shall provide for the basic, wind and weight spans.

i. The term basic span shall mean the horizontal distance between centers of adjacent supports on level ground from which the height of standard supports is derived with the specified conductor clearances to ground in still air at maximum temperature.
ii. The term wind span shall mean half the sum of adjacent horizontal span length supported on any one tower.
iii. The term weight span shall mean the length of conductor, the weight of which is supported at any tower at minimum temperature in still air. At suspension position, the minimum weight of conductor support shall not be less than 25% of the total weight of conductor in the two adjacent spans.
iv. The terms maximum span shall mean the maximum single span for which the distances between the conductors are designed.

For all 220kV & 132kV Tubular towers & all alternative lattice towers in place of tubular towers, weight span, wind span & basic span should be 300m.

2. Design Loads

The design shall be based on the following considerations:

1. Normal Conditions

a. Vertical loads (V): consisting of:

- Weight produced by the effective portion of the adjacent conductors and earth wire spans.
- Weight of insulator strings and lineman with tackles

b. Transverse loads (T) consisting of:

- Wind loads produced by the effective portion of the adjacent conductor and earth wire spans
- Wind loads pulls corresponding to type of towers

b. Longitudinal loads (L)

Longitudinal loads are the resultant forces produced by the maximum tension of conductors or earth wire in the direction perpendicular to cross arms.

2. Broken wire conditions (Abnormal conditions)

a. Suspension tower

- A1 - Any two phases of one circuit broken (No wind)
- A2 - Any one phase and earth wire broken (No wind)

b. Angle Tension tower

- B1 - Three phases of one circuit broken (No wind)

c. Terminal tower (Dead end) tower

- C1 - Three phases of one circuit and earth wire strung (No wind) (No load will be assumed on the slack span side)

d. Vertical loads (V) consisting of;

- 50% of weight produced by the effective portion of the adjacent conductor and earth wire spans
- Weight of the insulator strings and line man with tackles

e. Transverse loads (T)

- To be calculated with following formula (80 m + 60% of wind Span) x wind load per m. of conductor + wind load on insulators.
- 50% of normal condition for maximum angle pulls.

f. Longitudinal Loads (L)

- 50% of the maximum working tension of all conductors comprising one phase or 100% maximum tension of earth wire for suspension towers.
- 100% of maximum working tension of conductors or earth wire for angle, tension and terminal towers.

The decrease of the vertical and transverse loads above refers only to phases where conductors are broken.

Towers shall be designed so that all members will withstand normal and broken wire conditions with safety factors as specified in the document. The total loading for the tower shall include the dead weight of the tower plus transverse wind load on tower plus the simultaneous application of loading as specified above for each tower type. Wind loads on tower leg extension shall be taken into consideration. Terminal towers shall be designed to face the direction of the incoming line, and shall withstand the load of all conductors and earth wire(s).

Design of all RCC structures along with complete drawings shall be submitted by the contractor after vetting through a renowned and approved structural consultant, for approval from KE.

3. Standards

The work to be performed by the Contractor shall strictly comply with the clauses, and Schedules of these Specifications. If standards/particular requirements are not specified, the work shall comply with International or National Standards acceptable to K-Electric.

When equipment/material offered does not comply with the Specifications the specific exceptions thereto shall be stated at the time of the Bidding.

The Owner reserves the right to ask the Contractor to provide an English translation at no extra cost to the Contract of all the major standards upon which the Bid is based and subsequently the Contractor shall provide one copy in English when so requested.

Towers

1. General

i. Self-supporting lattice type towers shall be used throughout the entire route, where access is obstructed to transportation of tubular poles and erection cranes.
ii. All gantries shall be steel lattice type structures.

Steel lattice towers shall be square-base type. The members of lattice steel structure shall be hot rolled steel angle sections, and plates. All tower material shall be factory made and entirely galvanized by the hot dip process. The tower should have minimum service life of guaranteed 30 years with satisfactory operation. Contractor will provide the guarantee.

All material shall be tested at the steel mill in accordance with the applicable specification and standards under which they are manufactured. The Contractor shall supply the Owner with all certified mill tests. Tests shall be conducted in accordance with DIN Regulations or their equivalent. The tests to be conducted shall include, but are not limited to, uniformity of galvanizing coating, mechanical and chemical properties of all steel and additional embrittlement tests on high strength steel.

2. Types of Towers (Steel lattice towers)

The towers shall be designed that their heights may be extended or reduced at suitable intervals (preferably in accordance with already in practice in Owner's system). An extended or reduced tower shall be denoted by the addition of the height of extension or reduction to its basic designation. For the use of steeply sloped ground basic and extended towers shall be designed with different leg extensions, without reducing the specified factors of safety in any

manner, to compensate for variations in topography. The Contractor shall determine the definitive requirements during tower site survey and supply all leg extensions required.

For the installation of joint Box for OPGW, the contractor shall provide two bolt holes near the top of each tower. The exact size and locations of these holes shall be agreed between the contractor and KE during approval of tower drawings.

3. Material (Steel lattice towers)

Material for the steel towers shall be of the type and grade most suitable for the application intended and shall conform to the latest applicable standard, specifications and recommended practices of the industry. Mild steel and high strength steel shall be used for the fabrication of redundant members and stress bearing members of the towers. Only high strength tower bolts shall be used. All bolts shall be of the same strength.

The quality of steel to be used for the fabrication of the towers shall at least correspond with the requirements or such other standards as may be approved. The steel to be used shall be of a quality that will not have its physical properties changed by hot-dip galvanizing.

4. Design (Steel lattice towers)

he unit stresses in members and connections for the structural design calculation for the design loadings and design unbalanced loadings (broken wire conditions) multiplied by safety factor shall not exceed specified values. The towers shall be designed with an overload capacity (factor of safety) for normal design loads and for unbalanced design loads (broken wire conditions) as specified. No damage or permanent distortion of any members, bolts, and connections of fittings or elongations of bolts holes shall be permitted for these design conditions.

The slenderness ratios (L/R) of members shall not be exceeded as specified. "L" is unsupported length of member, and "R" is the corresponding radius of gyration of the members to their loading positions.

Each member whose longitudinal axis makes an angle less than 45 degrees with the horizontal shall be of sufficient section to withstand independently of all other loadings a concentrated load of 1000 N applied normal to the longitudinal axis at any point along with length.

For calculation of stresses in compression members reference is made to the "Guide for Design of Steel Transmission Towers of American Society of Civil Engineers" and to German Standard VDE 0210. Other approved, calculation methods may be applied according to the Standards specified.

The Contractor shall submit the stress analysis calculation for tower member of all tower types. An explanation shall be submitted with computer calculation.

5. Construction (Steel lattice towers)

The towers shall be of standard construction and shall be designed to reduce the number of different parts to a minimum, thus facilitating transport and erection. The minimum thickness for legs and compression members in cross arms and in earth wire peaks, gusset plates etc. shall not be less than as indicated. Stub angles shall be at least 2 mm thicker than the attached steel leg angle. Maximum width of the steel leg angle: 16 times the thickness of this steel leg angle. Tilted steel angles, flat and rods shall not be used for tower members.

The diameter of bolt holes for all types of towers shall not be more than 1.5 mm larger than the nominal diameter of the bolt. All members of the towers shall be connected by bolts. Connections of members shall be designed to avoid eccentricity as much as possible.

6. Bolts and Nuts

The diameter of all bolts for the connection of tower parts shall not be less than as indicated in accordance with metric thread (coarse) standard.

The length of bolts and the length of threads shall be such that bearing is upon the shank and not up the threads.

Bolts shall have hexagonal head and hexagonal nuts. Bolts and nuts shall be of high tensile steel. All nuts shall be secured by use of helical spring lock washers. Threads before galvanising shall be coarse thread. There shall be no excess of galvanizing at the root of the thread and nuts shall turn easily on the completed bolts without excessive looseness. Nut thread shall be taped after galvanizing so as to produce a finger-free fit on the galvanizing bolts.

7. Conductor Attachments

Conductor attachments shall be provided as required by their respective towers and all brackets shall be considered as part of their respective basic towers and shall be supplied as integral parts of them. Suspension towers shall 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.

8. Anti-climbing and Steps (Steel lattice towers)

Each tower shall be fitted with an anti-climbing device to prevent unauthorized persons from climbing the tower. The anti-climbing device shall be the spiked type or other approved type, and shall be fixed at a height not less than 3 meters above ground.

Step bolts shall be provided on one leg for each tower. They shall begin as near the base as practicable and continue to the top and they shall be spaced on alternate faces of the leg angles at approximately 40 cm centre. After erection all step bolts shall be at least 20 mm in diameter, 20 cm long, appropriately headed, and uniform for all towers.

9. Workmanship

All work shall be equal to the best modern practice in the manufacture and fabrication of materials covered by these Specifications. The Contractor shall be responsible for the correct fitting of all parts, shall replace free of cost any defective materials discovered during erection and pay all costs of field corrections for such replacements. All parts of the structures shall be neatly finished and free from kinks, twists or bends. All holes shall be made with sharp tools and shall be without torn or ragged edge. The fabrication shall be in strict accordance with the shop drawings prepared by the Contractor and approved by the Owner.

Structural material shall be straight and cleaned of all rust and dirt before laid out or worked in any manner. Shearing and cutting shall be performed carefully. Manually guided cutting torches shall not be used.

All bolt holes in steel members shall be punched, sub punched, reamed or drilled before galvanising. Holes shall be drilled instead of being punched if the thickness of the metal exceeds the diameter of the hole. All holes shall be clean-cut and without torn or ragged edges. All holes shall be cylindrical and perpendicular to the member.

The diameter of the finished bolt hole shall not be greater than the normal diameter of the bolt plus 1.5 mm. Plugging, welding or slotting of mispunched, mis-reamed or mis-drilled holes will not be permitted. The holes shall be located accurately so that when the members are in position the holes will be lined up before being bolted.

10. Galvanizing

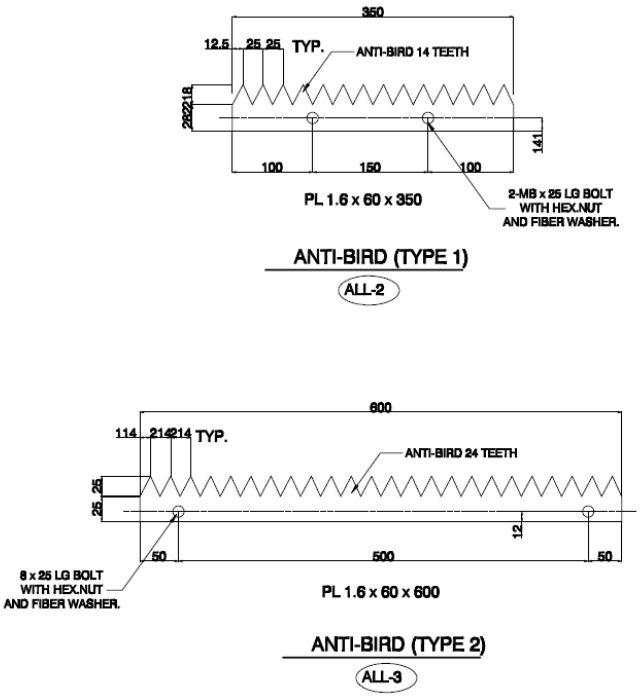
After the shop work has been completed, all material shall be cleaned and then, including bolts, nuts and washers, hot-dip galvanized. The zinc coating for tower members shall be at least 610 gr/m². gram/m². Where members are of such length that they cannot be dipped in one operation, great care shall be exercised to prevent warping. All holes in materials shall be free of excess spelter after galvanizing. All materials shall be safeguarded against embrittlement during galvanizing. The zinc coating shall be of uniform thickness and so applied that it will adhere to the surface of the steel. Major damage to galvanizing shall be cause for rejection. Material on which galvanizing has been damaged shall be re-dipped unless the damage is minor and local and can be repaired by applying galvanizing repair paint. All towers shall be painted as stipulated in painting specifications.

11. Plates

Weather-resisting enamel coated aluminium alloy plates shall be supplied as number and circuit plates. The plate for danger signs shall depict in red a skull with cross bones. The text DANGER shall be boldly written in red in letters as shown in the drawing. Lettering and size of the plates shall be to the Owner's requirements and generally as indicated on the Bidding Document drawings.

12. Anti-Bird Devices

All suspension towers and tension towers having jumper insulator strings shall be provided with anti- bird devices on each cross arm over insulator strings. The anti-bird devices shall be spike type galvanized and fitted with bolts and nuts.



Anti-bird devices types

Insulators and Fittings

1. Insulator Units

Insulators shall be long-rod insulators/disc insulators with aerodynamic and self-cleaning shape suitable for desert and desert-like conditions with alternating large/small diameter (if porcelain) sheds. The design must ensure that the shape of the insulator should mostly exclude a critical reduction of the creepage distance as a result of accumulation of dust and sand. Therefore, the surface must be smooth and under ribs are not accepted. The ratio of shed spacing to shed protrusion shall be larger than 0.65. The insulators shall have a minimum specific creepage distance of 45 mm/kV (phase-to-phase operating voltage).

i. For 132 kV lines, two long rod units shall be used in one string, in case of porcelain long-rod insulators.
ii. For 220 KV lines, three long rod units shall be used in one string, in case of porcelain long rod insulators.

Safety factor for insulator mechanical strength shall be minimum 3.5.

Two important tests of the insulator strings shall be carried out in a reputable laboratory.

i. Electro-Mechanical test with corresponding short-circuit current at 132 kV/220 KV strings (IEC-575).
ii. Artificial pollution test of an insulator string for both 132 kV /220 KV lines.

These tests shall be carried out together with insulator supplier. The costs of these tests shall be separately quoted by the insulator supplier. If any such tests were performed by the supplier previously, for identical insulators, the certified test reports will be enough for evaluation.

2. Porcelain Insulators

All porcelain shall be sound, free from defects and thoroughly verified. The glaze shall be smooth, hard, of a uniform shade and shall cover completely all exposed parts of the insulator. Insulator and fittings shall be unaffected by atmospheric conditions due to weather, proximity to the coast, fumes, ozone, acids, alkalis, dust or rapid changes of air temperature under working conditions. The insulators must be made of high-strength alumina porcelain and the physical characteristics of the porcelain shall comply with KER 110.2 of Standard DIN 40685, brown-glazed.

Long rod insulators shall comply with the specifications indicated in the Standards DIN 40680, sheet 1 and sheet 2, DIN 40686, sheet 1, DIN 40685.

Only those suppliers who have experience on an industrial scale in connection with alumina porcelain will be approved.

3 Metal Components

All ferrous metal components except those of stainless steel shall be hot dipped galvanized to give an average coating of 150 micro meter with surface decarbonizing method.

End caps shall be made of malleable cast iron and shall be of the clevis type. The pins shall be made of stainless steel or other suitable material of such quality that the unit shall comply with these Specifications. Pins and caps shall be of such design that they do not yield or distort under the specific mechanical loadings in such a manner as to add undue stresses to the porcelain.

4. Cement

Cement used in the construction of an insulator shall not fracture by virtue of expansion, or loosen by contraction, and proper care shall be taken to locate the individual parts correctly during cementing. The cement shall not give rise to chemical reaction with metal fittings and its thickness shall be as uniform as possible. Portland cement or a special lead antimony alloy has to be applied.

5. Insulator Fittings

All tower and conductor attachment hardware such as ball eyes, clevises, yokes plates, D-shackles, extension links, dead end bodies, jumper terminals etc. and arcing rings shall be supplied as required as part of the insulator strings. All ferrous parts shall be hot-dip galvanized. The zinc coating shall average 150 micron thick by utilizing surface de-carbonizing method. The utilizable height of tower - height of the tower from ground level to the attachment of lowest conductor is nominal as it does not take into account all forms of line fittings that could possibly reduce this height. The Contractor shall choose this line fittings and clamps so that this utilizable height is not reduced by more than 30 cm.

When selecting insulator string fittings, hot line maintenance shall be considered. The design of all conductor fittings and accessories shall avoid sharp corners or projections, which would produce high electrical stress in normal working. The design of the adjacent metal parts and mating surfaces shall be such as to avoid corrosion of the contact surfaces and to maintain good electrical contact under service conditions.

Arcing devices at line side and intermediate shall be designed to withstand a force of 1000 N, applied to the tip. Arcing accessories used in insulator strings shall, in principle, meet two requirements:

i. Protection of the insulant against intensive thermal radiation of the arc plasma.
ii. Improvement respectively homogenizing of the electric field around the live end of the insulator string.

Both requirements are met by the following design characteristics of accessories and strings:

i. The arcing accessory shall ring the metallic cap at the insulator end (transfer of the arc root subsequent to flash-overdue to dirt accumulation).
ii. The arc root shall be subject to unilateral short-circuit current supply at any point of the accessory (arc root shall safely and quickly be driven to the final burning point).
iii. The final burning point shall be so designed that the reflection to the insulant is kept to a low level (shielding effect). The inevitable consumption at the final burning point must not impair appreciably the performance of accessory (final burning point designed as a ball). The shortest possible distance between final burning point and insulant with respect to current intensity and duration of radiation shall be determined in a way that no thermal damage to the insulant may occur. The plasma jet at the final burning point shall emerge about vertically to the insulator axis and burn down stably without pendulum motions. The arcing accessory shall be provided with one final burning point only. The metal loss at the final burning point (arcing horn or ball) shall not exceed 2 cm for the maximum short circuit current specified in Schedule A1.
iv. The arcing accessory shall be made from solid material of small diameter. It shall be avoided that the arc root be supplied over a larger area (high moving speed of arc root).
v. Electrodes shall be made from steel (low consumption, poor thermal conductivity). Aluminum or aluminum alloys are not admissible high consumption related with considerable pollution of insulant).
vi. The maximum admissible temperature of the fittings with respect to the zinc coating and the hardness decrease of the material of fittings must not exceed 400 C. (This requirement is met at a short-circuit current density of 70 A/mm2 during 1 second.)
vii. The attachment of the arcing accessory to the respective string element shall be designed in such a manner that a contact force of at least 40kN can be applied and that any welding be produced during short-circuit which may impair the performance.
viii. The dimensions of arcing accessories shall be adapted to the used insulator types, the thermal and dynamical stresses and to the maximum service voltage.
ix. On long rod insulator strings, in principle, each string end must be provided with an arcing accessory; the use of intermediate arcing accessories is imperative on multiple insulator strings.
x. Audible discharges on the arcing accessory at the live end of insulator string must not occur at maximum service voltage.
xi. Arcing accessories must be hot dip galvanized to protect accessory against corrosion.
xii. The manufacturer shall be bound to prove the thermal and electrical performance of arcing accessories.

6. Insulator Strings

The complete suspension and tension strings with all clamps, fittings, and arcing rings shall have the mechanical and electrical characteristics as stated in.

The insulator strings shall also be capable of withstanding the mechanical loads applied by the required conductor working tensions, wind spans and weight spans and in addition the wind on the insulator string and the weight of the insulator string itself and the weight of the line-man with tackles when multiplied by the factors of safety specified in the Schedule. All insulator strings shall be attached to cross arms by means of shackles. Hooks shall not be used.

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.

Long rod insulator/disc insulator sets shall have open arcing rings with one final burning point (horn or ball) at both earth and live ends.

The yoke assemblies located between the insulator strings and the conductor shall be capable of transferring the static tensile load acting on the string uniformly to the two or three insulator strings as well as to the particular conductor.

Double tension or suspension insulator strings shall withstand dynamic loadings as follows. The load during rupture of insulator from the initial state up to the quiescent state shall be displaced in such a manner that no rupture will occur on the second insulator string. The yoke assembly adjacent to the conductor shall be capable of weakening the dynamic motions and to reduce peak loads that may cause damage to the insulators.

Electrical insulation level must remain unchanged if one string is lost due to break.

A minimum extension of yoke assembly subsequent to the rupture shall be ensured (displacement of tension clamps into the span).

The performance of the yoke assembly shall be proven by calculation or test. The arising insulator stresses must not exceed a harmful stress level. The yoke assemblies shall be capable of coping with the anticipated static and dynamic stresses.

All split pins for securing the attachment of fittings of insulator sets shall be of stainless steel and shall be backed by washers. Plated split pins shall not be used. The pins connecting the Long rod insulators shall be of stainless steel.

All bolts and nuts on insulator string fittings shall be galvanized as specified and shall be locked in an approved manner.

Adequate bearing area between fittings shall be provided and "point" and "line" contacts shall be avoided.

The general arrangement of the insulator strings which shall be used. With long rod tension insulator strings only double tension strings shall be used. For road crossings, railway crossings, power communication line crossings and waterway crossings etc., long rod/ disc insulators with double suspension strings shall be used.

The design of the fittings, as well as of the insulators, shall consider the radio interference performance of the insulator set. The noise limit for radio interference of the whole insulator string shall not exceed.

the values for grade V of BA 137: Part 2: 1973 and shall be proved by test if required by the Owner/Engineer without any extra cost to the Owner. As an alternative, tests according to VDE 0212.

Insulator string complete should have minimum service life of guaranteed 30 years with satisfactory operation. Contractor will provide the guarantee.

The insulator strings (Disc Insulator) shall consist of standard discs for a three phase 50 Hz, effectively earthed 220KV/132KV transmission system in a moderately polluted atmosphere. The discs shall be cap and pin, ball and socket type.

Conductors and Accessories

1. General

The particulars of the conductors to be supplied shall be as indicated in Data sheets.

2. Standards

The conductors shall be manufactured and tested in accordance with Standards as indicated in the document.

3. Surface Conditions

All wires making up the conductor shall be free of points, sharp edges, abrasions or other imperfections that would tend to increase radio interference and corona losses. The conductors shall also be free of metal particles and dirt. The make-up and the laying of the conductor strands shall be such as to produce a conductor free of a tendency to untwist or spring apart when cut. The stranding shall be such that, when subject to 50% of ultimate strength, there shall be no high wires but a real cylindrical form shall be maintained. The outermost layer of all conductors shall be stranded with a right-hand lay.

1. OPGW

The particulars of the OPGW to be supplied and installed shall be as indicated in the Schedule. The following Specification provides the key requirements and Tenders are required to provide all relevant information and a report and a list of comparison of the offered OPGW in case of deviations or due to an advanced technique as may be proposed besides the specified requirements.

The OPGW design shall be mechanically and electrically compatible with design of the transmission line. The OPGW shall be protected from Aeolian vibrations for life of the line. The total OPGW length shall be determined by the contractor taking into account sag, splices, drops at the joint locations etc.

The wires forming the outer strands of the OPGW shall be right hand lay and designed to prevent bird caging, strained popping and unravelling during normal handling and installation.

The OPGW shall be with approved and seals (waterproof) which shall not be removed until immediately prior to optical jointing.

The OPGW shall be designed to withstand the system fault currents and lightning currents without degradation of the optical attenuation of the fibres or mechanical damage to the ground wire strands.

The OPGW shall be associated with each circuit of a double circuit OHL.

The optical fibre shall be designed so as to prevent mechanical and optical degradation after thirty years of intermittent exposure to saline (marine) and desert and polluted weather.

No mid-span joints shall be allowed in the OPGW. All joints shall be performed in a tower joint box located at the top of the poles or towers.

2. Construction

Outer layer of OPGW shall be aluminium clad steel wire of smooth bodied construction. Optical fibre shall be of silicon type suitable to withstand temperature of about 100□C. Each fibre shall be jacketed by heat resistant material and stranded around central spongy rubber core. Considerations should be made on OPGW design to provide superior

reliability on thermal resistance, water proof, and strain reduction to fibres, mechanical strength and corrosion resistance.

Optical unit shall be protected against water by an aluminium tube which shall not have any other metallic material inside to avoid any current distribution.

The following standards shall generally be applicable:

- Aluminum clad steel wire: ASTM B 415, B 416, and VDE210
- Optical fiber: CCITT DIN recommendation G 652 for single mode.

The Contractor shall submit recommended procedure for stringing the OPGW together with sketches.

3. Optical Unit

The structure of the OPGW shall in general be in accordance with the short circuit current level and other installations parameters specified elsewhere. However, OPGW offered shall provide the following minimum requirements:

Operating wave length	1310 nm
Attenuation at 1310 nm	0.36 db (maximum)
Number of optical fibres	24 single mode
Cut off wave length	1150 - 1285 nm
Optical loss variation in temperature range - 25 to 150□C	less or equal to ± 0,05 db/KM
Chromatic dispersion at 1285-1330 nm	Less or equal to 5ps/km

Physical design of the proposed OPGW for installation on new OHTL's shall take into account sag and tension restrictions for transmission lines ruling spans.

The contractor shall design and furnish OPGW mounting hardware including all the necessary hardware required for a complete operational OPGW. This shall include, but no be limited to vibration dampers, suspension tower hardware (including AGS units), angle tower hardware, dead-end tower hardware, repair sleeves, earth bonding leads and OPGW clamps for vertically mounting OPGW on tower steel work. The OPGW shall be clamped at approx. 1-meter spacing on the tower and substation gantry structures.

4. Joint Boxes

Two types of joint boxes shall be proposed:

Type A: To be used for OPGW-PTGW connection to be installed at the top portion of the pole, tower or portal structure. An extra length shall be left inside for repeated splices.

Type B: Terminal joint boxes for connection of OPGW to the optical cord. These shall be similar to above except for the connection arrangement.

Junction box technology shall ensure only bottom cable entry, quick removal of box cover giving access to fibre splices, repair of fibre splicing at least three times during transmission line's working life.

5. Delivery Lengths

OPGW shall be delivered in agreed lengths. A thermal pad shall be placed on the outer spirals and thermal protection shall be at least equivalent to that obtained with an aluminium sheet covered by 10 mm cellular polyethylene.

After factory inspection the inner end of the cable shall be fitted with a suitable cap to ensure water tightness. The outer end shall be fitted with a watertight head compatible with cable pulling.

6. Tests and Spare Parts/Tools

The Tenderer shall be responsible to perform type test of tower, conductor, poles and hardware as per the relevant International standards and recommendations as mentioned in the Schedule H.

One set of all tools required by the CONTRACTOR for installation of terminations, splicing and for installation of repeater stations (if any) shall be supplied to the OWNER and the related price shall be stated in the proposal.

The Tenderer is required to submit a list of spare parts and tools together with the related prices in his proposal.

4. Conductor Grease

Only inner layers of copper conductors shall be greased. The grease shall be of neutral type and at a temperature of 100□ C the grease shall neither flow within nor extrude from the conductor.

The grease shall retain its properties as resistance to oxidization and chemical stability, at all service temperatures.

5. Accessories

1. General

Conductor accessories made of non-stainless steel shall be reliably protected against rusting. Materials and construction of conductor accessories shall be chosen to eliminate any possibility of electrolytic corrosion and radio interference.

The design of all conductor fittings, vibration and spacer dampers etc. shall be smooth and free from waves, ridges, sharp corners, projections and other irregularities to avoid corona.

2. Vibration Dampers

The vibration dampers shall preferably be of the Stockbridge type. The clamps of the dampers shall be designed to permit installation and removal by the use of hot-line tools. The dampers shall be attached to the conductor in a manner which will prevent damage thereto. Each damper weight shall be provided with one drain hole, positioned to be at the bottom of the weight when the damper is installed in a vertical place. The design of the damper is to be such as to ensure freedom from subsequent drops of the damper weights in service. The design shall avoid sharp corners or projections which would produce high electrical stress under normal working conditions.

Breakaway hexagonal bolts shall be used on all bolted clamps and shall ensure substantially consistent damping force. Dampers shall maintain gripping on the conductors through their life and shall not slip, twist or ratchet on the conductor. The materials comprising quality to withstand the exposure conditions encountered with a minimum operating life of 30 years.

The manufacturer shall calculate and submit the number of dampers per span, the position and the maximum span length for each damper size. These calculations shall be based on the following data:

- conductor and conductor arrangement, without armour rods.
- equivalent span lengths.
- conductor height above ground.
- local atmospheric conditions e.g. wind velocities etc.

The calculations shall be made for the following two terrain conditions, if not indicated otherwise or instructed.

- flat terrain, no trees, no obstructions
- undulating, relatively open country with some trees.
- any other type of terrain from where the line is passing.

The manufacturer shall, for each damper size tendered, prove that the maximum bending strain in the conductor at the clamps must not exceed ± 150 micro/m for conductors and ± 250 micro/m for steel conductors for the calculated number of dampers per span, position and maximum span length.

The manufacturer shall describe the calculations method.

3. Conductor Accessories

a. Suspension Clamps

Suspension clamps for attachment of conductors to insulator strings at suspension towers shall be the trunnion type or equivalent and shall consist of a clamping piece of metal alloy with bolts and other details made of hot dip galvanized forged steel. Suspension clamps must be designed for the loadings to be applied and must also reliably hold the conductor in the case of unbalanced conductor tensions to be expected in operation, however, the clamp shall permit the complete conductor to slip in a range of 10% to 30% of the ultimate tensile strength of the conductor. The clamp shall be free to pivot in the vertical plane and the rotation axis of the clamp shall intersect the conductor axis. The clamp shall be dimensioned according to VDE 0210 regarding mechanical strength. The clamping area should be grooved to increase resistance to conductor slippage. The suspension clamping detail shall be in such a manner that no magnetic loop is formed around the conductor.

b. Tension Clamp Assembly

Conductor tension assemblies shall be the type and size for the conductor which will be used on this work and shall be of the tubular compression type complete with compression, dead-end bodies, jumper terminals and steel eye end. Each dead-end assembly shall be capable of developing not less than 95 per cent of the ultimate strength of the conductor and shall have conductivity not less than that of the conductor.

The conductor tension clamp shall be supplied with a jumper terminal which may be bolted at 0ºC or 30 ºC angle.

c. Compression Joints

Compression joints for splicing conductors shall be of the tubular type suitable for the type and size of conductor used. Each connector shall be complete, consisting of one joint which shall be capable of developing strength not less than 95% of the rated ultimate strength of the conductor. The conductivity of the completed splices shall be not less than that of the conductor.

d. Repair Sleeves

Repair sleeves shall be the type and size for the conductor which will be used on this work and shall be composed of two pieces fitted into each other can be applied to reinforce a conductor having some of the strands damaged.

f. Spacer Dampers

For double bundle lines the spacer dampers shall be provided. Spacer dampers shall be designed to keep the individual conductors forming a bundle at the required distance, whatever service conditions may be prevailing, to prevent the conductors from clashing due to different wind - inducing lateral vibrations. Apart from that, the spacer dampers shall provide a measure of energy absorption which lessens the negative effects of line vibration. Contractor shall specify the positioning of the spacer dampers throughout the span.

The outer contours of the parts must be designed in such a way that at operating voltage no visible or audible corona discharges may occur on the spacer damper.

The rubber used between the spacer bar and clamp shells must be of a semi-conductive rubber that potential equalization between the bar and clamp shells is maintained. The rubber part must be completely protected from harmful ultraviolet light.

The clamp shells and spacer bar shall be made of corrosion-resistant, high strength aluminium alloy. All ferrous metal and iron parts shall be hot dip galvanized.

The spacer damper shall be permanently fixed on the conductors of the tensioned bundle by means of a clamping device.

It should be possible to secure all clamping screws in a form locking manner as to avoid their getting loose during service.

Contractor shall submit a full complete specification of the spacer dampers offered with drawings, together with laboratory test reports.

The grounding system shall be designed in accordance with "IEEE Guide for AC Substation Grounding".

The maximum resistance of the grounding system to earth at any point shall not exceed 0.5 ohms and tolerable potential differences. Step and touch voltages shall be in accordance with requirements and guidelines for safety defined in IEEE - Standard-80.

6. Grounding Grid

The grounding grid shall be made of 350 MCM (minimum) bare soft drawn, lead covered stranded copper of electrolytic grade and minimum 98% conductivity. The grounding grid shall be buried at a minimum depth of 0.6 m below ground level.

Foundations

1. General

i. The foundations for towers shall normally be of mass concrete or reinforced concrete. Where these are not applicable, the other forms of foundations (including pile foundations) shall also be used as required. Each tower foundation has to be proposed and justified by the Contractor but shall be approved by the Owner.
ii. The Contractor shall stake out the tower locations and submit to the Owner the foundation conditions including permissible bearing pressure expected by him at each tower together with the type of foundation considered applicable by him. The Contractor has to perform soil investigations at tower sites to verify the foundation conditions and submit the soil investigation report.
iii. The Contractor shall submit the actual maximum uplift and bearing load without any safety factor for each footing and for each type of tower. The stability of the foundations with respect to uplift shall be determined at a safety factor as indicated in the document The bearing pressure on the soil shall not exceed the limits laid down for each type of foundation and soil condition.
iv. Unless otherwise directed all tower footings shall be designed by the Contractor as individual leg footings, four footings per steel lattice tower and one pile cap per tubular pole tower. Dimensions of all leg footings shall be determined for tower reaction for the maximum down thrust, uplift and horizontal shear. All tower base reactions shall be computed from design structure loadings including their specified safety factors.
v. All concrete foundations shall be made from Sulphate Resisting Cement, in Karachi Area.
vi. If pile foundations are required after examining the soil investigations, the Owner shall be informed about the location and the design shall be made under strict control.
vii. Ultimate foundation loadings per leg shall be calculated as follows:

Compression and Uplift Loads for Straight Line Towers

Compression	(Overturning force + 1/4 max. applied vertical loads + 1/4 tower weight) x safety factor.
Uplift	(Overturning force - 1/4 x 1/3 max. applied vertical loads-1/4 tower weight) x safety factor.

2. Compression and Uplift Loads for Tension Towers

As above, but zero applied vertical loads in uplift case or special uplift loading for section towers.

In computing compression ultimate bearing stresses, the weight of concrete in foundations shall be multiplied by the relevant safety factors.

3. Safety Factors of Foundations

Safety factor in normal loading condition 1.8

Safety factor in unbalanced loading Condition 1.5

4. Foundation Design for Tubular Poles

The design for foundations of poles shall be made in accordance with "Design of Steel Transmission Pole Structures" prepared by ASCE.

5. General note for all types of foundations

Necessary measures shall be provided to protect the concrete from sulphates and acidic soil environment by coating bitumen on outer surfaces.

The foundation chimney will be extended minimum 50 cm. above ground level to provide concrete cover, for protection against debris and floods. On road crossings or islands guard rail protections suitably painted for warning to traffic will be also provided.

Grounding conductors of footings shall not be allowed to pass through concrete, nor shall they be allowed to have physical contact with reinforcing bars.

The backfill as well as undisturbed soil around the proposed foundation is to develop a minimum angle of internal friction of 25□. It will be reconfirmed by soil investigation by Contractors.

2. Types of Foundations

The following types of foundations for towers may be employed:

1. Concrete Block Foundation

This type of concrete block foundation shall be suitable for soft soil, sand or loose gravel occurring generally for the full depth.

2. Soft Rock Foundation

This type of concrete block foundation shall be suitable in the case where soft rock should occur from more than the bottom 50% of the soft soil foundation setting depth. The soft rock encountered may be of a homogeneous limestone or coral nature or of a harder limestone or other rock, but being fissured and stratified.

3. Hard Rock Foundation

This type of foundation shall be suitable for homogeneous hard rock.

4. Special Foundation

In addition, where special ground conditions exist, which do not allow any of the above designs in an original or modified form, special types of foundation as concrete piers, rafts or piling may be used.

5. Foundation in River/Wadi

This foundation type will be designed for protection of tower considering the highest water level/flood level in River/Wadi

6. Pile type foundations for pole structures.

3. Soil Characteristics

The Contractor shall ascertain the soil conditions and characteristics performing sub-surface soil explorations at each tower location by one standard penetration test. The test shall be made to a depth equal to the distance from the ground surface to the bottom of the footing, plus two meters. The tools and equipment to be used for the test shall be of the approved standard type. The results of the tests shall be compiled in an approved form and submitted to the Owner for verification.

The Contractor shall then finalize the design of each type of the foundations in accordance with the results of soil penetration test obtained. A selection of the foundation type shall be made for each tower to suit its particular site conditions, and the final tower list prepared.

Throughout the line route the Contractor must, at regular intervals, obtain samples of subsoil and ground water, which he shall have analysed in order to assure that no foreign agents are present that might have an adverse effect on concrete. The results of the analyses shall be forwarded to the Owner All sub-soil tests described shall be made as soon as possible after award of the Contract.

4. Calculation

i. For all foundations the Contractor shall submit detailed calculations in accordance with VDE 0210 showing that the ultimate earth bearing capacity according to the table is not exceeded by the maximum lateral pressure, due to loads acting on the tower times the corresponding safety factor and due to the dead weight of the tower and footing including backfill resting vertically upon the base of the footing.
ii. The foundation shall have a factor of safety against uplift for loading conditions as given below:

$$\frac{Wc+Ws}{T} = \text{Factor of safety}$$

Where Wc = dead weight of concrete footing which is under ground

Ws= = weight of soil in inverted pyramid shape on the base pad. The height of the pyramid shall be the depth to the base of foundation minus 25 cm

and T = maximum calculated uplift force

i. The Contractor shall also submit calculations and drawings showing the bearing capacity and stresses at each critical section of the concrete and the steel reinforcement.
ii. The possible deterioration of the consistency of cohesive soils and the resulting reduction there from shall be considered in the bearing capacity. If ground water exists, the corresponding decrease of weight of earth and concrete due to uplift conditions shall be considered in the calculations.
iii. Factors of safety for calculation of the maximum admissible earth pressure and the stability of foundation against uplift loads are stated in the document.
iv. For bidding purposes the design of foundations shall follow the Specifications and assumptions for normal, soft rock and hard rock soil conditions. Such designs are subject to modifications to suit Site conditions as approved by the Owner.
v. The calculation of foundations have to be done in accordance with Standard VDE 0210. For tower foundations consisting of four footings Standard VDE 0210 makes a distinction in calculation for foundations concreted at the inherent soil, for undercut foundations concreted in the inherent soil, and for foundations concreted at the shuttering of the excavation.

5. Tower Grounding (Earthing)

All four legs of each tower will be separately grounded according to DIN 57141/VDE 0141.

According to previous measurements, the earth specific resistivity seems to average 45 ohms - meter, in this alluvial coastal region.

This 45 ohm-meter specific resistivity is quite favourable for towers grounding. A grounding resistance of max. 3 ohms shall be specified for any individual tower.

Since 4 legs shall be equally grounded, each leg shall have max. 12 ohm grounding resistance.

This will be achieved by utilizing an Armco-steel grounding conductor, looped with 200 cm diameter around each leg, buried 150 cm depth. 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.

Armco steel is a very low carbon steel which is available from major steel manufacturers and has been used in many countries for grounding. Outer surface of Armco steel gets oxidized and serves as protective layer for inside metal against corrosion.

For tubular steel poles additional vertical grounding electrodes are recommended to achieve 3 ohms max. grounding resistance. Recommendation of "Design of steel Transmission Pole Structures – item 5-7" published by American Society of Civil Engineers shall be followed for grounding of steel poles.

Erection Work

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.

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.

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.

4. Retaining Walls

At locations where earth moving by landslides, 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.

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 right-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.

6. Installation of Foundation

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.

2. Excavation

i. The Contractor shall make the excavation necessary for the approved foundation type.
ii. Excavation operations shall be confined to a minimum working area consistent with efficient operations.
iii. 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.
iv. 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.

3. Setting

i. All foundations shall be assembled, placed, and set to the levels, measurements and batters shown on the approved setting diagrams.
ii. For all settings a maximum tolerance of 6 mm will be allowed on any dimension.
iii. 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.
iv. 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.

v. 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.

4. Back-fill and Clear-up

i. 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.

ii. 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.

iii. 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 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.

iv. 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.

5. Concrete Foundation

a. General

i. The Contractor shall provide all materials and facilities, machinery and equipment to install foundations, and design, transport, place, finish, protect a cure concrete. He shall also construct, erect and dismantle forms.

ii. 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.

b. 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.

c. 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.

d. Aggregate

i. 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).

ii. 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.

iii. 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.

e. Steel Reinforcement

Reinforcing bars shall be structural grade steel and shall comply with the concerning standard. They shall be free of loose, flaky crust and scale and of oil, grease, mud, concrete or other coating which might destroy or reduce its bond with concrete. Bends, cranks and overlappings 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.

f. 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.

g. 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.

h. 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.

i. 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.

j. 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.

k. Conveying, Placing and Curing

i. Only methods of transporting and placing which will prevent segregation or loss of ingredients and deliver concrete of the proper consistency will be permitted.
ii. Concrete shall be placed before the cement takes its initial set or within 30 minutes from the original mixing times, whichever is sooner.
iii. 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.
iv. 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.
v. Concrete shall be placed with the aid of mechanical vibrating equipment and supplemented by hand spading and tamping.
vi. 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.

l. Concreting under Extreme Weather Conditions

i. 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□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□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 77ºC. 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.

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.

7. Rock Anchor Foundation

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

i. 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 termite pipe to prevent dilution of the grout.

ii. 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.

iii. The entire grouting procedure shall be subject to approval.

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. 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.

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.

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.

8. Erection of Towers

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.

2. Handling and Storage

i. 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.
ii. 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.
iii. Tower material damaged shall be replaced by the Contractor at no cost to the Owner.
iv. 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.
v. All galvanized structures shall be painted partly before and partly after erection in accordance with attached painting specification.

3. Erection

i. After conductors have been installed and sagged, all towers shall be plumb with a tolerance on vertical deviation not exceeding 3 mm/m.
ii. 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.
iii. Each bolt shall be securely tightened with adequate but non-excessive torque. 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.
iv. 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.
v. 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.
vi. 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 cross arms as specified.
vii. Towers must be completely erected with all members in place and bolts securely tightened before any stringing of conductors or earth wires may be started. All towers shall be inspected by the Owner accompanied by the Contractor before the stringing operation.
viii. 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, owner's 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 bourn by the Contractor.

9. Installation of Grounding

i. 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.

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.

ii. For tower locations where the rods cannot be used due to soil conditions the Contractor shall at least install two ground strips each 20 m long, connected to the stubs inside the concrete foundations.

iii. 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.

iv. 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.

v. 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.

vi. 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.

vii. 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.

viii. 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

10. Installation of Insulator Strings

i. 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.

ii. 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.

iii. Workmen shall not climb upon insulator strings after installation.

iv. 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.

v. 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.

vi. 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.

11. Installation of Conductors and Accessories

1. Requirements

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

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

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.

4. Stringing

i. 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.

ii. 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.

iii. The conductors, joints and clamps shall be erected in such a manner that no bird caging 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

iv. strands or layers of the conductors, if required by the Owner; this property shall be demonstrated by actual tests.

v. 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, nicks or 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 cross arm. They shall be installed at such height as to support the conductor or earth wire 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 are obtained.

That the conductor tension between successive sagging operations 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 grid station shall be "Slack Spans". The conductor shall be coated with an approved grease immediately before final assembly in any fitting.

5. Splices

i. Full tension splices shall be made with strain compression joints.
ii. 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.
iii. 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.
iv. All joints or splices and repair sleeves shall be located at least 10 meters away from the structure.

6. Sagging

i. 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.
ii. 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.
iii. 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.
iv. The length of conductors or sagged on one operation shall be limited to the length that can be sagged satisfactorily.
v. 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.
vi. 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.
vii. 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.
viii. 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.
ix. 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.
x. 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.

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 spacing's which the manufacturer has determined from tests to be the most effective in reducing vibrations under wind velocities 0 to 25 km/h.

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 spacing's which the manufacturer has determined from tests to be the most effective whatever service conditions may be prevailing.

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 holds down weights shall be composed of 50 kg units. The Contractor shall submit a detailed calculation of hold down weights.

10. 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.

Steel Poles for Transmission Lines

1. Types of Tubular Poles

arm shall be circular or polygonal in shape, and tapered uniformly. The poles shall be in several sections and assembly of sections shall be achieved by slip joints. The tubular transmission line poles shall consist of a galvanized steel pole with six cross arms and shall be bolted on an anchor bolt system embedded in foundation. The pole and cross

The poles are of following types:

- Type PT - (0º-5º Angle)
- Type PS - "0º -30º Angle
- Type PLA -"0º -60º Angle
- Type PLB -"0º -90º Angle
- PLT -"Terminal 0º Angle
- PLDB-"Dead end with platform

P stands for tubular steel poles whereas subscripts T,S,LA,LB etc. have been adopted from existing nomenclature used by KESC to indicate function, angle for which pole is designed.

1. Double Circuit Steel Pole Type PT

Double circuit suspension pole for straight line position and angle upto five degrees for a wind span of 250 m, a weight span of 250 m.

2. 30 Degree Double Circuit Steel Pole Type PS

Double circuit strain pole for line angle up to 30 degrees on a wind span of 250 m, a weight span of 250 m.

3. 60 Degree Double Circuit Steel Pole Type PLA

Double circuit strain pole for line angle upto 60 degrees on a wind span of 250 m, a weight span of 250 m.

4. 90 Degree Double Circuit Steel Pole Type PLB

Double circuit strain pole for line angle upto 90 degrees on a wind span of 250 m, a weight span of 250 m.

5. Double Circuit Steel Pole Type PLT

Double circuit strain (terminal) pole for line angle of 0 degree on a wind span of 250 m, a weight span of 250 m.

6. Double Circuit Steel Pole Type PLDP

Double circuit strain dead end pole for dead ending line on one side having platform to support surge arresters, line traps and coupling capacitors.

2. Loadings

Each type of pole shall be designed to safely withstand the loading due to wind on pole, conductors, hardware and dead weight of a pole and fittings, due to resultant transverse load at angles as indicated hereafter.

Maximum wind velocity (VM) has been taken as 44.44 m/sec and the Reference wind velocity (VR) as 29.775 m/sec taking into account ground roughness coefficient as 0.67. The magnitude of wind load on pole is a pressure of 55 kg/m2. Wind Load on wires is 89 kg/m² on projected area having the width equal to the diameter of wire.

1. Wind on Pole

In order to determine the effect of the wind on the pole itself the latter shall be divided into elements of suitable height. The ultimate wind load in the transverse direction applied at the centre of gravity of an element shall be:

ATC= qo.CXTC.GT.d.L. (kg.)

Qo= Dynamic Reference pressure = 55 kg/m2

D = Average diameter of the pole (m)

L = Length of the element (m)

GT = Gust response factor 2.22(ZT)0.175

Where ZT= Height from centre of gravity of element above ground (m)

Drag coefficient CXTC shall be calculated in terms of Reynolds nos. which shall be equal to: R=20.8 x 105 x d G T

Where d=Average diameter of pole (m)

CXTC=1.2 for R 3 x 105

CXTC=0.75 for R 4.5 x 105

For values of Reynolds's nos between 3 x 105 and 4.5 x 105 the value of CXTC may be determined by: CXTC=15.195-2.555 log R

2. Ultimate Loads

Transverse, longitudinal and vertical loads on the pole body shall be along the pole.

The loads of and on conductors and insulators shall be assumed to act at the conductor attachment points.

Stringing conditions are mainly meant for design of cross arms. It shall be assumed that only two conductors shall be strung simultaneously and the Angle between the Anchorage and ground shall not be more than 15ºC.

Each pole shall be designed to withstand all combinations of vertical, transverse and longitudinal ultimate loads arising from the loading cases stated at relevant drawings.

3. Design Requirement

1. General

Each Pole shall be of self-supporting with embedded anchor bolts in foundations and shall be able to carry the loads and meet the loading conditions of this specification.

The general configuration and dimensions of poles and clearance shall be as per attached drawings. The diameters of poles shall not exceed the max. values used in present days practice. Section lengths shall not exceed 12 meters. The min. thickness of material used for poles shall be 6 mm.

The Contractor shall be fully responsible for the design of the poles and for their satisfactory performance. All design furnished by the Contractor and approved by the Owner shall be considered a part of this specification.

All designs and drawings submitted by the Contractor shall become the property of Owner. The Owner expressly reserves the right to use, reproduce in whole or in part to distribute, and to reuse any and all such drawings in connection with the installation, maintenance, replacement and repair of the materials to be furnished under the specification and also to make any and all such drawings and reproductions thereof available to subsequent Bidders and Contractors, where necessary in connection with fabricating and furnishing materials duplicating or closely similar to the materials to be furnished hereunder. The depositing of all such drawing with the Owner shall constitute a licence to the Owner to use said drawings in the manner herein stated.

2. Design Methods

All calculations for determination allowable stresses on pole shall be according to ASCE Methods "Design of Steel Transmission Pole Structures."

Poles shall be designed such that all sections will withstand normal and broken wire conditions with safety factors as specified.

All calculations carried out on computer shall be accompanied by a full explanation of the computer programmes and the methods used in the calculations.

As the poles are of cantilever type, consideration shall be given to the most unfavourable condition of simple buckling or combined buckling by bending and torsion.

Connection between the various parts to be achieved by slip joints, the overlapping length shall be at least equal to 1.5 times the Inside diameter of the female section.

In anchor base type poles the dimension and thickness of base plate as well as number, diameter and length of anchor bolts shall be determined by calculations and shall be selected from the range of International Standard.

3. Foundations

The foundations shall be designed on the following basis.

The foundation shall be able to withstand the ultimate forces tension, compression shear and uplift for the worst possible combination of ultimate loads.

For design purposes the weight of concrete may be taken as 2400 kg/m3 and of earth as 1600 kg/m3.

4. Material

Poles shall be made of low alloy high tensile steel sheet or plate having the tensile properties as specified. The steel shall be made by open hearth or basic oxygen processes.

The manufacturer may propose steel conforming to latest applicable Industry Standards Specification and recommendation practices provided such steel has the minimum yield point and minimum Elongation as specified. The manufacturer shall indicate the grade of steel and identify the standard to which the steel complies. The specification of steel shall be approved by the Owner. The following information shall be supplied by the Manufacturer:

- Ultimate Tensile Strength
- Minimum Guaranteed Yield Strength
- Minimum Elongation
- Detail of Test Piece
- Chemical Composition

1. Tensile Properties

The steels shall conform to the requirements as to tensile properties prescribed below:

Yield point kg/mm2 minimum 30 – 40

Elongation in 50 mm gauge length percent, minimum, up to 5 mm thickness 16

Elongation in 200 mm gauge length percent, minimum, 5 mm to 16 mm thickness 13

Over 16 mm thickness 17

2. Tolerances

The tolerance of Steel grade and Specification quoted by the Contractor shallapplicable. Tolerances in the manufacture of the poles shall be as follows:

- Overall length of pole ±1%
- Outside dia ± 1%
- Tube thickness ± 8%
- Twisting 1.5 Degree per 3 m
- Weight ± 3%

The poles shall be straight within 1/300 of length.

5 Fabrication

All types of poles shall be made of one or several sections or elements tapered uniformly starting with the base or butt end, decreasing in diameter at a suitable rate. In the case of poles made of several sections their assembly shall be achieved by slip joints.

Poles and crossarms shall have no transverse joints or welds and only one longitudinal weld per thickness of pole shall be permissible.

The upper part of the pole shall be made to accommodate cross-arm of the dimensions and clearances shown on the drawing, necessary for the attachment of conductor and shall be made to match aesthetics of the pole. Crossarms connection to the pole shall be made by flange type or box type. For the installation of joint Box for OPGW, the Contractor shall provide two welded brackets each having two bolt holes near the top of each pole. The exact size and locations of the holes shall be agreed between the Contractor and the Owner during approval of tower drawings.

In anchor base type poles the lower part shall be equipped with a base plate to be anchored on a concrete foundation by means of anchor bolts.

The anchor base shall be of sufficient cross section to develop the full strength of the pole by means of two transverse Electric welds. The base shall telescope the pole and one weld shall be on the inside of the base at the end of the pole and other weld on the outside at the top of the base.

Anchor bolts shall be of suitable diameter and length to develop full ultimate strength of the pole. The upper ends of anchor bolt shall be threaded and furnished with hexagonal heads. The lower end of the bolt shall have "L" bend of length not less than 3 times the diameter of bolt. The anchor bolts and

nuts shall be hot dip galvanized. Metal covers shall be provided for covering the nuts and the portion of the bolt extending about the base and metal cover shall be attached to the steel base by means of cap screws.

1. Welding

All welds shall be performed in works before galvanizing. All welding shall be Electric Arc according to International Standards and shall include the following processes:

- Shielded metal Arc welding
- Submerged Arc welding
- Gas metal Arc welding

The electrodes used shall be compatible with grade and chemical composition of the steel used and shall have mechanical properties at least equal to physical properties of the steel to be welded. Uncoated electrodes shall be used.

The welds shall conform to the following minimum requirements.

a. Longitudinal Welds 1.c. (For poles and crossarms)

- 90% penetration of all thickness of sheet steel.
- The weld shall be free from any inside and outside cracks.
- No blow holes on the surface of the weld shall be allowed.
- No surface blister shall be tolerated.

b. Transverse Weld1. c. (For Base Plate)

- 100% penetration between sheet steels regardless of thickness considerations.
- All welds shall be free from all cracks both inside and outside.
- No blow holes on the outside of the weld.
- The blisters, parasites, spherical inclusions exceeding 5% of the minimum thickness of the sheet steel shall be refused.

The detectible angular inclusions shall not be tolerated.

In order to maintain the quality of the weld manufacturer shall make use of the most adequate method and control instruments in order to verify the quality of completed weld: ultra-sonic or radio control methods (X or gamma rays) shall be used in the works.

2. Galvanizing

All parts of the poles and crossarms shall be hot dip galvanized after completion of manufacturing operations. No further manufacturing, touching up or modification shall be performed on the pole or crossarms after they have been galvanized.

The galvanizing shall be performed on both inside and outside faces of pole and crossarms.

The galvanizing of the relevant plate or sheet of steel used for the manufacturing of pole or crossarms and nuts and bolts shall be as per relevant standard stipulated in this specification.

6. Accessories

1. Sign Plates

All poles shall be fitted with Danger and number plates. The sign plates shall be fired ceramic surfaces on steel base plates the ceramic enamel shall completely cover the front and back of the interior edges of the attachment holes the enamel around the hole shall be protected by means of fibre washers.

2. Step Bolts

Removable step bolts of 16 mm dia and 130 mm step shall be provided in a staggered manner, every 450 mm on the pole above anti-climbing devices. Alternative type of step system can be offered by manufacturers.

3. Anti-Climbing Devices

The anti-climbing device shall consist of an arrangement of barbed wire around the pole to prevent unauthorised persons from climbing the pole. The anticlimbing device shall be fixed at about 3 m from ground level.

4. Anti-Bird Devices

All suspension poles shall have detachable anti-bird devices, over each suspension insulator string. These anti-bird devices shall be spike type and galvanized and can be fixed on cross-arms by use of bolts and nuts. The anti-bird devices shall be supplied by pole manufacturer.

All angle poles having jumper insulator strings will also be furnished with anti-bird devices.

7. Tests

1. Manufacturer Tests

The manufacturer shall select two samples from each heat to carry out the following tests to satisfy him that the products comply with this Specification.

a. For Steel

- Chemical Analysis
- Tensile Tests
- Bend Tests

b. For Nuts Bolts and Washers

- Tensile Strength Test
- Bend Test

The manufacturer shall maintain a record of tests carried out by him for examination by Inspector.

2. Acceptance Tests

The following acceptance tests shall be carried out.

a. For Pole

- Visual Examination
- Verification of Dimensions and Weights

- Prototype Test

b. For Nuts Bolts and Washers

- Verification of Dimensions
- Visual Inspection
- Proof Load Test
- Ultimate Tensile Strength Test
- Galvanizing Test
- Bend Test

3. Material Details

Information such as grade and standard of steel used giving ultimate tensile strength, min. elongation, min. yield strength, chemical composition of steel, standard and method of galvanizing and welding and method of fabrication of pole shall also be appended. English language copy of the particular standard according to which the steel is supplied, and the standard for all galvanizing, welding and other applicable steel shall be supplied with the Bid.

2. Outline Drawings

Outline drawings for each type of pole and showing the size, location and arrangement of all elements principal outline dimensions and conductor clearances to the poles, the size and length of elements shall be provided. It should be possible to verify the drag coefficient and weight of poles. Separate details to a large scale shall be shown for all insulator and ground wire connection. If necessary for clarification, a large scale shall also be used for plotting details.

3. Design Calculations and Stress Diagrams

Design calculations and stress diagrams shall show the following information. Detailed calculations of wind loadings on pole shall be included. Loading calculations, bending moments, stress diagrams, section modulus, and thicknesses, inside and outside diameter for each section or elements of pole.

Design calculations if carried out by computer shall be fully documented. Full details of the analytical methods used shall be provided. Documentations shall provide a full explanation of the methods of programming and the interpretation of the detailed results.

4. Foundation Drawing and Calculations

Fully dimensioned drawings of all foundations showing also the volume of the foundations. Calculations showing the loads imposed on the foundations and the resultant bearing pressure and uplift resistance of the foundations.

5. Shop Detail Drawings

Shop detail drawings showing all shop details including all dimensions slip joint or flanges, bevel cutting, bending and the identification mark and weight for each element. The Contractor shall not proceed with the shop detail drawings until the outline drawings and design stress diagrams have been approved by the Owner.

6. Erection Drawings

Erection drawings showing each element or section with its identification mark, location and position of the outstanding pole element number and size of connection bolts and all erection details.

7. Footing Installation Drawings

Footing erection drawings showing embedded part with its identification mark or all dimensions required for the proper setting and positioning of anchor bolts with relation to the centre of the pole.

8. Bills of Material

Bills of material for each pole shall show the quantity, kind, outside diameter, inside diameter thickness, length weight and assembly mark for each section, including bolts, washers, plates and all fittings complete for each poles.

Painting Specification of Galvanized OHL Structures

1. General Requirements

All galvanized steel poles and lattice towers are to be painted. Inside of the poles shall be painted in the manufacturers premises.

This specification defines the minimum requirements for the protective coating of the poles. Also for surface cleaning, preparation and application of paints.

The relevant requirements of the SA and DIN standards and of the standard SIS 05 5900, shall apply. If the above mentioned documents and the specifications are in conflict, the stricter one shall govern.

The Owner shall at all times have access to the work and materials for inspecting while the work is in preparation or progress.

If any work or material be found defective or not in compliance with the specifications, correction or replacement by the Contractor at his own cost is essential.

2. Responsibility and Guarantees

Inspection of coating by the Owner will neither relieve the manufacturer of the responsibility for the good quality of paint, nor the Contractor, of his responsibility for acquiring the specified quality of materials, nor for the correct performance of the work. The steel structures are to be protected against corrosion and damage through the influence of weathering, i.e. tropical conditions, including the incidence of dust, and storms and sea water spray. The Contractor shall bear the responsibility for all losses and damages that occur through inadequate corrosion protection and shall repair or replace the parts at his cost.

The Contractor shall bear the full responsibility for paint applied by him on surfaces primed or painted by others.

Corrosion protection is rated to last a guaranteed 15 (fifteen) years after Owner's Final Inspection and Acceptance.

3. Safety Precautions

All necessary precautions shall be taken by the supplier to protect personnel and property from hazards due to falls, injuries, toxic fumes, fires, explosion or other harm.

All paint and thinners shall be stored in an area that is well ventilated and protected from sparks, flame, direct rays of the sun and from excessive heat.

It shall be the responsibility of the Contractor that all work to be done and all equipment used is in accordance with the local authority regulations.

Temporary constructions, ladders, scaffolding runways etc, required for safe execution of the painting work shall be rigidly built of all materials, apparatus, equipment and men thereon.

Schedule A1 – "Design Data"

Table 3.1: Design Data

Description	132 kV	220kV
Nominal voltage	132 kV	220kV
Max. Operation voltage	145 kV	245kV
Min. Operation voltage	120 kV	200kV
Impulse dry withstand voltage	650 kV	1050kV
One-minute power freq. withstands Voltage	275 kV	460kV
Normal frequency	50 Hz	50Hz
Short Circuit Level	40 kA	50kA
Duration of short circuit	3 Sec.	3 Sec
Neutral point	Solidly earthed	Solidly earthed
Minimum air clearance to earth	Shown on tower outlines	Shown on tower outlines
Switching over voltage factor	3	3
Peak of switching over voltage	355 kV	600kV
Governing over voltage condition	Lightning Over-voltage	switching Over-voltage
Pollution degree for insulators	Very heavy pollution	Very heavy pollution
Isokraunic level days/annum	9.7	9.7
Minimum clearance over open country	9.0 m	9.0 m
Overhead line over road level (min)	10.5 m	10.5 m
Overhead line over rail level (min)	15.0	15.0

The above ground clearances must be maintained with no wind at 45ºC ambient temperature and 80C Copper conductor temperature. Clearances from buildings and structures shall be according to NESC National Electrical Safety Codes.

Schedule A2 – "Basic Mechanical and Civil Engineering Data"

Table 3.2: Basic Mechanical and Civil Engineering Data

Description	132 kV	220kV
Max. ambient temperature	45ºC	45 ºC
Min. ambient temperature	0 ºC	0 ºC
Everyday ambient temperature	30 ºC	30 ºC
Conductor max. temperature Copper and Copper weld	80 ºC	80 ºC
Max. relative humidity	90%	90%
Wind load on flat surfaces	146 kg/m²	146 kg/m²
Wind load on round surfaces at the projected area	89 kg/m²	89 kg/m²
Percentage of the load acting second	72%	72%

surface of towers		
Wind velocity for conductor cooling	2.0 ft./sec	2.0 ft./sec
Ice load on towers and conductors	-No-	-No-
+35C still air (EDS) ** **max pull**	18% UTS	18% UTS
Steel for masts	St 37 & 52 JIS-SS41, JIS-SS55	St 37 & 52 JIS-SS41, JIS-SS55
Steel for Bolts and nuts	ASTM A394 &A325 JIS 31180	ASTM A394 &A325 JIS 31180

Schedule A3 – "Minimum Clearances"

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

Table 3.3: Minimum Clearances

Item	Description	Minimum (in meters)
1	Normal ground for pedestrians only	9
2	Residential areas	10.5
3	Roads and streets	10.5
4	Highways	10.5
5	Over railways-from top of rail(without electric line system)	15.0
6	Over pipelines-from top of pipe	10.5
7	Horizontal distance to metal clad or roofed buildingsor buildings or structures upon which a man may stand	5.4
8	Power lines (above or below)	5.4
9	Telecommunication lines	5.4

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.

SCHEDULE B1 – "TOWER/POLE TYPE"

Tower Position Angle of Type Drawing No.

Type where used Deviation Insulator

Tubular Poles - 132 Kv, Copper/Aluminium Conductor

PT-132 Straight line 0º-5 º Suspension

PS-132 Light Angle 0 º -30 º Tension

PLA-132 Medium Angle0 º -60 º Tension

PLB-132 Heavy Angle 0 º -90 º Tension

PLT-132 Terminal 0 º Tension

PLDP-132 Dead End with0 º Tension

Platform for surge arresters, Coupling capacitors, line traps

Tubular Poles - 220 Kv, Copper/Aluminium Conductor

2PT-220 Straight line 0 ° -5 ° Suspension

2PS-220 Light Angle 0 ° -30 ° Tension

2PLA-220 Medium Angle0 ° -60 ° Tension

2PLB-220 Heavy Angle 0 ° -90 ° Tension

2PLT-220 Terminal 0 ° Tension

2PLDP-220 Dead End with0 ° Tension

Platform for surge arresters, Coupling capacitors, line traps

Lattice Alternative For Tubular Pole Structures

T-132 / 2T-220 Alternative 0 ° -5 ° Suspension for PT-132

TS-132 /2TS-220 Alternative0 ° -30 ° Tension for big angle

TEE OFF-132/ 2T-OFF Alternative forPLT-132Terminal/90 °

GANTRY-132/ 220 Gantry

Schedule B2 – "Design Spans"

Table 3.4: Design Spans

	Weight Span (m)	Wind Span (m)	Basic Span (m)
All Lattice towers for132 kV /220kv	250	250	250
All Alternative tubular pole in place of Lattice towers	250	250	250

Schedule B3 – "Sags And Tension"

Sag and Tension tables shall be submitted by the Contractor (obtained from conductor manufacturer) and following data will be obtained from these tables considering, everyday stress of conductor as 18% of ultimate strength.

- Sag Tension data for ruling span 40m-400m at an interval of 10 m.
- Sag tension data for initial and final condition of the above stated spans and for the temperature range of 2°C to 80°C with an interval of 2°C.
- Sag tension data for maximum wind condition.
- Sag tension data for every day stress.
- Stringing table for each ruling span.

OPGW tension limiting condition shall be 1.0m less than the conductor sag at corresponding span.

- Sag tension data for initial and final condition for the above stated spans and for the temperature range of 2°C to 80°C with an interval of 2°C.
- Sag tension data for maximum wind condition.
- Sag tension data for every day stress.
- Stringing table for each ruling span.

Schedule B4 – "Factors Of Safety"

Table 3.5: Factor Of Safety

Item	Description	Minimum Factor of Safety
1	Towers/poles and Foundation	
1.1	All types of towers/poles under normal working loads	Tower/pole 2.1/1.75
1.2	All types of towers/poles under broken wire loads (Unbalanced condition)	2.1/1.75
1.3	Foundations for all types of towers/poles based on normal working loads	1.8
1.4	Foundations for all types of towers/poles under broken wire loads	1.5
2	Insulator Strings	
2.1	Complete tension insulator strings and fittings at conductor maximum working tension based on minimum breaking load of insulator	3.5
2.2	Complete suspension insulator strings and fittings at maximum vertical load at insulator attachment point based on minimum breaking load of insulator	4.0
3	Conductors	
3.1	Conductors at final maximum working tension based on ultimate strength	3.5
3.2	Conductors at still air. Every day temperatures final tension based on ultimate strength	5
3.3.	Dead end compression clamps and compression splices based on conductor ultimate strength	5
4.4	Complete suspension assembly at maximum vertical load	4.0

SCHEDULE B5 – "Wind Load on 220kV Wires

Table 3.6: Wind Load on Wire

0	Description	Unit	Calculations (as per IEC 60826)
1a.	Wind Velocity	km/h	160
1b.	Wind Velocity	m/s	44.44
2.	Roughness Factor	-	0.67
3.	Reference Wind Velocity	m/s	29.775
4.	Wind Pressure	kg/m^2	55
5a.	Factor of Safety (Conductor)	-	2.69* (As Per IEC 60826)
5b.	Factor of Safety (Insulator)	-	4.416** (As Per IEC 60826)
6a.	Ultimate Wind Pressure		

	(including Factor of Safety for Conductor)	kg/m^2	148
6b.	Ultimate Wind Pressure(including Factor of Safety for Insulator)	kg/m^2	243
7a.	Transverse Wind Load due to wind Conductor (6.2.6.1 of IEC)	kg	966
7b.	Transverse Wind Load due to wind on Insulator (6.2.6.3 of IEC)	kg	365
7c.	Transverse Wind Load due to wind at angle	kg	376
8.	**Total Transvers Load**	**kg**	**1707**

* CXC x GC x GL = 1 x 2.72 x 0.9903 (Clause 6.2.6.1 of IEC 60826)

** Cxi x Gt = 1.2 * 3.68 (Clause 6.2.6.3 of IEC 60826)

SCHEDULE B6 – "Wind Loadings on Tower & Pole Structures"

Table 3.7: Wind Load on Tower and Pole

Sr. No	Description	Unit	Calculations (as per IEC 60826)
1a.	Wind Velocity	Km/h	160
1b.	Design Wind Velocity for towers	m/s	44.44
2.	Roughness Factor	-	0.67
3.	Reference Wind velocity	m/s	29.775
4.	Wind Pressure on towers	Kg/m^2	55
	Wind pressure on Poles	kg/m^2	89
6.	Factor of Safety (gust Factor) on tower	-	3.8
7.	Factor of Safety (drag co-efficient) **	-	2.8
8.	Wind Pressure without Over Load Factor	Kg/m^2	-

Average Value of GT = 3.8 ** Average Value of CXT = 2.8

F.O.S / Overload Factor = CXT x GT = 2.8 x 3.8 (Clause 6.2.6.4.1) of IEC 60826.

SCHEDULE C1 – "STANDARDS"

All the following equipment should conform to latest revision/editions of applicable IEC standards. In addition, all following standards should also be followed.

Table 3.8: Standards

Item	Description	Standards
1	Tower steel	
1.1	Structural steel/poles	DIN, Euronorm,JIS, BS, ASTM
1.2	High tensile steel	DIN, Euronorm, JIS, BSASTM
1.4	Bolts	DIN, JIS, ASTM
1.5	Galvanizing	ASTM (A123, A153), (Special Galv. For fittings)
2	Concrete	DIN, BS, ASTM, JIS
3	Reinforcement steel	DIN, BS, ASTM, JIS
4	Insulators	IEC, DIN, VDE
5	Line conductor	IEC 208
6	Earth wire	ASTM B 415, 416
7	Conductor, earth wire and insulator fittings	DIN, ASTM
8	Clearances on tower constructions and between	VDE 0210/NESC

	conductors	
9	Additional standard proposed by Tenderer	

Schedule E –1. 500mm² Copper Conductor

Table 3.13: 500mm² Copper Conductor		
Sr. No	**Cross section**	500 mm²
1	**Stranding (no. of copper wires)**	Minimum 53
2	**Diameter of copper wires**	Minimum 3.25 mm
3	**Diameter of complete conductor**	25.3-27.6 mm
4	**Direction of lay of outermost layer**	Right hand lay
5	**Mass of conductor**	4590 kg/km
6	**Ultimate strength**	According to VDE 0210
7	**Modulus of elasticity final**	12650 Kg
8	**Coefficient of linear expansion1.**	$17x10^{-6}$ at 20 ^{o}C
9	**DC resistance at 20C**	0.0369 ohms/km
10	**Standard un-jointed length on drum**	1500 meters

300 mm² Copper Conductor

Table 3.14: 300mm² Copper Conductor		
Sr. No	**Cross section**	300 mm²
1	**Stranding (no. of copper wires)**	61
2	**Diameter of copper wires**	2.5 mm
3	**Diameter of complete conductor**	22.5 mm
4	**Direction of lay of outermost layer**	Right hand lay
5	**Mass of conductor**	2700 kg/km
6	**Ultimate strength According to VDE 0210**	115.7KN
7	**Modulus of elasticity final**	12650 Kg
8	**Coefficient of linear expansion1.**	$1.7x10^{-6}$
9	**DC resistance at 20C**	0.0595 ohms/km
10	**Standard un-jointed length on drum**	1500 meters

400 Mm² Copper Conductor

Table 3.15: 400mm² Copper Conductor		
Sr. No	**Cross section**	400 mm²
1	**Stranding (no. of copper wires)**	61
2	**Diameter of copper wires**	2.89 mm
3	**Diameter of complete conductor**	26 mm
4	**Direction of lay of outermost layer**	Right hand lay
5	**Mass of conductor**	3600 kg/km
6	**Ultimate strength According to VDE 0210**	117.3KN
7	**Modulus of elasticity final**	12650 Kg

8	**Coefficient of linear expansion1.**	$1.7x10^{-6}$
9	**DC resistance at 20C**	0.0444 ohms/km
10	**Standard un-jointed length on drum**	1500 meters

240mm2 Copper Conductor

Table 3.16: 240mm² Copper Conductor		
Sr. No	**Cross section**	240 mm²
1	**Stranding (no. of copper wires)**	61
2	**Diameter of copper wires**	mm
3	**Diameter of complete conductor**	mm
4	**Direction of lay of outermost layer**	-
5	**Mass of conductor**	2219 kg/km
6	**Ultimate strength According to VDE 0210**	KN
7	**Modulus of elasticity final**	117.3 KN/mm²
8	**Coefficient of linear expansion1.**	-
9	**DC resistance at 20C**	0.07181 ohms/km
10	**Standard un-jointed length on drum**	mm

185mm2 Copper Conductor

Table 3.17: 185mm² Copper Conductor		
Sr. No	**Cross section**	185 mm²
1	**Stranding (no. of copper wires)**	37
2	**Diameter of copper wires**	mm
3	**Diameter of complete conductor**	mm
4	**Direction of lay of outermost layer**	-
5	**Mass of conductor**	1699 kg/km
6	**Ultimate strength According to VDE 0210**	KN
7	**Modulus of elasticity final**	117.3 KN/mm²
8	**Coefficient of linear expansion1.**	-
9	**DC resistance at 20C**	0.09375 ohms/km
10	**Standard un-jointed length on drum**	mm

500 mm² Aluminum Conductor

Table 3.18: 500mm² Aluminium Conductor		
Sr. No	**Cross section**	500 mm²
1	**Stranding (no. of copper wires)**	Minimum 53
2	**Diameter of copper wires**	Minimum 3.25 mm
3	**Diameter of complete conductor**	25.3-27.6 mm
4	**Direction of lay of outermost layer**	Right hand lay
5	**Mass of conductor**	1350 kg/km
6	**Ultimate strength**	According to VDE 0210

7	**Modulus of elasticity final**	6960 Kg
8	**Coefficient of linear expansion1.**	$23x10^{-6}$ at 20 ^{o}C
9	**DC resistance at 20C**	0.0605 ohms/km
10	**Standard un-jointed length on drum**	1500 meters

SCHEDULE E (continued) – "Optical Fibre Ground wire (OPGW)"

Table 3.19: Optical Fibre Ground Wire (OPGW)		
a) Ground wire features Manufacturer Type		
Ultimate strength		214
Modulus of elasticity (final)	KN/m	155
Coefficient of linear expansion per ºC		1.32x10-5
Standard mass of conductor per km		1225
Ambient Temperature range		-25 to +80
Standard unjointed length On reel		4000
Overall diameter of OPGW		17.5
Minimum bending radius -under normal conditions		500
b) Earth wire/Conductor featuresAluminum clad steel		
Cross section of earthwire	m	184.3
No. and size of strands alu-clad		22
Steel wire diameter		3.20
Electrical Resistance of earth wire conductor	Ohm/	0.435
Standards		ASTM B 415
c)Fibre Features		
Number of optical fibres Mode		24 Single mode
Operation wave length		1310
Cut off wave length		1150-1285
Attenuation at 1310 nm	db/km (m)	0.036
Optical loss variation in temperature range - 25 to 100 ºC	dB/km (m)	0.05
Chromatic dispersion at 1285-1330 nm	ps/nm km (m)	3.5
optical or mechanical degradation Standards	CC Rec. G	CCITT Rec. G 652

SCHEDULE F – "Material for Tower Grounding"

Table 3.20: Material for Tower Grounding	
Item	**Description**
1.	Ground rods
1.1	Copper weld ground rods 16 mm dia. 3 m long
2.	Ground conductor
2.1	Armco Steel, 20 mm Dia
2.2	Copper conductor 70 mm^2 (insulated)/Copper Conductor 350MCM (minimum) bare soft drawn lead covered stranded copper of electrolytic grade.
3.	Connection of ground electrode with stub angle
3.1	For connection of copper weld rods: Copper conductor as above

SCHEDULE G – "Soil Characteristics"

Table 3.21: Soil Characteristics				
Description	**Soil Conditions**			
	Normal Soil	**Non-Soft Hard**	**Cohesive**	**Cohesive Rock**
Assumed mass of earth of cubic meter (kg)	1800	1600	900	2200
Assumed angle of frustum of earth resisting uplift (Degree)	1525	1525	1525	1525
Assumed ultimate earth pressure for standard foundation underspecified loadings including factor of safety (KN/m^2)	250	700	1000	1500

Soil characteristics:

- Cohesive soil stiff, difficult to knead, with granular addition.
- Non-cohesive soil, natural soil, gravel, boulder, uniform.
- Assumed mass of concrete per cubic meter for all kinds of soil: 2400 kg.

SCHEDULE G – "Soil Characteristics"

Table 3.22: Soil Characteristics				
Description	**Soil Conditions**			
	Normal Soil	**Soft Hard**	**Hard Rock**	**Cohesive**
Assumed mass of earth of cubic meter (kg)	1800	1600	900	2200
Assumed angle of frustum of earth resisting Uplift (Degree)	15	25	-	-
Assumed ultimate earth pressure for standard foundation underspecified loadings including factor of safety (KN/m^2)	250	700	1000	1500

Soil characteristics:

- Cohesive soil stiff, difficult to knead, with granular addition.
- Non-cohesive soil, natural soil, gravel, boulder, uniform.
- Assumed mass of concrete per cubic meter for all kinds of soil: 2400 kg.

2.7 Underground Transmission Lines

There are two main types of underground transmission lines currently in use. One type is constructed in a pipe with fluid or gas pumped or circulated through and around the cable in order to manage heat and insulate the cables. The other type is a solid dielectric cable which requires no fluids or gas and is a more recent technological advancement.

Underground transmission lines are classified by type of pipes required and their insulation. At present, following types of transmission lines are in practice:

- High-pressure, fluid-filled pipe (HPFF)
- High-pressure, gas-filled pipe (HPGF)
- Self-contained fluid-filled (SCFF)
- Solid cable, cross-linked polyethylene (XLPE)

In the proposed 132 kV underground transmission lines, solid cable; cross-linked polyethylene (XLPE) transmission lines will be used. The cross-linked polyethylene (XLPE) underground transmission line is often called solid dielectric cable. The solid dielectric material replaces the pressurized liquid or gas of the pipe-type cables. This type of line relies on high quality manufacturing controls to eliminate any contaminants or voids in the insulation that could lead to electrical discharges and breakdown of the line from electrical stress. There is less maintenance with the solid cable, but impending insulation failures are much more difficult to monitor and detect. The diameter of the XLPE cables increase with voltage (Fig. 2.3).

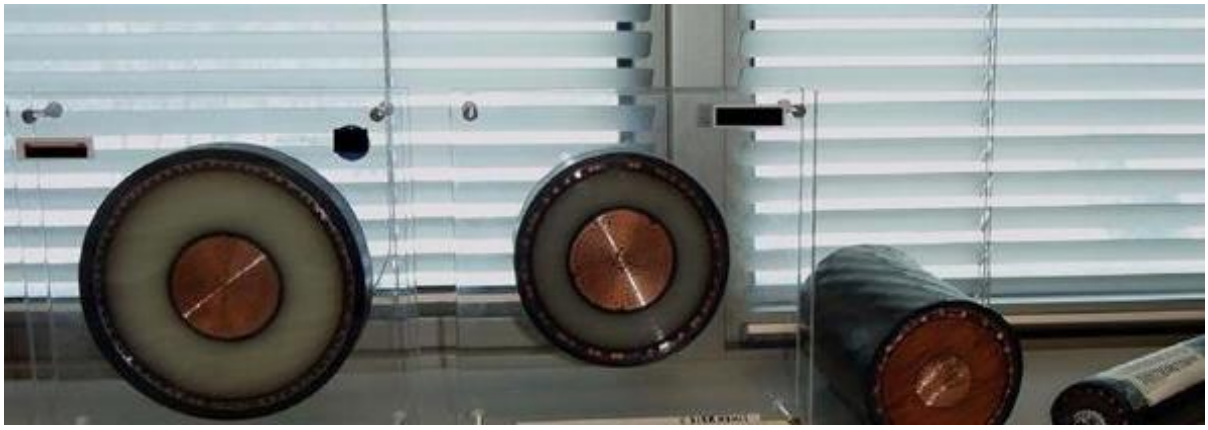


Fig. 2.3: Underground XLPE cables

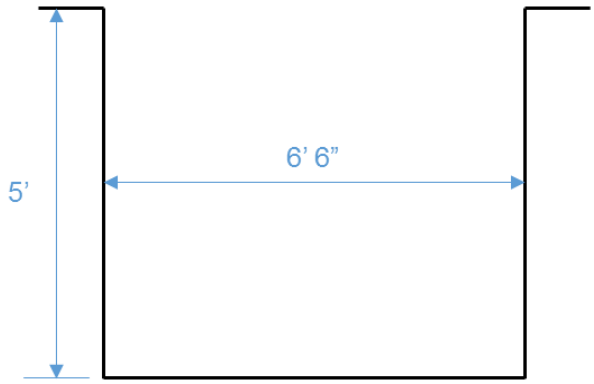
Each transmission line requires three separate cables, similar to the three conductors required for overhead transmission lines. They are not housed together in a pipe, but are set in concrete ducts or buried side-by-side. Each cable consists of a copper or aluminum conductor and a semi-conducting shield at its core. Cross-linked polyethylene insulation surrounds the core. The outer covering of the cable consists of a metallic sheath and a plastic jacket.

2.8 Activities involved in installation of Underground Transmission Lines

Many of the activities involved in installation of underground transmission lines may be conducted simultaneously so as to minimize the interference due to traffic and time. A fair estimated time of eight (8) weeks is foreseen for these activities.

ROW Requirement

5 ft. deep and 6.5 ft. wide ROW will be required.



Clearing Right of Way (ROW)

Similar to overhead transmission line construction, underground construction begins by staking the ROW boundaries and marking sensitive resources. Existing underground utilities are identified and marked prior to the start of construction. If the transmission line is constructed within roadways, lane closures will be required and traffic control signage installed. Construction activities including transport of material and equipment will disrupt traffic flow. Buildings are also prohibited in the ROW, since they would interfere with maintenance and repair work. At places the transmission line passes through unpaved areas, all shrubs and trees are cleared.

Trenching

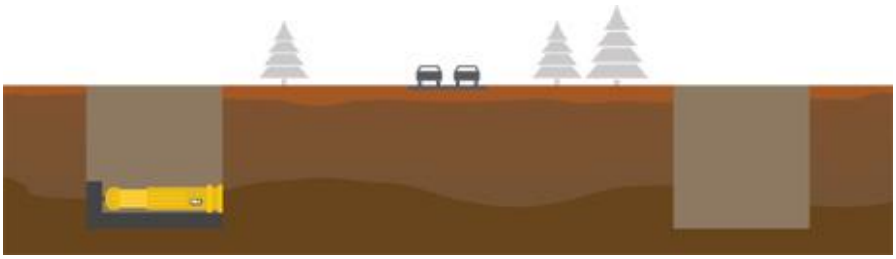
Most commonly, a backhoe is used to dig the trench as shown in Fig. 2.5. The excavation starts with the removal of the top soil in unpaved areas or the concrete/asphalt in paved areas. Large trucks haul away excavated subsoil materials to approved off-site location for disposal, or if appropriate, re-use. In accordance with OSHA requirements, trenches of a certain depth may require additional shoring. Trench size will vary depending on the cable type and the line's voltage. The Underground transmission line would normally be buried 1.42 m beneath the surface. In many instances, groundwater will be encountered during the trenching; groundwater may be pumped from the excavation to a suitable upland area or pumped directly into a tanker truck for transport to a suitable location for release.

Fig. 2.5: Excavation Using Backhoe

Thrust Boring

Thrust boring is required while intersecting PR mainline and Shahrah-e-Faisal.

Thrust boring, is a jack and bore drilling method typically used for installing steel pipe casing beneath an existing surface where the risk of hole collapse whilst installing larger diameters has been identified or where the grade is critical. Thrust boring, is typically performed by placing an auger equipped with a cutting head inside a 200mm to 1500mm diameter steel pipe. The auger is then attached to the rotation shaft of a thrust boring machine.



A large rectangular pit is usually dug on each side of the work area to accommodate the steel pipe and machinery used in this procedure. The pipe casing is jacked into place as the drilling is performed with any excess soil transferred out of the pipe by the auger's blades.

Thrust boring generally works best in soils that are located above the groundwater table. When groundwater is present during a boring operation, special dewatering measures must be taken to prevent the steel pipe casing from being flooded with water. However, at 4-4.5 ft. deep trench, groundwater is not envisaged along the proposed route alignment.

Laying of XLPE cable system

The proposed Underground XLPE cable systems will be buried directly into the trench. The depth and width of trench will be nearly 1.4 m and 1.5 m respectively throughout the route of the cable. The trench is covered/ backfilled with a layer of fine sand 15 cm thick and the cable is laid over this sand bed. The purpose of sand is to prevent the entry of moisture from the ground and thus protects the cable from decay. After the laying of the cable in the trench, it is covered/ backfilled with another layer of sand of about 10 cm thickness, care being taken so that no sharp stone should come in direct contact with the cable. When more than one cable is to be laid in the same trench, horizontal or vertical interaxial spacing at least 30cm is provided in order to reduce the effect of mutual heating and also to ensure that fault occurring in any one cable does not damage the adjacent cable. Transmission line underground area must be safe from accidental contact with construction equipment; and vegetation must be managed to avoid roots from interfering with the system. Use of light mortar or thermal filler instead of fine sand considerably improves the transmission properties.[1]

Advantages of laying cables by the above mentioned method are:

- Simple and less costly;
- Gives best conditions for dissipating the heat generated in the cables; and
- Clean and safe method as the cable is invisible and free from external disturbances.

Disadvantages of laying cables by the above mentioned method are:

- The extension of load is possible only by a completely new excavation which may cost as much as the original work;
- The alterations in the cable network cannot be made easily;
- The maintenance cost is very high;

[1] Underground Power cables, Nexons

- Locating a fault is difficult; and
- Cannot be used in congested areas where excavation is expensive and inconvenient.

Urban road ROWs often contain a wide variety of underground obstacles, such as existing utilities, natural features, topography, major roadways, or underpasses. The dimensions of the trench might need to be deeper and wider to avoid underground obstacles. Every effort is made to prevent impacts to existing utilities such as making minor adjustment to the alignment, relocating the existing utility, or putting the cables below the existing infrastructure.

Cable Installation obstacles

The cost of project increases with the number of obstacles that need to be crossed by excavating underneath or be avoided by routing around the obstacle. Common obstacles are streams, railroads, other utilities, sanitary and storm sewers, streets and highways in the right of way of proposed project.

Horizontal Boring/ Jack and Bore

Jack and bore construction is carried out in areas where open trench construction is obstructed by existing features such as main road, railroads, waterways, or other large facilities or utilities. Horizontal boring requires an extensive construction area on each side of the bore. Entrance and exit pits are excavated to accommodate the boring equipment and materials. An auger is used in the entrance pit to excavate a hole and remove spoils. A jack pushes a reinforced pipe in sections behind the auger head. When the pipe is installed, the entrance and exit pits are restored to their original condition.

The amount of disturbed construction area required for a jack and bore is usually proportional to the diameter of the bore, its maximum depth, and the length of the bore.

Cooling

XLPE conductors operate at about 176ºFto 194ºF. In order to conductors operate efficiently; heat must be carried away from the conductor and is achieved by selecting a suitable backfill material/soil in and around the trench and by adopting appropriate cable installation method i.e., cable will be well-spaced from others for good heat dissipation. However; in overhead transmission line air performs this function.

Backfilling

All of the heat generated from direct buried cables will be dissipated through the soil. The selection of backfill type can make a strong difference on the capacity rating. Different soils have different abilities to transfer heat. Saturated soils conduct heat more easily than for instance, sandy soils. For this reason, the design needs to determine the type of soil nearest the line. A soil thermal survey will be necessary before construction to help determine the soil's ability to move heat away from the line. Due to transmission at 132 kV, the current flowing in cable shall be low; hence heat dissipation is not of major concern.

Site Restoration

Site restoration for underground construction is similar to overhead transmission line construction restoration. When construction is completed, roadways, landscaped areas, and undeveloped areas are restored to their original condition and topography. Highway lands and shoulders are re-constructed so as to support road traffic. Roadside areas and landscaped private properties are restored with top soils that was previously stripped and stockpiled during construction or with new topsoil. Any infrastructure impacted by the construction projects such as driveways, curbs, and private utilities are restored to their previous function.

2.9 CONSTRUCTION MACHINERY / INSTRUMENTS

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

2.10 WASTE MANAGEMENT

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

2.11 Tentative Schedule of Site preparation and Construction

As per bid document before "December 2019' time has been given for the transmission line project. This project schedule will be available after award of the contract.

Chapter 3 Legislation & Administrative Framework

3.1 Introduction

Before initiation of any project, the mandatory legislations enacted by government and other regulatory agencies need to be studied. Governments from time to time have enacted many environmental rules, regulations, laws and guidelines specifying different requirements for diverse kind of projects. Therefore, it would be necessary to study those environmental laws pertaining to the project before its execution so that protection of environment can be ensured.

In this section, same methodology would be followed by studying those rules, regulations and laws that are relevant to the environmental and social aspects of the project "220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station". The assessment has been carried out to comply with both local and international laws and guidelines. The main among these are:

- National Environmental Laws & Legislations;
- Provincial Environmental Laws & Legislations;
- National & International Environmental and Social Guidelines; and
- Institutional Setup for Environmental Management.

This project will comprehensively practice the applicable requirements of policy documents, legislative framework and recommendations described in national and international guidelines of the project and will follow the institutions existing in the country that may influence the environmental management of the proposed project. These laws and guidelines have been incorporated in the mitigation measures and Environmental Management & Monitoring Plan (EMMP), which have been formulated for better environmental, ecological and social management.

3.2 National Environmental Laws & Legislations

In Pakistan, the awareness about necessity of having environmental protection laws and regulations developed since late 1970s. First step in this direction was the promulgation of the Pakistan Environmental Protection Ordinance, 1983. The organization entrusted with enforcement of environmental laws was then established viz. Pakistan Environmental Protection Agency in 1984. These efforts were continued and plan for protection of environment was developed called the Pakistan National Conservation Strategy.

Similarly, provincial governments also created Provincial Environmental Protection Agencies to look after the environmental issues in their regions. Then, in 1993, the National Environmental Quality Standards (NEQS) were made.

The powers of Environmental Protection Agencies were considerably enhanced by enacting the Pakistan Environmental Protection Act, 1997. And, the Pakistan Environmental Protection Agency Review of IEE and EIA Regulations (IEE-EIA Regulations), 2000 explained the details about the preparation, submission, and review of Initial Environmental Examinations (IEEs) and Environmental Impact Assessments (EIAs). Moreover, there are numerous other national laws that contain the provisions for protection of environment.

Previously, the issue of 'environmental pollution and ecology' was placed in Concurrent list in the Constitution which allowed both Federal and Provincial Governments to enact laws on it. But, Eighteenth Amendment to the Constitution of Pakistan, 2010, transferred this issue to the Provincial governments. Due to this, the functions related to the national environmental management were transferred to the provinces. The Federal Government has established two Environmental Tribunals one each in Karachi and Lahore. The Karachi Tribunal has control over the provinces of Sindh and Baluchistan while the Lahore Tribunal covers the provinces of the Punjab and the Khyber Pukhtunkhwa. The High Courts have designated senior civil judges as Environmental Magistrates to take all contraventions punishable in respect of handling of hazardous substances and pollution caused by motor vehicles etc. The international obligations in the context of environment will be management by the Ministry of Climate Change, Government of Pakistan.

Significant national environmental laws and legislations that have relevance to the project are as discussed under:

3.2.1 The Pakistan Environmental Policy, 2005[1]

The Pakistan Environmental Policy provides an overarching framework for addressing the environmental issues facing Pakistan, particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification, natural disasters and climate change. It also gives direction for addressing the cross sectoral issues as well as the underlying causes of environmental degradation and meeting international obligations.

The National Environmental Policy, while recognizing the goals and objectives of the National Conservation Strategy, National Environmental Action Plan and other existing environment related national policies, strategies and action plans, provide broad guidelines to the Federal Government, Provincial Governments, Federally Administrated, Territories and Local Governments for addressing environmental concerns and ensuring effective management for their environmental resources.

The National Environmental Policy aims to protect, conserve and restore Pakistan's environment in order to improve the quality of life for the citizens through sustainable development and the same is agreed by the proposed project "220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station".

3.2.2 Pakistan Penal Code, 1860[2]

Section XIV of PPC deals with the offences affecting the public health, safety, convenience, decency and morals. Person may be guilty of public nuisance if his act or omission causes common injury, danger or annoyance to the public or results in spread of infection of diseases dangerous to life. The section also deals with environmental pollution.

Provisions under this Act relating to environment are no longer being enforced after promulgation of the Pakistan Environmental Protection Act, 1997 and then by Sindh Environmental Protection Act, 2014. However, pollution offences can still be tried under the Pakistan Penal Code, 1860.

3.2.3 Land Acquisition Act, 1894[3]

This Act provides law for the acquisition of land needed for public purposes and for companies; and for determining the amount of compensation to be made on account of such acquisitions. The law provides details of various peculiarities involved in acquisition of land such as preliminary investigation, objection to acquisition, declaration of intended acquisition, enquiry into measurements, value & claims, taking possession, reference to court and procedure thereon, apportionment of compensation, payment, temporary occupation of land, acquisition of land for companies, disputes resolutions, penalties and exemptions etc. This Act has 55 sections addressing different areas. Such as section 4(2) mentions that it shall be lawful for any official authorized by the Collector to enter upon and survey, to dig or to do all other Acts necessary to ascertain that whether the land is adapted for such purpose.

For underground TL, the start and end point 6.5ft. wide ROW will be obtained from PQA and Malir Development Authority (MDA) and for tower base, land acquisition will be done as per Telegraph Act, 1885.

3.2.4 The Telegraph Act, 1885

The Telegraph Act (TA) was conceived in the British era for telegraphic poles and then was passed to post-independence Pakistan with a broader application covering also electric poles and towers. The original provision of this law was that the land occupied by telegraph poles was not to be compensated (only crops destroyed during the erection of the pole were compensated). This was based on the logic that a pole, covering only a negligible land area, does not cause substantial impacts to land users. This however is no longer applicable with the 220 or 500 KV transmission lines where the average area of impact is 900 sq. meters.

In case of impacts caused by the poles and towers for public facilities and transmission lines, land acquisition is not regulated by the LAA but instead by the Telegraph Act, 1885 (amended in 1975).

The Act (section 11) confers powers to the NTDC to enter private lands and (section 10) construct/maintain electricity towers and transmission lines without the need to acquire the land affected and paying compensation for it. However sub-section 10 (d), provides that the NTDC is required to avoid causing unnecessary damages to the affected land and

[1] *The Pakistan Environmental Policy, 2005,Govt. of Pakistan, Ministry of Environment*
[2] *Pakistan Penal Code(XLV of1860)6th October 1860*
[3] *The Land Acquisition Act 1894 (Act of 1894) http://punjabelaws.gov.pk/laws/12.html*

associated assets. Finally Sub Section 10 (d) and Section 16 provides that if any such damage occurs (i.e. damages to crops, irrigation facilities, and land quality or land income) the project proponent has to provide just compensation for the damages caused.

The Telegraph Act also requires the proponents to: (i) properly inform the affected people through written notices and onsite public meetings; (ii) compensate at market rates all the lands occupied by towers in urban areas, or replace the broad-based conventional towers by narrow-based tubular poles to minimize impact on land; (iii) avoid land impacts in rural areas through the use of towers with sufficient vertical clearance to allow the continuation of unrestricted farming and animal grazing; and, (iv) if the construction of such towers is impossible, compensate the land occupied by tower bases also in rural areas. In addition, the proponent will compensate by default all the crops, trees and other assets expected to be affected by the Transmission Line construction phases including (i) construction of tower bases; (ii) tower erection; and (iii) stringing of power cables.

This Act makes provision of installing towers without acquiring any land. However, provision is there for temporary acquisition of land during the construction period. During the proposed Transmission Line project, it will be ensured that land under the transmission lines is accessible and can be used productively. In the absence of such situation, the land will be acquired and compensation paid either under LAA (1894), or under the willing buyer-willing seller at market prices with consensus on price.

3.2.5 Antiquities Act, 1975[4]

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

No archeological and cultural site as protected under Antiquities Act 1975 is present near the proposed route alignment.

3.2.6 The Forest Act, 1927[5]

The Forest Act deals with the matters related with protection and conservation of natural vegetation/habitats. The Act contains procedures for constituting and managing various types of forests, such as reserved forests, village forests and protected forests. The Act empowers the provincial forest departments to declare any forest area as reserved or protected. It also defines the duties of forest related public servants, prohibits cutting of trees and prescribes penalties for violation of any provision of the Act.

The Project site does not encompass any reserve/protected forest area.

3.2.7 Cutting of Trees (Prohibition) Act, 1975

The Cutting of Trees Act prohibits cutting or chopping of trees without prior permission of the Forest Department. Section 3 of this Act states that "No person shall, without prior written approval of the local formation commander or an officer authorized by him in this behalf, cut fell or damage or cause to cut, fell or damage any tree growing within the five miles belt along the external frontiers of Pakistan."

There are number of trees on the preferred route and alternate routes. Most of the trees from the start where underground line will be laid at port qasim are Conocarpus species located at the islands and human planted. Also, few trees are located at the proposed tower locations. These trees can be avoided by avoiding them or if it is not possible, compensatory plantation will be provided at a ratio of 1:3.

3.2.8 The Electricity Act, 1910[6] & the Electricity (Amendment) Ordinance, 1979[7]

The electricity Act, 1910 relates to the supply and use of electrical energy. Supply of energy licenses and its revocation under various conditions is given in part II of the Act. This Act obligates licensee to pay compensation for any damages caused during the constructions and maintenance of any power distribution facilities. Part III of the Act discusses the

[4] *Act VII of 1976(Gazette of Pakistan, Extraordinary, Part 1, 14th January, 1976*
[5] *The Forest Act,1927(XVI of 1927) http://punjab laws.gov.com/laws/40.html*
[6] *The Electricity Act, 1910, (IX of 1910)*
[7] *The Electricity (Amendment) Ordinance, 1979, (LXII 0F 1979)*

supply, transmission and use of energy by non licensees. This law prohibits the generation, transmission, supply or use of energy, in any way that may injure any railway, tramway, canal or waterway or any dock, wharf or pier vested in or controlled by a local authority.

The electricity Act, 1910 is amended through the electricity (Amendment) Ordinance, 1979. Penalty of three years imprisonment or five thousand fines or with both is prescribed for dishonest abstraction or consumption of energy.

3.2.9 Electricity Rules, 1937[8]

These rules regulate the generation, transmission, supply and use of energy in Pakistan. The Act prescribes the conditions and procedures of issuance of licenses. General precautions for the safety of the public are mentioned. Construction, insulation and earthing of apparatus are prescribed to be done to prevent danger. Additional rules for electric tractions are also given.

3.2.10 The Electricity Control Ordinance, 1965[9]

This ordinance provides powers to control the production, distribution, use and consumption of electrical energy during an emergency throughout Pakistan. When the National Assembly is not in session and the President is satisfied that circumstances exist which render immediate legislation necessary, the president can promulgate the ordinance. The ordinance prescribes a penalty of six month or with fine, or with both, in case of non-compliance of the ordinance.

3.3 Provincial and Local Environmental Laws and Legislations

3.3.1 Sindh Environmental Protection Act (SEPA), 2014[10]

This Act has been enacted to provide for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution, and promotion of sustainable development. It equally lays emphasis for the preservation of the natural resources of Sindh and to adopt ways and means for restoring the balance in its eco-system by avoiding all types of environmental hazards.

Environmental Protection Council (EPC)

It has been formed consisting of Chief Minister as Chairman with Minister in charge of Environment Protection Department, Addl. Chief Secretary, Planning & Development Department, Government of Sindh and Secretaries of Environment, Finance, Public Health Engineering, Irrigation, Health, Agriculture, Local Government, Industries, Livestock & Fisheries Forest & Wildlife, Energy, Education Departments Government of Sindh and Divisional Commissioners of Sindh. Non-official members are also included (i.e. representatives of Chamber of Commerce & Industry and from medical or legal professions etc.) along with DG EPA & two Members of Provincial Assembly also form part of EPC.

The functions and powers of EPC include coordination & supervision of provisions of Act, approving provincial environmental & sustainable development policies & SEQS, provide guidance for protection & conservation, consider annual Sindh Environmental Report, deal with interprovincial and federal provincial issues, provide guidance for bio safety and assist Federal Government in implementation of various provisions of UN Convention on laws on Seas (UNCLOS).

Sindh Environmental Protection Agency (SEPA)

SEPA would be headed by Director General (DG) with the aim to exercise the powers and perform the functions assigned to it under the provisions of this Act and the rules and regulations made there under. The Agency shall have technical and legal staff and may form advisory committees.

The Agency shall administer and implement the provisions of this Act and rules and regulations. It shall also prepare environmental policies, take measures for implementation of environmental policies, prepare Sindh Environment Report and prepare or revise Sindh Environmental Quality Standards. SEPA shall also establish systems and procedures for

[8] *Electricity Rules, 1937*
[9] *The Electricity Control Ordinance, 1965, Ordinance No. XXVIII of 1965*
[10] Sindh Environmental Protection Act, 2014, Sindh Act No. VIII of 2014 dated 20th March, 2014

surveys, surveillance, monitoring, measurement, examination, investigation, research, inspection and audit to prevent and control pollution and to estimate the costs of cleaning up pollution and rehabilitating the environment and sustainable development. SEPA would also take measures for protection of environment such as to promote research; issues licenses for dealing with hazardous substances, certify laboratories, identify need for or initiate legislation, specify safeguards etc. SEPA would also encourage public awareness and education regarding environmental issues.

SEPA would have powers to enter or inspect under a search warrant issued by Environmental Protection Tribunal or a Court search at any time, any land or building etc. where there are reasonable grounds to believe that an offence under this Act has been or is being or likely to be committed. SEPA may also take samples, arrange for testing or confiscate any article in discharge of their duties.

This act has also provided for Sindh Sustainable Fund derived from various sources such as voluntary contributions or fees generated etc. This fund is utilized for protection, conservation or improvement of environment.

Salient Features

Section-11: No person shall discharge or emit or allow the discharge or emission of any effluent waste, pollutant, noise or adverse environmental effects in an amount, concentration or level which is in excess to that specified in Sindh Environmental Quality Standards.

Section-12 & 13: No person shall import hazardous waste into Sindh province and handle hazardous substances except under licenses etc.

Section 14: No person shall undertake any action which adversely affects environment or which lead to pollute or impairment of or damage to biodiversity, ecosystem, aesthetics or any damage to environment etc.

Section 15: This section deals with regulation of motor vehicles banning emission of air or noise pollutants being emitted from them in excess of allowable standards.

Section 17: This section states that no proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment and has obtained from Agency approval in respect thereof. SEPA shall review the IEE & EIA and accord approval subject to such terms and conditions as it may prescribe or require. The agency shall communicate within four (04) months its approval or otherwise from the date EIA is filed failing which the EIA shall deemed to have been approved.

Section 21: Where agency is satisfied that the discharge or emission has occurred in violation of any provision of this act or rules etc. then it may, after giving an opportunity to person responsible, by order direct such person to take such measures within specified period. The agency under this section has been empowered to immediately stop, prevent or minimize emission, disposal etc. for remedying adverse environmental effects.

Section 22: The person who fails to comply with section 11, 17, 18 and 21 shall be punishable with a fine which may extend to five million rupees, to the damage caused to environment and in the case of a continuing contravention or failure, with an additional fine which may extend to one hundred thousand rupees for every day during which such contravention or failure continues. And, where a person convicted under sub-sections 1 & 2 had been previously convicted for any contravention of this Act, the Environmental Protection Tribunal (EPT) may, in addition to punishment, award imprisonment for a term that may extend up to three years, or order confiscation or closure of facility etc.

Section 23: Where any violation of this Act has been committed by any of employee of any corporate body, then, that employee shall be considered to be guilty of environmental pollution.

Section 25: This section allows for establishment of Environmental Protection Tribunals.

The Act is attached as **Annexure –I**.

3.3.2 Sindh EPA Review of IEE and EIA Regulations, 2014

The Sindh Environmental Protection Agency (Review of IEE/EIA) Regulations 2014 divides projects in Schedules I& II depending upon the severity of environmental impact of the project as follows:

Schedule I: A project falls in Schedule I if it is likely to have adverse environmental impacts, but of lesser degree or significance and all the mitigation measures to handle the impact is manageable. Such types of projects need IEE report including EMP.

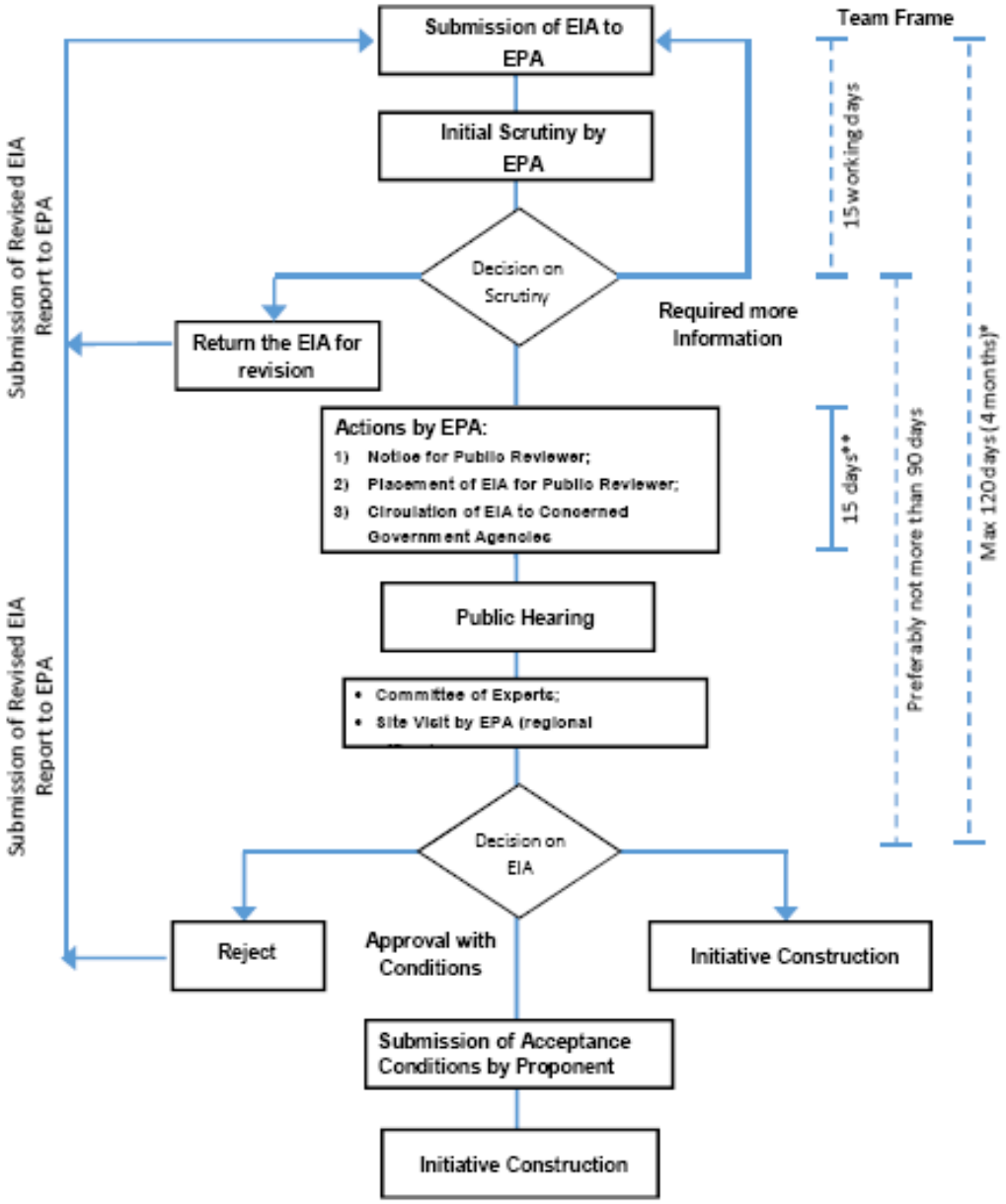
Schedule II: Projects are categorized in Schedule II if they generate significant adverse environmental impacts that require a comprehensive management plan, or if the project is located within or passes through: a) Areas declared by the Government of Pakistan as environmentally sensitive (National Parks/Sanctuaries/Game Reserve), b) Areas of international significance (e.g. protected wetland as designated by the RAMSAR Convention), or c) Areas designated by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) as cultural heritage sites.

According to Sindh Environmental Protection Agency Regulation 2014, a proponent of a project shall file an EIA with the Sindh Environmental Protection Agency, if the project falls in any category listed in Schedule II; since the projects listed in Schedule II are generally major projects and have the potential to affect a large number of people.

The project "220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station" falls in Schedule II requiring an EIA as the project is categorized as:

- ✓ A. Energy
- ✓ Transmission Lines(11 kV and above) and Distribution projects

These regulations are attached as **Annexure –II.**



Procedure for EIA Review and Approval process

3.3.3 Sindh Environmental Quality Standards

On June 28, 2016, the Sindh Environmental Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Air, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards, 2015 have been notified by Sindh EPA. The KE shall follow the SEQS in letter and spirit during project execution. The SEQS are attached as **Annexure –III.**

3.3.4 Hazardous Substances Rules, 2014[11]

These Rules were notified to stream line procedures for issuance of licenses to industries/ businesses that generate hazardous waste, safety precautions for workers; and devices them methods for the removal of hazardous wastes in an environmental friendly manner. The rules also specify procedures to be adopted for import, transport and disposal of hazardous waste; and identify two hundred and forty-three hazardous substances and synthetic chemicals.

[11] *Hazardous Substances Rules, 2014*

3.3.5 Sindh Wildlife Protection Ordinance, 1972 (SWPO)[12]

This ordinance provides for the preservation, conservation and management of wildlife in Sindh. This Ordinance lays down rules for formation and management of protected areas and prohibition of hunting of wildlife species declared protected under the ordinance. The ordinance also specifies three broad classifications of the protected areas: national parks, wildlife sanctuaries and game reserves. Wildlife sanctuaries are areas that have been set aside as undisturbed breeding grounds and cultivation and grazing is prohibited in the demarcated areas. Nobody is allowed to reside in a wildlife sanctuary and entrance for the general public is by special dispensation. However, these restrictions may be relaxed for scientific purpose or betterment of the respective area on the discretion of the governing authority in exceptional circumstances. Game reserves are designated as areas where hunting or shooting is not allowed except under special permits.

The project is located in Karachi suburbs and is not neighboring any Wildlife Sanctuary or Game Reserve.

3.3.6 The Sindh Cultural Heritage (Preservation) Act, 1994

The Sindh Cultural Heritage (Preservation) Act, 1994 is the provincial law for the protection of cultural heritage. Its objectives are similar to those of the Antiquity Act, 1975. No antiquity protected under these two laws is identified in the vicinity of the proposed project area.

3.4 K.E Safety Considerations on selection of T/L Routes

3.4.1 K.E Technical Procedure for Overhead Transmission Line

Installation of Grounding

i. 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. 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.
ii. A grounding resistance of max. 3 ohms is required for any tower.
iii. For tower locations where the rods cannot be used due to soil conditions the Contractor shall at least install two ground strips each 20 m long, connected to the stubs inside the concrete foundations.
iv. 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.
v. 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.
vi. 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.
vii. 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.
viii. 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.
ix. 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.
    a. during initial installation;
    b. 28 days after installation;
    c. Immediately before commissioning.

[12] *The Sindh Wildlife Protection Ordinance, 1972. 1 Sindh Ordinance No. V of 197 2. AN 13th April, 1972*

Installation of Insulator Strings

i. 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.
ii. 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.
iii. Workmen shall not climb upon insulator strings after installation.
iv. 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.
v. 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.
vi. 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.

Installation of Conductors and Accessories

1. Requirements:

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

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

3. Crossing of Public Services

i. 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.
ii. 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.
iii. 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.
iv. 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.

4. Stringing

i. 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.

ii. 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.

iii. The conductors, joints and clamps shall be erected in such a manner that no bird caging 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.

iv. 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.

v. Conductors shall be strung carefully to avoid kinking, loosening of strands, scraping, nicks or 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.

vi. 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 cross arm. They shall be installed at such height as to support the conductor or earth wire at its permanent elevation when clipped in.

vii. 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.

viii. 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.

ix. 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.

x. 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.

xi. 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.

xii. 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:

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

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

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

xvi. 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.

xvii. 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 grid station shall be "Slack Spans". The conductor shall be coated with an approved grease immediately before final assembly in any fitting.

xviii. Splices

xix. Full tension splices shall be made with strain compression joints

xx. 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.

xxi. 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.

xxii. All joints or splices and repair sleeves shall be located at least 10 meters away from the structure.

5. Sagging

i. 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.

ii. 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.

iii. 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.

iv. The length of conductors or sagged on one operation shall be limited to the length that can be sagged satisfactorily.

v. 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.

vi. 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.

vii. Conductor temperature at the moment of sagging shall be checked by an accurate thermometer.

viii. 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.

ix. 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.

x. 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.

xi. 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.

6. Splices

i. Full tension splices shall be made with strain compression joints.

ii. 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.

iii. 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.

iv. All joints or splices and repair sleeves shall be located at least 10 meters away from the structure

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 spacing's which the manufacturer has determined from tests to be the most effective in reducing vibrations under wind velocities 0 to 25 km/h.

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 spacing's which the manufacturer has determined from tests to be the most effective whatever service conditions may be prevailing.

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 holds down weights shall be composed of 50 kg units. The Contractor shall submit a detailed calculation of hold down weights.

10. Connections to Substations

i. The tensions of the conductors in the slack span between the terminal tower and gantry shall not exceed the tensions for loading diagrams.
ii. 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).
iii. Around the terminal structures and terminal equipment, a 2.5 m high fence shall be constructed taking
iv. 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.

3.4.2 Minimum Clearances

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

Table 3.1: Minimum Clearance required from live conductor

Item	Description	Minimum Clearances (in meters)
1.	Normal ground for pedestrians only	9.0
2.	Residential areas	10.5
3.	Roads and streets	10.5
4.	Highways	10.5
5.	Over railways-from top of rail (without electric line system)	15.0
6.	Over pipelines-from top of pipe	10.5
7.	Horizontal distance to metal clad or roofed buildings or buildings	5.4
8.	Power lines (above or below)	5.4
9.	Telecommunication lines	5.4

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

3.5 Environmental and Social Guidelines

The environmental as well as social guidelines related to the proposed project are as discussed under:

3.5.1 Environmental Protection Agency's (EPA's) Guidelines on Environmental & Social Aspects

The Federal EPA has prepared a set of guidelines for conducting environmental and social assessments as discussed under:

- **Policy & Procedures for the Filing, Review and Approval of Environmental Assessments, 2014**[13]

The Policy & Procedures for the Filing, Review and Approval of Environmental Assessments 2014, prepared by the SEPA under the powers conferred upon it by the Sindh Environmental Protection Act 2014, provide the necessary details on the preparation, submission, and review of the Initial Environmental Examination (IEE) and the Environmental Impact Assessment (EIA).

This EIA Study has followed the procedures defined in the Sindh Environmental Protection Act 2014 and Review guidelines 2014, and the EIA will be submitted to the SEPA in whose jurisdiction the project will be implemented. The PEPA has, however, been given the right to review any environmental report at any time and the power to revoke the decision of the provincial EPA, if it deems this to be necessary.

- **Guidelines for the Preparation and Review of Environmental Reports, 1997**

The guidelines on the preparation and review of environmental reports target project proponents and specify:

- The nature of the information to be included in environmental reports;
- The minimum qualifications of the EIA conductors appointed;
- The need to incorporate suitable mitigation measures at every stage of project implementation; and
- The need to specify monitoring procedures.

The terms of reference for the reports are to be prepared by the project proponents themselves. The report must contain baseline data on the study area, detailed assessment thereof, and mitigation measures.

- **Guidelines for Public Consultation**

These guidelines provide assistance throughout the environmental assessment of the project by involving the public which can lead to better and more acceptable decision-making. Timely, well planned and appropriately implemented public involvement, undertaken in a positive manner and supported by a real desire to use the information gained to improve the proposal, will lead to better outcomes, and lay the basis for ongoing positive relationships between the stakeholders. Specifically public involvement is a valuable source of information on key impacts, potential mitigation measures and the identification and selection of alternatives.

3.5.2 World Bank Guidelines on Environmental & Social Aspects[14]

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,;
- Environmental Assessment Sourcebook, Volume III: Guidelines for Environmental Assessment of Energy and Industry Projects. World Bank Technical Paper No. 154, Environment Department, the World Bank, 1991; and
- Pollution Prevention and Abatement Handbook: Towards Cleaner Production, Environment Department, the World Bank, United Nations Industrial Development Organization and the United Nations Environment Program, 1998.

The first two publications listed here provide general guidelines for the conduct of an IEE/EIA, and address the IEE/EIA practitioners themselves as well as project designers. While the Source book in particular has been designed for the Bank projects, and is especially relevant for the impact assessment of large-scale infrastructure projects, it contains a wealth of information which is useful to environmentalists and project proponents.

[13] *Policy and Procedure for the Filing, Review and Approval of Environmental Assessments, Government of Pakistan, November 1997*
[14] *World Bank Guidelines On Environmental & Social Aspects*

The Source book 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 Sourcebook also highlights concerns in social impact assessment, and emphasizes the need to incorporate socio-economic issues in EIA exercises.

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

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP)[15]. These industry sector EHS guidelines are designed to be used together with the General or multiple industry-sector guidelines as may be necessary. The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project such as host country context, assimilative capacity of the environment etc. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

Industry-Specific Impacts and Management

This include construction site waste generation, soil erosion and sediment, control from materials sourcing areas and site preparation activities, fugitive dust and other emissions (e.g. from vehicle traffic, land clearing activities, and materials stockpiles), noise from heavy equipment and truck traffic, potential for hazardous materials and oil spills associated with heavy equipment operation and fueling activities.

Performance Indicators and Monitoring

Where dust or potentially contaminated water runoff exists, site operations should comply with guidelines described. Monitoring should be conducted by trained individuals and monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Occupational health and safety performance should be evaluated against internationally published exposure guidelines. Projects should try to reduce the number of accidents among project workers.

[15] www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

Chapter 4 ENVIRONMENTAL & SOCIAL BASELINE OF THE PROJECT AREA

4.1 General

4.1.1 The Aim of Baseline Study

The baseline study relate to the physical, biological and socio-economic environment of the project area prior to the beginning of construction and operational activities.

This categorization would aid in understanding the prevalent macro and micro environment of this project and would enable assessment of possible environmental impacts that may arise as a result of the activities associated with the project. It would also assist the design team in defining the mitigation measures that would be required to minimize if not eliminate the negative impacts which are pointed out in this study.

4.1.2 Methodology

Information for this section was collected from different sources including electronic and print media, studies previously conducted in proposed project area by EMC and archives of the experts, consultations with institutions, Non-government Organizations (NGOs) and field surveys conducted for this study by the team of EMC Pakistan (Pvt.) Ltd. etc.

4.1.3 Study Area

The macroenvironment of the project area comprises the administrative area of Malir District.

The Project starts from proposed Engro Power Plant at 24°47'31.66"N & 67°22'43.28"E, initially run along Port Qasim road and Lotte Chemicals Pakistan and transformed into overhead after 2km at 24°47'24.70"N & 67°23'39.33"E. The overhead transmission line will run along the Eastern industrial zone of PQA (UC Ghaghar) and intersect National highway N5 near Ghaghar Phattak at 24°50'19.62"N & 67°26'13.04"E and enter UC Gulshan-e-Hadeed. After covering a distance, it will turn left and intersect New Malir Housing Scheme-1 and Eastern Bypass. It will then enter agriculture areas located at the right bank of Malir River at 24°55'26.35"N & 67°19'57.67"E and end near Goth haji Sheedi and connect via underground line to new Port Qasim Grid Station at 24°54'39.00"N & 67°16'60.00"E. Malir District is being administered by Malir Development Authority (MDA).

The macro environment and the route of the Transmission Line is shown in the Figure 4.1.

4.2 Physical Environment

4.2.1 Meteorology and Climate

The climate of the macroenvironment can be characterized by dry, hot and humid conditions and in general terms it is moderate, sunny and humid. Climatic conditions of the whole region are influenced in summer by the monsoon winds from the West and by winds from North (Quetta) during winter. There is a minor seasonal intervention of a mild winter from mid-December to mid-February followed by a long hot and humid summer extending from April to September, with monsoon rains from July to mid- September. The average annual rainfall is about 160 mm, of which 70% to 80% falls during the monsoon months of July, August and September. The annual maximum rainfall varies from 2.5 mm to 487 mm. The maximum rainfall recorded in one day is 205 mm in July 2009 and maximum annual rainfall is 487 mm in 1994. The summer temperatures are high, rising to over 46°C on some days. The winters are mild, although the night temperatures are quite low (up to 1.3°C) when the northern winds invade the area. The mean sea level (MSL) average atmospheric pressure during June to August is around 1000 mbar. From Nov to Feb average MSL pressure rises up to 1018 mbar. The relative humidity ranges from about 90% in the morning during May-September to 24% in the evening during December-January.

UC NO.	UC NAME	POPULATION 2005	AREA SQ KM	ROAD LENGTH (km)
UC-1	Ibrahim Hayderi	66177	16.64	78.50
UC-2	Rehri	47839	14.40	67.22
UC-3	Cattle Colony	63726	25.32	132.85
UC-4	Quaidabad	88158	6.63	36.59
UC-5	Landhi	59523	27.66	70.40
UC-6	Gulshan-e-Hadeed	99064	61.79	121.24
UC-7	Ghaghar	56368	373.73	285.60
BIN QASIM TOWN		480,855	526.20	792.40

Fig.4.1: Bin Qasim Town comprising part of Malir District

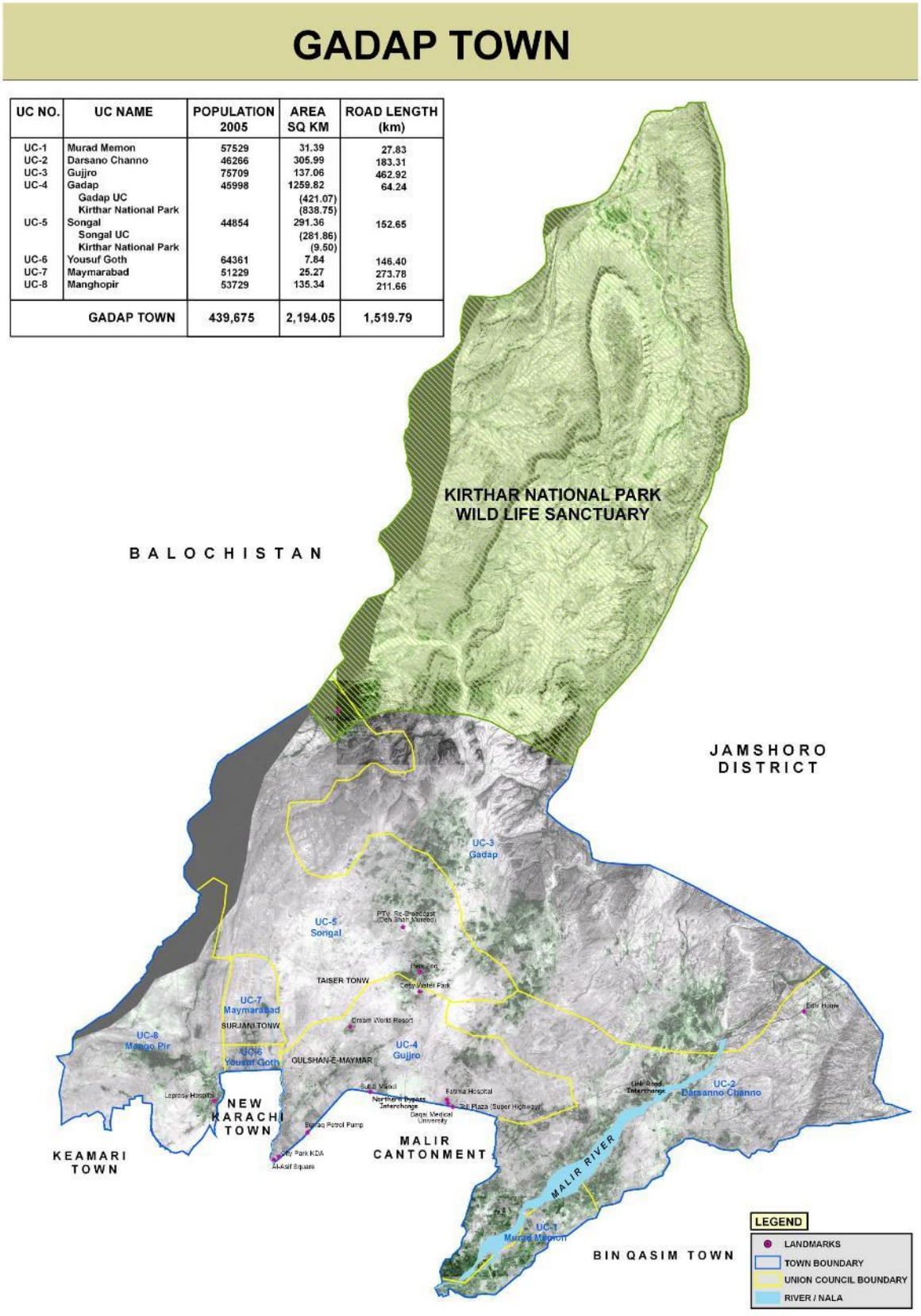


Fig.4.2: Gadap Town comprising part of Malir District

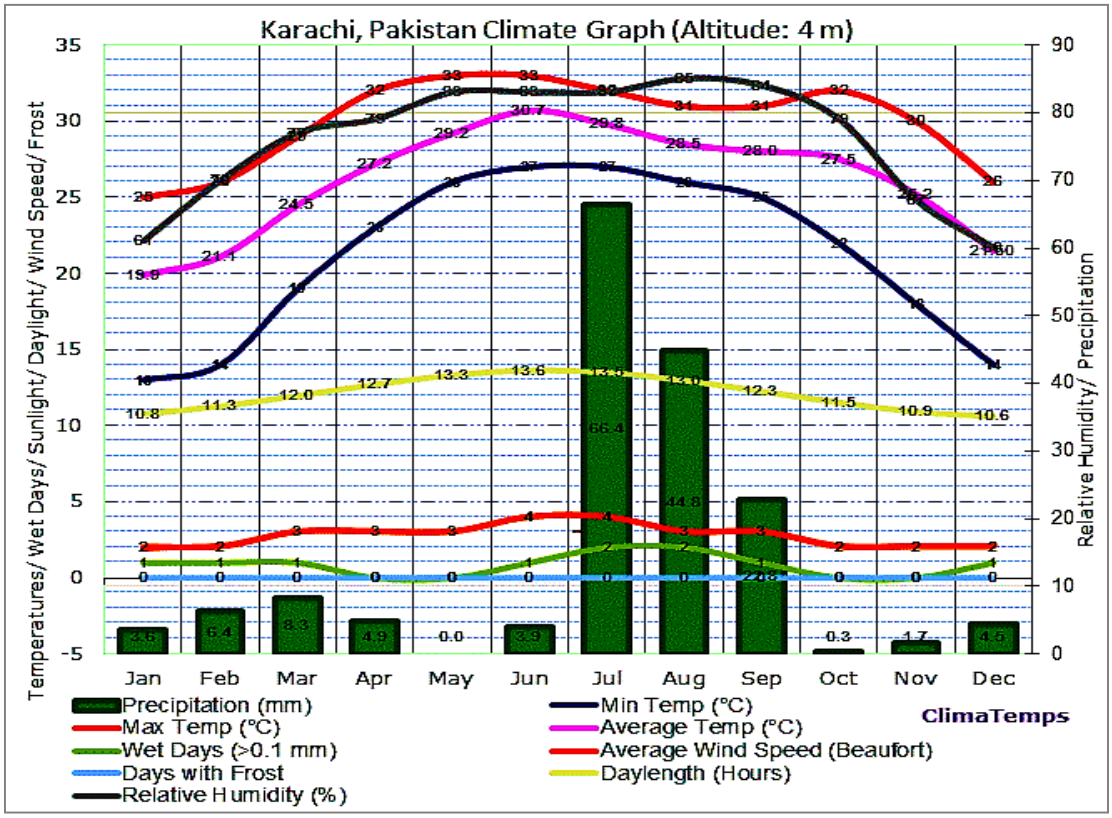


Figure 4.2: Climate of Karachi

Table 4.1: Karachi Weather Averages

Months	J	F	M	A	M	J	J	A	S	O	N	D
Average min temp (°C)	13	14	19	23	26	27	27	26	25	22	18	14
Average max temp (°C)	25	26	29	32	33	33	32	31	31	32	30	26
Average temp (°C)	19	20	24	28	30	30	30	29	28	27	24	20
Average rainfall (mm)	7	11	6	2	0	7	96	50	15	2	2	6
Wet days (>0.1mm)	1	1	1	0	0	1	2	2	1	0	0	1
Relative humidity (%)	61	70	77	79	83	83	83	85	84	79	67	60
Av. Wind speed (Beaufort)	2	2	3	3	3	4	4	3	3	2	2	2
Average no. of frosty days	0	0	0	0	0	0	0	0	0	0	0	0
Source: Pakistan Meteorological Department												

During the month of June the wind speed increases and ranges from 4-9m/s with a direction of 225° - 350°. Maximum velocities are recorded during the month of July i.e. from 9-12m/s with a prevailing direction of 225° - 315°. The month of July is usually considered as being the peak of the southwest monsoon. During the month of August wind speed ranges between 2 - 9m/s with a direction of 300° to 45° whereas during the month of October and November, wind blows with varying speed, between 3 and 9m/s and direction shifts between 45° and 320°. During the month of December the prevailing wind speed is predominately 2m/s from a variety of directions varying between 225° and 135° (DHA, circa 2007).

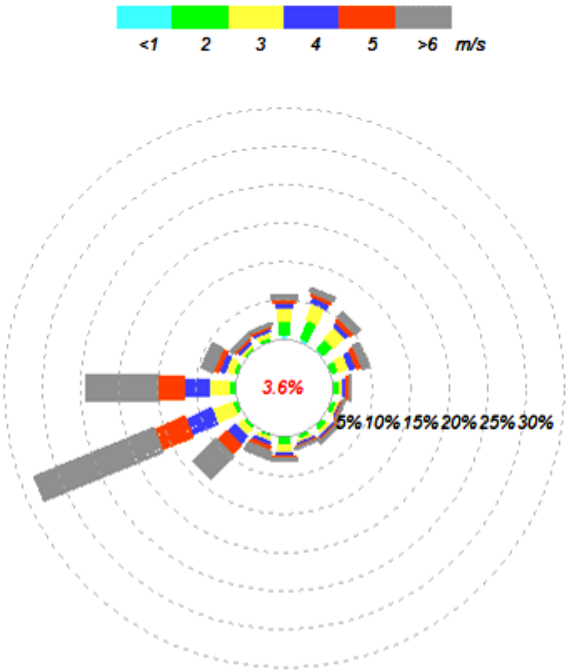


Figure 4.3: Wind rose of Karachi

Storms

High heat content of the Arabian Sea that is adjacent to the extensive heat zone of Pakistan usually upsets the heat balance and hence the water-balance of the region, particularly because it is the destination of windstorms. Tropical cyclones generally develop over Arabian Sea in low latitude i.e. 5-20 degrees north and dissipate after they move over land. The maximum frequency of tropical cyclone formation occurs in April, May and June and in the October-November period. The month of June receives least tropical cyclones in the region. About 76% of tropical cyclones in Karachi approach from the south through the east.

Tropical cyclones that come near the proximity of Karachi are generally weakened. The one that came near the coastal area on May 12, 1999 changed its direction and hit the coastal area of Badin, however Karachi was safe from this cyclone as it is located in the peripheral area and only rain showers of moderate intensity were recorded. The June 6, 2010 cyclone 03A, nick named Phet had landed on the coast of Oman and had lost its intensity. Moving in clockwise direction it poured heavy rains on Gwadar and Pasni. The rain bearing winds moved along the coastline towards Karachi. It touched Karachi only tangentially and brought 100 mm rainfall two days before it landed south of Thatta District.

The recent tropical cyclone of June, 2014 that hit the Oman had impact similar to June, 2007 cyclone, it also caused flooding and heavy rainfall in coastal belt of Balochistan and Badin & Thatta districts of Sindh, while Karachi remained safe from its impact.

Very Severe Cyclonic Storm Nilofar was the strongest tropical cyclone of 2014 within the North Indian Ocean and the strongest storm to form over the Arabian Sea since Phet in 2010. Nilofar originated from a low pressure area in the Arabian Sea that intensified into a depression on October 25. By October 31, Nilofar was reported to have weakened into a well-marked low pressure area.

Figure 5.3: Cyclone Nilofar shortly before peak intensity on October 28, 2014

Table 5.6: Intensity and Area of Storm Activity

Month	Intensity of Storms On an arbitrary al f 0 4	Primary Area of Activity
January	0 (No Storms)	–
February	0 (No Storms)	–
March	0 (No Storms)	–
April	2	Southern Arabian Sea
May	3	Southern Arabian Sea
June	3	Northern Arabian Sea
July	1Storms	Northern Arabian Sea
August	1	Northern Arabian Sea
Septemb	2	Northern and Central Arabian Sea
October	4 (Severe)	Southern and Eastern Arabian Sea

4.2.2 Ambient Air Quality & Noise

In order to analyze the existing air quality of the project area, ambient air monitoring was conducted.

The results achieved by the monitoring will be taken as baseline air quality of the area.

Air monitoring setup has been installed at the monitoring locations to collect ambient air quality data for 24 Hours. Pollutants being monitored included NOx, SO2, CO, CO2, O3, SPM, PM2.5, PM10 and Lead.

Air quality monitoring was conducted at five locations in the macroenvironment. The criteria of site selection for air quality monitoring in the macroenvironment was based on representativeness of the location i.e. locations selected for monitoring are representative of the various type of activities (Industrial operations, traffic congestion etc.) in the macroenvironment. The results of monitoring of the water quality are shown in Table 5.12.

Table 5.12: Results of Air Quality monitoring at selected locations

Item / Location	NO_2 (ppb)	NO (ppb)	SO_2 (ppb)	CO (ppb)	SPM ($\mu g/m^3$)	PM10 ($\mu g/m^3$)	PM2.5 ($\mu g/m3$)
1, Kohi Goth Bridge	11.01	30.25	22.26	5.52	180.21	44.69	18.67

2, Benazir Bhutto Village	92.46	177.84	71.86	5.42	194.13	85.00	29.31
3, Port Qasim Roundabout	67.43	79.29	63.39	3.76	206.39	88.06	26.16
4, Pakistan Steel	94.07	123.55	69.28	5.02	205.96	80.20	27.12
5, Shah Latif Town	13.02	34.99	23.34	3.27	185.73	57.67	22.80
Average	54.5	85.7	52.2	4.6	191.0	66.1	30.04
SEQS	43	32	45	9	500	150	35
Source: EIA of Construction and Rehabilitation of N5 by EMC Pakistan (Aug, 2015)							

Based on the result of the survey, the average values of NO2, NO and SO2 monitored in 5 locations exceeded the SEQS standards. It is due to the fact that a number of heavy vehicles such as large transport trailers and tank lorries passes the target section (as indicated also in the traffic survey) boosted the values. Exhaust fumes emitted by factories in the industrial areas also has an effect on boosting the values. On the other hand, values of CO, SPM, PM10 and PM2.5 were within the standards.

The noise level data generated from the survey suggest that the noise levels at the project site were well within the permissible limits. The noise levels were checked at four sides of the proposed plant location site.

Table 5.13: Noise Level Test Report

S.NO.	LOCATION/SOURCE	SEQS Limits : 55dB(A) Noise Level Readings			
		1	2	3	Mean
1	Intersection of National Highway	71	76	74	73.66
2	Near Engro Power plant	62	60	61	61
3	Near Sheedi Goth	57	59	60	58.66
4	In Eastern Industrial Zone, PQA	55	56	57	56

Noise Monitoring along the transmission route

The noise level at the proposed project alignment at different locations on the average is 66 dB (A), shows that the average noise measurements of the survey is exceeding the limits of SEQS for residential areas due to the heavy wind blowing and heavy mass of traffic flow at National Highway.

4.2.3 Hydrogeological features of Karachi Region

1) Hydrogeology of Karachi

Hydrogeologically, the city of Karachi lies in the Hab River Basin and the Malir River Basin. The Malir River Basin is drained by the Malir River and the Lyari River. The aquifer of Karachi is, therefore, mainly recharged by seepage from Hab River, Hab Dam as well as the Malir and the Lyari Rivers. The Hab River lies on the western frontier of Sindh and for some distance the boundary between Sindh and the Baluchistan provinces. It located about 30 km to the west of Karachi, along the Karachi- Lasbela boundary. It falls into the Arabian Sea near Cape Monze, with a total drainage course length of 336 km.

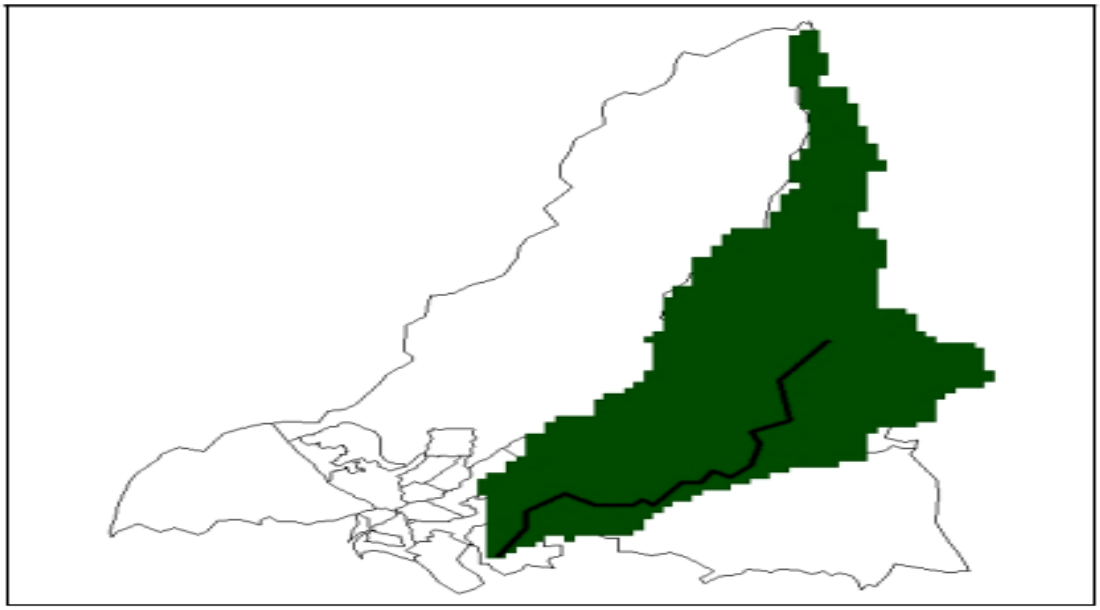
During the past several years, a number of pumping wells have been installed to meet requirements for the irrigation-water supply (to raise vegetables, fruits, dairy and poultry) and drinking-water supply for Karachi. Excessive pumping of groundwater and continuous lowering of water-table is likely to result in intrusion of seawater into the Malir Basin under natural seepage conditions and under artificially induced conditions of recharge of saline seawater in the coastal aquifer(s) of Karachi.

Malir basin is wedge shaped area and spread over 1520 sq.km and drained by Malir River. Khadeji Nadi, Thaddo Nadi and Mol Nadi are its main tributaries. Malir River, ephemeral in nature, flows in the district. This river is constituted from two major tributaries, Mol and Khadeji and smaller tributaries of Konkar, Thaddo and Sokan.

Khadeji is Perennial River in its upper reaches. The water of Khadeji Falls percolates into the sedimentary rocks after going some distance and it replenishes within Malir basin in the southern downstream. Some amount of water flows throughout the year inside the downward basin of Khadeji River.

Malir river flows from north-east of Karachi towards the Arabian Sea and terminates at Korangi creek. Mol and Khadeji join each other at 45th KM on the super highway and t hen join Malir River at Memon Goth. However, Sokan and Khadeji Rivers join Malir River at Landhi. The river becomes very wide from the point of Shah Faisal colony (up to one mile).

According to the study 'Flood Inundation Modeling for Malir Watershed of Karachi Considering Future Mean Sea Level Rise', conducted by University of Engineering & Technology, Lahore, in year 2011;The Malir River, which has a catchment area of about 1974 km2 traverses along the South -Eastern Boundary of the city of Karachi. The catchment area of Malir River is comparatively large and extends up to 112 km towards North of Karachi as shown in Figure 5.4.



Map of Karachi city showing the River Malir and its watershed

The System of Malir River is made up of major streams i.e. Mol and Khaddeji and other tributaries, Konkar, Thaddo and Sokan join it in the lower reaches. The system having total catchment area of about 1690 sq. km flows southwards and westwards and passes through Gizri Greek tidal estuary and discharges finally into the Arabian Sea. The width of river is about 200 m from upstream side at Super Highway Bridge and 1000m from the downstream side near Jam Sadiq Bridge.

The study concluded that the Mean sea level rise in the next hundred years will not cause any increase in flood inundation depths within the simulated watershed boundaries of the Malir River, hence area of Karachi city coming in the watershed of Malir River seems to be safe due to possible increase in mean sea level in the future 100 years. However, an increase in mean sea level by 600 cm could cause flood inundation in the southern part of the Malir river watershed.

2) Groundwater sources

Groundwater resources in Karachi area 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. The aquifers are estimated to lie at depths of 50-100 m.

In the upper Malir basin, the main areas of ground water extraction are the Thaddo valley upstream of Goth Rabu; Mol valley near Thano Shah Beg and upper stream; Turi Nala valley upstream of Goth Hasan Ali; Jarandi valley upstream of Goth Sufan; the Mol valley particularly in the Thano Shah Beg and Kathore areas, and Khadeji valley mainly in the Sari Sing area. Practically all the wells are located along stream banks and obtain water from the unconsolidated stream bed deposits. The depth of water varies from place to place ranging from 1.5m to about 30.5m. However, it ranges from 7.6 to 2.3m in most of the wells. Water extraction from 100 to 500 GPD, whereas some of the irrigation wells worked by diesel pumps yield upto 1200 GPD.

There are a few wells along Khadeji Nadi south of Goth Chhutta which tap water from Gaj limestone, which is thick bedded and cavernous. In this area the limestone occurs at a depth of about 2m and when worked with a diesel pump, the wells yield a supply of about 50,000 GPD

In the Turi Nala valley near village Goth Chhutta also some wells tap water from the Gaj limestone. The limestone is at a depth of 6m. The water table is at a depth of 24m. The water is brackish.

In the Konkar valley some wells east of Goth Isa, tap water from Gaj sandstone but the water is brackish. The Gaj rocks contain small springs and provide effluent seepage to some of the nalas. The perennial flow in the Mol and the Khadeji is largely due to such seepages.

3) Shallow Groundwater

Physico-chemical data of shallow groundwater (depth less than 30 meters) shows that the shallow wells, located in the vicinity of coast and in the proximity of polluted rivers, have relatively higher values of electrical conductivity, salinity and population of Coliform bacteria. The shallow groundwater is moderately saline, representing electrical conductivity values in the range of 1.1 to 1.9 mS/cm and salinity in the range of 1 ppt. The pH of shallow groundwater varies from mildly acidic (~6.3) to mildly alkaline values (~7.9). Areas with quite poor sanitary conditions have relatively low values of pH (~6.3 to 6.8). Shallow groundwater below 20 meters is slightly reducing. The dissolved oxygen is in the range of 1.5 to 7.9 mg/L. Turbidity of shallow groundwater varies between 3.6 NTU and 95 NTU. The concentration of HCO3 - (356-514ppm, n=4), Cl- (82-169 ppm, n=4) and SO4-2 (38-117 ppm, n=4) in shallow groundwater is very reasonable. The mean chemical concentrations of Cl-, SO4-2 and HCO3- in shallow groundwater are as follows:

Mean Cl- (Shallow Groundwater): 132.8 + 36.5 ppm (n=4)

Mean SO4 -2 (Shallow Groundwater): 63.3 + 36.7 ppm (n=4)

Mean HCO3 - (Shallow Groundwater): 423 + 67.4 ppm (n=4)

The range of variation in stable isotope content of total dissolved inorganic carbon (TDIC) and oxygen in Lyari River water is as follows:

δ 18 O (Shallow Groundwater) -6.3 to -5.8 ‰ V-SMOW (n=8)

δ 13 C (TDIC-Shallow Groundwater): -16.5 to -5.5 ‰ PDB (n=8)

The mean stable isotope content of 18O and 13C in shallow groundwater is as follows:

Mean δ 18 O (Shallow Groundwater): -5.9 + 0.32 ‰ V-SMOW (n=8)

Mean δ 13 C (TDIC-Shallow Groundwater): -10.1 + 3.3 ‰PDB (n=8)

The stable-isotope results indicate that the shallow / phreatic aquifers are recharged by a mixture of fresh waters of Indus River and Hab River (draining spring water and flooded rainwater), as well as polluted Layari and Malir rivers and their feeding drains (both under natural infiltration conditions and artificially induced infiltration conditions) and, to a much smaller extent, from direct recharge of local precipitation.

4) Deep Groundwater

In general, Deep groundwater is mostly saline and has high electrical conductivity (range: 1.9- 19.1 mS/cm) and salinity (range: 1.7-7.4 ppt), as compared to shallow groundwater.

Based on hydro chemical data of water samples collected from pumping wells, it is assumed that the shallow mixed deep groundwater discharged by large-scale pumping wells mainly represents the deep groundwater from confined aquifer. The mean chemical concentrations of Cl-, SO4-2 and HCO3- in shallow mixed deep groundwater are as follows:

Mean Cl- (Deep Groundwater): 2169.2 + 1828.0 ppm (n=9)

Mean SO4-2 (Deep Groundwater): 458.4 + 691.4 ppm (n=9)

Mean HCO3- (Deep Groundwater): 353.6 + 215.4 ppm (n=9)

The range of variation in stable isotope content of total dissolved inorganic carbon (TDIC) and oxygen in shallow mixed deep groundwater is as follows:

δ 18 O (Deep Groundwater): - 6.2 to -4.2 ‰ V-SMOW (n=10)

δ 13 C (TDIC - Deep Groundwater): -13.2 to -0.3 ‰ PDB (n=10)

The mean stable isotope content of 18O in shallow mixed deep groundwater is as follows:

Mean δ 18 O (Deep Groundwater): -5.3 +0.7‰ V-SMOW (n=10)

Mean δ 13 C (TDIC- Deep Groundwater): -10.5 + 3.7‰ PDB (n=10)

The hydro chemical and stable isotope results indicate that the confined aquifer hosts a mixture of rainwater from hinterlands and surrounding regions around coastal Karachi, as well as sea trapped water / seawater, through intrusion under natural infiltration conditions or under induced recharge conditions.

5) Groundwater Recharge Characteristics/Sea water Intrusion

Presently, coastal Karachi is known to have five sources of recharge to its groundwater reserves.

(i) Rainfall,

(ii) Indus River water supply

(iii) Hab-River & Hab Lake water supply

(iv) Polluted Lyari and Malir rivers/ contributory channels draining mixtures of domestic industrial and agricultural wastewater, composed of pre-said three sources

(v) Seawater

The possibilities of major contribution to groundwater recharge of shallow/phreatic aquifer directly by local rainfall seems very small, due to very poor frequency of rainfall events and rainfall intensities in the Karachi and high evaporation rates. The long-term (15 years annual record) mean monthly average precipitation for Karachi is between 0-15 mm during the months of January to June, 23 - 91 mm during the months of July to September, and 0-7 mm during the months of October to December.

The remaining four sources play a significant role in recharge of the shallow aquifer-system and deep groundwater system (confined aquifer) in coastal Karachi. Unpolluted seawater of Karachi coast is characterized by a δ 18O value of ~ +1 ‰ VSMOW and a chloride content of ~23000 ppm. Both the Lyari River and Malir River waters, as well as the Indus River water and the Hab Lake water, have extremely very low aqueous contents of chloride and sulfate ions as compared to seawater. The average mean value of δ 18O in polluted river waters is ~ 5 ‰ V-SMOW and in shallow groundwater is -5.9 ‰ V-SMOW. The relatively deeper ground waters representing confined aquifer have a mean δ 18O value of -4.3 ‰ VSMOW and excessively high values of aqueous chloride and sulfate.

Drainage Pattern:

The Malir River syncline is recipient of the surface flow from the North of Landhi and Bin Qasim towns; it constitutes the flood plains of Malir River. Malir River and its flood plains are home to the discharge of effluent from the Industries and Cattle Colony at Quaidabad. The drainage pattern of the area is therefore highly damaged/degraded.

Most of the flood plain of Malir River has become highly urbanized while its bed has been encroached upon by vegetable growers who use the unmitigated and highly polluted wastewater for growing vegetables. This has rendered large sections of the river bed sick and salinized. The industrial waste contamination has additionally reduced the biodiversity of the river bed to the extent that very little natural flora or fauna are found along its valley.

The effluent being used by the cultivators is ponded for a sufficiently long time along the flowing channel and diverted into the fields where heavy duty pumps have been installed.

Diversion channel of wastewater

The diversion into the pond and storage for sometimes only partly serves the purpose of anaerobic treatment. It does not appear to be carryout any treatment towards removal of contaminants (chemical or biological) because the growers themselves admit that they need to run the pumps almost around the clock to irrigate as large an area as 20-25 acres in each field.

Water constitutes an important section of Physical Environment of an EIA Study to define its magnitude, quality and occurrence throughout the project corridor. Of the total water found on earth, about 3% is fresh water. Of this 3%, the groundwater comprises 95%, surface water 3.5% and soil moisture 1.5%. Out of all the fresh water on the earth, only 0.36% is readily available for diversity uses and applications.

These waters are found exposed to the surface of earth in the form of mobile and immobile state in the form of snow-clad mountains, rivers, non-river streams, rain, sleet, wetlands and oceans. Surface resourced waters are highly susceptible to natural and anthropogenic derived contamination in terms Chemical and Biological pollution and thus are not used for sensitive applications such as drinking directly, unless it is pre-treated.

4.2.4 Topography and soil features

The Project area has variegated topography ranging in height from below the datum level in the south along the tidal swamps and mud flats of coastal strips to the maximum of 525 meters above the mean sea level at Mol. escarpment in Sindh Kohistan. The project location is covered with un-differentiated piedmont and sub-piedmont deposits consisting of loosely packed boulders, cobbles, pebbles and coarse to fine stand.

The soil types in Port Qasim are highly pervious with low water bearing and moisture retention capacities. The soil is typical of a semi-arid region, in which little pedogenesis and profile development have taken place. The soil horizon is poorly developed or are very shallow, and very little leaching has taken place. The soil may be classified as alluvial soil. Most of the soil have undergone very little leaching in their formation. There is also addition of wind-blown material at some places. The soil is generally low in organic matter, nitrogen and humus, and clay colloidal matter is very low or absent. Soil is poor in major and micro nutrients with low fertility.

The soil composition is also fairly homogeneous without anomalies. Soil up to 25m is composed of medium to coarse sand with fine gravel. Standard Penetration Test (SPT) 1values indicate that the soil dense to very dense. The presence of a clay layer at about 26m has been found, which is quite hard. As there is no ground water and little moisture, this layer is consolidated. Below this layer of clay there is again a medium to coarse sand layer with some clay. This layer is also very dense with a high SPT value.

4.2.5 Geology of District Malir

Malir district has a variegated topography, ranging in height from below the datum level in south along the tidal swamps and mud flats of Ibrahim Hyderi and Bin Qasim coastal strips to the maximum of 525 meters above the mean sea level at Mol escarpment in Sindh Kohistan.

General Geology

Topographically the area can be divided into five different broad zones.

1. The ridge and runnel upland in Sindh Kohistan
2. The piedmont colluvial fans and peneplains of Gadap
3. The plains of Moidan and Gadap
4. The plains and plateaus of Malir-Lyari interfluous
5. The plains and hills of the coastal belt.

The ridge and runnel upland in Sindh Kohistan is the sector of rugged topography in the north of Malir district that is spread over the width of an offshoot branch of Kirthar range. These distal hill forks out of the kirthar range separating Dadu district and Khuzdar district in Baluchistan. The two ranges separate south from mountain knot of Gorag where altitude is 2126 meters. The main Kirthar range goes to South and merges into the Indus Plain near Amri, while the off shoot range pursues a south west course, gradually diminishing in height towards Gadap plain.

In regimen of fluvial erosion, the colluvial fringe develops by merging of alluvial fans of individual streams depositing the erosional load of coarse sediments at the foot of hillsides. The deposits combined with material brought by sheet wash from hillsides remains mostly unconsolidated, and under the process of weathering develop into good fertile soil where water is available. In dry or semi-arid conditions this shelving deposit of unconsolidated material often creates badland topography of deeply scarred earth, unsuitable both for cultivation and habitation. Covered by sparse thorny shrubs, these however, serve as grazing grounds for goat and sheep.

Down from the colluvial fans in the small drainage basins of various streams are patches of alluvial plains of varying sizes and irregular shapes, separated or partly divided by extensions of the spurs of ridges. In the ridge and runnel sector of the District in the north, the most notable plain is that of Moidan, spreading from the western flanks of Mehar Jabal to the left bank of Hub River. The plain gets narrower southward, pressed by the colluvial fans descending westward from Mari Gathi, and merges with narrower strips of shang and Khar Nala up to the valley of Mandiaro.

In the upper reaches the two main effluents of Malir are Khadeji Nadi and Mol Nadi, which have their catchments basins in Sindh Kohistan in a synclinal fold between the main Kirthar range and its off shoot branches.

The southern stretch of Malir district follows the coastal strip of Korangi and Gharo creeks, demarcating the northern side of the old Indus delta. An area to south of the east-west base line of triangular outline of Karachi division subsided and was covered by the sea, making a shallow basin. In course of time the deltaic deposits of the Indus filled up this shallow basin, whereas the up throw part to the north of the fault line made a coastal edge.

4.2.6 Geology, Geomorphology and Soil

Geology: Karachi is the part of major synclinorium stretching from Ranpathani River in the east to Cape Monze in the west, Mehar and Mole Jabal (Mountains) in the north. Within the synclinorium a number of structures such as Pipri, Gulistan-e-Jauhar, Pir Mango and Cape Monze are exposed. The presence of concealed structures under the Malir River valley, Gadap and Maripur plains can fairly be deduced.

Rock aggregates, sand, limestone and clay are some of the potentials for gainful utilization. Gulistan-e-Jauhar member of the Gaj formation offers groundwater potential for limited use. The area is underlain by rocks of sedimentary origin

ranging in age from Eocene to Recent. Major structural trends and the basin axis strike generally south but with a "bulge" to the east also called Karachi Arc (Bender and Raza 1995).

Geomorphology of Karachi: Karachi is located in the south of Sindh, on the coast of the Arabian Sea. It covers an area of approximately 3,600 km2, comprised largely of flat or rolling plains, with hills on the western and northern boundaries of the urban sprawl. The city represents quite a variety of habitats such as the sea coast, islands, sand dunes, swamps, semi-arid regions, cultivated fields, dry stream beds, sandy plains, hillocks. Classified according to physiographic features, Karachi City District can be divided into three broad categories: Hilly Region (Mountain Highland), Alluvial Plain (Piedmont Plain) and Coastal Areas (Valley Floor). The metropolitan area is divided by two non-perennial river streams namely Lyari and Malir Rivers. The Malir River flows from the east towards the south and centre, and the Lyari River flows from north to the south west. Gujjar and Orangi are the two main tributaries of the Lyari River while Thaddo and Chakalo are the main tributaries of the Malir River. The dry weather flow of both rivers carries urban sewage that is ultimately drained in the Arabian Sea. Among the various physiographic features, low flat-topped parallel hills devoid of vegetation, interspersed with widespread plains and dry riverbeds are the main topographic characteristics of the city.

Soil: The soil mainly consist of yellow to light brown silt stone & sand stone, greyish clay & yellow sandstone in different areas of East Karachi.

Lithology: Mainly consist of siltstone, clay, sandstone & limestone of Gulistan-e-Jauhar member of Gaj formation of Miocene.

Geological Structure: The area is anticlinal in structure which dips towards NE & NW. A fault line also passes through the region from south to NE towards Gulshan-e-Iqbal town.

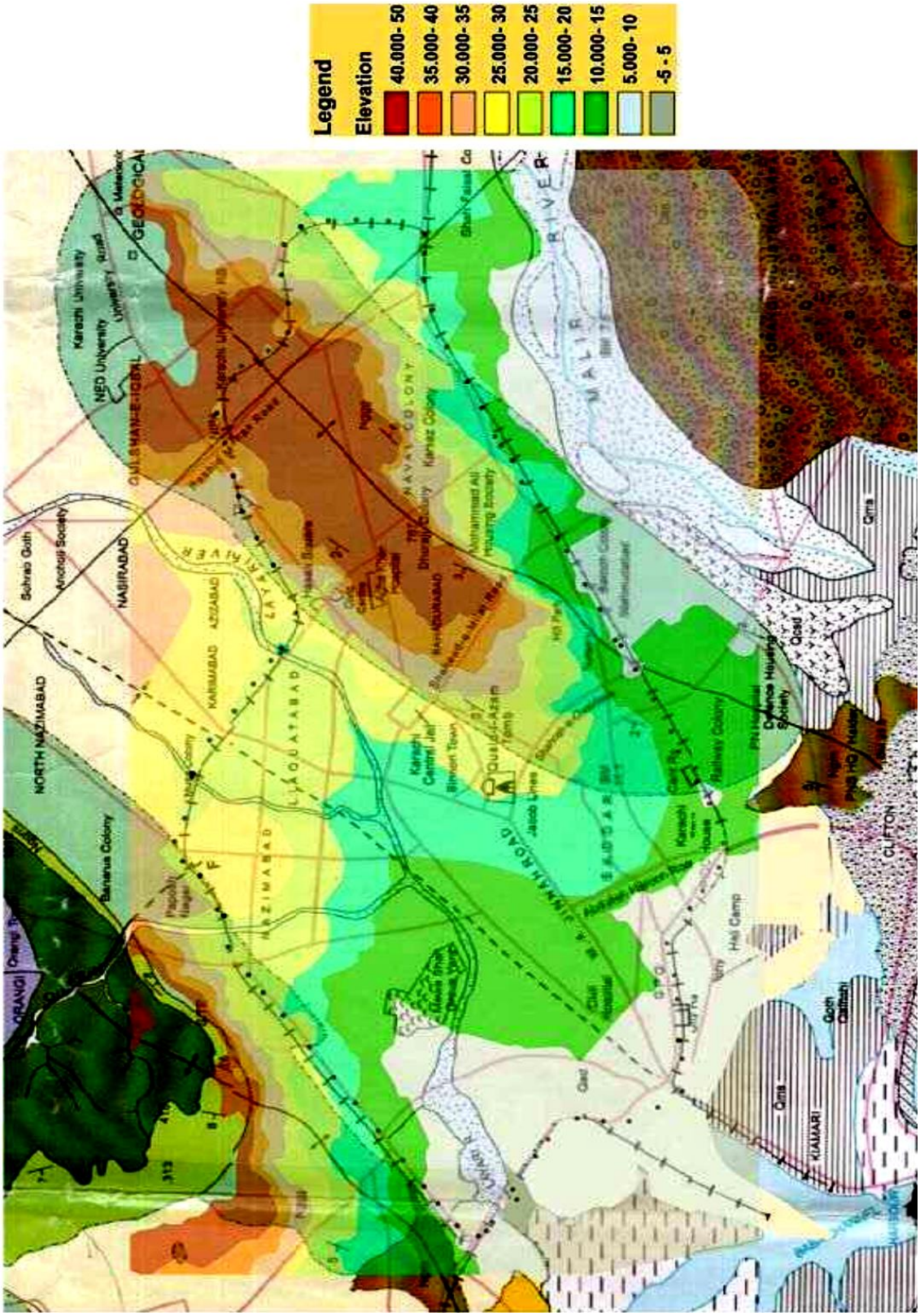


Figure 4.4: Geomorphological Map of Karachi

4.2.7 Seismicity

Seismic activity in the Indus Delta and its estuarine area, which include the creeks, resulting from ancient deltaic activity, and hence the Malir River bed as well as Lyari River are all located on the passive continental margin, is due to and mainly from intra-plate active faults, particularly the Rann of Kutch and Pab Faults and their strands. There are four active fault lines in the vicinity of Karachi coast. They are Karachi-Jati, Allah Bund-Rann of Kutch Fault, Surjan-Jhimpir,

and Pab. The Allah Bund Fault passes in the proximity of the Steel Mills and Karachi Nuclear Power plant. The project site is on Malir River bed which for seismicity considerations is a syncline and hence vulnerable to shocks although of intra-plate nature. The orientation of the Rann of Kutch fault is roughly east-west; it is 225 km in length and is responsible for the production of earthquakes of considerably high magnitude of up to 7.6 M on Richter scale and of IX to X intensity on the Modified Mercali, MM scale. The Pab fault on the other hand is 135 Km in length and is oriented northsouth. However, the shocks being of intra-plate nature are not likely to be destructive.

Over the last sixty years, earthquakes of intensity lower than 5 on Richter Scale, including those in 1945 and 1985, have struck this city.

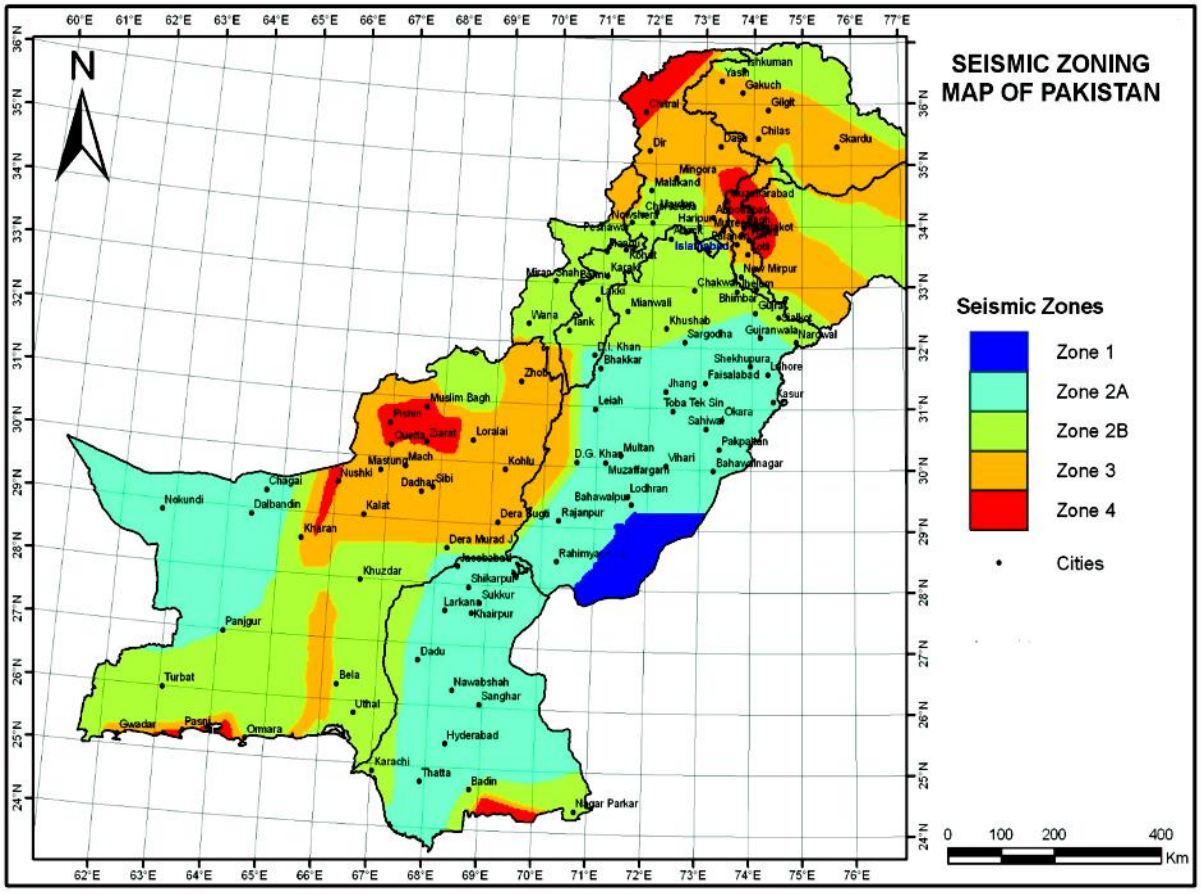


Figure 4.5: Seismic Zones of Pakistan

Karachi Building Control Authority has placed Karachi in Zone 2B, based on the actual events, the past observance of fault movement and other geological activities it has been inferred that Karachi is situated in a region where moderate earthquake of magnitude 5.0 to 6.0 equivalent to intensity between VII and VII on Modified Mercallis Scale may occur. On the basis of correlation of different scales and zoning, Karachi has been established as being situated in a noticeably moderate earthquake zone. Since heavy construction is not likely to be involved at the project site therefore observation of the building code in letter and spirit would be sufficient as mitigation measure.

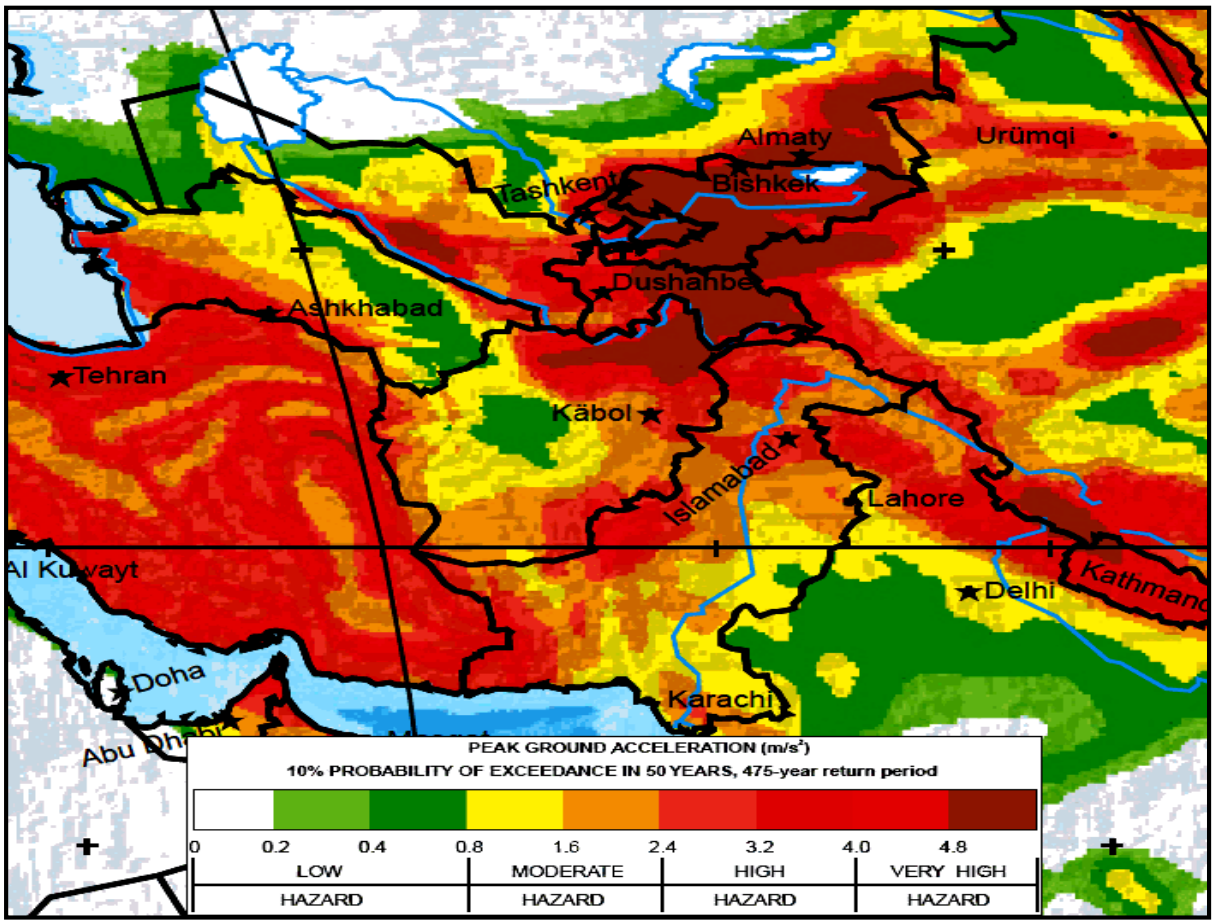


Figure 4.6: Peak Ground Acceleration (m/sec2)

4.2.8 Water Supply and Sewerage System

The water supply and sewerage system is managed by Karachi Water Supply & Sewerage Board (KW&SB). Present water supply system of Karachi City has a supply capacity of 560 mgd. Actually as of the end of year 2006, the KW&SB supply bulk water of about 630 mgd beyond the capacity as shown in following Table. Out of 630 mgd, water of 209 mgd is supplied without filtration, which is equivalent to one third of actual supply amount of 630 mgd.

Table 4.3: Present Water Supply Capacity

Supplied from		Rated Capacity	Actual Supply
Gharo Filtration Plant		20 mgd	30 mgd
Pipri Filtration Plant	with Filtration	100 mgd	102 mgd
	without Filtration	-	32 mgd
Dumlottee Conduit (without Filtration)	from Wells	20 mgd	0 mgd
	from GK/K-III Systems	-	17 mgd
NEK Old Filtration Plant		25 mgd	5 mgd
NEK New Filtration Plant		100 mgd	100 mgd
COD Filtration Plant	with Filtration	115 mgd	104 mgd
	without Filtration	-	48 mgd
Hub Filtration Plant		80 mgd	80 mgd
Supply without Filtration (from K-III System)		100 mgd	95 mgd
Supply without Filtration (from GK System)		-	17 mgd
Total		560 mgd	630 mgd

The water distribution network in Karachi covers 18 towns, 6 Cantonments and a Defense Housing Authority (DHA) Area. These 18 towns are included in 5 administrative water supply zones classified by the KW&SB, which is shown on Figure. Bin Qasim Town is included in Zone I.

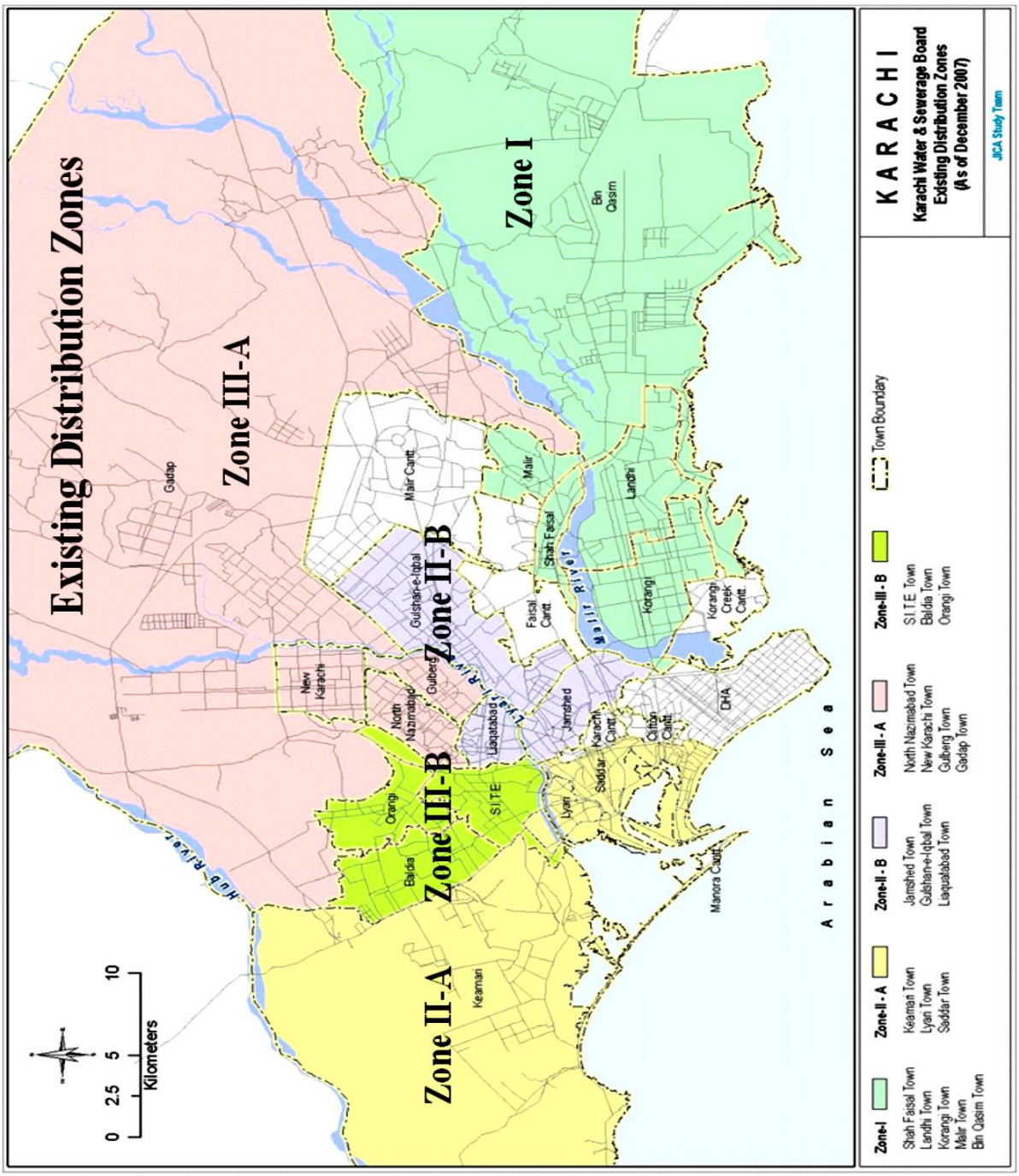


Figure 4.7: Existing Water Distribution Zones

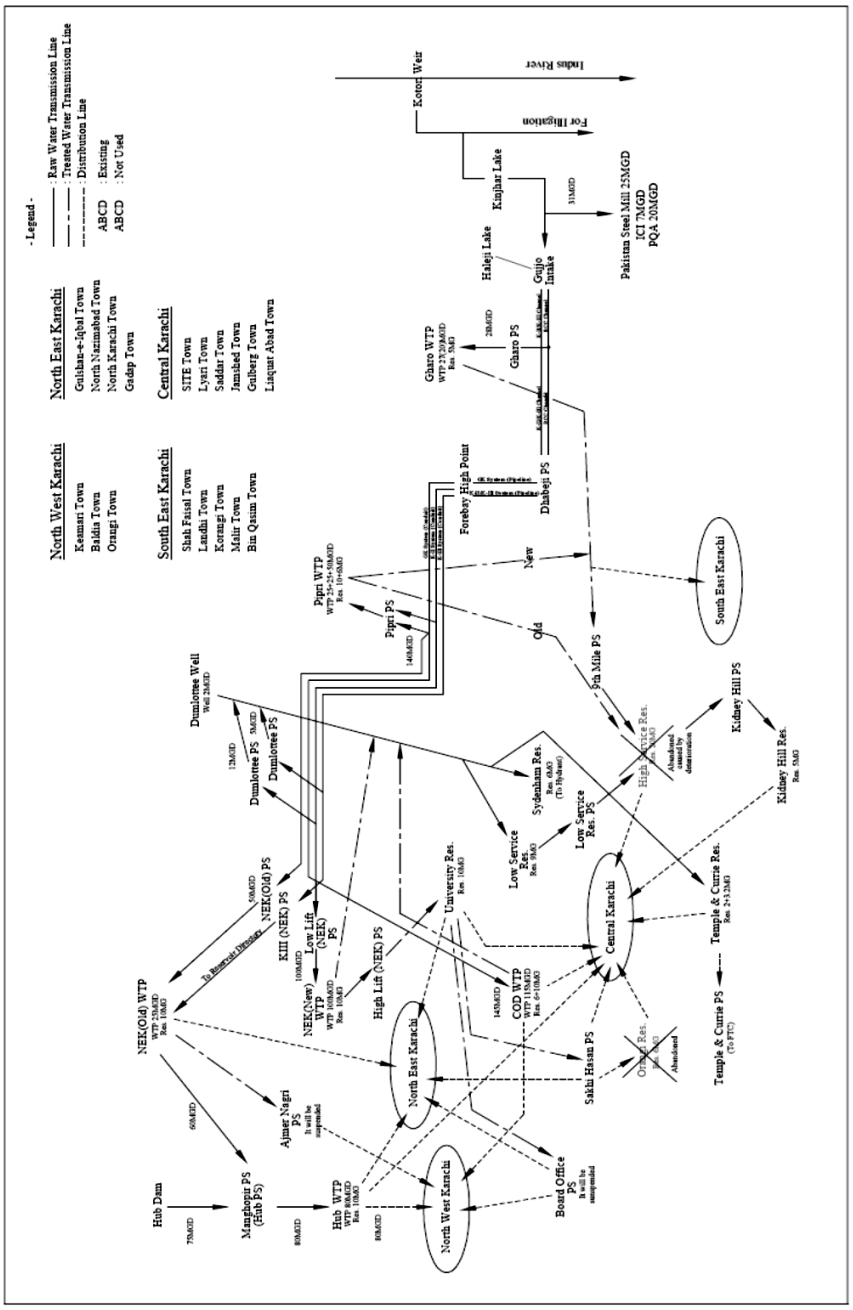


Figure 4.8: Water Transmission System

The existing sewerage catchment area which covers 18 towns in Karachi city is divided into three districts, namely: respective catchment area of T.P-1, T.P-2 and T.P-3. Total design capacity of three treatment plant is 686,000m3/day (T.P-1: 232,000m3/day, T.P-2: 209,000m3/day, T.P-3: 245,000m3/day) but currently, only T.P-1 and T.P-3 are operational. T.P-2 has suspended since three years ago because of O&M matters such as technical troubles and budget, etc. Of total quantity of wastewater of 1.76 million m3/day being discharged in Karachi, only approximately 25% of the total quantity is treated in T.P-1 and T.P-3. The remained wastewater is being discharged into 'Nala'. In order to review the existing Master Plan of the sewerage system as well as water supply which was prepared from 1985 to 1988, KW&SB formulated the Master Plan of the water supply and sewerage system in cooperation with JICA in 2008. However, most of the projects for rehabilitation and augmentation proposed in the Master Plan study, etc. have not been carried out due to financial constraint of KW&SB.

4.2.9 Water Quality

Because of unsafe and insufficient water supply and low sanitation coverage, as well as people's poor hygiene habits, around 60 percent of children suffer from diarrhea that is fatal if not treated in time. Concerns have been raised by various quarters about contamination in drinking water supply in the distribution network and possible linkages with water borne diseases in the city. The seriousness of the issue can be rated from the fact that in the year 2002, the Provincial Ombudsman Sindh, Justice Haziqul Khairi in response to a growing number of reports received from all over the Sindh province about the supply of contaminated drinking water, instituted a study for investigating the claims of the public and assessing the causes of contamination.

Regarding the quality of surface water supplied to the consumers, the Study Report prepared by Dr. Mirza Arshad Ali Beg, concluded that about 75% of the water supplied to Karachi is chlorinated. Shortfall in the availability of water for drinking constrains the distribution to intermittent supply that is one of the main causes of water pollution.

The water that leaks through the distribution mains and smaller pipes, particularly the ones that were laid long time before and in the Third Phase of the Bulk Water Supply scheme for Karachi, creates an underground pool during the supply hours. This serves as a nursery to the micro-organisms, including fecal coliform released by the leaky sewers crisscrossing the water supply pipes. Sewage might enter into the distribution system due to vacuum created during idle hours. This is the reason for the gradual depletion of free-active chlorine in the treated water as it proceeds from the filter plant to the distribution network and in its onward journey to the households. The findings of the analysis of the water samples suggest that the water even though treated gets contaminated in the distribution network and on its way to the consumers.

This finding suggests that the water as received by the residents is not safe for drinking. Assessment of ground water quality in the aforementioned Ombudsman Study Report indicated that ground water has been over exploited in Sindh and the drying of traditional wells in the vegetable and fruit growing areas in the suburbs of Karachi has occurred. Although water quality has not been tested yet, groundwater pollution by nitrates, pesticides, heavy metals and hydrocarbons discharged into the environment is not negligible. The salinity of groundwater in Southern Sindh, particularly in the coastal areas has increased since over pumping has induced seawater to flow in, causing what is known as seawater intrusion.

The fact, also acknowledged by KW&SB that 150 mgd (681,900 m3/day) of water supplied to the consumers is chlorinated and bypasses the KW&SB filter plants is an important indicator of the need of addressing this issue on a priority basis. The Ombudsman Study Report says that the water drawn from about 95% of the wells in the city of Karachi is contaminated with sewage bacteria and also contains total dissolved solids beyond permissible limits. The Ombudsman Study Report also documents that 90% of the survey sample tests conducted by PCSIR indicate that the water is unfit for drinking purposes referring to the guidelines set by the World Health Organization (WHO).

4.2.10 Storm Water Drainage

Following Table outlines stormwater drainages and nallahs under each township administration. Drainages are artificial water channels for stormwater drainage; on the contrary, nallahs are natural water channels. Many drainages are connected to nallahs and some drainages connected to river directly; Nallahs discharge into rivers such as Lyari River and Malir River receiving stormwater. As sewage collection system in Karachi City is not enough and its maintenance is not satisfactory, stormwater drainage and nallahs have to receive sewage all year long in addition to stormwater in rainy season.

Table 4.5: Town-wise Stormwater Drainage/Nallah Length

Town	Depth (m)	Width (m)	Length (km)
1. Keamari Town	1.21	0.91~3.04	7.62
2. SITE Town	2.13	3.65	16.08

3. Baldia Town	1.22	2.43	11.77
4. Orangi Town	1.52	2.43~3.65	34.1
5. Lyari Town	1.37	0.6~13.7	19.4
6. Saddar Town	1.37	3.05	11.14
7. Jamshed Town	1.5	2.43	33.8
8. Iqbal Town	3.64	2.4~15.2	28.0
9. Faisal Town	1.22~4.57	1.52~24.0	20.1
10. Landhi Town	1.22	2.43	35.36
11. Korangi Town	1.52	2.74	36.4
12. North Nazimabad Town	1.22	2.4	30.7
13. North Karachi Town	1.22	2.4	45.1
14. Gulberg Town	1.37	2.4	22.1
15. Liaquatabad Town	1.52	3.65	19.5
16. Malir Town	**1.22**	**3.04**	**6.15**
17. Bin Qasim Town	**1.22**	**3.64**	**14.63**
18. Gadap Town	1.22	3.65	24.43
Total			416.38
Source: KWSB			

There are no exclusive pumping facilities for stormwater drainage in Karachi City. However, many pumping stations called "ejector", which were constructed for sewage discharge to natural nallahs or rivers have worked as stormwater pumping facilities in rainy season.

Roadside drains are cleaned by KW&SB one to two months before monsoon season comes every year. Removed and collected silt/garbage is conveyed to designated solid waste disposal sites. However, roads are cleaned afterwards by town administration and silt/garbage is transferred to drains again. This is said to be how inundation is caused. In addition to above mentioned administrative issues, many drains and nallhas have been already encroached on by illegal houses and buildings. Strong enforcement of building code and other relevant laws is expected. Another major issue with malfunctioned drains/nallahs is that garbage is easily and routinely dumped to these facilities, which leads to their reduced sections. Comprehensive solid waste management system has to be introduced.

4.3 Description of Biological Environment

The ecology of microenvironment and macroenvironment of the project area has completely changed as a result of continuous emergence of urban conglomerates. Ecological risk of high order has been induced by land clearance and removal of natural vegetation from the plains during the urban sprawl to make room for industrialization and urbanization. This has degraded the physical environment as quantified in the above section & the biological environment in the sense that the entire macroenvironment has lost its biodiversity.

4.3.1 Flora

The level of anthropogenic activity in the project area is high. Some of the communities in the area have been involved in the practice of cutting the woods (Prosopis juliflora) for their livelihood and fuel. This has resulted in loss of natural habitat by transforming the area into barren land. The natural scrub forest once occupying the macroenvironment has been degraded and most of the area has been converted to barren piece of land. As a result of this ecological shift, most of the endemic wildlife has either left or become locally extinct.

Few tree species found along the proposed route of TL which includes *Conocarpus erectus, Euphorbia caudicifolia Calotropis procera and Propis Juliflora. Conocarpus erectus* species are mainly found along the road islands.

Propopis Juliflora located at the banks of Malir River

Euphorbia caudicifolia

Conocarpus erectus

Conocarpus erectus

Euphorbia caudicifolia

Propopis Juliflora

4.3.2 Fauna

The project site land is a part of an industrial estate and is almost barren, sparsely inhabited with little vegetation comprising mostly bushes. Areas occupied by industry blocks and roadsides are planted by providing artificial irrigation. Due to human disturbance and shrinking habitat, only nominal fauna could be recorded on the site. However, the habitat of common wild animals, who could be found if there had been no disturbance in this area, comprises: Jackal, Porcupine, Fox and Wild Hare. Birds of the eco-zone likely include Grey Partridge, Common Quail, Spotted Owlet, Indian Nightjar, Woodpecker, Passerines, etc. Reptiles of the area included Monitor Lizard, Spiny-tailed Lizard, Krait, Vipers and Rat Snake.

Fauna

Mangroves

There are mangroves on the coast in the south side of Karachi and main species of mangroves are Avicennia marina and Ceriops tagal. As mangrove has undertaken roles in the protection of the coast, nutrient retention, providing fuel wood and fodder to local people and their livestock, and providing habitat to spawning fish, crustaceans and birds and it needs to be conserved. Mangroves are atlease 2 km away from the proposed transmission.

Figure 4.9: Ecosystem around the project area

Threats

At present, there are no serious threats to the animal species, most of which have already moved to the distant surrounding area due to disturbance. Only the species adapted to the presence of humans occur in the area. These include Rodents, Squirrels, and Birds usually associated with human habitations in the vicinity of water points or garbage areas where food is available. Lizards are surviving well in the rocky or wasteland area even with sparse vegetation.

As regards plants, most of the vegetation will have to be cleared off during site clearance at tower base or along the ROW of UG TL, however the impact is negligible.

4.4 Description of Socio-Economic Environment

4.4.1 Overview

The socio-economic baseline provides an overview of the social and economic conditions of the project area based on primary and secondary data sources. This overview helps in understanding the socio-economic importance of the project area and contributes towards identification of any social risks that the project proponents must be aware of during the project design phase. Moreover, interaction with stakeholders in the vicinity of the project area helps identify the scope of CSR activities for Kia Lucky Motors Pakistan. The baseline data presented here also provides a basis for monitoring project activities during the project implementation and operations phase.

220kV double circuit transmission line is located in Malir District of Karachi Division. Moreover, as per the old administrative structure, the project site falls in Bin Qasim Town. Therefore, the social baseline for this project is based on secondary data for Malir District and Bin Qasim Town and primary data collated through consultations with primary stakeholders.

4.4.2 Macro-environment: District Malir

Administrative Context

The city of Karachi is divided into six districts and Malir District is the largest district by area within Karachi. Malir District is also the most rural district of Karachi Division. The district covers an enormous area of 2,268 square kilometers, which is more than half of Karachi's total land area. The district derives its name from its headquarter town of Malir. The word Malir basically denotes a region of pastoral wealth, a patch of rich and fertile plain or meadow in Rajasthani, Saraiki and Sindhi.

In 2000, Malir District was dissolved into Malir, Bin Qasim and Gadap Towns. However, Malir District was restored to its district status through official notification from the Government of Sindh on 11th July 2011. The district is headed by an elected Chairman and is run as a District Municipal Corporation. Malir District is further divided into 22 Union Councils which are governed by elected Chairmans.

Demographic Characteristics of the Micro-environment

Based on the last census in 1998, the population of Malir District was 981,412. More than half the population (55.90%) were males and slightly less than half (44.10%) were females. A comparison of the urban and rural populations shows that, approximately two-thirds of the population lived in urban areas, while the remaining third inhabited the rural areas of the district. Due to the large rural land use of the district, the population density (432 persons/sq. km) is much lower than other districts of Karachi.

There has been no census since 1998 and data from the current population census of 2017 is not yet published. Due to the long gap between the last two census, only estimations can be made for recent demographic data for Malir. According to a Social Profile of Karachi developed by Al-Hasan Systems Pvt. Limited, the population of District Malir was 22,42,142 in 2015 based on estimations from Table -1 of the 1998 Census. Similarly, the sex ratio and population density for 2015 were estimated at 127 and 791, respectively. Based on this preliminary analysis, it can be seen that the population of Malir District has more than doubled over the last two decades.

Table 5.22: Population distribution of District Malir in 1998

Gender	Number	Percentage
Both Sexes	981,412	100%
Male	548,645	55.90%
Female	432,767	44.10%
Area	981,412	100%

Rural	320,946	32.70%
Urban	660,466	67.30%
Source: Population Census Organization		

Table 5.23:Town/Cantonment wise Population breakup of District Malir, 2015		
District	Town/Cantonment	2015 Estimated Population
Malir District	Bin Qasim	630,035
	Gadap	576,080
	KorangiCreek Cantonment	121,821
	Malir	792,386
	Malir Cantonment	121,821
	Total	2,242,142

Table 5.24: percentage of Population by Religion 1998			
Religion	Total	Rural	Urban
Muslim	96.57	96.51	96.60
Christian	2.08	0.71	2.75
Hindu	1.10	2.53	0.41
Qadyani (Ahmadi)	0.18	0.15	0.19
Schedule Caste	0.03	0.07	0.01
Other	0.04	0.04	0.04
Source: Population Census Organization			

Table 5.25: percentage of Population by Mother Tongue 1998			
Mother Tongue	Total	Rural	Urban
Urdu	15.87	6.21	20.57
Punjabi	17.46	10.56	20.81
Sindhi	25.08	58.44	8.87
Pashto	20.67	4.09	28.72
Balochi	8.51	15.25	5.23
Saraiki	2.36	0	3.50
Other	10.06	5.45	12.31
Source: Population Census Organization			

Religion and Culture

According to the 1998 Census, the majority of the people in the district are Muslims (96.57%), with minor representation from Christian and Hindu communities. Sindhi is the most common mother tongue in the district with nearly a quarter (25.08%) of the population having identified Sindhi as their mother tongue. A large proportion of people have identified Pushto (20.67%), Punjabi (17.47%) and Urdu (15.87%) which indicates a significant number of Pathans, Punjabis and Mahajirs have migrated to the district. A rural-urban analysis of the mother tongue indicates that majority of the Sindh-speaking community resides in the rural areas of the district, while Urdu, Punjabi and Pushto speakers dominate the urban areas.

Among Sindhis, the tribes that are settled here are Syed, Jokhia, Khaskheli, Palri, Bareja, Bhabra, Dhars, Sirhindi Jamot and Mohannas. These tribes are landowners, keep herds and do fishing. Among the Baloch, the tribes that reside in the district are Kulmati, Jadgal, Gorgej, Hoot, Vadela, Vashki, Zarzedagh, Tumpi, Lashari, Laghri, Khosa, Rindh, Brohi, Harani. Among the Memons are Modaani, Chitrani, Bolani and Hamlani. The new settlers are from India and have settled in this district after 1947. After the downfall of Dhaka, the inhabitants from former East Pakistan migrated to this district.

Household Characteristics

According to the 1998 Census, the average household size for Malir was 6.2, while the rural household size (5.8 persons) was slightly lower than the urban statistic (6.8). This may be due to the lack of health services and relatively higher infant mortality rate in the rural areas. The Multi-Indicator Cluster Survey (MICS) 2014 provides several important parameters for Malir District's housing and utility aspects. According to the MICS survey, 75% of the residents are owners of their homes, regardless whether they live in bungalows, apartments, and villages. Only 25% of Malir's residents live as tenants. With respect to housing conditions, the MICS survey indicates that the majority of Malir's residents have complete housing structures with respect to flooring, roof and exterior walls. Electricity is available through K-Electric to 95% of Malir's inhabitants; those that are deprived of electricity are small goths in the rural areas.

Table 5.26: Ownership of Dwelling District Malir

Owned by a HH member	Not Owned		
Yes	Total	Rented	Other
75%	25%	22.5%	2.6%

Source: MICS-Sindh 2014 (Sindh Bureau of Statistics)

Table.5.27: Housing characteristics District Malir

Characteristics	Natural	Rudimentary	Finished	Other
Flooring	2.8%	0.2%	92.6%	4.4%
Roof	0.3%	2.5%	95.1%	2.2%
Exterior walls	1.0%	0.9%	98.0%	0.2%

Source: MICS-Sindh 2014 (Sindh Bureau of Statistics)

Electricity Availability District Malir

Table.5.28: Electricity Availability in District Malir

Utilities	Yes	**No**
Electricity	95%	**5%**

Source: MICS-Sindh 2014 (Sindh Bureau of Statistics)

Infrastructure Facilities

Source of Drinking Water

Clean and safe water is one of the major problems faced by the residents of Malir District Though the Karachi Water and Sewerage Board's pipelines bring in approximately 580 million gallons of water daily from the Indus River and Hub Dam to Karachi, yet majority of the villages have not been given water connections and have to depend on ground water and tankers to meet their drinking water and domestic consumption needs.

Irrigation

Malir: Karachi zone is basically an arid (barani) area. The major source of irrigation in the district are underground water and rainfalls. Farmers in the area are largely dependent on tube wells for cultivating their lands1.

Land Use

[1] http://www.yespakistan.com/HDF/Karachi/Karachi.asp

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 steadily growing2.

Various categories land uses in the Malir District and neighboring areas are shown in Figures below.

Natural Gas

People in Malir District use natural gas supplied by SSGC for cooking and heating purposes. During the recent past, demand for natural gas has increased considerably, whereas supply has also reduced, resulting in a gas deficit. When gas supply is not available, people also use wood as fuel for cooking which is bought from wood sellers in the local bazaars. This situation is also seen in areas where gas connections are not available.

Road Network

Road network is considered as a vehicle for economic development and social change. An efficient road network not only develops a quick and efficient transportation system but also opens up new areas hitherto remained closed. It brings about social integration among rural and urban sectors and greatly assists in providing access to basic amenities such as education and health facilities. An effective road network also increases the awareness of rural inhabitants regarding their rights and responsibilities as citizens.

Malir:

Total road length of the Malir district is 2688.43 Kilometers3. There are the following major roads which connect Malir District with the rest of the country:

Super Highway (M9) leading north-west, towards other cities in the provinces of Sindh, Punjab and Khyber Pakhtunkhwa.

National Highway (N5) leading south-west, towards other cities in Sindh and Punjab.

Archaeological and Cultural Heritage Sites

The proposed transmission line route does not contain any structures and artifacts of historical and cultural interest that must be preserved. However The Antiquities Act 1975, administered by the provincial government, exists for the preservation of cultural heritage. Destruction and/or defacement of antiquities are an offence under the Act.

Status of Education Sector

According to the 1998 Census, the literacy rate for Malir District was 53.56% with a gender-wise difference of 61.4% for males and 42.9% for females. Interestingly, there is not a major difference in the literacy rate for urban (55.7%) and rural (49.1%) areas. Similarly, the proportion of educated people 10-years and above in the district is around a half (52.9%) of the total population with a gender-wise difference of 60.9% for males and 42.1% for females. The large rural area of the district where there are no education facilities combined with the fact that many rural households cannot pay for the transportation costs of their children are the major reasons for relatively low literacy rates in Malir District.

Table.5.30: literacy Ratio By Gender

Area	Both Sexes	Male	Female
Malir District	53.56	61.44	42.87

[2] http://www.ke.com.pk/pdf/download/Maymar%20Gadap%20Grid%20station%20final%20Report.pdf
[3] http://www.kmc.gos.pk/

Rural	49.16	58.57	38.05
Urban	55.65	62.69	45.43
Source: Population Census Organization			

Table.5.31: Schools in Malir District				
Name of Taluka	Boys	Girls	Mixed	Total
Bin Qasim Town	43	25	114	182
Gadap Town	137	92	226	455
Total Malir District	180	117	340	637
Enrolment Status Malir District				
Name of Taluka	Boys	Girls	Total	
Bin Qasim Town	12636	10326	22962	
Gadap Town	17424	14869	32293	
Total Malir District	30060	25195	55255	
Source: SEMIS Census 2014-15				

Table.5.32: Schools in Malir District			
Name of Talukas	Male	Female	Total
Bin Qasim Town	481	364	845
Gadap Town	901	423	1324
Total Malir District	1382	787	2169
Source: SEMIS Census 2014-15			

Status of Health Sector

Apart from private health facilities across the district, there are a variety of public health facilities. The most common public health facility in the district are Dispensaries (70), followed by Basic Health Units (BHU)s (12) and Rural Health Centers (5) and Mother & Child Health Facilities (5). There are only two public hospitals in Malir District.

Table.5.33: Health Facilities in Malir District		
S. No.	Type	Count
1	Dispensary	70
2	Basic Health Unit	12
3	Rural Health Center	5
4	Mother & Child Health Facility	5
5	Hospital	2

Economy

Sources of Income and Livelihoods

Malir: Malir is an industrial and commercial city with a diverse economic base. The main occupation of the people is business and trade. The other major portion of the population consists of labor class including skilled and unskilled labor. The remaining portion of the population are employed as civil servants, salaried individuals in private companies, and engaged in agriculture. Many women also contribute to the local economy, working mostly in schools, colleges and hospitals4.

Agriculture

[4] http://www.yespakistan.com/HDF/Karachi/Karachi.asp

Agriculture sector plays a significant role in the overall economic performance of Pakistan. Currently, this sector provides employment opportunities to 45% of the labor force in the country. This sector provides sources of livelihood to 60% of the population in the rural areas. Agriculture contributes 21% to the Gross Domestic Product (GDP) of Pakistan5.

Malir: There is no extensive cultivation in the district, yet vegetables and fruits are cultivated on a small scale. Main crops of these areas are, tomato, onion, potato, cabbage, cauliflower, turnip, cucumber and carrot. Among fruits; coconut, chikoo, guava, papaya, and banana are produced in this district6.

Livestock

Livestock sector maintains a unique position within the agriculture sector of Pakistan. It contributes 51% to the value addition in agriculture sector of Pakistan. It also contributes 9% to the GDP of Pakistan. Besides, this sector provides foreign earnings, dairy products' needs, food security and daily cash income to the people of Pakistan. It helps to reduce the income inequalities, especially in the case of emergencies (floods, crop failure etc.). Hence this sector is considered as the most secure source of livelihood for small farmers and landless poor. The share of Sindh province in livestock population of Pakistan is 20%7.

Good breed of buffalo and cow are found in the districts. Sheep, goat, camel, horse, ass and mule are also the main livestock of the districts. The numbers of large animals exceeds the number of smaller animals showing people's preferences for keeping cattle rather than goats or sheep. Livestock in the districts suffers in particular from shortage of high quality feed and fodder crops as a result of the overall shortage of water

Enterprise and Industrial Sector

Malir: Bin Qasim Industrial Zone is the largest industrial area of Sindh province, spread over 25,000 acres of land of Port Qasim / Bin Qasim Town area, occupied by large and medium size industrial units. Currently, there are 180 large and medium size units operating in the area. Bin Qasim Industrial Zone has the potential to emerge as the Financial Hub of Karachi. Some of the prominent industries of this area are: Pakistan Steel, Lotte Pakistan PTA Ltd., Toyota Indus Motors, Pak Suzuki, Engro Polymer, FFC Jordan, Procter & Gamble, Ghandhara Nissan, National Foods, Nestle Pakistan, Fauji Oil Terminals, Ali Danyal Industries, Gamalux Oleochemicals, Shujabad Agro Industries, PAN Industries, IFFCO Pakistan Ltd., Mapak Oil Ltd., Universal Cables Ltd., Faisalabad Oil Refinery and TripPak Films Ltd.

4.4.3 Microenvironment

Existing Conditions of the Microenvironment

General Overview: The project comprises of 132 kV underground transmission line from Jacob Lines Grid Station to Gizri Grid Station. The project lies in Malir District.

[5] Economic Survey of Pakistan 2012-13
[6] http://www.yespakistan.com/HDF/Karachi/Karachi.asp
[7] Economic Survey of Pakistan 2012-13

Figure 4.15: Start point of 220 kV TL from Engro Power Plant

Figure 4.16: Proposed underground ROW

Figure 4.17: ROW of overhead TL in Eastern Industrial Zone, PQA

Figure 4.18: New PQA GS site

Figure 4.19: Intersection point along Eastern Bypass

Figure 4.20: Consultation at Sheedi Goth

Chapter 5 Public Consultation & Participation

Public Participation is a mandatory requirement of the Environmental Impact Assessment exercise under the Sindh Environmental Protection Act 2014 and the rules & regulations framed thereunder. Public consultation & participation process provides an opportunity for those directly & indirectly affected by the project to express their concerns during the feasibility phase before finalization of the project design. It aims to ensure that the EIA process is transparent and robust and enables sustainability in the design, implementation, operation & management of development projects.

- The key objectives of public involvement are to:
- Obtain local knowledge about the microenvironment (project neighborhood) that may be useful for decisions regarding the project design and identification of potential impacts;
- Facilitate consideration of alternatives, mitigation & compensatory measures;
- Ensure that important impacts are not overlooked and benefits are maximized;

Following are the benefits envisaged from the Public Consultation & Participation process:

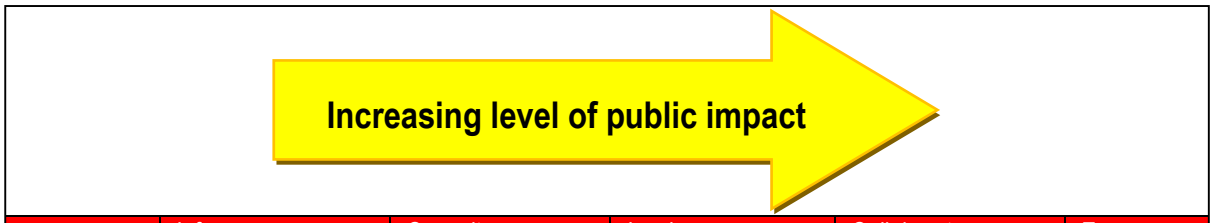
Table 5.1: The benefits of effective participation for different groups

Proponent	Decision-Maker	Neighborhood/Local Community
Raises the proponent's awareness of the potential impacts of a proposal on the environment and the affected community	Achieves more informed and accountable decision-making	Provides an opportunity to raise concerns and influence the decision-making process
Legitimizes proposals and ensures greater acceptance and support	Provides increased assurance that all issues of legitimate concern have been addressed	Provides an opportunity to gain a better understanding and knowledge about the environmental impacts and risks that may arise
Improves public trust and confidence	Demonstrates fairness and transparency, avoiding accusations of decisions being made 'behind closed doors'	Increases awareness of how decision-making processes work, who makes decisions & on what basis
Assists by obtaining local information/data	Promotes good relations with the proponent and third parties	Empowers people, providing the knowledge that they can influence decision making and creating a greater sense of social responsibility
Avoids potentially costly delays later in the process by resolving conflict early	Avoids potentially costly delays later in the process by resolving conflict early	Ensures all relevant issues and concerns are dealt with prior to the decision

In the context of the present project for laying of transmission lines from 450 MW Engro Power Plant to New Port Qasim Grid Station there is a need to strictly follow the procedures laid down under the environmental regulations and all relevant bylaws prescribed by PQA, MDA and relevant provincial government departments of the Government of Sindh.

Purpose of stakeholder engagement for '220 kV Double Circuit Transmission Line' project is to:

- Inform nearby resident, commercial interests and institutions in the immediate neighborhood about the project and its likely impacts;
- Ascertain the views of those facing direct and indirect impacts and identify feasible measures that can be adopted to alleviate the negative impacts and enhance the positive aspects



	Inform	Consult	Involve	Collaborate	Empower
Public participation goal.	To provide the public with balanced and objective information to assist it in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision inclduing the developoment of alternatives and the identiofication of the preferred solution.	To place final decision-making in the hands of the public.
Promise to the public.	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	To partner with the public in each aspect of the decision inclduing the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public.

Figure 5.1: Public Participation Approach

5.1. Identification of Stakeholders

The major stakeholder groups involved in an EIA and their interests are explained in the following paragraphs:

1. Local People/Neighborhood: Individuals or groups in the vicinity of the project site are informed regarding the project background and context. Due to their proximity to the project site, they are often the most vulnerable stakeholders and therefore, consultation with these stakeholders is carried out throughout the project life. The consultation exercise provides opportunity to appraise the stakeholders regarding the consultation process, identify likely project impacts, and record local communities' concerns. Moreover, intensive stakeholder engagement during the planning stage of the project provides a basis for reducing the trust defecit and encourages confidence-building.
2. Proponents: The main aim of the project proponent is to accomplish the objectives of the project through cost-effective and sustainable project activities. To this end, the project proponents recognize that strong relationships and friendly relations with stakeholders is inevitable for project success. Thereby, from the onset, the proponent strives to engage stakeholders at all levels, informs them regarding project goals, design and and any alternatives. Moreover, they try to create public understanding and acceptance of the proposal through the provision of basic information on the project throughout the life cycle. They try to accomplish the project through general acceptance of the design and keep improving through use of public inputs on alternatives and mitigation measures.
3. Government Agencies: The government agencies involved in the EIA process are mandated to have their policy and regulatory responsibilities addressed in impact analysis and mitigation consideration. For the competent authority, an effective public involvement programme will ensure a project proposal that effectively incorporates environmental and social concerns. Moreover, in line with international standards, SEPA invites the proponent for evidence of CSR activities in the past and plans for CSR activities in the project vicinity. During the EIA review, the most important concern for SEPA is a transparent public consultation process and a strong stakeholder engagement plan that can address the concerns and suggestions of all stakeholders.

4. NGOs/Interest groups: Comments from NGOs and specific interest groups often provide a useful policy perspective on the project's methodology and implementation mechanism. For example, due to the vast exposure of certain NGOs and interests groups, alternative measures for reaching the project goals may be advised that is more environmentally friendly and socially acceptable. Their views are also helpful when developing CSR programs and later on through monitoring and evaluation of these programs.

5. Other Groups: Other interested groups include those who are experts in particular fields and can make a significant contribution to the EIA study. The advice and knowledge of relevant government agencies, academia and private companies most directly concerned with the proposal are often sought. More often than not, a range of experts from these groups are consulted and their input is solicited based on the project requirements.

The main stakeholders for the 220 Kv Transmission Line project have been identified in Table 5.2.

Table 5.2: Stakeholders for the 220 Kv Double Circuit Transmission Line Project	
Main Primary Stakeholders	Sheedi Goth Lotte Chemicals Kareem Bux Goth
Government Departments	Sindh Environmental Protection Agency (SEPA) Malir Development Authority (MDA)
NGOs/Interest groups	Urban Resource Center Shehri-CBE National Forum for Environment & Health (NFEH)

5.2. Consultation Approach & Methodology

Consultation was conducted in two stages for the 220 Kv Transmission Lines Project. A social survey team identified residential neighborhoods, commercial interests and other institutions in the area that may face direct impacts from laying of the transmission lines. In preparation for the survey a 'Project Brief' was prepared highlighting the salient features of the project and the proposed route of the transmission line. In the first stage, a reconnaissance survey was conducted whereby all stakeholders along the proposed route were identified. Relevant public service institutions directly involved in service provision in the areas were also identified.

During the second stage, a social survey field team engaged residents, commercial interests, social service institutions, and government departments along the transmission route. Those stakeholders who were not available at the first attempt, were re-visited on the same day or followed-up for their comments during the next few days. During each meeting, the project team introduced the project to the stakeholders, recorded their concerns and suggestions and provided contact details to enable stakeholders to share further comments over email or in writing. The comments solicited from stakeholders were helpful in examination of the potential environmental & social aspects of the project and identification of possible mitigation measures.

5.3. Consultation Feedback

The comments, concerns and suggestions received from stakeholders during the consultation meetings and in writing to EMC's Karachi Office have been collated in this section. The comments have been analyzed through categorization of stakeholder comments based on the stakeholders in the vicinity of the project site.

5.3.1. Concerns & Suggestions

The concerns and suggestions of stakeholders have been segregated into specific categories based on the interests of the stakeholders. These are elucidated in Table 5.3.

Stakeholder Categories	***Concerns & Suggestions***
1. Industrial Area (Lotte Chemical Pakistan, Fauji Fertilizer Co)	• The transmission line should not interfere our day to day operations and if an underground transmission line is laid near our units, prior information and notices should be made to us. Also detailed plans are shared for the Transmission line route and its specifications should be shared with us. • If traffic on roads and industries would be hampered, traffic management plan should be shared with the industries.

	• The underground TL route should not encroached the industrial units or its utility lines.
2. Institutions (Local Government, GoS Departments)	• Representatives of the relevant Union Councils came forward and appreciated the works and offered all support from their offices.
3. Residential Pockets (Goth Kareem Bux, Haji Sheedi Goth)	• Representatives of residential pockets visited welcomed the project and hoped that load-shedding would decrease in the areas. • The residents requested that the construction works should be planned to avoid minimum disturbance to residents. • They requested that K-Electric should inform them beforehand regarding the timings of the construction works and should respond to their complaints swiftly. • The works should be carried out in the shortest possible time; areas should not be left dug-up for several days. • As the work is usually completed by contractors and sub-contractors, K-Electric should monitor their works to ensure proper task completion.

Consultation Photos

Residents of Goth Kareem Bux

Residents of Goth Haji Sheedi

Chapter 6 Screening of Alternatives

6.1 Introduction

The screening of alternatives is a part of the EIA process to select the best among all possible project options. The alternatives of a project are defined as the options that can help to meet the objectives of a project by different means including an alternative project site, technology or material, design or inputs. The key criteria when identifying alternatives is that they should be feasible and reasonable.

6.2 The 'No Action' Alternative

The foreseen rise in power demand with the expansion and increase in population of Karachi requires bulk supply of electric power. The most significant outcomes of "No Action" approach would be a negative impact on current electricity supplies, and the possibility of complete blackouts at times of high demand if this approach persisted then the City of light would have to slow down the growth rate of its economy and all its development projects will come to a standstill.

The newly generated electricity from Engro Power Plant should be further distributed to the local network. Moreover, the addition of this circuit in EHT network will ensure the required degree of reliability for power system and comfort the shift engineers, grid operators in easy and efficient management of load. The KE consumers will surely be benefitted after the energization of this circuit. The augmentation of bulk supply through underground transmission lines will be able to meet the rising power demand. Therefore "No Action" alternative option will not be considered as beneficial for the proposed development.

6.3 Transmission technologies alternative

6.3.1 Overhead versus Underground Transmission line

The decision between overhead versus underground transmission lines was also considered. Certainly, electric power can be transmitted by underground power cables which assist the transmission of power crosswise over thickly populated urban zones, territories where area is occupied or arranging assent is troublesome, waterways and other natural obstacles, land with extraordinary natural or environmental heritage, regions of significant or prestigious infrastructural advancement and area whose worth must be kept up for future urban development and rural improvement.

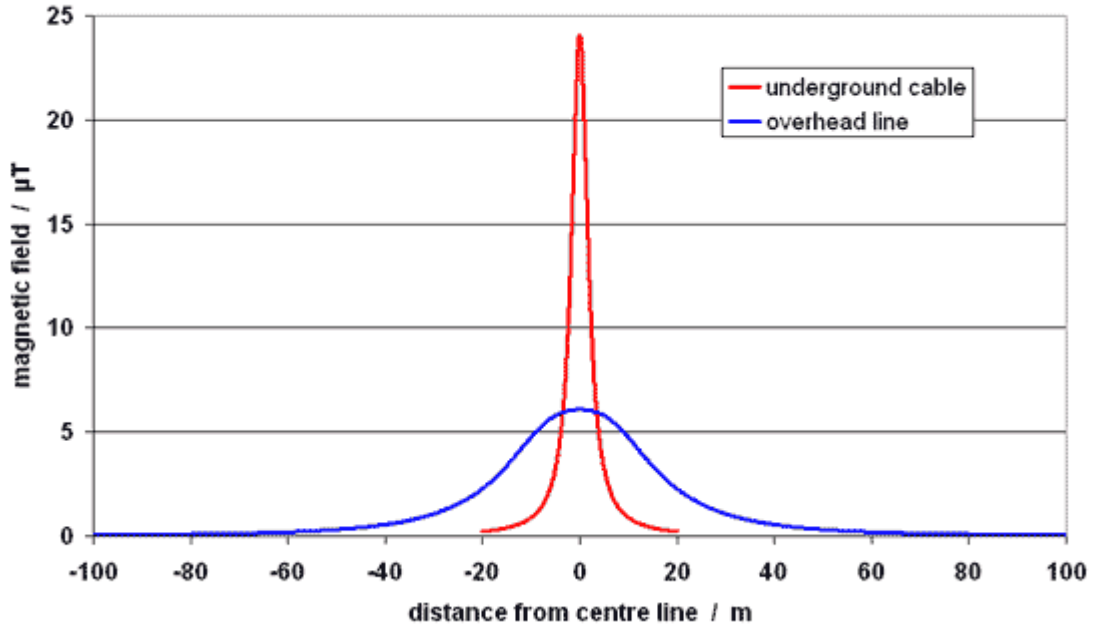
Underground Transmission

- Less subject to harm from extreme climate conditions (mostly lightning, wind and heavy showering);
- Remarkably decreases the intensity of electromagnetic fields (EMF) in the surrounding area. All electric currents produces EMF, yet the protecting shield provided by the earth encompassing underground cables limits their extent and power;
- Underground cable require a narrower encompassing strip to introduce; though an overhead line require a surrounding strip of around 20–200 meters wide to be kept for all time clear for safety, support and repair;
- Site restoration for underground construction is a much larger effort than it is for overhead construction because soil is disturbed along the entire route;
- High-voltage underground transmission lines require small substations called transition substations wherever the underground cables connects to overhead transmission;

- Underground high-voltage transmission lines generally need to be replaced after approximately 40 years;
- Underground cables pose no risk to low flying airplane or to natural life, and are essentially more secure as they pose no shock hazard (except the digging and excavation);
- There maintenance and repair is very arduous and time consuming;
- Underground lines are silent except in the immediate area near the transition substations, which are lighted throughout the night for security purposes;
- They are less likely to cause death or injury due to accidental contact with the lines/cables;
- The transmission through underground is more expensive than overhead electrical cables, and the life cycle expense of an underground power cable is two to four times more than an overhead electrical cable.

Overhead Transmission

- Installation of overhead lines may prevent from removal of small trees and bushes along the transmission ROW;
- Overhead lines are at great risk against lightning strikes which can cause interruption and serious accident;
- Overhead lines use bare conductors and can be damaged;
- Aesthetically unattractive as they distract the scene of the landscape;
- It doesn't require high cost in construction, repair & maintenance;
- Overhead high voltage lines can emit hiss or hum noises;
- When people come into accidental contact with overhead lines, the implications are extremely severe;
- Overhead lines have a life expectancy of more than 80 years;
- Its cost is lesser than Underground Transmission line.



Source: http://www.emfs.info/sources/underground

Figure 4.2: EMF effect comparisons between Underground and over headline

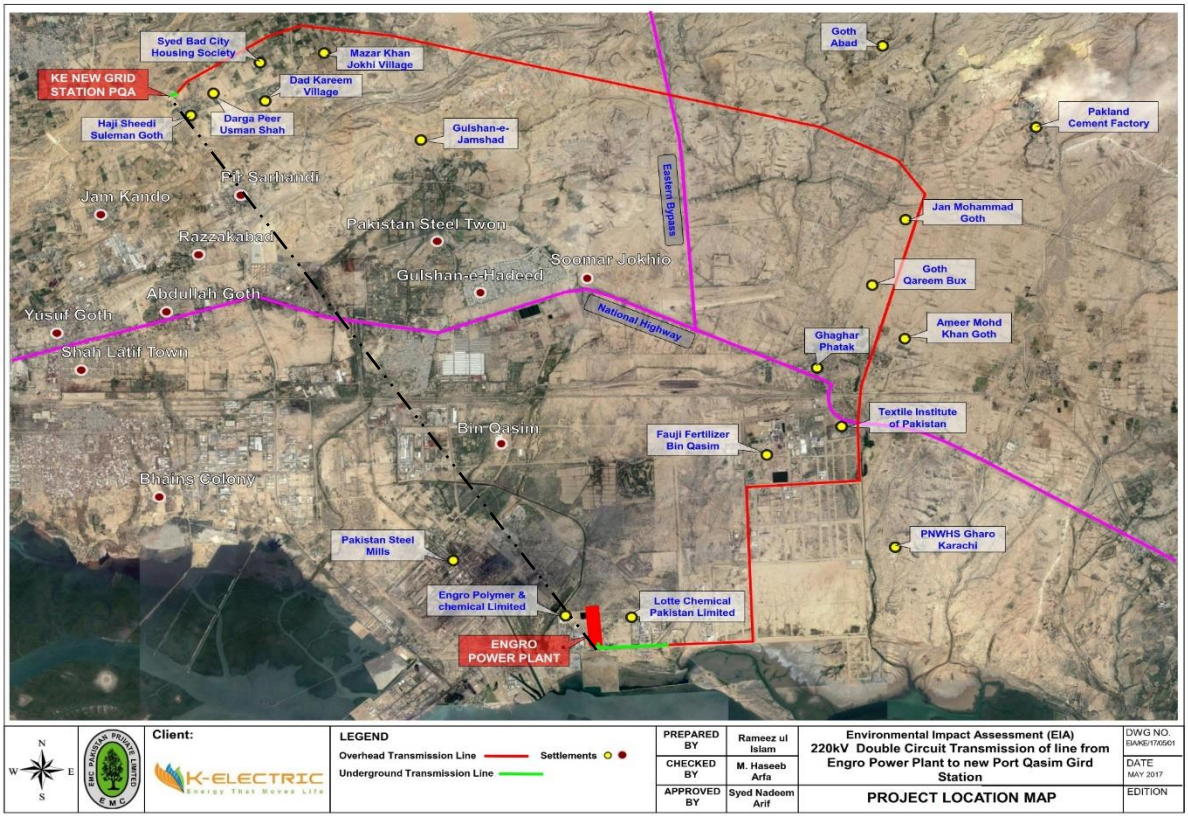
In underground cable EMF concentration increases in the centre line because of the buried in the earth but in the contemporary overhead transmission line EMF affect disperses with low concentration to 60 m from the centre.

6.3.2 High Pressure, Fluid-Filled Pipe Type Cable or Solid Cable, Cross-Linked Polyethylene

XLPE cable will be used since some problems associated with HPFF pipe-type underground transmission lines including maintenance issues and possible contamination of surrounding soils and groundwater due to leaking oil have been observed. XLPE cable has become the national standard for underground electric transmission lines which are less than 200 kV. There is less maintenance with the solid cable, but impending insulation failures are much more difficult to monitor and detect.

6.3.3 Straight line versus proposed alignment

The following figure shows the two potential (Red and Black) routes that are investigated in this alternative analysis.



Proposed alignment (38 km)
Straight Line Route (17 km)

Following is the comparison of these two routes.

Table Error! No text of specified style in document..**1: Comparison of Option-0 and Option-1**

Name	Proposed alignment (38 km)	Straight Line Route (17 km)
Land Acquisition	◎ Most of the land along the ROW is open land and will be acquired by the proponent.	Δ Most of the land along this route is industrial land including Pakistan Steel Mill and large villages. The land acquisition cannot be possible for this option.
Social Impact	◎ According to the survey, there is no village or social setting that is located inside the	Δ According to the above map, some of the villages are located inside the ROW as well as

	ROW of min. 30 m. The route is so selected to avoid the social settings.	few of the industries.
Minimum clearance with other objects.	◎ The proposed route will comply with the KE standards for the min. clearance required from other objects.	△ The proposed route will not comply with the KE standards for the min. clearance required from other objects.
Ecology	○ According to the safety standards, clearing of bushes will be required under the tower area and tall trees may be cut to accommodate the power lines.	△ A detailed ecological survey for this option is not undertaken. Therefore it is not clear that how much ecology will be affected due to this area.
Cost for Construction	△ Construction cost for the transmission of electricity is more as compared to straight line option due to increase in length and increase in number of towers	◎ Construction cost for the transmission of electricity for this route will be less and less towers will be installed.
Comparison to proposed option	**Proposed**	**△**

Evaluation：
◎：Preferable
○：Less than preferable but no negative impacts
△：Not preferable

According the above evaluation, the preferred option will be the proposed route selected for the project in terms of safety, land acquisition and social acceptance.

Poles versus Towers

Poles: Poles have small footprint; they are more appropriate for urban areas but less cost effective as it costs four times more compared with conventional towers.

Towers: The conventional towers occupy more space. These are recommended for the present project in the open environment of the Project site.

6.3.4 Selection of transverse routes

Transverse routes of transmission line will be designated through the technical criteria and must consider the following subjects

- Minimization of transmission line length that may prevent the excess use of resources;
- Minimize the disruption of traffic, mobility/access of people;
- Minimize the disruption of existing utility lines;
- Minimize the cutting of trees;

Several factors must be taken into account to lay the TL which as discussed as follows:

Availability of ROW

ROW must be acquired for the preferred route. It is evident that the selected route will avoid major social settings like housing structures, industries, shops, government departments, commercial areas. Land for underground TL and for tower base must be acquired from relevant local agencies like PQA and MDA.

Two major linear structures are laid between the two GS i.e. Mainline of Pakistan Railways and National Highway (N5). In case of overhead transmission, it should not be a problem to cross these linear structures. However, minimum clearances should be provided for case of maximum sag conditions.

6.3.5 The Preferred Option

The installation of overhead transmission line would not exert negative impacts associated with the power line such as visual intrusion as the area is undeveloped and barren. Also the installation of overhead transmission line would not exert negative impacts associated with the power line such as high EMF especially in residential areas, impacts on road, street infrastructure, utilities services and terrestrial utilization. Subsequently, the range and power of electromagnetic fields (EMF) generated as a result of high voltages are considered low in overhead transmission line. Maintenance work on the overhead transmission line is easy and time saving as compare to underground transmission. Therefore overhead transmission option will be feasible and remain beneficial for the proposed development.

The Preferred Route

Figure 6.2 shows the preferred route (shown in Red) due to the following resons:

1. It avoids major residential areas and railway Pipri Marshalling Yard
2. It avoids the undeveloped Bin Qasim Industrial Park
3. Also the acquisition of ROW is easy as compared to alternative layout as shown in black in below picture

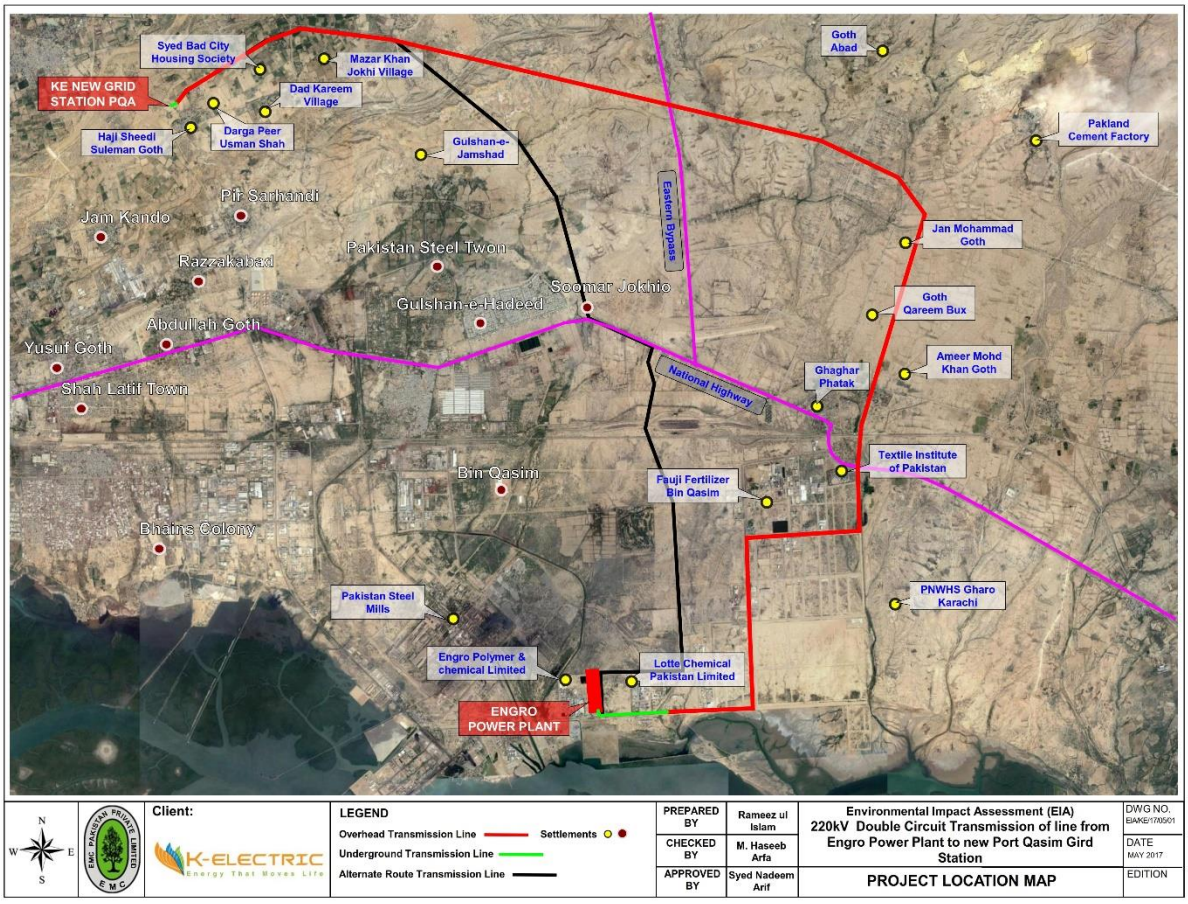


Figure 6.1: Preferred Route alignment for laying of 220 KV TL (as shown in Red)

Chapter 7 Potential Environmental Impacts & Proposed Mitigation Measures

7.1 Introduction

This chapter documents the findings of assessment of potential environmental and socio-economic impacts and proposes their mitigation measures. It includes identification, analysis, prediction, significance and characteristics of the impacts and mitigation measures to prevent unacceptable adverse effects through the implementation of appropriate project modifications.

This chapter plays a vital role in environmental impact assessment and identifies all significant impacts during the designing, construction and operation phases of the project. Environmental and social aspects identified during the stakeholder consultations and by the screening process are assessed for their severity and mitigation measures have been proposed on the basis of assessment. Additionally residual impacts are identified using professional judgment that may persist after adoption of mitigation measures. The proponent will adopt these mitigation measures to reduce, minimize and compensate for the negative impacts as far as possible.

7.2 Screening Methodology

Potential Project impacts have been identified in this section related to the project pre-construction (siting), construction and operation phases. Impact predictions are based on the consultants' previous experiences on similar projects; professional judgment; data collected in the field; discussions with local communities, relevant government officials and relevant technical specialists. Predicted impacts relate to all aspects of the proposed 220 kV Transmission line. Many of the mitigation measures are related to route alignment, others with good construction practices.

7.3 Designing Phase: Impacts and their Mitigation Measures

Designing phase impacts are primarily related to i) land acquisition, resettlement and approvals; ii) sensitive receptors (schools, hospitals, environmentally sensitive areas) and existing infrastructure (roads, railways); and iii) physical cultural resources (PCRs). Mitigations are mainly related to careful selection of the right of way for underground transmission line so as to avoid or minimize impacts.

7.3.1 Land Acquisition, Resettlement and Approvals

The ROW will be obtained from PQA/MDA for the UG TL and for the tower base for OH TL in the very beginning. NOCs from relevant institutions will be taken before the laying of TL.

7.3.2 Physical Cultural Resources by affecting any archaeological site

There are no protected cultural and heritage sites located near the proposed TL route. Construction of underground transmission line does not impact any cultural / heritage site.

7.3.3 Sensitive Receptors and Existing Infrastructure

The construction of underground transmission line ROW has the potential to negatively impact sensitive receptors (schools, hospitals) and existing infrastructure (roads, railways, utility Lines). No residential or public buildings like factory, school, hospital, mosque or graveyards are permitted within the corridor of underground transmission line.

Mitigation Measures

- During the selection of ROW for underground transmission line, significant efforts should be made to avoid or minimize impacts on sensitive receptors or existing infrastructures;
- Prior notices shall be given to the legal shop owners and residents before the starting commissioning activities near these settings;
- GRM as discussed in Section 8 shall be followed in letter and spirit;
- Impacts on public utilities should be minimized by incorporating environment friendly construction methods in the engineering design; and
- Works around public utilities should be carried out in consultation with relevant authorities.

7.3.4 Movement of People/Traffic

The excavation & backfilling of underground transmission line ROW may result in obstruction to movement of people/ local traffic. However, overhead TL will provide passageways for humans and animals passing through the corridor.

Mitigation Measures

- Cables that cross main roads will be achieved through thrust boring under the road;
- The excavation and backfilling activities should be scheduled (skipping peak hours) to minimize the impact of barrier to the movement of people and traffic.

7.3.5 Temporary Construction Camps

There may be a requirement to establish small construction camp. If not undertaken carefully these activities can result in deterioration of air & water quality, and social impacts including social unrest and disease transmission.

Mitigation Measures

- Camps are to be located away from residential areas to minimize nuisance;
- Sanitation facilities in the camps if provided should be mobile and collect its wastewater or connected to the local sewerage system;
- Bathing of construction crew should be prohibited at the camp as it will required large quantity of water as well as wastage.

7.3.6 Establishing responsibility on construction contractor regarding disposal of spoil/ excavated earth

Construction Contractor/Waste Contractor shall be made responsible through contract documents for proper disposal of the spoil / excavated earth and not to dump these spoils/ earth near open plots / open spaces / open storm water drains / in front of residents or left unattended along the construction site. It should be disposed in KMC designated landfill site.

A proper site rehabilitation plan shall be made by the contractor include the spoil / excavated earth disposal arrangements

7.3.7 Establishing responsibility on construction contractor to abide SEQS

Contractors shall also be made responsible through contract documents to follow Sindh Environmental Quality Standards (SEQS) and applicable standards during all the construction operations and ensure compliance of the same through periodic environmental monitoring reports.

7.3.8 Health and Safety of Workers and Public

Contractors shall be made responsible through contract documents to follow Standard Practices and Standard Operating Procedures (SOPs) to ensure health & safety of workers at the site and public during all construction operations.

7.3.9 Living and Livelihood of the Neighboring Community

The proposed transmission line passes near the neighboring settings including Lotte chemical Pakistan limited, Fauji Fertilizer Bin Qasim, Textile Institute of Pakistan, Goth Qareem Bux, Jan Mohammad Goth, Ghulam Hussaim Jokhi Village, and Hahi Sheedi Suleman Goth. Cattle grazing, stone quarrying, gravel and sand collection and transportation, besides wood cutting are the main occupation of neighboring people. They are also working in industry in monthly wages. However, these agricultural practices and livestock herding are limited to the area. Therefore, there are no significant impacts on these livelihoods of neighboring community.

7.4 Construction Phase: Impacts and Mitigation Measures

Construction phase impacts include erosion of soil; impacts on surface and groundwater; solid waste management; air quality issues, primarily related to dust generation; noise; vegetation removal or cutting of trees and other impacts on flora and fauna; aesthetic impacts; and occupational and community health risks. Mitigation measures include good construction and housekeeping practices, and compensatory planting for the loss of trees in the ROW.

7.4.1 Erosion of soil

Project activities may cause erosion of soil. Such activities may be identified as transportation of materials and equipment, preparation of tower base for overhead TL, excavation for UG TL and for laying of transmission cables, backfilling and restoration of road, landscaping, and removal of natural vegetation etc. Usually, the exposed soil after excavation for foundations is vulnerable to erosions and runoff by heavy rains.

But, the impact of all these activities would be less significant and temporary lasting only for construction period. However, the aspects of soil erosion such as blockage of surface drainage network, impact on quality of natural water and biological system may cause potential environmental impacts that may also affect their users.

Mitigation Measures

- The most suitable strategy to avoid adverse environmental impact of soil erosion is to limit area from where the removal of vegetation is being done to construction site only. The other areas should be disturbed least;
- Construction activities should be scheduled to avoid runoff due to rain;
- The dredged soil must be contained in an enclosure to reduce the chances of runoff during the seasons of precipitation;
- Stock piles of fine material should be wetted or covered with tarpaulin especially during windy weather conditions;
- Site workers should wear dust masks especially during the dry and windy weather conditions;
- Debris should be collected during construction and disposed of in low lying areas near the site;
- After constructional activities are finished, the site which is cleared temporarily and is recommended for vegetation should be re-vegetated promptly;
- Cut and fill should be balanced to the extent practical at each site in order to minimize the need for fill and for spoil disposal. Cut material should be used to level the site area or be disposed at designated spoil disposal sites;
- Excess spoil should only be directed to designated disposal areas and temporary quarries; no disposal in waterways is allowed.

7.4.2 Impacts on Surface and ground water sources

Generally the type and significance of the impact is dependent on the characteristics of the water resource, the design of the structures and their method of construction.

Mitigation Measures

- All excavated soil should be completely removed;
- Debris and vegetation clogging culverts should be regularly cleared;
- Soil runoff from the site leading to off-site contamination (particularly during rainy season) should not be allowed; and
- Spillage of oil and grease from the vehicles should be avoided.

7.4.3 Fuel, Oil & Chemical handling, storage and disposal

Inappropriate handling, storage and disposal of fuels, oils and chemicals at construction sites may lead to contamination of soil.

Mitigation Measures

- Chemicals and oils should be stored in secure designated areas with temporary impermeable bunds at distance of at least 100 m from any water course;
- Refueling, oil changing and engine maintenance of machinery, equipment and vehicles should be avoided at construction site;
- Oil contaminated materials should be disposed at designated waste disposal facilities.

7.4.4 Water Consumption and Conservation

Water is used in numerous construction activities such as concreting, curing, plastering, domestic etc. Water required for such activities is being met from external sources such as water tankers supplying water to the construction site.

Mitigation Measure

- Regular monitoring of water consumption, conservation and quality;
- Use of leak proof water storage tanks;

7.4.5 Solid Waste Management

Typical solid waste generated during construction include waste concrete, steel scrap, wooden scaffolding, empty cement bags, excavated soil, wood remains etc. Solid waste generated during land clearance and Earth-fill material will be in large quantities. This waste has the potential to cause negative impact on the surroundings if not properly managed and disposed of. It is likely to block nearby drainage channels that can ultimately cause localized flooding during monsoon season. Random storage of this waste is hazardous to the workers at the site as well. Windblown debris is a nuisance to the nearby dwelling units. Poor waste management practices would result in short term and long term negative impacts on the aesthetics of the surrounding.

Mitigation Measures

- A Comprehensive Waste management Plan for Construction phase should be developed;
- Construction sites should be equipped with temporary refuse bins, and construction wastes should be collected on a daily basis and contained in a temporary designated waste storage area on each site;
- Designated waste storage areas should not be within 50 m of water ways;
- Any hazardous waste should be separated and stored in areas clearly designated and labeled, and disposal in environmental friendly manner.
- All type of wastes should be routinely collected from the designated area and disposed at licensed waste disposal facilities approved by SEPA; and
- Upon completion of activities at a construction site all solid wastes should be completely removed and the site should be re-contoured or prepared for natural re-vegetation.

7.4.6 Dust Emissions

Construction activities that may lead to dust generation include cutting and excavation; transportation and tipping of cut materials; handling and storage of aggregates in concrete plants; concrete batching; site leveling and clearing of trees; and associated activities. The quantity of dust that may generate on a particular day of construction phase will depend on the magnitude and nature of activity and the atmospheric conditions prevailing on that day.

Mitigation Measures

- Dust emissions from soil piles and aggregate storage stockpiles should be reduced by keeping the material wet by sprinkling water at appropriate frequency and erecting windshield walls on three sides of the piles;
- It should be mandated by KE to Contractor to backfill the trenches after laying of the TL and rehabilitate the excavated area to its original position. If it is a road, the backfilling will be followed by levelling and carpeting of road with bitumen;
- Vehicular movement should be restricted to a specific time for dumping of supplies and construction materials; and
- Workers should wear dust masks and safety goggles, especially during dry and windy weather conditions to avoid health risk.

7.4.7 Exhaust Emissions

Major sources of exhaust emissions are standby diesel generators, material transport vehicles and emissions from construction machinery/earth moving equipment. Major exhaust emissions of concern are CO, CO_2, SOx, NOx and PM10. These emissions are injurious to human health in high concentration and also can cause vegetation damage by clogging the photosynthesis process in plants.

Mitigation Measures

- All vehicles, generators and other equipment used during the construction will be properly tuned and maintained in good working condition in order to minimize emission of pollutants;
- Emissions from the machinery and vehicles will be monitored on regular basis to ensure compliance of SEQS;
- Excessive engine idling will be discouraged and machinery causing excessive pollution (i.e. visible clouds of smoke) will be banned from sites;
- Standby generators for power supply will be kept away from pathways and will be placed at locations where probabilities of human intervention are limited; and

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

7.4.8 Noise and Vibration

During the construction phase noise will be generated from the operation of heavy machinery and haulage of construction materials to and around construction sites and construction activities including concrete mixing, excavation, thrust boring, drilling, backup power generators for supply of electricity; use of pressure horn etc. These construction activities are expected to produce noise levels in the range of 80 – 95 dB and may cause discomfort to local residents and fauna.

Vibration and noise could become a major consideration (within 100m of schools, religious premises, hospitals or residences etc.).

Mitigation Measures

- Machinery operation and high noise activities should be carefully planned and scheduled;
- To the extent practical batching plants and construction areas should not be located within 500 meters of a settlement;
- Where that is not possible, high noise activities should cease between 20:00 and 06:00 hrs at any construction site within 500 meters of a settlement, or if noise complaints are received from settlement residents.
- Vehicles and machinery will be equipped with silencers. Contractors will be required to fit noise shields on high noise construction machinery;
- Site labor working in high noise area such as where noise level exceeds 80 dB (A), will wear earplugs;
- The stationary sources of noise such as concrete mixers, batching plant, power generators and pumps will be selected and segregated from work areas and residents; and
- Occupational health, safety and environmental procedures and Environmental management plan for proposed project would be followed.

7.4.9 Impacts on Ecology (Flora and Fauna)

Construction activities of underground transmission line may slightly affect some species of flora and fauna of common nature, however this impact would be minimum as all activities would be limited and strictly carried out on the transmission line ROW. Also the overhead TL will require the least footprint and only site clearance is required at tower bases. Most of the TL route ROW is barren. Therefore, the impact of ecology from OH TL is negligible.

Mitigation Measures

- Compensatory plantation shall be provided at a ratio of 1:3;
- Selection of plants for landscaping should consider the habitat suitability, trees of national interest, flowering trees and shrubs; and
- By using the best practice for vegetation clearing and disposal practices; will minimize the environmental risk associated with clearing and disturbance of vegetation communities.

7.4.10 Occupational Health and Safety

The construction of civil works poses an inherent risk of injury to workers from accidents and hazardous working environments. There may be either minor or major accidents due to different activities of construction phase.

Mitigation Measures

- Preventive and protective measures including modification, substitution, or elimination of hazardous conditions, with particular attention to live power lines, working at height, working above water, EMFs, high noise levels, and exposure to chemicals will be made;
- Measures for the management and appropriate disposal of hazardous wastes will be undertaken to ensure protection of the workforce and the prevention and control of releases and accidents;
- Appropriate fire extinguishers and fire response plans will be available at the site;
- Appropriately stocked first-aid equipment and stations at both work sites and temporary construction camps, including appropriately trained first aid staff on site and adequate transport facilities for moving injured persons to the nearest hospital will be available;
- Training for workers and appropriate incentives to use and comply with health and safety procedures and PPEs will be provided;
- Procedures for documenting and reporting occupational accidents, diseases, and incidents;
- Emergency prevention, preparedness, and response arrangements will be in place;
- There will be strict safety requirements for personnel assigned to construction work;
- To maintain safe conditions for the general public, all substations will be fenced and gated, that must be locked at all times; and
- Appropriate signage will be posted that shows the owner of the substation, the hazardous nature of the substation and contact information.

7.4.11 Heat Stress to Construction Workers

There will be a very likely impact of sunlight causing heat stress to construction workers during summer season. Also the project corridor has no significant vegetative cover.

Mitigation Measures

- Move to a cool place e.g. cool shady area;
- Provide plenty of drinking water;
- Break the working in shifts; and
- Massage muscles gently to ease spasms, or firmly if cramped, then apply ice packs and drink glucose.

7.4.12 Impacts on Traffic

Traffic flow in the locality of project slightly increases during construction activities. The transportation of trucks for raw materials and mobilization and demobilization of the earth works equipment are required during construction phase of proposed project. This activity has potential to directly impact the traffic flow along the right of way of proposed transmission line. This increase in traffic may congest the flow of traffic along eastern bypass, Dumlotee Road, National Highway (N5) and roads in Eastern Industrial Zone of PQA etc.; and may cause some accidental injuries and deteriorate the air quality of ambient air.

Mitigation Measures

- Traffic management plan will be developed and implemented during the construction phase;
- Excavation near industries should be done during non-peak hours and the construction should be done in pieces near residential areas;

- Construction activities will be scheduled to reduce the chances of traffic jams;
- Adequate and appropriate road signs will be erected to warn road users along the ROW of transmission lines;
- The movement of equipment (trucks) during the construction of the proposed project will be limited to 9:30 am - 4:30 pm per day;
- Raw materials for construction work will be adequately covered within the trucks to prevent any escaping into the air and along the roadway;
- Vehicles will be maintained regularly to reduce the exhaust emissions; and
- Any complain launched by community member will be responded and appropriate action will be taken to avoid it in future.

7.4.13 Socio-economic Impacts

During construction phase, an average of approximately 100-120 persons will be employed on contract basis which will put the positive impact on the socio-economic status of Karachi Division.

7.4.14 Damage to Other Utilities by Using the Existing ROW

There can be risk of damage to other utilities during excavation activities. All drawings of existing services along the chosen route alignment must be acquired by the Contractor. It must be avoided to the sewerage line and other water mains will be broken down. If the breakage of the lines occurred, repair must be made as quickly as possible. KE should mandate the Contractor to rehabilitate the lines as its original positions with coordination with the relevant agencies.

7.4.15 Community Health & Safety

The construction of transmission lines may pose a modest risk to local communities from emergency events such as entry of local people in dangerous working environments and can also disrupt the traffic. In case of underground TL, falls into the trenches made for laying of transmission cables at night can also occur.

Mitigation Measures

- Emergency response plan should be prepared and implemented during entire phase of construction;
- Procedures for interaction with local and regional emergency and health authorities should be made;
- In order to minimize traffic congestion (if applicable), deliveries of materials and equipment should avoid peak traffic hours between 6:30-8:30 am and 3:30-4:30 pm;
- Erection of towers and poles for the overhead TLs should be barricaded and crane movement should be assessed prior to the operation near the residential areas and communities;
- It should be mandated by KE to Contractor to backfill the trenches in case of UG TLs after laying of the pipeline and rehabilitate the excavated area to its original position. If it is a road, the backfilling will be followed by levelling and carpeting of road with bitumen;
- Proper lighting at night near trenches will be ensured; and
- Diversions, danger points and works at culverts, bridges and construction sites will have appropriate warning signs; this is particularly important at night to avoid accidents.

7.5 Operational and Maintenance Phase: Impacts and Mitigation Measures

The most focusable area in the impact assessment process of proposed project is operational and maintenance activities of New PQA Grid Station, 02 number of Line Bays & Transmission Line as impacts generated during these phases may have long term and continuous affects. Potential operational issues include impact on migratory birds, spills or release of oils or hazardous materials, SF_6, EMF effects, occupational and community health and safety risks, risks from fires, earthquakes. Mitigation measures have been incorporated into the design to minimize them to acceptable levels.

7.5.1 Impact on migratory bird flyways

The birds during migration fly at elevations between 800 and 2000 m, whereas maximum height of the towers of the transmission lines is less than 40 m. As such, the 220 kV transmission line routes will not cause any obstruction for the flight of migratory birds. Similarly the transmission line will not intercept Indus Flyway (Green Route) causing any disruption to flight of migratory birds.

Figure 7.1 shows Indus Flyway. This famous route from Siberia to various destinations in Pakistan over Karakorum, Hindu Kush, and Suleiman Ranges along Indus River down to the delta is known as International Migratory Bird Route Number 4. It is also called as the Green Route or more commonly Indus Flyway, one of the important migratory routes in the Central Asian - Indian Flyway. The birds start on this route in November. February is the peak time and by March they start flying back home. These periods may vary depending upon weather conditions in Siberia and/or Pakistan. As per an estimate based on regular counts at different Pakistani wetlands, between 700,000 and 1,200,000 birds arrive in Pakistan through Indus Flyway every year. Figure 7.2 shows the Migratory route, breeding range and wintering range of Ferruginous Duck Aythya nyroca in Pakistan. This study suggests that the project site is not on the corridor of migratory birds.

Therefore no adverse impact on migratory birds is expected.

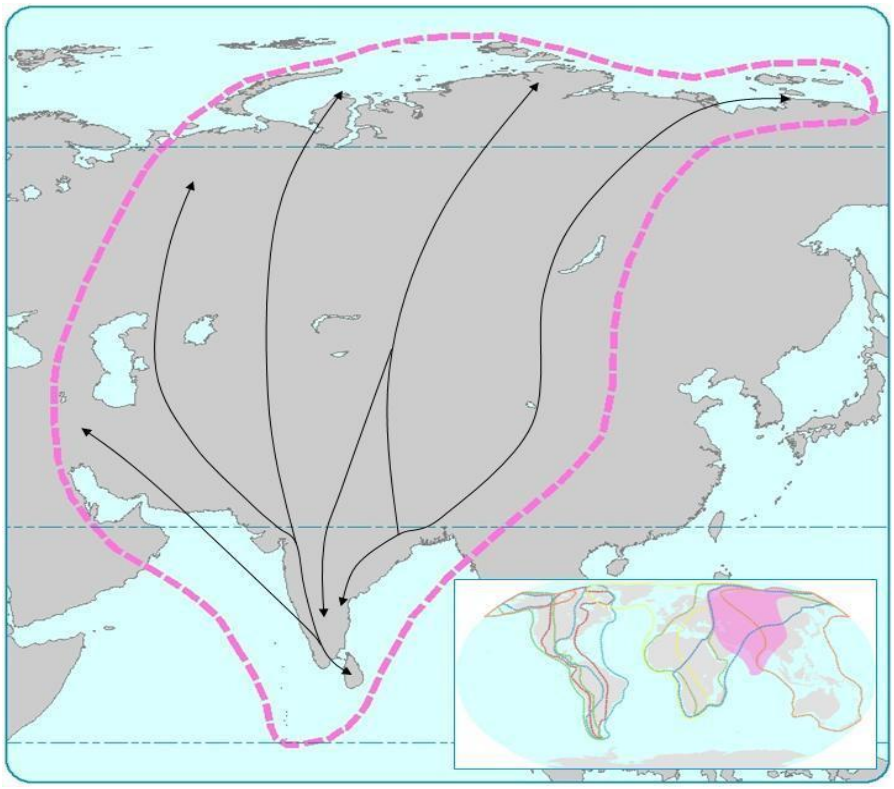


Figure 7.1: Eurasian/South Asia Migratory bird flyway (Source: Birdlife International)

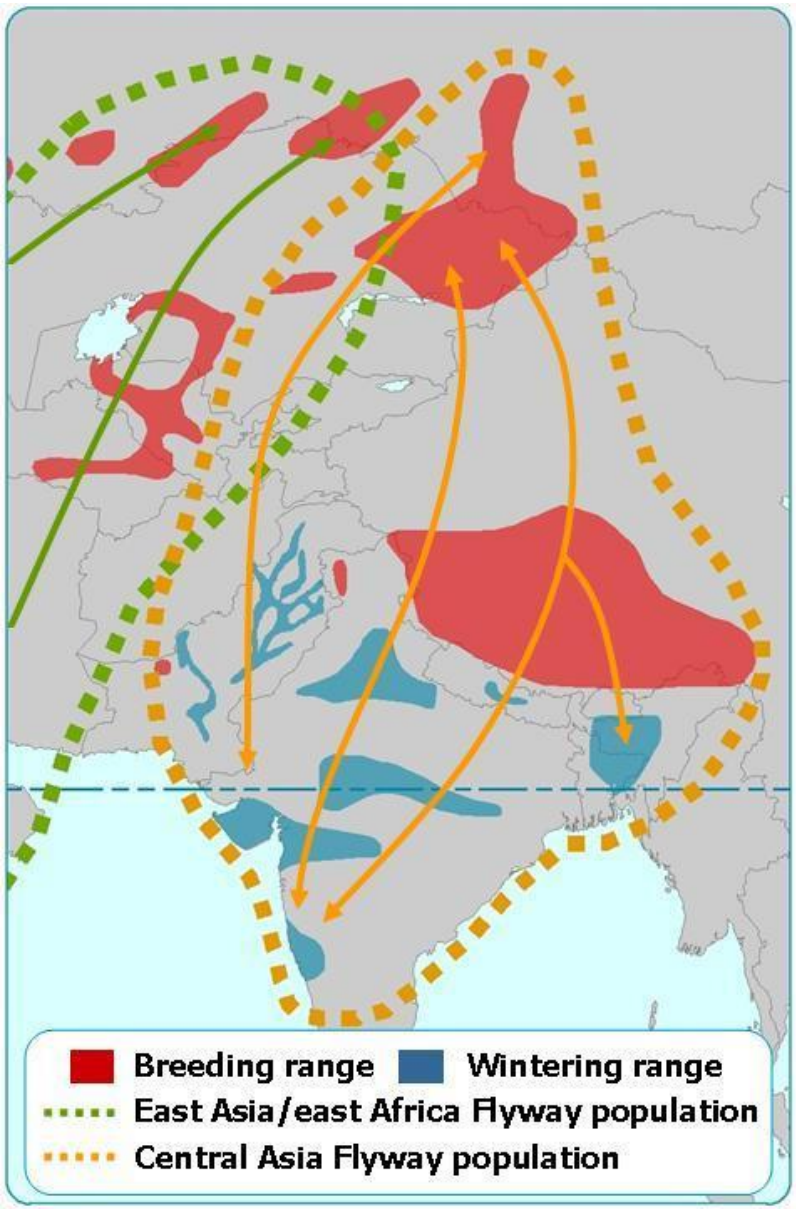


Figure 7.2: Migratory route, breeding range and wintering range of Ferruginous Duck Aythya nyroca in Pakistan (Source: Birdlife International)

Mitigation Measures

- All suspension poles shall have detachable bird protection devices, over each suspension insulator string.
- Bird flappers and deflectors will be installed on conductors to avoid collision of birds on strings.

7.5.2 Health Impacts

a. Human Exposure to Electromagnetic Fields (EMF)

During the operation phase the Transmission Line will be energized and there will be an increase in the level of electromagnetic fields (EMFs) in the ROW vicinity.

In epidemiological studies, researchers try to establish whether there is a statistical association between selected groups of people with certain types of exposures of EMF and diseases. Some epidemiological studies have suggested a possible link between exposure to magnetic fields and childhood leukemia. It is unclear however, whether exposure to magnetic fields actually caused the disease. Some studies do not include magnetic field measurements when trying to determine an association and no epidemiological study has drawn direct conclusions about a link between cancer and EMF.

Experimental studies involve exposing cells, tissues and/or animals to magnetic fields under controlled conditions. These studies allow researchers to closely control magnetic field exposure and provide information about any small scale biological changes that magnetic fields may cause. Experimental studies have not found that magnetic fields are the cause of any disease.

Many reputable health authorities such as the World Health Organization (WHO) and Health Canada have conducted thorough reviews of all the different types of studies and research on EMF and health. These health authorities have examined the scientific weight-of-evidence and have determined that when all of the epidemiological and experimental studies are considered together, the consensus is that there is no cause-effect relationship between exposure to magnetic fields and human health. The WHO concludes:

From the current scientific literature there is no convincing evidence that exposure to radiation field shortens the life span of humans or induces or promotes cancer (WHO, 2006).

Similarly, the World Bank Electric Power Transmission and Distribution EHS Guidelines state: Although there is public and scientific concern over the potential health effects associated with exposure to EMF (not only high voltage power lines and substations, but also from everyday household uses of electricity), there is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines and equipment. However, while the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern (World Bank, 2007).

The World Bank Electric Power Transmission and Distribution EHS Guidelines recommend evaluating potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation (ICNIRP); average and peak exposure levels should remain below the ICNIRP recommendation for general public exposure. The WHO reviews also conclude that exposures below the limits recommended by the ICNIRP international guidelines do not appear to have any known consequence on health.

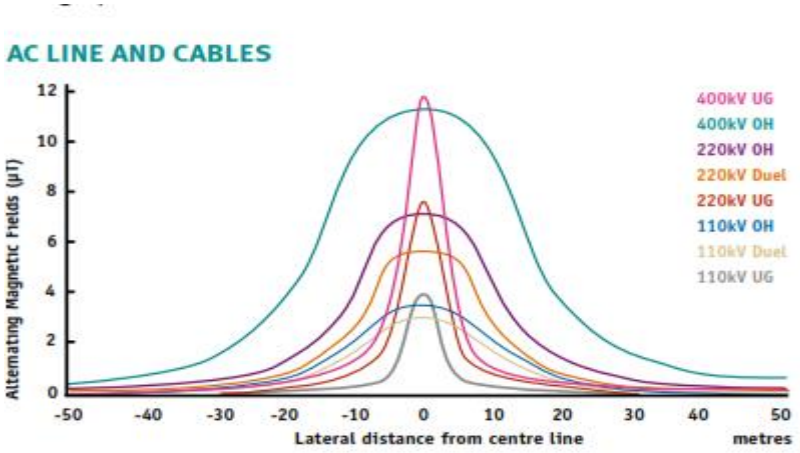
Mitigation Measures

To minimize potential EMF impacts from the Project the following mitigation measures have been adopted:

- Design the transmission line to ensure that electric and magnetic fields are minimized, given the voltage and load requirements;
- Design line accordingly as not to increase background EMF at sensitive receptors;

- Operation phase EMF monitoring will be undertaken. Average and peak exposure levels should remain below the ICNIRP recommendation for general public exposure; and
- EMF monitoring will be conducted as per pre-defined procedures of KE. Further, maintain the complaints register.

Both Ac and Dc technologies produce magnetic fields and both decrease with distance as you move away from the line or cable. See graphs below:



Source: EMF-You-Booklet_2014

Figure 7.3: 220 KV Overhead Transmission line: Maximum magnetic field

The EMF below the proposed 220 kV overhead transmission line is to be predicted around 6 microtelsa (μT), which is well below the ICNIRP guideline of 100 μT. Overall no significant adverse EMF impacts are predicted during Project operation.

Electrocution and Induced Currents

Electrocution can occur as a result of direct contact with high-voltage electricity or from contact with tools, vehicles, ladders, or other devices that are in contact with high-voltage electricity. Power line fields can also induce voltages and currents on conductive objects such as metal roofs or building, fences, and vehicles. When a person or animal comes in contact with a conductive object a perceptible current or small secondary shock may occur.

Mitigation Measures

- Warning signs will be posted at towers along the ROW.
- Conducting objects (e.g. fences or other metallic structures) installed near power lines will be grounded to prevent shock.

7.5.3 Wind, Fire and Earthquake Hazards

Wind, fire and earthquakes pose risks to the project operation and the likelihood of occurrence consider medium with significance of impact is major.

Mitigation Measures

- Transmission towers have been design as per relevant national building codes which include earthquake resistance and loading requirements related to wind conditions.

- Transmission support structures such as tower foundations have also been designed to withstand different combinations of loading conditions including extreme winds that generally exceed earthquake loads.
- Electricity arcing from power lines can be a fire hazard. To mitigate against fire hazards:
  - The fire hazards risk will be minimized through the use of tall towers and wide ROW.
  - System protection features designed to safeguard the public and line protection systems will consist of Transmission Line relays and circuit breakers that are designed to rapidly detect faults and cut-off power to avoid shocks and fire hazards.
  - Regular maintenance of the protection system including conductors and circuit breakers will be undertaken.

7.5.4 Electromagnetic Interference

The corona of overhead Transmission Line conductors and high frequency currents of overhead Transmission Line can create radio noise which interferes with broadcast signals or electronic equipment.

Mitigation Measures

- During design the ROW alignment was selected so as to avoid settlements;
- Standard design guidelines have been adopted to limit the conductor surface gradients so as to minimize electronic interference.

7.5.5 Impact of Gaseous Emissions

The only source of gaseous emissions from the proposed project is the standby power generators and the vehicles of use during maintenance work.

Mitigation Measures

- All vehicles, power generators and other equipment used during the maintenance work will be properly tuned and maintained in good working conditions in order to minimize emission of pollutants; and
- Emissions from the machinery and vehicles will be monitored on regular basis to ensure compliance with SEQS.

7.5.6 Impact of Waste

The operation and maintenance activities of proposed project may generate some hazardous and non-hazardous waste such as wires and wild vegetation etc. which if not disposed of properly could have adverse impacts on the environment.

Mitigation Measures

- Ensure that all solid waste collected during operational or maintenance work is disposed of in an appropriate disposal site in the locality.

7.5.7 Sulfur Hexafluoride Gas (SF6)

Sulfur Hexafluoride (SF_6) will be used as a gas insulator for electrical switching equipment. Commercially available SF6 is not dangerous, and is not specifically subjected to the local environmental regulations. The use of SF6, 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) SF6 released into the atmosphere is considered a greenhouse gas with a significantly higher global warming potential (GWP) of 23900 than that of CO2 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 SF6 accumulation outside the compartments
- Ensure it is provided in sealed containers
- SF6 handling and operational procedures shall be in accordance with KE SF6 Monitoring & Management procedure and in line with IEC 60376

Leakage checks must be carried out at grids and ensure it does not go beyond 0.1% per annum.

7.5.8 Positive Socioeconomic Impact

Project operation will result in a number of significant positive socio-economic impacts including:

- Generating employment for local people; and
- Improving the technical skills of local people.

Chapter 8 Environmental Management & Monitoring Plan

8.1 Introduction

8.1.1 General

This section discusses the implementation and management of mitigation measures that are required for proposed project that includes progressive report and techniques to assure that all necessary environmental protection measures are carried out in the future as planned and to reduce residual impact to acceptable levels and achieve the expected outcomes of the project. The Environmental Management and Monitoring Plan (EMMP) are based on the type, extent and duration of the identified environmental impacts. The EMMP has been prepared following the regulatory requirements and guidelines.

Environmental management and monitoring is mandatory activity to be undertaken by the administration over the entire project cycle showing its commitment towards meeting environmental regulations/standards as well as maintaining health and safety standards.

The environmental management and monitoring programs are implemented from the very early stages of planning and execution phases of the project. In fact the authorization of the project is the point of initiation of environmental management plan. The monitoring data, observations recorded and test results / analyses are vital and formulate legal documents to be kept in safe custody and may be provided to competent authority as and when required in accordance to Sindh Environmental Protection Act 2014.

EMMP is a dynamic and a live document that is under constant review having periodic revisions and may be updated as required. Any amendments in the procedures, information are notified to the concerned personnel after the approval from the competent authority for subsequent implementation. It also highlights the responsible personnel to work for the implementation of this EMMP.

The Proponent will be responsible for implementing the EMMP and ensuring that all personnel management are informed about the EMMP and the requirement to implement the procedures it contains. The EMMP is intended as a quick reference for Project personnel and regulators to monitor compliance.

8.1.2 Objectives of EMMP

The EMMP will serve as a principal execution module of the project that would not only mitigate adverse environmental impacts during the designing, construction, operational and maintenance phase of the project but also ensures that environmental standards and good housekeeping is maintained. Continuous environmental monitoring is exercised to ensure that preventive measures are in place and are effective; to sustain environmental integrity. Some of the key objectives of the EMP are to:

- Outline mitigation measures recommended in the EIA and define the responsibility and implementation of these measures;
- To outline functions and responsibilities of personnel;
- To state and implement standards and guidelines which are required under environmental legislations particular in context to the project,
- Facilitates the implementation of the mitigation measures by providing the technical details of each project impact, and proposing implementation schedule of the proposed mitigation measures;

- Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented; and
- Identify training requirements at various levels and provide a plan for the implementation of training sessions

It is important that the recommendations and mitigation measures are carried out according to the spirit of the environmental assessment process and in line with the guidelines. The EMMP are presented in Table 8.1 and Table 8.2. Screening of potential environmental and social impacts has played a vital role in reconfirming typical mitigation measures and in identifying any different approaches based on the feasibility and detailed design assumptions and any alternatives available at this stage.

8.1.3 Legislation and Guidelines

Legislation and guidelines pertaining to this project have been discussed at length in chapter 3 of EIA study of 220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station. It shall ensure that the project activities during designing, construction and operation phases of the project would follow the relevant environmental legislations and guidelines. The staff of the proponent and contractor should also be aware of these laws.

8.2 Environmental Management Plan (EMP)

The impacts and their mitigation measures have been classified into those relevant to the designing, construction, operational and maintenance phase. The matrix provides details of the mitigation measures recommended for each of the identified impacts, time span of the implementation of mitigation measures, and the responsibility of the institution. The institutional responsibility has been specified for the purpose of the implementation and the supervision. The matrix is supplemented with a monitoring plan (Table 8.1).

The monitoring plan is designed based on the project cycle. During the designing period, the monitoring activities will focus on (i) checking the contractor's bidding documents, particularly to ensure that all necessary environmental requirements have been included and (ii) checking that the contract documents' references to environmental mitigation measures requirements have been incorporated as part of contractor's assignment and making sure that any advance works are carried out in good time. Where detailed design is required (e.g. for power distribution lines and avoidance of other resources) the inclusion and checking of designs must be carried out. During the construction period, the monitoring activities will focus on ensuring that environmental mitigation measures are implemented, and to guide any remedial action to address unexpected impacts. Monitoring activities during project operation will focus on recording environmental performance and proposing remedial actions to address unexpected impacts.

8.2.1 Institutional Framework for Implementation of EMP

This Framework illustrates the roles & responsibilities required for the implementation of EMP. The transmission line would be laid for KE who would also finance it. KE would provide technical staff for laying of that transmission line. Environmental management during different phases of proposed project would also be performed by KE. The contractors, staff and supervisors would be trained to ensure environmental safety. The EMP will be prepared to cover all phases of the project including designing, construction, operation and maintenance and the Proponent will ensure that all activities during all phases are in compliance with the EMP and SEQS. The brief Organizational structure for Environmental management is given in Figure 8.1.

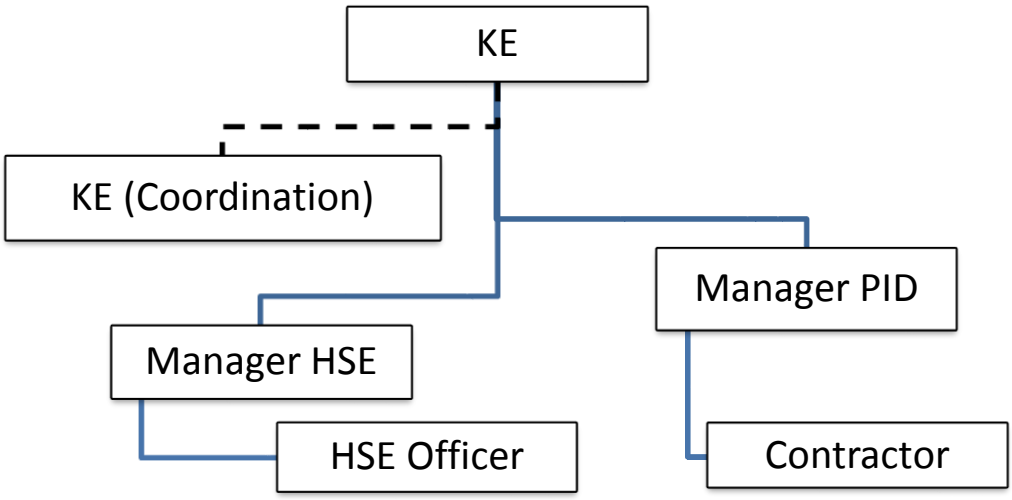


Fig. 8.1: Proposed Organizational setup for environmental management

The K-Electric (KE)

KE would perform the following roles and responsibilities:

- The K-Electric (KE) top management will be responsible for the successful execution of the project;
- KE will ensure that the project complies with regulatory requirements;
- KE is responsible and accountable for HSE performance;
- Provide physical and financial resources to ensure better performance of HSE department;
- It would also be ensured that EMP is followed, staff is properly trained and with requisite expertise and execution of project in accordance with approved plan;
- To keep in place emergency and rescue plans for safety of staff and general public.

HSE Manager

In management plan, the role of HSE Manager is always considered vital. Some roles and responsibilities of HSE Manager are as under:

- To improve the coordination and exchange of information between management, employees and contractors etc.;
- Ensure the health and safety of employees;
- Monitor the progress of development and implementation of EMP;
- To ensure that the point of views of staff and contractors are considered and placed in the EMP accordingly;
- Propose corrective and preventive measures wherever environmental deviations exceed compliance limits;
- To review EMP every year, tracking issues and change the EMP accordingly with the solutions and suggestions; and
- To contribute towards the actions to deliver the management plan and ensure its continued development.

HSE Officer

The role of HSE Officer will be authorized by HSE Manger. Some roles and responsibilities of HSE Officer are as under:

- Integrate as far as possible the aims and objectives of different users within an agreed plan;
- Maintain a balanced, holistic approach to the solution of concerned issues in accordance with the legislative requirements;

- Provide professional guidance on questions relating to the environmental management and issues raised by contractors/ relevant personnel; and
- Implement the suggestions and recommendations given in EMP.

Manager PID

- To consider and react to issues and solutions proposed by HSE department;
- To evaluate the progress of development and implementation of EMP; and
- To approve any change in decision making and authorities in consultation with HSE Manager, if appropriate.

Contractors

Some roles and responsibilities of Contractors are as under:

- To carry out development activities in environmentally sound manner;
- To coordinate with HSE Officer to resolve pertinent issues;
- To ensure that the project activities are undertaken in an environment friendly manner and the mitigation measures are implemented as per the recommendations of EIA;
- Evaluate compliance with SEQS, National and International Policies for Environmental Protection;
- To manage and implement environmental management practices as given in this EMP as well as HSE policies adopted/ prepared by the proponent.

8.3 Environmental Training

An environmental training program will be prepared to address the need of contractor's site staff and build their capacity to effectively implement project-specific EMMP. HSE Officer will coordinate with contractors to organize training for their staff and to help them establish system /infrastructure for future sustainability. In addition to the training arranged and imparted by the HSE officer for complete project team, the contractor will also plan small training sessions for workers involved in specific jobs. Cost of trainings and mitigation measures will be deemed included in contract cost. Environmental Training Plan is provided in Table 8.2.

8.4 GRIEVANCE Redress Mechanism (GRM)

KE and its Construction Contractor will adopt the Community GRM Procedure outlined below, which requires interaction, consultation, and timely resolution of legitimate grievances. This approach is aimed at building a reputation of responsiveness, concern and responsibility among the community, with a view to building and sustaining acceptance and support for the construction and operation of the project.

The grievance officer recruited by Construction Contractor will place a complaint register at an accessible location (Union Council office, mosque, or at camp site) for respective community so anyone can register their complaint in this register and on weekly basis, it will be checked by the GRC.

KE and its Contractor(s) shall foster a sense of working with the local community and demonstrate that the Project takes a proactive stance to grievances.

In implementing KE's Community Grievance Procedure, the Contractor(s) shall:

- Record all grievances using the template Grievance Form given at the end of this section;
- Assess and advise the resolution of the grievance in the time frame required by the assessment.

All grievances will be investigated and a response (outlining a resolution) provided by KE/Contractor(s) as soon as possible and not more than 30 days after receiving the grievance. If more time is required for resolution, the person raising the grievance and KE shall be kept informed.

While the Contractor(s) is not prevented from initiating the grievance resolution, any corrective action taken must be in coordination with KE.

KE and its Contractor(s) shall ensure sufficient resources are allocated on an ongoing basis to achieve effective implementation of this Plan. The Contractor Plan shall describe the resources allocated to and responsibility for the execution of each task and requirement contained therein, and shall describe how roles and responsibilities are communicated to relevant personnel.

Table 8.1: Environmental Management and Monitoring Plan

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
Designing Phase							
Migratory bird flyways / Birds	Chance of Collision of Birds with the conductor string	• All suspension poles shall have detachable bird protection devices, over each suspension insulator string. • Bird flappers and deflectors will be installed on conductors to avoid collision of birds on strings.	CC	Check the bird protection devices are installed	Monthly / reported quarterly basis	CC/KE	Bird protection devices = Rs.400-500 per set
Temporary Construction Camps	Deterioration of air & water quality, and social impacts	• Camps are to be located away from residents/commercial activities to minimize nuisance; • Sanitation facilities in the camps if provided should be mobile and collect its wastewater or connected to the local sewerage system; • Bathing of construction crew should be prohibited at the camp as it will require large quantity of water as well as wastage.	CC	Consumption in liters / Construction sites/camps	Measured on daily basis / reported quarterly basis	CC/KE	Cost Sanitation facilities = Rs.3 lacs to 4 lacs per cabin
Excavation & backfilling of underground transmission line ROW may result in obstruction	Movement of People/Traffic	• Cables that cross main roads will be achieved through thrust boring under the road; and • The excavation and backfilling activities should be scheduled (skipping peak hours) to minimize the impact of obstruction to the movement of people and traffic.	CC	Traffic diversion sites, check access routes of pedestrians and construction sites / At ROW along the roads and footpaths	Monthly / reported quarterly basis	CC/KE	Cost of thrust boring will be evaluated and borne by CC
Contract clauses	Contractor may not perform the work in environmental friendly manner	• Construction Contractor/Waste Contractor shall be made responsible through contract documents for proper disposal of the spoil / excavated earth and not to dump these spoils/ earth near open plots / open spaces / open storm water drains / in front of residents or left unattended along the construction site. It should be disposed in KMC designated landfill site. • A proper site rehabilitation plan shall be made by the contractor include the spoil / excavated earth disposal arrangements • Contractors shall also be made responsible through contract documents to follow Sindh Environmental Quality Standards (SEQS) and applicable standards during all the construction operations and ensure compliance of the same through periodic environmental monitoring reports. • Contractors shall be made responsible through contract documents to follow Standard Practices and Standard Operating	KE				

Table 8.1: Environmental Management and Monitoring Plan

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
		Procedures (SOPs) to ensure health & safety of workers at the site and public during all construction operations. • As the work is usually completed by contractors and sub-contractors, K-Electric should monitor their works to ensure proper task completion.					
Construction Phase							
Excavation, storage of soil and waste, generation of waste	Soil Erosion	• Construction activities should be scheduled to avoid runoff due to rain; • The dredged soil must be contained in an enclosure to reduce the chances of runoff during the seasons of precipitation; • Stock piles of fine material should be wetted or covered with tarpaulin especially during windy weather conditions; • Cut and fill should be balanced to the extent practical at each site in order to minimize the need for fill and for spoil disposal. Cut material should be used to level the site area or be disposed at designated spoil disposal sites; • Excess spoil should only be directed to designated disposal areas and temporary quarries; no disposal in waterways is allowed.	CC	Check any obstruction in existing drains due to construction, check lifting of waste material, check waste management plan / At construction site	Monthly / reported quarterly basis	CC/KE	Water Sprinkling Cost = Rs.3.0/gallon/ km Cost of enclosure and tarpaulin will be evaluated and borne by CC
Water Resources	Impact on Surface and ground water sources	• All excavated soil left after backfilling should be completely removed; • Debris and vegetation clogging culverts and drains should be regularly cleared; and • Soil runoff from the site leading to off-site contamination (particularly during rainy season) should not be allowed.	CC	Check drainage infrastructure / Construction sites near drainage infrastructure	Monthly / reported quarterly basis	CC/KE	Mitigation cost will be evaluated and borne by CC
Fuel, Oil & Chemical handling, storage and disposal	Soil contamination	• Spillage of oil and grease from the vehicles should be avoided. • Chemicals and oils should be stored in secure designated areas with temporary impermeable bunds at distance of at least 100 m from any water course; • Refueling, oil changing and engine maintenance of machinery, equipment and vehicles should be avoided at construction site; • Oil contaminated materials should be disposed at designated waste disposal facilities.	CC	Check contamination on the ground, check waste disposal / Vehicles/ machinery in working areas	Monthly / reported quarterly basis	CC/KE	Cost of preparing temporary bunds will be evaluated and borne by CC
Construction Waste Disposal	This waste has the potential to cause	• A Comprehensive Waste management Plan for Construction phase should be developed;	CC	Domestic waste, Hazardous waste –	Measured on daily basis and	CC/KE	Waste disposal cost

Table 8.1: Environmental Management and Monitoring Plan

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
	negative impact on the surroundings if not properly managed and disposed of. Irregular storage of this waste is hazardous to the workers at the site as well	• Construction sites should be equipped with temporary refuse bins, and construction wastes should be collected on a daily basis and contained in a temporary designated waste storage area on each site; • Designated waste storage areas should not be within 50 m of water ways; • Any hazardous waste should be separated and stored in areas clearly designated and labeled, and disposal in environmental friendly manner. • All type of waste should be routinely collected from the designated area and disposed at licensed waste disposal facilities approved by SEPA; and • Upon completion of activities at a construction site all solid wastes should be completely removed and the site should be re-contoured or prepared for natural re-vegetation.		Chemical waste, electro waste, Paper and Polythene material waste and Wood / Collection, handling, storage areas and disposal	reported quarterly		will be evaluated by CC after selecting waste management contractor
Dust Emissions	Deterioration of local Air Quality	• Dust emissions from soil piles and aggregate storage stockpiles should be reduced by keeping the material wet by sprinkling water at appropriate frequency and erecting windshield walls on three sides of the piles; • It should be mandated by KE to Contractor to backfill the trenches/excavations after laying of the pipeline/tower foundations and rehabilitate the excavated area to its original position. If it is a road, the backfilling will be followed by levelling and carpeting of road with bitumen; • Vehicular movement should be restricted to a specific time for dumping of supplies and construction materials; and • Workers should wear dust masks and safety goggles, especially during dry and windy weather conditions to avoid health risk.	CC	SPM, PM_{10}, $PM_{2.5}$, SOx, NO, NO_2 and CO / Near Construction site (if several construction sites with a buffer distance of 5 km working consecutively or together, each site will be monitored at in a month)	Measured monthly for 12 working hours / reported quarterly basis	CC/KE	Rs.20,000 per site per month
Exhaust Emissions	Deterioration of local Air Quality	• All vehicles, generators and other equipment used during the construction will be properly tuned and maintained in good working condition in order to minimize emission of pollutants; • Emissions from the machinery and vehicles will be monitored on regular basis to ensure compliance of SEQS;	CC	Smoke, CO, Noise, NOx, PM, SO_2 / All construction vehicles	Measured monthly/ reported quarterly basis	CC/KE	Rs.15,000 per vehicle per month

Table 8.1: Environmental Management and Monitoring Plan

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
		• Excessive engine idling will be discouraged and machinery causing excessive pollution (i.e. visible clouds of smoke) will be banned from sites; • Standby generators for power supply will be kept away from pathways and will be placed at locations where probabilities of human intervention are limited; and • The stack height of the generators used will be at least 3 m above the ground.					
Noise and Vibration	Construction activities are expected to produce noise levels in the range of 80 – 95 dB and may cause discomfort to local residents	• Machinery operation and high noise activities should be carefully planned and scheduled; • To the extent practical batching plants and construction areas should not be located within 500 meters of a settlement; • Where that is not possible, high noise activities should cease between 20:00 and 06:00 hrs at any construction site within 500 meters of a settlement, or if noise complaints are received from settlement residents. • Vehicles and machinery will be equipped with silencers. Contractors will be required to fit noise shields on high noise construction machinery; • Site labor working in high noise area such as where noise level exceeds 80 dB (A), will wear earplugs; • The stationary sources of noise such as concrete mixers, batching plant, power generators and pumps will be selected and segregated from work areas and residents; and • Occupational health, safety and environmental procedures and Environmental management plan for proposed project would be followed.	CC	Noise Intensity (dB) / Near Construction site (if several construction sites with a buffer distance of 5 km working consecutively or together, each site will be monitored at in a month)	Monthly / reported quarterly basis	CC/KE	Rs.5,000 per site per month
ROW Clearance	Impacts on Ecology (Flora and Fauna), cutting of trees	• Compensatory plantation shall be provided at a ratio of 1:3; • Selection of plants for landscaping should consider the habitat suitability, trees of national interest, flowering trees and shrubs; and • By using the best practice for vegetation clearing and disposal practices; will minimize the environmental risk associated with clearing and disturbance of vegetation communities.	CC	Check tree cutting, compensatory plantation, inventory of cleared trees / plants / At construction alignment	Monthly / reported quarterly basis	CC/KE	Rs.5,000 per tree planting

Table 8.1: Environmental Management and Monitoring Plan

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
Safety Precautions for the Workers	The construction of civil works poses an inherent risk of injury to workers from accidents and hazardous working environments. There may be either minor or major accidents due to different activities of construction phase	• Preventive and protective measures including modification, substitution, or elimination of hazardous conditions, with particular attention to live power lines, working at height, working above water, high noise levels, and exposure to chemicals will be made; • Measures for the management and appropriate disposal of hazardous wastes will be undertaken to ensure protection of the workforce and the prevention and control of releases and accidents; • Appropriate fire extinguishers and fire response plans will be available at the site; • Appropriately stocked first-aid equipment and stations at both work sites and temporary construction camps, including appropriately trained first aid staff on site and adequate transport facilities for moving injured persons to the nearest hospital will be available; • Training for workers and appropriate incentives to use and comply with health and safety procedures and PPEs will be provided; • Procedures for documenting and reporting occupational accidents, diseases, and incidents; • Emergency prevention, preparedness, and response arrangements will be in place; • There will be strict safety requirements for personnel assigned to construction work; • To maintain safe conditions for the general public, all substations will be fenced and gated, that must be locked at all times; and • Appropriate signage will be posted that shows the owner of the substation, the hazardous nature of the substation and contact information.	CC	Accidents, PPEs, Annoyance, Fire Hazards, Safety Protocols, Spill on Land and Spill on Water / All construction areas	Continuous / reported quarterly basis	CC/KE	PPE cost will be borne by CC Rs.12,000 per set of PPE
Traffic Movement near construction site	Traffic flow in the locality of project will slightly increase during construction activities of the	• Traffic management plan will be developed and implemented during the construction phase; • Excavation near industries should be done during non-peak hours and the construction should be done in pieces near residential areas;	CC	Traffic flow, timing of activities, near misses and injuries records and reporting	Continuous / reported quarterly basis	CC/KE	Mitigation cost will be evaluated and borne by CC

Table 8.1: Environmental Management and Monitoring Plan

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
	project, which directly impact the traffic flow along the right of way of transmission lines and in the vicinity of grid station. This increase in traffic may congest the flow of traffic on eastern bypass, Dumlotee Road, National Highway (N5) and roads in Eastern Industrial Zone of PQA; and may cause some accidental injuries and deteriorate the air quality of ambient air.	• Construction activities will be scheduled to reduce the chances of traffic jams; • Adequate and appropriate road signs will be erected to warn road users along the ROW of transmission lines; • The movement of equipment (trucks) during the construction of the proposed project will be limited to 9:30 am - 4:30 pm per day; • Raw materials for construction work will be adequately covered within the trucks to prevent any escaping into the air and along the roadway; • Vehicles will be maintained regularly to reduce the exhaust emissions; and • Any complain launched by community member will be responded and appropriate action will be taken to avoid it in future.		/ At crossroads and along transmission line Right of Way			
Social Impacts	Community health & safety issues	• Emergency response plan should be prepared and implemented during entire phase of construction; • Procedures for interaction with local and regional emergency and health authorities should be made; • In order to minimize traffic congestion (if applicable), deliveries of materials and equipment should avoid peak traffic hours between 6:30-8:30 am and 3:30-4:30 pm;	CC	Review of complaint register Local Consultations / Near Construction site	Monthly / reported quarterly basis	CC/KE	Mitigation cost will be evaluated and borne by CC

Table 8.1: Environmental Management and Monitoring Plan

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
		• Erection of towers and poles for the overhead TLs should be barricaded and crane movement should be assessed prior to the operation near the residential areas and communities; • It should be mandated by KE to Contractor to backfill the trenches in case of UG TLs after laying of the pipeline and rehabilitate the excavated area to its original position. If it is a road, the backfilling will be followed by levelling and carpeting of road with bitumen; • Proper lighting at night near trenches will be ensured; and • Diversions, danger points and works at culverts, bridges and construction sites will have appropriate warning signs; this is particularly important at night to avoid accidents		Surface topography, Proper backfilling and carpeting / All excavated areas	Continuous / reported quarterly basis	CC/KE	Backfilling and carpeting cost will be evaluated and borne by CC
Operational and Maintenance Phase							
Wind, fire and earthquakes	Electricity arcing, poles and towers dislodgment	• Transmission support structures such as tower foundations have also been designed to withstand different combinations of loading conditions including extreme winds that generally exceed earthquake loads • System protection features designed to safeguard the public and line protection systems will consist of Transmission Line relays and circuit breakers that are designed to rapidly detect faults and cut-off power to avoid shocks and fire hazards.	KE/CC	Regular maintenance of the protection system including conductors and circuit breakers will be undertaken	Monthly / reported quarterly basis	KE	Mitigation cost will be evaluated and borne by KE
Human Exposure to Electromagnetic Fields (EMF)	Adverse health effects	• Undertake EMF monitoring as per KE predefined procedures.	KE	Electromagnetic Field (EMF) / Transmission line Corridor	Conducted and reported annually	KE	Rs.8,000 per site per year
Gaseous Emissions	Air pollution	• All vehicles, power generators and other equipment used during the maintenance work will be properly tuned and maintained in good working conditions in order to minimize emission of pollutants; and • Emissions from the machinery and vehicles will be monitored on regular basis to ensure compliance with SEQS.	KE	Smoke, CO, Noise, NOx, PM, SO_2 / All maintenance vehicles	During maintenance activities	KE	Rs.15,000 per vehicle
Solid Waste	The maintenance activities may generate some	• Ensure that all solid waste collected during operational or maintenance work is disposed of in an appropriate disposal site in the locality.	KE	Waste collection and disposal records	During maintenance activities	KE	Waste disposal cost will be

Table 8.1: Environmental Management and Monitoring Plan

Environmental Aspect	Impacts	Mitigation Measures	Mitigation Responsibility	Monitoring Parameters / Location	Monitoring Frequency	Monitoring Responsibility	Cost Estimates
	hazardous and non-hazardous waste such as wires and wild vegetation etc.			/ Maintenance areas			evaluated by KE based in the quantity and type
Sulfur Hexafluoride Gas (SF6)	GHG emissions, asphyxia in confined areas	• Ventilation of the areas concerned, in addition to permanent surveillance of the gas volumes, will help to eliminate the risk of SF6 accumulation outside the compartments • Ensure it is provided in sealed containers • SF6 handling and operational procedures shall be in accordance with KE SF6 Monitoring & Management procedure and in line with **IEC 60376**	KE	Check ventilation requirements in confined spaces where risk of SF6 leakage is there / Grid station site	Conducted and reported annually	KE	

Notes
KE = K-Electric; CC = Construction Contractor; SEQS = Sindh Environmental Quality Standards; PM = Particulate Matter.

Table 8.2: Environmental Training Plan

Staff	Responsibilities	Areas	Schedule
Project staff	Contractor/HSE Officer	• Findings of EIA • Mitigation Measures • EMP • Waste disposal procedures • Camp Operation • Social and Cultural values of the Project areas • Environmental sensitivity of the Project area • Flora and Fauna of the area • Emergency Response Plan • Community Issues	Prior to start of Project activities
Drivers	Contractor/HSE Officer	• Road safety • Road restrictions • Defensive driving	Before and during construction activities
Camp/Site Staff	Safety Officer	• Waste Disposal • Housekeeping	Before and during construction activities

8.5 Monitoring Forms

Environmental reviews will decide for necessary items to be monitored which are based on regular reports including measured data submitted by the project proponent. When necessary, the project proponent should refer to the following monitoring form for submitting reports.

Table 8.4 (A): Sample Forms for Ambient Air Quality Monitoring Record

PM_{10} (Respirable Particulate Matter)

Location	*S.No.*	*Date*	*Time (Hrs: Min)*	*Result ($\mu g/m^3$)*	*SEQS ($\mu g/m^3$)*	*Remarks*
	1				150	
	2				150	
	3				150	
	4				150	
	5				150	
	6				150	
	7				150	
	8				150	

Table 8.4(B): Sample Forms for Ambient Air Quality Monitoring Record

CO, SOx, NOx

Location	*S.No.*	*Parameter*	*Date*	*Time (Hrs:Min)*	*Result (µg/m3)*	*SEQS (µg/m3)*	*Remarks*
	1	CO			…….. (mg/m^3)	5 (mg/m^3)	
	2	SOx				120	
	3	NOx				40	

Table 8.5 : Sample Form for Noise Quality Monitoring Record

Location	*S.No.*	*Date*	*Time (Hrs:Min)*	*Analysis*	*Result dB(A)Scale*	*SEQS*	*Remarks*
	1					55 / 45*	
	2					55 / 45	
	3					55 / 45	
	4					55 / 45	
	5					55 / 45	
	6					55 / 45	
	7					55 / 45	
	8					55 / 45	
***Limits are for Commercial Area, Day Time / Night Time**							

(Domestic/non-hazardous solid wastes)

Location:_____ Date:_____Source:_____(domestic/ non-hazardous)

Table 8.6: Sample Form for Solid Waste Monitoring Board

Total Quantity (kg)	*Components*	*Weight (as discarded)*	*% by weight (as discarded)*	*Recyclables*	*Non-recyclables*	*Organic waste*
	Food/kitchen waste					
	Plastics					
	Metals					
	Paper					
	Textile/Rugs					
	Cardboard					
	Glass					
	Rubber					
	Others					
Total						

Generation Rate:

Total waste generated = _____ kg/capita/day

No. of persons in units

Summary:

- Total Waste Generated (as collected) =_____kg
- Recyclable waste quantity =_____kg
- Non-Recyclable waste quantity =_____kg
- Organic waste quantity =_____kg
- %age of Recyclables =_____%
- %age of Non-recyclables =_____%
- %age of Organic waste =_____%
- Total waste send for recycling =_____kg
- Total waste send for landfill =_____kg

Comments:

(Hazardous solid wastes)

Location:_____ Date:_____ Source:_____(Hazardous)

Table 8.7: Sample Form for Solid Waste Monitoring Board

Total Quantity (kg) Recyclables	*Hazardous waste Components*	*Weight (as discarded)*	*% by weight (as discarded)*	*Characteristics (corrosive, toxic, explosive, etc.)*	*Non-recyclables (requiring disposal)*
Total					

Total waste generated = _____ kg/capita/day

No. of persons in units

Summary:

- Total Waste Generated (as collected) = _____ kg
- Recyclable waste quantity = _____ kg
- Non-Recyclable waste quantity = _____ kg
- %age of Recyclables = _____ %
- %age of Non-recyclables = _____ %
- Total waste send for recycling = _____ kg
- Total waste send for disposal = _____ kg

Comments:

(Health & Safety)

Monitoring Items	Monitoring Results

Note: Needed during both the construction and operational phase

(Electromagnetic Fields)

Monitoring Items	Monitoring Results

Note: Needed during the operational phase

Chapter 09 Conclusion and Recommendations

9.1 Conclusion

This Environmental impact assessment study was carried out to identify the environmental and socioeconomic impacts of the project 220 kV Double Circuit Transmission Line from 450 MW Engro Power Plant to New Port Qasim Grid Station.

During study, environmental and socioeconomic baseline information was collected from variety of sources including visit of project area, previous environmental reports and studies conducted in the area, published literature and field surveys. All these information were used to compose the profile of the physical, biological and socioeconomic environment of the area which is likely to be affected by the proposed project activities. Information for the project description was provided by the project management and their contractor.

On the basis of baseline and project description, potential environmental impacts were identified on the project's physical, biological and socioeconomic environments. The potential impacts during the construction phase of the proposed project included the generation of dust and gaseous emissions, traffic congestion/ diversions, noise, construction waste, flora and fauna, health and safety and socioeconomic effects. Similarly, the key environmental and social issues during the operation phase included the Electromagnetic field, periodic/fault maintenance.

The EIA process finds that the impacts of the project activities at the design, construction and operation stages have been adequately addressed and mitigation measures duly proposed wherever needed. Adoption of mitigation measures will ensure reduction of impact on the micro and macroenvironment as well as socio-economic conditions to acceptable levels. The development of this project will be compatible with the requirements of the Sindh Environmental Protection Act 2014, Sindh Environmental Protection Agency (Review of IEE/EIA) Regulations 2014, and Sindh Environmental Quality Standards (SEQS); as well as other regulatory requirements of Government of Sindh and Government of Pakistan. The issue of environment, health & safety has been duly incorporated in the design, construction & operations phases of the project.

On the basis of the findings of the EIA Study, it is possible to conclude that:

- Construction and Operation of Transmission line will, on adoption of the mitigation measures, have no significant impact on the physical as well as socio-economic composition of the microenvironment and macroenvironment of the project area;
- The likely impact of construction and operation of the Transmission line will be appropriately mitigated through proven technologies, careful planning and landscaping;
- The project will meet the forecasted demand for energy due to extension of the project;
- Employment opportunities will be enhanced and improved;
- The proposed 220 kV Supply Line; after commissioning will become an integral part of the microenvironment and a friendly component of its macroenvironment.

Mitigation will be assured by a program of environmental monitoring conducted to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged. This will include observations on and off site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the EPA Sindh.

9.2 Recommendations

The study recommends and confirms that the proponent shall adopt all environmental management processes in full, as prescribed by the national and international laws and guidelines and given in the EIA document. Following essentials recommendations which are also the part of EMP as mitigation measures will be followed by KE/Contractor in letter and spirit:

- During the selection of ROW for underground transmission line, significant efforts should be made to avoid or minimize impacts on sensitive receptors or existing infrastructures;
- Prior notices shall be given to the industries and neighboring communities before the starting commissioning activities near these sensitive locations;
- Prior notices shall be given to the legal shop owners and residents before the starting commissioning activities near these settings;
- It should be mandated by KE to Contractor to backfill the trenches after laying of the underground pipeline portion and rehabilitate all the excavated areas to its original position. If it is a road, the backfilling will be followed by levelling and carpeting of road with bitumen;
- For cutting of trees, compensatory plantation shall be provided at a ratio of 1:3;
- A Comprehensive Waste management Plan for Construction phase should be developed;
- Wastes should be routinely collected from the designated area and disposed at licensed waste disposal facilities approved by SEPA;
- Protective measures against high noise intensity, soil erosion, traffic problem, land pollution and water contamination will be taken care of;
- Proper traffic management plan should be developed and implemented to avoid the accidents and traffic jams;
- Emergency response plan should be prepared and implemented during entire phase of construction;
- Preventive and protective measures including modification, substitution, or elimination of hazardous conditions, with particular attention to live power lines, working at height, working above water, EMFs, high noise levels, and exposure to chemicals will be made; and
- The Project will thus respond to all aspects of sustainability: Economic, social and environmental and will thus be a sustainably viable project.

The study therefore recommends that the EIA report should be approved with the provision that the suggested mitigation measures will be adopted and the Environmental Management Plan will be followed in letter and spirit.

ANNEXURES

Annexure – I

Sindh Environmental Protection Act 2014

EXTRAORDINARY **Registered No. M324**

The Sindh Government Gazette

Published by Authority

KARACHI THURSDAY MARCH 20, 2014

PART-IV

PROVINCIAL ASSEMBLY OF SINDH
NOTIFICATION
KARACHI, THE 20TH MARCH, 2014.

NO.PAS/Legis-B-06/2014- The Sindh Environmental Protection Bill, 2014 having been passed by the Provincial Assembly of Sindh on 24th February, 2014 and assented to by the Governor of Sindh on 19th March, 2014 is hereby published as an Act of the Legislature of Sindh.

THE SINDH ENVIRONMENTAL PROTECTION ACT, 2014.

SINDH ACT NO. VIII OF 2014.

AN
ACT

to provide for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution, and promotion of sustainable development.

Preamble.

WHEREAS it is expedient to provide for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution, promotion of sustainable development, and for matters connected therewith and incidental thereto;

PART-I

It is hereby enacted as follows:-

Short title and commencement.

1. (1) This Act may be called the Sindh Environmental Protection Act, 2014.

(2) It extends to the whole of the Province of Sindh.
(3) It shall come into force at once.

Definitions.

2. In this Act, unless there is anything repugnant in the subject or context-

(i) "adverse environmental effect" means impairment of, or damage to, the environment and includes—

(a) impairment of, or damage to, human health and safety or to biodiversity or property;

(b) pollution; and

(c) any adverse environmental effect as may be specified in the rules or regulations made under this Act;

(ii) "Agency" means the Sindh Environmental Protection Agency established under section 5 of this Act;

(iii) "agricultural waste" means waste from farm and agricultural activities including poultry, cattle farming, animal husbandry residues from the use of fertilizers, pesticides and other farm chemicals and agricultural runoff;

(iv) "air pollutant" means any substance that causes pollution of air and includes soot, smoke, dust particles, odor, light, electro-magnetic radiation, heat, fumes, combustion exhaust, exhaust gases, noxious gases, hazardous substances and radioactive substances;

(v) "biodiversity" or "biological diversity" means the variability among living organisms from all sources, including inter-alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems;

(vi) "biosafety" means the mechanism developing through policy and procedure to ensure human health and the environmentally safe application of biotechnology;

(vii) "Council" means the Sindh Environmental Protection Council established under section 3 of this Act;

(viii) "discharge" means spilling, leaking, pumping, depositing, seeping, releasing, flowing-out, pouring, emitting, emptying or dumping into the land, water or atmosphere;

(ix) "ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit;

(x) "effluent" means any material in solid, liquid or gaseous form or combination thereof being discharged from industrial activity or any other source and includes a slurry, suspension or vapour;

(xi) "emission standards" means the permissible standards established by the Agency for emission of air pollutants and noise and for discharge of effluent and waste;

(xii) "environment" means-
(a) air, water, land and natural resources;
(b) all layers of the atmosphere;
(c) all organic and inorganic matters and living organisms;
(d) ecosystems and ecological relationships;
(e) buildings, structures, roads, facilities and works;
(f) all social and economic conditions affecting community life; and
(g) the inter-relationship between any of the factors in sub-clause (a) to (f) made under this Act;

(xiii) "environmental aspect" means an organization's activities or services that can interact with the environment;

(xiv) "environment audit" means a systemic scrutiny of environmental performance of an organization, factory, company or manufacturing and production unit regarding to its operations;

(xv) "environmental impact assessment" means an environmental study comprising collection of data, prediction of qualitative and quantitative impacts, comparison of alternatives, evaluation of preventive, mitigation and compensatory measures, formulation of environmental management and training plans and monitoring arrangements, and framing of recommendations and such other components as may be prescribed;

(xvi) "Environmental Management Plan" means a site specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment and comply with the environmental legislation;

(xvii) "Environmental Protection Order" means an order passed under Section 21 made under this Act.

(xviii) "Environmental Protection Tribunal" means the Environmental Protection Tribunal constituted under section 25 of this Act ;

(xxix) "Environmental Review" means a quantitative and qualitative assessment of documents submitted by proponent, comments from public and Government agencies or organizations;

(xx) "factory" means any premises in which industrial activity is being undertaken;

(xxi) "genetically modified organism" means any organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology and which does not occur naturally through mating and or recombination and includes both living and non-living modified organisms;

(xxii) "Government" means the Government of Sindh;

(xxiii) "Government Agency" includes:-

(a) A department, attached department or any other office of Government; and

(b) A development authority, local authority, company body corporate established or control by Government;

(xxiv) "Court" means the Court of the Judicial Magistrate First Class;

(xxv) "hazardous substance" means-

(a) a substance or mixture of substances, other than a pesticide as defined in the Agricultural Pesticides Ordinance, 1971 (II of 1971), which, by reason of its chemical activity or toxic, explosive, flammable, corrosive; radioactive or other characteristics, causes, or is likely to cause, directly or in combination with other matters an adverse environmental effect; and

(b) any substance which may be prescribed as a hazardous substance;

(xxvi) "hazardous waste" means waste which is or which contains a hazardous substance or which may be prescribed as hazardous waste, hospital waste, nuclear waste, obsolete pesticides and persistent organic pollutants;

(xxvii)"hospital waste" means waste medical supplies and materials of all kinds, and waste blood, tissue, organs and other parts of the human and animal bodies, from hospitals, clinics, laboratories and veterinary facilities;

(xxviii) "industrial activity" means any operation or process for manufacturing, making, formulating, synthesising, altering, repairing, ornamenting, finishing, packing or otherwise treating any article or substance with a view to its use, sale, transport, delivery or disposal, or for mining, for oil and gas exploration and development, or for pumping water or sewage, or for generating, transforming or transmitting power or for any other industrial or commercial purposes;

(xxix) "industrial waste" means waste resulting from an industrial activity;

(xxx) "initial environmental examination" means a preliminary environmental review of the reasonably foreseeable qualitative and quantitative impacts on the environment of a proposed project to determine whether it is likely to cause an adverse environmental effect for requiring preparation of an environmental impact assessment;

(xxxi) "local authority" means any agency set up or designated by Government, by notification in the official Gazette, to be a local authority for the purposes of this Act;

(xxxii) "local council" means a local council constituted or established under a law relating to local government;

(xxxiii) "motor vehicle" means any mechanically propelled vehicle adapted for use upon land whether its power of propulsion is transmitted thereto from an external or internal source, and includes a chassis to which a body has not been attached, and a trailer, but does not include a vehicle running upon fixed rails;

(xxxiv) "municipal waste" includes sewage, refuse, garbage, waste from abattoirs, sludge and human excreta and the like;

(xxxv) "noise" means the intensity, duration and character of sounds from all sources, and includes vibration;

(xxvi) "non degradable plastic products" means a plastic product which are made from the non-biodegradable substances;

(xxxvii) "nuclear waste" means waste from any nuclear reactor or nuclear plant or other nuclear energy system, whether or not such waste is radioactive;

(xxxviii) "Oxo-biodegradable Plastic Products" means a plastic product made of a polymer by adding a pro-degrading additive containing a transition metal salt, except cobalt, which cause the plastic to degrade and bio-grade from oxidative and cell mediated phenomena either simultaneously or successfully;

(xxxix) "person" means any natural person or legal entity and includes an individual, firm, association, partnership, society, group, company, corporation, co-operative society, Government Agency, non-governmental organization, community-based organization, village organization, local council or local authority and, in the case of a vessel, the master or other person having for the time being the charge or control of the vessel;

(xl) "pollution" means the contamination of air, land or water by the discharge or emission of effluent or wastes or air pollutants or noise or other matter which either directly or indirectly or in combination with other discharges or substances alters unfavorably the chemical, physical, biological, radiational, thermal or radiological or aesthetic properties of the air, land or water or which may, or is likely to make the air, land or water unclean, noxious or impure or injurious, disagreeable or detrimental to the health, safety, welfare or property of persons or harmful to biodiversity;

(xli) "prescribed" means prescribed by rules made under this Act;

(xlii) "project" means any activity, plan, scheme, proposal or undertaking involving any change in the environment and includes-

(a) construction or use of buildings or other works;

(b) construction or use of roads or other transport systems;

(c) construction or operation of factories or other installations;

(d) mineral prospecting, mining, quarrying, stone-crushing, drilling and the like;

(e) any change of land use or water use; and

(f) alteration, expansion, repair, decommissioning or abandonment of existing buildings or other works, roads or other transport systems, factories or other installations;

(xliii) "proponent" means the person who proposes or intends to undertake a project;

(xliv) "regulations" means regulations made under this Act;

(xlv) "rules" means rules made under this Act;

(xlvi) "sewage" means liquid or semi-solid wastes and sludge from sanitary conveniences, kitchens, laundries, washing and similar activities and from any sewerage system or sewage disposal works;

(xlvii) "Schedule Plastic Products" means all types of flexible plastic packaging and disposable plastic products made of Polythene, Polypropylene, Polystyrene and Poly-ethylene Terephthalate (PET), used for food and non-food items, like shopping bags, garbage bags, snacks packs, water and milk packaging, shrink wraps, bubble pellet wraps, films, liners, woven or non-woven bags, mulch films;

(xlviii) "Sindh Environmental Quality Standards" means standards established by the Agency under clause (e) of sub-section(1) of section 6 and approved by the Council under clause (c) of sub-section(1) of section 4 made under this Act;

(xlix) "standards" means qualitative and quantitative standards for discharge of effluent and wastes and for emission of air pollutants and noise either for general applicability or for a particular area, or from a particular production process, or for a particular product, and includes the Sindh Environmental Quality Standards, emission standards and other standards established under this Act and the rules and regulations;

(l) "strategic environmental assessment" mean an analysis of a proposed policy, legislation, plan or programme to determine whether the principles of sustainable development have been integrated therein and to identify its likely environmental effects and such components as require an initial environmental examination or environmental impact assessment;

(li) "sustainable development" means development that meets the needs of the present generation without compromising the ability of future generations to meet their needs;

(lii) "trans-boundary environmental impacts" means environmental impact arising from beyond the boundaries or limits of Sindh province and causing any adverse environmental impact or pollution in the air, land, water and coaster water of Sindh province;

(liii) "waste" means any substance or object which has been, is being or is intended to be, discarded or disposed-of, and includes liquid waste, solid waste, waste gases, suspended waste, industrial waste, agricultural waste, nuclear waste, municipal waste, hospital waste, used polyethylene bags and residues from the incineration of all types of waste.

(liv) "waters (coastal waters, internal waters, territorial waters and historical waters)" means such limits of the waters adjacent to the land territory as may be specified in the Territorial Waters and Maritime Zones Act, 1976 (LXXXII of 1976).

PART-II
THE SINDH ENVIRONMENTAL PROTECTION COUNCIL.

Establishment of the Sindh Environmental Protection Council.

3. (1) The Government of Sindh shall, by notification in the official Gazette, establish a Council to be known as the Sindh Environmental Protection Council consisting of-

(i)	Chief Minister or such other person as the Chief Minister may nominate in this behalf.	**Chairperson**
(ii)	Minister-in-charge of the Environment Protection Department.	**Vice Chairperson**
(iii)	Additional Chief Secretary, Planning and Development Department, Government of Sindh.	**Ex-officio Member**
(iv)	Secretaries of the Environment, Finance, Public Health Engineering, Irrigation, Health, Agriculture, Local Government, Industries, Live Stock and Fisheries, Forest and Wildlife, Energy, Education, Departments of Government of Sindh and the divisional commissioners of Sindh.	**Ex-officio Members**

(v)	Such other persons not exceeding twenty- five as Government may appoint from representatives of the Chambers of Commerce and Industry and industrial associations, representatives of the Chambers of Agriculture, the medical and legal professions, trade unions, non-governmental organizations concerned with the environment and sustainable development, and scientists, technical experts and educationists.	**Non-official Members**
(vi)	Director General, Sindh Environment Protection Agency	Member / Secretary
(vii)	**Two Members of the Provincial Assembly of Sindh amongst the eleven Members of the Standing Committee on Environment nominated by the Speaker**	**Members**

2) The Members of the Council, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.

(3) A non-official member, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-appointment but shall not hold office for more than two terms.

(4)The Council shall frame its own Rules of Procedure.

(5) The Council shall hold meetings, as and when necessary, but not less than two meetings, shall be held in a year.

(6) The Council may constitute committees of its members and entrust them with such functions as it may deem fit, and the recommendations of the committees shall be submitted to the Council for approval.

(7) The Council, or any of its committees, may invite any technical expert or representative of any Government Agency or non-governmental organization or other person possessing specialized knowledge of any subject for assistance in performance of its functions.

Functions and Powers of the Council.

4. (1) The Council shall-

(a) co-ordinate and supervise the enforcement of the provisions of this Act and other laws relating to the environment in the Province;

(b) approve comprehensive provincial environmental and sustainable development policies and ensure their implementation within the framework of a conservation strategy and sustainable development plan as may be approved by Government from time to time;

(c) approve the Sindh Environmental Quality Standards;

(d) provide guidelines for the protection and conservation of species, habitats, and biodiversity in general and for the conservation of renewable and non-renewable resources;

(e) coordinate integration of the principles and concerns of sustainable development into socio-economic and development policies, plans and programmes at the provincial, district and local levels;

(f) consider the annual Sindh Environment report and give appropriate directions thereon and cause it to be laid before the Provincial Assembly;

(g) deal with inter-provincial and federal-provincial issues, and liaise and coordinate with other Provinces through appropriate inter-provincial forums regarding formulation and implementation of standards and policies relating to environmental matters with an inter-provincial impact;

(h) provide guidelines for biosafety and for the use of genetically modified organisms; and

(i) assist the Federal Government or Federal Agency in implementation and or administration of various provision of United Nation Convention on Laws on Seas, 1980 (UNCLOS) in coastal waters of the province.

(2) The Council may, either itself or on the request of any person or organization, direct the Agency or any Government Agency to prepare, submit, promote or implement projects for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, and the sustainable development of resources or to undertake research in any specified aspect of environment.

PART-III
THE SINDH ENVIRONMENTAL PROTECTION AGENCY

Establishment of the Sindh Environmental Protection Agency.

5. (1) Government shall, by notification in the Official Gazette, establish the Sindh Environmental Protection Agency, to exercise the powers and perform the functions assigned to it under the provisions of this Act and the rules and regulations made thereunder.

(2) The Agency shall be headed by a Director General who shall be appointed by Government on such terms and conditions as it may determine.

(3) The Agency shall have such administrative, technical and legal staff as Government may specify, to be appointed in accordance with such procedure as may be prescribed.

(4) The powers and functions of the Agency shall be exercised and performed by the Director General.

(5) The Director General may, by general or special order, delegate any of these powers and functions to staff appointed under sub-section (3).

(6) For assisting the Agency in the discharge of its functions Government shall establish Advisory Committees for various sectors and appoint as members thereof eminent representatives of the relevant sector, educational institutions, research institutes and non-governmental organizations.

Functions of the Agency.

6. (1) The Agency shall –

(a) administer and implement the provisions of this Act and the rules and regulations;

(b) prepare, in co-ordination with the appropriate Government Agency or local council and, in consultation with the concerned Advisory Committees where established, environmental policies for the approval of the Council;

(c) take all necessary measures for the implementation of the environmental policies approved by the Council;

(d) prepare and publish an annual Sindh Environment Report on the state of the environment in the province;

(e) prepare or revise and establish the Sindh Environmental Quality Standards with approval of the Council:

Provided that before seeking approval of the Council, the Agency shall publish the proposed Sindh Environmental Quality Standards for public opinion in accordance with the prescribed procedure;

(f) ensure enforcement of the Sindh Environmental Quality Standards;

(g)where the quality of ambient air, water, land or noise so requires, the Agency may, by notification in the Official Gazette establish different standards for discharge or emission from different sources and for different areas and conditions as may be necessary:

Provided that where these standards are less stringent than the Sindh Environmental Quality Standards; prior approval of the Council shall be obtained;

(h) establish systems and procedures for surveys, surveillance, monitoring, measurement, examination, investigation, research, inspection and audit to prevent and control pollution, and to estimate the costs of cleaning up pollution and rehabilitating the environment in various sectors;

(i) take measures to promote research and the development of science and technology which may contribute to the prevention of pollution, protection of the environment, and sustainable development;

(j) issue licences, approval for the consignment, handling, transport, treatment, disposal of, storage, handling or otherwise dealing with hazardous substances;

(k) certify laboratories as approved laboratories for conducting tests and analysis and one or more research institutes as environmental research institutes for conducting research and investigation for the purposes of this Act;

(l) identify the needs for and initiate legislation in various sectors of the environment;

(m) provide assistance to relevant Federal and Provincial Government Agencies in the management of environment accidents and natural and environmental disasters, including conduct of inquiry thereto;

(n) render advice and assistance in environmental matters including such information and data available with it as may be required for carrying out the purposes of this Act:

Provided that the disclosure of such information shall be subject to the restrictions specified in Part XI (Access to Information);

(o) assist Government Agencies, local councils, local authorities and other persons to implement schemes for the proper disposal of wastes so as to ensure compliance with the Sindh Environmental Quality Standards;

(p) provide information and guidance to the public on environmental matters;

(q) recommend environmental courses, topics, literature and books for incorporation in the curricula and syllabi of educational institutions;

(r) promote public education and awareness of environmental issues through mass media and other means including seminars and workshops;

(s) establish and maintain mechanisms, including its own website, to disseminate information, subject to the provisions of this Act, regarding policies, plans and decisions of the Government, the Council and the Agency, relating to the environment;

(t) specify safeguards for the prevention of accidents and disasters which may cause pollution, collaborate with the concerned persons in the preparation of contingency plans for control of such accidents and disasters, and co-ordinate implementation of such plans;

(u) review and approve mitigation plans and give guidance and directions, where necessary, relating to clean up operations ordered under this Act;

(v) encourage the formation and working of non-governmental organizations, community organizations and village organizations to prevent and control pollution and promote sustainable development;

(w) take or cause to be taken all necessary measures for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution and promotion of sustainable development; and

(x) perform any function that the Council may assign to it.

(2) The Agency may -

(a) undertake inquiries or investigation into environmental issues, either of its own accord or upon complaint from any person or organization;

(b) request any person to furnish any information or data relevant to its functions;

(c) initiate, with the approval of Government, requests for foreign assistance in support of the purposes of this Act and enter into arrangements with foreign agencies or organizations for the exchange of material or information and participate in international seminars or meetings;

(d) recommend to Government and the Council the adoption of financial and fiscal programmes, schemes or measures for achieving environmental objectives and goals and the purposes of this Act, including -

(i) taxes, duties, cesses and other levies; and

(ii) incentives, prizes, awards, rewards, subsidies, tax exemptions, rebates and depreciation allowances;

(e) establish and maintain laboratories to help in the performance of its functions under this Act and to conduct research in various aspects of the environment and provide or arrange necessary assistance for the establishment of similar laboratories in the private sector;

(f) arrange, in accordance with such procedure as may be prescribed, financial assistance for projects designed to facilitate in discharge of its functions; and

(g) acquire assistance of concerned authorities of district administration and other relevant agencies, departments and police assistance for enforcement of this Act.

Powers of the Agency.

7. Subject to the provisions of this Act, the Agency may-

(a) lease, purchase, acquire, own, hold, improve, use or otherwise deal in and with any property both moveable and immovable;

(b) sell, convey, mortgage, pledge, exchange or otherwise dispose of its property and assets;

(c) fix and realize fees, rates and charges for rendering any service or providing any facility, information or data under this Act or its rules and regulations;

(d) enter into contracts, execute instruments, incur liabilities and do all acts or things necessary for proper management and conduct of its business;

(e) appoint, with the approval of Government and in accordance with such procedures as may be prescribed, such advisers, experts and consultants as it considers necessary for the efficient performance of its functions on such terms and conditions as it may deem fit;

(f) summon and enforce the attendance of any person and require him to supply any information or document needed for the conduct of any enquiry or investigation into any environmental issue;

(g) Director General may authorize any officer or official to enter and inspect or under a search warrant issued by Environmental Protection Tribunal or a Court, search at any time, any land, building, premises, vehicle or vessel or other place where or in which there are reasonable grounds to believe that an offence under this Act has been, or is being, or likely to be committed;

(h) take samples of any materials, products, articles or substances or of the effluent, wastes or air pollutants being discharged or emitted or of air, water or land in the vicinity of the discharge or emission;

(i) arrange for the testing and analysis of samples at a certified laboratory;

(j) confiscate any article used in the commission of the offence where the offender is not known or cannot be found within a reasonable time:

Provided that the powers under clauses (f), (g), (h) (i), and (j) shall be exercised in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898) or the rules and regulations and under the direction of the Environmental Protection Tribunal or a Court; and

(k) establish the Sindh Environmental Co-ordination Committee comprising the Director-General as its Chairman and such other persons as Government shall appoint as its members to exercise such powers and perform such functions as shall be delegated or assigned to it by Government for carrying out the purposes of this Act and for ensuring coordination among Government Agencies in implementation of environmental policies.

PART-IV
SINDH SUSTAINABLE DEVELOPMENT FUND

Establishment of the Sindh Sustainable Development Fund.

8. (1) There shall be established a Sindh Sustainable Development Fund.

(2) The Sindh Sustainable Development Fund shall be derived from the following sources, namely—

(a) allocations and grants made or loans advanced by the Government of Sindh or by the Federal Government;

(b) aid and assistance, grants, advances, donations and other non-obligatory funds received from foreign governments, national or international agencies, and non-governmental organizations; and

(c) voluntary contributions from private, corporate, multinational organizations and other persons.

(d) Any fees generated under the provision of this act including the fines imposed against contraventions including penalties.

(3)The Sindh Sustainable Development Fund shall be utilized in accordance with such procedures as may be prescribed for -

(a) providing financial assistance to projects designed for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, the sustainable development of resources and for research in any specified aspect of the environment; and

(b) any other purposes which, in the opinion of the Board, will help achieve environment objectives and the purposes of this Act.

Management of the Sindh Sustainable Development Fund.

9. (1)The Sindh Sustainable Development Fund shall be managed by a Board known as the Provincial Sustainable Development Fund Board consisting of—

(i)	Additional Chief Secretary, Planning and Development Department, Government of Sindh,	**Chairperson**
(ii)	Such officers of Government, not exceeding five (05), as Government may appoint including Secretaries of the Environment, Finance, Industries and Local Government Departments, Government of Sindh.	**Ex-officio Members**
(iii)	Such non-official persons, not exceeding five(05), as Government may appoint, including representatives of the Chambers of Commerce and Industry, non-governmental organizations and major donors.	**Non-official Members**
(iv)	Director General, Sindh Environmental Protection Agency.	**Secretary/ Member**

(2) The members of the Board, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.

(3) A non-official member of the Board, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-nomination, but shall not hold office for more than two terms.

(4) The Board shall frame its own rules of procedure with the approval of Government.

(5) In accordance with such procedures and such criteria as may be prescribed, the Board shall have the power to —

(a) sanction financial assistance for eligible projects;

(b) invest moneys held in the Sindh Sustainable Development Fund in such profit-bearing Government bonds, saving schemes and securities as it may deem suitable; and

(c) take such measures and exercise such powers as may be necessary for utilization of the Sindh Sustainable Development Fund for the purposes specified in sub-section (3) of section 8.

(6) The Board shall constitute committees of its members to undertake regular monitoring of projects financed from the Sindh Sustainable Development Fund and to submit progress reports to the Board which shall publish an Annual Report incorporating its annual audited accounts and performance evaluation based on the progress reports.

Accounts.

10. (1) The Agency shall maintain proper accounts of the Sindh Sustainable Development Fund and other relevant records and prepare annual statement of accounts in such form as may be prescribed.

(2) The accounts of the Sindh Sustainable Development Fund shall be audited annually by the Auditor General of Pakistan.

PART-V
PROHIBITIONS AND ENFORCEMENT

Prohibition of certain discharges or emissions and compliance with standards.

11. (1) Subject to the provisions of this Act and the rules and regulations, no person shall discharge or emit or allow the discharge or emission of any effluent, waste, pollutant, noise or any other matter that may cause or likely to cause pollution or adverse environmental effects, as defined in section 2 of this Act, in an amount, concentration or level which is in excess to that specified in Sindh Environmental Quality Standards; or, where applicable, the standards established under Section 6(1)(g)(i); or direction issued under Section 17, 19, 20 and 21 of this Act; or any other direction issued, in general or particular, by the Agency.

(2) All persons, in industrial or commercial or other operations, shall ensure compliance with the Environmental Quality Standards for ambient air, drinking water, noise or any other Standards established under section 6(1)(g)(i); shall maintain monitoring records for such compliances; shall make available these records to the authorized person for inspection; and shall report or communicate the record to the Agency as required under any directions issued, notified or required under any rules and regulations.

(3) Monitoring and analysis under sub-section (1) and (2), shall be acceptable only when carried out by the Environmental Laboratory certified by the Agency as prescribed in the rules.

Prohibition of import of hazardous waste.

12. No person shall import hazardous waste into Sindh province or its coastal, internal, territorial or historical waters, except acquiring prior approval of the Agency.

Handling of hazardous substances.

13. Subject to the provisions of this Act, no person shall import, generate, collect, consign, transport, treat, dispose of, store, handle or otherwise use or deal with any hazardous substance except-

(a) under a licence issued by the Agency; or

(b) in accordance with the provisions of any other law, rule, regulation or notification for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Government is a party.

Prohibition of action adversely affecting Environment.

14. (1) Subject to the provisions of this Act and the rules and regulations, no person shall cause any act, deed or any activity, including-

(a) recycling or reuse of hospital waste and infectious waste;

(b) disposal of solid and hazardous wastes at unauthorized places as prescribed;

(c) dumping of wastes or hazardous substances into coastal waters and inland water bodies;

(d) release of emissions or discharges from industrial or commercial operations as prescribed;

(e) recycling or reuse or recovery of hazardous wastes or industrial by-products in an unauthorized or non-prescribed manner or procedure; and

(f) any activity which may cause adverse environmental affect due to trans boundary projects of Province of Sindh.

which lead to pollution or impairment of or damage to biodiversity, ecosystem, aesthetics or any damage to environment and natural resources as defined in section 2 (xxxvi) of this Act.

(2) No person shall generate, handle, transport, dispose of or handle the hospital waste and infections waste except in accordance with the Hospital Waste Management Rules and in such manner as may be prescribed.

(3) No person shall import, manufacture, stockpile, trade, supply, distribute or sell any scheduled plastic product which is non-degradable. The scheduled plastic products must be oxo-biodegradable and the pro-degradant used must be approved by the Agency or any other department or agency and in such manner as prescribed.

Regulation of motor vehicles.

15. (1) Subject to the provisions of this Act, no person shall operate or manufacture a motor vehicle or class of vehicles from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the Sindh Environmental Quality Standards or, where applicable, the standards established under sub-clause (i) of clause (g) of sub-section (1) of section 6.

(2) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any motor vehicle or class of vehicles shall install such pollution control devices or other equipment or use such fuels or undergo such maintenance or testing as prescribed.

(3) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any manufacturer of motor vehicle or class of vehicles shall use such manufacturing standard or design or pollution control devices or other equipment or undergo such testing as may be prescribed.

(4) Where a direction has been issued by the Agency under sub-section (2) and (3) in respect of any motor vehicles or class of motor vehicles, no person shall operate or manufacture any such vehicle till such direction has been complied with.

Certified Environmental Laboratory.

16. (1) The monitoring, testing and analysis carried out in compliance or for the enforcement of any provisions of this Act

(2) The laboratory or organization having any facility for environmental monitoring, testing and analysis and intend to perform under sub-section (1) shall register with the Agency in accordance with the Environmental Laboratory Certification Rules as prescribed.

PART-VI
ENVIRONMENTAL EXAMINATIONS AND ASSESSMENTS

Initial environmental examination and environmental impact assessment.

17. (1) No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof.

(2) The Agency shall –

(a) review the initial environmental examination and accord its approval, subject to such terms and conditions as it may prescribe, or require submission of an environmental impact assessment by the proponent; or

(b) review the environmental impact assessment and accord its approval subject to such terms and conditions as it may deem fit to impose or require that the environmental impact assessment be re-submitted after such modifications as may be stipulated or decline approval of the environmental impact assessment as being contrary to environmental objectives.

(3) Every review of an environment impact assessment shall be carried out with public participation and, subject to the provisions of this Act, after full disclosure of the particulars of the project.

(4) The Agency shall communicate its approval or otherwise within a period of two months from the date that the initial environmental examination is filed, and within a period of four months from the date that the environmental impact assessment is filed complete in all respects in accordance with the regulations, failing which the initial environmental examination or, as the case may be, the environmental impact assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations:

(5) The provisions of sub-sections (1), (2), (3) and (4) shall apply to such categories of projects and in such manner as prescribed:

(6) The Agency shall maintain separate registers for initial environmental examination and environmental impact assessment projects, which shall contain brief particulars of each project and a summary of decisions taken thereon, and which shall be open for inspection to the public during office hours.

Strategic environmental assessment.

18. (1) All provincial government agencies, departments, authorities, local councils and local authorities responsible for formulating policies, legislation, plans and programmes to be implemented in Sindh province which may cause any environmental impact in the jurisdiction of the province shall, before submitting the same to the competent authority for approval, forward to the Sindh Environmental Protection Agency a strategic environment assessment containing —

(a) description of the objectives and features of the proposed policy, legislation, plan or programme that are in consonance with the principles of sustainable development;

(b) assessment of the adverse environmental effects, if any, likely to be caused during implementation of the policy, legislation, plan or programme alongwith proposed preventive, mitigation and compensatory measures;

(c) analysis of possible alternatives; and

(d) identification of those components of the policy, legislation, plan or programme, if any, in respect of which specific environmental impact assessment need to be carried out in due course.

(2) The Agency shall, in consultation with the concerned Government Agencies and Advisory Committees where established, review the strategic environment assessment, within sixty (60) days of its filing, and prepare a report containing its comments and recommendations in respect thereof which shall be forwarded to the initiating Government Agency, authority, local council or local authority and duly considered by it and the competent authority before approval or otherwise of the proposed policy, legislation, plan or programme.

(3) The provisions of sub-sections (1), and (2) shall apply to such categories of policies, plans and programmes and in such manner as may be prescribed.

Environmental monitoring.

19. (1) The Agency shall carry out or arrange environmental monitoring of all projects in respect of which it has approved an initial environmental examination or environmental impact assessment to determine whether the actual environmental impact exceeds the level predicted in the assessment and whether the conditions of the approval are being complied with.

(2) For purposes of sub-section (1), the Agency may require the person in charge of a project to furnish such information as it may specify pertaining to the environmental impact of the project, including quantitative and qualitative analysis of -

(a) discharge of effluents, wastes, emissions of air pollutants, noise and any other matter or action that may be found offensive under section 14 from the project on daily, weekly, monthly or annual basis;

(b) ambient quality of the air, water, noise and soil before, during and after construction and during operation of the project.

(3) On review of the data collected by it and information provided, the Agency may issue such directions to the person in charge as it may consider necessary to ensure compliance with the conditions of the approval.

Environmental Audit and Review.

20. (1) The Agency shall from time to time require the person in charge of a project to furnish, within such period as may be specified, an environmental audit or environmental review report or environmental management plan containing a comprehensive appraisal of the environmental aspects of the project.

(2) The report of a project prepared under sub-section (1) shall include -

(a) analysis of the predicted qualitative and quantitative impact of the project as compared to the actual impact;

(b) evaluation of the efficacy of the preventive, mitigation and compensatory measures taken with respect to the project; and

(c) recommendations for further minimizing or mitigating the adverse environmental impact of the project.

(3) Based on its review of the environmental audit report, the Agency may, after giving the person in charge of the project an opportunity of being heard, direct that specified mitigation and compensatory measures be adopted within a specified time period and may also, where necessary, modify the approval granted by it under section 17.

PART-VII
ENVIRONMENTAL PROTECTION ORDER

Environmental Protection Order.

21. (1) Where the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of any provision of this Act, the rules or regulations or of the conditions of a licence, or is likely to cause, or is causing or has caused an adverse environmental effect, the Agency may, after giving the person responsible for such

discharge, emission, disposal, handling, act or omission an opportunity of being heard, by order direct such person to take such measures as the Agency may consider necessary within such period as may be specified in the order.

(2) In particular and without prejudice to the generality of the foregoing power, such measures may include —

(a) immediate stoppage, preventing, lessening or controlling the discharge, emission, disposal, handling, act or omission, or to minimize or remedy the adverse environmental effect;

(b) installation, replacement or alteration of any equipment or thing to eliminate, control or abate on a permanent or temporary basis, such discharge, emission, disposal, handling, act or omission;

(c) action to remove or otherwise dispose of the effluent, waste, air pollutant, noise, or hazardous substances;

(d) action to restore the environment to the condition existing prior to such discharge, disposal, handling, act or omission, or as close to such condition as may be reasonable in the circumstances, to the satisfaction of the Agency; and

(e) impose a penalty as prescribed.

(3) Notwithstanding the provisions of sub-section (1), in an emergency situation where, for reasons to be recorded, the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of the provisions of this Act and that circumstances of the case warrant immediate action in the public interest, it may pass an ad-interim order of the nature described in sub-sections (1) and (2) by providing reasonable opportunity of hearing.

PART-VIII
OFFENCES AND PENALTIES

Penalties.

22. (1) Whoever contravenes or fails to comply with the provisions of sections 11, 17, 18 and 21 or any order issued there under shall be punishable with a fine which may extend to five million rupees, to the damage caused to environment and in the case of a continuing contravention or failure, with an additional fine which may extend to one hundred thousand rupees for every day during which such contravention or failure continues:

Provided that if the contravention of the provisions of section 11 also constitutes a contravention of the provisions of section 15, such contravention shall be punishable under sub-section (2).

(2) Whoever contravenes or fails to comply with the provisions of sections 13, 14, 15 and 16 or any rule or regulation or conditions of any license, any order or direction, issued by the Agency, shall be punished with a fine, and in case of continuing contravention or failure with an additional fine which may extend to ten thousand rupees for every day during which such contravention continues.

(3) Where an accused has been convicted of an offence under sub-sections (1) and (2), the Environmental Protection Tribunal and Court shall, as the case may be, in passing sentence, take into account the extent and duration of the contravention or failure constituting the offence and the attendant circumstances.

(4) Where an accused has been convicted of an offence under sub-sections (1) or (2), the Environmental Protection Tribunal or Court, as the case may be, shall endorse a copy of the order of conviction to the concerned trade or industrial association, if any, or the concerned Provincial Chamber of Commerce and Industry or the Federation of Pakistan Chambers of Commerce and Industry.

(5) Where a person convicted under sub-sections (1) and (2) had been previously convicted for any contravention of this Act and its rules or regulations, the Environmental Protection Tribunal, as the case may be, may, in addition to the punishment awarded thereunder-

(a) sentence him to imprisonment for a term that may extend up to three years;

(b) order the closure of the factory;

(c) order confiscation of the facility, machinery and equipment, vehicle or substance, record, document or other object used or involved in contravention of the provisions of this Act;

(d) order such person to restore the environment at his own cost, to conditions existing prior to the contravention or as close to such conditions as may be reasonable in the circumstances to the satisfaction of the Agency; and

(e) order that compensation be paid to any person or persons for any loss, or damage to their health or property suffered by such contravention.

(6) The Director General or an officer generally or specially authorised by him in this behalf may, on the application of the accused, compound an offence under this Act with the permission of the Environmental Protection Tribunal or Court in accordance with such procedure as prescribed.

(7) Where the Director General is of the opinion that a person had contravened any provision of this Act, he may, subject to the rules, by notice in writing to that person require him to pay to the Agency a penalty in the amount set out in the notice for each day the contravention continues.

Offences by body corporate.

23. Where any contravention of this Act has been committed by a body corporate, and it is proved that such offence has been committed with the consent or connivance of, or is attributed to any negligence on the part of, any director, partner, manager, secretary or other officer of the body corporate, such director, partner, manager, secretary or other officer of the body corporate, shall be deemed guilty of such contravention along with the body corporate and shall be punished accordingly:

Provided that in the case of a company as defined under the Companies Ordinance, 1984 (XLVII of 1984), only the Chief Executive as defined in the said Ordinance shall be liable under this section.

Explanation.— For the purposes of this Section, "body corporate" includes a firm, association of persons and a society registered under the Societies Registration Act, 1860 (XXI of 1860), or under the Co-operative Societies Act, 1925 (VII of 1925).

Offences by Government Agencies, local authorities or local councils.

24. Where any contravention of this Act has been committed by any Government Agency, local authority or local council, and it is proved that such contravention has been committed with the consent or connivance of, or is attributable to any negligence on the part of, the Head or any other officer of Government Agency, local authority or local council, such Head or other officer shall also be deemed guilty of such contravention along with the Government Agency, local authority or local council and shall be liable to be proceeded against and punished accordingly.

PART-IX
ENVIRONMENTAL PROTECTION TRIBUNALS AND COURTS

Environmental Protection Tribunals.

25. (1) Government may, by Notification in the Official Gazette, establish as many Environmental Protection Tribunals as it considers necessary and, where it establishes more than one Environmental Protection Tribunal, it shall specify territorial limits within which, or the class of cases in respect of which, each one of them shall exercise jurisdiction under this Act.

(2) An Environmental Protection Tribunal shall consist of a Chairperson who is, or has been, or is qualified for appointment as a Judge of the High Court to be appointed after consultation with the Chief Justice of the High Court and two members to be appointed by Government, of which at least one shall be a technical member nominated from amongst the officers of the Agency with suitable professional qualifications and experience in the environmental field.

(3) For every sitting of the Environmental Protection Tribunal, the presence of the Chairperson and not less than one Member shall be necessary.

(4) A decision of an Environmental Protection Tribunal shall be expressed in terms of the opinion of the majority of its members, including the Chairperson, or if the case has been decided by the Chairperson and only one of the members and there is a difference of opinion between them, the decision of the Environmental Protection Tribunal shall be expressed in terms of the opinion of the Chairperson.

(5) An Environmental Protection Tribunal shall not, merely by reason of a change in its composition, or the absence of any member from any sitting, be bound to recall and rehear any witness who has given evidence, and may act on the evidence already recorded by, or produced, before it.

(6) An Environmental Protection Tribunal may hold its sittings at such places within its territorial jurisdiction as the Chairperson may decide.

(7) No act or proceeding of an Environmental Protection Tribunal shall be invalid by reason only of the existence of a vacancy in, or defect in the constitution, of, the Environmental Protection Tribunal.

(8) The terms and conditions of service of the Chairperson and members of the Environmental Protection Tribunal shall be such as may be prescribed.

Jurisdiction and powers of Environmental Protection Tribunals.

26. (1) An Environmental Protection Tribunal shall exercise such powers and perform such functions as are, or may be, conferred upon or assigned to it by or under this Act or the rules and regulations.

(2) All contraventions punishable under sub-section (1) of section 22 shall exclusively be triable by an Environmental Protection Tribunal.

(3) An Environmental Protection Tribunal shall not take cognizance of any offence triable under sub-section (2) except on a complaint in writing by—

(a) the Agency or any Government Agency or Local Council; and

(b) any aggrieved person, who has given notice of not less than thirty days to the Agency, of the alleged contravention and of his intention to make a complaint to the Environment Protection Tribunal.

(4) In exercise of its criminal jurisdiction, the Environmental Protection Tribunal shall have the same powers as are vested under the Code of Criminal Procedure, 1898 (Act V of 1898).

(5) In exercise of the appellate jurisdiction under section 27 the Environmental Protection Tribunal shall have the same powers and shall follow the same procedure as an appellate court in the Code of Civil Procedure, 1908 (Act V of 1908).

(6) In all matters with respect to which no procedure has been provided for in this Act, the Environmental Protection Tribunal shall follow the procedure laid down in the Code of Civil Procedure, 1908 (Act V of 1908).

(7) An Environmental Protection Tribunal may, on application filed by any officer duly authorised in this behalf by the Director General, issue bailable warrant for the arrest of any person against whom reasonable suspicion exists, of his having been involved in contravention punishable under sub-section (1) of section 22:

Provided that such warrant shall be applied for, issued and executed in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898):

Provided further that if the person arrested executes a bond with sufficient sureties in accordance with the endorsement on the warrant he shall be released from custody, failing which he shall be taken or sent without delay to the officer in-charge of the nearest jurisdiction police station.

(8) All proceedings before the Environmental Protection Tribunal shall be deemed to be judicial proceedings within the meaning of sections 193 and 228 of the Pakistan Penal Code (Act XLV of 1860), and the Environmental Protection Tribunal shall be deemed to be a court for the purpose of sections 480 and 482 of the Code of Criminal Procedure, 1898 (Act V of 1898).

(9) No court other than an Environmental Protection Tribunal shall have or exercise any jurisdiction with respect to any matter to which the jurisdiction of an Environmental Protection Tribunal extends under this Act and the rules and regulations.

(10) Where the Environmental Protection Tribunal is satisfied that a complaint made to it under sub-section (3) is false and vexatious to the knowledge of the complainant, it may, by an order, direct the complainant to pay to the person complained against such compensatory costs which may extend to one hundred thousand rupees.

Appeals to the Environmental Protection Tribunal.

27. (1) Any person aggrieved by any order or direction of the Agency under any provision of this Act or the rules or regulations may prefer an appeal with the Environmental Protection Tribunal within thirty days of the date of communication of the impugned order or direction to such person.

(2) An appeal to the Environmental Protection Tribunal shall be in such form, contain such particulars and be accompanied by such fees as prescribed.

Appeals from orders of the Environmental Protection Tribunal.

28. (1) Any person aggrieved by any final order or by any sentence of the Environmental Protection Tribunal passed under this Act may, within thirty days of communication of such order or sentence, prefer an appeal to the High Court.

(2) An appeal under sub-section (1) shall lie before the High Court of Sindh.

Jurisdiction of Judicial Magistrate.

29. (1) Notwithstanding anything contained in the Code of Criminal Procedure, 1898 (Act V of 1898), or any other law for the time being in force, but subject to the provisions of this Act, all contraventions punishable under sub-section (2) of section 22 shall exclusively be triable by the Court of Judicial Magistrate of First Class having of First Class having jurisdiction.

(2) A Judicial Magistrate shall be competent to impose any punishment specified in sub-sections (2) and (4) of section 22.

(3) A Judicial Magistrate shall not take cognizance of an offence triable under sub-section (1) except on a complaint in writing by—

(a) the Agency; and

(b) any aggrieved person.

Appeals from orders of the Judicial Magistrate.

30. Any person aggrieved by any final order or sentence passed by a Judicial Magistrate under section 28 may, within thirty days from the date of the communication of such order or sentence, appeal to the Court of the District and Sessions Judge defined as Green Court under this Act, whose decision thereon shall be final.

PART-X
PUBLIC PARTICIPATION

Public participation.

31.(1)The Agency shall cause relevant details of any proposed project regarding which an Environmental Impact Assessment has been received to be published, alongwith an invitation to the public to furnish their comments thereon within a specified period.

(2) In accordance with such procedure as may be prescribed, the Agency shall hold public hearings to receive additional comments and hear oral submissions.

(3) All comments received under sub-sections (1) and (2) shall be duly considered by the Agency while reviewing the environmental impact assessment or strategic impact assessment, and decision or action taken thereon shall be communicated to the persons who have furnished the said comments.

PART-XI
GENERAL

Power to make and amend schedule.

32. The Agency may, by notification in the official Gazette, make and amend the schedule.

Indemnity

33. No suit, prosecution or other legal proceedings shall lie against Government, the Council, the Agency, the Director General of the Agency, members, officers, employees, experts, advisors, committees or consultants of the Agency or Environmental Protection Tribunal or Court or any other person for anything which is done or intended to be done in good faith under this Act or rules or regulations.

Dues recoverable as arrears of land revenue.

34. Any dues recoverable by the Agency under this Act and rules or regulations shall be recoverable as arrears of land revenue.

Act to override other laws.

35. The provisions of this Act shall have effect notwithstanding anything inconsistent therewith contained in any other law for the time being in force.

Power to make rules.

36. The Sindh Environment Protection Agency may, by notification in the Official Gazette, make rules for carrying out the purposes not in consistence of this Act with the approval of Government.

Power to make regulations.

37. (1) For carrying out the purposes of this Act, the Agency may, by Notification in the Official Gazette and with the approval of Government, make regulations not inconsistent with the provisions of this Act or the rules.

(2) In particular and without prejudice to the generality of the foregoing power, such regulations may provide for —

(a) submission of periodical reports, data or information by any Government Agency, local authority or local council in respect of environmental matters;

(b) preparation of emergency contingency plans for coping with environmental hazards and pollution caused by accidents, natural disasters and calamities;

(c) appointment of officers, advisors, experts, consultants and employees **as per prescribed rules**;

(d) levy of fees, rates and charges in respect of services rendered, actions taken and schemes implemented;

(e) monitoring and measurement of discharges and emissions;

(f) categorization of projects to which, and the manner in which sections 17, 18 and 20 applies;

(g) laying down of guidelines for preparation of initial environmental examination, environmental impact assessment and strategic environmental assessment, and development of procedures of their filing, reviews and approval.

(h) laying down standard operating procedures for environmental sampling, examination of water, waste water, gaseous emissions, solid waste and noise;

(i) providing procedures for handling hazardous substances; and

(j) installation of devices in, use of fuels by, and maintenance and testing of motor vehicles for control of air and noise pollution.

BY ORDER OF THE SPEAKER
PROVINCIAL ASSEMBLY OF SINDH

G.M.UMAR FAROOQ
SECRETARY
PROVINCIAL ASSEMBLY OF SINDH

Karachi: Printed at the Sindh Government Press
20-3-2014

Annexure – II

SEPA (Review of IEE/EIA) Regulations 2014

Karachi dated the 16th December, 2014.

NOTIFICATION

NO.EPA/TECH/739/2014:- In exercise of the powers conferred by section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government, is pleased to make the following regulations, namely:-

1. Short title and commencement

(1) These regulations may be called the Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2014.

(2) They shall come into force at once.

2. Definitions.-

(1) In these regulations, unless there is anything repugnant in the subject or context -

(a) "Act" means the Sindh Environmental Protection Act, 2014 (VIII of 2014);

(b) "Agency" means the Sindh Environmental Protection Agency as defined under section 2(ii);

(c) "Committee" means the Environmental Assessment Advisory Committee constituted under regulation 24;

(d) "Director General" means the Director General of the Agency;

(e) "EIA" means an environmental impact assessment as defined in section 2(xv);

(f) "IEE" means an initial environmental examination as defined in section 2(xxx);

(g) "section" means a section of the Act.

(h) "Firm" means the Environmental Consulting Firm certified by the Agency;

(i) "Environmental Sensitive areas" means the area which falls under sensitive sites like protected areas, or the sites which may have crucial and growing importance;

(j) "protected area" means any area which safeguards the earths precious bio-diversity protect outstanding areas of natural beauty and conservation of cultural significance;

(k) "Schedule" means the Schedule to these regulations;

(l) "urban area" means an area within the limits of a town, municipality or city and includes any area declared as such by Government by notification in the official gazette;

(2) All other words and expressions used but not defined in these regulations shall have the same meaning as are assigned to them in the Act.

3. Projects requiring an IEE

A proponent of a project falling in any category listed in Schedule-I shall file an IEE with the Agency, and the provisions of section 17 shall apply to such projects.

4. Projects requiring an EIA

A proponent of a project falling in any category listed in Schedule-II shall file an EIA with the Agency, and the provisions of section 17 shall apply to such projects.

5. **Projects requiring checklist**

A proponent of a project falling in any category listed in Schedule-III shall file environmental checklist with the Agency and the provisions of section 17 shall apply to such projects.

6. Projects not requiring an IEE or EIA

(1) A proponent of a project not falling in any category listed in Schedules-I, II and III shall not be required to file an IEE or EIA:

Provided that the proponent shall file -

(a) an EIA, if the project is likely to cause an adverse environmental effects;

(b) an application for projects not listed in Schedules-I, II and III in respect of which the Agency has issued guidelines for construction and operation for approval accompanied by an undertaking and an affidavit that the aforesaid guidelines shall be fully complied with.

(2) Notwithstanding anything contained in sub-regulation (1), the Agency may direct the proponent of a project, whether or not listed in Schedule I or II or III, to file an IEE or EIA or environmental check list, for reasons to be recorded in such direction:

Provided that no such direction shall be issued without the recommendations in writing of the Committee.

(3) The provisions of section 17 shall apply to a project in respect of which an IEE or EIA or environmental checklist is filed under sub-regulation (1) or (2).

7. Preparation of IEE/EIA and environmental checklist

(1) The Agency may issue guidelines for preparation of an IEE or an EIA or an environmental checklist, including guidelines of general applicability, and sectoral guidelines indicating specific assessment requirements for planning, construction and operation of projects relating to particular sector.

(2) Where guidelines have been issued under sub-regulation (1), an IEE or EIA or environmental checklist shall be prepared, to the extent practicable, in accordance therewith and the proponent shall justify in the IEE or EIA or in environmental checklist any departure therefrom.

8. Review Fees

The proponent shall pay, at the time of submission of an IEE or EIA or environmental checklist, a non-refundable review fee to the Agency as per rates shown in Schedule-IV

9. Filing of IEE, EIA and environmental check list.

(1) Ten hard copies and two electronic copies for an IEE and EIA reports shall be filed with the Agency prepared by Firm.

(2) Every IEE and EIA shall be accompanied by -

(a) an application, in the form prescribed in Schedule-V;

(b) copy of receipt showing payment of the Review Fee.

(c) no objection certificates from the relevant departments in case of EIA shall be the part of reports;

(d) the environmental check list as per its guidelines.

10. Preliminary scrutiny

(1) Within fifteen working days of filing of the IEE or EIA or environmental check

list, the Agency shall –

(a) confirm that the IEE or EIA or environmental check list is complete for purposes of initiation of the review process; or

(b) require the proponent to submit such additional information as may be specified; or

(c) return the IEE or EIA or environmental checklist to the proponent for revision, clearly listing the points requiring further study and discussion.

(2) Notwithstanding anything contained in sub-regulation (1), the Agency may require the proponent to submit an additional information at any stage during the review process.

11. Public participation

(1) In the case of an EIA, the Agency shall simultaneously with issue of confirmation of completeness under sub-regulation (2) of regulation 9, cause to be published in any English or Urdu national newspaper and in a local newspaper of general circulation in the area affected by the project, a public notice mentioning the type of project, its exact location, the name and address of the proponent and the places at which the EIA of the project can, subject to the restrictions in sub-section (3) of section 17, be accessed.

(2) The notice issued under sub-regulation (1) shall fix a date, time and place of public hearing for any comments on the project or its EIA.

(3) The date fixed under sub-regulation (2) shall not be earlier than fifteen days from the date of publication of the notice.

(4) The Agency shall also ensure the circulation of the EIA to the concerned Government Agencies and solicit their comments thereon.

(5) All comments received by the Agency from the public or any Government Agency shall be collated, tabulated and duly considered by it before decision on the EIA.

(6) The Agency may issue guidelines indicating the basic techniques and measures to be adopted to ensure effective public consultation, involvement and participation in EIA assessment.

12. Review

(1) The Agency shall make every effort to carry out its review of the environmental checklist within thirty days, IEE within sixty days, and of the EIA within four months of issue of confirmation of completeness under regulation 9.

(2) In reviewing the EIA, the Agency shall consult such Committee of Experts be constituted for the purpose by the Director General, and may also solicit views of concerned Advisory Committee, if any, constituted by the Agency.

(3) The Director-General may, where he considers it necessary, constitute a committee to inspect the site of the project and submit its report on such matters as may be specified.

(4) In reviewing the IEE, the Director General may constitute a committee of the officers from within the Agency on case to case basis in view of the jurisdiction and location of the project for the purpose to extend final recommendation about the approval or rejection of the IEE.

(5) In reviewing of the IEE, the Director General may direct the proponent and Firm to present the report before the committee as given under sub-regulation (4) and the Director General may also invite environmental experts from outside the Agency for the purpose of assistance.

(6) The review of the IEE or EIA by the Agency shall be based on quantitative and qualitative assessment of the documents and data furnished by the proponent, comments from the public and Government Agencies received under regulation 10, and views of the committees mentioned in sub-regulations (2) and (3) above.

(7) The environmental check list shall be reviewed as per guidelines issued by the Agency.

13. Decision

(1) Subject to regulation 9 and 11, the documentary evidence in the form of videos (soft copies) of public hearing shall be submitted by the proponent at the time of environmental approval or at any stage of review process, to the Agency.

(2) On completion of the review, the decision of the Agency shall be communicated to the proponent in the form prescribed in Schedule-VI in the case of an IEE and environmental check list, and in the form prescribed in Schedule-VII in the case of an EIA and for environmental checklist.

14. Conditions of approval

(1) Every approval of an IEE or EIA or check list shall, in addition to such conditions as may be imposed by the Agency, be subject to the condition that the project shall be designed and constructed, and mitigatory and other measures adopted, strictly in accordance with the IEE or EIA or environmental check list, unless any variations thereto have been specified in

the approval by the Agency.

(2) Where the Agency accords its approval subject to certain conditions, the proponent shall -

(a) before commencing construction of the project, acknowledge acceptance of the stipulated conditions by executing an undertaking in the form prescribed in Schedule-VIII;

(b) before commencing operation of the project, obtain from the Agency written confirmation that the conditions of approval, and the requirements in the IEE or EIA or environmental check list relating to design and construction, adoption of mitigatory and other measures and other relevant matters, have been duly complied with.

15. Confirmation of compliance

(1) The request for confirmation of compliance under clause (b) of sub-regulation (2) of Regulation 13 shall be accompanied by an Environmental Management Plan indicating the measures and procedures proposed to be taken to manage or mitigate the environmental impacts for the life of the project, including provisions for monitoring, reporting and auditing.

(2) Where a request for confirmation of compliance is received from a proponent, the Agency may carry out such inspection of the site and plant and machinery and seek such additional information from the proponent as it may deem fit:

Provided that every effort shall be made by the Agency to provide the requisite confirmation or otherwise within twenty days of receipt of the request, with complete information, from the proponent.

(3) The Agency may, while issuing the requisite confirmation of compliance, impose such other conditions as the Environmental Management Plan, and the operation, maintenance and monitoring of the project as it may deem fit, and such conditions shall be deemed to be included in the conditions to which approval of the project is subject.

16. Deemed approval

The period for communication of decision stipulated in sub-section (4) of section 17 shall commence from the date of filing of an IEE or EIA or environmental check list in respect of which confirmation of completeness is issued by the Agency under clause (a) of sub-regulation (1) of regulation 9.

17. Extension in review period

Where the Agency in a particular case extends the period of four months under the provisions of sub-section (4) of section 17, it may extend the further period as it may

deem fit, for the reasons to be recorded in writing thereof.

18. Validity period of approval

(1) The approval accorded by the Agency under section 17 read with regulation 12 shall be valid, for commencement of construction, for a period of three years from the date of issue.

(2) If construction is commenced during the initial three years validity period, the validity of the approval shall stand extended for a further period of three years from the date of issue.

(3) After issue of confirmation of compliance, the approval shall be valid for a period of three years from the date thereof.

(4) The proponent may apply to the Agency for extension in the validity periods mentioned in sub-regulations (1), (2) and (3), which may be granted by the Agency in its discretion for such period not exceeding three years at a time, if the conditions of the approval do not require significant change:

Provided that the Agency may require the proponent to submit a fresh IEE or EIA, if in its opinion changes in location, design, construction and operation of the project so warrant.

19. Entry and inspection

(1) For the purpose of verification of any matter relating to the review or to the conditions of approval of an IEE or EIA or environmental check list prior to, before or during and after commencement of construction or operation of a project, duly authorized staff of the Agency shall be entitled to enter and inspect the project site, factory building and plant and equipment installed therein.

(2) The proponent shall ensure full cooperation of the project staff at site to facilitate the inspection, and shall provide such information as may be required by the Agency for this purpose and pursuant thereto.

20. Monitoring

(1) After issue of approval, the proponent shall submit a report to the Agency on completion of construction of the project.

(2) After issue of confirmation of compliance, the proponent shall submit an annual report summarizing operational performance of the project, with reference to the conditions of approval and maintenance and mitigatory measures adopted by the project.

(3) The proponent shall, in order to enable the Agency to effectively monitor compliance with the conditions of approval, furnish such additional information as the Agency may require.

21. Cancellation of approval

(1) Notwithstanding anything contained in these regulations, if, at any time, on the basis of information or report received or inspection carried out, the Agency is of the opinion that the conditions of an approval have not been complied with, or that the information supplied by a proponent in the approved IEE or EIA or environmental check list is incorrect, it shall issue notice to the proponent for show cause within two weeks of receipt thereof as to why the approval should not be cancelled.

(2) In case no reply is received or if the reply is considered unsatisfactory, the Agency may, after giving the proponent an opportunity of being heard -

(i) require the proponent to take such measures and to comply with such conditions within such period as it may specify, failing which the approval shall stand cancelled; or

(ii) cancel the approval.

(3) On cancellation of the approval, the proponent shall cease construction or operation of the project forthwith.

(4) Any action taken under this regulation shall be without prejudice to any other action that may be taken against the proponent under the Act or rules or regulations or any other law for the time being in force.

22. Registers of IEE,EIA and Check list projects

Separate Registers to be maintained by the Agency for IEE, EIA and environmental check list projects under sub-section (6) of section 17 shall be in the form prescribed in Schedule-IX.

23. Environmentally sensitive areas

(1) The Agency may, by notification in the official Gazette, designate an area to be an environmentally sensitive area.

(2) Notwithstanding anything contained in regulations 3, 4 and 5, the proponent of a project situated in an environmentally sensitive area shall be required to file an EIA with the Agency.

(3) The Agency may from time to time issue guidelines to assist proponents and other persons involved in the environmental assessment process to plan and prepare projects located in environmentally sensitive areas.

(4) Where guidelines have been issued under sub-regulation (3), the projects shall be planned and prepared, to the extent practicable, in accordance therewith and any departure therefrom justified in the EIA pertaining to the project.

24. **Environmental Assessment Advisory Committee.-** For the purpose of rendering advice on all aspects of the environmental assessment including guidelines procedure and categorization of projects, the following Advisory Committee shall be constituted:-

(i) Director Technical, Sindh Environmental Protection Agency (EIA/IEE)	**Chairman**
(ii) Chief Environment, Planning and Development Department	**Member**
(iii) Four representative on each of industry, non-Governmental organization, legal and other experts	**Members**

25. Repeal and Savings. (1) The provisions of the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environmental Assessment Impact Regulations 2000, to the extent of the Province of Sindh are hereby repealed.

(2) All orders made, notification issued, actions taken under the repealed Regulations shall remain in force until amended, altered or repealed by the provisions of these Rules.

DIRECTOR GENERAL
SINDH ENVIRONMENTAL PROTECTION AGENCY

SCHEDULE I

(See Regulation 3)

A. Agriculture, Livestock and Fisheries

1. Poultry, livestock, stud and fish farms
2. Projects involving packaging, formulation, cold storage and warehouse of agricultural products.

B. Energy

1. Hydroelectric power generation less than 50 MW
2. Thermal power generation less than 100MW
3. Coal fired power plants with capacity less than 50 MW
4. Transmission lines less than 11 KV, and grid station
5. Waste-to-energy generation projects including bio-mass less than 25 MW
6. Solar project
7. Wind project

C. Oil and Gas projects:

1. Oil and gas 2D/3D Seismic survey and drilling activities
2. Oil and gas extraction projects including exploration and production located outside the environmentally sensitive areas
3. Construction of LPG storage facilities
4. Construction of LPG,CNG filling station and petrol pumps

D. Manufacturing and processing

1. Ceramics and glass units less than 500 million
2. Food processing industries with total cost less than Rs. 200 millions
3. Pharmaceutical units.
4. Marble units

5. Carpet manufacturing units

6. Rice mills, ghee/oil mills ,

7. Brick kilns

8. Stone crushing units

9. Man-made fibers and resin projects with total cost less than Rs. 200 millions

10. Manufacturing of apparel, textile garments unit , including dyeing, bleaching and printing, with total cost less than Rs.50 million

11. Wood products with total cost more than Rs.100 million

12. Steel re-rolling mills

13. Recycling plants

E. Mining and mineral processing

Commercial extraction of sand, gravel, limestone, clay, sulphur and other minerals not included in Schedule II with total cost less than Rs.100 million

1. Crushing, grinding and separation processes

2. Smelting plants with total cost less than Rs100 millions

F. Transport

1. Flyovers, underpasses and bridges having total length less than 500 meters

G. Water management, dams, irrigation and flood protection

1. Dams and reservoirs with storage volume less than 25 million cubic meters of surface area less than 4 square kilometers

2. Small-scale irrigation systems and drainage system with total cost less than Rs. 100 million

H. Water supply and filtration

Water supply schemes and **filtration** plants with total cost less than 100 million (Including projects of maintenance, up gradation, reconstruction of existing projects.)

I. Waste disposal and treatment

1. Solid and non-hazardous waste with annual capacity less than 10,000 tons

2. Waste water treatment for sewage treatment facility with total cost less than 200M

3. Industry specific Waste water treatment facility for Industrial effluent (small scale plant)

J. Urban development

1. Housing schemes less than 10 acres

2. Mutli-story buildings having residential and commercial setup on the total plot size is less than 2000 sq.yards

3. Hospitals with capacity of 50 beds, health care unit/laboratories with 500 OPD/day.

4. Construction of Educational, Academic institutions on land less than 10 acres.

K. Other projects

Any other project for which filing of an IEE is required by the Agency under sub-regulation (2) of Regulation 6.

SCHEDULE II

(See Regulation 4)

List of projects requiring an EIA

A. Energy

1. Hydroelectric power generation over 50 MW
2. Thermal power generation over 100MW
3. Coal power projects above 50 MW
4. Transmission lines (11 KV and above) and distribution projects.
5. Nuclear power plants
6. Wind energy projects if falls under any sensitive, protected area.

B. Oil and Gas projects

1. Petroleum refineries.
2. LPG and LNG Projects(including LNG Terminals, re-gasification units) except LPG filling stations
3. Oil and gas transmission systems
4. Oil and gas gathering system, separation and storage.

C. Manufacturing and processing

1. Cement plants
2. Chemical manufacturing industries
3. Fertilizer plants
4. Steel Mills
5. Sugar Mills and Distilleries
6. Food processing industries including beverages, dairy milk and products, slaughter houses and related activities with total cost more than Rs. 200 Million
7. Industrial estates (including export processing zones)
8. Man-made fibers and resin projects with total cost of Rs 200M and above
9. Pesticides (manufacture or formulation)
10. Petrochemicals complex
11. Synthetic resins, plastics and man-made fibers, paper and paperboard, paper pulping, plastic products, textiles (except apparel),printing and publishing, paints and dyes, oils and fats and vegetable ghee projects, with total cost more than Rs.

10 million
12. Tanning and leather finishing projects
13. Battery manufacturing plant

D. Mining and mineral processing

1. Mining and processing of coal, gold, copper, sulphur and precious stones
2. Mining and processing of major non-ferrous metals, iron and steel rolling
3. Smelting plants with total cost of Rs. 100 million and above

E. Transport

1. Airports
2. Federal or Provincial highways or major roads (including rehabilitation or rebuilding or reconstruction of existing roads)
3. Ports and harbor development
4. Railway works
5. Flyovers, underpasses and bridges having total length of more than 500m

F. Water management, dams, irrigation and flood protection

1. Dams and reservoirs with storage volume of 25 million cubic meters and above having surface area of 4 square kilometers and above
2. Irrigation and drainage projects serving 15,000 hectares and above
3. Flood Protection

G. Water supply and filtration

Large Water supply schemes and **filtration** plants.

H. Waste Disposal and treatment

1. Handling, storage or disposal of hazardous or toxic wastes or radioactive waste (including landfill sites, incineration of hospital toxic waste)
2. Waste disposal facilities for municipal or industrial wastes, with total annual capacity of 10,000 tons and above.
3. Waste water treatment facility for industrial or municipal effluents.

I. Urban development and tourism

1. Housing schemes above 10 acres

2. Residential/commercial high rise buildings/apartments from15 stories and above.

3. Land use studies and urban plans (large cities)

4. Large scale public facilities.

~~5.~~ Large-scale tourism development projects

J. Environmentally Sensitive Areas

All projects situated in environmentally sensitive areas

K. Other projects

1. Any other project for which filing of an EIA is required by the Agency under sub-regulation (2) of Regulation 5.

2. Any other project likely to cause an adverse environmental effect

SCHEDULE-III

List of projects requiring environmental screening (through check list)

a. Construction of, offices and small commercial buildings (1-6 story),home industrial units, ware houses, marriage / banquet facilities, large scale motor vehicles workshops, restaurants / food outlets ,large baking unit subject to the compliance with existing zoning laws.

b. Reconstruction / rehabilitation of roads (small roads in urban area and farm to market roads more than 2 km.

c. On-farm dams and fish farms.

d. Pulses mills.

e. Flour Mills

f. Projects promoting energy efficiency (small scale).

g. Lining of existing minor canals and /or water courses.

h. Canal cleaning

i. Forest harvesting operations

j. Rain harvesting projects

k. Rural schools (Secondary and Higher Secondary) and rural and basic health units having at least ten beds capacity.

l. BTS Towers

m. Lime Kilns

n. Ice factories and cold storage.

o. Cotton oil mill

p. Warehouses for pesticides and pharmaceuticals

Schedule-IV

(See Regulation 7)

Description	IEE	EIA	Environmental Check list
Projects	Rs.100,000	Rs.200,000	Rs.30,000 except BTS Towers which is Rs.15,000

SCHEDULE V

[See Regulation 8(2)(a)]

Application Form

1.	Name and address of Proponent		Phone: Fax: Telex:	
2.	CNIC No. of proponent			
3.	Description of project			
4.	Location of project			
6.	Objectives of project			
7.	IEE/EIA attached?	IEE/EIA : Yes/No		
8.	Have alternative sites been considered and reported in IEE/EIA?		Yes/No	
9.	No Objection Certificate of relevant stakeholders		Name(s)	
10.	Existing land use		Land requirement	
11.	Is basic site data available, or has it been measured?	(only tick yes if the data is reported in the IEE/EIA)	Available	Measured
		Meterology (including rainfall)	Yes/No	Yes/No
		Ambient air quality	Yes/No	Yes/No
		Ambient water quality	Yes/No	Yes/No
		Ground water quality	Yes/No	Yes/No
12.	Have estimates of the following been reported, especially Quantitative Analysis?		Estimated	Reported
		Water balance	Yes/No	Yes/No
		Solid waste disposal	Yes/No	Yes/No
		Liquid waste treatment	Yes/No	Yes/No
13.	Source of power		Power requirement	
14.	Labour force (number)	Construction: Operation:		
15.	Environmental Consulting Firm			

Verification. I do solemnly affirm and declare that the information given above and contained in the attached IEE/EIA is true and correct to the best of my knowledge and belief.

Date

Signature, name and _____
designation of proponent
(with official stamp/seal)

SCHEDULE VI

[See Regulation 12]

Decision on IEE/Environmental Check List

1. Name and address of proponent _____

   _____

2. Description of project

3. Location of project

4. Date of filing of IEE

5. After careful review of the IEE, the Agency has decided –

   (a) to accord its approval, subject to the following conditions:

   _____
   _____

   or (b) that the proponent should submit an EIA of the project, for the following reasons –

   _____
   _____

   [Delete (a) or (b), whichever is inapplicable]

Dated

Tracking no.___

Director-General
Sindh Environmental Protection Agency
(with official stamp/seal)

SCHEDULE VII

[*See* Regulation 12]

Decision on EIA

1. Name and address of proponent _____

   _____

2. Description of project _____

3. Location of project _____

4. Date of filing of EIA _____

5. After careful review of the EIA, and all comments thereon, the Federation Agency has decided –

   (a) to accord its approval, subject to the following conditions:

   _____
   _____

   or (b) that the proponent should submit an EIA with the following modifications-

   _____
   _____

   or (c) to reject the project, being contrary to environmental objectives, for the following reasons:

   _____
   _____

   [Delete (a)/(b)/(c), whichever is inapplicable]

Dated

Tracking no.___

Director-General
Sindh Environmental Protection Agency
(with official stamp/seal)

SCHEDULE VIII

[See Regulation 13(2)]

Undertaking

I, (full name and address) as proponent for (name, description and location of project) do hereby solemnly affirm and declare that I fully understand and accept the conditions dated , and undertake to design, construct and operate the project strictly in accordance with the said conditions and the IEE/EIA/Environmental Check List.

Signature, name and
designation of proponent
(with official stamp/seal)

Witnesses
(full names and addresses)

_____

_____

SCHEDULE IX

(See Regulation 21)

Form of Registers for IEE and EIA and Environmental Check List projects

S. No.	Description	Relevant Provisions
1	2	3
1.	Tracking number	
2.	Category type (as per Schedules I, II & III)	
3.	Name of proponent	
4.	Name and designation of contact person	
5.	Name of consultant	
6.	Description of project	
7.	Location of project	
8.	Project capital cost	
9.	Date of receipt of IEE/EIA/Environmental Check List	
10.	Date of confirmation of completeness	
11.	Approval granted (Yes/No)	
12.	Date of approval granted or refused	
13.	Conditions of approval/reasons for refusal	
14.	Date of Undertaking	
15.	Date of extension of approval validity	
16.	Period of extension	
17.	Date of commencement of construction	
18.	Date of issue of confirmation of compliance	
19.	Date of commencement of operations	
20.	Dates of filing of monitoring reports	
21.	Date of cancellation, if applicable	

Annexure – III

Sindh Environmental Quality Standards, 2016

EXTRAORDINARY Registered No. M324

The Sindh Government Gazette

Published by Authority

KARACHI THURSDAY JANUARY 28, 2016

PART-I

GOVERNMENT OF SINDH
SINDH ENVIRONMENT PROTECTION AGENCY

NOTIFICATION

NO.EPA/TECH/739/2014:- In exercise of the powers conferred under clause (g) of sub-section (1) of section of 6 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of the Sindh Environmental Protection Council, is pleased to establish the following standards:-

1. (1) These Standards may be called the Sindh Environmental Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Airs, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards, 2015.

(2) These Standards shall come into force at once.

2. In these Standards, unless there is anything repugnant in the subject or context –

(a) "Government" means the Government of Sindh;

(b) "Standards" means the Sindh Environmental Quality Standards.

SINDH ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND LIQUID INDUSTRIAL EFFLUENTS (mg/l, UNLESS OTHERWISE DEFINED)

S. No.	Parameter	Standards		
		Into Inland Waters	Into Sewage Treatment [5]	Into Sea [ ]
1	2	3	4	5
1.	Temperature 40 ^{0}C or Temperature Increase *	≤3^{o}C	≤3^{o}C	≤3^{o}C
2.	pH value (H^+) .	6-9	6-9	6-9
3.	Biochemical Oxygen Demand (BOD)5 at 20^{0}C [1]	80	250	80**
4.	Chemical Oxygen Demand(COD) [1]	150	400	400
5.	Total Suspended Solids (TSS)	200	400	200
6.	Total Dissolved Solids (TDS)	3500	3500	3500
7.	Oil and Grease	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.3	0.3
9.	Chloride (as Cl^-)	1000	1000	SC***
10.	Fluoride (as F^-)	10	10	10
11.	Cyanide (as CN^-) total .	1.0	1.0	1.0
12.	An-ionic detergents (as MBAS)[2]	20	20	20
13.	Sulphate (SO_4^{2-})	600	1000	SC***
14.	Sulphide (S^{2-})	1.0	1.0	1.0
15.	Ammonia (NH_3)	40	40	40
16.	Pesticides [3]	0.15	0.15	0.15
17.	Cadmium [4] ..	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent [4] ..	1.0	1.0	1.0
19.	Cooper [4]	1.0	1.0	1.0
20.	Lead [4]	0.5	0.5	0.5
21.	Mercury [4]	0.01	0.01	0.01
22.	Selenium [4]	0.5	0.5	0.5
23.	Nickel [4] ..	1.0	1.0	1.0
24.	Silver [4]	1.0	1.0	1.0
25.	Total toxic metals	2.0	2.0	2.0
26.	Zinc	5.0	5.0	5.0
27.	Arsenic [4]	1.0	1.0	1.0
28.	Barium [4]	1.5	1.5	1.5
29.	Iron	8.0	8.0	8.0
30.	Manganese	1.5	1.5	1.5
31.	Boron [4]	6.0	6.0	6.0
32.	Chlorine	1.0	1.0	1.0

Explanations:

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Sindh 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.
2. Methylene Blue Active Substances; assuming surfactant as biodegradable.
3. Pesticides include herbicides, fungicides, and insecticides.
4. Subject to total toxic metals discharge should not exceed level given at S. N. 25.
5. Applicable only when and where sewage treatment is operational and BOD5=80mg/l is achieved by the sewage treatment system.
6. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.

* The effluent should not result in temperature increase of more than 3^0C at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the point of discharge.

** The value for industry is 200 mg/l

*** Discharge concentration at or below sea concentration (SC).

Note: 1. Dilution of liquid effluents to bring them to the STANDARDS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.

2. The concentration of pollutants in water being used will be subtracted from the effluent for calculating the STANDARDS limits".

"SINDH ENVIRONMENTAL QUALITY STANDARDS FOR INDUSTRIAL GASEOUS EMISSION (mg/Nm^3, UNLESS OTHERWISE DEFINED)."

S. No.	Parameter	Source of Emission		Standards
1	2	3		4
1.	Smoke	Smoke opacity not to exceed		40% or 2 Ringleman Scale or equivalent smoke number
2.	Particulate matter	(a) Boilers and Furnaces		
	(1)	(i)	Oil fired	300
		(ii)	Coal fired	500
		(iii)	Cement Kilns	300

		(b) Grinding, crushing, Clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas.	500
3.	Hydrogen Chloride	Any	400
4.	Chlorine	Any	150
5.	Hydrogen Fluoride	Any	150
6.	Hydrogen Sulphide	Any	10
7.	Sulphur Oxides [2] [3]	Sulfuric acid/ Sulphonic acid plants	
		Other Plants except power Plants operating on oil and coal	1700
8.	Carbon Monoxide	Any	800
9.	Lead	Any	50
10.	Mercury	Any	10
11.	Cadmium	Any	20
12.	Arsenic	Any	20
13.	Copper	Any	50
14.	Antimony	Any	20
15.	Zinc	Any	200
16.	Oxides of Nitrogen	Nitric acid Manufacturing unit.	3000
	(3)	Other plants except power plants operating on oil or coal:	
		Gas fired	400
		Oil fired	600
		Coal fired	1200

Explanations:-

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1 percent Sulphur content in fuel oil. Higher content of Sulphur will case standards to be pro-rated.
3. In respect of emissions of Sulphur dioxide and Nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to Standards specified above, comply with the following standards:-

A. **Sulphur Dioxide**

Sulphur Dioxide Background levels Micro-gram per cubic meter (ug/m^3) Standards.

Background Air Quality (SO_2 Basis)	Annual Average	Max. 24-hours Interval	Criterion I Max. SO_2 Emission (Tons per Day Per Plant)	Criterion II Max. ground level increment to ambient (One year Average)
Unpolluted	<50	<200	500	50
Moderately Polluted*				
Low	50	200	500	50
High	100	400	100	10
Very Polluted**	>100	>400	100	10

* For intermediate values between 50 and 100 ug/m^3 linear interpolations should be used.
** No projects with Sulphur dioxide emissions will be recommended.

B. Nitrogen Oxide

Ambient air concentrations of Nitrogen oxides, expressed as NO_X should not be exceed the following:-

Annual Arithmetic Mean 100ug/m^3 (0.05 ppm)

Emission level for stationary source discharge before missing with the atmosphere should be maintained as follows:-

For fuel fired steam generators as Nanogram (10^0-gram) per joule of heat input:

Liquid fossil fuel	130
Solid fossil fuel..	300
Lignite fossil fuel	260

Note:- Dilution of gaseous emissions to bring them to the STANDARDS limiting value is not permissible through excess air mixing blowing before emitting into the environment.

Sindh Environmental Quality Standards for Motor Vehicle Exhaust and Noise

(i) For in-use Vehicles

S. No.	Parameter	Standards (maximum permissible limit)	Measuring Method	Applicability
1	2	3	4	5
1.	Smoke	40% or on the Ringleman Scale during engine acceleration mode	To be compared with Ringleman Chart at a distance of 6 meters or more.	Immediate effect
2	Carbon Monoxide	6 %	Under idling conditions: Non-dispersive infrared detection through gas analyzer.	
3.	Noise	85 db (A)	Sound-meter at 7.5 meter from the source.	

For new Vehicles

EMISSION STANDARDS FOR DIESEL VEHICLES

(a) For passenger Cars and Light Commercial Vehicles (g/Km)

Type of Vehicle	Category/Class	Tiers	CO	HC+ NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8
Passenger Cars.	M 1: with reference mass (RW).	Pak-II, IDI	1.0	0.7	0.08		All imported and local manufactured
	up to 2500 kg. Cars with RW over 2500 kg. to meet NI Category standards	Pak-II DI	1.0	0.9	0.10	NEDC (ECE 15+ EUDCL)	Diesel vehicles with effect from 01-07-2012
Light Commercial Vehicles	NI-I (RW≤1250 Kg)	Pak-II IDI	1.0	0.70	0.08		
		Pak-II DI	1.0	0.90	0.10		
	NI-II(1250kg< RW < 1700 Kg)	Pak-II IDI	1.25	1.0	0.12		
		Pak-II DI	1.25	1.3	0.14		
	NI-III(RW< 1700 Kg)	Pak-II IDI	1.50	1.2	0.17		
		Pak-II DI	1.50	1.6	0.20		

Parameter Standards (maximum permissible limit) Measuring method

Noise	85 db (A)	Sound-meter at 7.5 meters from the source

(b) For Heavy Duty Diesel Engines and Large Goods Vehicles (g/Kwh)

Type of Vehicle	Catogry/ Class	Tiers	CO	HC	NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8	9
Heavy Duty Diesel Engines	Turks and Buses	Pak-II	4.0	1.1	7.0	0.15	ECE-R-49	All Imported and local manufactured diesel vehicles with the effect 1-7-2012
Large goods Vehicles	N2(2000 and up	Pak-II	4.0	7.0	1.10	0.15	EDC	

Parameter Standards (maximum permissible limit) Measuring method

Noise 85 db (A) Sound-meter at 7.5 meters from the Source

Emission Standards for Petrol Vehicles (g/km)

Type of Vehicle	Category/ Class	Tier	Co	HC+ NOx	Measuring Method	Applicability
1	2	3	4	5	6	7
Passenger Cars.	M 1: with reference mass (RW). upto 2500 kg. Cars with RW over 2500 kg. to meet N1 Category standards	Pak-II	2.20	0.5	NEDC (ECE 15+ EUDCL)	All imported and new models * locally manufactured petrol vehicles with effect from 1st July, 2009**

Light Commercial Vehicles	NI-I (RW<1250 kg) NI-NI-II (1250kg> kg RW < 1700 Kg)	Pak-II	2.20	0.5	
		Pak-II	4.0	0.65	
		Pak-II	5.0	0.08	
	NI-III(RW> 1700 kg)				
Motor Rickshaws & Motor Cycles	2,4 strokes < 150 cc	Pak-II	5.5	1.5	ECER 40
	2,4 strokes > 150cc	Pak-II	5.5	1.3	

Parameter Standards (maximum permissible limit) Measuring method

Noise source	85 db (A)	Sound-meter at 7.5 meters from the

Explanations:

DI:	Direct Injection.
IDI:	Indirect Injection.
EUDCL:	Extra Urban Driving Cycle.
NEDC:	New European Driving Cycle.
ECE:	Urban Driving Cycle.
M:	Vehicles designed and constructed for the carriage of passenger and Comprising no more than eight seats in addition to the driver's seat:
N:	Motor vehicles with at least four wheels designed and constructed for the carriage of goods.
*	New model means both model and engine type change.
**	The existing models of petrol driven vehicles locally manufactured will immediately switch over to Pak-II emission standards but no late than 30th June, 2012.

SINDH ENVIRONMENTAL QUALITY STANDARDS FOR AMBIENT AIR

Pollutants	Time-weight average	Concentration in Ambient Air	Method of measurement
Sulphur Dioxide(SO2)	Annual Average*	80 µg/m³	Ultraviolet Fluorescence method
	24 hours**	120 µg/m³	
Oxides of Nitrogen as (NO)	Annual Average*	40 µg/m³	Gas Phase Chemiluminescence
	24 hours**	40 µg/m³	
Oxides of Nitrogen as (NO2)	Annual Average*	40 µg/m³	Gas Phase Chemiluminescence
	24 hours**	80 µg/m³	
O³	1 hour	130 µg/m³	Non dispersive UV absorption method
Suspended Particulate Matters(SPM)	Annual Average*	360 µg/m³	High Volume Sampling (Average flow rate not less than 1.1 in 3/minutes)
	24 hours**	500 µg/m³	
Respirable Particulate Matter PM10	Annual Average*	120 µg/m³	ß Ray absorption method
	24 hours**	150 µg/m³	
Respirable Particulate Matter PM2.5	Annual Average*	40 µg/m³***	ß Ray absorption method
	24 hours**	75 µg/m³	
Lead Pb	Annual Average*	1 µg/m³	ASS Method after sampling using EPM 2000 or equivalent filter paper
	24 hours**	1.5 µg/m³	
Carbon Monoxide(CO)	8 hours**	5 mg/m³	Non Dispersive Infra Red(NDIR) method
	1 hours**	10 mg/m³	

*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly and at uniform interval.

** 24 hourly/8 hourly values should be met 98% in a year, 2% of the time. It may exceed but not on two consecutive days.

***Annual Average limit of 40μ/m³ or background annual average concentration plus allowable allowance of 9μg/m³, whichever is lower.

Sindh Standards for Drinking Water Quality

Properties / Parameters	Standard Values for Sindh	WHO Standards	Remarks
Bacterial			
All water intended for drinking (e.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Most Asian countries also follow WHO standards
Physical			
Colour	≤ 15 TCU	≤ 15 TCU	
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable	
Odour	Non	Non	

	objectionable/Acceptable	objectionable/Accep table
Turbidity	⟨ 5 NTU	⟨ 5 NTU
Total hardness as $CaCO_3$	< 500 mg/l	---
TDS	⟨ 1000	⟨ 1000
pH	6.5 – 8.5	6.5 – 8.5
Chemical		
Essential Inorganic	***mg/Litre***	***mg/Litre***
Aluminium (Al) mg/l	≤ 0.2	0.2

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Antimony (Sb)	≤ 0.005 (P)	0.02	
Arsenic (As)	≤ 0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium(Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl)	< 250	250	
Chromium (Cr)	≤ 0.05	0.05	
Copper (Cu)	2	2	
Toxic Inorganic	***mg/Liter***	***mg/Litre***	
Cyanide (CN)	≤ 0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤ 1.5	1.5	
Lead (Pb)	≤ 0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤ 0.001	0.001	
Nickel (Ni)	≤ 0.02	0.02	

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Nitrate (NO_3)	< 0.50	50	
Nitrite (NO_2)	≤ 3 (P)	3	
Selenium (SE)	0.01 (P)	0.01	
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	---	
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Organic			
Pesticides mg/L		PSQCA No. 4639-2004. Page No. 4 Table No. 3 Serial No. 20-58 may be consulted.***	Annex II
Phenolic compounds (as Phenols) mg/L		< 0.002	
Polynuclear aromatic hydrocarbons (as PAH g/L)		0.01 (By GC/MS method)	
Radioactive			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

*** PSQCA: Pakistan Standards Quality Control Authority

Proviso:

The existing drinking water treatment infrastructure is not adequate to comply with WHO guidelines. The Arsenic concentrations in some parts of Sindh have been found high then Revised WHO guidelines. It will take some time to control arsenic through treatment process. Lead concentration in the proposed standards is higher than WHO Guidelines. As the piping system for supply of drinking water in urban centers are generally old and will take significant resources and time to get them replaced. In the recent past, Lead was completely phased out from petroleum

products to cut down Lead entering into environment. These steps will enable to achieve WHO guidelines for Arsenic, Lead, Cadmium and Zinc. However, for bottled water, WHO limits for Arsenic, Lead, Cadmium and Zinc will be applicable and PSQCA Standards for all the remaining parameters.

Sindh Environmental Quality Standards for Noise

S. No.	Category of Area / Zone	Effective from 1st Jan, 2015		Effective from 1st January, 2015	
		Limit in dB(A) Leq *			
		Day Time	Night Time	Day Time	Night Time
1.	Residential Area (A)	65	50	55	45
2.	Commercial Area (B)	70	60	65	55
3.	Industrial Area (C)	80	75	75	65
4.	Silence Zone (D)	55	45	50	45

Note: 1. Day time hours: 6:00 a.m to 10:00 p.m

2. Night time hours: 10:00 p.m to 6:00 a.m

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

3. **Repeal and Savings.**

(1) The provisions of the Statutory Notification dated 10th August, 2000 and 18th October, 2010, issued by the Ministry of Environment, Government of Pakistan, to the extent of the Province of Sindh are hereby repealed.

(2) All actions taken, proceedings initiated shall be deemed to have been taken and initiated validly under the the provisions of these Rules.

DIRECTOR GENERAL
SINDH ENVIRONMENTAL PROTECTION AGENCY

Karachi: Printed at the Sindh Government Press
28-1-2016