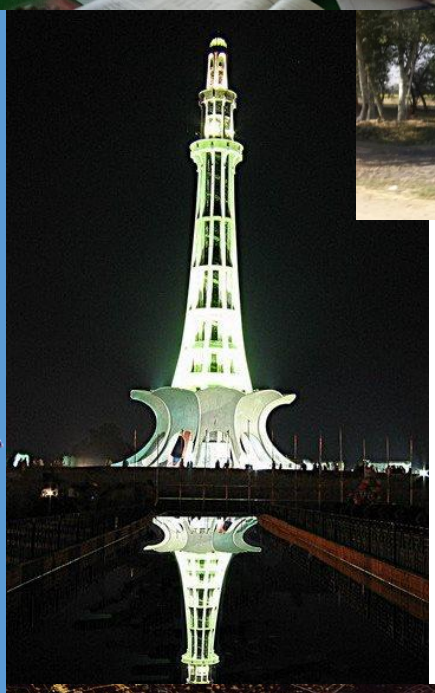
ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

AMENDMENT IN MASTER PLAN FOR LAHORE DIVISION (THE PROJECT)

DISTRICTS LAHORE, KASUR, NANKANA SAHB & SHEIKHUPURA











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AMENDMENT IN MASTER PLAN FOR LAHORE DIVISION (THE PROJECT)

Districts Lahore, Kasur, Sheikhupura and Nankana Sahb

Environmental Impact Assessment (EIA) Report

Lahore Development Authority (LDA), Lahore

Executive Summary

The Lahore Development Authority (LDA) has envisaged to prepare a comprehensive Master Plan for the whole Lahore Division which is hereinafter referred to as “the Project Area”. The Project site is geographically located between 30°38’31.93”E to 32°03’37.99” and 73°17’37.86” to 74°42’05.83”. The site is surrounded by the India in east, Gujranwala in the north, Faisalabad in the west and Sahiwal & Pakpattan in the south. The project site is accessible through all major Roads like Grand Trunk Road, Ring Road Multan Road, Ferozpur Road, Lahore-Sheikhupura Road and Motorway-M2.

Lahore Development Authority (LDA), Government of the Punjab, has designated its Metropolitan Planning Wing and Strategic Policy Unit with the task of preparation of this Master Plan for future 20 years i.e. till year 2035. For this purpose, Environmental Impact Assessment (EIA) study has been prepared in accordance with the TOR’S given and as integral part for land use planning. *It is added here that the term “Master Plan for Lahore Division” is hereinafter referred to the Amendment in Master Plan for Lahore Division (The Project)*.

The preparation and submission of an Environmental Impact Assessment (EIA) report for any development project is a statutory obligation under Punjab Environmental Protection Act, 1997 (PEPA, 1997) amended in 2012 in terms of Section 12 of the Act. The current Project falls under Schedule- II of subsection H of IEE/EIA Regulation as per section 12 of Environmental Protection Act and thus requires Environmental Impact Assessment - EIA.

The approach adopted for carrying out the EIA study includes review of the available data, analysis of collected data, establishing environmental baseline survey of the project related to physical, ecological & social environment, impact identification and suggesting mitigation measures and preparation of environmental and disaster management plan.

1. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

The project will comply with all the national legislation relating to the environment as specified in Punjab Environmental Protection Act (PEPA), 1997 Amended 2012. The

national legislations relating to the environment in Pakistan in order to obtain the required regulatory clearances are listed below:

- The National Conservation Strategy, 1992
- Punjab Environmental Protection Act (PEPA) 1997 Amended 2012
- The Pakistan Environmental Protection Agency Regulations, 2000,
- The National Environment Policy, 2005
- The National Forest Policy, 2001
- National Environmental Quality Standards (NEQS) 2000
- The Forest Act. of 1930
- The Provincial Wildlife Act 1975
- Land Acquisition Act., 1894
- Climate Change Policy and Framework 2010
- Punjab Local Government Ordinance, 2001
- Punjab Local Government Act, 2013
- Lahore Development Authority Act, 1975
- LDA Land Use Rules, 2014
- LDA (Master Plan) Rules, 2014
- LDA Building and Zoning Regulations, 2007
- National Disaster Risk Reduction Policy 2013
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

The project also complies with World Bank safe guard policy and other provincial and departmental applicable laws and regulations that includes Pakistan Explosives Act 1884 and Pakistan Penal Code, 1860.

2. PROJECT DESCRIPTION

The Project is located in Lahore Division which is an administrative division of Punjab Province, Pakistan and called the third tier of government. Lahore statistical division contains the districts of Lahore, Nankana Sahib, Kasur, and Shekhupura. The area of Lahore Division is about 11413.5 km² with the population of 14 million in accordance with 1998 census. With average growth rate of 3.20, the current population of Lahore division is estimated as 25 million. A projection is that by year 2035 there will be almost 50 million people living in the division. The unplanned expansion of the Lahore division, competing land use and exponential population

growth with the rate upto 3.20 had put the burden on existing infrastructure causing multiple problems like land use conflicts, traffic congestion, pollution, environmental degradation, water degradation and social implications. Therefore, master planning is required for the Lahore division in order for structured development with pragmatic approach that can mainstream current industrial and residential development The total area of Project that is estimated for master planning is about 348,565.38 Acres. The master plan is designed up till 2035 with estimated total population growth of Lahore division up to 50 million. The design population for the master plan of Lahore division 2035 is about 24.72 million. There are total 48 proposed areas selected for the master planning in Lahore Division out of 04 areas falls in Lahore District, 10 areas falls in Nankana District, 16 areas fall in Kasur District and 18 areas fall in Shiekhpura District. The description of each of these existing and proposed project areas with mapping are given in section 3.5

3. Analysis of Alternatives

The analysis has been carried out critically so as to justify the need of the Project. Besides the economic viability, environmental and social soundness of the proposed Project should also be considered when analyzing various alternatives. The various alternatives considered during the conduct of the study are as under:

- No Project Option (NPO)
- Location alternatives
- Layout alternatives
- Design alternatives

Over the years various efforts were made for the preparation and implementation of the master plans for the Lahore. However, the last plan Integrated Master Plan of Lahore (IMPL) in 2004 up to 2021. Due to one reason or other this plan cannot implemented in its true spirit.

Similarly from time to time various Outline Development Plans (ODPs), Agroville Development Plans for areas around Lahore has been prepared. These includes Bhai Phero Development Plan (1992-2017), Kahana Nau Development Plan (2000-2025), Kot Radha Kishan Development Plan (1994), Nankana Sahib Infrastructure in Selected Settlement Agroville Plan, Pattoki Infrastructure in Selected Settlement

Agroville Plan, Raiwind Development Plan, Outline Sheikhupura Development Plan etc. were prepared but cannot be implemented for reasons mentioned above.

Over the last few years the city has undergone some significant changes. Implementation of major infrastructure projects such as Lahore Ring road, Metro Bus Transit, Under Passes, Fly overs etc. has changed the characteristics of the Lahore from old one. The IMPL is unable to cope with the present situation even if all the resources are gathered to implement it. On account of this reality as the first phase the IMPL was amended in 2014 and notified in 2015.

With the approval of LDA Master Plan Rules, 2014, along with the jurisdiction of LDA extended over Lahore Division, this calls for immediate need to improve the quality of life and ensure sustainable development for the subject area. Similarly, various ODPs and Agroville plans of these areas need to be integrated in one Plan for the whole division. This solution can be achieved through proper study and updating for Master Plan of Lahore Division which will ensure proper and regular coordination of all public agencies. In this regards, no project option will mean that the concerned authority i.e. LDA takes no action and let the problems worsen.

4. ENVIRONMENTAL BASELINE CONDITIONS

Topography: The topography of the project area is generally plane sloping from north-west to south-west. The general height of the Lahore division is about 190 meters above the sea level. River Ravi is flowing in the mid while River Satlej is flowing on southern side towards Kasur just before the divisional boundary

Geology and Seismology: The project site is located in Punjab which is a vast plain of alluvial material, deposited by Indus basin and its tributaries crossing the Punjab Plain. The alluvial deposits underlying the site are deposited by the rivers.

The thickness of alluvial deposits in Lahore division is thought to be more than 300 m which are underlain by the basement rocks of the Indian shield. The alluvial deposits mainly consist of sands, with intercalation of silt and clay layers of varying thickness.

Soil: Subsurface Lithology is composed of Lean Clay/Silt/Silty/Sand/Poorly Graded Sand with Silt up to maximum investigated depth of 30 m below NSL. The topmost

soil layer mostly comprises of Lean Clay in very soft to soft state. The thickness of this layer is approximately 3.0 m below NSL. This cover is absent at places.

Climate: The coldest month is January in which the mean maximum temperature is 19.4 °C and the mean minimum temperature is 6.6 °C. June is the hottest month with the mean maximum temperature near 39.8 °C and the mean minimum temperature as 27.4 °C. The average annual rainfall during the last 20 years period from (1991-2010) works out to be 55.25 mm.

Water Resources: Surface water in the Study Area of the Project is present in the form of a rivers and canals. Surface water in the Study Area of the Project is present in the form of a river and canals. The rivers are Ravi and Sutlej while canals are Banbarwali Ravi Bedian Canal (BRB), Upper Chenab Canal, Qadirabad Balloki Link Canal, Lahore Branch Canal Butcherkhana Distributory. The detail of surface water and its analysis are given in detail in section 5.2.7

Hydrology: Lahore division is a part of Punjab Province of Pakistan. Geologically, this area is a part of lower Indus Basin. Two main rivers pass from Lahore Division, Ravi River and Sutlej River. The slope of the land in planned area is to the south-west, which directs the rivers to flow in this path. Average slope of the area is 0.32m/km. The following link canals pass through our study area, Bambanwala Ravi Bedian Link Canal, Qadirabad-Bulloki Link Canal, Balloki – Sulemanki Link, Lower Bāri Doāb Canal, Upper Chenab Canal and Lower Chenab Canal

In addition, the following hydraulic structures lie inside our study area, Balloki Barrage, BRB-Ravi Siphon. Furthermore, the planned areas have abundance of water in the form of groundwater aquifer. The aquifer of Lahore District is broadly viewed as a single contiguous, unconfined aquifer. The short term hydrology report is attached as Annex-

Air Quality: At present, major sources of air pollution are industrial and mobile sources. Other sources of ambient air pollution are the generators in industrial and commercial units for alternative power supply sources. The overall quality of ambient air at most of the location is good except particulate matter which is higher at road sides. All samples taken at road side have found high values of PM.

Noise Level: Number of sources of noise emission has been detected in the study area. These sources are vehicular traffic i, operation of industrial activities, operation of generators in commercial activities, operation of pumping & disposal stations

Noise levels were monitored at 08 locations in whole project boundary. The results shows that the noise levels on all major roads are much higher than NEQS but the noise levels are in compliance in villages and settlements

4.1. Natural and Biological Environment:

Flora and Fauna: The project sites had significantly higher biodiversity richness which was 101 species of fauna and 148 species of flora. Fauna includes 70 species of birds, 13 of mammals, 15 of reptiles and 3 of amphibians whereas there were 148 species of flora in the area. None of the native plant species are under threat as per IUCN Red list but they are under serious threat locally as they have been exterminated and replaced with other species. Same is the case with native fish species that suffer from decline due to over exploitation, water pollution and introduction of invasive species

Crops and Vegetables: A large number of vegetables are grown in the study area that includes Phool Gobhi/cauliflower (Brassica oleracea Ver. Botrytis), Band Gobhi (Brassica oleracea Ver. capitate) Turnip, Raddish (Raphanus sativus), Carrot (Daucus carota), Bhindi, Tomato (Lycopersicum esculentum), Vegetable Marrow (Cucurbita pepo), Baingan etc. Crops usually seeded in the area include Rice, Barley (Hordeum vulgare), Jawar (Andropogan sorghum), Maize and Sugarcane along with other fodder. Wheat crop was also identified.

4.2. Socio-Cultural Environment

Socio-economic features of project area that mainly focus on demography, occupation, education, housing, health, family income, basic amenities, land use, livestock, resettlement concerns, archaeology, shrines and mosques are presented in section 5.6. The field surveys conducted in the Project Area and data collected from the relevant agencies indicate that there is 1.2 million population in the project area with total built up area 62689.74 acres. 135 villages/towns have been identified in project area, out of which 16 villages/towns fall in Lahore District, 17 villages/towns fall in Tehsil Muridkey, Ferozewala and Sheikhupura of Sheikhupura

District, 9 villages/towns fall in District Nanakana Sahib and remaining 91 villages/towns fall in District Kasur

5. Impacts and Mitigation

5.1. Positive Impacts

The major positive impacts of the project include-:

- Sustainable use of available natural resources
- Improvement in infrastructure and utility services
- Improvement in health care, education, water supply and sewerage facilities
- Lesser the migration from small cities towards big city due to improved facilities
- Increase the employment rate with livelihood as it involves development of residential and industries areas, public administration, institutions and infrastructure facilities.
- Enhanced space for industrial sector and cluster of industry brings industrial symbiosis
- Increase in quality of life due to infrastructure and basic facilities.
- Scenic beauty of area due to increase in green spaces and public parks
- Positive impact on woman

5.2. Environmental Impacts during Planning Stage and Mitigation Measures

5.2.1. Environmental Impacts during Planning Stage

Ground Water

The sole supply of water to the Lahore Division depends upon the abstraction of groundwater. The rapid growth rate of population, progressive migration of people from the nearby areas towards the city and the establishment of numerous industries has resulted in rapid increase in water demand. Further increase in population uptill 2035 will result in decline in ground water aquifer with threat to deplete the ground water resource. In accordance with recent study the depletion rate of ground water for Lahore district is about 2.5-3.0 feet per year. Further proposed urbanization and industrialization has the tendency to reduce the ground water recharge, as a significant part of the land has become impermeable. The existence of saline groundwater in the nearby areas of Raiwind and Kasur, in the south of Lahore, is a potential threat to the aquifer under the Lahore city.

Surface Water Resources and Quality

Currently the entire wastewater from Lahore District is collected through a network of 14 main drains and discharged into the River Ravi without any treatment. The wastewater from Nankana, Shiekhpura and part of Kasur districts are also finally discharged in to the River Ravi. The waste water from southern part of Kasur district is discharge in to River Sutlej. This wastewater is being discharged into the rivers without any treatment and contains category of industrial, commercial and residential wastewater. Due to non-availability of fresh water in River Ravi, the river is converted in to sewage. With the potential to increase in population with development of residential areas, housing schemes and industrial areas in districts of Lahore division the pollution level and quantities of wastewater is likely to increase many folds which may have direct negative impact on our surface water resource and indirectly; on agriculture, ground water and human health.

Flood

The project sites include two rivers i.e. Ravi and Sutlej and number of canals and drains so there is chance of flood hazard to occur at the project sites. According to the PDMA-DRP, the River Ravi belongs to the category B flooding (medium Level Flood). In Sutlej river, most of the flow is yielded by heavy monsoon rains. Following settlements of project area have a potential risk of flooding in river Ravi for 100 years return period in accordance with short term hydrological study attached as Appendix III. The settlements include Bhai Pheru, Bucheki, Mandi Faizabad, Mor Khunda, and Syed Wala can subjected to flooding. The settlement Ferozwala is under potential threat of flooding due to Deg Nallah. The settlement Muredke is under potential threat of flooding due to Nikki Deg Drian The map of flood prone areas are attached as Annex III

Climate Change

Pakistan is rated among the top 10 most vulnerable countries to climate change. The major concerns of climate change in reference to our project site areas are given as under-;

- Increased variability of Monsoon;
- Projected recession of Glaciers threatening IRS Flows;

- Increased risks of Extreme Events (floods, droughts, cyclones, extreme high / low temperatures etc.);
- Severe water- and heat-stressed conditions in arid and semi-arid regions leading to reduced agricultural productivity;
- Increase in Deforestation; Loss of Biodiversity;
- Health Risks

The major extreme climatic events in reference to our project areas are given as under-:

- Isolated hailstorm in and around urban area of Lahore in 2011
- Urban Flooding in Lahore due to extreme rainfall of about 46.7 inches in 2013
- Localized Cloud Burst rains causing urban flooding in Lahore (1996)
- Large scale flooding in 1988 and 1992 in Lahore
- History's worst drought during 1999 – 2002 in Lahore
- Intense heat waves during 2003, 2005, 2007 and 2010 (53.7 °C) in Lahore

The climate change poses the serious threat in project areas if not mitigated or without an adaptive capability for the extreme climatic events.

Land Resources

The LDA will require land acquisition for widening and improvement of the existing roads, development of bypass roads for various existing town/villages etc, development of inter town and villages roads, development of new main roads, connecting roads, accessibility roads, sewerage systems including pumping stations, disposal stations, treatment plants, development of recreational areas, public utilities, buildings, administration buildings, toll stations and weighing stations

High Voltage Transmission Lines

The high voltage transmissions line are passing and planned to be passed from some of the project areas. These transmissions line if not been buffered have variety of health impacts on human. The short term health impacts include Headaches, Fatigue, Anxiety, Insomnia, Prickling and/or burning skin, Rashes and Muscle pain. The long term health impacts include risk of damaging DNA, risk of cancer, risk of leukemia, risk of neurodegenerative disease and risk of miscarria.

Transportation

The big Cities mainly depend on transport system for their economic survival and socio-environmental sustainability and the transport system has a direct impact on all sectors of an economy. At present many infrastructure facilities such as under passes, wide roads, bridges, signal free corridor etc. have been made in Lahore but increasing population with traffic volume rapidly overburden these facilities and vigorously worsen in future also. The situation will be in worst position if long-term planning of transportation in master plan has not been done. The major impact would be seen on our economy if high efficiency transport system will not be designed for Lahore division.

Solid Waste

Solid waste generation rate on average in Lahore City is approximately 0.85 kg per capita per day. Considering 50 Million population of Lahore Division, the total municipal solid waste will be generated 20,000 tons/day. Municipal solid waste produced from Lahore division if not managed properly, will cause aesthetic problems and also produce odor along with the spread of many diseases. Similarly, medical waste produced from medical facilities etc. if not properly managed and disposed, it can result in injury by contaminated sharp material and infection with Hepatitis B, C, and HIV etc.

5.2.2. Mitigation Measures during Planning Stage

Ground Water

- LDA through WASA should take measures to control demand by reducing per capita water availability by educating households to use water more wisely.
- For long-term sustainability of drinking water supplies, the possibility of supplementing groundwater supplies with surface water supplies should be explored, wherever possible. For Lahore division, provision of surface water supply from the River Ravi or BRBD, UCC, QB Link etc. canal system may be considered after addressing quality concerns.
- New housing societies should also be made aware of the problem and their groundwater extraction quota should be fixed based on specified per capita demand
- Use high efficiency irrigation for agriculture use such as use drip irrigation instead of flood irrigation
- To increase recharge to groundwater, rainwater harvesting should be encouraged in all new and old housing schemes and in areas proposed for

the residential and industrial use. For this purpose, special recharge zones may be developed to facilitate groundwater recharge

- In order to promote the culture of water conservation, a metering system should be introduced to charge water on a volumetric basis

Surface Water Resource and Quality

- Water quality challenges need to be addressed in an integrated manner and by adopting pollution prevention strategies by LDA along with other concerned agencies like EPA.
- Industries have to install wastewater treatment plant at source and should discharge the water that meets the NEQS. If possible the water should be recycled in to other processes or can be used for flushing and washing.
- Strict compliance is needed from enforcement agency like EPA on wastewater effluent NEQS from industries
- Wastewater treatment plant should have installed on all the outfalls that falls in to the river Ravi. For that recommendation of WWTP study for Ravi Riverfront Urban Development Project should be followed.
- Recommendations of River Ravi Commission should be followed, which include development of constructed wetlands on drains before discharge into the river Ravi and provision of septic tanks in new housings.

Flood

- Channelization and modification of river area from only where there is chance of flood hazard to occur.
- Develop large retention ponds in between river and flood prone identified areas. Water can be trapped in a retention pond and then released at a controlled discharge to prevent flooding.
- Dikes/Bund should be developed precise to the identified flood prone areas along the side of the rivers in order to prevent the flood.

Climate Change

Pakistan developed the Climate Change Policy and Framework in 2010 by Ministry of Climate Change. This policy and framework till yet not have been implemented and we have still face challenges of climate change. In order to effective mitigation and adaptation towards climate change, the Government has to implement the climate change policy and its framework at sectorial, institutional and departmental level on urgent basis.

Land Resources

The land acquisition should be done in accordance with the land acquisition act 1897 and its amendments. Compensation against land, structure, disturbance allowance should be provided to the affecties as per market price

High Voltage Transmission Lines

The National Transmission and Dispatch Company (NTDC) should share the plan with Lahore Development Authority (LDA) for new transmission lines that are proposed to pass from the project area. The LDA will mark the area in master plan and adequate buffer zone at least 50 meters will be provided.

The LDA should also mark the area of already existing transmission lines that are passing from the project area and adequate buffer zone along the transmission line should be provided.

Transportation

- The public transport should have been improved through inter and intra city mass transit that can be faster, cheaper, and more relaxing. It also helps minimize environmental damage caused by excessive car use.
- Private cars on road should be discouraged by increasing parking fee and vehicle tax on owners.
- Improve bicycle and pedestrian facilities and programs.

Solid Waste

- Currently in the City of Lahore LWMC is main responsible organization for management of solid waste. Its jurisdiction needs to be increased in adjoining area up to Lahore division Level and its coordination with local departments needs enhanced.
- Already landfill site present in Lahore at Mehmood Boti and one engineered landfill site is present at lakhodair. The LWMC has already suggested landfill sites and transfer stations in Lahore and Kasur region. The Landfill Sites for other districts such as Nankana and Shiekhpura should also be studied and develop and included in the master plan.
- The municipal waste should be managed in accordance with waste management hierarchy.
- Care must be taken as not to mix medical waste with municipal waste.
- Medical waste need to be segregated and collected in house in accordance with the Hospital Waste Management Rules, 2005. The collected waste should be given to LWMC for safe disposal in Landfill site after autoclaving.

Currently main disposal of hospital waste is through incineration which should be stopped as incineration is now least preferred technology for hospital waste management having problem of toxic air emissions.

5.3. Environmental Impacts during Development Stage and Mitigations

5.3.1. Environmental Impacts during Development Stage

Physical Environment

Major impacts on the physical environment include:

The contractors/LDA will require temporary acquisition of land for establishment of Contractor's camp and other facilities and disposal sites for safe disposal of surplus construction and excavated spoil material. It is obvious that rental/leasing of land for establishing of Contractor's facilities will change the local land use pattern. However, the change in land use will be temporary. Potential conflicts may emerge with the landowners regarding the restoration of temporarily acquired areas for establishing Contractor's facilities, particularly those for borrow and spoil disposal areas. Borrow pits and other landscape depressions, if left open, may prove hazardous to human beings, livestock and wildlife. Moreover rain water ponding in open pits can be a potential health hazard both for human beings and livestock due to the mosquito breeding and the pollution caused by stagnation of the water. Soil erosion may aggravate in the workshop areas as a result of improper runoff drawn from the equipment washing-yards and improper management of construction activities in hilly areas particularly in the vicinity of natural streams. Soil erosion may also occur during the excavation of for roads, sewerage and water supply lines in addition to quarry areas. The reduction in vegetative cover will reduce the binding capacity of the soil and increase its susceptibility to erosion by the force of rainfall. Land may be contaminated by the spillage of chemicals like fuels, solvents, oils, paints and other construction chemicals and concrete.

Surface water resources may be contaminated by the spillage of fuel and chemicals or by dumping of waste material and effluents generated by the kitchens and toilets at the construction campsites. River, canals and nullahs may be contaminated with chemicals, oil, lubricants, detergents, etc. through runoff from the construction area, construction camp and equipment washing-yards.

Solid and liquid waste will be generated from construction camps and from construction activities if not managed, it will pose threat to environment. If the waste is allowed to be disposed in rivers/nullahs as well as on open areas, it will not only cause litter and ast;hetic issues but will also cause contamination.

Due to the construction activities like excavation, clearing, leveling and compaction with the use of machinery like batching plants, excavators, dump truck, Road Rollers, Graders, Haul Trucks, cranes and other transport vehicles etc. Most of these are using diesel engines that generate noise and exhaust emissions. Generally, the above activity is generating particulate- matter (PM_{10}), smoke, dust, CO and NOx in the ambient air, which is deteriorating the air quality and resulting in impacts on human health, fauna and flora.

During the implementation of the project a large amount of equipment and construction plant will be utilized for construction of the works. The equipment would include bulldozers, scrapers, excavators, compactors, trucks, large capacity dumpers, graders, heavy duty cranes, concrete batching plants and stone crushers. The operation and movement of such equipment will increase the noise and vibration in the Project Area. The impact will be significant when compared to the without project situation.

Ecological Environment

The main negative impacts expected from the implementation and construction of this Master plan are; loss of agricultural land, loss of biodiversity, habitat loss and fragmentation, water, noise, air and light pollutions and change in groundwater recharge capacity. The detail Summary on Ecological Environment is given in Ecological Study attached as Appendix I

Socio-Cultural Environment

Residential/ agricultural and commercial land may need to be acquired to accommodate the proposed facilities. Similarly, some households may lose their commercial and residential structures, and Government/public sector infrastructure may be disrupted. Various religious and cultural properties like mosques and graveyards by individuals may get disrupted and few parts of the selected sites. During the construction stage, noise and dust problems will affect the health of

locals. Similarly, general mobility of the locals will be disturbed during this stage of the project. During the construction stage, squatters living along the nullah side and roads may be affected. In this way, the business of the squatters will suffer. Agricultural land, which is the main source of income of the people belonging to the proposed areas, will be affected during the construction stage. Fire hazards may increase in shopping complexes and parking areas. The arrival of affectees of different projects under development plan to the proposed areas may create a positive impact on the local business. However, this may become a threat to the available natural resources including water, fire wood, etc.

Noise generated by the construction machinery during the construction of roads and bridges is likely to affect the Project Area particularly the sensitive receptors like schools, hospitals, nearby community. Particular impact is envisaged on the community residing along the roads, which are either being widened or newly proposed.

There are number of large scale orchards in the area and fruit trees are grown by the people in large numbers along their agricultural fields. Therefore, the impact on horticulture during construction phase will be significant.

Induction of a foreign Contractor may cause cultural issues with the local community due to the unawareness of the local social norms and values. Similarly, the induction of outside labor during construction activities may create social problems like social movements, protests in the form of processions, etc.

As the Project activities are being carried out within the residential/agricultural/commercial areas of the local community, as a result of it, women activities in the field may be affected during the construction stage particularly in case of semi urban and rural areas.

The induction of outside Contractor labour may create social and gender issues due to the unawareness of local customs and norms. It may also cause hindrance to the mobility of the local women. However, due to this increase in land will shift the trend of the local from agriculture farming to selling of land for residential and commercial purpose.

5.3.2. Mitigation Measures during Development Stage

Physical Environment

Land required for establishing contractor's facilities including borrowing earth material (if required) and dumping excess spoil will be leased directly from private landowners by the Contractor. Rental terms will have to be negotiated to the satisfaction of the landowners concerned. Supervisory Consultants will monitor the process of restoration and ensure, through the terms of the construction contracts, that landowners are compensated according to the terms of the lease agreements, and the restoration actions agreed upon by the Contractors are duly carried out. The photo-documentation of the existing land prior to temporary acquisition should also be available, which will be beneficial to resolve the restoration conflicts between the landowners and contractor. Construction camps and workshop will be located at a minimum distance of 250 m from the existing plantations and settlements, etc. This limit will be 500 m in case of batching plant. As far as possible, waste land or barren land i.e. areas not under agricultural, residential or forestation will be used for borrow material (if required) and setting up Project facilities. Good engineering practices will help in controlling the soil erosion both at construction sites and in peripheral areas, particularly in borrow and dumping areas and along the haul tracks. The Contractor will be required to train its workforce in the storage and handling of materials like furnace oil, diesel, petrol and chemicals, etc., that can potentially cause soil contamination. The Contractor will be required to prepare training manual and module for all the construction related activities along with the schedule of training program and submit to the supervisory consultants for approval. Soil contamination by asphalt and other obnoxious materials will be minimized by placing all the containers in caissons or dumped into pits lined with impervious liners to avoid contamination of soils/groundwater from leachates. Proper drainage facility will be provided at the camp areas to avoid the water accumulation, which will minimize the soil contamination. Proper solid waste management plan should be developed by the Contractor and implemented to avoid the litter and any other waste problems. Adequate number of solid waste containers should be placed within the camp area and surroundings to ease in storage and collection/disposal of solid waste.

Availability of water for campsite facilities and construction purposes will be ensured by the Contractor prior to the start of construction activities. The Contractor will seek

approval from the PMU and LDA/Local departments for use of the water resources for construction purposes. The Contractor will prepare guidelines for the workers for minimizing the wastage of water during the construction activities and at campsites. Construction camps will be established in the area with adequate natural drainage channels in order to facilitate flow of the treated effluents. The wastewater effluent from the Contractor's workshops and equipment washing-yards will be passed through gravel/sand beds to remove oil/grease contaminants before discharging it into surface water sources. Similarly, the wastewater effluent from the campsite will be treated before its disposal into the surface water sources. A proper solid waste management plan (including storage, collection, transportation and disposal) should be developed to avoid contamination of the surface water resources. Batching plants should be placed at least 1 KM from any surface water body present in the project site. Water reuse and recycling strategy should be adopted on all batching plants. During the construction activities it should be ensured that the paint or other lubricants should not spilled into water channels.

A solid waste management plan should be made the responsibility of the construction contractor to provide for the designation of appropriate waste storage area on the site and a schedule for the timely collection and removal of construction debris to an approved dump site. The organic waste produced during site clearing should be mechanically mulched and composted at the site and used for landscaping. Providing adequate number of camps/restrooms for the workmen and waste baskets and dumpsters is essential to keep the construction site clean and pest free. Contractor should instruct his work force not to throw solid waste here and there, and common storage points should be made by the Contractor from where at the end of the day contractor should transport the whole day's solid waste to designated disposal site.

Asphalt plants should be located at least 500 m downwind from the populated areas, wildlife habitats, and Contractors' camps, to minimize the impact of emissions. Asphalt and concrete batching plants should be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce the level of particulate emissions. Vehicles and other construction machinery should be properly tuned and maintained, to avoid hazardous level of emissions. Where dust emissions are high,

these will be reduced by a regular sprinkling of water for keeping the dust settled, at least twice a day. In order to prevent environmental pollution, haul-trucks carrying, earth, sand, aggregate and other materials will be kept covered with tarpaulin to help contain the construction materials being transported within the body of each carrier between the sites.

LDA in consultation with other concerned departments such as EPA, Punjab will set up a system to monitor the noise levels in the Project Area near the construction activities. For the construction machinery generating noise level in excess of that prescribed in NEQS and WHO limits, Contractor will make arrangements to bring the noise level within applicable limits (including proper tuning of vehicles and mufflers/silencers). Movements of the trucks and other construction machinery causing high noise levels must be restricted at night time to avoid disturbance to the nearby locality. Truck drivers should be instructed not to play loud music at night and stop use of horn. Proper noise barrier boundary walls will be built on asphalt/ concrete plants which come close to any locality. To protect sensitive receptors including schools and hospitals from noise, thick tree plantation will be carried out towards the roadside, where there is enough space available between the boundaries of schools and roads.

Ecological Environment

Negative impacts on ecological environmental due to development of master plan can be mitigated by; minimizing biodiversity loss by developing Green Infrastructure, restoration of native vegetation on railroad and roadside verges and river and canal banks, Identification and conservation of areas important for priority animal species, planning for nature conservation through the restoration of ecological networks, urban agriculture and kitchen gardening. The detail summary of mitigation of negative impacts on ecological environment is given in Appendix I

Socio-Cultural Environment

Effective construction controls should be used by the Contractor to avoid inconvenience to the locals due to noise, smoke and fugitive dust. Proper arrangements in the form of alternative routes should be made to ensure that the mobility of locals should not be disturbed. After consultation with the traffic police, a proper traffic management plan should be prepared by the Contractor for mainroads

specifically in order to avoid accidents. The Contractor will take due care related to the disposal of construction materials as well as solid waste disposal from the site, so that the nearby communities will not suffer. The Contractor will take care of the local communities water sources so that these should not be contaminated or destroyed. Safety lookouts should be built to prevent people and vehicles from passing at the time of heavy equipment operation area. Haul-trucks carrying concrete, aggregate and sand fill materials will be kept covered with tarpaulin to help contain construction materials being transported between the sites. In construction camps, amenities of life including clean food, water and sanitation facilities should be provided to these camps. The Contractor should arrange first aid boxes at camps. During the construction, accessibility of vehicles to the workshops should be ensured so that the business of shopkeepers will not be disturbed. Construction activities should be carried out during the night time, as most of the markets are closed at sunset. Affectees along with their children losing their agricultural land should be given employment opportunities on preferential basis during the construction stage. Similarly, in order to restore the livelihood of the people belonging to business and agriculture residing in nearby areas a proposed site for Truck Stand should be given labour opportunities during the construction stage. The main historical sites like shrines should be avoided from damage by the widening of roads. Similarly, by adopting protection measures, during construction, any negative impacts on cultural and historical sites may be minimized. In this regard, it is recommended that the Contractor should prepare a site specific management plan to avoid any damage to the sites. The Contractor will warn the workers not to indulge in any theft activities and if anyone would get involved in such type of activities, he will have to pay penalty and would be handed over to the police. Similarly, at the time of employing, the Contractor has to take care that the workers should be of good repute. The Contractor's camp will be properly fenced and the main gate will be locked at night with a security guard to check prevent the theft issues from the community side. To avoid the cultural issues, the Contractor will facilitate the local labor during the construction activities. The Contractor will have to select the specific timings for the construction activities so as to cause least disturbance to the local population, particularly women, considering their peak movement hours. The Contractor will take due care of the local community and the sensitivity towards the local customs and

traditions will be encouraged. The Contractor will warn the staff strictly not to indulge in any un-ethical activities and to obey the local norms and cultural restrictions particularly with reference to women.

5.4. Environmental Impacts Resulting From Project Operation and Mitigations

5.4.1. Environmental Impacts from Project Operation

Physical Environment

Due to the development of residential schemes and societies with same level of standards and facilities like Lahore city the urbanization load on the city will be relieved. This will lead to the new opportunities for the commercial areas. The commercial markets will also develop which will share pressure on the existing overloaded commercial market and areas in the city. Due to the operation of the proposed roads and bridges along with extensions of the old ones will reduce the vehicular load in the city and generally traffic conditions will get improve during the operation stage. Due to the improved traffic conditions there will be a remarkable reduction in traffic hazards. If cross-drainage structures are not adequately maintained and cleaned, natural nullahs tend to become choked with debris and eroded soil, adversely affecting the quality of the surface water in the Project Area. The implementation of the proposed Master Plan land values will increase considerable on proportional basis. The lands which are located near to the proposed residential areas especially commercial sides will increase considerably. This will be positive impact on the land owners. However, due to this increase in land will shift the trend of the local from agriculture farming to selling of land for residential and commercial purpose. The noise pollution will be lesser than the construction phase. However, it will definitely be more than the pre-construction stage on account of the increase in traffic on the newly constructed and widened roads. However, it is expected that the resultant sound level will remain well within the NEQS limits. Due to the operation of the parks and playgrounds, recreational activities among the locals will increase. Operation of the bus terminals will help in the reduction of the vehicular load in the city and overcome the haphazard condition in the old bus terminals. Due to the construction of intercity bus terminals at the new locations, traffic load in the city will be reduced to a large extent. During operation stage about

2500 cusec of wastewater will be generated from Lahore Division. This waste water poses the threat to fresh water resource especially to River Ravi if not been treated. Additionally it may deteriorate quality of downstream and may also be threat to the local flora and fauna.

Ecological Environment

During operational phase the ecological impacts include urban development on biodiversity, Change in land use pattern, Habitat degradation due to higher pollutants, Habitat Fragmentation, Bird Collisions and strikes and Change in groundwater recharge capacity.

Socio-Cultural Environment

Increased number of planned residential areas will be a positive impact regarding the local business of the shopkeepers, tourist guides, hotels and food stalls. However, this increased number of visitors may become a threat to the available natural resources. This may also create uneasiness for the locals. Noise generated by the vehicles will further increase, which will disturb the local communities, school staff and students, etc. existing near the roads. Health problems on account of air pollution may increase in the operation stage of the Project. There will be risk of fire hazard on shopping plazas, bus terminals etc. Health issues may generate due to the improper cleanliness of toilets at bus terminals, shopping complexes, public parks and play grounds.

5.4.2. Mitigation Measures during Operational Stage

Physical Environment

- For the air and noise quality, a monitoring system will be established by LDA/PMU and EPA to ensure that ambient air and noise levels are within the permissible limits. To reduce the noise levels, if deemed necessary, provision of thick tree plantation, noise barriers and double glazed windows will be assessed as per site conditions for the sensitive receptors including schools and hospitals. For the liquid waste problem, wastewater treatment plant(s) should be constructed and before the disposal of wastewater into the surface water body. In order to retrieve the aesthetic view of the area, sufficient additional plantation of different trees will be carried out. In order to avoid the soil contamination, a fully paved area should be designated for the

vehicles maintenance in each bus terminal/truck stand. Solid waste from the incinerator, slaughter house, Mutton and fish market should be collected properly and disposed of after proper recycling. It will be ensured by the road/Highway Department that storm water drains and road drainage system are periodically cleared to maintain the water flow.

Ecological Environment

To mitigate the operational impacts and for restoration of natural features; strategies and implementation plan should be adopted fallowed as

- Use of native species
- EIA of all new developments
- Groundwater recharge
- Rain water harvesting
- Pollution control by following NEQS
- Solid waste management
- Wastewater treatment plants
- Urban agriculture and kitchen gardening
- Farm mechanization for increased agricultural productivity
- Tunnel Farming
- Green roofs and walls
- Policy Framework for green infrastructure
- Biotope/habitat opportunity mapping and making ecological action plans for individual cities.

Socio-Cultural Environment

In order to solve the accident problems, speed limit, sign boards and speed breakers should be provided on roads. The visitors should be briefed about not damaging/degrading the natural resources. Traffic police should ensure that the vehicles are properly tuned up to minimize the air and noise pollution. Firefighting arrangements should be provided in the operation stage for the shopping complexes and parking plazas, and bus terminals, etc. Proper arrangement for the cleanliness of the toilets and waiting rooms should be provided for the passengers at bus terminals.

6. Environmental Management and Monitoring Plan (EMMP)

- In order to counter the significant negative impacts, a detailed EMMP has been developed that includes the proposed mitigation measures against the potential adverse impacts along with defining the roles and responsibilities of each organization for management and monitoring of impacts. The EMMP also outlines the monitoring requirements for compliance and effects monitoring of the Project, communication and documentation, site restoration and necessary training of the staff required. If this EMMP is strictly enforced during each stage of the Project, the level of negative impacts will be minimized or made negligible and positive impacts will be enhanced.

- It is recommended that mitigation measures proposed in impacts and mitigation chapter and EMMP should be adequately implemented at design, construction and operation stages.

7. Stake Holders Consultation

Stakeholder's consultation was done in order to have their view point about the project. Twentyfive (25) comprehensive consultations including scoping sessions and focus group discussions were held. In addition, a few consultations were also held in the form of detailed interviews of individuals including men and women at project area. The different stakeholders which are identified for the project includes Water and Sanitation Agency (WASA), Forest Department, River Ravi Commission, World Wildlife Fund (WWF), Lahore Waste Management Company (LWMC), Parks and Horticulture Authority (PHA), Lahore Chamber of Commerce, Urban Unit Punjab, Community residing in towns of Project Area, Industries and Small industrial Associations in Project Area. The detail concerns of stakeholders are given in Chapter- 8

8. Conclusion and Recommendation

The implementation of the proposed master plan project has overall positive impacts during operational stage (after development) both to community and country as well. By the development and implementation of the update IMP for the Lahore division,

though there will be a relief for availability of planned facilities to the locals. The project is very much needed in order to have orderly future urban growth which will reduce pressure on our natural resources. Planed urban development has variety of positive impacts including intact natural resource with urban development, Public utilities and infrastructure facilities at their own places rather coming towards main district (Lahore), enhanced green areas through housing and building control guidelines, aesthetic uplifting, improved industrial sector and non-quantifiable socio economic benefits.

There are some negative impacts during planning, construction-implementation and operational phase of the project which can be mitigated as suggested in the report and overall positive impacts overweigh these negative impacts.

Master Plan should check trends based on the past and present practices and should device strong legislation for the implementation of the proposed land uses in the Master Plan. In this regards, recommendation for the ineffective implementation of the previous IMPL should be kept in the mind

After the detail environmental assessment, it is concluded that the project is environmentally feasible at proposed site only if the mitigation measures suggested in this EIA report are adopted during planning, construction and operational stages of the project. The mitigations suggested in the report are sufficient to successfully complete and run the project in an environment friendly manner.

Further, the key studies which need to be carried out at planning level and on later stages are given as under-:

- Climate Change Vulnerability Assessment
- Ground Water Quality and Aquifer Assessment
- Surface water Quality Assessment and its use
- Hydrological Study and Modeling of River Ravi
- Rainwater harvesting potential and implementation
- Detail Socio- Economic Study of Project Areas
- Social Impact Assessment

- Transportation and Modeling Study
- Action Areas Plans and Subject Plans for each sector of development should also be prepared.

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CHAPTER 1

INTRODUCTION

Subjective to the extension of Lahore Development Authority with its jurisdiction expanded to the scope of Lahore Division, the Authority has decided to prepare a comprehensive Master Plan for the whole Lahore Division which is hereinafter referred to as “the Project Area”. The Project site is geographically located between 30°38’31.93”E to 32°03’37.99” and 73°17’37.86” to 74°42’05.83”. The site is surrounded by the India in east, Gujranwala in the north, Faisalabad in the west and Sahiwal & Pakpattan in the south. The project site is accessible through all major roads like Grand Trunk Road, Ring Road Multan Road, Ferozpur Road, Lahore-Sheikhupura Road and Motorway-M2.

Lahore Development Authority (LDA), Government of the Punjab, has designated its Metropolitan Planning Wing with the task of preparation of this Master Plan for future 20 years i.e. till year 2035. For this purpose, Environmental Impact Assessment (EIA) study has been prepared in accordance with the TOR’S given and as integral part for land use planning.

1.1. PROJECT DETAIL & BACK GROUND OF PROJECT

Lahore has a very unique and back dating history. The very first structure in this region is the “Baradari of Kamran Mirza” which was built by the brother of Mughal Emperor Humayun in 16th century across the river Ravi. At that time, whole of the sub-continent was controlled by a central government housed in Delhi, which decided to build a fort near River Ravi, called the Lahore Fort. In addition, a walled city was also developed around the fort to house the people who moved here and resided from then on.

As the time passed on, the Walled City of Lahore Fort started growing and spread out of walls of the city, and as we know of it now, is the second largest megalopolis city of Pakistan and is provincial capital for Punjab Province. It had housed 5.143 million people as per 1998 census but its population has grown to some 9 million at present, and Lahore is now considered to be one of the 35 largest cities of the world. Lahore is not only a megalopolis city of Pakistan rather it serves as an economic hub for the whole region. It supports the economy of the region with an annual GDP of $40 billion (as of 2008). The contribution of Lahore to the national economy is supposed to be around 13.2% and Lahore's GDP is projected to be $102 billion by the year 2025, with a slightly higher growth rate of 5.6% per annum, as compared to Karachi's 5.5%. In addition to its economic contributions, Lahore also serves as a service hub for whole of the Punjab. It possesses the finest health facilities, educational institutions, commercial centers, employment opportunities, industrial areas, etc. in the whole province and enjoys the privilege of being the supreme city in the whole region.

Despite the fact that Lahore owns innumerous pull factors to attract people from all over the country, it yet suffers lack of proper planning for sustainable future. An overview of the current development situation draws attention of every citizen to ponder upon where the city is going to be. Lahore Division is located at heart of Punjab province covering an area of about 14,687sq.km and serves as a service hub for whole province but the development in this region, has taken an unforeseen and unanticipated direction which is leading to exploitation of resources, and residents are suffering from lack of basic services in some areas, which a metropolitan city and neighboring units must have.

Before year 1975, Lahore Improvement Trust (LIT) was working for betterment of the city which was later on reformed as Lahore Development Authority (LDA) under the Lahore Development Authority Act, 1975. Both the LIT and the LDA were & are entrusted with the task to prepare and implement a Master Plan for the area under jurisdiction, and lead the region towards sustainable development. In 1966, the first master plan for Lahore was prepared which was named as “Master Plan for Greater Lahore, 1961” which guided the development of Lahore until 1980 when the second plan called the “Lahore Urban Development & Traffic Study, 1980” was prepared and

acted as a structure plan for Lahore for more than 10 years. Subsequently, other plans including the “Transportation Study of Lahore, 1991”, “Integrated Master Plan for Lahore, 2004”, and “Lahore Urban Transport Master Plan, 2012”. In addition, multiple Outline Development Plans (ODPs) were also prepared which were & are supposed to guide the development of smaller urban settlements in the Lahore Division.

Out of the aforementioned master/ development plans, Integrated Master Plan for Lahore (IMPL)-2021 and Lahore Urban Transport Master Plan, 2012, along with some of the ODPs are still in force which are being used to achieve the targeted future for Lahore Division. A glimpse over the current development situation of the region shows that, to some extent, the currently inforce plans have however, failed to cope up with the development needs of the region. Moreover, the enforcement agencies had also not been able to implement the said plans, and Lahore has now taken an unforeseen geographical shape. Lahore was expected to grow towards the southern direction (between Multan Road and Ferozpur Road) uptill Raiwind, and the area beyond Ferozpur Road in the east was declared as Agriculture Area, and development was prohibited in this direction. However, in contradiction to the anticipation of these plans, more urban growth has been observed in the eastern direction across Ferozpur Road (in frozen/ prohibited area) during recent years.

Furthermore, it is also worth mentioning that Lahore’s development is also restricted by River Ravi in north & west and BRB Canal in the east, which clearly suggests that Lahore cannot grow beyond these limits until & unless such necessary measures are taken to project development beyond these barriers. Moreover, due to the pull factors of Lahore city, smaller urban settlements in surrounding areas are not finding enough room for development as sustainable urban areas.

In light of the above referred grim situation, the Lahore Development Authority (LDA) has decided to prepare an amendment in master plan for the whole Lahore Division instead of just the Metropolitan Area. This plan is supposed to guide the future development of all the urban area falling under the Lahore Division for future 20 years i.e. till year 2035 and objectives of this Master Plan are;

- Future Development – To Guide the development of Lahore Region (Lahore Division) for future 20 years
- Integration – All parts of the region to be integrated by making them self-sufficient in future development
- Quality Living – To provide the residents with adequate quality of life and hygienic environment
- Sustainability – To ensure resource optimization and preserve options for future generations along with developments

1.2. NEED FOR THE ENVIRONMENTAL ASSESSMENT

The preparation and submission of an Environmental Impact Assessment (EIA) report for any development project is a statutory obligation under Punjab Environmental Protection Act, 1997 (PEPA, 1997) amended in 2012 in terms of Section 12 of the Act which states as under:

No proponent of a project shall commence construction or operation unless he has filed with the Provincial Agency, an initial environmental examination or where the project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the Provincial Agency approval in respect thereof.

The current Project falls under Schedule- II section H of subsection 1 (Land use studies and urban plans-large cities) of IEE/EIA Regulation as per section 12 of Environmental Protection Act and thus requires Environmental Impact Assessment-EIA.

The Environmental Impact Assessment has been prepared during entire master planning stage in order to obtain Environmental Approval /NOC from Environmental Protection Agency EPA-Punjab. In accordance with the Punjab Environmental Protection Act, distinct Environmental Impact Assessment and subsequent NOC approval will be required for owners during construction stage of each of the project such as roads, housings and industries etc. in accordance with the master plan.

It is worth mentioning here that for such master planning projects, the international practices for conducting environmental assessments suggest that a Strategic

Environmental Assessment (SEA) Study should be carried out for the Amendment in the Master Plan for Lahore Division. For this purpose, the Framework/ Guidelines for preparation of a Strategic Environmental Assessment (SEA) for this project have been laid out at Appendix-IV.

1.3. PURPOSE OF THE STUDY

The purpose of the EIA study is to identify the possible beneficial and adverse environmental impacts during the project planning and implementation as presently envisaged and propose the applicable mitigation measures to be implemented in order to minimize the negative impacts and preparation of Environmental Management Plan (EMP).

This EIA report has been prepared keeping in view the following regulations and guidelines:

- Pakistan Environmental Protection Act (PEPA), 1997.
- Pakistan Environmental Protection Agency Regulations, 2000 for review of IEE and EIA.
- Pakistan Environmental Impact Assessment procedures, 2000.

1.4. OBJECTIVES OF EIA STUDY

The EIA document is intended to provide the decision-makers and all stakeholders with an understanding of the impacts during implementation of Lahore division master plan. The assessment includes suggested efforts to avoid or minimize the adverse effects and methods to enhance the positive effects.

The objectives of the EIA study are as follows:

- Investigate and record the existing social, economic, and environmental conditions that correspond to the proposed location of the project prior to the implementation.
- Describe the different aspects of the proposed project including the ground water aquifer assessment, storm water drainage, flood prone areas, wastewater collection and treatment, solid waste management, power supply, access and internal road network.

- Define and assess the potential beneficial and adverse impacts resulting from the project.
- Propose mitigation measures in order to minimize the adverse effects and enhance the beneficial effects.
- Prepare an Environmental Management and Monitoring Plan (EMMP) for the project.

1.5. APPROACH ADOPTED TO CONDUCT THE STUDY

Following approach and methodology has been adopted for conducting the EIA studies:

1.5.1. Review of Available Data

A detailed review of the following available documents of the project was conducted:

- TOR'S.
- Detail Maps of the Project Sites
- Integrated Master Plan Lahore 2021
- Outline Development Plans
- Site Details
- Existing Situation and Proposed Plans

The basic objective of the review was to fully understand the Project and the extent of the developmental activities. The review of studies helped to assess the nature and extent of the impacts related to the planning and implementation of the proposed project activities.

1.5.2. Delineation of Area of Project Influence or Study Area

Before proceeding to the environmental analysis of the project, it is imperative to delineate the area of project influence. The project planning as well as implementation may have a variety of direct and indirect impacts on the physical, ecological and human resources of the Project Area and its surroundings. Even the direct impacts may be of primary or secondary nature. Strictly speaking, the primary impacts are directly related to the circumstances where land is to be acquired and

the people are affected in so far as their physical displacement or relocation is involved. Likewise, removal of vegetation cover during implementation of the project may also be considered as a primary impact. On the other hand, secondary impacts entail the direct impacts on physical, ecological and human resources arising from the pollution caused by noise, vibrations, toxic emissions, spill overs, fugitive dust, or consumption of natural resources, etc. As Lahore division is not planned, therefore, the environmental impacts due to the land use conflicts are also significant. This aspect has also been kept in mind while delineating the study area. The whole Study Area Map in figure 1.1 for reference.

1.5.3. Environmental Baseline Survey of the Project

Prior to the start of the baseline environmental survey, a checklist was developed. The major items, which were considered for physical, ecological and social environment, are discussed in the subsequent paragraphs.

1.5.3.1. PHYSICAL ENVIRONMENT

For collecting information on the physical environment, the following main parameters were considered:

a. Land Resources (that includes land use, soil composition, topography, geology, contamination of soil and soil erosion, etc.)

b. Water Resources (that includes sub-surface and surface water and ground water etc)

c. Climate (including temperature, rainfall, humidity, wind direction, etc.), Ambient Air and Noise Quality

d. Existing solid waste and waste water management and effluents disposal practices and storm water drainage

e. Other infrastructure (public and private)

To record the baseline conditions of the ambient air quality, noise levels, ground water, stack emissions from industries and sewage water, Environmental monitoring at different sites in the project area was carried out form EPA certified Third party

Environmental Laboratory The map of Environmental Monitoring showing sampling points at different locations of the proposed master plan is attached as Annex- I

1.5.3.2. ECOLOGICAL ENVIRONMENT

Under the ecological environment, the following main parameters were covered:

a. Flora (including vegetation cover of Project Area, trees, shrubs and grasses, and their loss due to implementation of the project, etc.)

b. Fauna (including wildlife, avifauna, domestic animals, etc.)

c. Reserved Forests and Wildlife Sanctuaries in Project Area or its vicinity

d. Migratory birds (if any)

e. Endangered Species (both flora and fauna)

1.5.3.3. SOCIAL AND CULTURAL ENVIRONMENT

To assess the social and cultural baseline settings of the Study Area, social survey was carried out to accomplish the following specific objectives:

a. To establish the socio-economic conditions.

b. To identify the potential disruption of private infrastructure (if any)

c. To identify poor and vulnerable groups and strategies to ensure that such groups should get benefit from the Project.

d. To ensure adequate public/stakeholder consultations and their participation.

e. To identify the effects on available common resources of the community due to the implementation of the Project.

1.5.4. PUBLIC AND STAKEHOLDERS CONSULTATION

In addition to recording the baseline conditions of the Project Area and awareness about the project, public and stakeholders consultations were also carried out including potential Project Affected Persons (PAPs); general population residing in the Project Area; World Wild Life Fund (WWF), Environmental Protection Department, Punjab, International Union for Conservation of Nature, Lahore

Conservation Society, Civil Society, Lahore Waste Management Company, Water and Sanitation Agency (WASA) and Local NGOS etc.

1.5.5. Analysis of Data

After collection of the physical, ecological and social environmental and social data from both primary and secondary sources; a critical analysis was made to assess the existing baseline conditions and potential impacts.

1.5.6. Screening of Potential Environmental Impacts and Mitigation Measures

After thorough review of the field notes, collected data, extent of the proposed project activities and detailed discussions with the stakeholders, the potential impacts during planning and implementation stage of Project were assessed. Further measures were proposed to mitigate the negative impacts and to enhance the positive impacts. The potential impacts and mitigation measures were assessed covering the following parameters:

- Environmental problems due to the Project location (i.e. location of different components of the Project)
- Environmental problems related to design
- Environmental problems associated with the construction stage
- Environmental problems resulting from Project operation stage

1.5.7. Preparation of Environmental Management Plan (EMP)

An EMP depicting the mitigation measures and monitoring plan has also been developed. Institutional capacity building of the Client has also been reviewed and enhancement was proposed for the effective implementation of the EMP.

1.6. STRUCTURE OF THE REPORT

This document is structured as follow:

Chapter 1 provides an introduction to the report and project; Chapter 2 describes the legislative and policy framework governing the project; Chapter 3 provides an overall description of the project; Chapter 4 gives analyses of the various alternatives

considered; Chapter 5 provides general environmental and social baseline conditions of the project, Chapter 6 assesses the overall environmental impacts of the project and recommends appropriate mitigation measures, Chapter 7 provides an EMP, DMP and institutional arrangements Chapter 8 presents the concerns of major stakeholders, Chapter 9 presents conclusions and recommendations.

Appendix-I contains Ecological Study Appendix II contains Environmental Monitoring conducted by 3rd party Environmental Laboratory, Appendix III is the Short term Hydrological Study

Annexure-I contains map for Landfill sites, Annex II contains biodiversity map, AnnexIII is the map for flood prone areas, Annex IV map for Environmental Monitoring Locations, Annex V Photo log of Project Site, and Annex VI contains Environmental Social Baseline Survey Data Sheet.

1.7. EIA STUDY TEAM

A team of experienced professionals drawn from various disciplines and having relevant experience of conducting Environmental and Social assessments participates in the preparation of an Environmental Impact Assessment Report. The study team collaborated during a comprehensive survey of the project site discussions with the proponents and stakeholder's, collection and analysis of data, conducting surveys and spot analysis and preparation of the report in consultation with specialists. Services of other experts were also availed on need basis and a researcher compiled secondary physical and socio-economic data of the project area. This Environmental Impact Assessment has been prepared by the following core team:

Table 1 .1 EIA Study Team

Sr. No.	Name	Position Held	Qualifications
1	Aleem Butt	Environmental Team Leader- EIA	M.phil Environmental Sciences (GCU), M.Sc Environmental Sciences (PU), NEBOSH, Lead Auditor
2	Mr. Schrique	Principle Environmentalist	MSc Environmental Engineering, B.Sc Civil Engineering, M.Sc Software Engineering

Sr. No.	Name	Position Held	Qualifications
3	Dr. Faiza Sharif	Senior Ecologist	Phd (Conservation Biology) GC University Lahore
4	Dr. Saleem	Hydrology/ Hydraulic Specialist	Phd (Water Resources Engineering)
5	Mr. Umar Hayar	EIA Specialist	M. Phil. Environmental Science (GCU Lahore).
6	Mr. Rashid Mahmood	Botanist	M. Phil. Botany (GCU Lahore), PhD Scholar Environmental Science (GCU Lahore)
7	Ms. Sumbal Nazir	Zoologist	M. Phil. Zoology (GCU Lahore), PhD Scholar Environmental Science (GCU Lahore)
8	Muhammad Asif	Development Scientist	M.Sc Development Sciences PU Lahore
9	Muhammad Habib Ahmad	Social Scientist	M.Sc Sociology PU
10	Moaz Shakoor	Assistant Environment	(BBA Hons) University of Lahore

CHAPTER 2

POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

2.1. GENERAL

This Chapter provides an overview of the official policy framework and legislation that apply for controlling the environmental consequences of the Project implementation and operation. The Project is expected to comply with all the legislation related to the environmental aspects in vogue in Pakistan.

2.2. NATIONAL POLICY FRAMEWORK

Following elements of national policy framework are the most relevant to this project:

2.2.1. Pakistan Environment Protection Act, 1997

The PEPA provides for the protection, conservation, rehabilitation and improvement of the environment, for prevention and control of pollution, and for the promotion of sustainable development. It expanded on the environmental matters covered in the earlier Pakistan Environment Protection Ordinance, 1983.

The PEPA envisages a Pakistan Environment Protection Council (PEPC) to be the supreme policy-making body, supported by the Pakistan Environment Protection Agency ("Pak-EPA") and Provincial Environment Protection Agencies ("Provincial EPAs"). The PEPC is mandated to approve national environmental policies within the framework of a national conservation strategy as may be approved by the Federal Government from time to time. The Pak-EPA and Provincial EPAs are established to enforce National Environmental Quality Standards ("NEQS") approved by the PEPC as well as empowered to carry out their functions under the Act. Provincial Sustainable Development Funds have been established to provide financial assistance to suitable projects. Discharges or emissions in excess of the NEQS established by the PEPC or other standards established by the PEPA have been prohibited. The Federal Government has been empowered to levy a pollution

charge on persons not complying with the NEQS. A two-stage environmental screening process has been introduced for proposed projects involving the filing of either an Initial Environmental Examination ("IEE") or, for projects likely to cause an adverse environmental effect, a comprehensive Environment Impact Assessment ("EIA").

Import of hazardous waste has been prohibited. Handling of hazardous substances has been prohibited except under license. To ensure compliance with the NEQS, the PEPA and Provincial EPAs have been empowered to direct that motor vehicles shall install such pollution control devices or use such fuels or undergo such maintenance or testing as may be prescribed. The PEPA and Provincial EPAs have been empowered to issue the Environmental Protection Orders to deal with an actual or potential adverse environmental effect in violation of the provisions of the 1997 Act. Environmental Tribunals have been constituted with exclusive jurisdiction to try serious offences under the 1997 Act. Minor offences relating to pollution by motor vehicles, littering and waste disposal and violation of rules and regulations are to be tried by Environmental Magistrates. An aggrieved person can file a complaint with the Environmental Tribunal after giving 30-days notice to the PEPA or the Provincial EPAs concerned.

Section 31 of the 1997 Act enables the Federal Government, by notification in the Official Gazette, to make Rules for carrying out the purposes of the 1997 Act, including Rules for implementing the provisions of international environmental agreements specified in the Schedule of the 1997 Act. The PEPA enables the EPAs to make Regulations, with the approval of the Federal Government, by notification in the Official Gazette, that are consistent with the provisions of the 1997 Act and the Rules made under it (Section 33).

The following Rules and Regulations have been notified to date:

- National Environmental Quality Standards (Self-Monitoring and Reporting by Industries) Rules, 2001: to provide a mechanism for self-monitoring of effluent and pollution discharge by industry;

- Provincial Sustainable Development Fund (Procedure) Rules, 2001, Provincial Sustainable Development Fund (Utilization) Rules, 2001: for the filing, appraisal and approval of sustainable development project;
- Pollution Charge for Industry (Calculation and Collection) Rules, 2001: for determining and collecting a pollution charge applied, ad volarem, to the pollution level of an industry;
- Environmental Samples Rules, 2001: for the collection of environmental samples for use as evidence before the Environmental Tribunal;
- Hospital Waste Management Rules, 2005: for the handling and disposal of hospital waste;
- Environmental Tribunal Rules, 1999: for the establishment and operation of Environment Tribunals;
- Pakistan Bio-safety Rules, 2005;
- Pakistan Environment Protection Agency (Review of IE andEIA Regulations), 2000: for the procedure to be followed in the review and approval of IEEs and EIAs; and
- Environmental Laboratories Certification Regulations, 2001: for the certification of laboratories where environment samples can be tested.
- It is pointed out that PEPA provides a wide and comprehensive definition to the term “environment” as under:

  “environment” means:

  a. air, water and land;
  b. all layers of the atmosphere;
  c. all organic and inorganic matter and living organisms;
  d. the ecosystem and ecological relationships;
  e. buildings, structure, roads, facilities and works;
  f. all social and economic conditions affecting community life; and

g. the inter-relationship between any of the factors specified in sub-clauses (a) to (f)

It will be appreciated that the definition of "environment" includes, specifically, buildings and social conditions.

2.2.2. Punjab Environment Protection (Amendment) Act, 2012

After the 18th Amendment, the responsibility to legislate on environment and ecological matters became the sole domain of the Provincial Governments. Statutes, however, remain in force until repealed or struck down. The Government of Punjab, therefore, sought to "provincialize" the PEPA by amending its provisions to reflect the decentralization. Thus, wherever the PEPA makes reference to the Federal Government (as in the powers of the Federal Government to pass an order or make an appointment), the reference was amended to read the Provincial Government. In addition, the amount of some fines was increased. In all other respects, the Punjab Environment Protection (Amendment) Act, 2012 is identical to PEPA and the framework of regulation it creates. The Pakistan Environment Protection Council is now the Punjab Environment Protection Council and when it approves standards, these will be known as Punjab Environment Quality Standards to replace the NEQs. A Punjab Environmental Protection Tribunal has been established in Lahore that hears complaints filed by the EPA, Punjab or individuals and appeals against orders of the EPA, Punjab. Appeals against final orders of the Tribunal may be appealed before the Lahore High Court.

The Amendment Act gives the Provincial Government the power to make rules and to authorize the making of regulations under PEPA. In copying the federal PEPA of 1997, the Amendment Act conferred onto the Government of Punjab additional power to regulate by rules the international environmental agreements listed in the Schedule to PEPA.

Under the amended PEPA, the following subsidiary legislation is in effect and of relevant for the purposes of this report:

2.2.2.1. Pakistan Environment Protection (Review of IEE and EIA) Regulations, 2000

Under Section 12 of PEPA, all projects must obtain approval of their Initial Environment Examinations (IEE) or, where the project is likely to cause an adverse environment effect, approval of their Environment Impact Assessment (EIA). The EIA approval process includes a statutory public hearing of comments on the EIA. Contravention of Section 12 of PEPA is an offence. Under Section 12, the Federal Government may make rules for the regulation of the IEE and EIA approval process. The Pakistan Environment Protection Agency (Review of IEE and EIA) Regulations, 2000 (the "IEE/EIA Regulations") provides such regulatory framework.

Under the IEE/EIA Rules, all projects listed in Schedule II thereto must submit an EIA for approval to the relevant EPA. With respect to the components of Master Plan of Lahore Division, The Project fall in Schedule II, Subsection 'H' as listed below-:

H. Urban development and tourism

1. Land use studies and urban plans (large cities)
2. Large-scale tourism development projects with total cost more than Rs.50 million

It may be noted that the PEPA gives definition to "adverse environment effect" as meaning 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 environment effect as may be specified in regulations. The master plan project comes in Land use studies and urban plans large city thus require an EIA. Other components of the Project such as construction of roads, buildings, industries, electric transmission, grids and sewage treatment required separate EIA and approval from the provincial department i.e. Punjab EPA

The EPA has the authority to issue guidelines of general applicability and sectoral guidelines for construction and operation of the project, following which an EIA or the IEE must be filed in compliance with the guidelines as far as possible. The EPA will inform the proponent of the status of the assessment or examination within ten days of its filing "complete in all respects", will further make an effort to complete the

review within 45 days of the completed submission of an IEE and within 90 days of a completed submission of an EIA. Review of the EIA must be done with public participation. Following the approval or conditions imposed on the commencement of the Project, the proponent must submit confirmation of compliance with the measures and procedures mentioned within the decision of the examination or assessment. The approval is deemed to valid through a period of three years.

The EPA may establish an Environment Assessment Advisory Committee to give advice on all aspects of environmental assessments, guidelines and categorization of Projects.

2.2.2.2. Policy and procedure for the filing, review and approval of environment assessments

Part of a package of guidelines notified along with PEPA in 1997, this document sets out the key policy and procedural requirements for environmental approval. It contains a brief policy statement on the purpose of environmental assessment and the goal of sustainable development, requires that environmental assessments be integrated with feasibility studies, defines the jurisdiction of Federal and Provincial EPAs and Planning & Development Departments, lists of the responsibilities of proponents, and lists the duties of Responsible Authorities. It provides schedules of proposals that require either an IEE or an EIA.

2.2.2.3. Guidelines for the Preparation and Review of Environmental Reports, 1997

These Guidelines are a part of the PEPA and the Regulations and are confined to general aspect of environment report preparation. They provide comprehensive instructions on commencing an environment assessment, assessing impacts (identification, analysis and prediction, baseline data, significance), mitigation and impact management (and preparing environment management plan), reporting, review and decision making (role, steps, remedial options, checks and balances), monitoring and auditing (systematic follow up, purpose, effective data management) and project management (inter-disciplinary teams, programming and budgeting).

Guidelines stipulate that the IEE should be undertaken at the pre-feasibility or, at the latest, at the beginning of the feasibility stage; and that the EIA must be conducted

during the feasibility stage and all the environmental work must be made available to all those who are undertaking financial, economic and technical studies. The jurisdiction of the Federal EPA is exercised over projects on federal land, military projects, projects involving trans country impacts and in projects involving trans province impacts where there is a prior agreement for federal jurisdiction or where parties cannot reach a decision for the same.

The review of procedures, guidelines and categorizations is an ongoing process and the Guidelines prescribe that the Director General of the EPA appoint an Environmental Assessment Advisory Committee that will provide guidance in the development of all aspects of the environment assessment.

An integral part of the environment assessment is conformity with the conditions set in the environmental approval and the NEQS.

It is the responsibility of the proponents to use the environmental assessment to explore alternative actions that may minimize the adverse environmental effects and calculate the long and short-term implications of the proposed actions. As early as possible within a project cycle, the proponents in consultation with other agencies should assess in detail the possible environmental impact on the project. The proponents must not undertake any construction prior to the EIA or IEE, and it is in their own best interests to consult the Responsible Agency on all cases as soon as it is possible. The proponents must follow the guidelines for preparation of review of environmental reports 1997. It is furthermore the responsibility of the proponents to obtain any information necessary for the preparation of the EIA/ IEE, assess in detail the environmental impacts and consult and take into account comments by agencies, community and the NGOs.

2.2.2.4. Guidelines for Public Consultation, 1997

These Guidelines, part of a package notified along with PEPA, covers consultation, involvement and participation in the statutory public hearings of EIA required under PEPA. It helps identify stakeholders and provides techniques for public consultation (principles, levels of involvement, tools, building trust), consensus buildings and dispute resolution and in facilitation involvement (including the poor, women, building communities and NGO capacity).

2.2.2.5. Guidelines for Sensitive and Critical Areas, 1997

The Guidelines identify officially notified protected areas in Pakistan, including critical ecosystems, archaeological sites, etc., and present checklists for environmental assessment procedures to be carried out within or near to such sites. Environmentally sensitive areas include, among others, archaeological sites, biosphere reserves and natural parks, and wildlife sanctuaries and preserves. It is pointed out these Guidelines were prepared before the 18th Amendment but continue in force until amended or repealed. Thus the discussion below includes offices such as the Federal Director General Archeology, which no longer exists. In such circumstances, the word “Federal” may be replaced by “Provincial” as the context requires.

2.2.2.6. Sectoral Guidelines for Environmental Reports

Several guidelines, all notified as part of a package along with PEPA, include guidelines for i) major thermal power stations, ii) major chemical and manufacturing plants, iii) industrial estates, iv) major roads, v) sewerage and vi) oil and gas exploration. These guidelines have been drafted following a format which specifies guidance and requirements on i) a sector overview of the industry and processes; ii) potential impacts on the environment; iii) mitigation measures; iv) monitoring and reporting; v) management and training; and vi) a checklist of likely environmental impacts and mitigation measures.

2.2.3. National Conservation Strategy

The Pakistan National Conservation Strategy (NCS), which was approved by the federal cabinet in March 1992, is the principal policy document on environmental issues in the country (IUCN, 1992).

The NCS outlines the country’s primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan’s natural and physical environment. The core areas that are relevant in the context of the proposed project are pollution prevention and abatement, restoration of

rangelands, increasing energy efficiency, conserving biodiversity, supporting forestry and plantations, and the preservation of the cultural heritage.

2.2.4. National Environment Policy 2005

The national environmental policy 2005 aims to protect conserve and restore Pakistan's environment in order to improve quality of the life of citizens through sustainable development. The main objectives of the policy are;

- Conservation, restoration and efficient management of the environmental resources.
- Integration of the environmental considerations in policy making and planning process.
- Capacity building of government agencies and other stakeholders at all levels for the better environmental management.
- Meeting international obligations effectively in line with the national aspirations.
- Creation of a demand for environment through mass awareness and community mobilization.

2.2.5. The National Forest Policy 2001 of Pakistan

This policy covers the Renewable Natural Resources (RNR) of Pakistan i.e. Forests, Watersheds, Rangelands, Wildlife, Biodiversity and their habitats. The policy seeks to launch a process for eliminating the fundamental causes of the depletion of RNR through the active participation of all the concerned agencies and stakeholders, to realize the sustainable development of the resources. It is an umbrella policy providing guidelines to the Federal Government, Provincial Governments and territories for the management of their RNR. In consonance with it, the Provincial and District Governments may devise their own policies in accordance with their circumstances.

The goal of this policy is to foster the sustainable development of RNR of Pakistan, for the maintenance and rehabilitation of its environment and the enhancement of

the sustainable livelihoods of its rural masses especially women, children and other deprived groups.

The elements of the policy shall be as follows:

- Reducing the impact of socio-economic causes.
- Population planning in critical eco-systems.
- Providing substitutes to firewood in the wooded mountains.
- Reducing poverty, poverty of opportunity, and powerlessness.
- Reducing political interference in the Forestry and Wildlife Departments.
- Renovating and invigorating the institutions of RNR.
- Supporting Local Governments in the sustainable development of their RNR.
- Policies for fragile Eco-systems.
- Riverain forests.
- Irrigated Plantations.
- Preservation of relict and unique forests.
- Wildlife.
- Rangelands and desert eco-systems.
- Planting of trees and fodders on farmlands.

2.2.6. PAKISTAN ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURES

These guidelines are descriptive documents describing the format and content of IEE/EIA reports to be submitted to Federal and Provincial EPA/EPD for obtaining NOC. Following are the major areas, which are covered by these guidelines:

- The Environmental Assessment report formation (scoping, type and category of project, description of project, alternatives, site selection, baseline data).
- Assessing impacts (identification, analysis and significance).
- Mitigation and impact management and preparing an environmental management plan.
- Reporting (format, main features, shortcomings, other forms of presentation).
- Review and decision making (role, steps, remedial options, checks and balances).
- Monitoring and auditing (systematic follow up, effective data management).
- Project Management (inter-disciplinary teams, programming and budgeting).

2.2.7. NATIONAL ENVIRONMENTAL QUALITY STANDARDS (NEQS), 2000

The NEQS 2000 specify the following standards:

- Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea (three separate sets of numbers)
- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources
- Maximum allowable concentration of pollutants (03 parameters) in gaseous emissions from vehicle exhaust.
- Maximum allowable concentration of pollutants (08 parameters) in ambient air.
- Maximum allowable noise levels for different zones.

These standards apply to the gaseous emissions and liquid effluents discharged by industrial plants, batching plants, campsites and construction machinery. The standards for vehicles will apply during the construction as well as operation phase of the project. Standards for ambient air quality have been prescribed to preserve clean air.

2.2.8. National Climate Change Policy, 2012

The National Climate Change Policy (NCCP) was adopted in 2012 and is the country's first climate change policy. The main climate-related threats recognized by the NCCP are:

a. Considerable increase in frequency and intensity of extreme weather events, coupled with erratic monsoon rains causing frequent and intense floods and droughts;

b. Projected recession of Hindu Kush-Karakoram-Himalayan (HKH) glaciers due to global warming and carbon soot deposits from trans-boundary pollution sources, threatening water inflows into Indus River System;

c. Increased siltation of major dams caused by more frequent and intense floods;

d. Increased temperature resulting in enhanced heat- and water-stressed conditions, particularly in arid and semi-arid regions, leading to reduced agricultural productivity;

e. Further decrease in already scanty forest cover from too rapid change in climactic conditions to allow natural migration of adversely affected plant species;

f. Increased intrusion of saline water in the Indus Delta, adversely affecting coastal agriculture, mangroves and breeding grounds of fish;

g. Threat to coastal areas due to projected sea level rise and increased cyclonic activity due to higher sea surface temperatures;

h. Increased stress between upper riparian and lower riparian regions on sharing the water resources;

i. Increased health risks and climate change induced migration.

The goal of the NCCP is to ensure that climate change is mainstreamed in the economically important and vulnerable sectors of the economy and to steer Pakistan towards low-carbon growth. With regards adaptation, the NCCP sets out policy measures for water resources, agriculture and livestock, human health, forestry and biodiversity, mountain areas, rangelands and pastures, arid areas, coastal and marine ecosystems. With regards mitigation, the NCCP sets out policy measures with regards energy, transport, agriculture and livestock, carbon sequestration and forestry. It also proposes cross-sectoral policy measures for poverty, gender, town planning and provides for capacity building and institutional strengthening.

2.2.8.1. Framework for Implementation of Climate Change Policy (2014-2030)

As a follow-up to the National Climate Change Policy, 2012 the Climate Change Division of the Government of Pakistan issued the Climate Change Implementation Framework in November 2013. Under the Federal Government Rules of Business, 2012, the Climate Change Division of the Government of Pakistan is responsible for, inter alia, “National policy, plans strategies and programs with regard to disaster management, including environmental protection, preservation, pollution, ecology, forestry, wildlife, biodiversity, climate change and desertification.” The Framework is within the ambit of responsibilities of the Ministry of Climate Change and should guide provincial and local state institutions in their actions.

The Framework was developed keeping in view the current and future anticipated climate change threats to Pakistan various sectors. Accordingly, it sets out a framework implementation schedule for adaptation and mitigation actions in, inter alia, the water, forestry, disaster preparedness, vulnerable ecosystems and urban planning sectors. The Framework prescribes specific actions within each sector that match the requirement of stated objectives.

The Project Proponent should review the Framework to incorporate its stipulated actions into the plans and proposals for the Lahore Division Master Plan Project.

2.2.9. Punjab Wildlife Protection, Preservation, Conservation and Management Act, 1974

Under the Punjab Wildlife Act, wild animal means any wild bird or animals specified in the First, Second, Third or Fourth Schedule to the Act; game animal means any wild animal specified in the First and Fourth Schedule to the Act; protected animal means a wild animal specified in the Third Schedule to the Act; and unprotected animals are those wild birds or animals specified in the Fourth Schedule to the Act. The Government of Punjab may add or exclude wild animals from the Schedules to the Act. No person may hunt a protected animal and hunting of game animals is permitted under a permit issued under the Act. Snares and the use of hawks and dogs etc. for coursing game animals is prohibited. Killing of any wild animals in defense of life, prevention of damage to livestock is not an offence. Animals killed or found dead, dying or caught otherwise than in accordance with the provisions of the Act are presumed to be the property of the Government of Punjab. No person may be in possession of a wild animal unless in possession of a certificate of lawful possession issued by an authorized officer. No person may transfer to another any animal specified in the Second Schedule without a valid certificate of lawful possession. No person may export or import any wild animal or exotic species or any trophy or meat specified in the Second Schedule without a permit issued under the Act. No person may deal with wild animals or meat or trophies thereof unless in possession of a valid license issued by an authorized officer. The Government may declare any area to be a wildlife sanctuary, wildlife breeding farm, national park, game reserve, Wildlife Park, zoological garden or zoo and safari park and private game reserves, wildlife parks and safari parks. No person may hunt a wild animal within a distance of one mile of a wildlife sanctuary. Hunting, trapping or killing wild animals is prohibited in wildlife breeding farms, as is the act of teasing a wild animal. Hunting is prohibited in a national park. The Government of Punjab may grant permits for the hunting of specified numbers of game animals in a game reserve. The hunting, trapping or killing of wild animals at a wildlife park, zoological garden or zoo and safari park is prohibited such as is the teasing of wild animals. Contraventions of the Act are punishable with imprisonment or fine or both of a term of up to five years and a sum up to Rs. 30,000/-. And contraveners may have their licenses suspended for a period of up to five years.

2.2.10. International Treaties

2.2.10.1. Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)

The parties to the Convention acknowledge the importance of conserving migratory species, and the need to pay special attention to species the conservation status of which is unfavorable.

a. To avoid any migratory species becoming endangered, the parties must endeavor:

b. to promote, cooperate in or support research relating to migratory species;

c. to provide immediate protection for migratory species included in Appendix I; and

d. to conclude Agreements covering the conservation and management of migratory species listed in Appendix II.

To protect endangered migratory species, the parties to the Convention will endeavor:

a. to conserve or restore the habitats of endangered species;

b. to prevent, remove, compensate for or minimise the adverse effects of activities or obstacles that impede the migration of the species; and

c. to the extent feasible and appropriate, to prevent, reduce or control factors that are endangering or are likely to further endanger the species.

Range States of migratory species ("range" means areas of land or water that a migratory species inhabits, crosses or overflies on its migration route) must prohibit the taking of animals belonging to species listed in Appendix I, subject to certain exceptions (taking for scientific purposes, or to enhance the propagation or survival of the species). Such exceptions must be precise as to content and limited in space and time, and should not operate to the disadvantage of the species.

The conservation and management of the species listed in Appendix II may require international agreements. Guidelines for agreements:

a. restore or maintain the migratory species concerned;

b. cover the whole of the range of the migratory species concerned;

c. be open to accession by all Range States, whether or not they are parties to the Convention;

d. where feasible, concern several species.

The Bonn Convention was signed in 1979 and entered into force on 1 November 1983.

2.2.10.2. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

The purpose of CITES, as stated in the first paragraph of its preamble, is to protect wild fauna and flora for current and future generations. Wild fauna and flora are described as an irreplaceable part of the natural systems of the earth and as being valuable from aesthetic, scientific, cultural, recreational and economic points of view. CITES establishes international co-operation for the protection of certain species from over-exploitation through international trade. The purpose of adopting the convention was not only to avoid aggravation of an ecological problem, but also to prevent a penalization of countries, in particular the US, with stricter ecological legislation.

CITES classifies plants and animals according to three categories, or appendices, based on how threatened they are. Appendix I lists species that are in danger of extinction. It also prohibits outright the commercial trade of these plants and animals; however, some may be transported internationally in extraordinary situations for scientific or educational reasons.

Appendix II species are those that are not threatened with extinction but that might suffer a serious decline in number if trade is not restricted; their trade is regulated by permit. Appendix III species are protected in at least one country that is a CITES member and that has petitioned others for help in controlling international trade in that species.

Appendix I, about 1200 species, are species that are threatened with extinction and are or may be affected by trade. Commercial trade in wild-caught specimens of these species is illegal (permitted only in exceptional licensed circumstances). Trade of captive-bred animals or cultivated plants of Appendix I species are considered Appendix II specimens, with concomitant requirements (see below and Article VII). The Scientific Authority of the exporting country must make a non-detriment finding, assuring that export of the individuals will not adversely affect the wild population. Any trade in these species requires export and import permits. The Management Authority of the exporting state is expected to check that an import permit has been secured and that the importing state is able to care for the specimen adequately. Notable animal species listed in Appendix I include the red panda, gorilla, the chimpanzee species, tigers, Asiatic lion, leopards, Jaguar, Cheetah, Asian elephant etc.

Appendix II, about 21,000 species, are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild. In addition, Appendix II can include species similar in appearance to species already listed in the Appendices. International trade in specimens of Appendix II species may be authorized by the granting of an export permit or re-export certificate. In practice, many hundreds of thousands of Appendix II animals are traded annually. No import permit is necessary for these species under CITES, although some Parties do require import permits as part of their stricter domestic measures. A non-detriment finding and export permit are required by the exporting Party. Examples of species listed on Appendix II are the great white shark, American black bear etc.

Appendix III, about 170 species, are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species. The species are not necessarily threatened with extinction globally. In all member countries, trade in these species is only permitted with an appropriate export permit and a certificate of origin from the state of the member country who has listed the species. Examples of species listed on Appendix III and the countries

that listed them are the two-toed sloth by Costa Rica and Alligator Snapping Turtle by the USA.

In addition to plants and animals and their parts, the Convention also restricts trade in items made from such plants and animals, such as clothing, food, medicine, and souvenirs. By 2009 more than 5,000 animal and 28,000 plant species had been classified.

The CITES was signed on 3 march 1973 and entered into force on 1 July 1975

2.2.11. Local Government Laws

The Constitution of the Islamic Republic of Pakistan, 1973 is the basic legal document of Pakistan setting out, inter alia, a two-tier federal system consisting of a federal government of Pakistan and provincial governments. Local government is mentioned in Article 32 of the Constitution as a Principle of Policy in the following terms:

Promotion of Local Government Institutions: The State shall encourage Local Government institutions composed of elected representatives of the areas concerned and in such institutions special representation will be given to peasants, workers and women.

Further, Article 37 of the Constitution enshrines another Principle of Policy related to decentralization in the following terms:

Promotion of Social Justice and Eradication of Social Evils: The State shall decentralize the Government Administration so as to facilitate expeditious disposal of its business to meet the convenience and requirements of the public.

The 18th Amendment of 2010 has made a significant change in respect of the powers of local governments to regulate land use in their local areas. Before the 18th Amendment, the Constitution envisaged government only at the Federal and provincial levels. Local governments were obligations imposed on the provinces through the Constitution's Principles of Policy, a set of Constitutional policy statements that are otherwise not justiciable. As such, the manner and form of local governments was more or less the prerogative of the provincial government

legislating on the subject. However, the 18th Amendment changes this position. The newly inserted Article 140-A of the Constitution states:

2.2.11.1. Local Government:

a. Each Province shall, by law, establish a local government system and devolve political, administrative and financial responsibility and authority to the elected representatives of the local governments.

b. Elections to the local governments shall be held by the Election Commission of Pakistan

As such, the local government system has been fully recognized as a third tier of governments by the Constitution. Importantly, this amendment allows for the recognition of a constitutional mandate of an elected local government system. Such a mandate would be protected against encroachment through enforcement of Fundamental Rights through the judiciary. This has not been the case before. In a recent decision of the Lahore High Court, this mandate was judicially recognized and the LDA was restrained from undertaking any further development activity – something the Court held was the mandate of elected local governments – until local governments elections were held and local governments were formed that could evaluate and approve such development activity for themselves.

2.2.11.2. Punjab Local Government Ordinance, 2001

The Punjab Local Government Ordinance, 2001 ("PLGO") aims to reconstruct and regulate local governments in the Punjab. The PLGO applies to the whole of the province of Punjab except for cantonment areas.

- The PLGO establishes local governments at the sub-provincial level. In urban areas, from the bottom up, these levels are: Union Council, Town and Districts and City Districts.

- In urban areas, land use and building control is practiced by Town Municipal Administrations and by the District or City District Government. Section 54-A of the PLGO gives the Town Municipal Administrations powers to, inter alia:

- prepare spatial plans for the Town in collaboration with the District Government, including plans for land use, zoning and other functions for which the Town Municipal Administrations are responsible;
- execute and manage development plans;
- exercise control over land use, land sub-division, land development and zooming by public and private sectors for any purpose including recreation, parks, entertainment within the spatial and master plan for the City District;
- provide, manage, operate, maintain and improve the municipal infrastructure and services, including water supply and sewage and sewage treatment and disposal, parks, playgrounds and open spaces etc.

Under Schedule 6 of the PLGO, concerned local government may provide, promote or subsidize facilities for the recreation of the public; lay out and maintain recreational gardens.

2.2.11.3. Punjab Local Government Act, 2013

The Punjab Local Government Act, 2013 aims to rationalize and reorganize the local government system in the Punjab. It applies to the whole of Punjab except cantonment areas and will take effect in such places at such times as the Government of Punjab may notify. Till date, no notification in this regard has been issued.

The Act establishes a Metropolitan Corporation for Lahore and Municipal Corporations and Municipal Committees for such urban areas as the Government of Punjab may notify. The Lahore Metropolitan Corporation and Municipal Committees have broadly similar powers to, inter alia,

- approve spatial plans, master plans, zoning, land use plans including classification and reclassification;
- implement rules and bye-laws governing land use, housing, markets, zoning, environment, roads and public utilities etc.;

- Exercise control over land use, land sub-division, land development and zoning by public or private sectors for any purpose, including for recreation, parks and entertainment etc.;
- water supply and control and development of water resources;
- sewage and sewage treatment and disposal;
- development and maintain museums, art galleries, libraries, community and cultural centers; and
- conserve historical and cultural assets

2.2.11.4. Lahore Development Authority Act, 1975

The Lahore Development Authority Act, 1975 aims to provide for the constitution of the LDA in order to provide a comprehensive system of metropolitan planning and development in order to improve the quality of life in Lahore, establish an integrated metropolitan and regional development approach and a continuing process of planning and development, to ensure optimum utilization of resources etc.

The Act establishes the LDA and grants it wide powers to carry out planning and development within the Lahore Division. The LDA is to prepare schemes for, inter alia, recreation facilities and preservation of objects or places of historical importance and execute the same after approval from the Government of Punjab.

The scope of the Act and, by extension, the jurisdiction of the LDA has been increased by the LDA Amendment Act, 2012. Whereas previously the LDA exercised jurisdiction within its “controlled area”, it now exercises control within the entire Lahore Division.

The LDA Amendment Act also permits the LDA to enter into agreements with persons for the purposes of preparing, establishing and developing housing and other schemes, buildings, infrastructure, services etc. The LDA Amendment Act also specifically allows the LDA to modify schemes prepared under the LDA Act through classification, reclassification or redevelopment.

The LDA Amendment Act also now confers wide powers onto the LDA in regards of control of the master plan of the Lahore Division. The Act now requires the LDA to

exercise land use "in the prescribed manner", namely in accordance with the LDA Master Plan Rules and LDA Land Use Rules.

The amendment to the LDA Act now allows the LDA to acquire land and pay compensation and provides its own statutory method of payment of compensation. This means the LDA may dispense with the use of the Land Acquisition Act, 1894. One of the newly introduced forms of compensation is by way of alternate land and development sites or a combination of both. The Act also now provides for a Tribunal that will hear objections related to the acquisition of land by the LDA. The LDA Amendment Act thus provides an alternate remedy for the redress of grievances in acquisition cases, which otherwise are a burden on the workload of the civil courts and High Court of Lahore.

2.2.11.5. LDA Land Use Rules, 2014

The LDA Land Use Rules, 2014 are made under powers conferred onto the LDA by the LDA Act, 1975. These Rules repeal the LDA Land Use (Classification, Reclassification and Redevelopment) Rules, 2009, which in substance, scope and nature were similar to the Punjab Land Use (Classification, Reclassification and Redevelopment) Rules, 2009. These Rules can thus be looked upon as an "upgrade" of earlier Rules, albeit only for the purposes of the LDA.

Similar to the Land Use Rules, the LDA Land Use Rules categorize areas within the LDA's Control Area as residential, commercial, industrial, institutional, mixed-use, peri-urban, special development zone, agricultural and notified area. In addition, the LDA may designate may specific the uses of various parcels of land falling under special development zones. Land use in each land use classification shall either be permitted or permissible and, if not either, prohibited. The Land Use Rules recognize historically significant area if the same have been designated as a historically, architecturally or archeologically significant area. The LDA is to ensure strict compliance with the relevant provision of law regarding historically significant or environmentally sensitive areas.

The Rules provides procedures for the notification of a land use classification map, reclassification and redevelopment. The Rules prescribe a blanket prohibition on the conversion of land use, whether through its own procedures or procedures found in

the LDA (Master Plan) Rules, 2014 or the Punjab Land Use (Classification, Reclassification and Redevelopment) Rules, 2009 unless a conversion fee is paid. The Rules set out the rates of the conversion fees. Note that the Rules prescribe a fee for the conversion of agricultural land to industrial, institutional or intercity services.

The Rules also contain provisions for the "temporary commercialization of land or property for a period of up to 10 years. Permission for temporary commercialization may be granted by fulfilling a number of set conditions that include, inter alia, set back, but not Floor-Area Ratios.

2.2.11.6. LDA (Master Plan) Rules, 2014

The Lahore Development Authority (Master Plan) Rules, 2014 are made under powers conferred under the LDA Act. The Rules provide that the LDA shall, from time to time prepare a master plan for the "area". "Area" has been defined as the Lahore Division "to which the LDA Act applies. The Rules prescribe the process by which the LDA is to formulate master plans. However, till a new master plan is formulated, Rule 13(1) states "Master Plan 2021 Lahore" along with its provisions and amendments shall continue to be in force till the preparation of new master plan by the LDA or any amendment by the LDA. The Rules also provide for a mechanism by which master plans – including, presumably, Master Plan 2021 – may be amended. Such mechanism provides for public consultation before an amendment may be affected.

The Rules follow the land use classifications found in the Lahore Development Authority Land Use Rules, 2014. Property developers are required to seek a No Objection Certificate that their scheme is in compliance with the master plan.

The Rules provide that their provisions shall prevail in the event there is a conflict in respect of permitted and permissible uses in the existing master plan or the Lahore Development Authority Land Use (Classification, Reclassification and Redevelopment) Rules, 2009 and the Rules also repeal the latter. The Rules also exclude the applicability of the Punjab Land Use (Classification, Reclassification and Redevelopment) Rules in the Lahore Division and state no other authority, except the LDA, shall have jurisdiction to deal with the master plan in the Lahore Division.

The effect of the Rules is to recognize Master Plan 2021 as the existing master plan for the Lahore Division and to harmonize the land use rules operating therein. There are only one set of land use rules applicable in Lahore Division at this time: the LDA Land Use Rules.

2.2.11.7. LDA Building and Zoning Regulations, 2007

The LDA Building and Zoning Regulations, 2007 were issued in 2008. The LDA Building and Zoning Regulations, 2007 were back-dated from the date they were adopted by the LDA and not the date they were published in the official Gazette.

These Building and Zoning Regulations comprise of ten chapters. Chapter 1 sets out common definitions as well as the zones these Building and Zoning Regulations apply to. Chapter 1.2 differentiates between Residential Zones, Commercial Zones, Industrial Zones and Special Area Zones. Special Area Zones include the Walled City area or Historically Significant Areas as specified in the approved Master Plan or schemes to be prepared by the LDA; flood plains as defined in the approved Master Plan; and Environmentally Sensitive Areas including natural parks, wild life parks, forests and water shed areas.

The Residential Zone is sub-divided into Approved Schemes, Established Built-Up Areas and Predominantly Open Areas. The Commercial Zone is sub-divided into plots of 6 kanals and above on roads at least eighty feet wide, Central Business District, Main Civic and Commercial Centers, Neighborhood Commercial Areas, Other Commercial Areas, Converted Plots and Predominantly Open Areas. The Industrial Zone is sub-divided into Industrial Estate and Industrial Areas in Approved Schemes, Industrial Zones in Established Built-up Areas and Industrial Zones in Predominantly Open Areas.

Chapters 2, 3 and 4 provides for site requirements in Residential, Commercial and Industrial Zones, respectively, and prescribe mandatory open areas, building height and FAR, amongst other requirements in each of their sub-zones.

Chapter 5 provides for parking requirements and prescribes specifications for parking space standards for various types of land-use. For example, one car space is required for every 12000 square feet of covered area in apartment buildings and hotels must provide one car space for every six rooms. The Chapter also prescribes

general provisions such as parking standards, parking requirements, minimum floor heights and maximum ramp angles in parking garages and parking areas.

Chapter 6 prescribes space and safety requirements. Chapter 6.1.4 provides for the sub-division of plots in Approved Housing Schemes and in other areas.

Chapter 7 provides for the structural design of Multi-Storey Buildings and mobile-phone antenna towers.

Chapter 8 provides for builders' obligations on a building site. Chapter 9 continues to provide the roles and responsibilities of builders, consultants, contractors and DAs and the LDA. Chapter 10 outlines the procedure for the sanction of a building plan by a DA or the LDAs.

2.2.11.8. Integrated Master Plan for Lahore (IMPL) - 2021

Master Plan 2021 is properly known as Integrated Master Plan for Lahore – 2021 and was prepared by the National Engineering Services Pakistan (Private) Limited for the LDA and was approved by the Lahore District Council on 6 October 2004.

Vide Rule 13(1) of the LDA Master Plan Rules, the LDA has adopted Master Plan 2021 as the master plan for Lahore which shall continue in force until replaced or amended.

Chapter 9.3.3 of Volume I of the Master Plan notes that Lahore has 59 monuments, including Jehangir's Tomb, Noor Jehan's Tomb and Kamran's Baradari. Chapter 12 lists the Existing Flood Protection Facilities of Lahore, and includes the Shahdara Flood Protection Bund as protecting the site of Jehangir's Tomb.

Chapter 18.2.7 of Volume II of the Master Plan notes the "Integrated Master Plan should revive the potential of waterside recreation along River Ravi by providing active and passive recreation along river banks. Chapter 19.6.8 lists proposed public facilities including recreation. The Master Plan of Volume II has proposed three parks along the river side to exploit the river's recreational facilities. Chapter 22.3 of Volume II recreational facilities for Lahore, including three parks along the river side.

Chapter 25 of Volume II of the Master Plan sets out flood management and growth possibilities across River Ravi and prescribes short and long-term plans in order to plan and prepare for floods.

2.2.12. Resettlement Laws

2.2.12.1. Constitutional Provisions

Article 23 of the constitution of Pakistan establishes the right of every citizen to acquire, hold and dispose his/her property in any part of Pakistan. Article 24 of the constitution of Pakistan relating to the Protection of Property Rights is most important, and has direct relevance to the project Affected people. Its first two clauses are;

1) No person shall be compulsorily deprived of his property save in accordance with law.

2) No property shall be compulsorily acquired or taken possession of save for a public purpose, and save by the authority of law which provides for compensation therefore and either fixes the amount of compensation or specifies the principles on and the manner in which compensation is to be determined and given.

2.2.12.2. Land Acquisition Act, 1894

The Land Acquisition Act 1894 is a “law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be paid on account of such acquisition”. The raison de etre of this piece of legislation is, therefore, two-fold: firstly to fulfill the needs of government and companies for land required by them for their projects, and secondly, to determine and pay compensation to those private persons or bodies whose land is so acquired. The exercise of the power of acquisition has been limited to public purposes.

This Act basically governs the acquisition of private properties for public purposes for development projects in Pakistan. It comprises 55 Sections pertaining to: area notifications and surveys; acquisition; compensation and apportionment of awards; dispute resolution; penalties; and exemptions, but neither this nor any other law of the land, covers resettlement and rehabilitation of persons in the manner as a

mandatory process according to current perceptions and requirements of the international financing agencies.

Some of the main provisions include:

- Section 4 deals with publication of preliminary notification and power for conducting survey;
- Section 6 requires the Government makes a more formal declaration of intent to acquire land;
- Section 7 necessitates the Land Commissioner to direct the Land Acquisition Collector (LAC) to take order of the acquisition of the land;
- Section 8 requires the LAC to then direct the land to be marked out, measured and planned;
- The LAC gives notice to all Affected Persons (AP) that the Government intends to take possession of the land and if they have any claims for compensation that should to be made to him at an appointed time;
- Section 10 delegates power to the LAC to record statements of APs in the land or any part thereof as co-proprietor, sub-proprietor, mortgagee, and tenant or otherwise;
- Section 11 enables the Collector to make enquiry into measurements, value and claim and issue the final “award". Included is the land's marked area and valuation of compensation;
- Section 16: When the LAC has made an award under Section 11, he will then take possession and the land shall thereupon vest absolutely in the Government, free from all encumbrances;
- In case of dissatisfaction with the award APs may request the LAC to refer the case onward to the court for decision. This does not affect the taking possession of the land;

- The award of compensation for the owners for acquired land is determined at its market value plus 15% in view of compulsory nature of the acquisition for public purposes;
- Section 28 relates with determining compensation values and interest premium for land acquisition;
- Section 31 provides that the LAC can, instead of awarding cash compensation in respect of any land, make any arrangement with a person having an interest in such land, including the grant of other lands in exchange;
- Grievance redress is established through the formal land acquisition process at a point in time or through appeals to the court

2.2.13. THE WORLD BANK REGULATIONS

2.2.13.1. Provisions of Bank's Safeguards Policies

The following World Bank's Safeguards have been triggered by the Project based on the field investigations related to environment as well as social sectors.

Operational Policy-4.01

Operational Policy 4.01 identifies the general policy of the World Bank about the EIA, lays down the procedures and guidelines for conducting EIA of the projects including the aspects to be considered in EIA, public consultation and information disclosure procedures

Operational Policy-4.04

Operational Policy 4.04 deals with the conservation of natural habitat. As the project will pass through some forest areas, the project will have to adopt the guidelines of this policy to mitigate the adverse impacts on natural habitat.

Operational Policy-4.11

This policy addresses physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be

located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community.

The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrowers national legislation, or its obligations under relevant international environmental treaties and agreements.

During field survey no cultural/historical/archeological property was identified along the Project Corridor. However, should any such property/chance find/artifact get identified during implementation, the Contractor will stop work, protect the cultural property, contact the relevant government department/ agency responsible and handover the artifact/chance find, etc.

BP-17.50-Disclosure Policy

For meaningful consultations between the borrower and project-affected groups and local NGOs on all Category A and B projects proposed for the World Bank financing, the borrower provides relevant material in a timely manner prior to consultation and in a form and language that are understandable and accessible to the groups being consulted.

For a category A project, the borrower provides for the initial consultation a summary of the proposed project's objectives, description, and potential impacts; for consultation after the draft EA reports is prepared, the borrower provides a summary of the EA's conclusions. In addition, for a Category A project, the borrower makes the draft EA report available at a public place accessible to project-affected groups and local NGOs.

In accordance with the Disclosure Policy of the World Bank, the Environmental and Social Assessment (ESA) and Resettlement Plan (RP) will be disclosed at the info shop and the Project sites, viz., Project Offices and Public Libraries. The Executive Summary will be translated into Urdu will also be disclosed at the Project site where it will be accessible to affectees.

2.2.14. OTHER ENVIRONMENT RELATED STATUTES

This section outlines the other statutes apart from Pakistan Environmental Protection Act, 1997, which are relevant to the project.

2.2.14.1. Pakistan Explosives Act, 1884

Under the Explosives Act, the project contractors are bound by regulations on handling, transportation and using explosives during quarrying, blasting, and other purposes.

2.2.14.2. The Forest Act, 1927

The Forest Act empowers provincial governments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce; quarrying and felling, lopping and toping of trees, branches in reserved or protected areas.

2.2.14.3. Pakistan Penal Code, 1860

The Pakistan Penal Code deals with offences where public or private property and/or human lives are affected due to the intentional or accidental misconduct of an individual or body of people. In the context of environment, the Penal Code empowers the local authorities to control noise, noxious emissions and disposal of effluents. The NEQS enforced by the EPAs supersede the application of this legislation on industries and municipalities.

2.2.14.4. National Disaster Risk Reduction Policy 2013

This policy document introduces a proactive and anticipatory approach by laying special emphasis on risk assessment, prevention, mitigation and preparedness, with the aim of creating a resilient nation. The policy aims to reduce socio-economic vulnerabilities to disaster in specific area as well as dealing with the environmental and other hazards that trigger them.

CHAPTER 3

PROJECT DESCRIPTION

3.1. GENERAL

This Chapter provides an overview of the project location, each site description and proposed amendment components.

3.2. LOCATION OF THE PROJECT

The Project is located in Lahore Division. The project map is given in figure 1-1.

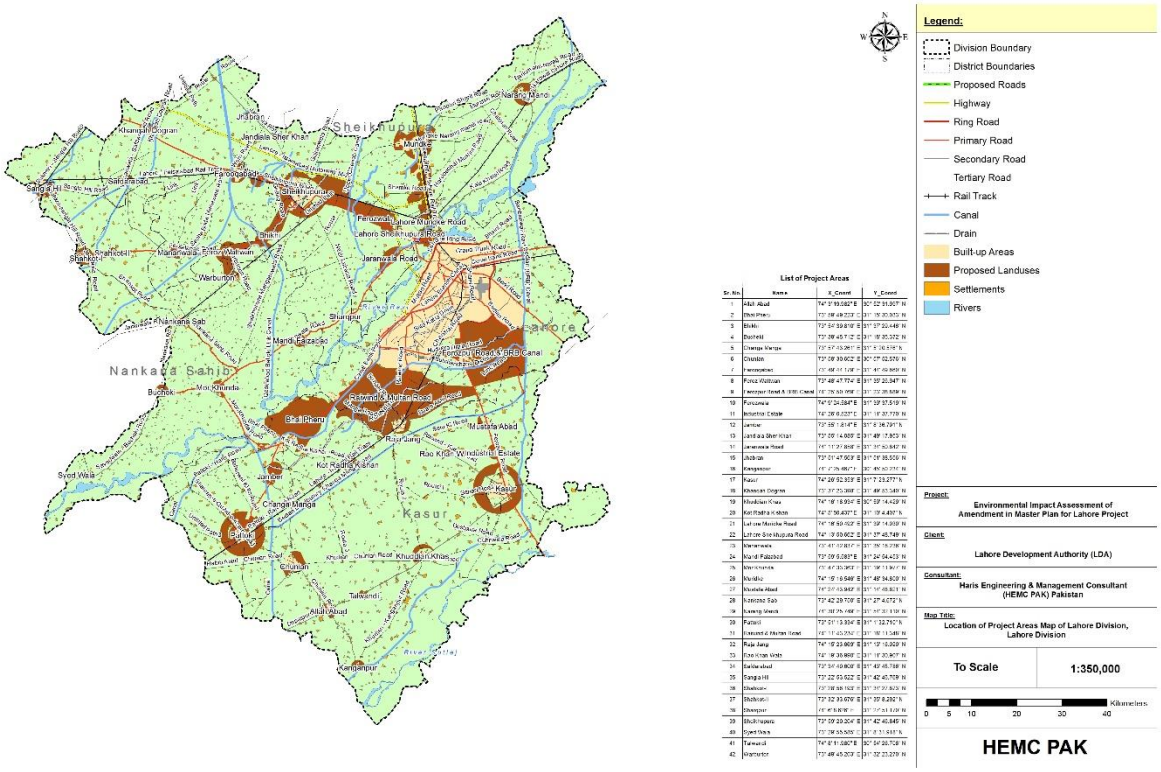


Figure 3 .1 Location of Project Area - Lahore Division

3.3. TOTAL AREA & DESIGN POPULATION OF THE PROJECT

The total area of Project that is estimated for master planning is about 348,565 Acres. The master plan is designed up till 2035 with estimated total population growth of Lahore division up to 50 million. The design population for the master plan of Lahore division 2035 is about 24.72 million.

3.4. DESCRIPTION OF PROJECT AREA-LAHORE DIVISION

Lahore Division is an administrative division of Punjab Province, Pakistan and called the third tier of government. Lahore statistical division contains the districts of Lahore, Nankana Sahib, Kasur, and Shekhupura. The area of Lahore Division is about 11413.5 km² with the population of 14 million in accordance with 1998 census. With average growth rate of 3.20, the current population of Lahore division is estimated as 25 million. A projection is that by year 2035 there will be almost 50 million people living in the division. The unplanned expansion of the Lahore division, competing land use and exponential population growth with the rate upto 3.20 had put the burden on existing infrastructure causing multiple problems like land use conflicts, traffic congestion, pollution, environmental degradation, water degradation and social implications. Therefore, master planning is required for the Lahore division in order for structured development with pragmatic approach that can mainstream current industrial and residential development.

The description of the each district of Lahore division is given as under-:

3.4.1. LAHORE

Lahore district is the provincial capital of Punjab province Pakistan that contains two tehsils i.e. Lahore Cantonment and Lahore City. The total area of Lahore is 1,772 square kilometres (684 sq mi). According to the 2013 census, the population was 12.2 million of which 81.17% were urban. In year 2000 the two tehsils of Lahore were replaced with ten subdivisions called towns, which are Allama Iqbal, Aziz Bhatti, Data Ganj Baksh, Gulberg, Nishtar, Lahore Cantonment, Ravi, Samanabad, Shalimar, and Wagah. Lahore is bounded on the north and west by the Sheikhupura

District, on the east by Wagah, and on the south by Kasur District. The Ravi River flows on its northern side. Lahore is the second largest metropolitan area in Pakistan and 14th most populous city in the world. It is an important historical centre in South Asia. With a rich history dating back over a millennium, Lahore is a main cultural centre of the Punjab region and Pakistan and is the largest Punjabi city in the world. One of the most densely populated cities in the world, Lahore remains an economic, political, transportation, entertainment, and educational hub of Pakistan.

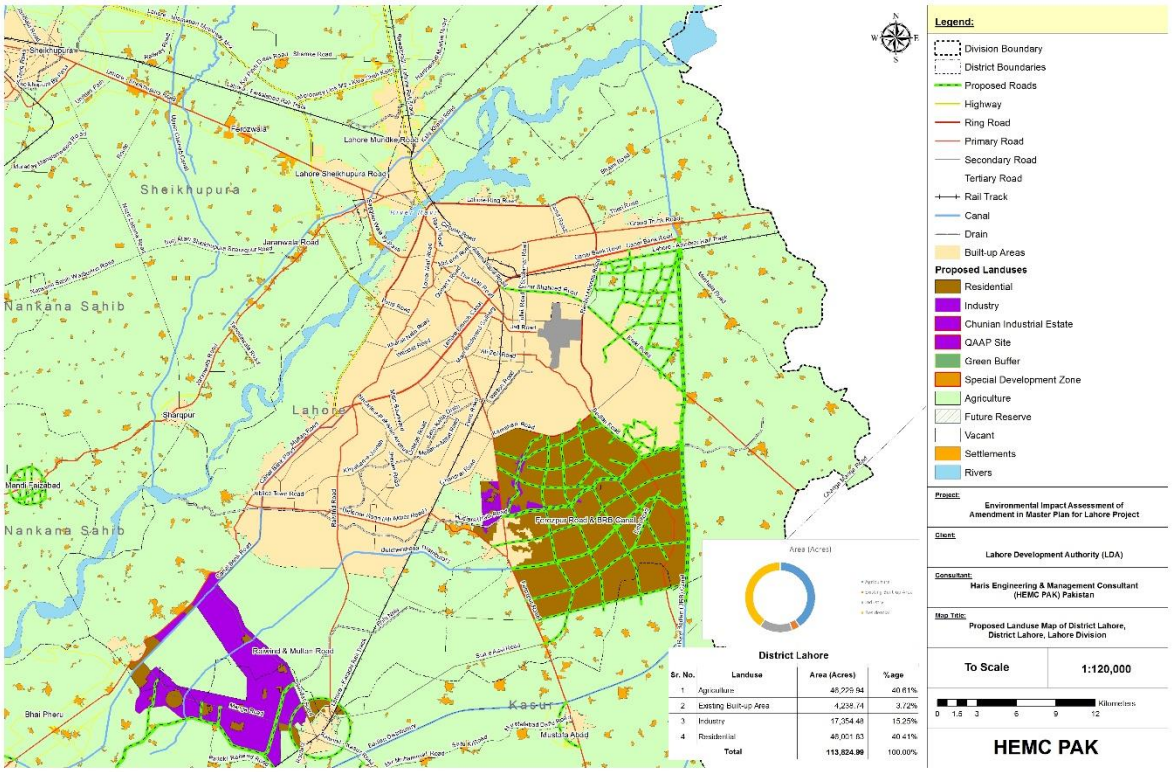


Figure 3 .2 Location Map of District Lahore

3.4.2. NANKANA SAHIB

Nankana Sahib is a district in the Punjab province of Pakistan. The district of Nankana Sahib is located about 75 kilometres (47 mi) west of Lahore and about 55 kilometres (34 mi) east of Faisalabad. The current population of Nankana Sahib is around 350,000 (2015 estimated figures) with average growth rate 2.35 %. The district Nankana Sahib has 3 tehsils namely Nankana Sahib, Shah Kot and Sangla Hill. Among these tehsils shahkot is the largest urban center. Nankana Sahib is a town of Gurdwaras (Sikh temples), the most important of these being the 'Nanak's Ayan' called Janam Asthan or Birth place of Nanak. Guru Nanak passed his whole

childhood and young age in Nankana Sahib. Sikhs in all over the world are the followers of Baba Guru Nanak Sahib. Nankhana Sahib is surrounded by 4 districts i.e. Kasur, Shiekhpura, Faisalabad and Lahore. The district is linked with Kasur, Lahore Shiekhpura and Faisalabad from GT road and M2 motor way. The district is also the site for some ambitious development including new facilities for visiting pilgrims, a modern hospital, international hotels, housing and planned international airport.

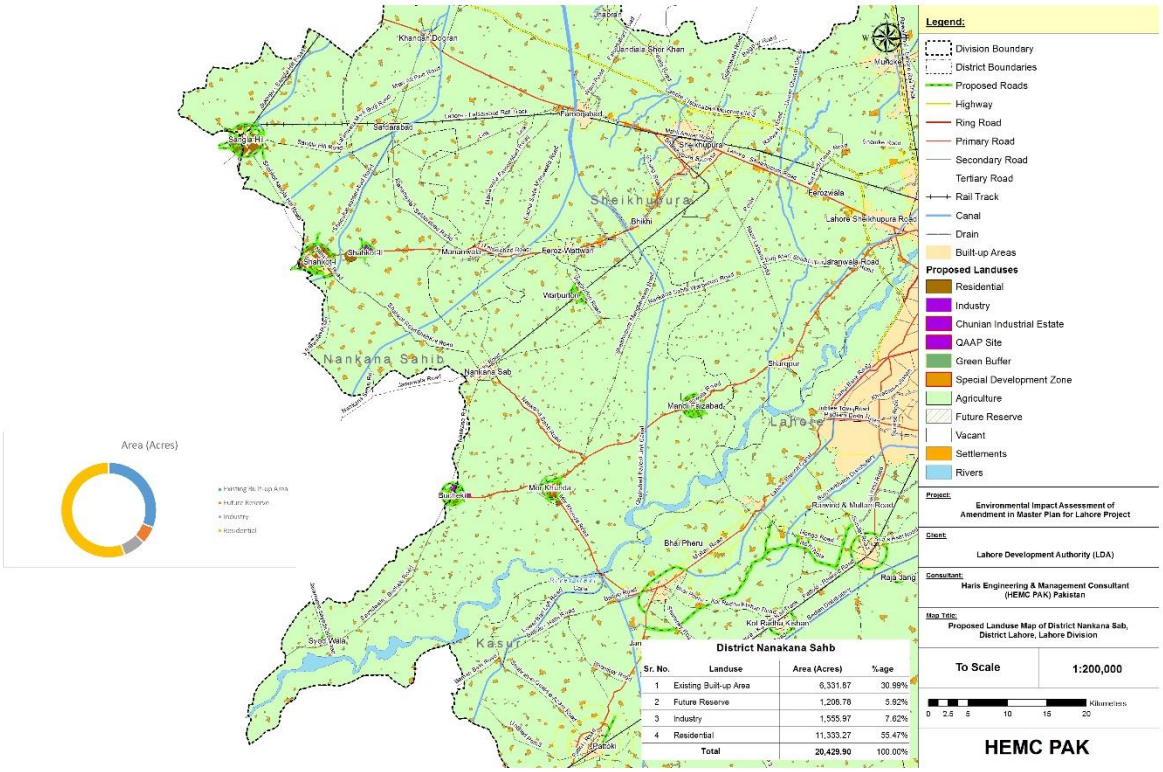


Figure 3 .3 Location Map of District Nankana Sab

3.4.3. KASUR

Kasur is one of the districts in the province of Punjab, Pakistan It came into existence on 1 July 1976. Earlier it was part of Lahore District. The district is bounded by the Ravi River in the north-west and river Sutlej in the south-east. Whereas the old course of Beas River bifurcates the district into two equal parts locally known as Hither and Uthar or Mithan Majh. Both of the areas have a height differential of approximately 5.5 meters. The natural surface elevation of the district is 198 meters above the sea level, having a general slope from north-east to south-west. Whereas the east and west ends of the district comprise the flood plains of the

rivers Satluj and Ravi, characterized by breaching of looping river Channels braided around meander bars. Kasur district is attached with Lahore from east, attached with Nankana Sahibfrom north, attached with Faisalabad from west and attached with Okara and India from south. Kasur is connected with road network of ferozpur road from Lahore and Gand Sighwala, Raiwind road from Raiwind and Depalpur road from Depalpur. The Kasur city is adjacent to the border of Ganda Singh Wala. Kasur has four tehsils namely Chunian, Qasu, Kot Radha Kishan and Pattoki. The district capital is Kasur city, the birth city of the Sufi poet Bulleh Shah, well known in that region as well as in the whole of Pakistan. The total area of the district is 4,796 square kilometres with estimated population 1.7 million (2015 estimates) and average growth rate about 2.99 %. Kasur is the 20th most populous city of Pakistan. The district is one of the major tourist attractions because of the famous guard changing ceremony on Ganda Singh Wala border. The city is also the resting place of Sufi poet Bulleh Shah. Kasur is famous for its very spicy fish, a sweet dish called Andrassay, Falooda and Kasuri Methi.

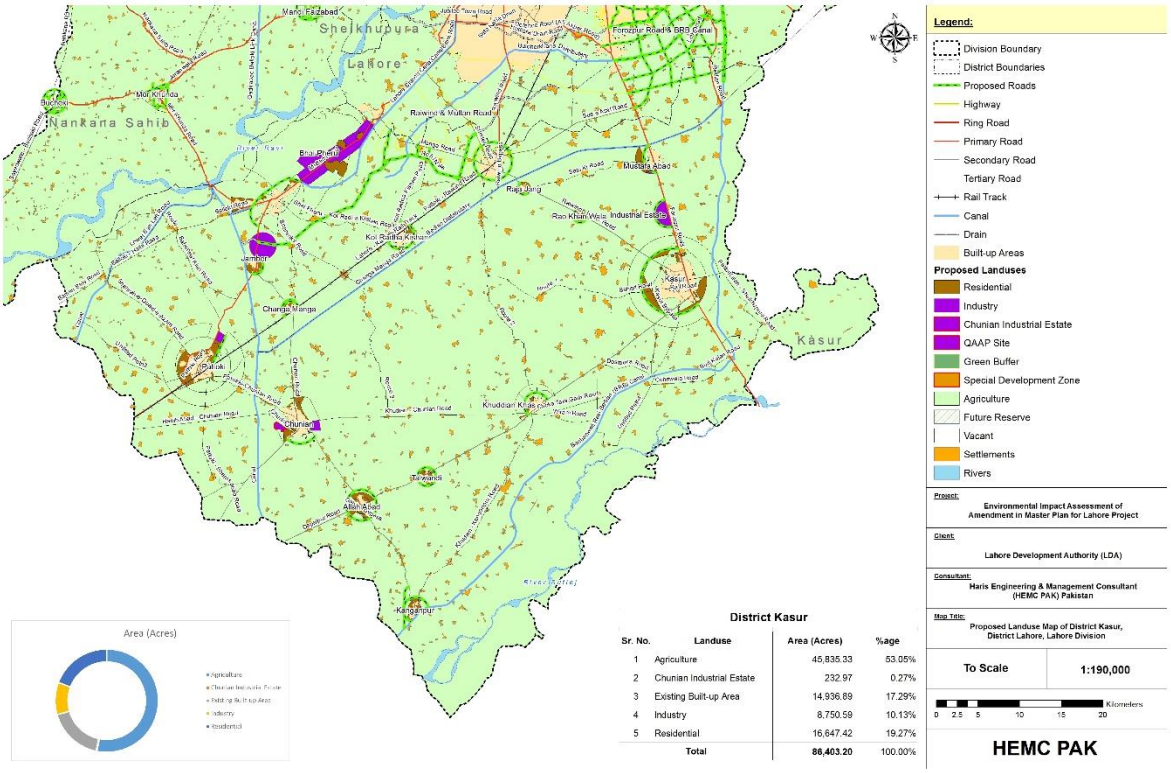


Figure 3 .4 Location Map of District Kasur

3.4.4. SHIEKHPURA

Sheikhupura District is located about 35 km northwest of Lahore in Pakistan. It is known for its historical places, and is commonly known locally as Qila Sheikhupura, because of the fort in the city, constructed by the Mughal Emperor Jahangir. The name of Sheikhupura is derived from a nickname of Prince Jahangir, who was known as Sheikhu by his father King Akbar. The present city of Sheikhupura was built by Mughal Emperor Jahangir in 1607. The district has 05 tehsils namely Sheikhu Pura, Feroz Wala, Murid Ke, Sharaq Pur and Safdar Abad. Among them Sheikhpura is the capital of Shiekhpura district. The shiekhpura district is the 16th largest city of Pakistan and is bounded by Lahore to the east, Gujranwala to the north, Hafizabad to the west and Nankana Sahib to the south. The area of shiekhpura district is about 5960 km2 with estimated population of 1.3 million. The district is commonly known for its worth-seeing historical places, industrial and agriculture surroundings and one of the best export-quality rice. It also owns Shakespeare of Punjabi poetry, famous sufi poet Waris Shah whose Heer is an imperishable legend of divine love. The best attractive sites for visitors in shiekhpura are Hiran Minar, Fort (Qila Sheikhupura), Company Bagh, Tomb of Shah Jamal, Sacha Sodha, Shrine of Mian Sher Muhammad Sharaqpuri, Shrine of Syed Pir Bahar Shahand Shrine of Syed Waras Ali Shah.

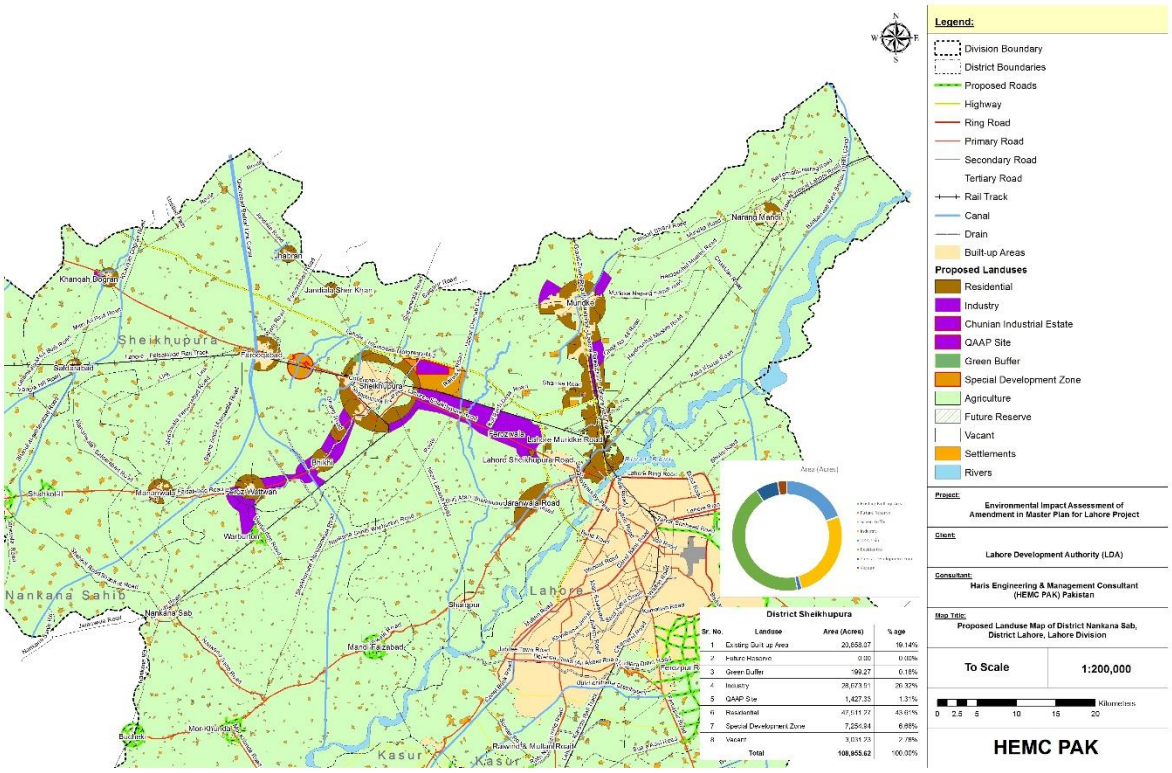


Figure 3 .5 Location Map of District Sheikhupura

3.5. DESCRIPTION OF SITE PROJECT AREAS IN LAHORE DIVISION

There are total 48 proposed areas selected for the master planning in Lahore Division out of 04 areas falls in Lahore District, 10 areas falls in Nankana District, 16 areas fall in Kasur District and 18 areas fall in Shiekhpura District. The description of each of these existing and proposed project areas with mapping are given as under-:

3.5.1. DISTRICT LAHORE

Two project areas fall in district Lahore detail description of which is given as under-:

3.5.1.1. PROJECT AREA (PA)-LHR-1- (FEROZPUR ROAD AND BRB CANAL)

Description of Project Area

In the West, area is bounded by Ferozepur Road starting from Chungi upto Hadyara Drain and extends along with Hadyara Drain upto proposed structure plan road. The boundary along structure plan intersects Defence Road joning Ferozepur Road at Kahna Kacha stop upto village Julkey.

In South, area is bounded by a proposed structure plan road starting from Ferozepur road near village Julkey upto BRB Canal.

In East, area is bounded by BRB canal starting from near Jahman upto Hadyara Drain.

In North, area is bounded by Hadyara drain starting from BRB canal upto Bedian Road, at North west Bedian Road staring from Hadyara Drain upto Ring Road at Nawaz Sharif Interchange and Ring Road joining Kamahan Road starting from Nawaz Sharif Interchange upto Ferozepur Road.

Proposed Project Area Master Plan

For Industrial Use: Area along Hudiara Drain with depth of 750 meters on both sides from Ferozpur Road upto Saora village towards East and along charar draintowards North incorporating existing industries is proposed for industrial use.

For Residential Use: Rest of the project Area is proposed for residential use.

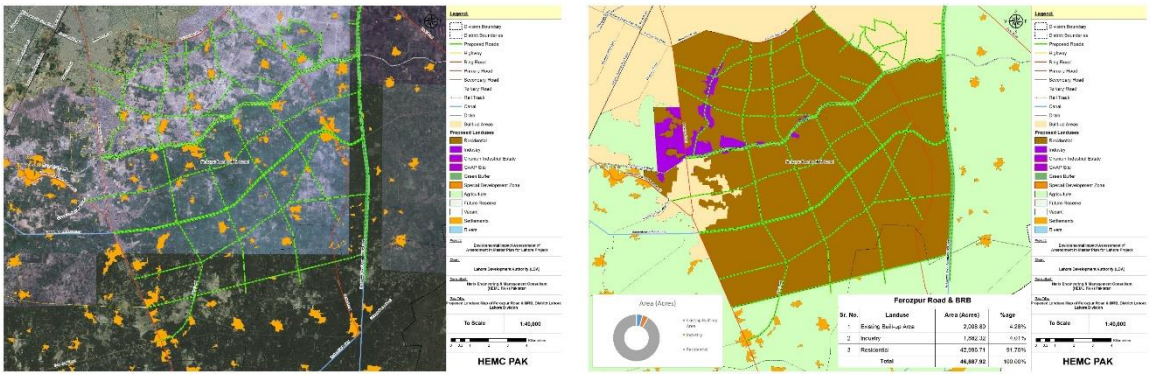


Figure 3 .6 Existing Situation Map and Proposed Plan of Ferozpur Road & BRB

3.5.1.2. PROJECT AREA Site-LHR-2 (Raiwind City)

Description of Project Area

In the North, area bounded by LDA City boundary and 1st proposed structure road (passing from Lake City, Bahria Town Sector-E) upto UBD Canal.

In the East, area bounded by Ferozpur road.

In the South, area bounded by Sua e Asal Road upto Raiwind, then along Southern boundary of Raiwind City, Bhucke Manjha, Butcherkhana Distributary, Rakh Mudke, Talib Sarai village upto Multan Road.

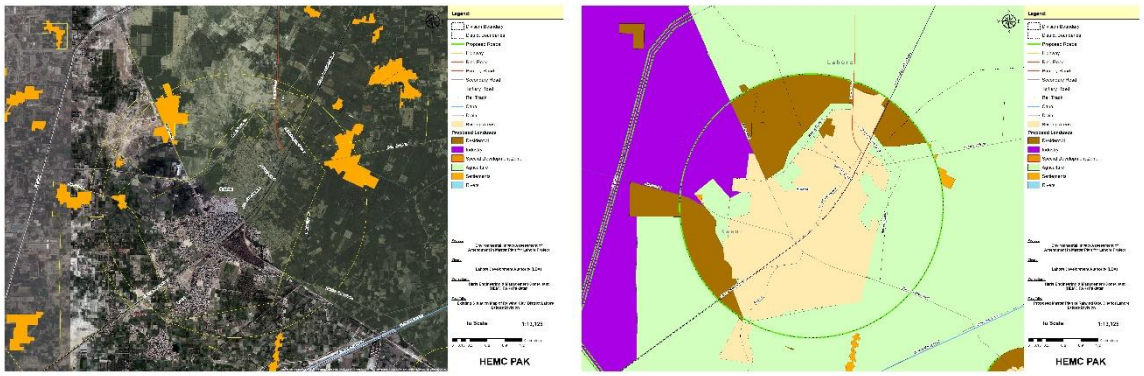


Figure 3 .7 Existing Situation Map and Proposed Plan of Raiwind City

Proposed Project Area Master Plan

For Residential Use: The area in the northern and south-western side has been declared as residential area.

For Industrial Use: Area between Sunder Road & Manga Road has been declared as Industrial Area.

For Agriculture Use: The vacant area across railway line in the east and south-east has been kept as agriculture area.

3.5.1.3. PROJECT AREA Site-LHR-3 MULTAN ROAD

Description of Project Area

The area of this site extends on both sides of Multan Road starting from Manga in the north and ends till northern boundary of Bhai Pheru in the south.

Proposed Project Area Master Plan

For Residential Use: The residential settlements falling within the site boundary, have been kept residential.

For Industrial Use: Strip on both sides of Multan Road has been declared Industrial Area.

For Agriculture Use: The area across the industrial strip on both sides of Multan Road has been declared agriculture area.

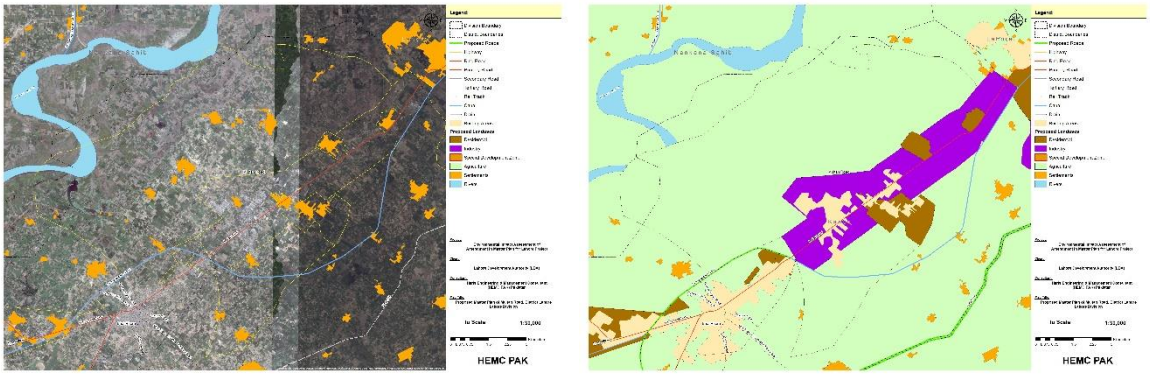


Figure 3 .8 Existing Situation Map and Proposed Plan of Multan Road

3.5.1.4. PROJECT AREA (PA)-LHR-4 (MULTAN ROAD, SUE ASAL ROAD, RAIWIND AND MANGA)

Description of Project Area

In the North, area bounded by LDA City boundary Lahore-Raiwind Road. In the East, area extends across Railway Line. In the South, area extends to the southern Railway Line and in the west, the area extends along Sunder Road & Manga Road.

Proposed Project Area Master Plan

For Residential Use: In the South, area along Railway line comprising Jodhudhire, Jamalpura, Rakh Jadu Burhanpura, Chaju wala and Raiwind upto proposed structure Road. In the West, area comprising of Manga, Samada, Sundar and Shamkey Khan. In the South, the area adjacent to Chak No.65, Rakh Mudke, Rosa, Talib Sarai, Chah Majhuwala, Sultanke, Mull, Bhai Kot, Nahla and Wara Kumharan.

For Industrial Use: In the South, area along Sundar-Raiwind Road (with an approx. depth of 2.3 Km towards South) and Manga-Raiwind Road (with an approx. depth of 1.6 Km) on both sides. The Notified Industrial Areas remains intact.

For Agriculture Use: Area bounded by Ferozepur Road in East upto LDA City Boundary in North running along 1st proposed structure road passing through Lake City and Bahria Town Sector E upto UBD Canal. Along Sue e Asal Road in the South, UBD Canal in the West and Sundar Road excluding industrial area. Area bounded between Sundar-Raiwind Road, Manga-Raiwind Road and Multan Road by excluding proposed Industrial Area.

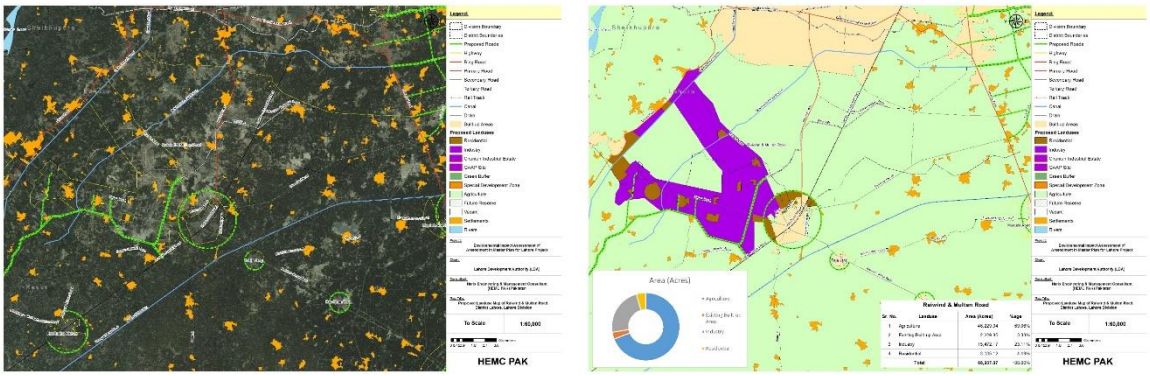


Figure 3 .9 Existing Situation Map and Proposed Plan of Sua-e-Asal Road, Raiwind and Multan Road

3.5.2. DISTRICT NANKANA SAHIB

Nine project areas fall in district Nankana Sahib detail description of which is given as under-:

3.5.2.1. Project Area (PA)-NSB-01(Mandi Faizabad)

Description of Project Area

In the North: About 1 km away from Jaranwala Road.

In the South: About 1.5 km on Mandi Faizabad-Nawan Kot Road till distributary.

In the East: 1 km before Mirzapur on Jaranwala Road.

In the West: Till Astana Aliya Rehan wala on Jaranwala Road

Proposed Project Area Master Plan

For Industrial Use: In the North East, area bounded by Lahore-Jarawala road, Dhaokemandi (with the depth of approx. 0.8km) Project boundary.

For Residential Use: Area along Lahore Janrwala Road with a depth of approx. 1 km on both sides.



Figure 3 .10 Existing Situation Map and Proposed Project Area Master Plan of Mandi Faizabad

3.5.2.2. Project Area (PA) -NSB-02 (Syed Wala)

Description of Project Area

In the North: About 600 Meters from Main Bazar Syed Wala on Jaranwala-Syed wala Road.

In the South: Till Syed Wala-Barra Ghar-Bucheki Road.

In the East: About 2km away from Jaranwala-Syed Wala Road.

In the West: About 700 meters away from Jaranwala-Syed Wala Road

Proposed Project Area Master Plan

For Residential Use: Whole Project Area is proposed for Residential purpose keeping in view existing trends.



Figure 3 .11 Existing Situation Map and Proposed Project Area Master Plan of Syed Wala

3.5.2.3. Project Area (PA)-NSB-03 (Bucheki)

Description of Project Area

In the North: Till Attari Ram Singh on Nankana Road

In the South: About 600 meters away from Bucheki bypass on Syed wala-Bara Ghar Road.

In the East: About 2 km from Bucheki Bypass on Jaranwala-Lahore Road

In the West: Till District Nankana Sahib limits

Proposed Project Area Master Plan

For Industrial Use: In the North, area bounded by Lahore-Jaranawala road and project boundary. In the South, small area along Bucheki Bypass and Bucheki road with an approximate depth of 1.5 km on either side.

For Residential Use: In the West, area bounded by Nankana road and Bucheki Bypass. In the South, area bounded by Lahore-jarawala road, Bucheki Bypass, Bucheki road and project boundary

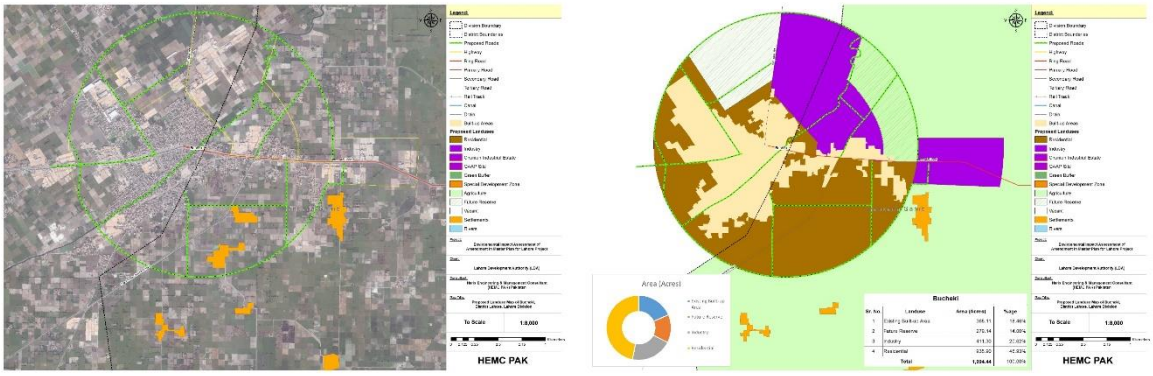


Figure 3 .12 Existing Situation Map and Proposed Project Area Master Plan of Bucheki

3.5.2.4. Project Area (PA)-NSB-04 (Nankana Sahib)

Description of Project Area

In the North: 1 km away from Manawala Bypass on Shahkot Road

In the South: About 300 meters away from Nankana Sahib on Mangtawala Road

In the East: About 300 meters from Nankana Sahib Bypass on Nankana-Warburton Road

In the West: About 300 meters away from Manawala Bypass on Jaranwala Road

Proposed Project Area Master Plan

All the uses of ODP are retained as such.

3.5.2.5. Project Area -NSB-05 (Shahkot-I)

Description of Project Area

In the North: Till Chak # 82 Rasulpur Araian on Safdarabad-Shahkot Road

In the South: Till Shahkot Minor on Jaranwala Road

In the East: Till Crescent cotton Mills Shahkot on Lahore-Sheikhupura-Faisalabad Road

In the West: Till Nankana Sahib District limits

Proposed Project Area Master Plan

For Residential Use: The land uses as mentioned in the ODP are retained as such, however rest of the area from ODP boundary upto project boundary is proposed as residential area.

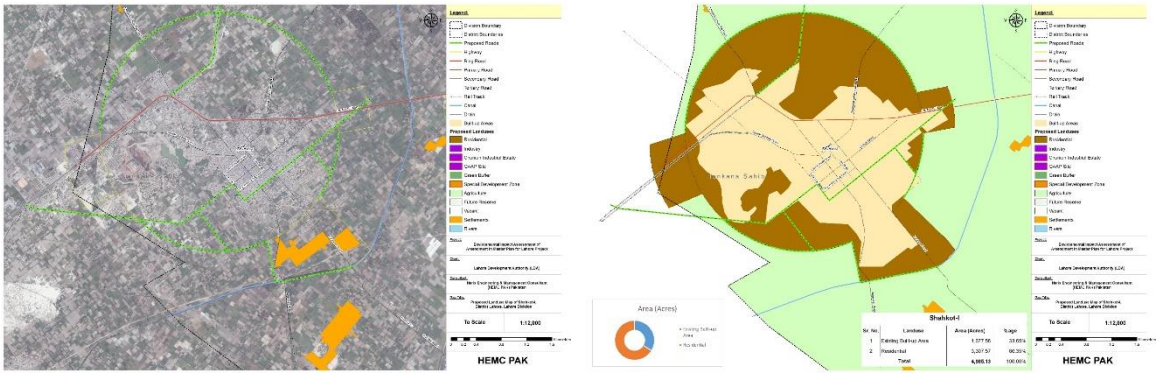


Figure 3 .13 Existing Situation Map and Proposed Project Area Master Plan of Shahkot-I

3.5.2.6. Project Area (PA)-NSB-06 (Sangla Hill)

Description of Project Area

In the North: about 600 meters from Ahmad Town Scheme & till Bhulair on Bhulair Road

In the South: Till TEVTA Building on Shahkot-Sangla Hill Road

In the East: about 2.5 km away from Railway Station along Railway line

In the West: Till Nankana Sahib District limits

Proposed Project Area Master Plan

For Residential Use: The land uses as mentioned in the ODP are retained as such, however rest of the area from ODP boundary upto project boundary is proposed as residential area.



Figure 3 .14 Existing Situation Map and Proposed Project Area Master Plan of Sangla Hill

3.5.2.7. Project Area (PA) -NSB-07 (More Khunda)

Description of Project Area

In the North: About 1.8 km from Lahore-Jaranwala Road

In the South: Till More Khunda Bypass on Bhai Pheru-Halla Road

In the East: Till Petrol Pump on Lahore-Jaranwala Road

In the West: Till More Khunda Bypass on Lahore Jaranwala Road

Proposed Project Area Master Plan

For Industrial Use: In the North East, area bounded by Lahore Jarawanala Road and Project Boundary with the depth of Approx. 0.7km towards West.

In the South West, area along Lahore Jaranwala Road with a depth of 0.5Km on both sides upto Guggian Gillan village towards East.

For Residential Use: Rest of the area is proposed as residential area.

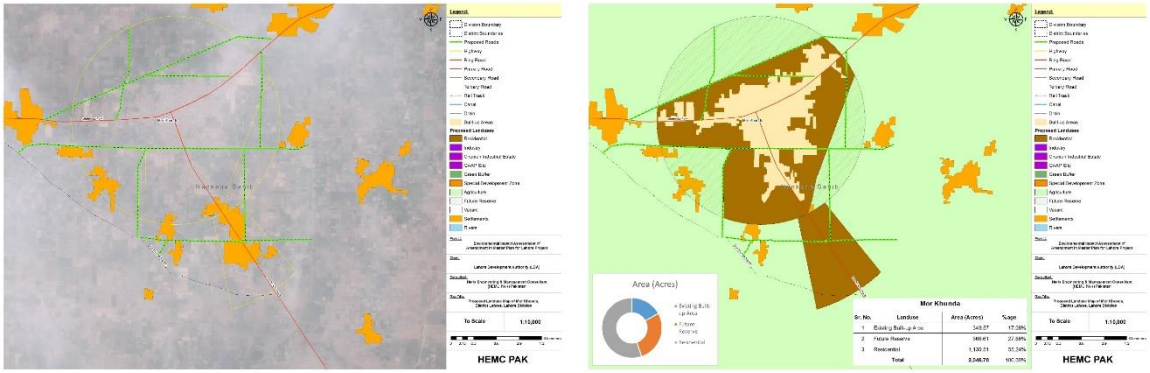


Figure 3 .15 Existing Situation Map and Proposed Project Area Master Plan of Mor Khunda

3.5.2.8. Project Area (PA)-NSB-08 (Shahkot-II)

Description of Project Area

In the North: About 1.5 km from Lahore-Sheikhupura-Faisalabad Road

In the South: About 700 meters away from Lahore-Sheikhupura-Faisalabad Road

In the East: Till end of Crescent Cotton Mills

In the West: Till Shahkot Flour Mill

Proposed Project Area Master Plan

For Industrial Use: Whole Project Area is proposed as Industrial area.

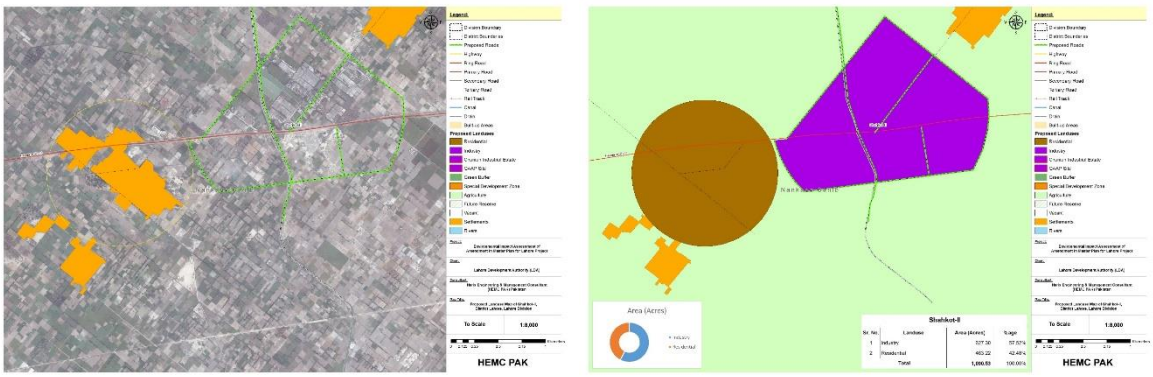


Figure 3 .16 Existing Situation Map and Proposed Project Area Master Plan of Shahkot-II

3.5.2.9. Project Area (PA)-NSB-09-(Warburton)

Description of Project Area

Area of length about 1.5 km towards North West, from Railway station Warburon.Area towards distributary Nanakana Sahib Warburton road in the South.

Proposed Project Area Master Plan

For Industrial Use: In the South East, area bounded by Nankana sahib warburton Road (with a distance of approx. 1.5 Km from project boundary) and project boundary.

In the South area along Nankana sahib warburton Road upto a distance of approx.0.8 Km with a depth of approx. 0.3 km towards North West.

For Residential Use: Rest of the area is proposed for residential use.

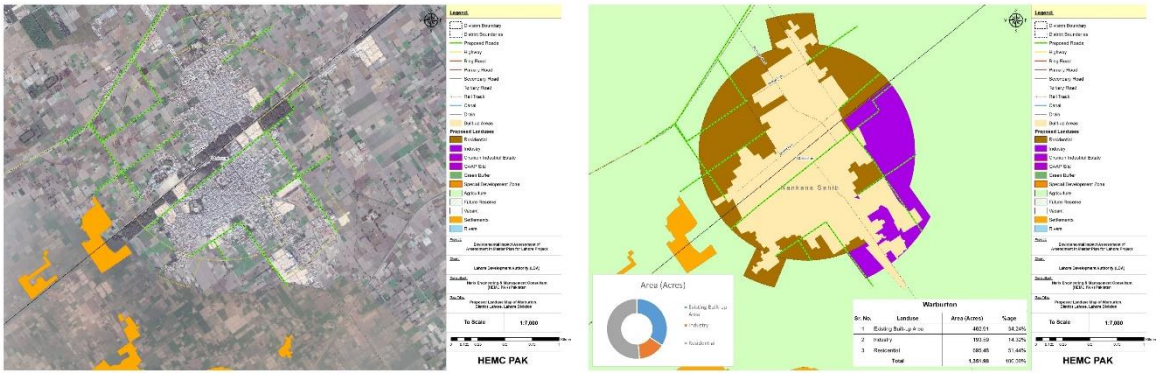


Figure 3 .17 Existing Situation Map and Proposed Project Area Master Plan of Warburton

3.5.2.10. Project Area Site-NSB-08

Description of Project Area

The area of this site runs on both sides of Sheikhupura-Faisalabad Road adjacent to the Site-NSB-10.

Proposed Project Area Master Plan

For Industrial Use: Whole of the project site has been declared as industrial area except the existing built-up area.

For Residential Use: Existing built-up area has been kept for residential use.



Figure 3 .18 Existing Situation Map and Proposed Project Area Master Plan of Site-NSB-08

3.5.3. DISTRICT KASUR

Sixteen project areas fall in district Kasur detail description of which is given as under-:

3.5.3.1. Project Area (PA)-K-01 (Kasur)

Description of Project Area

Boundary in the form of circle about 8 km diameter around the Kasur City

Proposed Project Area Master Plan

Residential Area is proposed in the South East and South West direction.

Landuse proposed as Sub Neighborhood Centre and Orchards in the existing ODP of Kasur are proposed as Residential area.

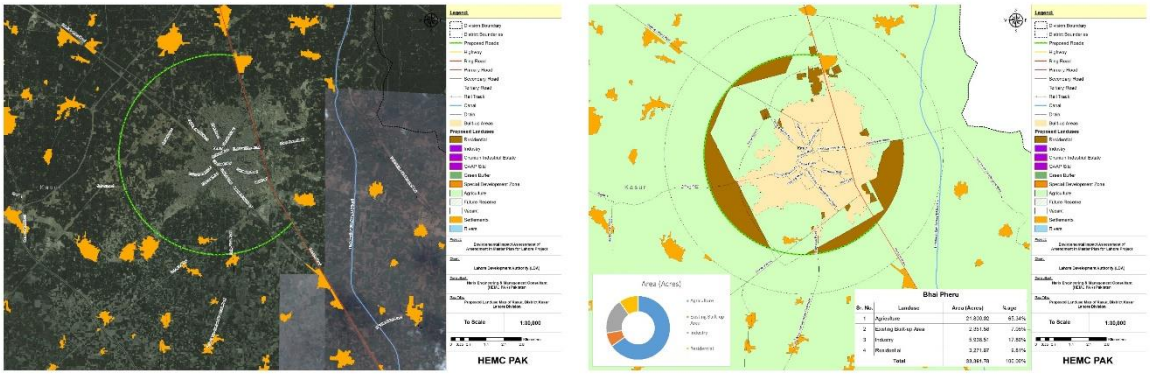


Figure 3 .19 Existing Situation Map and Proposed Project Area Master Plan of Kasur

3.5.3.2. Project Area (PA)-K-02 (Mustafabad)

Description of Project Area

Boundary of about 2.9 km radius in the form of Semi Circle around the Mustafabad in the western direction along Ferozpur road.

Proposed Project Area Master Plan

Industrial Area is proposed along the water bodies in the western direction along Ferozpur road.

Residential Area is proposed in the western direction of Mustafabad.

Landuse proposed as Sub Neighborhood Centre and Orchards in the existing ODP of Mustafabad are proposed as Residential area.

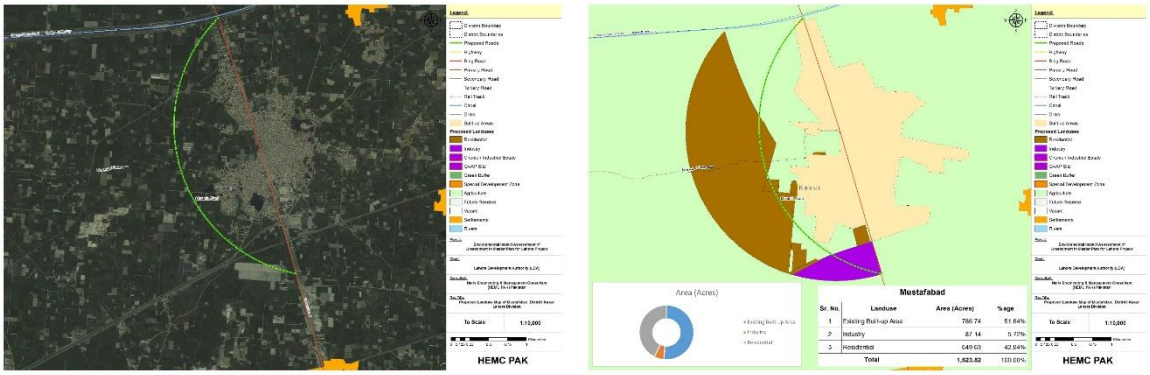


Figure 3 .20 Existing Situation Map and Proposed Project Area Master Plan of Mustafabad

3.5.3.3. Project Area (PA)-K-03 (Industrial Estate)

Description of Project Area

Boundary of about 2.7 km radius in the form of Semi Circle around the in the western direction along Ferozpur road.

Proposed Project Area Master Plan

Industrial Area is proposed in the western direction along Ferozpur road.

Thehwadana Settlement is kept as Residential Area

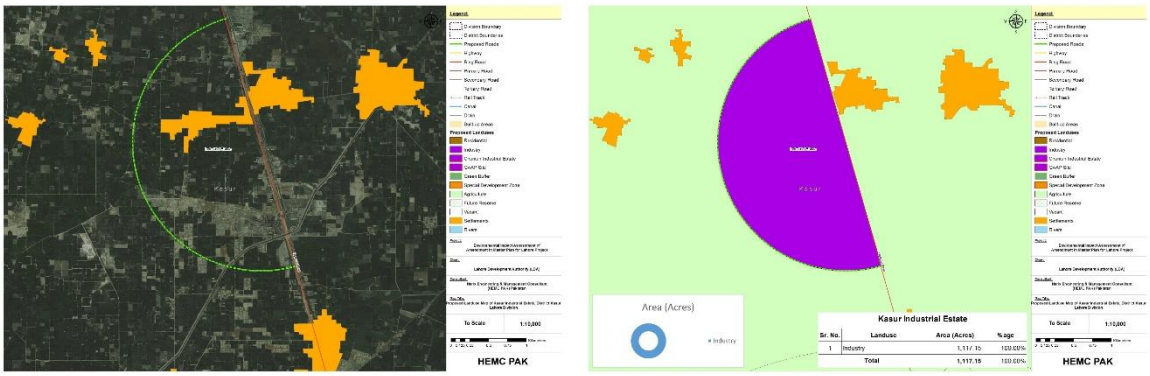


Figure 3 .21 Existing Situation Map and Proposed Project Area Master Plan of Kasur Industrial Estate

3.5.3.4. Project Area (PA)-K-04 (Khudian Khas)

Description of Project Area

Boundary of about 2.3 km radius in the form of Semi Circle around the Khudian in the north western direction.

Proposed Project Area Master Plan

Residential Area is proposed in the south western direction.

Landuse proposed as Educational Institute along railway line, Open Space along railway line near Ahmed City, and Orchards in the existing ODP of Khudian Khas are proposed as Residential area.

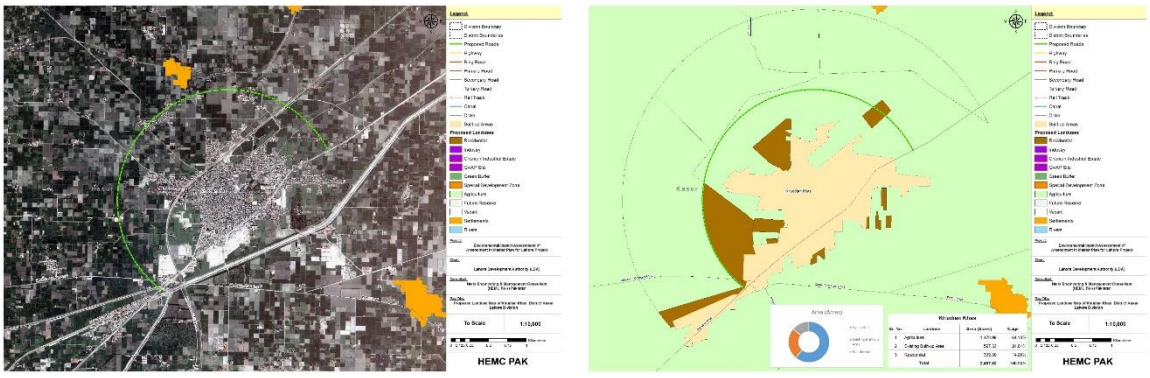


Figure 3 .22 Existing Situation Map and Proposed Project Area Master Plan of Khudian Khas

3.5.3.5. Project Area (PA)-K-05 (Rao Khan Wala)

Description of Project Area

Boundary in the form of circle about 1.6 km diameter around the Rao Khan Wala.

Proposed Project Area Master Plan

Residential Area is proposed in the form of circle about 1.6 km diameter around the Rao Khan Wala.



Figure 3 .23 Existing Situation Map and Proposed Project Area Master Plan of Rao Khan Wala

3.5.3.6. Project Area-K-06 (Raja jang)

Description of Project Area

Boundary in the form of circle about 1.6 km diameter around the Raja Jang

Proposed Project Area Master Plan

Residential Area is proposed in the form of circle about 1.6 km diameter around the Raja Jang



Figure 3 .24 Existing Situation Map and Proposed Project Area Master Plan of Raja Jang

3.5.3.7. Project Area (PA)-K-07 (Kot Radha Kishan)

Description of Project Area

Boundary in the form of circle about 3.8 km diameter around the Kot Radha Kishan

Proposed Project Area Master Plan

Residential Area is proposed sourrounding the existing built up area of Kot Radha Kishan.

Landuse earmarked as Proposed Educational Institute along Bhae Pheru Kot Radha Kishan Road, and Orchards in the existing ODP of Kot Radha Kishan are proposed as Residential area.

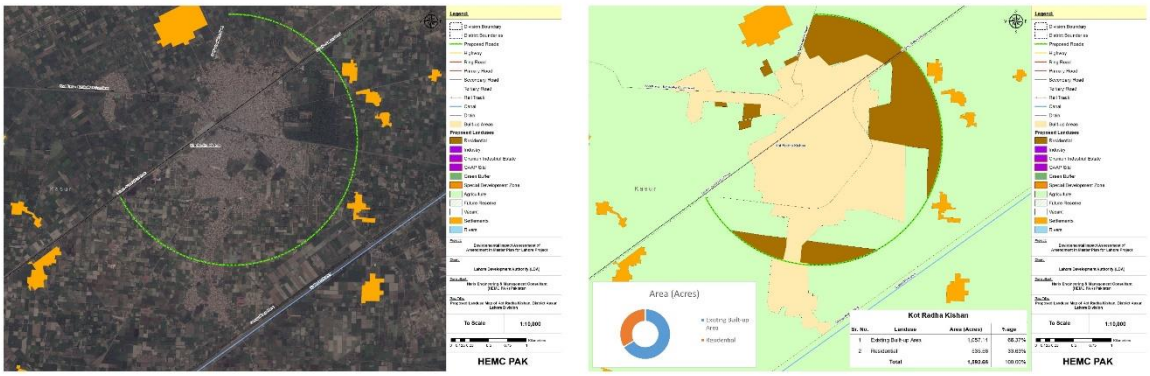


Figure 3 .25 Existing Situation Map and Proposed Project Area Master Plan of Kot Radha Kishan

3.5.3.8. Project Area (PA)-K-08- (Changa Manga)

Description of Project Area

Boundary of about 1.5 km diameter in the form of Semi Circle around the Changa Manga in the north western direction

Proposed Project Area Master Plan

Residential Area is proposed about 1.5 km diameter in the form of Semi Circle around the Changa Manga in the north western direction.

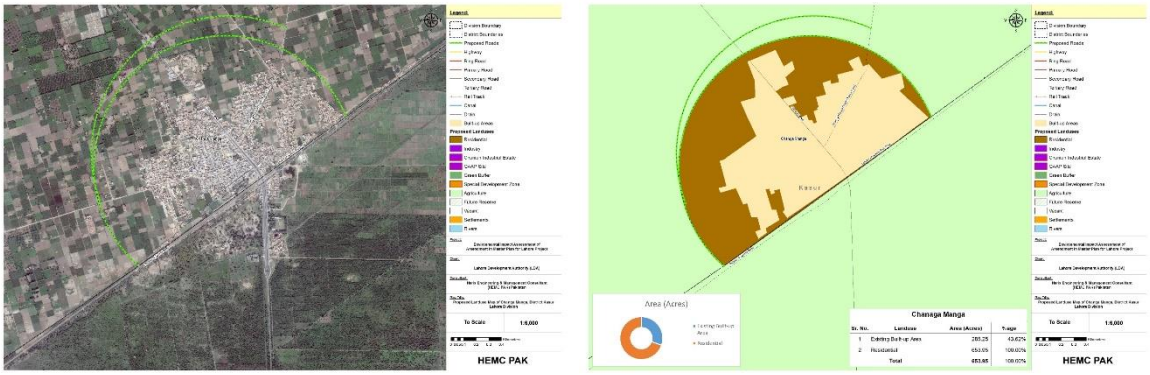


Figure 3 .26 Existing Situation Map and Proposed Project Area Master Plan of Changa Manga

3.5.3.9. Project Area (PA) -K-07- (Bhae Pheru)

Description of Project Area

The area Bounded by Manga Mandi in the North. The area bounded by Chunian Industrial Estate in the West & East. Area bounded by ODP boundary of Bhaepheru.

Proposed Project Area Master Plan

Industrial Area is proposed about 1 km in depth along Multan road on both sides from Manga Mandi to ODP boundary of Bhae Pheru.

ODP uses of Bhae Pheru are intact as it is. The area of Chunian Industrial estate is proposed as Agriculture Area

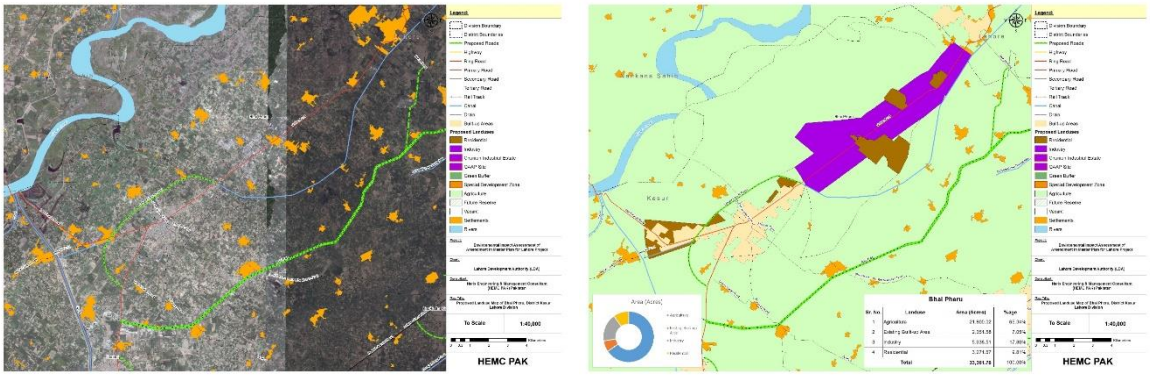


Figure 3 .27 Existing Situation Map and Proposed Project Area Master Plan of Bhai Pheru

3.5.3.10. Project Area (PA)-K-9- (Jamber)

Description of Project Area

Boundary of about 4.0 km diameter in the form of Semi Circle around the Jamber in the north, east and south direction.

Proposed Project Area Master Plan

Industrial Area is proposed about 2492 acres from balloki sulemanki canal with a depth of 4 km towards eastern side.

Residential Area is proposed about 1748 acre Balloki Sulemanki Link Canal with a depth of 4km towards southern direction.

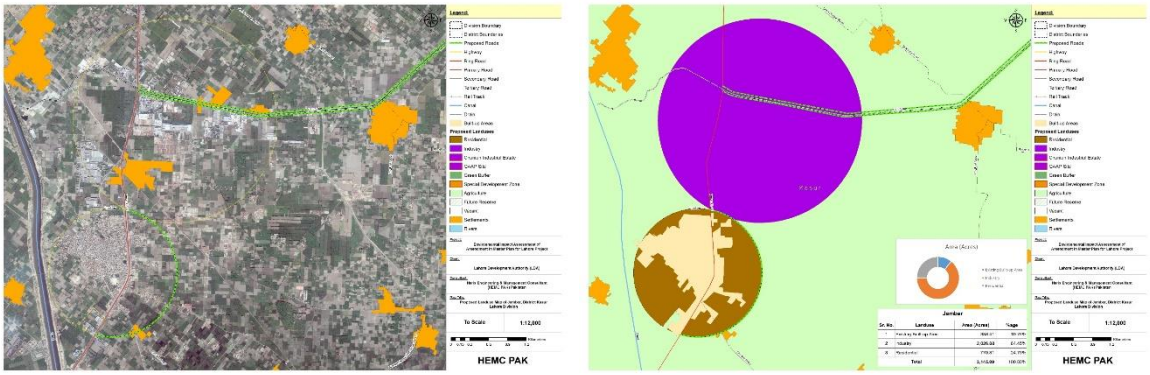


Figure 3 .28 Existing Situation Map and Proposed Project Area Master Plan of Jamber

3.5.3.11. Project Area (PA)-K-11 (Chunian)

Description of Project Area

Boundary in the form of circle about 6.5 km diameter around the Chunian

Proposed Project Area Master Plan

Residential Area is proposed in the form of circle in the north, south and western direction.

Industrial Area is proposed in the eastern direction.

Landuse marked as Existing Orchards/Open Space and proposed Open Space in the existing ODP of Chunian are proposed as Residential area.

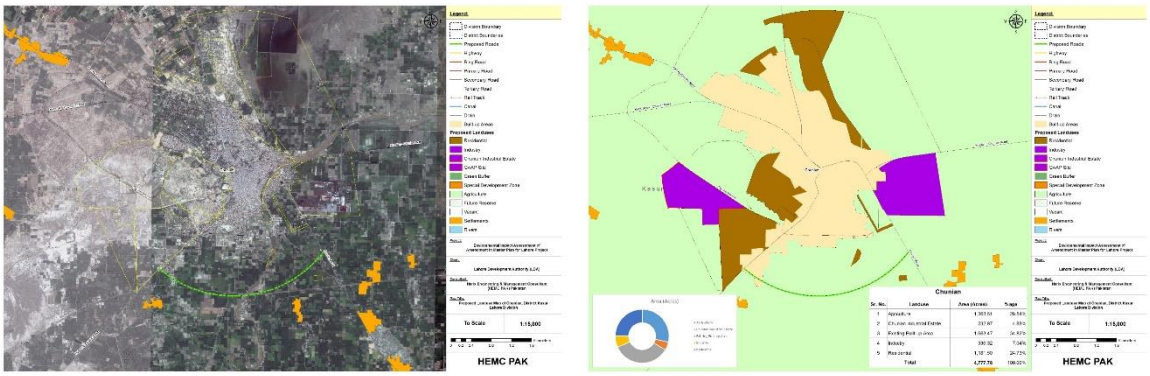


Figure 3 .29 Existing Situation Map and Proposed Project Area Master Plan of Chunian

3.5.3.12. Project Area (PA)-K-12 (Allahabad)

Description of Project Area

Boundary in the form of circle having diameter about 3.75 km around Allahabad.

Proposed Project Area Master Plan

Residential Area is proposed in the form of circle having diameter about 3.75 km around Allahabad.

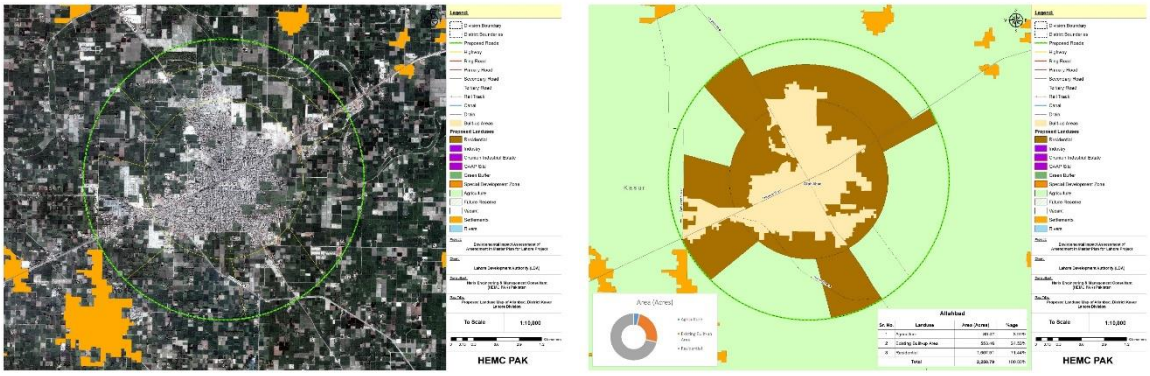


Figure 3 .30 Existing Situation Map and Proposed Project Area Master Plan of Allahabad

3.5.3.13. Project Area (PA)-K-13 (Kanganpur)

Description of Project Area

Boundary of about 2.0 km diameter in the form of Semi Circle around the Kanganpur in the north, west and south direction.

Proposed Project Area Master Plan

Residential Area is proposed about 2.0 km diameter in the form of Semi Circle around the Kanganpur in the north, west and south direction.

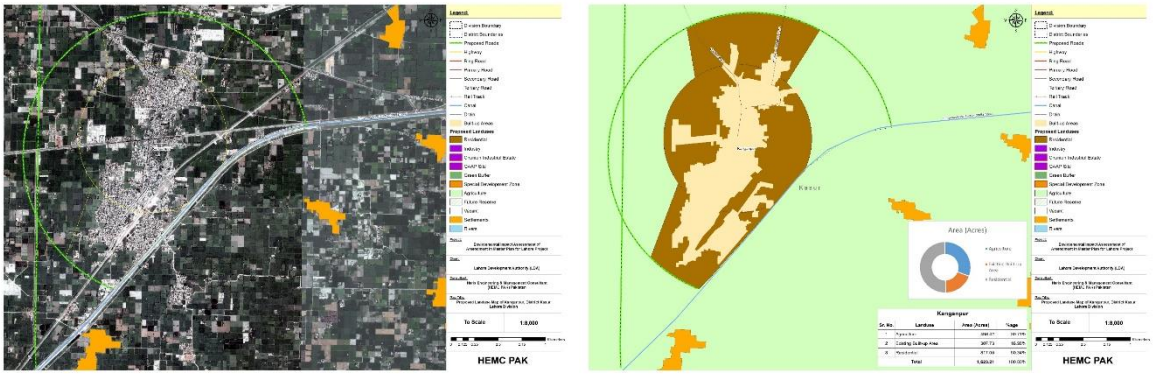


Figure 3 .31 Existing Situation Map and Proposed Project Area Master Plan of Kanganpur

3.5.3.14. Project Area (PA)-K-14 (Pattoki)

Description of Project Area

Boundary in the form of circle having diameter about 6.5 km around Pattoki.

Proposed Project Area Master Plan

Residential Area is proposed about 3806 acres in the north, west & south direction.

Landuse earmarked as proposed Educational, Agriculture, Commercial and Institutional cum offices in the existing ODP of Pattoki are proposed as Residential area.

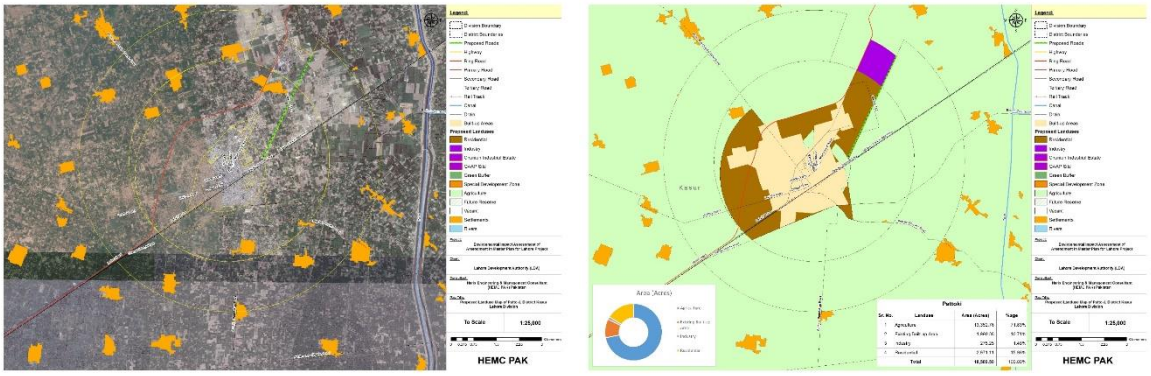


Figure 3 .32 Existing Situation Map and Proposed Project Area Master Plan of Pattoki

3.5.3.15. Project Area (PA)-K-15 (Talwandi)

Description of Project Area

Boundary in the form of circle having diameter about 2.3 km around Talwandi.

Proposed Project Area Master Plan

Residential Area is proposed in the form of circle having diameter about 2.3 km around Talwandi.



Figure 3 .33 Existing Situation Map and Proposed Project Area Master Plan of Talwandi

3.5.3.16. Project Area Site-K-11

Description of Project Area

This project site is in the form of a circle along Multan Road and is located in north of Jamber settlement.

Proposed Project Area Master Plan

The whole of the project site has been declared as industrial area except the existing built-up area.

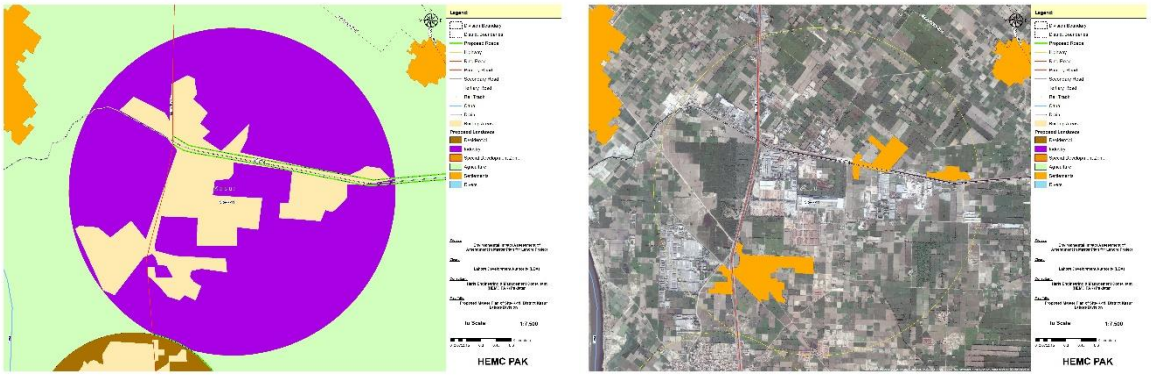


Figure 3 .34 Existing Situation Map and Proposed Project Area Master Plan of Site-K-11

3.5.4. DISTRICT SHEIKHUPURA

3.5.4.1. PA-SKP-1(Sheikhupura City)

Description of Project Area

In the North, area boundary align with the Lahore Islamabad Motorway M-2,

In the East, aligns with Tehsil boundary.

In the West,aligns with Kurlkey drain upto Jhaamkay settlement on both sides of Sargodha road.

In the South,area running parallel along Sheikhupura Bypass Road.

Proposed Project Area Master Plan

For Residential Use: The area from tehsil limits in eastern side to western side till Jhamkay settlement and northern side up to motorway except areas reserved for green buffer and industrial use as residential. In southern direction area of about 2

km running parallel to existing ODP boundary of Sheikhupura as residential except area reserved as industrial.

For Industrial Use: From tehsil limits in eastern direction till Sheikhu Garden Housing Scheme as industrial, and till railway line in northern direction, and 1 Km away from Lahore Sheikhupura Road. 500 m area from Bado Road on each side till 5km from Lahore Sheikhupura Road as Industrial.

For Green Buffer: 250 m green buffer from Motorway in Northern direction and 100 m along Inter Change. Area surround by HiranMinarof about 3 km.

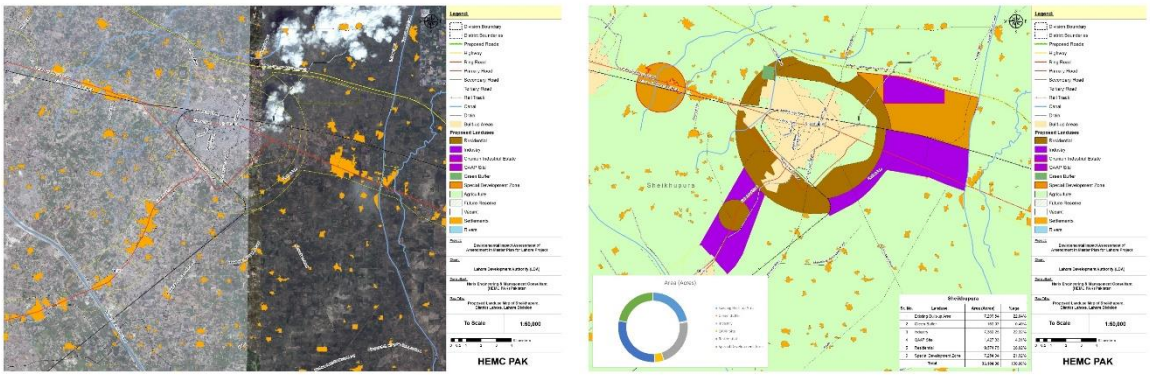


Figure 3 .35 Existing Situation Map and Proposed Project Area Master Plan of Sheikhupura City

3.5.4.2. Project Area (PA)-SKP-2- (Muridke)

Description of Project Area

In the North, area bounded by GT road & railway line near PSO rachna petrol station.

In the South, area bounded by Lahore bypass near NHA office (near KSK Campus)

In the West, area bounded by DeghNullah&Canal and MuridkeDistributory& Village KotHanif.

In the East, area bounded by Railway line, Chak no.44 road and KhudakiBasti Scheme.

Proposed Project Area Master Plan

For Residential Area: The area from northern to southern direction except the area in between railwayline and G.T. Road as residential.

For Industrial Use: From Preimer Housing scheme on railway line till ODP boundary of Muridkein between railway line and G.T. Road as industrial. From Model City Housing Scheme till project area boundary in northern direction in between G.T. Road and Railway line as Industrial. Area along both side of Sheikhupura-Muridke Road till project area boundary as industrial.Area along Narowal-Muridke road from Siddiqia colony scheme till project Area boundary as industrial.

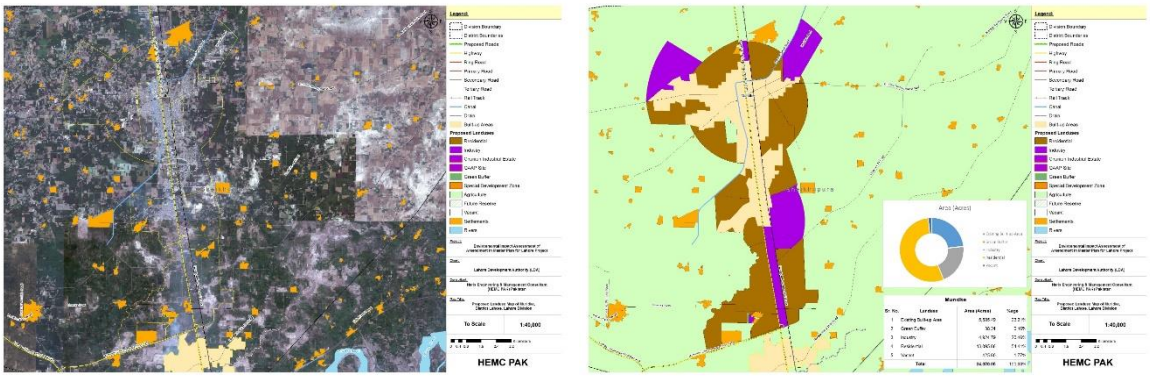


Figure 3 .36 Existing Situation Map and Proposed Project Area Master Plan of Muridke

3.5.4.3. Project Area (PA)-SKP-3 (Ferozwala)

Description of Project Area

In the North, area bounded from Lahore Sheikhupura Road to include Dera Major Riaz, Karianwala crossing kotpindi das road towards Nabipur.

In the South, area bounded from Lahore Shiekhupura Road to include TibbaRehmat Khan, Sarai and Mominpura.

In the West, area bounded Khanpur canal near Khanpur village.

In the East, area bounded from Lahore Islamabad Motorway M-2.

Proposed Project Area Master Plan

Area along Lahore Sheikhupura Road from Lahore Motorway (Kot Abdul Malik interchange) till Khanpur canal as industrial except few existing residential colonies.



Figure 3 .37 Existing Situation Map and Proposed Project Area Master Plan of Ferozwala

3.5.4.4. Project Area (PA)-SKP-4 (Farooqabad)

Description of Project Area

In the North, area bounded from Lahore Sargodha road towards Mureedke settlement.

In the South, area bounded from Lahore Sargodha road to include NokharNawan settlement.

In the West, area bounded by QadarabadBalloki link Canal.

In the East, area running parallel to the drain and crossing Lahore Sargodha road.

Proposed Project Area Master Plan

For Residential Use: All the area surrounded by existing ODP boundary of Farooqabadfrom northern to southern direction till project area boundary as residential.

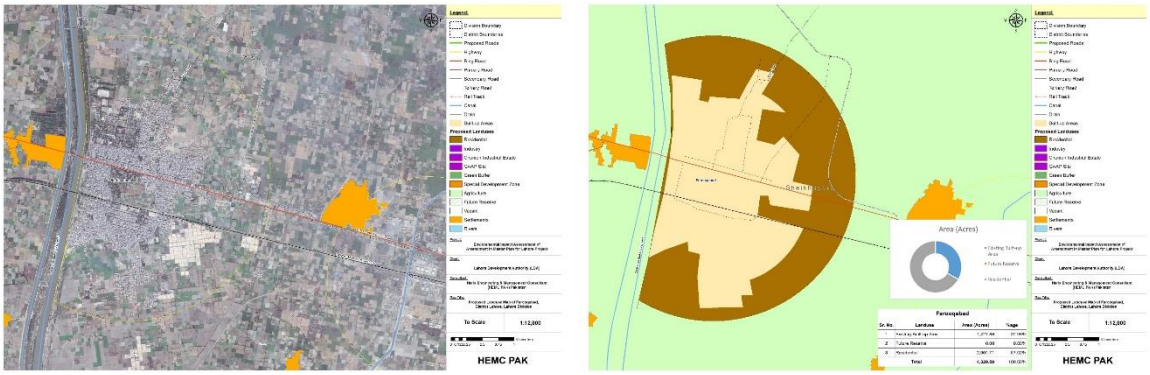


Figure 3 .38 Existing Situation Map and Proposed Project Area Master Plan of Farooqabad

3.5.4.5. Project Area (PA)-SKP-5 (Narangmandi)

Description of Project Area

In the North, area bounded by Manawala settlement to Mayoun da Dera along NarowalMuridke road.

In the SouthWest, area running parallel to Kala KhataiNarangmandiRoad from Manawala settlement to Khun.

In the East, area bounded from Khun to Younas Park.

Proposed Project Area Master Plan

All the uses of ODP of NarangMandi are retained as such and some area has been included other than ODP as residential in the North Eastern side

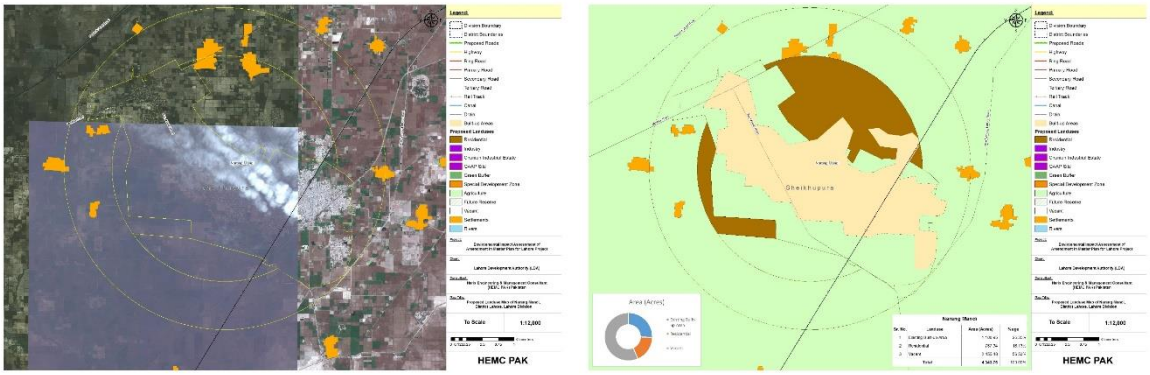


Figure 3 .39 Existing Situation Map and Proposed Project Area Master Plan of Narang Mandi

3.5.4.6. Project Area (PA)-SKP-6- (Sharqpur)

Description of Project Area

In the North West, area bounded bynaibhini towards distributary approximately 1 km loop running parallel Jaranwala road in Sharaqpur.

In the South East, area bounded by Hafiz sidhi settlement and Ghareebaabad settlement approximately 1 km loop running parallel Jaranwala road in Sharaqpur.

Proposed Project Area Master Plan

All the uses of ODP of Sharaqpur are retained as such, other than the landuses that proposed as orchards in existing ODP are proposed as residential.

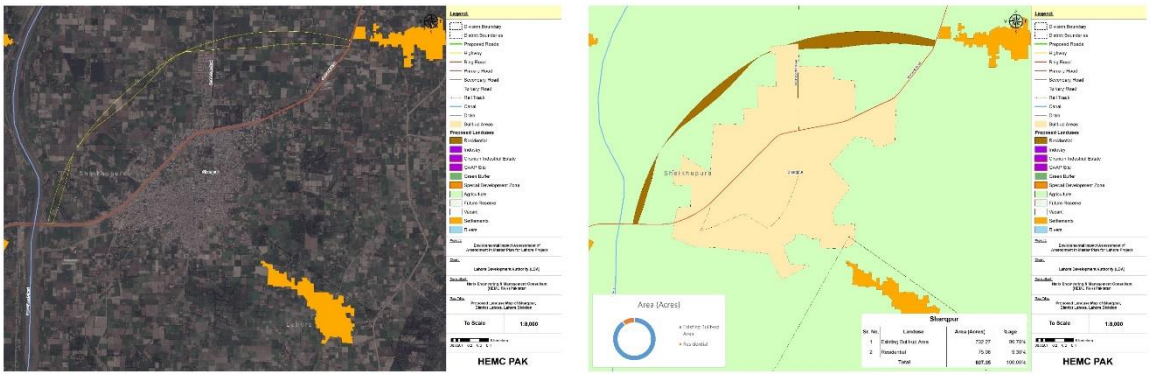


Figure 3 .40 Existing Situation Map and Proposed Project Area Master Plan of Sharqpur

3.5.4.7. Project Area (PA)-SKP-7 (Safdarabad)

Description of Project Area

Area bounded by approximately 1.5 km in circular form from Railway Station, Safdarabad.

Proposed Project Area Master Plan

For Residential Use: Area bounded by approximately 1.5 km in circular form from Railway Station, Safdarabad.

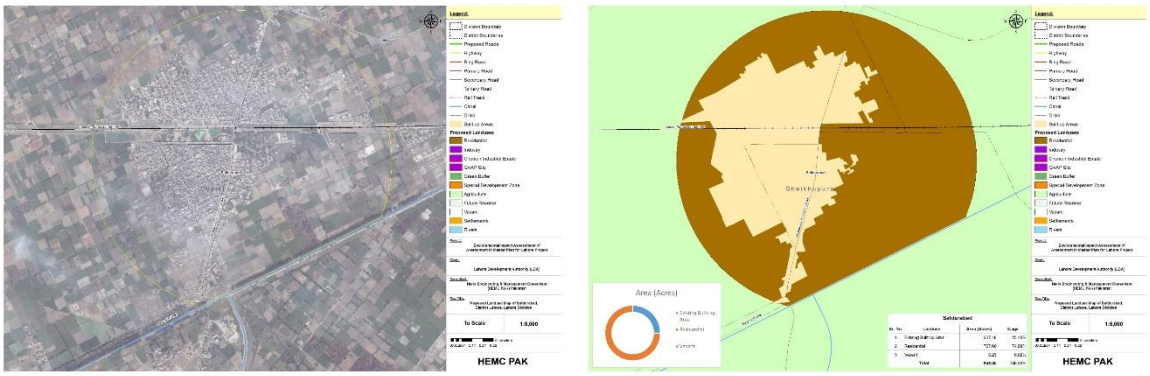


Figure 3 .41 Existing Situation Map and Proposed Project Area Master Plan of Safdarabad

3.5.4.8. Project Area (PA)-SKP-8(Bhiki)

Description of Project Area

Area running parallel about 1 km in depth from Kudalthi More to QadarabadBalloki Link Canal along Lahore Sheikhupura- Faisalabad Road on both sides.

Proposed Project Area Master Plan

For Residential Use: From Rasool town till Khariawala village and area surround by Bhikhi settlement as Residential.

For Industrial Use: All the remaining area (other than residential) from Kudalthi More to QadarabdBalloki canal as industrial till project Area boundary.

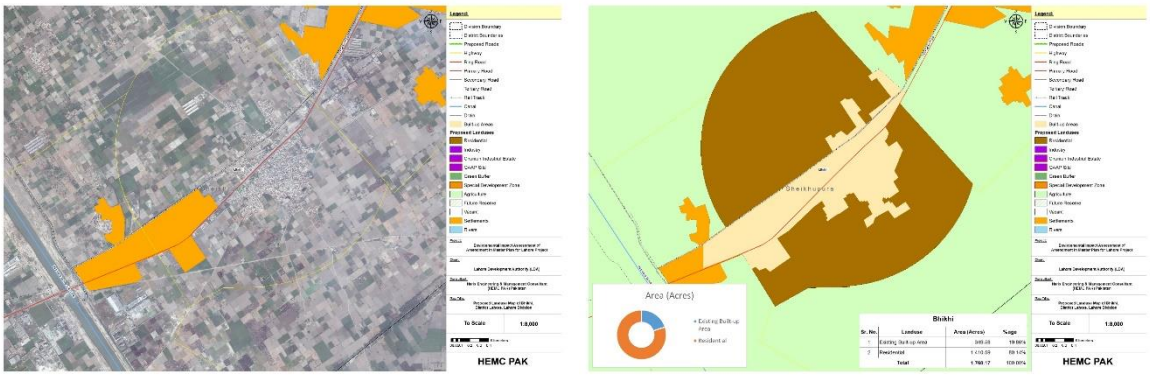


Figure 3 .42 Existing Situation Map and Proposed Project Area Master Plan of Bhikhi

3.5.4.9. Project Area (PA)-SKP-9 (Ferozwatwan)

Description of Project Area

Area running parallel approximately 1.5 km in depth from QadarabadBalloki Link Canal to TaaliChak along Lahore Sheikhupura- Faisalabad Road on both sides.

Proposed Project Area Master Plan

For Residential Use: About 500 m in depth on NawanKot settlement as residential. About 1.5 km away from Sheikhupura-Faisalabad Road in northern direction and 1 km in southern direction as residential.

For Industrial Use: Rest of area other than residential use is industrial till project area boundary from canal to TaaliChak.

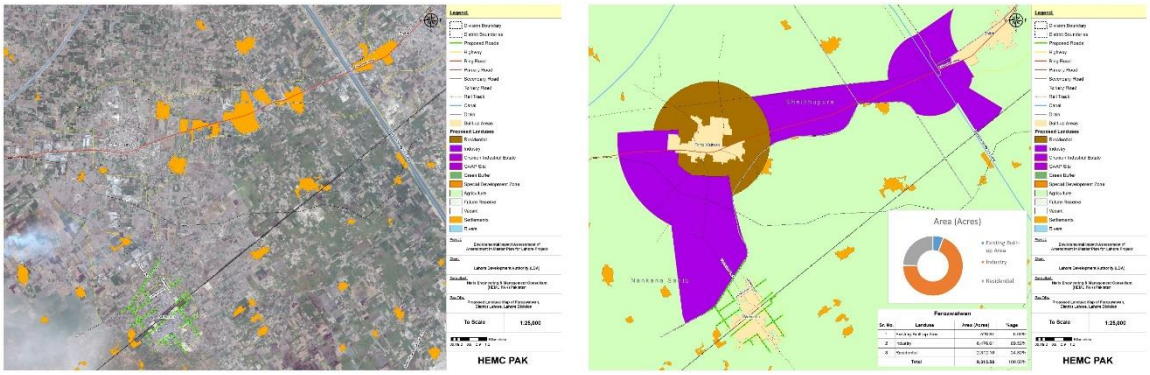


Figure 3 .43 Existing Situation Map and Proposed Project Area Master Plan of Ferozwatwan

3.5.4.10. Project Area (PA)-SPA-10 (Manawala)

Description of Project Area

In the North, area running parallel about 1 km in depth along Lahore Sheikhupura Faisalabad Road.

In the South, area bounded by Saimnullah.

In the West, area bounded by Iqbal Nagar to Saimnullah road.

In the East, area bounded by briks road and Saimnullah.

Proposed Project Area Master Plan

For Residential Use: The area marked as project area from northern to southern direction till project area boundary as residential.

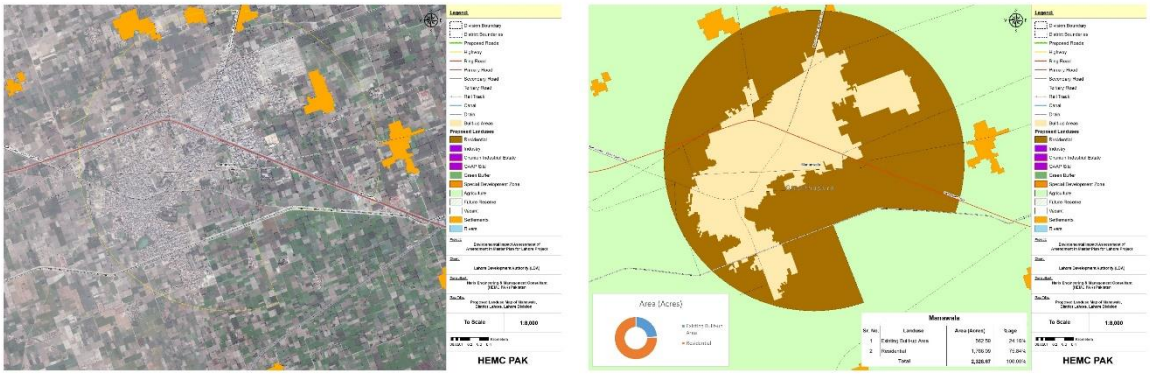


Figure 3 .44 Existing Situation Map and Proposed Project Area Master Plan of Manawala

3.5.4.11. Project Area (PA)-SKP-11 (KhanqahDogran)

Description of Project Area

The area is bounded about 1 km all around from the center of Khanqah Doran

Proposed Project Area Master Plan

For Residential Use: The area is bounded about 1 km all around from the center of Khanqah Doran as residential except area reserved for industrial use within project area boundary

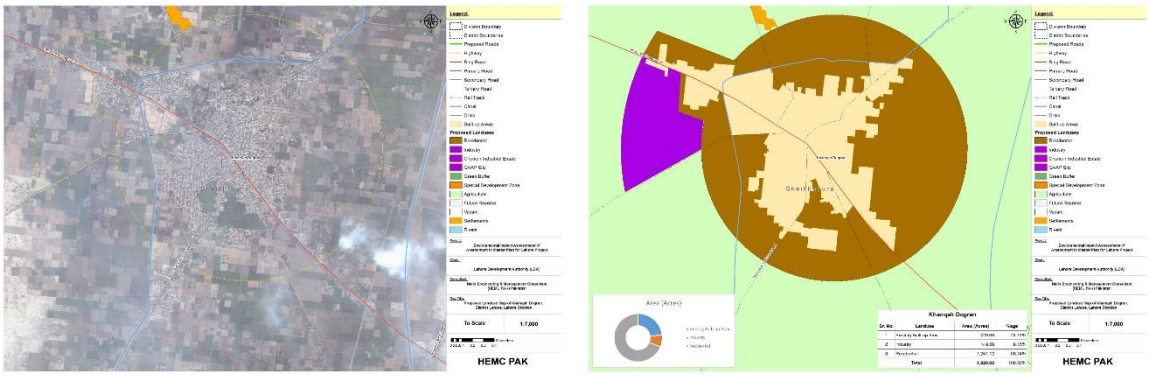


Figure 3 .45 Existing Situation Map and Proposed Project Area Master Plan of Khanqah Dogran

3.5.4.12. Project Area (PA)-SKP-12 (JandialaSher Khan)

Description of Project Area

The area running parallel about 0.6 km in depth along JandialaRoad on both sides in Jandiala Sher Khan.

Proposed Project Area Master Plan

For Residential Use: The area running parallel about 0.6 km in depth along JandialaRoad on both sides in JandialaSher Khana as residential

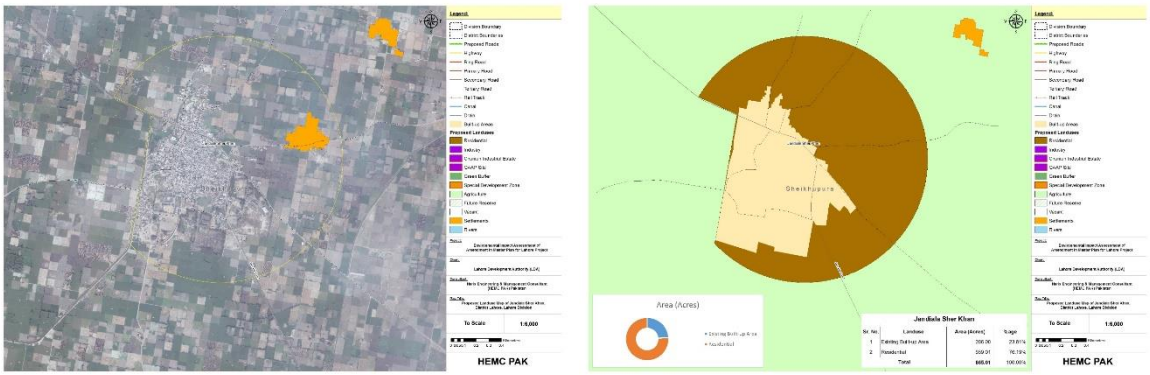


Figure 3 .46 Existing Situation Map and Proposed Project Area Master Plan of Jandiala Sher Khan

3.5.4.13. Project Area (PA)-SKP-13 (Jhabran)

Description of Project Area

Area running parallel about 1 km in depth along both sides of Hafizabad road from drain to kaakargil road crossing in Jhabran.

Proposed Project Area Master Plan

For Residential Use: Area running parallel about 1 km in depth along both sides of Hafizabad road from drain to kaakargil road crossing in Jhabranas residential.

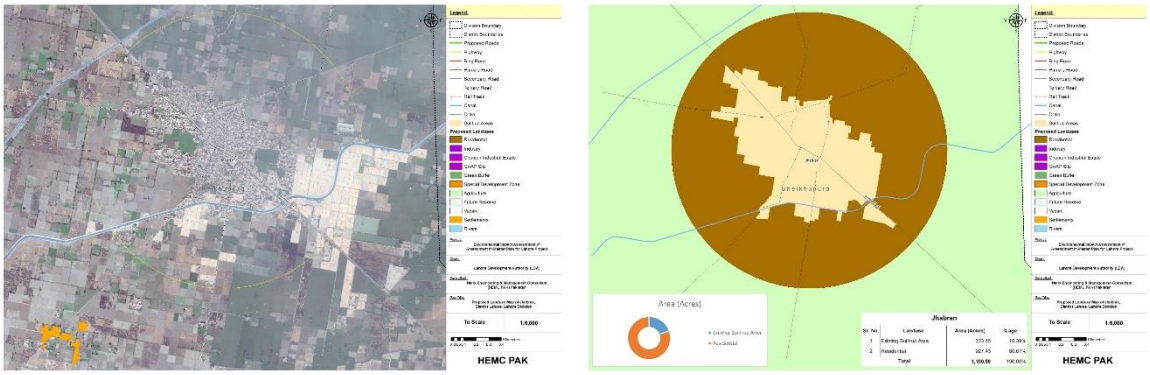


Figure 3 .47 Existing Situation Map and Proposed Project Area Master Plan of Jhabran

3.5.4.14. Project Area (PA)-SKP-14 (Jaranwala Road)

Description of Project Area

Area running parallel about 1-2 km in depth along north western side of Jaranwala road from Faizpur interchange to Dhamkey settlement.

Proposed Project Area Master Plan

For Residential Use: Area running parallel about 1-2 km in depth along North Western side of Jaranwala road from Faizpur interchange to Dhamkey settlements residential.

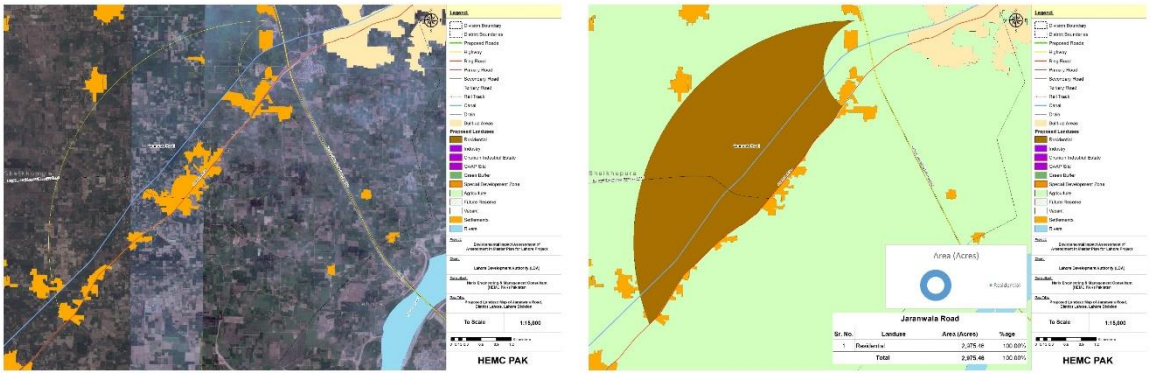


Figure 3 .48 Existing Situation Map and Proposed Project Area Master Plan of Jaranwala Road

3.5.4.15. Project Area (PA)-SKP-15 (Lahore Muridke Road)

Description of Project Area

Area running parallel to Lahore Muridke Road upto the built up area in the eastern western side

Proposed Project Area Master Plan

For Residential Use: Area running parallel along eastern western side of Lahore Muridke Road keeping in intact the existing industries (from Shadrah Morr to Lahore bye-pass linking to Kala Shah Kaku Interchange)

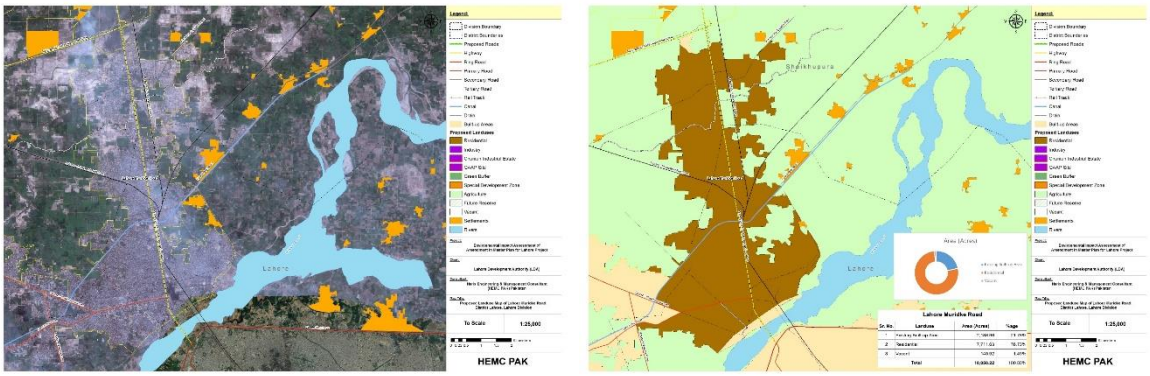


Figure 3 .49 Existing Situation Map and Proposed Project Area Master Plan of Lahore Muridke Road

3.5.4.16. PA-SKP-16 (Lahore Sheikhupura Road)

Description of Project Area

Area running parallel about I Km in depth along Northern and southern side Build up area of Lahore Sheikhupura Road upto Dosako Chowk and 1 km in depth along Northern Side buildup area from Dosako Chowk to Kotabdul Malik Interchange

Proposed Project Area Master Plan

For Residential Use: Area running parallel along northern side buildup area of Lahore Sheikhupura Road (from Shadrah Morr to Kot AbdulMalik Interchange).

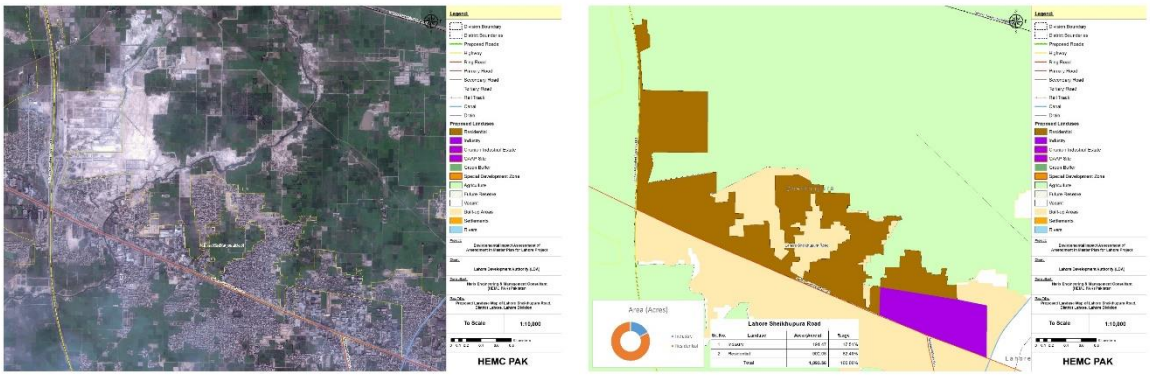


Figure 3 .50 Existing Situation Map and Proposed Project Area Master Plan of Lahore Sheikhupura Road

3.5.4.17. Site-SKP-15

Description of Project Area

This site runs along both sides of Grand Trunk Road between Ferozwala in south and Muridke in the north.

Proposed Project Area Master Plan

For Residential Use: The area on the western side and south-eastern side has been declared as residential area.

For Industrial Use: The area on the eastern side has been proposed as industrial area. Moreover, the land between the G.T. Road and the Railway Line has also been declared as Industrial area.

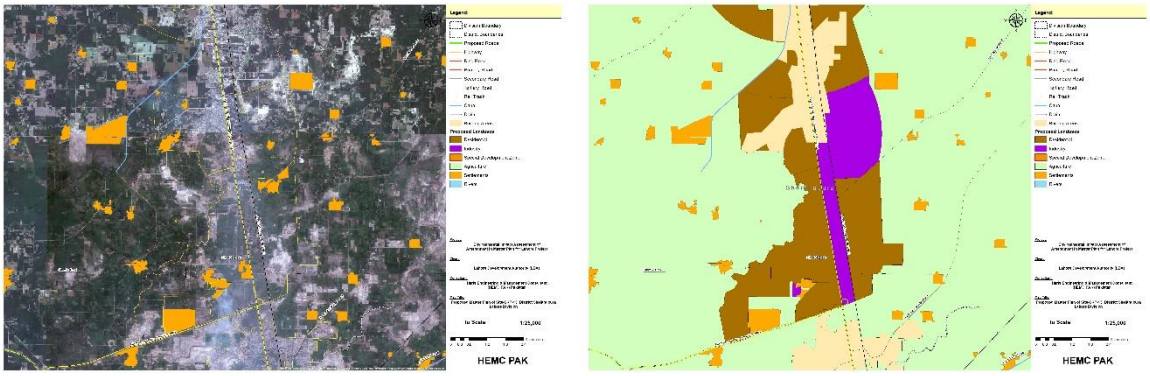


Figure 3 .51 Existing Situation Map and Proposed Project Area Master Plan of Site-SKP-15

3.5.4.18. Site-SKP-18 (Dhantpura)

Description of Project Area

The site is in circular form near settlement Dhantpura and is located in east of Farooqabad.

Proposed Project Area Master Plan

For Residential Use: The whole of the site area has been declared as residential area.

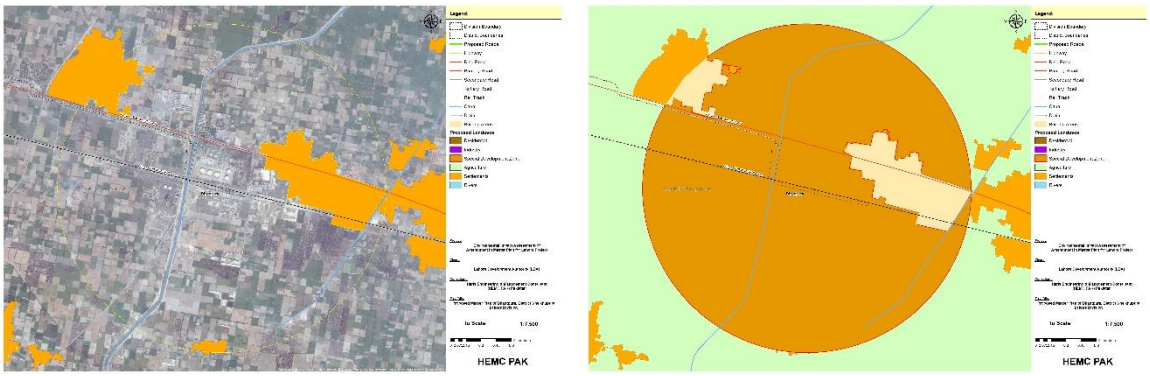


Figure 3 .52 Proposed Project Area Master Plan of Dhantpura

3.6. INFRASTRUCTURE AND UTILITY SYSTEM REQUIREMENTS

3.6.1. Electricity

The total electricity requirement of the whole projected master plan will be 2000 MW till 2035. The electricity requirement will be supplied by LESCO.

3.6.2. Natural Gas Requirement

About 500,000 Mega liter of natural gas will be needed for the projected master plan till 2035. The natural gas requirement will be full filled from SNGPL, Biogas and LPG. SNGPL asked to develop detail plan for Natural gas supply after the notification of master plan.

3.6.3. Water Requirement

The total water requirement for the projected master plan will be 3000 cusecs up till 2035. The quantity is calculated by taking water consumption 300 LPCD. The water requirement will be fulfilled from ground water resource. Detail water requirement and its services design will be done after the notification and implementation of the master plan.

3.6.4. Sewerage Requirement

Sewerage will be required for residential and industrial settings in the projected master plan. For Lahore district WASA is in the jurisdiction for sewerage system while other districts are the jurisdiction of districts governments. The sewerage will be lay down by respective service provider in the districts soon after the notification

of the implementation of the projected areas in the master plan by Lahore Development Authority. The Lahore Development Authority requested service providers of respective districts to design detail plan of sewerage after the notification of master plan. The industries and private housings should construct own sewerage which then connected to the main sewerage line.

3.6.5. Solid Waste Management

Solid waste generation rate on average in Lahore City is approximately 0.85 kg per capita per day. Considering the design population 24.72 Million of the master plan 2035, the total municipal solid waste will be generated 20,000 tons/day. The major part of this waste is the residential. Types of solid waste from residential areas will be the food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, tin cans, aluminum, other metals, ashes, street leaves, special wastes and household hazardous waste. Commercial waste comes from stores, restaurants, markets, and offices. Types of commercial waste are paper, cardboard, plastics, wood, food waste, glass, metals and sometimes-special wastes. The industrial waste comes from industry and depends upon the type of industry. The management of solid waste commercial and residential in Lahore district is the responsibility of Lahore Waste Management Company (LWMC) while in other 3 districts (Shiekhpura, Kasur and Nankana) the solid waste is collected by the district government. For project areas of Lahore district LWMC will be the responsible for solid waste management while in other districts the LWMC model will be replicate in district governments for the better management of solid waste

3.6.6. Road Network

Lahore division is connected with well-established road network that comprised of motorway, truck road, primary roads, secondary roads, local roads, streets and rural roads. The roads that carries the intercity traffic and major volumes of sub urban travel includes the GT Road both eastern and northern sections, Sheikhupura Road, Jaranwala/ Sharaqpur Road, Multan Road, Raiwind Road, Ferozepur Road and M-2 motor way. Partially constructed Lahore Ring Road (LRR) with its operation loops in west, north and eastern side of the city has improved accessibility for inter suburban travel and regional traffic to the Lahore airport. . Provincial roads connect mainly

between urban districts. The existing road network of the Lahore division is shown in map below-:

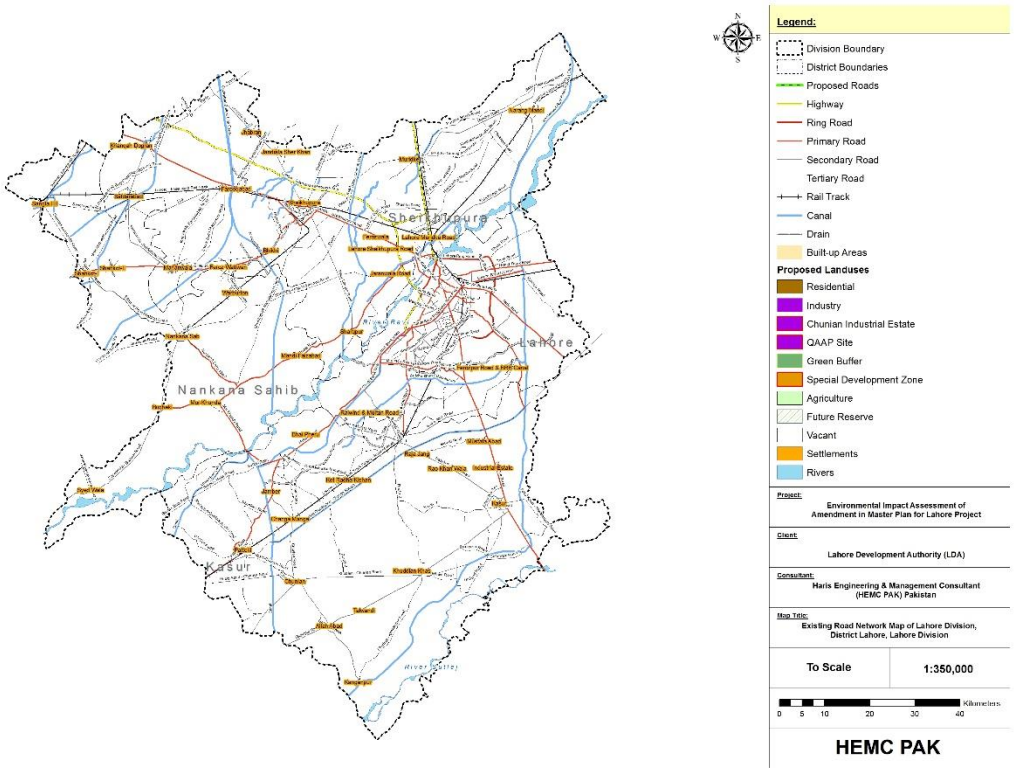


Figure 3 .53 Existing Road Network Map of Lahore Division

In order to improve the connectivity of existing cities in Lahore Division with the proposed project areas of the master plan more structure roads have been planned that have potential of adequate right of ways and connectivity with the project area. The planned road network is shown in map below-:

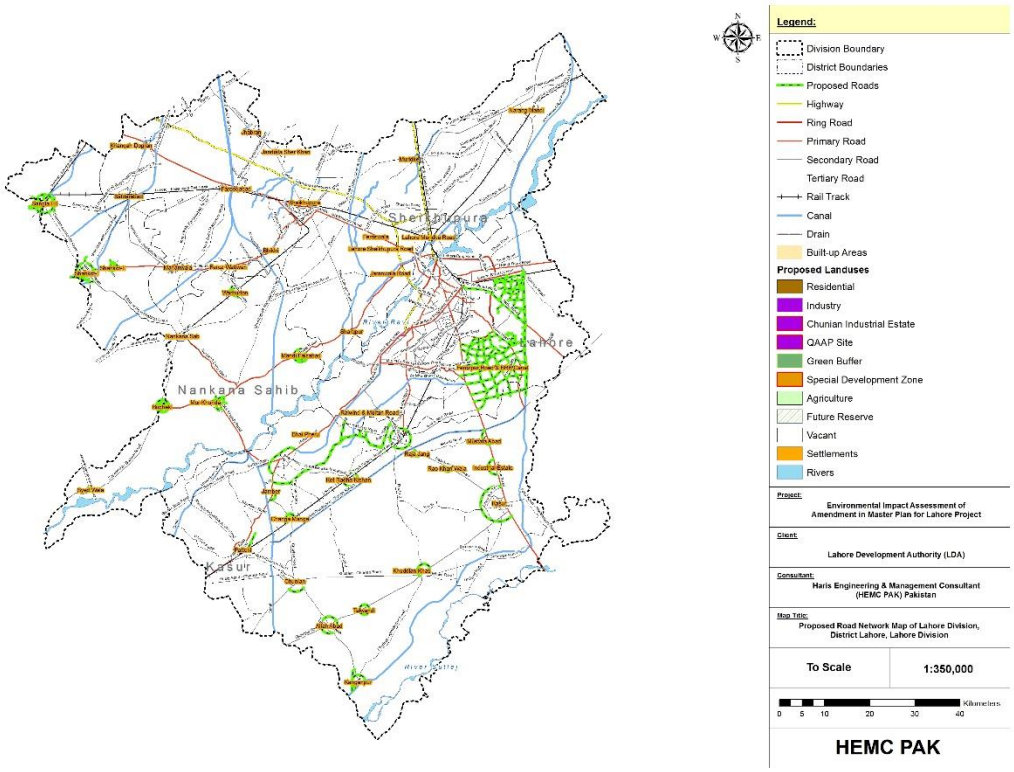


Figure 3 .54 Proposed Road Network Map of Lahore Division

CHAPTER 4

ANALYSIS OF ALTERNATIVES

4.1. General

This chapter deals with an analytical overview of the different alternatives that have been considered in the master planning stage. The analysis has been carried out critically so as to justify the need of the Project. Besides the economic viability, environmental and social soundness of the proposed Project should also be considered when analyzing various alternatives. The various alternatives considered during the conduct of the study are as under:

- No Project Option (NPO)
- Location alternatives
- Layout alternatives
- Design alternatives

4.2. No Project Option (NPO)

Lahore, the city of gardens is the provincial capital of Punjab. It is the second largest city of Pakistan with a population over 7 million. It is enriched with cultural and historical monuments and attracts thousands of visitors each year. Spatially it is expanding towards southern and eastern sides. Lahore has been dynamic in its physical as well as functional growth, but has usually developed in a piecemeal fashion independently although planning was there. it took its present shape as a result of three planning efforts which were exercised one after the other. All these planning documents were formed to manage the rapidly changing character of the city from industrial to service, trade and business hub.

4.3. Planning Efforts

4.3.1. Master Plan for Greater Lahore, 1966

First planning effort for the master plan of Lahore started in 1960. On the recommendation of Second Five Year Plan (1960-65) of the Government of Pakistan, the preparation of Master Plan for Greater Lahore was started in 1961. For this task a master plan committee was set up by the Punjab Government realizing that neither the Lahore Municipal Corporation (LMC) nor the Lahore Improvement Trust (LIT) was equipped to undertake this job.

The first plan was supposed to delineate the zoning and subdivision regulations; development of new satellite towns and establishment of 24 km green belt surrounding the whole city. It particularly focused upon the augmentation of economic base of the present town and the need to create new industrial towns. A very little effort was made to ensure the enforcement of this plan but the industrial estates were developed at Kot Lakhpat, Chunian to the south and Kala Shah Kaku in the north of the city. It was also reported that greenbelt around the city could not be provided due to perpetual urbanization, development pressure and failure to create self- sufficient industries. Figure 4-1 shows the map of the Master Plan for Greater Lahore, 1966.

This plan preparation process took five years and was submitted to the Provincial Government for vetting and approval in 1966. However, it was not until 1972 when the Master Plan, after remain pending for more than six years due to administrative bottlenecks and legal lacuna, was sanctioned by the Punjab Government. By the time this Plan came into force on 1st September 1972, the circumstances had changed and the data on which its proposals were based got outdated. Further, unplanned development continued to take place in the areas proposed in the Master Plan for planned development. So excessive delays in approval rendered the Master Plan outdated by the time it was put into operation and this became the key reason due to which this Plan could not taste the flavor of successful implementation.

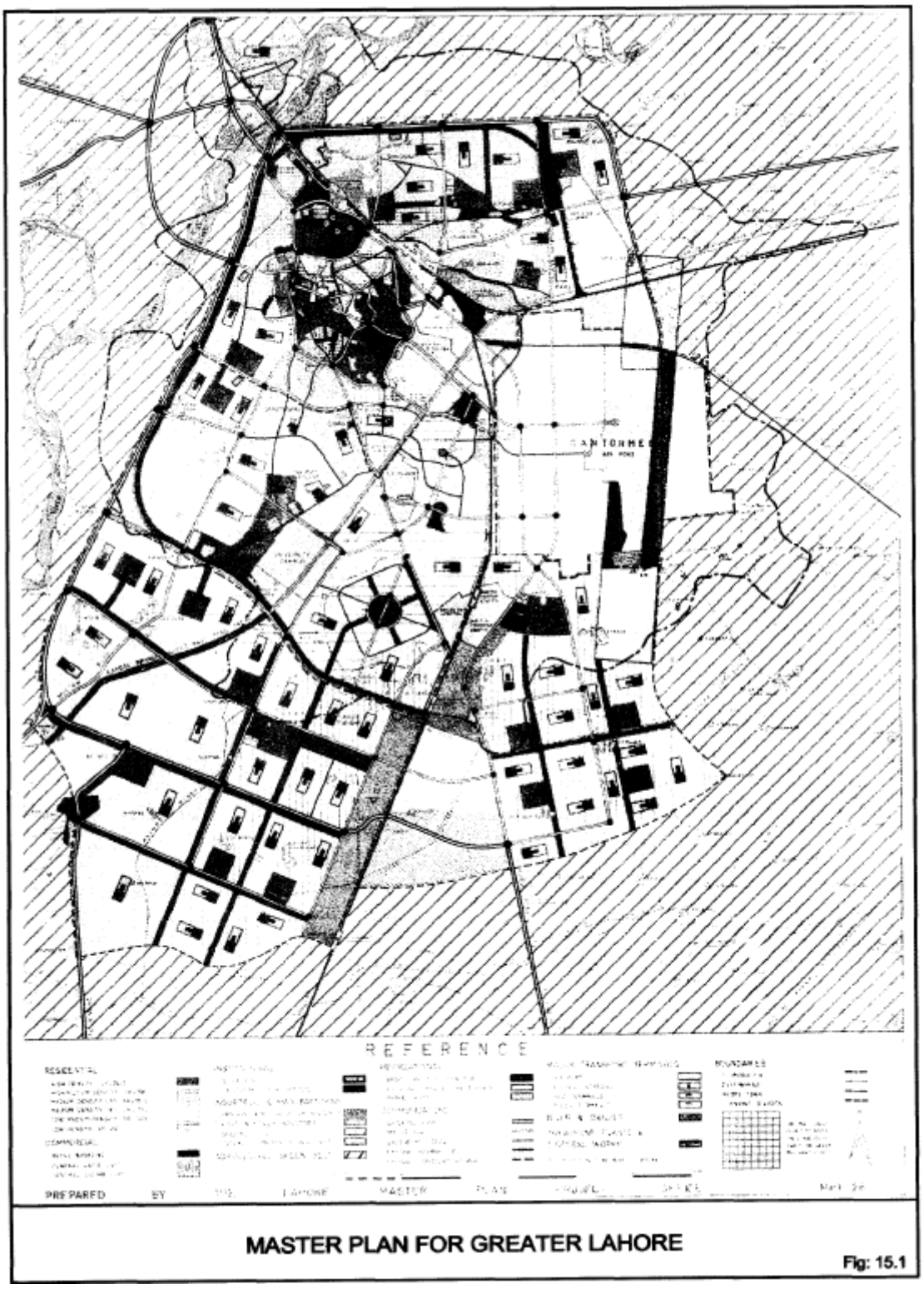


Figure 4 .1 Master Plan for Greater Lahore, 1966

4.3.2. Lahore Urban Development and Traffic Study (LUDTS), 1980

The Lahore Urban Development and Traffic Study (LUDTS) was conducted as a joint team of foreign and local consultants for LDA. The study was financed by a credit from the International Development Agency (IDA), World Bank. The intention of this urban planning study was to provide a structure plan or guiding framework to act as a background for action programs in the metropolitan areas of Lahore for 20 years' time horizon (1981-2000). The justification given for this 'Structure Plan' was that the Master Plan -1966 was drafted on the basis of information collected almost a decade earlier. This study declared the Master Plan as an inadequate document for rigid adherence and implementation. Figure 4-2 shows the map of LUDTS.

The LUDTS was formed in 1980 and is important to note because of the active participation of the Lahore Development Authority (LDA) in its preparation and implementation. Moreover, it was prepared in a short time period based on land use surveys and very little primary data. The plan itself had no legal status except as a guiding document for the LDA. However, one of the main factors that contributed to the fame of the LDA as a leading development authority was the implementation of the Structure Plan-1980. The main focus was to prepare a structure plan for the Lahore Metropolitan Area (LMA) for a time period of 20 years. This plan indicated the development directions from south to southwest and some development was also proposed across the river Ravi. The particular focus was on densification of built-up areas, decentralization of existing centres and establishment of new centers. The LDA has been successful to a great extent in controlling the development of private housing schemes and ensuring the primary road network while applying the proposals of the Structure Plan. The policies regarding densification and development of old built up areas could not be pursued due to the lack of local plans which could not be prepared.

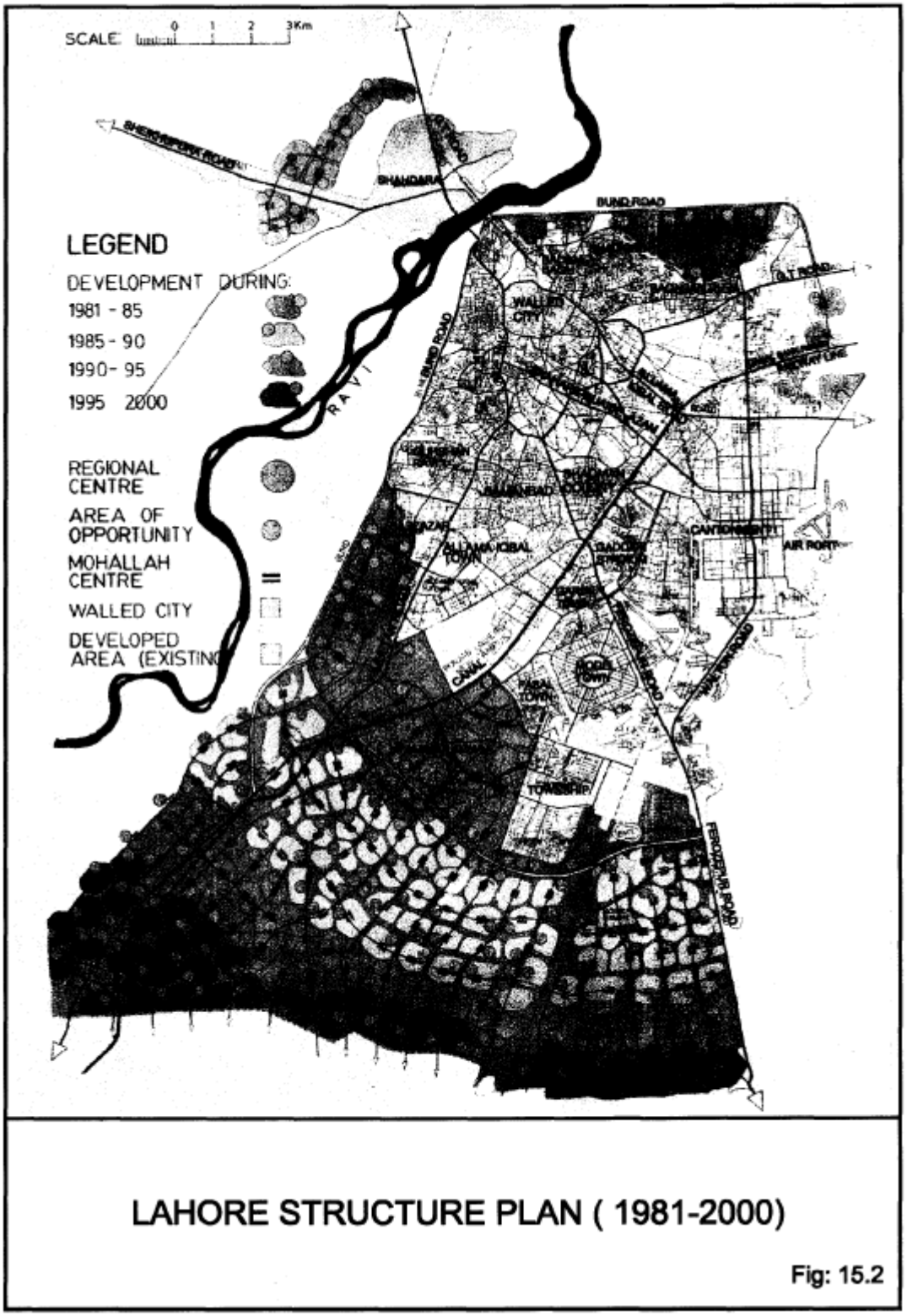


Figure 4 .2 Lahore Urban Development and Traffic Study, 1980

4.3.3. Integrated Master Plan for Lahore (IMPL) -2021

As the Structure Plan 1980 was about to expire in 2000, the LDA decided to prepare a new plan for Lahore, and this task was entrusted to NESPAK (a local consulting firm). The first draft of the new Plan was completed in July 1998 and the consulting firm submitted it under the title `Integrated Master Plan for Lahore-2021' to LDA for comments and review. The draft Plan received severe criticism on various accounts not only from the concerned staff of LDA but also from technical experts, eminent professionals and academicians. The consulting firm revised the Plan in the light of numerous comments and submitted the revised version to LDA in November 2002. During this process, the status of LDA and Local Government set up of Lahore changed due to the implementation of the Devolution Plan of the military regime in August 2001. A New City District Government (CDG) was set up in Lahore by dividing the city into six towns, each governed by a Town Municipal Administration. Initially, the Devolution Plan proposed merger of LDA in CDG but later, due to some political pressures and vested interests, LDA remained as a separate entity of CDG through LDA Ordinance 2002. Under this scenario, the new Master Plan had to be thoroughly revised. But after few changes mainly in the proposed institutional set up, it was approved by the Lahore District Council for implementation on October, 2004. Figure 4-3 shows the IMPL map.

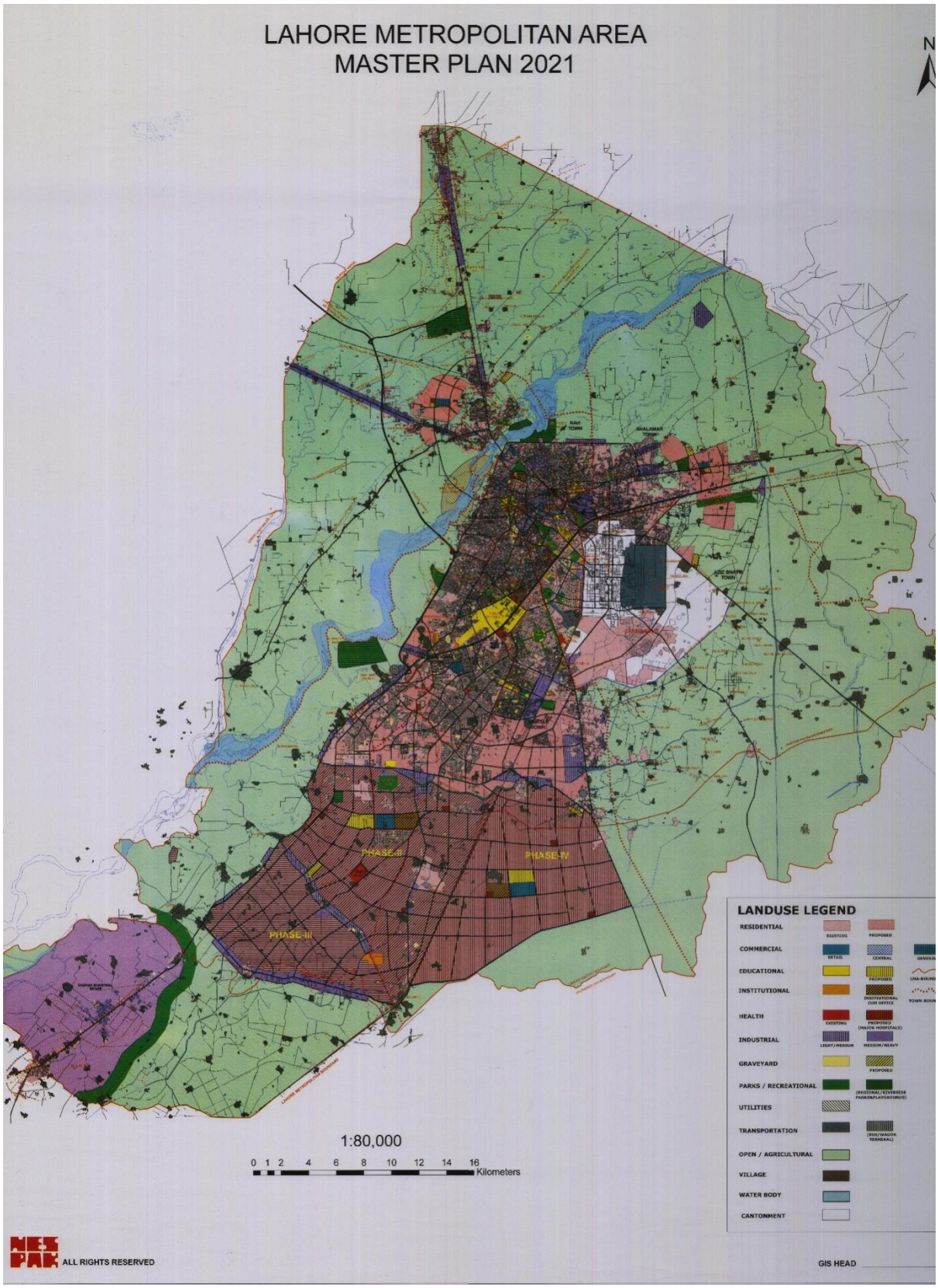


Figure 4 .3 Integrated Master Plan for Lahore - 2021

IMPL includes the most of Lahore district and Ferozewala Tehsil of Shekhupura district and an adjacent area of the Kasur district. The preparation process of IMPL includes data accumulation, processing, planning surveys, field visits and analytical studies. A detailed land use survey was conducted in 2001-2002 of the study area. The final draft of the plan was presented to the Project Steering Committee which cleared it in June, 2004. The plan was finally approved by the Lahore District Council on October 2004. The form and contents of the IMPL appears to be quite comprehensive as compared to the previous two plans prepared for Lahore.

The IMPL is the first development plan which has been approved by the CDG council after the implementation of devolution plan in Pakistan. The general observation and the interviews with various stakeholders reveal that the IMPL proposals have not been implemented in letter and spirit albeit it was approved by the CDG Lahore. There could be many reasons for the lack of its implementation and the main reasons include; the erroneous forecasts of various land uses, inappropriate location of proposed land uses, irrational proposal for designation of roads for commercialization, inadequate support of policy for infill and densification and a lack of strategy for the financing of the proposed projects.

On the whole, IMPL document is relatively a comprehensive but there are areas where there is a need to show special interest and reworking. First of all the plan needs to have exclusive and focused strategy in orientation with more economic consideration. Then there is a dire need to refine and revise the projections related to population, employment and land use requirements. After this, to facilitate and harmonize the urban development, a robust and detailed strategy must be included as a part of the master plan. Along with this, the plan will benefit from a comprehensive urban design assessment to generate more effective zoning and subdivision regulations. In the end, zoning and subdivision regulations are required to assess to foster a more enabling approach to urban development.

This has resulted in the intermixture of incompatible land-uses and numerous civic problems including traffic hazards, traffic bottlenecks, lack of integrated community facilities/service, public infrastructure, haphazard growth of planned and unplanned private housing societies, illegal growth of cottage industries etc.

In the IMPL sufficient arrears were proposed for the residential expansion, industrial, commercial and institutional zones including public infrastructure in South. However, the proposed city in reality expand in one direction due one or other reasons as mentioned above. This created multifarious problems for the regulatory as well as implanting authorities and agencies responsible for the provision of civic and utility public infrastructure services. Side by side towards North, the city expansion took place in shape of regular and irregular schemed and the DHA also extended it various sectors beyond cantonment limits along Barki road, BRB canal, Hudiara drain towards Kasur. In the proposed plan areas was also reserved for Chunian industrial estate whereas about 20% of the estate is colonized in the last decade. Industrial development largely took place in haphazard manner along Defence road, Sundar road, Manga-Raiwind road and adjoining areas. Due to this unplanned growth of industries and residential areas location proposed in the city municipal limits the rich agriculture land has also been compromised.

These problems are likely to worsen with the passage of time because of urbanization at rate of 7 % per annum, all parts of the city as well as division is affected. The present state of living environment in the city is also result of non-implementation of updated plans with respect of existing situation. The environment as an overall is deteriorating and threatening the sustainable development. The current issues are the lack of coordination of different control agencies with the city and division. Non provision of police force and demolition machinery for timely operation against illegal and unauthorized constructions.Weak and slow legal proceedings/action against the defaulters.Disrespect of laws and regulation and corruption.

Similarly from time to time various Outline Development Plans (ODPs), Agroville Development Plans for areas around Lahore has been prepared. These includes Bhai Phero Development Plan (1992-2017), Kahana Nau Development Plan (2000-2025), Kot Radha Kishan Development Plan (1994), Nankana Sahib Infrastructure in Selected Settlement Agroville Plan, Pattoki Infrastructure in Selected Settlement Agroville Plan, Raiwind Development Plan, Outline Sheikhupura Development Plan etc. were prepared but cannot be implemented for reasons mentioned above.

Over the last few years the cirt has undergone some significant changes. Implementation of major infrastructure projects such as Lahore Ring road, Metro Bus Transit, Under Passes, Fly overs etc. has changed the characteristics of the Lahore from old one. The IMPL is unable to cope with the present situation even if all the resources are gathered to implement it.

On account of this reality as the first phase the IMPL was amended in 2014 and notified in 2015. Figure 4-4 shows the amended IMPL phase-I.

With the approval of LDV Master Plan Rules, 2014 which provides the jurisdictions of LDA over Lahore Division, this calls for immediate need to improve the quality of environment and ensure the development of environmentally sustainable and health city and division. Similarly, the various ODPs, Agroville Plans of these areas needs to be integrated in one Plan for the whole division. This solution can be achieve through proper study and updating for Master Plan of Lahore Division which will ensure the proper and regular coordination of all building control agencies. In this regards, no project option will mean that the concerned authority i.e. LDA takes no action and let the problems worsen. Therefore, NPO is not a feasible option.

4.4. Location Alternatives

An urban area/city cannot be planned in isolation. This is particularly true in case of Lahore, which being the provincial capital and a metropolis has a vast area of influence from master planning point of view. With the creation of LDA, LMA was delineated in May, 1975 and was later extended towards south in January, 1988 based on the growth trends in the southern corridor. Delineation of the LMA boundary was affected for better development control and channelizing urban growth. The previous IMPL has taken the district Lahore along with Ferozwala tehsil and the adjacent rural areas of Kasur district as the study area which is based on the LDA jurisdiction areas.

With the passage of time and the hurdles faced in the implementation of the IMP and considering the need for additional land for housing, industrial and the current agriculture practices the extent of the area to be considered for the planning of the updated Master Plan needs to be redefined.

Various options were available based on the land requirements for the future demands for the residential, industrial, commercial, agriculture and public utilities. Following criteria was developed to identify the most suitable areas for fulfill these land needs:

i. Wherein possible, the land uses of built up areas in the existing Master Plan Outline Development Plans and Agroville Development Plans Proposed in past is kept intact.

ii. Future land uses are proposed for housing, industry and special Development Zone on the basis of results of surveys and studies.

iii. Existing infrastructure and proposed, road network and other linages / bye passes are proposed as per the need for integrated development and to provide efficient transportation linkages and synergy.

iv. Land allocations for spatial growth in the form of concentric circles and following compact growth principles.

Therefore, under the provision of LDA Act, 1975 and newly passed rules the LDA Master Plan Rules, 2014 has extended the jurisdiction of the LDA from Lahore districts with some adjoin areas to Lahore Division which is now the criteria for the Project Area. Therefore this area includes the Lahore District, Kasur District, Sheikhupura District and Nanakana Sahib District areas based on the above criteria. Map showing the boundary limits of these districts is attached as Figure 4-5.

4.5. Layout - Alternatives

4.5.1. Criteria

Considering the rules master plan location criteria is based on following aspects:

- Vision for growth and development;
- Objectives containing demands of various segments of economy;
- Strategy for area development;
- Land use plan;

- Peri-urban structure plan;
- Proposed projects and programs; and
- Proposed institutional arrangements and implementation framework.

Based on the above criteria the study revealed that in Lahore district and adjoining areas large scale residential development has taken place along radial routes as linear development as well as in surrounding areas in the shape of clusters, private housing schemes and land sub-divisions to cater for the need of local residents and labor force working in the adjoining areas. Similarly need for the ample spaces for educational institutions, parks and industrial zones are also manifold. Hence these were also considered for the layout. Therefore, the major parameters considered for the layout are residential, commercial and agriculture along with allocation of appropriate space for other infrastructural facilities.

Based on the study and analysis there sites namely Site-LHR-I, 2 and 3 are proposed in Lahore district, fourteen sites namely Site-KR-01 to 14 are proposed in Kasur district, fourteen sites namely Site-SHP-1 to 14 in Shakupura district and nine sites namely Site-NSB-1 to 9 are prosed in Nankana Sahib district for the amendment in IMPL. Map showing the district wise proposed areas are attached as Figure 4-6.

4.5.2. Residential Areas

Lahore is the second largest city of Pakistan and its population is increasing at alarming rate due to the urbanization and industrial development. Therefore, proposed planned and affordable housing along with basis infrastructure services is the key issues and one of the mega reason for the master planning. Hence a major share of residential areas has been included in Lahore division master planning exercise. Almost all the site of four districts forming Lahore division has provision for the residential areas except the designated industrial estates. Map showing the existing and proposed residential areas is shown in Figure 4-7.

4.5.3. Industrial Areas

Considering the current status and development trends need for the industrial areas cannot be avoided to keep the division in balance as well as support the country economy.

The Punjab Board of Investment and Trade (PBIT) and Lahore Chamber of Commerce and Industries (LCCI) has demanded for the provision of more industrial areas to accommodate the existing as well as new proposed Industrial Projects to invigorate economic performance of the region through enhanced employment opportunities in Industrial Sector, attract more industrial projects and foreign investment and to keep the residential areas free from the industrial areas by allocated spaces at appropriate locations.

The Punjab Industrial Development and Management Company (PIDMEC) has also launched some mega industrial Projects such as Quaid-e-Azam Apparel Park in Sheikhupura and Sunder Industrial Estate need to be integrated through amendment in the proposed unified Master Plan of Lahore Division.

Considering and conducting demand analysis in Lahore district industrial areas provision is provided in Site 1, 2 and 3, in Kasur district site 2, 3, 9 and 10 have provision of industrial areas, in Shahkhupura district sites 1, 2, 3, 5, 6, 8 and 9 have provisions for industrial areas and in Nanakana Sahib district sites 1, 3 7, 8 and 9 have provision for the industrial areas. Map showing the location of the proposed or adopted existing industrial areas are shown as Figure 4-8.

4.5.4. Transportation Facilities

Road functions are classified into five categories: main highways, primary, secondary, tertiary and access roads. Main highways are the exit roads joining the districts of Lahore, Kasur, Shekhupura and Nanakanan sahib.

Primary roads are mostly main roads of the city while secondary roads act as connection between tertiary and primary roads and are constructed to reduce traffic congestions on the primary roads. Tertiary roads are normally those roads present inside proposed societies. To ease the traffic congestion problem in the City, primary roads development and improvements are already been initiated upto the

international standards and a comprehensive plan is already available which will be integrated with this plan.

Other roads which are deemed necessary to improve the accessibility of the proposed areas in line with the designated routes such as industrial area and agricultures requires movement of heavy equipment will also be included or proposed or a procedure will be laid down along with time lines etc.

The existing and proposed new inter-city and intra-city which are being proposed or being implemented to improve the transportation such as orange line Project will integrate and considered for the update Master Plan. Location of the existing road infrastructure and proposed developments are shown as Figure 4-9.

4.5.5. Agriculture Areas

As per the law the concerned Authority shall notify the area falling outside the peri-urban area as agriculture area based on the intended and existing uses.

Land use in agricultural area are (a) Permitted use: (i) crop; (ii) orchard; (iii) pasture land; (iv) livestock such as dairy or poultry farm; (v) forest; (vi) nursery or a green house, horticulture; (vii) tube well; (viii) existing rural settlement or village; (ix) place of worship or prayer; (x) place of burial or cremation; (xi) corner shop; (xii) house within and contiguous to rural settlement; and (xiii) farm house within the boundaries of a farm if the minimum area of the farm is not less than 4 kanals. (b) Permissible use: (i) agricultural machinery workshop; (ii) brick kiln, milk chilling and pasteurization; (iii) basic health unit; (iv) animal husbandry clinic; (v) country club; (vi) public or private recreational park; (vii) zoo or wildlife park: (viii) CNG station and petrol pump; (ix) BTS tower; (x) community facility or public utility; (xi) Bus terminal or truck stand (`C' class bus terminal not less than 32 kanals in District Lahore and not less than 8 kanals in other districts and `D' class bus terminal not less than 4 kanals); (xii) fruit and vegetable market; (xiii) grain market; (xiv) cattle market; and (xv) education and health institution.

Based on this the proposed and exiting areas for the agriculture were identified and will be notified and concerned departments shall ensure strict compliance of the relevant provisions of law regarding uses as described above. Map showing the existing agri areas and adopted as agri areas is shown as Figure 4-10.

4.5.6. Future Development of the City

Presently, Lahore has attained the status of being second biggest city of Pakistan and the provincial capital of Punjab. Lahore Metropolitan Area (LMA) comprises ofDistrict Lahore, Tehsil Ferozewala (District Sheikhupura) in the north and part of Tehsil Kasur in the south. Growth of Lahore during 1961-1970 is remarkable and specially when in 1966 a master plan was prepared to control the unplanned growth of Lahore. Major development started after the formation of Lahore Development Authority (LDA) in 1975.

After 1978, number of housing schemes like Awan Town, Campus Colony, Map showing the Growth of LMA during Different Periods Canal View Cooperative Housing Society, Hamid Park Housing Scheme (HS), Rehmanbad etc. got approval from LDA. There was a boom of housing schemes in Lahore during the period 1981-1990. As per the record of Lahore Development Authority (LDA), there are 140 housing schemes (both public and private) which got approval for the purpose of planned housing development. Out of these 140 housing schemes, a sample of 15 is taken. Each selected scheme contains a minimum of 1000 plots of different categories.

Urbanization phenomenon occurred because of migration (Rural to Urban & International) and natural increase. There is an astonishing thing that every year 600,000 - 700,000 people are arriving in the major cities from various parts of the country, thus pushing up to the demand for houses, but construction is not picking up at the required level. Natural increase is another factor which has also increased the demand for housing in the country. Both these factors (natural increase and migration) exerted a huge pressure and resultantly the population of Lahore increases very rapidly. This rapid increase in population then ultimately increased the demand of housing so as to accommodate the additional population within the boundary of LMA.

According to 1998 census, the housing stock in LMA was 967,202 of which 77.62% was in urban areas of LMA. More than 91% of the total stock was in District Lahore, around 7% in District Seikhupura and around 2% in District Kasur areas.

Land prices in the suburbs of Lahore- have manifold since 2001. Price of one Kanal of land vary and ranges from 3.5 to about 4.0 million rupees. Similarly, 01 Kanal house in areas like Defense, Gulberg, Model Town, Tech Society, Garden Town, etc. are 1.2 - 2.5 Crore of rupees. These prices were less than a quarter from what are now 2-3 years back. These values are diminishing hopes of middle class to own property despite Government's assurances about resolving housing problems. According to owners and property dealers, the rates increased when overseas Pakistanis invested their assets in their homeland after the 9/11 incident.

According to LDA, Directorate of Katchi Abadis Local Government and Rural Development, Government of Punjab, there are 308 Katchi Abadis in Lahore, out of which LDA has developed 73 Katchi Abadis having a population of 163,000 to grant the proprietary right. According to Asian Development Bank (ADB) Pakistan Urban Sector Profile 1993, the urban population of Lahore living in Katchi Abadis and slum areas was about 1.7 million or about 38% of the city population. After attaining the proprietary rights the people prefer to stay in these slums and Katchi Abadies. The reason behind this is the location of these areas. These areas are very close to the main city area and mostly are situated near the down town area. Due to this attraction the people are reluctant to leave the places and avoid constructing houses in the new schemes situated far away from the city center

All these issues will be tackled in the updated plan by allocating appropriate lands with designated uses as through notifications in the updated Plan.

4.5.7. Recreational Facilities

In normal condition, parks and open spaces will be used as recreational purposes. Parks and open spaces are also helpful for evacuation purposes during emergencies such as earthquakes, fire hazards, landslides etc. To meet this objective, to minimize the traffic congestions in the city and outlet bottlenecks ample spaces and land will be transformed into an urban and recreational parks.

In addition to this, new riverside parks along with footpaths are proposed at the appropriate locations. Government offices, which were minimal in the whole city have been proposed to shift in Government offices complex situated at new allocated areas; therefore, their evacuated land will also be developed as parks and

open spaces to serve as recreational sites as well as evacuation spaces in case of any emergency.

4.6. Design Alternatives

As the design for subprojects has to be carried out at later stage, so different design alternatives for each subproject will be carried out based on site conditions and best alternative will be selected for implementation. For the Project design, National as well as International design standards shall be adhered strictly. Another important aspect for the Project design shall be its resistance to natural disasters such as floods, earthquakes etc. Strict rules shall be enforced for the compliance of local building codes, suitable for construction of buildings, which can resist an earthquake like October 8, 2005. The design will be initiated parallel to the construction works in order to save time.

4.7. Conclusion

Based on the pros and cons of different location alternatives and town layouts it may be concluded that no other alternative such as site shifting of the whole of Lahore city is suitable. However, best usage of the existing site, proposed town layouts, improvement/rehabilitation of the existing facilities along with provision of all new facilities, and new towns will be most viable solution and will maximize the environmental, social and economic benefits with the minimum disturbance to the area.

CHAPTER 5

DESCRIPTION OF BASELINE ENVIRONMENT

5.1. GENERAL

This chapter describes the baseline conditions, which cover the existing physical, ecological, and socio-economic environment of the Project Area as well as the Study Area. Information on these aspects has been derived from the desk study of available data, field visits to the Project/Study Area and information obtained through detailed consultation with the Government departments and other agencies.

5.2. PHYSICAL ENVIRONMENT

5.2.1. Topography

The topography of Lahore division is generally plane sloping from north-west to south-west. The general height of the Lahore division is about 190 meters above the sea level. River Ravi is flowing in the mid while River Satlej is flowing on southeren side towards Kasur just before the divisional boundary. The division may be divided into two parts, a low lying or riverine area along the two bordering rivers and upland, away from the rivers. Number of canals and sewerage nauhllahs are also present in the division. The topographic map of Lahore division is given as under-:

5.2.2. Geology

The project site is located in Punjab which is a vast plain of alluvial material, deposited by Indus basin and its tributaries crossing the Punjab Plain. The alluvial deposits underlying the site are deposited by the rivers.

The thickness of alluvial deposits in Lahore division is thought to be more than 300 m which are underlain by the basement rocks of the Indian shield. The alluvial deposits mainly consist of sands, with intercalation of silt and clay layers of varying thickness.

5.2.3. Seismology

The project site falls in the Punjab plain which shows low to moderate level of seismicity. The project region has also been subjected to severe shaking in the past due to earthquakes in the Himalayas. The epicenters of low to moderate magnitude earthquakes recorded in the Punjab Plain are associated with the subsurface fractures in the basement rocks which are concealed by the thick alluvial deposits. The known main active fault near Lahore is the Main Boundary Thrust (MBT) which passes at a distance of about 180 km towards northeast along the Himalayan front.

Probabilistic seismic hazard assessment recently carried out for Lahore area as part of the revision of seismic provisions of the Building Code of Pakistan shows that the project area falls in Zone 2A. Seismic zone of Pakistan is shown in figure 5-1.

It is therefore recommended that the project structures should be designed to cater the requirements of Zone 2A of Building Code of Pakistan (2007). Based on the evaluation of tectonic setting and seismicity of the project region, it is recommended that the important project structures should be designed to withstand a horizontal peak ground acceleration of 0.15g with 10% probability of exceedance in 50 year.

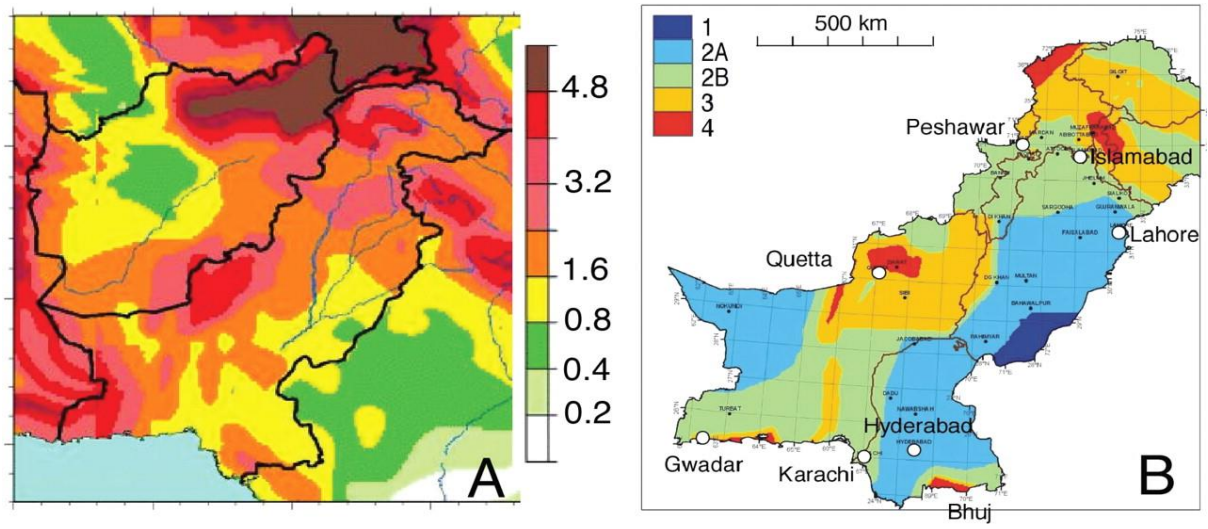


Figure 5 .1Seismic Zone of Pakistan (Geological Survey of Pakistan)

5.2.4. Soil

Subsurface Lithology is composed of Lean Clay/Silt/Silty/Sand/Poorly Graded Sand with Silt up to maximum investigated depth of 30 m below NSL. The topmost soil

layer mostly comprises of Lean Clay in very soft to soft state. The thickness of this layer is approximately 3.0 m below NSL. This cover is absent at places.

A 7.0 m thick layer of Silt/Silty/Sand/Poorly Graded sand with silt material in loose state is present underneath the topmost layer. The water table in the area is shallow in general having water logging and water pounding in some places. The minimum depth of ground water table observed at site is about 1 meter but it varies from 3.0 to 70.0 meter below NSL.

The base soil of project areas may need to be improved with ground improvement techniques for safe placement of foundations and structures.

5.2.5. Land Use

The land use map of the Lahore Division is given as under-:

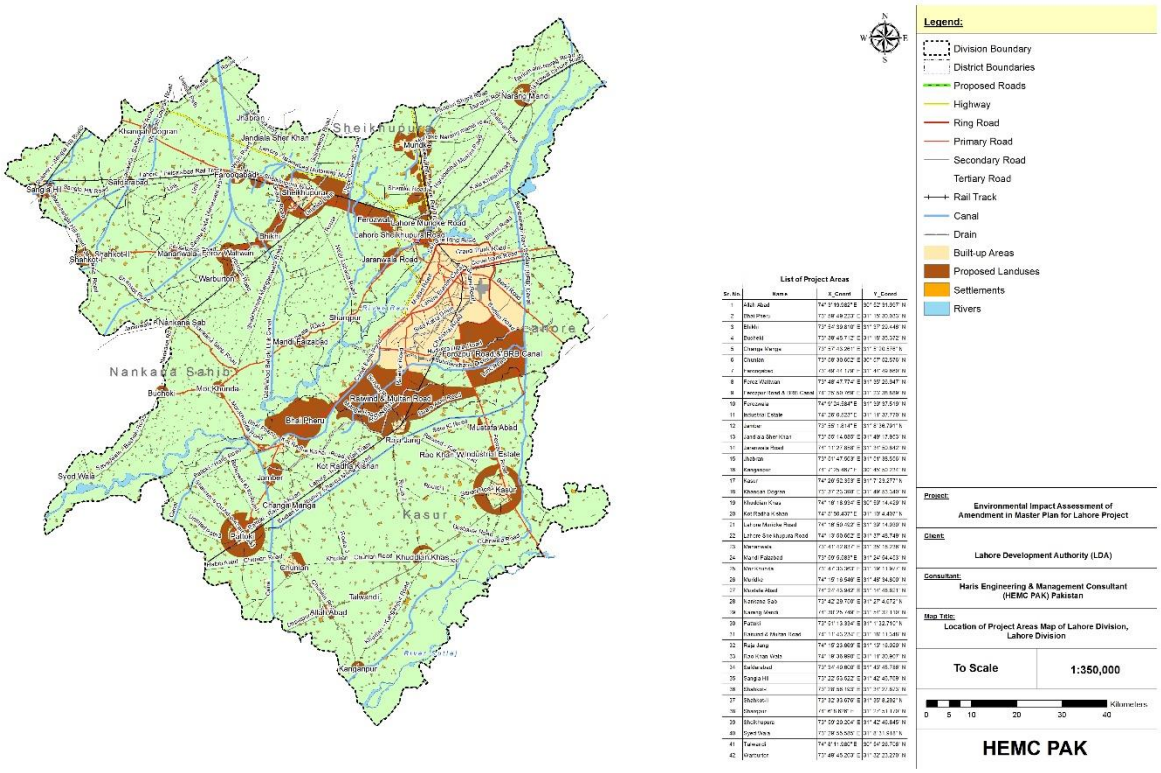


Figure 5 .2 Existing Landuse Map of Lahore Division

The existing landuse details of the project areas are given as under;

Table 5 . 1 Existing Landuse Details of Project Areas

Sr. No.	Landuse	Area (Acres)	%age
1	Existing Builtup Area	62,689.74	17.99%
2	Proposed Agriculture	92,065.27	26.41%
3	Future Reserve	1,208.78	0.35%
4	Agriculture (To be affected)	192,601.58	55.26%
Total		**348,565.38**	100.00%

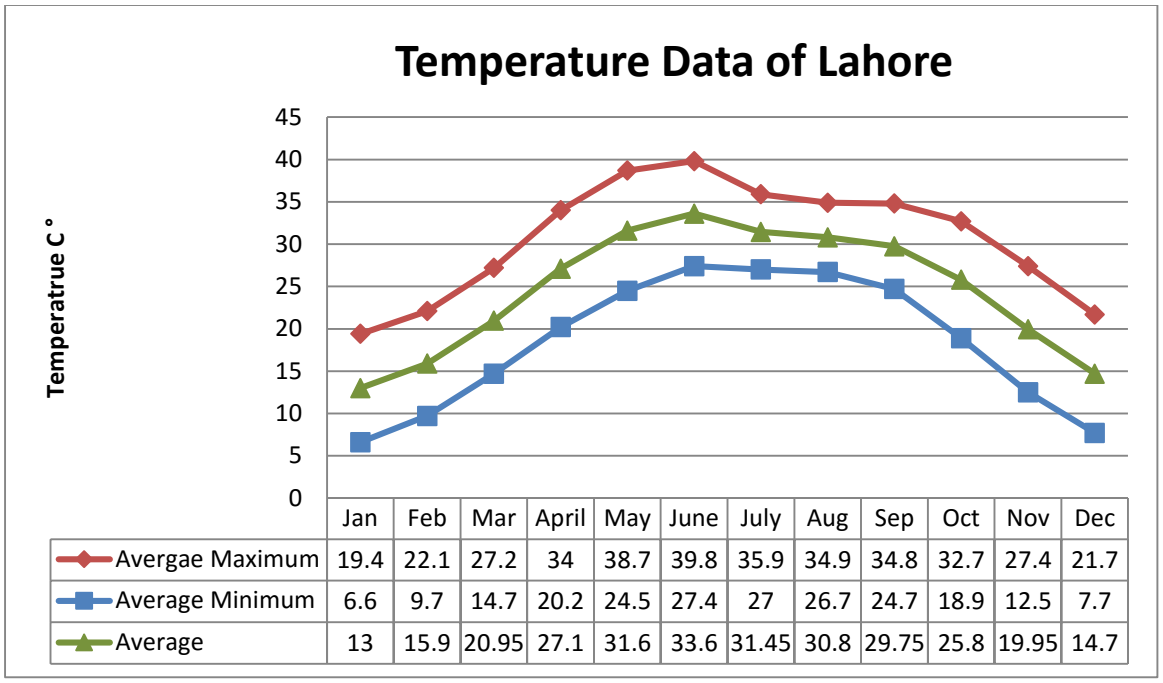
Additionally, the proposed landuse details of all the project sites are given in the following table;

Table 5 . 2 Proposed Landuse Details of Project Areas

Sr. No.	Landuse	Area (Acres)	%age
1	Agriculture	92,065.27	26.41%
2	Chunian Industrial Estate	232.97	0.07%
3	Existing Built-up Area	62,689.74	17.99%
4	Future Reserve	1,208.78	0.35%
5	Green Buffer	11.32	0.00%
6	Industry	56,519.84	16.21%
7	Residential	127,581.38	36.60%
8	Special Development Zone	7,254.94	2.08%
9	(Data Missing)	1,001.12	0.29%
Total		**348,565.38**	100.00%

5.2.6. Climate

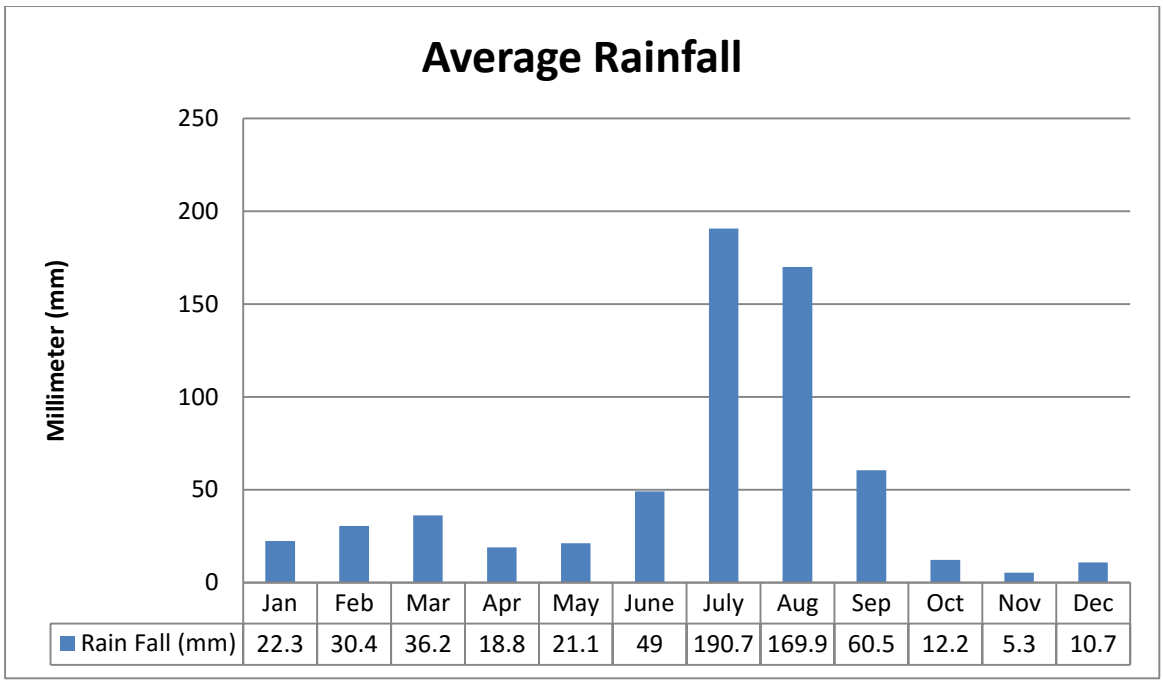
Lahore has distinct seasons marked by wide variation in temperature. The coldest month is January in which the mean maximum temperature is 19.4 °C and the mean minimum temperature is 6.6 °C. June is the hottest month with the mean maximum temperature near 39.8 °C and the mean minimum temperature as 27.4 °C. Mean temperature of the region during the last 20 years (1991-2010) is given in Figure 5-2.



	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Avergae Maximum	19.4	22.1	27.2	34	38.7	39.8	35.9	34.9	34.8	32.7	27.4	21.7
Average Minimum	6.6	9.7	14.7	20.2	24.5	27.4	27	26.7	24.7	18.9	12.5	7.7
Average	13	15.9	20.95	27.1	31.6	33.6	31.45	30.8	29.75	25.8	19.95	14.7

Figure 5 .3Temperature Data of Lahore Region (Data Source: Climatic Data Processing Centre (CDPC), Pakistan Meteorological Department, Karachi)

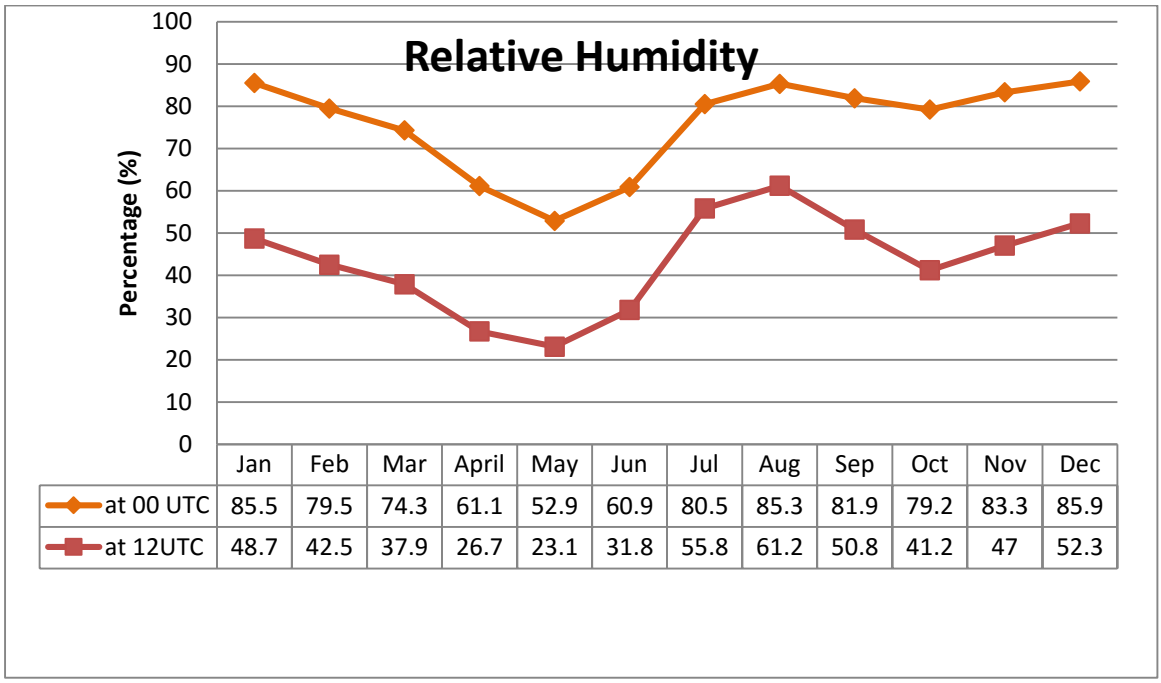
The average annual rainfall during the last 20 years period from (1991-2010) works out to be 55.25 mm. Nearly 70% of it received in the form of high intensity showers during the monsoon (July, August, September) and the remaining in winter. The yearly variations are considerable. The average monthly rainfall at Lahore during the last 20 years (1991-2010) is also shown in Figure 5-3.



	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Rain Fall (mm)	22.3	30.4	36.2	18.8	21.1	49	190.7	169.9	60.5	12.2	5.3	10.7

Figure 5 .4Average Rainfall of Lahore Region (Data Source: Climatic Data Processing Centre (CDPC), Pakistan Meteorological Department, Karachi)

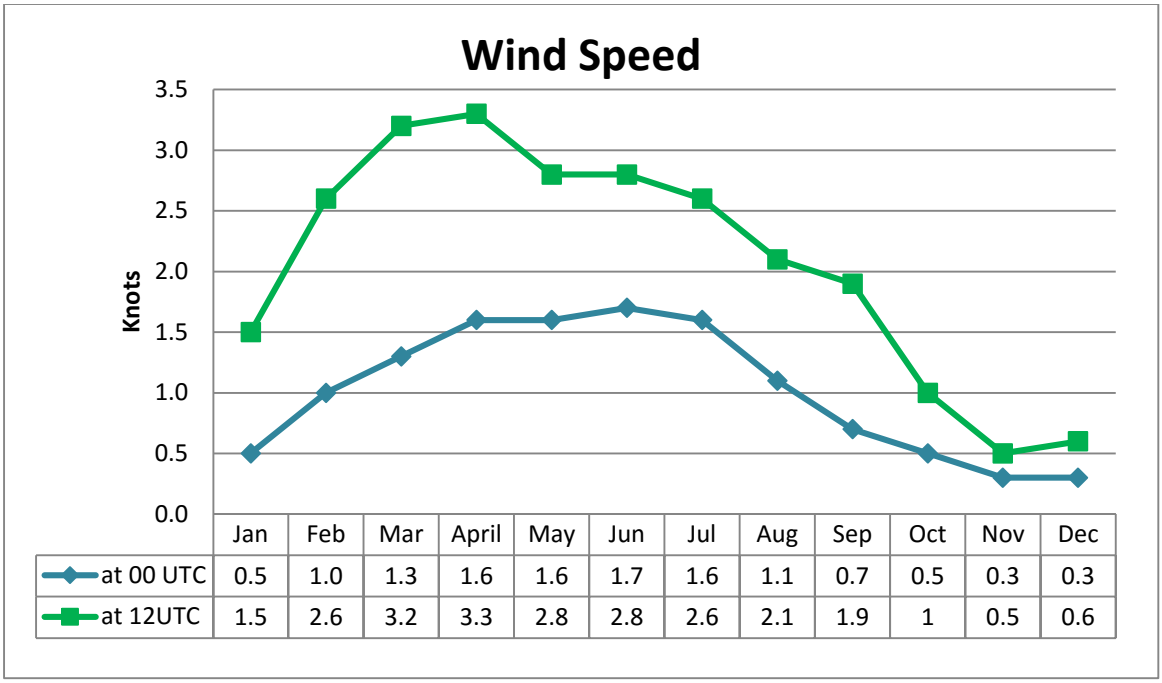
The most humid period is in month of August with maximum average relative humidity is 85.3 % and minimum average relative humidity 61.2 %. The average relative humidity of Lahore region form last 20 years (1991-2010) recorded is shown in Figure 5-4.



	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
at 00 UTC	85.5	79.5	74.3	61.1	52.9	60.9	80.5	85.3	81.9	79.2	83.3	85.9
at 12UTC	48.7	42.5	37.9	26.7	23.1	31.8	55.8	61.2	50.8	41.2	47	52.3

Figure 5 .5Average Relative Humidity of Lahore Region (Data Source: Climatic Data Processing Centre (CDPC), Pakistan Meteorological Department, Karachi)

During cold seasons of the year northern winds prevail and during hot seasons southern winds. Monthly mean velocity of the wind (Knots) taken for the period 1991-2010 are shown in Figure 5-5.



	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
at 00 UTC	0.5	1.0	1.3	1.6	1.6	1.7	1.6	1.1	0.7	0.5	0.3	0.3
at 12UTC	1.5	2.6	3.2	3.3	2.8	2.8	2.6	2.1	1.9	1	0.5	0.6

Figure 5 .6Average wind speed of Lahore Region (Data Source: Climatic Data Processing Centre (CDPC), Pakistan Meteorological Department, Karachi)

5.2.7. Water Resources

5.2.7.1. Surface Water

Surface water in the Study Area of the Project is present in the form of a river and canals. The details are given in Table 5-1 -:

Table 5 .3 Surface Water Bodies in Project Areas

Rivers	River Ravi
	River Sutlej
Canals	Banbarwali Ravi Bedian Canal (BRB)
	Upper Chenab Canal
	Qadirabad Balloki Link Canal
	Lahore Branch Canal
	Butcherkhana Distributory

In order to access the quality of surface water, Environmental Sampling & Analysis form 3rd party Environmental Laboratory has been carried out on rivers and canals. The locations of sampling point are given in Annex-IV while results are given in Appendix II

Surface water samples were tested for 37 parameters in accordance with PAK-NEQS. The detail report is attached as Appendix II.

After detail analysis of surface water of canals and rivers, it is found out that only river Ravi have found high in pollution load with contamination of heavy metals and high organic matter.

5.2.7.2. Ground Water

Groundwater was encountered at around 1-70 m depth below the NSL as per environmental surveys. Given a margin for seasonal fluctuations, the groundwater may be considered to rise/fall beyond this depth by about 1 m. In order to check the quality of ground water, 16 samples have been taken from whole division by 3rd party Environmental Laboratory. The map of sampling groundwater is given as Annex-IV. The detail report is attached as Appendix II.

After thorough analysis of ground water taken from different districts, it is found out that samples taken from district Kasur and Lahore is unfit for drinking found high TDS and contaminated with heavy metal and microbes. There is no microbiological, chemical and toxic contamination found in samples that is taken from district Nankana Sahib and district Shiekhpura and can be utilized for drinking purposes.

5.2.8. Hydrology

Lahore division is a part of Punjab Province of Pakistan. Geologically, this area is a part of lower Indus Basin. The name “Punjab” itself is an indicative of healthy presence and importance of rivers in this area. This word “Punajab” comes from 'punj-aab' meaning five rivers. The five rivers of Punjab were Sutlej, Bias, Ravi, Jehlum and Chenab Rivers. It is to be noted here that Bias River have discontinued to flow in Pakistan, as discussed later. This blessing has resulted in cultivation on mast part of land in Punjab as well as in the study area.

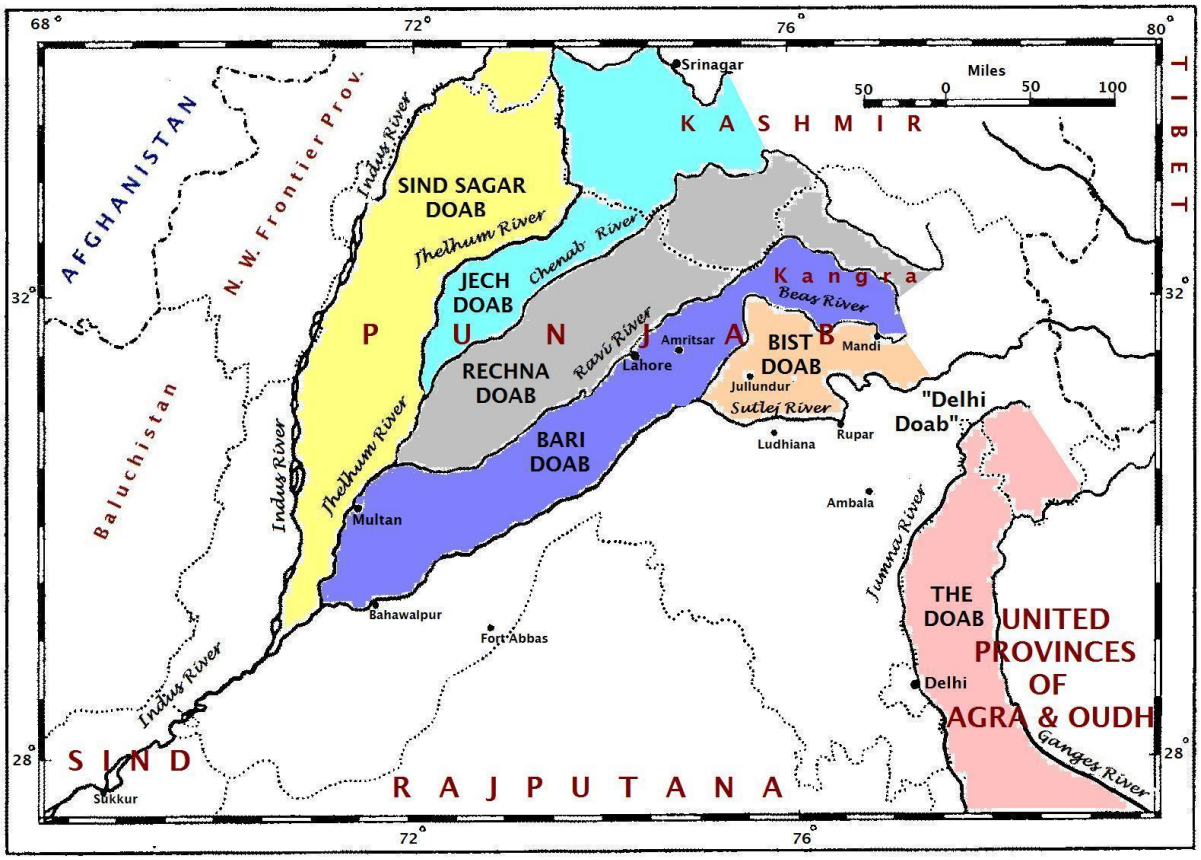


Figure 5 .7 Watershed of Punjab Province

Two main rivers pass from Lahore Division, Ravi River and Sutlej River. The slope of the land in planned area is to the south-west, which directs the rivers to flow in this path. Average slope of the area is 0.32m/km.

These rivers have a major contribution in glorious history of the study area. All the "historical assets" of Lahore, including but not limited to Lahore Fort, Badshahi Mosque and Kamran ki Baradari, were built adjacent to Ravi River.

As per the Indus basin treaty of 1960, six major rivers were divided among Pakistan and India. As per the treaty, the rights of Eastern Rivers (Sutlej, Bias and Ravi) were allocated to India, while the rights of Western Rivers (Chenab, Jehlum and Indus) were reserved with Pakistan. Since the Indus basin treaty, India has completed series of structures to store and divert water from upstream and use it for generation of electricity and irrigation. These interventions have put a stop to ecological and sustainable flows in these rivers, thereby depriving the downstream areas of Pakistan, including Lahore Division from naturally available water for irrigation. Two of the rivers, Ravi and Sutlej, allocated to India, still flows seasonally through the

study area. While Bias River have discontinued to flow. The old bed of Bias River still exists in Kasur. To meet the irrigation demands, Pakistan constructed multiple link canals which divert water from western rivers to Eastern Rivers.

The following link canals pass through our study area:

a. Bambanwala Ravi Bedian Link Canal

b. Qadirabad-Bulloki Link Canal

c. Balloki – Sulemanki Link

d. Lower Bāri Doāb Canal

e. Upper Chenab Canal

f. Lower Chenab Canal

In addition, the following hydraulic structures lie inside our study area

a. Balloki Barrage

b. BRB-Ravi Siphon

Furthermore, the planned area have abundance of water in the form of groundwater aquifer. The aquifer of Lahore District is broadly viewed as a single contiguous, unconfined aquifer. The presence of alluvial soil, frequent flooding and excessive rains in this region for hundreds of years have enriched this aquifer with abundance of water.

Groundwater for drinking purposes is extracted from a depth of 120-200 metres (m). It is pumped for irrigation, domestic, industrial and commercial purposes. Despite presence of link canals, the famer falls short of water to irrigate crops. In order to meet the demands, more than 10,000 tube wells have been installed for agricultural purposes.

5.3. Natural and Biological Environment

Natural and biological environment account of the Project and Study Area is given in detail in Ecological Study attached as Appendix I of the report. However summary of the Ecological Study account for the baseline environment is given as under-:

5.3.1.1. Flora and Fauna

The baseline ecological study was of 30 days in which tours of the area were arranged to assess plant and animals in different times of the day present in different habitats. After a vigorous literature review, certain criteria were established to evaluate animal and plant species in different habitats. Keeping in view international and national legislation, protection status of species found in all habitats was determined. Significantly many birds and reptile species were found to be protected as they were either under threat as per IUCN Red list or were protect under national wildlife act. The project sites had significantly higher biodiversity richness which was 101 species of fauna and 148 species of flora. Fauna includes 70 species of birds, 13 of mammals, 15 of reptiles and 3 of amphibians whereas there were 148 species of flora in the area. None of the native plant species are under threat as per IUCN Red list but they are under serious threat locally as they have been exterminated and replaced with other species. Same is the case with native fish species that suffer from decline due to over exploitation, water pollution and introduction of invasive species

The biodiversity map of project site is attached as Annex II

5.3.1.2. Vegetables

A large number of vegetables are grown in the study area. Some important of these are Phool Gobhi/cauliflower (Brassica oleracea Ver. Botrytis), Band Gobhi (Brassica oleracea Ver. capitate) Turnip, Raddish (Raphanus sativus), Carrot (Daucus carota), Bhindi, Tomato (Lycopersicum esculentum), Vegetable Marrow (Cucurbita pepo), Baingan etc.

5.3.1.3. Crops and Fodder

Crops usually seeded in the area include Rice, Barley (Hordeum vulgare), Jawar (Andropogan sorghum), Maize and Sugarcane along with other fodder. Wheat crop was also identified sown on the project site.

5.3.2.1. Wildlife Sanctuaries and Game Reservoirs

No wild life sanctuary or game reservoir is located in the vicinity of the project area.

5.3.2.2. Rare or Endangered Species

Many birdsand reptile species of project areawere found to be protected as they were either under threat as per IUCN Red list (1 bird and 2 reptile species) or were protected under Punjab Wildlife Act (22 bird and 6 reptile species). One bird (*Otus bakkamoena*) and 5 reptile species (*Ptyas mucosa, Xenochrophis piscator, Varanus bengalensis, Pangshura smithii* and *Lissemys punctata Adersoni*) are protected either under CITES appendix I, II or III. Two mammal species (*Felis chaus*and *Herpestes mungo*)are also protected under Punjab Wildlife Act. Among fish species Mully (*Wallago attu*) is 'near threatened' in IUCN Red Data Lists but there are other fish species like *Rita rita* (Ravi Khagga) that also suffer from serious threat and decline due to over exploitation, water pollution and introduction of invasive species.

5.4. Air Quality

At present, major sources of air pollution are industrial and mobile sources. Other sources of ambient air pollution are the generators in industrial and commercial units for alternative power supply sources.

Ambient air quality was monitored in accordance with PAK-NEQS at 16 locations in whole project site in order to access the overall air quality of project site. The map of Air Quality monitoring is given in Annex-IV.

The ambient air monitoring was carried at identified locations for period of 24 hours in accordance with the PAK-NEQS. The monitored parameters included Carbon mono-oxide (CO), Nitrogen dioxide (NO2), Sulphur dioxide (SO2), Particulate Matter (PM10) and Particulate Matter (PM2.5). The results of ambient air are given in Appendix II

The overall quality of ambient air at most of the location is good except particulate matter which is higher at road sides. All samples taken at road side have found high values of PM.

5.5. Noise Levels

Number of sources of noise emission has been detected in the study area. These sources are

- Vehicular Traffic in Project Area
- Due to Operation of Industrial Activities
- Due to operation of Generators in Commercial Activities
- Due to operation of pumping & disposal stations

Noise levels were monitored at 16 locations in whole project boundary. The noise monitoring map is given in Annex IV while results are attached as Appendix II

The results shows that the noise levels on all major roads are much higher than NEQS but the noise levels are in compliance in villages and settlements

5.6. Socio Economic Environment

Socio-economic studies focus mainly on demography, occupation, education, housing, health, family income and expenditure, basic amenities, land use, livestock, resettlement concerns, industry, archaeology, tourism, land values, role of women etc. The socio economic baseline data was collected from field surveys conducted from November, 2015 to December, 2015 and previous secondary surveys.

Household and Population: The field surveys conducted in the Project Area and data collected from the relevant agencies indicate that there is 1 million population in the project area with total built up area 46,365.7 acres.

Villages/Towns in Project Area: 135 villages/towns have been identified in project area, out of which 16 villages/towns fall in Lahore District, 17 villages fall in Tehsil Muridkey, Ferozewala and Sheikhupura of Sheikhupura District, 9 villages/towns fall in District Nanakana Sahib and remaining 91 villages/towns fall in District Kasur. The detail of the survey villages/towns, and population is shown in table 5-9 below:-

Table 5 . 4 Detail of the Survey Villages

Sr. No.	DISTRICT	TEHSIL/TOWN	VILLAGE/ SETTLEMENT	POPULATION
1.	Lahore	Lahore South East	Keet	1300
			Srach	2500
			Badarpur	5000
			Khano harni	4000
			Mala Ram	2000
			Saya Asal	2500

			Asal	2500
			Jham	1250
			Bado Ki	1250
			Asal Suleman	1300
			Khand	2500
			Chak Bota	3000
			Watna	1300
			Geabaga	1600
			Jalalpura	1350
			Jodhath	3500
2.	Sheikhupura	Muridke		100000
		Ferozwala	Tetli	6000
			Sekham	4000
		Sheikhupura / Farooq Abad	Sachsoda	15000
			Kot Sondo	10000
			Paday	12000
			Kamyarpura	13000
			Bando ki	12000
			Asoirky	10000
			Warn	17000
			Chanke	14000
			Kange	12000
			Kugar	16000
			Butterh	13000
			Chack 523	10000
			Chack 560	10000
		Sheikhupura / Nawan Kot	Nawan Kot	30000
		Sheikhupura / Ferozwattwan	Ferozwattwan	30000
3.	Kasur	Pattoki / Pattoki Phatak	Mindian wala	3000
			Purani Mandi Pattoki	2500
			Fraz Colony	3500
			Tor kot	2250
			Adan	3400
			Partab Garh	1600
			Waan khara	1850
			Doba Pind	3000
			Fareeda Kot	4000
			Narwaki	3400
			Malan Wala	3300
			Sachak Dholan	2400
			Gheen	3200
			Doaki	2700
			Khrepar Sharif	3500
			Ghanjian Wala	3600
			Teeliann	4500
			Muhammad Din Kot	3500
			Bheedian	4500
		Pattoki / Phool Nagar Road	Lambay Jageer	10000
			Mega	4000
			Kamorkal	5400
			Auulakh	6700
			Baloki	8000

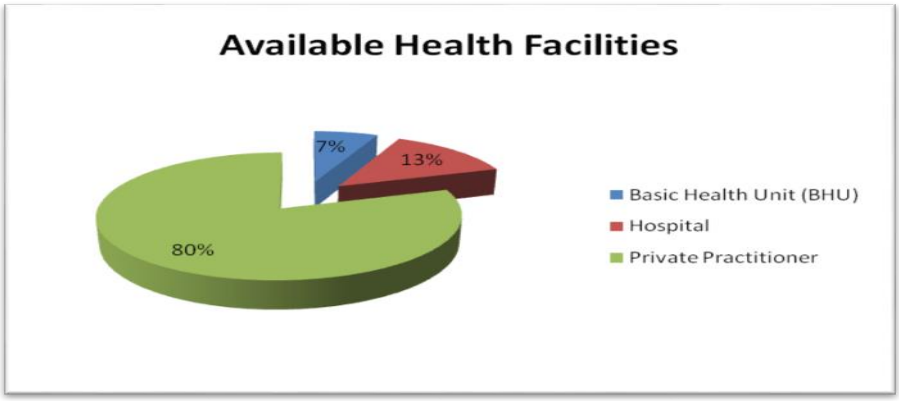
			Jalleki	5000
			Sarnaki	6000
			Shair Pur	4500
			Ghumnaki	6000
			Barmake	3500
			Boonga	7000
		Pattoki / Jamber Road	Chalian	3400
			Kot Naka Singh	4500
			Chakoki	5000
			Kot Radha Kishan	10000
			Nawi Basti	12000
			Phalntar	3600
			Nawi Abadi	7000
			Kot Akbar Abadi	12000
			Dhobsari	12000
			Thathi Pind	4000
		Kasur / Mustafabad	Mustafabad main	2500
			Sattouki	4500
			Meher Muhammad	500
			Panhana Wala	700
			Reeg	400
			Siryali	500
			Bari Siryali	900
			Cheena Wala	600
			Raye kalan	500
			Balluki	700
			Wadana	500
			Pakki Velli	400
			Choti Kari	600
			Natthay	700
			Havelyan	450
		Kasur	Kasur	150000
			Hera kot	20000
			Ghulam Muhammad khan kot	15000
			Phetu wala kot	10000
			Committee Ghar chck	5000
			Murad kot	30000
			Bulleh Shah	10000
			Railway Road	10000
			Usman khan raod	10000
			Islam pura	7000
			Draz shah	65000
			Nawab shah	7500
			Tahil pura	6000
			Adah wala	3500
			Anwar wala	3500
			Pillow wadana	4000
			Paki hawali	4000
		Kasur/Khuddan Khas	Khaca pacca	1000
			Sand a klan	500
			Dholan	300
			Bhigpur	200
			Khai	500
			Nandan pura	200

			Ding shan	700
			Rait chala	400
			Cher kot	700
			Bgaban pura	900
			Saad	300
			Rakh wala	200
			Nain wala	210
			Said sad	230
			Wiran gaggia	250
			Noor pura	175
			Todho wala	200
			Fakeer wala	350
			Doholy wala	170
4.	Nankana Sahib	Nankana Sahib	Mandi Faizabad	2500
			Syed Wala	2000
			Bucheki	4000
			Nankana Sahib	5500
			More Khundal	3000
			Warburton	4000
		Shah Kot	Shah kot-I	12000
			Shah kot-II	1500
		Sangla Hill	Sangla Hill	7000
			Total population	**994085**

Health: The survey indicates out of 135 villages there are 17 Private & Public Hospitals and 10 basic health units in Project area, 120 private practitioners (not qualified doctors but dispensers, quakes, etc) are practicing as health facility provider in different villages.

Table 5 . 5 Available Health Facilities

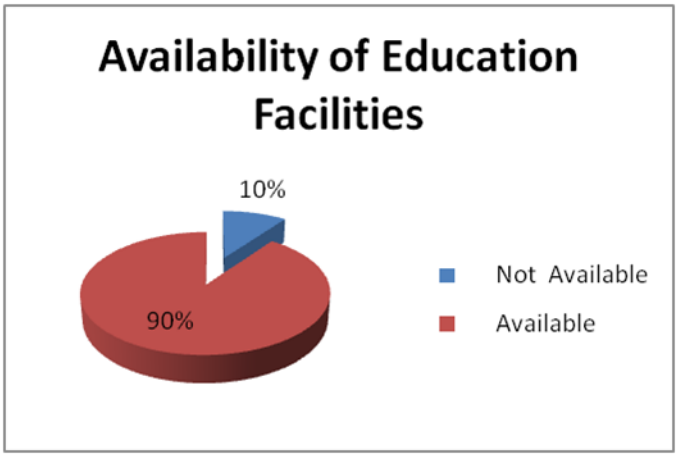
Sr. No.	Name of Facility	No. of Health Facility	Percentage %
1	Basic Health Unit (BHU)	10	7
2	Hospital	20	13
3	Private Practitioner	120	80
Total		**150**	**100**



Education: Survey indicates that, out of 135 villages/towns 90 % villages/towns have education facility from primary to higher secondary levels. There is one Veterinary university present in the project area. In 10% villages, there is no educational facility, even at primary school level. The parents have to send their children to the nearest village where school is available. Girl's schools are far less than schools for boys in the project area. Therefore, it is difficult for the girls to having access to educational institution. Traveling long distance to access the school for girls is the main cause of illiteracy.

Table 5 . 6 Availability of Educational Facility

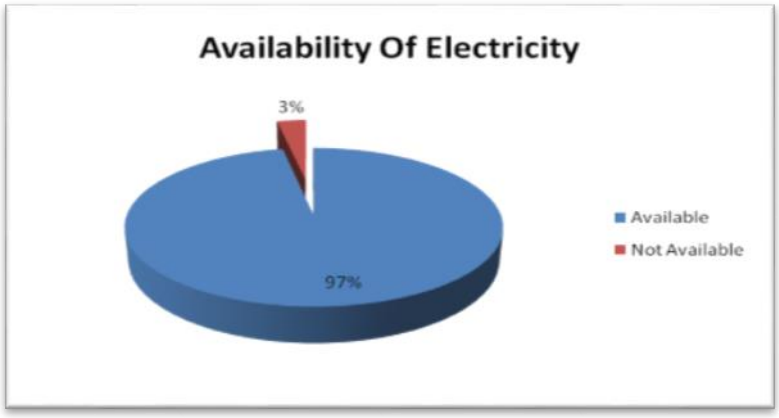
Education Facility	Villages/Towns	Percentage %
Not Available	13	10
Available	122	90
Total	**135**	**100**



Electricity: It is evident from the survey results that 97% villages/towns have electricity facility, whereas 3% villages do not have the facility of electricity. The villages/towns, where electricity facility is not available, people use kerosene oil as a source of light.

Table 5 . 7 Availability of Electricity

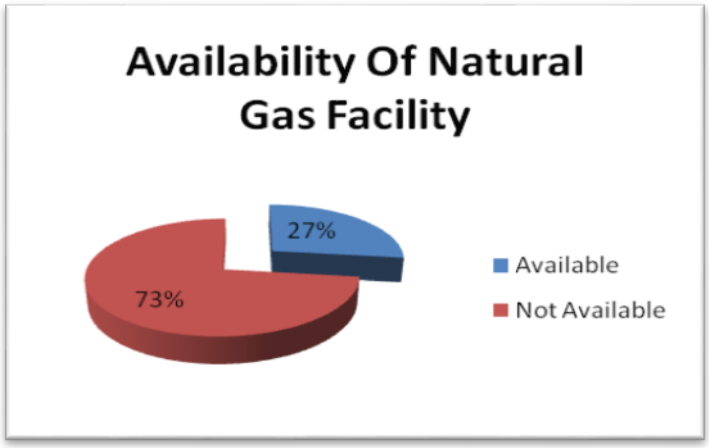
Electricity	Villages/Towns	Percentage %
Available	131	97
Not Available	04	03
Total	**135**	**100**



Natural Gas Supply: The survey reveals that only 27% villages/towns of the total project area are enjoying the natural gas facility provided by government; while, significant number of villages (73%) have to use wood or gas cylinders for fuel purpose.

Table 5 . 8 Availability of Natural Gas Facility

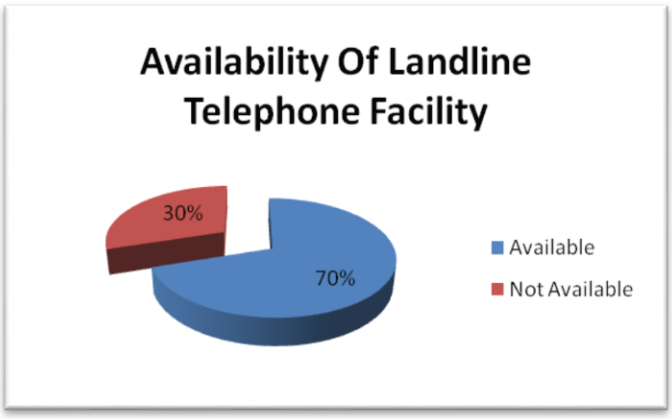
Natural Gas Supply	Villages/Towns	Percentage %
Available	37	27
Not Available	98	73
Total	**135**	**100**



Telephone Facility: Most of the people use mobile telephone facility; however, the availability of landline telephone facility in the surveyed villages indicates that 70% villages have telephone facility and 30% villages do not have telephone facility. In 30% villages where telephone facility is not available, the only option is to use mobile phones; however the signal strength is weak for mobile phones in these areas.

Table 5 . 9 Availability of Landline Telephone Facility

Telephone	Villages/Towns	Percentage %
Available	94	70
Not Available	41	30
Total	**135**	**100**

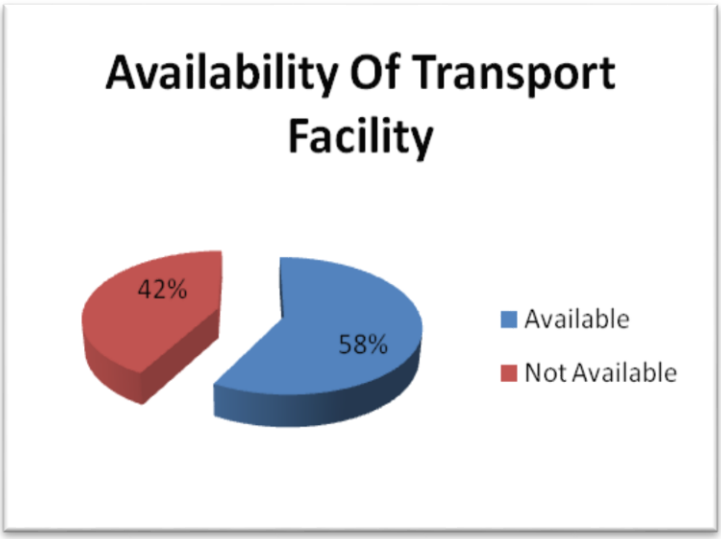


Transport: The survey results indicate that people of 58% villages have access on public transport e.g. bus, van and Rickshaw (Chingchi) etc for traveling purpose. The

remaining 42% villages do not have public transport and they use private transport such as Motor Car, Motor Cycle, Bicycle or travel by foot.

Table 5 . 10 Availability of Transport Facility

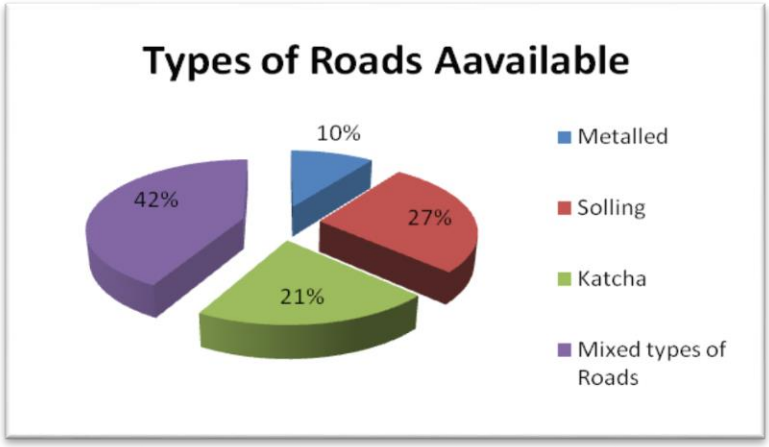
Public Transport	Villages/towns	
	No.	Percent %
Available	78	58
Not Available	57	42
Total	**135**	**100**



Access Roads: Survey results indicates that a large number of the villages/towns have either soling (27%) or katcha (21%) roads/track. 10% villages have only Metalled roads. Furthermore, 42% of the villages have mixed types of roads.

Table 5 . 11 Types of Roads Available to Villages/Towns

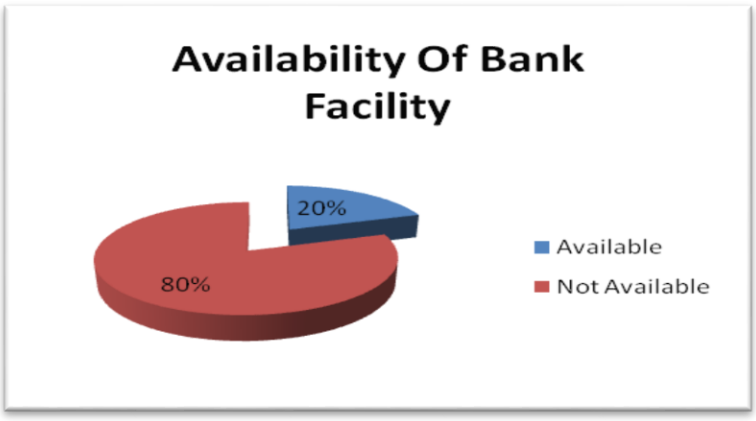
Type of Road	Villages/Towns	
	No.	Percentage %
Metalled	14	10
Solling	36	27
Katcha	29	21
Mixed types of Roads	56	42
Total	**135**	**100**



Bank Facility: The survey reveals that Bank facility is available in only 20% village/towns of the project area; whereas, in 80% villages this facility is not available. Where this facility is not available, residents have to travel long distances to access the facility to the nearest urban commercial centers.

Table 5 . 12 Availability of Bank Facility

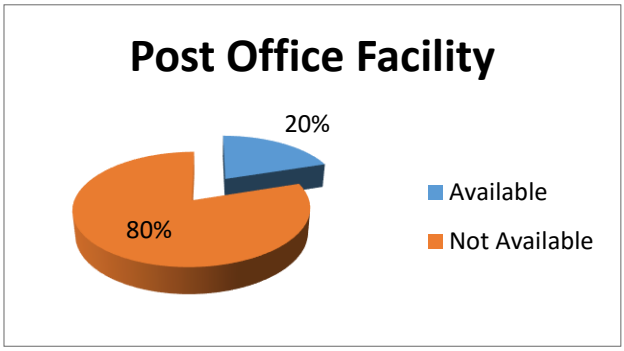
Bank	Villages/Towns	**Percentage %**
Available	27	20
Not Available	108	80
Total	**135**	**100**



Post Office: Survey results indicated that 20% villages have Post Office facility at their door step; while, (80%) villages do not have this facility. The residents of the villages, where the facility is not available, have to travel long distance to reach the nearest post office.

Table 5 . 13 Post Office Facility

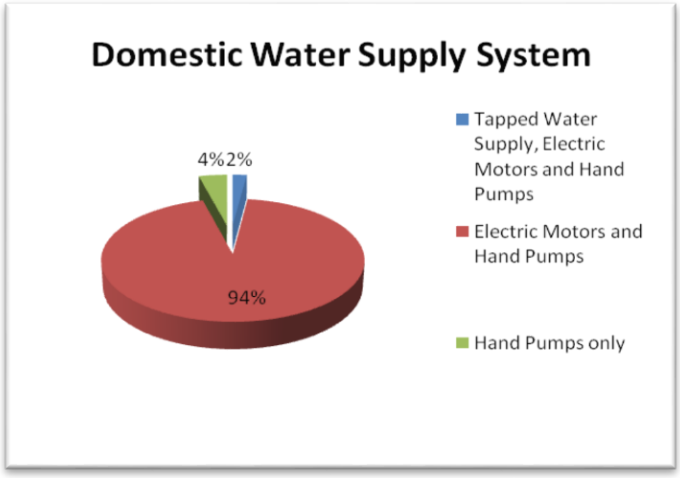
Post Office	Villages/Towns	Percentage %
Available	27	20
Not Available	108	80
Total	**135**	**100**



Domestic Water Supply: An easy access to potable / safe drinking water is one of the basic human rights and needs. Survey indicates that the residents of the total project area are deprived of tapped water supply system; only 2% people have this facility. Most of the population of project area (94%) use both hand pumps and electric motor pumps to extract ground water for domestic water usage. There are only 4% of villages where extraction of ground water is being carried out only through hand pumps.

Table 5 . 14 Domestic Water Supply System

Water Supply System	Villages/ Towns	Percentage %
Tapped Water Supply, Electric Motors and Hand Pumps	3	02
Electric Motors and Hand Pumps	127	94
Hand Pumps only	5	04
Total	**135**	**100**



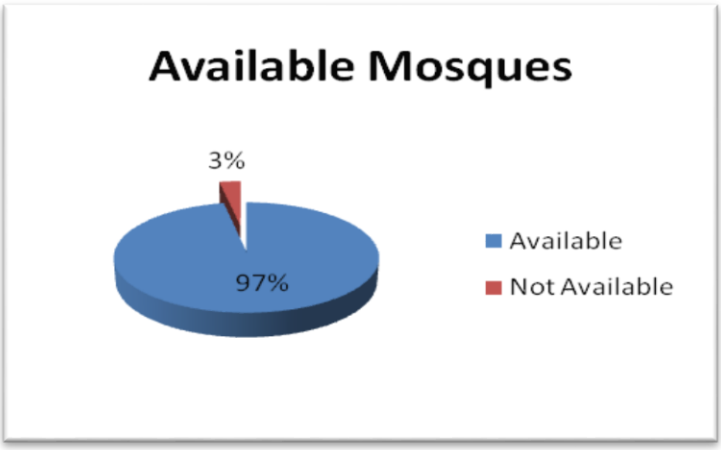
Sewerage System: Proper sewerage system is not available in the project villages. However, the local residents use small open drains and septic tanks system made by them.

5.6.1. Archaeological and Historical Monuments/Sites

Mosques: Survey indicates that 97 % of villages have mosques while non-availability in only 3% villages.

Table 5 . 15 Available Mosques in Project Area

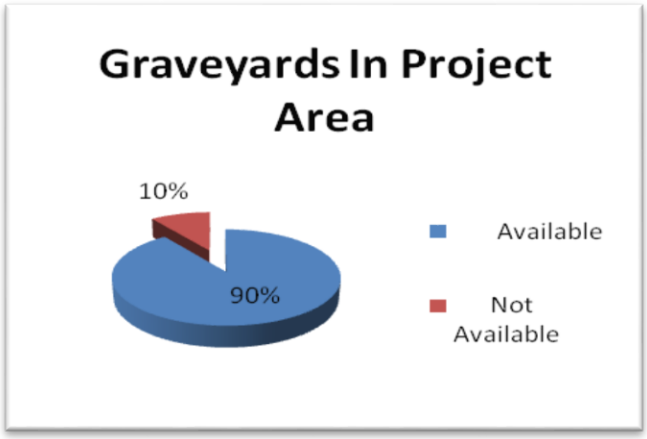
Mosque	Villages/Towns	Percentage %
Available	131	97
Not Available	4	3
Total	**135**	**100**



Graveyards: 90% villages have graveyard out of total 135 surveyed villages. However, 10% villages do not have graveyards.

Table 5 . 16 Graveyards in Project Area

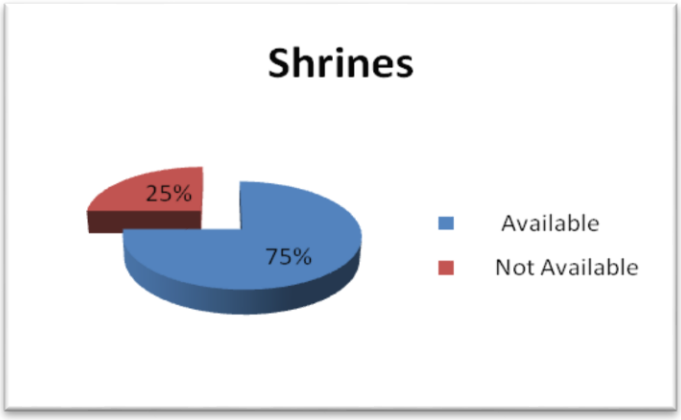
Graveyard	Villages/Towns	Percentage %
Available	121	90
Not Available	14	10
Total	**135**	**100**



Shrines: 75% villages have shrines whereas, 25% villages do not have shrines.

Table 5 . 17 Shrines in Project Area

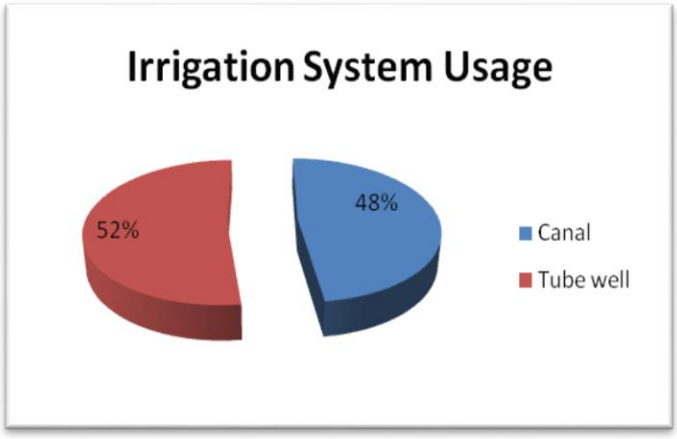
Shrines	Villages/Towns	Percentage %
Available	101	75
Not Available	34	25
Total	**135**	**100**



Irrigation System: Study revealed that 52% Villages/Towns depend upon tube well (ground water) for irrigation purpose and 48% Villages/Towns use canal water for their agriculture lands. Multiple Responses were recorded in each village due to availability of more than one option.

Table 5 . 18 Irrigation System Usage in Project Area

Irrigation System	Percent %
Canal	48
Tube well	52
Total	**100**

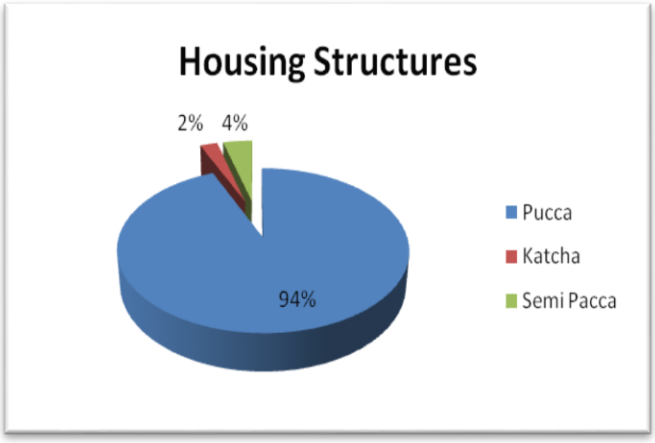


Housing Structures: Housing characteristics of the population indicate the living condition and social well-being. Survey indicates that 93.6% of the houses of the selected households in the Project Area are Pucca, while 2.4% are Katcha, and 4%

are Semi-Pacca. During the field visit, the katcha housing pattern was only observed in the proposed urban areas of few villages of Kala Katai road.

Table 1.16: Table Housing Structures

Housing Structures	Percentage %
Pucca	93.6
Katcha	2.4
Semi Pacca	4
Total	**100**



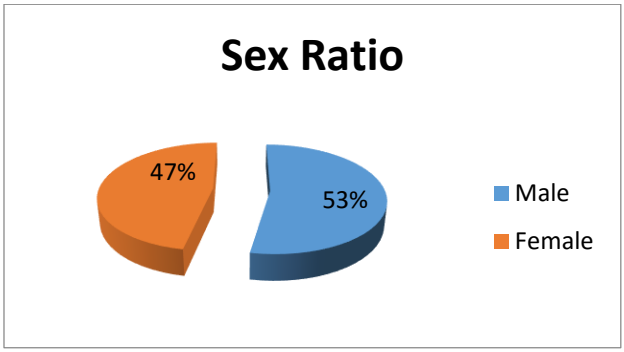
Cropping Pattern and Average Yield: The major crops grown in project area are rice, Sugar cane and wheat. A few numbers of villages sow vegetables (Potato, Onion, Carrot, Radish, Peas, Pumpkin, Bringle etc.) and Orchards of Illaichi & Guava were also observed in project area. The average yield of major crops in project area is 40 to 45 (maunds) per acre for each crop. The data contains multiple responses because every village produces number of crops.

Solid Waste Disposal: Solid waste disposal is another key problem being faced by the population of the Project Area. Only a few localities have the facility of filth depot, while a majority of the population of the Project Area throws the solid waste of their houses in vacant plots, into River drains/nullahs and in streets also.

Language Spoken: Main languages spoken in the Project Area is Punjabi. While only few people speak Urdu due to it is the official language. Few Pashto speaking people were also found and consulted in the Project Area.

Settlements Pattern: The settlement pattern of the Project Area has a mixed origin i.e. urban, semi-urban and rural. Few areas of Lahore, Sheikupura, Kasur and Nankana districts are urban or semi urban such as Farooqabad, Nawakot and ferozwala etc. Large number of all types of industries small, medium and large scale exist within and outside the project Area.

Sex Ratio: According to the survey 53 % population in the project area are male while 47 % are the female



CHAPTER 6

SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1. General

This chapter identifies the identified potentially significant environmental and social impacts which are likely to arise due to the proposed intervention on the physical, ecological and socio-cultural environment of the Project Area as well as Study Area. Proposed project has three main stages i.e. planning, implementation development and operation.This chapter also identifies and suggests practically possible and economically viable mitigation and remedial measures that will help to avoid, reduce or compensate the identified potentially significant adverse environmental and social impacts and enhancement of the potential benefits of the Master Plan.

6.2. Approach Adopted for Impacts Identification and Mitigation Measures

The proposed Project is at the planning stage and topographic survey and detailed design for all the proposed facilities has to be carried out at later stages. To identify the potentially significant adverse environmental and social impacts checklists, matrices and overlays were used.

Impact Identification

In this regards, initially checklist method was used to screen out the potentially significant and insignificant impacts. Checklist was developed for physical, ecological and socio-cultural environment by the experts keeping in view the type of existing uses, future trends without proposed intervention and with proposed intervention based on the critical parameters related to the land use and other infrastructure utilities and facilities in the Project Area.

After the initial screening of impacts through checklists, matrices were used to evaluate the temporal based potentially significant environmental and social impacts of the proposed Project. The Impact Evaluation Matrix was developed by placing project activities along one axis (i.e. Y-axis), and on the other axis (i.e., X-axis) the different environmental parameters likely to be affected by the proposed project actions grouped into categories i.e. physical, ecological and socio-economic environment. For the impact assessment, project impact evaluation matrix is used by dividing the project action into different project phases i.e. planning, development and operation.

In order to identify the spatial based (location based) impacts, overlays are used. An overlay is based on a set of transparent maps each of which represents the spatial distribution of environmental characteristics (for example land use changes from agriculture to residential, floods etc.). Information for an array of variables is collected for the standard geographical units within the Project Area and recorded in a series of maps typically one for each parameter. These maps are overlaid to produce a composite map. The resulting composite maps characterize the area's physical, ecological, socio-economic and other relevant characteristics relative to the location of the proposed Project. Software used for the overlays are Arc View and AUTOCAD. For the subject Project digitized available Google Earth Imageries and ARC GIS was used to prepared overlay maps.

In addition to this, estimation through project stages was another tool which was used to identify the impacts. For impact assessment, Lahore Division area under the jurisdiction of the LDA was considered as Study Area due to the reasons that almost all the project activities have to be carried out within this area. The Project Area is the sites selected for the Master Planning within the Lahore Division. All in all there are total 48 sites located in Lahore, Kasur, Sheikhupure and Nankanasahid districts. Map of Study Area including the Project Area is shown in Figure 5-1.

Mitigation Measures

A three-step process of mitigation was adopted for the proposed Master Plan, based on the hierarchy of elements into the stages of the EIA process when they are typically applied. Generally, as project design becomes more detailed, the opportunities for impact avoidance narrow and the concern are to minimize and

compensate for unavoidable impacts. However, these distinctions are not rigid and opportunities for creative mitigation should be sought at all stages of EIA and project planning.

Impact avoidance.

This step is most effective when applied at an early stage of project planning. It can be achieved by:

- not undertaking certain projects or elements that could result in adverse impacts;
- avoiding areas that are environmentally sensitive; and
- putting in place preventative measures to stop adverse impacts from occurring, for example, change in alignment of the road to avoid resettlement issues.

Impact minimization.

This step is usually taken during impact identification and prediction to limit or reduce the degree, extent, magnitude, or duration of adverse impacts. It can be achieved by:

- scaling down or relocating the proposal;
- redesigning elements of the project; and
- taking supplementary measures to manage the impacts.

Impact compensation.

This step is usually applied to remedy unavoidable residual adverse impacts. It can be achieved by:

- rehabilitation of the affected site or environment, for example, by habitat enhancement and conservation of river riparian areas;
- restoration of the affected site or environment to its previous state or better, as typically required for mine sites, forestry roads and seismic lines; and
- replacement of the same resource values at another location, for example, by wetland engineering to provide an equivalent area to that lost to drainage or infill.

6.3. Positive Environmental Impacts Resulting from the Project Operation

Following are the main positive impacts are envisaged due to the implementation of the proposed projects under LDA;

- Master Planning will guide the land use trends of the Lahore Division in a manner that will ensure the sustainable use of available natural resources and utilities services.
- The infrastructure and utility services in the project areas is likely to become better than at present due to implementation and development of master plan.
- The migration from small city towards large city for better facilities will become lesser having better and improved facilities in small city.
- The implementation of the master plan will increase the employment rate with livelihood as it involves development of residential and industries areas, public administration, institutions and infrastructure facilities.
- There will be more employment opportunities, health care and educational facilities in all project areas due to the implementation of master plan.
- The implementation of master plan brings improvement in the industrial sector due to enhance space given for the industry and increase in industrial areas. The cluster of different type of industries in the industrial area will bring industrial symbiosis.
- The implementation of proposed master plan will result in promoting healthy environment in terms of the availability of safe and clean water, availability of sanitation facilities, health and education facilities.
- By the implementation of master plan the quality of life will increase due to the availability of basic facilities like health, education and road networks at their door step.

- The scenic beauty of the area may be improved in the operation phase due to the public parks and play grounds.

- Public parks & play grounds will be a major source of entertainment and recreation for the locals, which may decrease the tensions of the domestic life of the people.

- Due to implementation of master plan the living standard of women in the project area will increase due to the availability of basic facilities at their door step like health, education and easy market accessibility that ultimate helps woman to perform their daily house activities efficiently.

6.4. Environmental Impacts during Planning Stage and Mitigation Measures

Following is the description of the potentially significant impacts envisaged during the planning stage which includes all the activities before the implementation stage of the project:

6.3.1.1. Groundwater Resources

- Good quality potable water is a fundamental requirement for human health and survival. Lahore and adjoin areas forming is the second largest city of Pakistan. Its population is increasing at a rapid rate of 3.2 per cent per year. In 1901 the population of Lahore was 0.203 million which, by 1990, has increased to about 5 million. At present, the population is near more than 10 million.
- Lahore district and city due to fast growth of population, poor town-planning (non-compliance of laws and regulations as well as IMPL) and industrialization are causing problems in supplying public services. Supply and sustainability of clean water stands among the most crucial problems related to proposed Master Planning.
- The sole supply of water to the Lahore Division depends upon the abstraction of groundwater. Potential rapid growth rate of population, progressive migration of people from the nearby areas towards the city and the establishment of numerous industries has resulted in rapid increase in water demand.
- The number of wells and, hence, the groundwater abstraction willbe on increasing in accordance with the growth of population, housing schemes and industrial zones.

- On the other hand, proposed urbanization and industrialization has the tendency to reduce the ground water recharge, as a significant part of the land has become impermeable.
- With the increasing number of tubewells, the groundwater level, which used to exists at about minimum encountered 4.5 m deep has already started declining rapidly. A decline of 15.5 meters in water-table during 1960 to 1991 was noticed in Lahore City (Alam, 1996).At present, the water-table in the central area of the city has gone down to 28 m from the surface level (WASA, 1999). In accordance with recent study the depletion rate of ground water for Lahore district is about 2.5-3.0 feet per year.
- The existence of saline groundwater in the nearby areas of Raiwind and Kasur, in the south of Lahore, is a potential threat to the aquifer under the Lahore city. There is a danger of deterioration of the aquifer water-quality if the saline water finds a path to reach the city area due to the potential increase in the abstraction by the proposed residential and industrial areas.
- The flushing out of this saline water, if it once enters the aquifer, would then be nearly impossible.
- Development of water supplies to serve the local needs is particularly challenging in adjoin areas of the Lahore such as Nankana, Kasur, Sheakupra areas where natural conditions potential to cater the anticipated future demands of the amount of groundwater resources available and aquifers water resource development. As such, these areas should be identified for potential project sponsors.

6.3.1.2. Surface Water Resources and Quality

- Currently the entirewastewater from Lahore District is collected through a network of 14 main drains and discharged into the River Ravi without any treatment. The wastewater from Nankana, Shiekhpura and part of Kasur districts are also finally discharged in to the River Ravi. The waste water from southern part of Kasur district is discharge in to River Sutlej. This wastewater has been discharge into the rivers without any treatment and contains category of industrial, commercial and residential wastewater. Due to non-availability of fresh water in River Ravi, the river is converted in to sewage.
- The high pollution load in river Ravi has created overall negative impact on ground water as well as on agriculture which is being done on adjacent to the river and where river water is directly used for irrigation. Already some studies have been found high values of heavy metals in crops that have been grown in adjacent to the river Ravi.

- With the potential to increase in the residential areas, housing schemes and industrial areas in districts of Lahore division the pollution level and quantities of wastewater is likely to increase many folds which may have negative impact on agriculture, ground water and human health.

6.3.1.3. Flood

- The project sites include two rivers i.e. Ravi and Sutlej and number of canals and drains so there is chance of flood hazard to occur at the project sites. According to the PDMA-DRP, the River Ravi belongs to the category B flooding (medium Level Flood). Two categories of flood can occur in the project area i.e. urban and riverine. The recent flood noted in River Ravi is at Shahdara Gauging Station is 250,000 cusecs and considered as medium flood level. This is the highest flood level noted in River Ravi after year 2000 as construction of Thein Dam on Indian side greatly reduces the flows in River Ravi while the highest flood that observed in River Ravi is in 1988 which was around 586,000 cusecs.
- In Sutlej RiverMost of the flow is yielded by heavy monsoon rains. The maximum recorded flood discharge occurred in 1955, when the river flowed at nearly 600,000 cubic feet (17,000 cubic metres) per second. The risk of floods has drastically reduced since construction of series of dams on Sutlej River on Indian side.
- Flood is considered as most drastic and re-occurring hazards in Pakistan. Roughly 1.84 million people across Pakistan have been affected by floods triggered by heavy monsoon rains. At least 346 people have been killed and 620 others have been injured in flood-related incidents, according to the latest figures released by the National Disaster Management Authority (NDMA).
- The most recent flood was occurred in current year of 2014 and considered as one of the biggest flood in the history of Pakistan. According to the National Disaster Management Authority (NDMA) almost 312 people have died, with 2,275,000 affected and nearly 1.7 million acres (687,965 hectares) of crops lost due to this recent flood. The most affected were in Punjab Province and declared a state of emergency.
- Following settlements of project area have a potential risk of flooding in river Ravi for 100 years return period in accordance with short term hydrological study attached as Appendix III. The settlements include Bhai Pheru, Bucheki, Mandi Faizabad, Mor Khunda, and Syed Wala can subjected to flooding.
- The settlement Ferozwala is under potential threat of flooding due to Deg Nallah
- . The settlement Muredke is under potential threat of flooding due to Nikki Deg Drian
- The map of flood prone areas are attached as Annex III

- The short term hydrological study which shows each river flow and each project area analysis in accordance with flooding is attached as Appendix III

6.3.1.4. Climate Change

Pakistan is rated among the top 10 most vulnerable countries to climate change. The government estimates that Pakistan has, collectively, suffered losses to the tune of $20 billion due to the adverse and increasing effects of climate change.“Pakistan is among the countries which are most vulnerable to climate change, and has a very low technical and financial capacity to adapt to its adverse impacts in accordance with one report submitted in November 2015 in National Assembly.

The major concerns of climate change in reference to our project site areas are given as under-;

- Increased variability of Monsoon;
- Projected recession of Glaciers threatening IRS Flows;
- Increased risks of Extreme Events (floods, droughts, cyclones, extreme high / low temperatures etc.);
- Severe water- and heat-stressed conditions in arid and semi-arid regions leading to reduced agricultural productivity;
- Increase in Deforestation; Loss of Biodiversity;
- Health Risks

The major extreme climatic events in reference to our project areas are given as under-:

- Isolated hailstorm in and around urban area of Lahore in 2011
- Urban Flooding in Lahore due to extreme rainfall of about 46.7 inches in 2013
- Localized Cloud Burst rains causing urban flooding in Lahore (1996)
- Large scale flooding in 1988 and 1992 in Lahore
- History's worst drought during 1999 – 2002 in Lahore
- Intense heat waves during 2003, 2005, 2007 and 2010 (53.7 °C) in Lahore

The climate change poses the serious threat in project areas if not mitigated or without an adaptive capability for the extreme climatic events. Further detail Climate Change Vulnerability Assessment of Lahore Division is required for detail analysis of climate change with mitigation and adaptive strategies.

6.3.1.5. Land Resources

The LDA will require land acquisition for:

- Widening and improvement of the existing roads
- Development of bypass roads for various existing town/villages etc.
- Development of inter town and villages roads,
- Development of new main roads, connecting roads, accessibility roads,
- Sewerage systems including pumping stations, disposal stations, treatment plants.
- Development of recreational areas, public utilities, buildings, administration buildings, toll stations, weighing stations

6.3.1.6. High Voltage Transmission Lines

The high voltage transmissions line are passing and planned to be passed form some of the project areas. These transmissions line if not been buffered have variety of health impacts on human. The short term health impacts include Headaches, Fatigue, Anxiety, Insomnia, Prickling and/or burning skin, Rashes and Muscle pain. The long term health impacts include risk of damaging DNA, risk of cancer, risk of leukemia, risk of neurodegenerative disease and risk of miscarria.

6.3.1.7. Transportation

Today big Cities mainly depend on transport system for their economic survival and socio-environmental sustainability and the transport system has a direct impact on all sectors of an economy. The impacts of ill-planned transport system on human environment include congestion, more energy consumption, pollution, traffic crashes, wastes time, delay, decreases productivity and imposes costs on society. There has been a major growth of traffic volume in Lahore over the past two decades due to increase in urban population with a large number of vehicle owners and citizens who transact businesses from one part of the city to another. At present many infrastructure facilities such as under passes, wide roads, bridges, signal free

corridor etc. have been made in Lahore but increasing traffic volume rapidly overburden these facilities at present and vigorously worsen in future. Due to these factors there will be worst position if long-term planning of transportation in master plan has not been done. The major impact would be seen on our economy if high efficiency transport system will not be designed for Lahore division.

6.3.1.8. Solid Waste

Solid waste generation rate on average in Lahore City is approximately 0.85 kg per capita per day. Considering 50 Million population of Lahore Division, the total municipal solid waste will be generated 20,000 tons/day. It is hard to estimate the medical waste because the number and capacity of hospitals have not been assessed. Municipal solid waste produced from Lahore division if not managed properly, will cause aesthetic problems and also produce odor along with the spread of many diseases. Similarly, medical waste produced from medical facilities etc. if not properly managed and disposed, it can result in injury by contaminated sha;rp material and infection with Hepatitis B, C, and HIV etc.

At present proper solid waste management and disposal system exists in Lahore district that is done by LWMC. A proper management system is working day and night in the city which collects solid waste from all areas and disposes it off at Land fill sites marked by the government. Apart from that many energy projects like waste to energy, bio gas production from organic waste, Compost projects and landfill gas electricity from LWMC are in progress

6.5. Mitigation Measures during Planning Stage

6.4.1. Ground Water

- LDA through WASA should take measures to control demand by reducing per capita water availability by educating households to use water more wisely.
- For long-term sustainability of drinking water supplies, the possibility of supplementing groundwater supplies with surface water supplies should be explored, wherever possible. For Lahore division, provision of surface water supply from the River Ravi or BRBD, UCC, QB Link etc. canal system may be considered after addressing quality concerns.
- New housing societies should also be made aware of the problem and their groundwater extraction quota should be fixed based on specified per capita demand.

- New housings and business commercial units should use water efficiency equipment's. This can be achieved through incentive programs to homeowners and businesses to encourage replacement of plumbing fixtures and appliances with water-efficient models.
- Use high efficiency irrigation for agriculture use such as use drip irrigation instead of flood irrigation
- To increase recharge to groundwater, rainwater harvesting should be encouraged in all new and old housing schemes and in areas proposed for the residential and industrial use. For this purpose, special recharge zones may be developed to facilitate groundwater recharge. While doing so rights of downstream water users must be protected. In this regard, after considering the provision of IRSA use of Sutlej river water can be considered.
- In order to promote the culture of water conservation, a metering system should be introduced to charge water on a volumetric basis. This will help in reducing water use, in the same way as is being done for electricity, gas and other utilities.
- Water should be treated as an economic good and its exploitation rights be given through a proper permit system and compatible prices especially to the industrial sector. At the same time, existing environmental laws need to be implemented seriously.

- An integrated water resource management approach should be adopted by involving all stakeholders for the protection of water quality. The linkage between research and development needs to be strengthened.

- The following actions may help in the management and mitigation of water-related industrial risks in the context of Master Plan:

  - Companies need to be conscious of their water footprints (i.e. water use and wastewater discharge) throughout their entire value chain, including suppliers and product use.

  - Companies might assess their physical, reputational and regulatory risks and seek to align the evaluation with the company's energy and climate risk assessment.

- Engage key stakeholders (e.g. communities, NGOs, government bodies, suppliers and employees) as part of risk assessment, long-term planning and implementation activities.

- Industries can monitor their water resources and continue to develop strategies to maintain their water reserves and adopt management practices geared towards creating efficiency per unit of production. • Industries can invest in treating wastewater at source and reuse it. This will build up their reputation in society and help in avoiding future water risks.

- Zoning of industries concept should be introduce such as to promote water conservation in the industrial sector, attention must be given to water intensive sectors.

- It is therefore, imperative to assess the mechanism of groundwater-replenishment, pollution-levels and pollution-sources, for sustainable development and conservation of these resources as a part of this updated Master Plan of Lahore Division.

6.4.3.1. Surface Water Resource and Quality

Water quality challenges need to be addressed in an integrated manner and by adopting pollution prevention strategies by LDA along with other concerned agencies like EPA. Water pollution can be reduced by eliminating contaminants at source which is the most effective way to protect water quality. The prevention of pollution at source is a cost effective solution as less money is required on waste handling, storage, treatment, remediation, and regulatory monitoring. Industrial units need to recycle wastewater generated from one process into other processes if it satisfies water quality standards. Water quality solutions include:

- Industries have to install wastewater treatment plant at source and should discharge the water that meets the NEQS. If possible the water should be recycled in to other processes or can be used for flushing and washing.
- Strict compliance is needed from enforcement agency like EPA on wastewater effluent NEQS from industries
- Wastewater treatment plant should have install on all the outfalls or drains that falls in to the river Ravi

- Recommendations of River Ravi Commission should be followed, which include development of constructed wetlands on drains before discharge into the river Ravi
- Regular monitoring of water quality. For this purpose, capacity of institutions (staff, laboratories, technologies, finances) should be enhanced.
- Water quality rules and regulations should be enforced in order to prevent the discharge of untreated effluents from industries and each municipality.
- A sustainable pollution control strategy needs to be devised in order to reduce wastewater volumes. This approach may include the segregation of wastewater streams, process modification techniques and recycling and reuse of wastewater.
- Proper education and awareness campaigns about the importance of water-quality need to be launched. Media and non-governmental organizations (NGOs) can play a vital role in this aspect.
- Intelligentsia/academia should be encouraged to conduct research on finding indigenous low-cost water treatment solutions for the industry.

6.4.3.2. Flood

Flood prone areas can be managed by following engineering solutions-:

- Channelization and modification of river area from only where there is chance of flood hazard to occur.
- Develop large retention ponds in between river and flood prone identified areas. Water can be trapped in a retention pond and then released at a controlled discharge to prevent flooding.
- Dikes/Bund should be developed precise to the identified flood prone areas along the side of the rivers in order to prevent the flood.

6.4.3.3. Climate Change

- Climate change is a global phenomenon and none of the countries, whether big or small, can fight the battle alone. Therefore, international bodies such as Intergovernmental Panel on Climate Change (IPCC) have been established which regularly monitor various aspects related to climate change such as the patterns of carbon consumption, weather phenomena, climate-related extremes and regional and global effects. Additionally, a greater part of

responsibility lies on the individual countries as well. Many countries have established indigenous bodies to assess the regional impacts of climate change and to devise effective strategies to mitigate.In Pakistan Climate Change Policy and Framework have been developed in 2010 by Ministry of Climate Change. This policy and framework till yet not have been implemented and we have still face challenges of climate change. In order to effective mitigation and adaptation towards climate change, the Government has to implement the climate changepolicy and its framework at sectorial, institutional and departmental level on urgent basis.

- Detail Climate change venerability assessment study is needed for Lahore division
- The infrastructure should be designed in respect to the extreme climatic events in order to prevent urban flooding and urban heat island effect.

6.5.1.1. Land Resources

- The land acquisition should be done in accordance with the land acquisition act 1897 and its amendments. Compensation against land, structure, disturbance allowance should be provided to the affecties as per market price.

6.5.1.2. High Voltage Transmission Lines

The National Transmission and Dispatch Company (NTDC) should share the plan with Lahore Development Authority (LDA) for new transmission lines that are proposed to pass from the project area. The LDA will mark the area in master plan and adequate buffer zone at least 50 meters will be provided.

The LDA should also mark the area of already existing transmission lines that are passing from the project area and adequate buffer zone along the transmission line should be provided.

6.5.1.3. Transportation

The efficient transport system for Lahore Division should be designed and part of detail master plan. The traffic reduction and efficient transport strategy should be developed that mainly include-:

- The public transport should have been improved through inter and intra city mass transit that can be faster, cheaper, and more relaxing. It also helps minimize environmental damage caused by excessive car use.
- Private cars on road should be discouraged by increasing parking fee and vehicle tax on owners.
- Improve bicycle and pedestrian facilities and programs.

6.5.1.4. Solid Waste

- Currently in the City of Lahore LWMC is main responsible organization for management of solid waste. Its jurisdiction needs to be increased in adjoining area up to Lahore division Level and its coordination with local departments needs enhanced.
- Already landfill site present in Lahore at Mehmood Boti and one engineered landfill site is present at lakhodair. The LWMC has already suggested landfill sites and transfer stations in Lahore and Kasur region. The map of suggested landfill sites and transfer stations are attached as **Annex I**
- The Landfill Sites for other districts such as Nankana and Shiekhpura should also be studied and develop and included in the master plan.
- The municipal waste should be managed in accordance with waste management hierarchy which is currently lacking in society and waste management company.
- Care must be taken as not to mix medical waste with municipal waste.
- Medical waste need to be segregated and collected in house in accordance with the Hospital Waste Management Rules, 2005. The LWMC has already studied and plan out detail hospital waste management in Lahore district. The collected waste should be given to LWMC for safe disposal in Landfill site after autoclaving. Separate spaces have been given in Landfill for hospital waste. Currently main disposal of hospital waste is through incineration which should be stopped as incineration is now least preferred technology for hospital waste management having problem of toxic air emissions.

6.6. Environmental Impacts during Development Stage and Mitigations

6.5.1. Physical Environment

6.5.1.5. Land Resources

The contractors/LDA will require temporary acquisition of land for:

- Establishment of Contractor’s camp and other facilities.
- Disposal sites for safe disposal of surplus construction and excavated spoil material.
- It is obvious that rental/leasing of land for establishing of Contractor’s facilities will change the local land use pattern. However, the change in land use will be temporary.

- Potential conflicts may emerge with the landowners regarding the restoration of temporarily acquired areas for establishing Contractor's facilities, particularly those for borrow and spoil disposal areas.

- Borrow pits and other landscape depressions, if left open, may prove hazardous to human beings, livestock and wildlife. Moreover rain water ponding in open pits can be a potential health hazard both for human beings and livestock due to the mosquito breeding and the pollution caused by stagnation of the water.

- Soil erosion may aggravate in the workshop areas as a result of improper runoff drawn from the equipment washing-yards and improper management of construction activities in hilly areas particularly in the vicinity of natural streams. Soil erosion may also occur during the excavation of for roads, sewerage and water supply lines in addition to quarry areas.

- The reduction in vegetative cover will reduce the binding capacity of the soil and increase its susceptibility to erosion by the force of rainfall. The loss of vegetative cover can increase propensity for landslides.

- Quarrying of rock from sandstone bed or picking of sand from the nullah beds for use in the construction of masonry or gabion walls may lead to destabilization of the slope and enhance land sliding.

- Scarified/scraped materials, if not disposed of properly, may contaminate the soils.

- Land may be contaminated by the spillage of chemicals like fuels, solvents, oils, paints and other construction chemicals and concrete. This normally happens when these materials are transported in open or loosely capped containers or by careless handling.

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

- Potential conflicts may emerge with landowners regarding the restoration of temporarily acquired areas for establishing contractor's facilities, particularly those for borrow and spoil disposal areas.

6.5.1.6. Water Resources

- Surface water resources may be contaminated by the spillage of fuel and chemicals or by dumping of waste material and effluents generated by the kitchens and toilets at the construction campsites.

- Natural streams and canals may be contaminated with chemicals, oil, lubricants, detergents, etc. through runoff from the construction area, construction camp and equipment washing-yards.

- Cutting of shrubs and trees will also accelerate the soil erosion, which will cause the silting of natural streams.

- River, canals and nullahs may be contaminated with chemicals, oil, lubricants, detergents, etc. through runoff from the construction area, construction camp and equipment washing-yards.

- Sewage is generated from the construction camps. This may contaminate surface and groundwater, if not disposed of properly.

6.5.1.7. Solid and Liquid Waste

Solid and liquid waste will be generated from construction camps and from construction activities if not managed, it will pose threat to environment. If the waste is allowed to be disposed in rivers/nullahs as well as on open areas, it will not only cause litter and asthetic issues but will also cause contamination. Establishment of construction camps will enhance the solid waste generation, which may cause contamination. Nullahs may also be affected by chocking.

6.5.1.8. Ambient Air Quality

- Due to the construction activities like excavation, clearing, leveling and compaction with the use of machinery like batching plants, excavators, dump truck, Road Rollers, Graders, Haul Trucks, cranes and other transport vehicles etc. Most of these are using diesel engines that generate noise and exhaust emissions. The possibility of exhaust emissions increases when old vehicles/plants are utilized for the

execution purposes. Generally, the above activity is generating particulate- matter (PM_{10}), smoke, dust, CO and NOx in the ambient air, which is deteriorating the air quality and resulting in impacts on human health, fauna and flora. The movement of heavy machinery and vehicles on the dirt tracks is also causing fugitive dust emissions.

- An air pollution source for this projects activities are unpaved roads. Dust plumes behind vehicles moving along unpaved roads represent a typical occurrence, since as the vehicle travels over an unpaved road, the force of the wheels on the road surface causes pulverization of the surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake (behind the vehicle) continues to act on the road surface after the vehicle has passed (U.S. EPA, 1975). As an approximation, fugitive dust (dust generated from unpaved roads is termed “fugitive dust” because it is not discharged into the atmosphere in a confined-flow stream) from unpaved roads can be considered to average about 75 lb per vehicle-mile of travel (Hesketh and Cross, 1981). This dust would be a problem for the surrounding communities and institutions. Fugitive dust is not expected to be a problem for national monument as the fugitive dust

6.5.1.9. Noise Level

- During the implementation of the project a large amount of equipment and construction plant will be utilized for construction of the works. The equipment would include bulldozers, scrapers, excavators, compactors, trucks, large capacity dumpers, graders, heavy duty cranes, concrete batching plants and stone crushers. The operation and movement of such equipment will increase the noise and vibration in the Project Area. The impact will be significant when compared to the without project situation.

6.5.2. Ecological Environment

The potential impacts due to construction of proposed project activities on the aquatic and terrestrial ecology of the area are given in detail in **Appendix I**- Ecological Impact Study. However summary of main impacts are given as under-:

The main negative impacts expected from the implementation and construction of this Master plan are; loss of agricultural land, loss of biodiversity, habitat loss and

fragmentation, water, noise, air and light pollutions and change in groundwater recharge capacity.

6.5.3. Socio-Cultural Environment

The main impacts envisaged during the construction stage of the projects under master plan update are described below;

6.5.3.1. Local Communities/Workforce

- During the construction stage, noise and dust problems will affect the health of the locals.
- Similarly, general mobility of the locals will be disturbed during this stage of the project.
- Construction of the road as well as the widening of the nullahs may create problems for the local residents as the drainage pattern may be disrupted. Similarly, due to the disruption of the drainage pattern, local's shortest way to reach the main road will also be affected.
- During the construction stage, improper traffic management can create problems of traffic flow and accidents on roads.
- Usage of the Community's common resources like potable water, fuel wood, etc. by the Contractor workforce may create conflicts between the community and the Contractor.
- Improper arrangement of the disposal of construction materials may create problems for the local residents during the construction stage of the project.
- Relocation/disturbance to the existing utilities like electric poles, telephone poles, etc. may affect the routine life of the community.
- Slippage of the Contractor's staff while working at nullals and canals may occur.

6.5.3.2. Loss of Livelihood

- During the construction stage, the business of shopkeepers working in the vicinity of the proposed projects may be affected due to the non-accessibility of vehicles.

- Agricultural land which is the main source of income of the people belonging to the proposed residential and industrial zones, will be affected during the construction stage.

- During the construction stage, the community will lose their livelihood as they are doing jobs at this site.

6.5.3.3. Disruption of Cultural and Historical Properties

During the construction stage, a few parts of the cultural and archeological sites may get affected by the widening of roads.

6.5.3.4. Cultural Issues

Induction of a foreign Contractor may cause cultural issues with the local community due to the unawareness of the local social norms and values. Similarly, the induction of outside labour during construction activities may create social problems like social movements, protests in the form of processions, etc.

6.5.3.5. Gender Issues

- As the Project activities are being carried out within the residential/agricultural/commercial areas of the local community, as a result of it, women activities in the field may be affected during the construction stage particularly in case of semi urban and rural areas.

- The induction of outside Contractor labour may create social and gender issues due to the unawareness of local customs and norms. It may also cause hindrance to the mobility of the local women.

6.7. Mitigation Measures

6.6.1. Physical Environment

6.6.1.1. Land Resources

- Land required for establishing contractor’s facilities including borrowing earth material (if required) and dumping excess spoil will be leased directly from private landowners by the Contractor. Rental terms will have to be negotiated to the satisfaction of the landowners concerned. Supervisory Consultants will monitor the process of restoration and ensure, through the

terms of the construction contracts, that landowners are compensated according to the terms of the lease agreements, and the restoration actions agreed upon by the Contractors are duly carried out. The photo-documentation of the existing land prior to temporary acquisition should also be available, which will be beneficial to resolve the restoration conflicts between the landowners and contractor.

- Construction camps and workshop will be located at a minimum distance of 250 m from the existing plantations and settlements, etc. This limit will be 500 m in case of batching plant.

- Prior to the commencement of construction activities, the Contractor will submit a layout and location plan of the facilities to the Engineer-in-charge, and LDA Project Management Unit (PMU), for its scrutiny and approval.

- As far as possible, waste land or barren land i.e. areas not under agricultural, residential or forestation will be used for borrow material (if required) and setting up Project facilities.

- Following protection measures should be adopted for slope stabilization;

  - Trimming down of the slopes
  - Provision of benches for safety of the cut faces
  - Provision of ditch type drain along the toe
  - Provision of small toe walls against highly dipping beds
  - Provision of chutes for dispersal of surface runoff
  - Drains will be constructed to prevent flooding on the carriageways and surrounding areas in case of new roads.

- Good engineering practices will help in controlling the soil erosion both at construction sites and in peripheral areas, particularly in borrow and dumping areas and along the haul tracks. However, the following measures will be adopted as per site conditions:

- Depending upon the side slopes, retaining walls will be provided for ensuring the integrity of the road embankments against erosion especially in

case of the flooding potential road in order to support the side slope, a retaining wall will be necessary.

- For weak side slopes flood prone areas, vegetative cover will be provided to check the erosion.
- The plantation for slope protection will be carried out, which will constitute fast growing indigenous trees with deep root system for anchoring the soil material and under growth of bushes and creeping grasses having capability of developing mesh of shallow fibrous roots to protect the slope against pitting from rain water.
- Main drainage courses should be lined to avoid soil erosion. Steep bed slopes should be avoided.
- Barren lands or natural depressions should be used for dumping the excavated spoil material ensuring that local drainage should not be disturbed.
- All the lands to be identified for disposal of spoil may be acquired on temporary basis on lease and after the needful, the land would be given back to owner. It is desirable that the Contractor should carry out the dumping in a systematic manner with stony material at the bottom and soil material on the top (for at least one meter depth) and the area is properly leveled so that the owner may bring this land into some economic use. This will be an additional benefit of the Project to the local communities as there is shortage of level land in the area for cultivation or otherwise.
- The Contractor will be required to train its workforce in the storage and handling of materials like furnace oil, diesel, petrol and chemicals, etc., that can potentially cause soil contamination. The Contractor will be required to prepare training manual and module for all the construction related activities along with the schedule of training program and submit to the supervisory consultants for approval.
- Soil contamination by asphalt and other obnoxious materials will be minimized by placing all the containers in caissons or dumped into pits lined

with impervious liners to avoid contamination of soils/groundwater from leachates.

- Proper drainage facility will be provided at the camp areas to avoid the water accumulation, which will minimize the soil contamination.
- Proper solid waste management plan should be developed by the Contractor and implemented to avoid the litter and any other waste problems. Adequate number of solid waste containers should be placed within the camp area and surroundings to ease in storage and collection/disposal of solid waste.

6.6.1.2. Water Resources

- Availability of water for campsite facilities and construction purposes will be ensured by the Contractor prior to the start of construction activities. The Contractor will seek approval from the PMU and LDA/Local departments for use of the water resources for construction purposes

- The Contractor will be required to liaise closely with the local communities to ensure that any potential conflicts related to common resource utilization for the Project purposes are resolved quickly.

- The Contractor will prepare guidelines for the workers for minimizing the wastage of water during the construction activities and at campsites.

- Construction camps will be established in the area with adequate natural drainage channels in order to facilitate flow of the treated effluents.

- The wastewater effluent from the Contractor's workshops and equipment washing-yards will be passed through gravel/sand beds to remove oil/grease contaminants before discharging it into surface water sources. Similarly, the wastewater effluent from the campsite will be treated before its disposal into the surface water sources.

- Borrow pits and natural depressions with pre-laid impervious liners will be used to dispose of scarified/scraped material, and then covered with soil.

- At appropriate locations, proper outfalls for the road side drains to divert surface run-off from the carriageway, will be provided to prevent the flooding of streams and nullahs.

- A proper solid waste management plan (including storage, collection, transportation and disposal) should be developed to avoid contamination of the surface water resources.

- Batching plants should be placed at least 1 KM from any surface water body present in the project site. Water reuse and recycling strategy should be adopted on all batching plants

- During the construction activities it should be ensured that the paint or other lubricants should not spilled into water channels.

6.6.1.3. Solid and Liquid Waste

- A site waste management plan should be made the responsibility of the construction contractor to provide for the designation of appropriate waste storage area on the site and a schedule for the timely collection and removal of construction debris to an approved dump site.

- The organic waste produced during site clearing should be mechanically mulched and composted at the site and used for landscaping.

- Providing adequate number of camps/restrooms for the workmen and waste baskets and dumpsters is essential to keep the construction site clean and pest free.

- Arrangements should be made for regular garbage collection and removal of sewage from the construction site.

- Proper recycling techniques have to be followed for the recovery of recyclable materials as this will not only reduce quantity of solid waste, but will also provide suitable raw material for reuse.

- Proper disposal method (i.e. landfill) should be used keeping in view the ground conditions and burning and dumping of solid waste into drains should not be allowed.

- Contractor should instruct his work force not to throw solid waste here and there, and common storage points should be made by the Contractor from

where at the end of the day contractor should transport the whole day's solid waste to designated disposal site.

6.6.1.4. Ambient Air Quality

- The existing quarry sites will be used to borrow the aggregate materials.
- Asphalt plants should be located at least 500 m downwind from the populated areas, wildlife habitats, and Contractors' camps, to minimize the impact of emissions.
- Asphalt and concrete batching plants should be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce the level of particulate emissions.
- Vehicles and other construction machinery should be properly tuned and maintained, to avoid hazardous level of emissions.
- The standards applicable to gaseous emissions generated by the construction vehicles, equipment, and machinery will be enforced during the construction of works.
- Where dust emissions are high, these will be reduced by a regular sprinkling of water for keeping the dust settled, at least twice a day.
- In order to prevent environmental pollution, haul-trucks carrying, earth, sand, aggregate and other materials will be kept covered with tarpaulin to help contain the construction materials being transported within the body of each carrier between the sites.

6.6.1.5. Noise Levels

- LDA in consultation with other concerned departments such as EPA, Punjab will set up a system to monitor the noise levels in the Project Area near the construction activities.
- LDA through PMU will facilitate the EPA in enforcing noise standards as prescribed in the NEQS.
- For the construction machinery generating noise level in excess of that prescribed in NEQS and WHO limits, Contractor will make arrangements to

bring the noise level within applicable limits (including proper tuning of vehicles and mufflers/silencers).

- Movements of the trucks and other construction machinery causing high noise levels must be restricted at night time to avoid disturbance to the nearby locality. Truck drivers should be instructed not to play loud music at night and stop use of horn.

- Proper noise barrier boundary walls will be built on asphalt/ concrete plants which come close to any locality.

- To protect sensitive receptors including schools and hospitals from noise, thick tree plantation will be carried out towards the roadside, where there is enough space available between the boundaries of schools and roads.

- In order to avoid the noise pollution in the congested areas as far as possible Contractor should plan the construction activities in the off peak hours.

6.6.2. Ecological Environment

The detail mitigation of negative impacts on ecological environment are given in Appendix I. However summary of mitigation is given as under-:

Negative impacts on ecological environmental due to development of master plan can be mitigated by; minimizing biodiversity loss by developing Green Infrastructure, restoration of native vegetation on railroad and roadside verges and river and canal banks, Identification and conservation of areas important for priority animal species, planning for nature conservation through the restoration of ecological networks, urban agriculture and kitchen gardening

6.6.3. Socio-Cultural Environment

6.6.3.1. Local Communities/Workforce

- Effective construction controls should be used by the Contractor to avoid inconvenience to the locals due to noise, smoke and fugitive dust.

- Proper arrangements in the form of alternative routes should be made to ensure that the mobility of locals should not be disturbed.

- After consultation with the traffic police, a proper traffic management plan should be prepared by the Contractor for mainroads specifically in order to avoid accidents.

- The Contractor will take due care related to the disposal of construction materials as well as solid waste disposal from the site, so that the nearby communities will not suffer.

- The Contractor will take care of the local communities water sources so that these should not be contaminated or destroyed.

- Safety lookouts should be built to prevent people and vehicles from passing at the time of heavy equipment operation area.

- Haul-trucks carrying concrete, aggregate and sand fill materials will be kept covered with tarpaulin to help contain construction materials being transported between the sites.

- In construction camps, amenities of life including clean food, water and sanitation facilities should be provided to these camps. The Contractor should arrange first aid boxes at camps.

6.6.3.2. Loss of Livelihood

- During the construction, accessibility of vehicles to the workshops should be ensured so that the business of shopkeepers will not be disturbed.

- Construction activities should be carried out during the night time, as most of the markets are closed at sunset.

- Affectees along with their children losing their agricultural land should be given employment opportunities on preferential basis during the construction stage.

- Similarly, in order to restore the livelihood of the people belonging to business and agriculture residing in nearby areas a proposed site for Truck Stand should be given labour opportunities during the construction stage.

6.6.3.3. Disruption of Historical Properties

- The main historical sites like shrines should be avoided from damage by the widening of roads. Similarly, by adopting protection measures, during construction, any negative impacts on cultural and historical sites may be minimized. In this regard, it is recommended that the Contractor should prepare a site specific management plan to avoid any damage to the sites.

6.6.3.4. Cultural Issues

- The Contractor will warn the workers not to indulge in any theft activities and if anyone would get involved in such type of activities, he will have to pay penalty and would be handed over to the police. Similarly, at the time of employing, the Contractor has to take care that the workers should be of good repute. The Contractor's camp will be properly fenced and the main gate will be locked at night with a security guard to check prevent the theft issues from the community side.

- To avoid the cultural issues, the Contractor will facilitate the local labor during the construction activities.

6.6.3.5. Gender Issues

- The Contractor will have to select the specific timings for the construction activities so as to cause least disturbance to the local population, particularly women, considering their peak movement hours.

- The Contractor will take due care of the local community and the sensitivity towards the local customs and traditions will be encouraged.

- The Contractor will warn the staff strictly not to indulge in any un-ethical activities and to obey the local norms and cultural restrictions particularly with reference to women.

6.8. Environmental Impacts Resulting From Project Operation and Mitigations

6.7.1. Physical Environment

- Due to the development of residential schemes and societies with same level of standards and facilities like Lahore city the urbanization load on the city will be relieved.

- This will lead to the new opportunities for the commercial areas. The commercial markets will also develop which will share pressure on the existing overloaded commercial market and areas in the city.

- Due to the operation of the proposed roads and bridges along with extensions of the old ones will reduce the vehicular load in the city and generally traffic conditions will get improve during the operation stage.

- Due to the improved traffic conditions there will be a remarkable reduction in traffic hazards.

- Construction of the new bridges will divert the city traffic load into the relevant direction, which may help in the reduction of traffic congestion in the city.

- Surface run-off from the impervious surface of the carriageway or slopes can aggravate the drainage problems and can damage the road surface during the operation stage.

- If cross-drainage structures are not adequately maintained and cleaned, natural nullahs tend to become choked with debris and eroded soil, adversely affecting the quality of the surface water in the Project Area.

- Land value is the value of a property including all its improvements and upgrades. It is estimated in accordance to location, socioeconomics, government regulations, desirability for residents as a place to live, vicinity to schools parks and recreational facilities, roadway accessibility, and distance to retail establishments. A parcel of land has a value based on surrounding improvements the authority has made. The Master Plan is a

comprehensive long term plan intended to guide growth and development of Lahore Division. Therefore, with the implementation of the proposed Master Plan land values will increase considerable on proportional basis. The lands which are located near to the proposed residential areas especially commercial sides will increase considerably. This will be positive impact on the land owners. However, due to this increase in land will shift the trend of the local from agriculture farming to selling of land for residential and commercial purpose.

- The noise pollution will be lesser than the construction phase. However, it will definitely be more than the pre-construction stage on account of the increase in traffic on the newly constructed and widened roads. However, it is expected that the resultant sound level will remain well within the NEQS limits.

- Due to the operation of the parks and playgrounds, recreational activities among the locals will increase.

- Operation of the bus terminals will help in the reduction of the vehicular load in the city and overcome the haphazard condition in the old bus terminals.

- Due to the construction of intercity bus terminals at the new locations, traffic load in the city will be reduced to a large extent.

- During the operation stage of all the projects, noise and air pollution problems for the nearby residing community as well as for the area may increase.

- Spillage of oil and other lubricants at Bus terminal and Truck stand will contaminate the soil as well as the surface water resources.

- During the operation stage of the facilities, it is expected that about 20,000 tons per day of solid waste will be generated from Lahore division. Municipal solid waste produced from Lahore Division if not managed properly, will cause aesthetic problems and also produce odor along with the spread of many diseases. Similarly, medical waste produced from medical facilities etc. if not properly managed and disposed, it can result in injury by

contaminated sharp material and infection with Hepatitis B, C, and HIV etc. At present for the Lahore district, LWMC will be in charge for the management of solid waste while district governments are responsible for management of solid waste in others districts

- During operation stage about 2500 cusec of wastewater will be generated from Lahore Division. This waste water poses the threat to fresh water resource especially to River Ravi if not been treated. Additionally it may deteriorate quality of downstream and may also be threat to the local flora and fauna.

- About 3000 cusec of fresh water will be required; currently ground water is used as fresh water resource in Lahore division. If same will be used, then it will pose negative impact on our ground water resource. Already Lahore district ground water is depleting at the rate of 2.5-3.0 feet per year.

6.7.2. Ecological Environment

The details Ecological Impacts and mitigation during operational stage are given in Appendix I

6.7.3. Socio-Cultural Environment

- Increased number of planned residential areas will be a positive impact regarding the local business of the shopkeepers, tourist guides, hotels and food stalls. However, this increased number of visitors may become a threat to the available natural resources. This may also create uneasiness for the locals.

- Noise generated by the vehicles will further increase, which will disturb the local communities, school staff and students, etc. existing near the roads.

- Health problems on account of air pollution may increase in the operation stage of the Project.

- There will be risk of fire hazard on shopping plazas, bus terminals etc.

- Health issues may generate due to the improper cleanliness of toilets at bus terminals, shopping complexes, public parks and play grounds.

6.9. Mitigation Measures

6.8.1. Physical Environment

- For the air and noise quality, a monitoring system will be established by LDA/PMU and EPA to ensure that ambient air and noise levels are within the permissible limits.

- To reduce the noise levels, if deemed necessary, provision of thick tree plantation, noise barriers and double glazed windows will be assessed as per site conditions for the sensitive receptors including schools and hospitals.

- In order to cater to the solid waste problems, the solid waste management plan should be developed. The LWMC model should be replicated in other districts of Lahore division as well.

- Medical Waste should be separated and collected, transport and disposed in accordance with Punjab hospital waste management rules 2014. The ultimate collection, transportation and disposal of medical waste should be given to LWMC instead individual management. Strong monitoring system is required for management of hospital waste.(Detail given in Chapter Stakeholder consultation with LWMC).

- Already LWMC has identified new landfill sites in Kasur and Lahore districts but for other districts new landfill sites should be identified. (Detail given in Chapter Stakeholder consultation with LWMC).

- For the liquid waste problem, wastewater treatment plant(s) should be constructed and before the disposal of wastewater into the surface water body, it should be treated properly. (Detail already given in Planning mitigations)

- For Groundwater usage, alternative options of using fresh water resource like canal water and river water should be explored. (Detail Already given in Planning mitigations)

- In order to retrieve the aesthetic view of the area, sufficient additional plantation of different trees will be carried out.
- In order to avoid the soil contamination, a fully paved area should be designated for the vehicles maintenance in each bus terminal/truck stand.
- Solid waste from the incinerator, slaughter house, Mutton and fish market should be collected properly and disposed of after proper recycling.
- In order to avoid air pollution generated by the incinerator, suitable pollution control device should be used.
- It will be ensured by the road/Highway Department that storm water drains and road drainage system are periodically cleared to maintain the water flow.

6.8.2. Socio-Cultural Environment

- In order to solve the accident problems, speed limit, sign boards and speed breakers should be provided on roads.
- The visitors should be briefed about not damaging/degrading the natural resources.
- Traffic police should ensure that the vehicles are properly tuned up to minimize the air and noise pollution.
- Firefighting arrangements should be provided in the operation stage for the shopping complexes and parking plazas, and bus terminals, etc.
- Proper arrangement for the cleanliness of the toilets and waiting rooms should be provided for the passengers at bus terminals.

CHAPTER 7

ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The goal of the Environmental Management and Monitoring Plan (EMMP) is to ensure that all the necessary mitigation measures are carried out to counter any adverse environmental impacts and that enhancement of positive measures is used, where feasible and practical. One of the aims of the monitoring plan is to actually observe and analyze these impacts, thereby providing the information to help in the modification of mitigation measures to reduce the risks and hazards associated with these development activities.

7.1. General

For the effective implementation and management of the proposed mitigation measures, it is necessary to develop an EMMP, which basically provides a mechanism to address the potential impacts of the Project activities and to develop a monitoring program in order to minimize the potential impacts during the design, construction and operational stages of the Project. The EMMP has been prepared with the objectives of:

- Outlining the mitigation measures required for avoiding or minimizing the potential impacts assessed by EIA.
- Developing a monitoring mechanisms and identifying the requisite monitoring parameters to confirm the effectiveness of the mitigation measures recommended in the EIA.
- Defining roles and responsibilities of the Project proponent for the implementation of EMMP and identifying areas, where these roles and responsibilities can be shared with other parties involved in the execution and monitoring of the Project.

- Defining the requirements necessary for documenting compliance with the EMMP and communicating it to all the concerned regulatory agencies.
- Prescribing the mechanisms with which consultation with stakeholders during the Project will be maintained.

7.2. Structure of EMMP

The EMMP consists of the following sections:

- Legislation, Guidelines and Environmental Standards
- Organizational Structure and Roles and Responsibilities
- Mitigation Management Matrix (MMM)
- Environmental Monitoring Program
- Communication and Documentation Plan
- Change Management Plan
- Training Program

7.3. Legislation, Guidelines and Environmental Standards

The main environmental legislation relevant to the Project are the Pakistan Environmental Protection Act, 1997 (Amended 2012), EPA Regulations 2000, etc. NEQS, laid down by Pak-EPA will be followed.

Details of all the applicable legislation and acts have been provided in Chapter-2 of this document.

Following standards will be followed during the design, construction and operation stages of the Project.

7.3.1. Effluents

The NEQS will be used for the effluents. The NEQS for industrial and municipal effluents define the maximum allowable concentration of pollutants in effluents

released into different types of receiving bodies. These standards will apply to all the effluents from Project facilities.

7.3.2. Gaseous Emission

The NEQS for gaseous emissions define the maximum allowable concentration of pollutants in gaseous emissions from the industries. This standard will apply to all gaseous discharges from the Project facilities.

7.3.3. Ambient Air Quality

NEQS Ambient air quality standards should be used for the project in Appendix II

7.3.4. Noise

Standards for vehicle-generated noise are prescribed under the NEQS and will be followed (Appendix II)

7.3.5. Drinking Water

Potable water quality standards also form part of the NEQS. However, WHO drinking water quality guidelines will be used as reference point for determining drinking water quality. These are outlined in Appendix II

7.3.6. Disaster Management

After the devastating impact of Earthquake 2005, National Disaster Management Ordinance promulgated in Dec 2006 which was later on passed by the Parliament as National Disaster Management Act-2010. The implementation of Disaster Management Act, 2010 would be ensured by the National Disaster Management Commission and Provincial Disaster Management Commission which was formed under this act.

7.4. Roles and Responsibilities

The following organizations would be involved in the implementation of the proposed Project:

- Lahore Development Authority (LDA) as the Project proponent and owner of EMMP.

- Supervisory Consultants (SC) at Construction Stage as the monitor of the EMMP.
- Contractor (s) responsible for the implementation of the EMMP.
- Project Management Unit (PMU) will be responsible for the implementation and monitoring of project activities.
- District/Local Government as Coordinating Agency and responsible for compliance of the environmental legislations and standards.
- EPA, Punjab responsible for auditing to ensure compliance of environmental legislation.
- National Disaster Management Authority (NDMA) its provincial and district level departments

The roles and responsibilities of the above key players are described in the following paragraphs:

7.4.1. Lahore Development Authority (LDA)

Lahore Development Authority (LDA) is responsible for new planned development in Lahore, Punjab, Pakistan. It also regulates and issues permits for new construction and housing projects, private houses, and commercial development. It also manages Lahore's parks and green areas. The Punjab Legislative Assembly established the Lahore Development Authority under the LDA Act of 1975. It had previously been called the "Lahore Improvement Trust". It has three wings:

- Urban Development Wing
- Water and Sanitation Agency (WASA)
- Traffic Engineering and Planning Wing (TEPA)

The Project Proponent (i.e. LDA) along with district/local governments will be responsible for ensuring the overall implementation of EMMP during the Planning, Designing, Construction and Operation stages of the Project.

During the Construction stage of the Project, LDA will ensure that the Project activities are being executed as per provisions of the EMMP and other applicable

laws and regulations. It is proposed that an Environmental Officer (EO) supported by one environment inspector and one social inspector should also be deployed by LDA to ensure that design and implementation activities are being carried out as per provisions of the EMMP. In addition to that, EO will also look after the upcoming future projects. Organogram of LDA is attached as Figure 8.1.

During the operational stage, concerned departments will be responsible for the implementation of mitigation measures and LDA will be responsible through EO for monitoring of O&M activities being carried out by different departments to ensure that they are in compliance with the EMMP.

Note: DG : Director General, ADG(H) : Additional Director General (Housing), DKA : Director Kachi Abadi, DLD : Director Land Development, DEM : Director Estate Management, DEM(QAT) : Director EM Quaid-e-Azam Town, DEM Ave : Director Estate Management Avenue, PDIT : Project Director Information Technology, DCS : Director Computer Service, DE : Director Enforcement, DHP : Director Hidden Properties, D Law : Director Law , CTP : Chief Town Planner, DTP : Director Town Planning , D Comm :Director Commercialization Arch : Director Architecture, D Rcry : Director Recovery, CMP : Chief Metro Politian Planner, DMP : Director Metro Politain Planning, D Rch :Director Recovery, CE : Chief Engineer , ACE : Add Chief Engineer , DDHQ : Deputy Director Head Quarter , DR : Director Revenue , DB : Director Building , DEME : Director , DP&D :Director Planning & Development, ADG (HQ) : Additional Director General(Head Quater), DEdu : Director Education, DA :Director Admin, DF : Director Finance, DPR :Director Public Relation, C&I : Co-ordination & Implementation

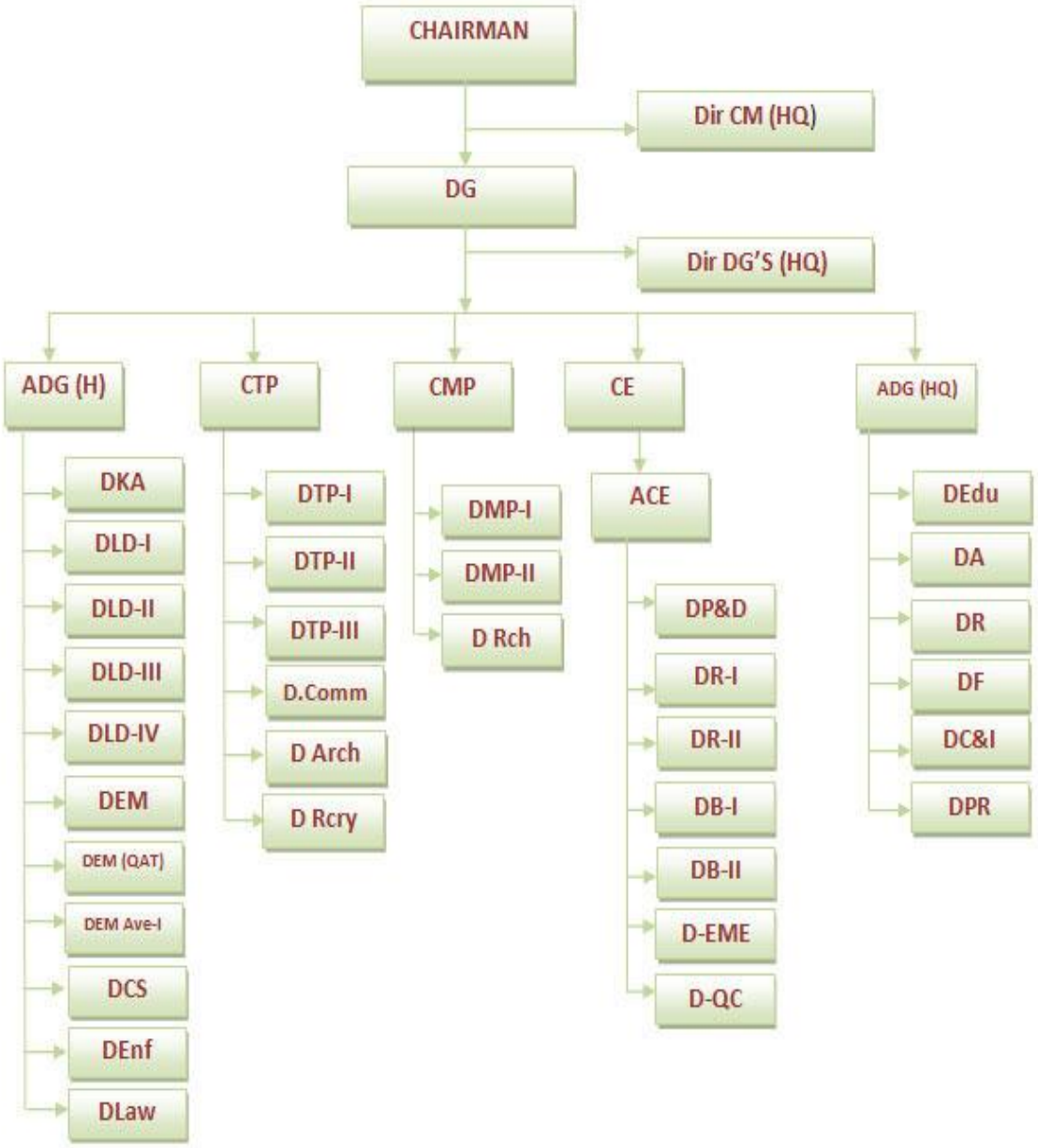


Figure 7 .1 Organogram of Lahore Development Authority

Specific responsibilities of LDA at all project stages are as follows:

7.4.1.1. Planning and Design Stage

EO will be responsible for:

- Ensuring that mitigation measures proposed at the planning and design stages have been adequately incorporated in the design.
- Setting up systems for environmental management.
- Coordinating with different agencies including EPA-Punjab, LDA/PMU, and district/local government responsible for compliance of environmental

legislation. Liaison will also be maintained with local NGOs and community based organizations (CBOs) that make observations regarding the implementation of the Project components.

- Ensuring that the terms of reference for each Project Contractor adequately cover the environmental and social issues and participate in short listing, where appropriate.
- Ensuring that the Contractors develop and carry out environmental implementation plans that are consistent with the EMMP.
- Supervising environmental assessments, and providing substantial inputs and guidance.
- Having EIAs/ IEEs submitted for approval to the EPA, Punjab.

7.4.1.2. Pre-Construction Phase

EO and his staff will be responsible for:

- Verifying PAPs on the basis of specified legal documents.
- Verification of public facilities and the utilities needed to be relocated. In the case of relocation of public utilities, ensure that alternative arrangements have been carried out.
- Carrying out consultation and information dissemination campaign on the compensation procedures, entitlement packages, and the proposed resettlement sites.
- Verifying that proper traffic management plan has been provided in case of rehabilitation of the existing roads.
- To assist in establishing a grievance redressal committee to ensure fair and transparent resettlement processes.
- Ensuring that an adequate notice period is given to PAPs before shifting.
- Identifying major issues of conflict between PAPs and the LDA/PMU/Contractors during the implementation of resettlement and relocation activities.

- Ensuring that the Contractor has carried out photo documentation of the construction sites as well as areas selected for establishing construction camp and other facilities like asphalt plant, etc. and copies of the same have duly been received by LDA.

7.4.1.3. Construction Phase

EO and his staff will be responsible for:

- Liaison between Project staff of LDA, Supervision Consultant's (SC) staff and PMU to monitor environmental compliance during construction.
- Supervising and providing technical support to the Project and operations staff to help ensure compliance with the EMMP.
- Identifying any problems due to the restricted access during construction and verifying whether ramps/diversions/alternative routes have been provided, where ever required.
- Periodic review of community complaints register maintained by SC and Contractor.

7.4.1.4. Operation Stage

- Coordinating with the operations staff working under different departments including Municipal Committee, Heath, Education, Forest and other relevant departments to monitor environmental compliance during the operation of Project facilities.
- Reporting on the progress of environmental compliance to the EPA-Punjab.
- Assessing the long-term environmental impact during the operation of the Project facilities.
- Monitoring of tree plantation plan as per EMMP requirements to ensure proper O&M of the plantation.

7.4.2. Supervisory Consultants

SC will be responsible for the following activities:

- Supervising the Project's Contractor(s) and ensuring that all the contractual obligations related to the design and construction, as well as environmental and social compliance are met.
- Ensuring that day-to-day construction activities are carried out in an environmentally sound and sustainable manner.
- Assisting the Project management for coordinating with officials, community groups, government departments etc. on the environmental issues and obtaining the necessary clearances from the regulatory authorities.
- Monitoring of the environmental aspects of the Projects during construction to ensure that the environmental requirements of the contract and the mitigation measures proposed in the EMMP are implemented.
- Supervising contractor(s) and preparing environmental input for the monthly progress report.
- Carryout environmental training activities for Contractor'(s) staff.
- Ensure that asphalt plants, construction camps and other facilities are properly sited and installed in accordance with the contract.
- Determine the timing and exact locations of both baseline and routine air, noise and water quality monitoring in accordance with the contract provisions.
- Undertake critically important routine visual observations for construction, waste disposal and overall environmental management practices by the Contractor(s).
- Devise solutions to environmental issues as they arise. Development Projects inevitably give rise to the problems of excessive dust, noise levels and other impacts that are in some instances unavoidable. Good construction supervision requires that every effort be made to minimize these impacts. A team approach is essential. Circumstances may arise

requiring creative solutions based on site specific conditions as they are encountered.

- Check that the Contractor backfills the soil, compacts, and leaves the ground in the original condition after excavation of pits for subsurface investigations/borrow pits.
- Keep checks and controls so that the pollution of the land and water resources due to the spills of lubricants, fuel, chemicals, and other wastes does not take place.
- To see that the Contractor keeps the damages to the minimum while making tracks for accessibility and that the damage is remedied properly.
- Monitor that the Contractor adjusts his working hours during the construction activities in such a manner that it causes least inconvenience to the local population.
- To keep the working site/camps tidy so as to avoid unhealthy impacts on the work force.

7.4.3. Contractor

As referred earlier, implementation of the EMMP will be the sole responsibility of the Contractor(s). All the environmental measures related with the construction activities will be implemented by the Contractor and MMM. Contractor will depute a Manager, Environment, Health and Safety (EHS), who will be responsible for implementation of the EMMP. He will prepare a traffic management plan, effluent and solid waste management plan and emergency response plan. In case the Contractor fails to implement the mitigation measures, he will be responsible to pay penalty to be fixed by a committee comprising EO-DAM, Environmental Specialist of PMU and Supervisory Consultant (i.e. Resident Engineer). Supervisory Consultant will make recommendation to deduct the amount of penalty from the invoice of the Contractor.

7.4.4. PMU & District/ Local Government

PMU under LDA is an entity responsible for the approval of Projects and disbursement of funds for implementation of the Projects. In addition to this, PMU will

be responsible for coordination between other concerned departments, authorities and other relevant departments including local government.

To implement the updated Master Plan, LDA will establish PMU based at Lahore with field offices at district locations and responsible for implementation, monitoring and reporting of the project. In addition PMU is also responsible for release of funds as per work done. Local departments are responsible for identification of Projects through relevant line departments and to ensure implementation of the projects in a sustainable and socially acceptable manner.

Local departments will also establish an environmental unit, which is responsible to ensure the compliance of National Environmental Legislation and safeguards policies of donor agencies. Environmental Specialist at local level will be responsible for compliance of EMMP activities for the selected Project to be implemented under this Project. He will visit the Project Area periodically and ensure the implementation of the EMMP in its true spirit.

7.4.5. National and Provincial Disaster Management Authority

The National Disaster Management Authority (NDMA) is the focal point for coordinating and facilitating the implementation of strategies and programs on disaster risk reduction, response and recovery. Similarly, Disaster Management Authorities has been established at provincial, regional, district and municipal levels.

NDMA provides technical guidance to national and provincial stakeholders about formulation of plans, strategies and programs for disaster risk management. NDMA is also working on capacity development of national, provincial and local stakeholders in collaboration with PDMAs and DDMAs.

The NDMA has also developed National Disaster Risk Management Framework in which nine priorities area has been identified. The framework is given as under-: “Achieving sustainable social, economic and environmental development in Pakistan through reducing risks and vulnerabilities, particularly those of the poor and marginalized groups, and by effectively responding to and recovering from disaster impact”.

Nine priority areas that have been identified within this framework include-:

i. Institutional and legal arrangements for DRM
ii. Hazard and vulnerability assessment,
iii. Training, education and awareness,
iv. Disaster risk management planning,
v. Community and local level programming,
vi. Multi-hazard early warning system,
vii. Mainstreaming disaster risk reduction into development,

Provincial Disaster Management Authority was formed as result of National Disaster Management Act, 2010. PDMA is the coordinating authority that provides a platform for all provincial departments to formulate strategies, preparedness and response to a disaster. In case of a disaster, PDMA not only oversees search, rescue and evacuation of the affected people, but also takes concrete measures to provide immediate relief, early recovery and long-term rehabilitation to them. In case of emergencies, the PDMA works closely with District Governments to organize initial and subsequent assessment of disaster affected areas, and determine the course of action to ensure long-term rehabilitation of the affected population (DRP-2013)

PDMA has developed Disaster Response Plan (DRP) that clearly mentioned the coordination mechanism between key provincial departments. The DRP provides guidelines that must be followed in case of the disaster.

PDMA has also setup Command and Control center and High Frequency Radio Network in order to coordinate disaster response. All departmental representatives report to the 3C in case of a natural disaster. These departmental representatives are subject experts and they furnish their advices to the Director General, PDMA to help him plan the course of action in response to a disaster. All departments possess equipment that can be mobilized and the PDMA's job is to utilize the cumulative resources of the Government of Punjab to respond to a disaster.

In case of the Lahore Division Master Plan Project the PDMA is the supreme organization that formulates polices and strategies in order to prevent and reduce the disaster. The District Disaster Management Authority DDMA and Tehsil Disaster Management Authority TDMA will work in close coordination with PDMA and ensure the implementation of Disaster Preparedness and Response Plan (DPRP).

7.4.6. Roles and Responsibilities

The duties and responsibilities of PDMA, DDMA are given as under-:

PDMA

- Coordinate complete spectrum of disasters in the province/region, Formulate provincial/regional disaster risk management plan,
- Continuously monitor hazards, risks and vulnerable conditions within the province/region,
- Develop guidelines and standards for provincial/regional and local stakeholders regarding their role in disaster risk management,
- Ensure preparation of disaster risk management plans by all districts,
- Coordinate implementation of provincial disaster risk management plan in accordance with the National Framework
- Promote education, awareness and training on disaster risk reduction and response,
- Provide necessary technical assistance and advice to local authorities for carrying out their functions effectively,
- Coordinate emergency response in the event of a disaster, through the Provincial/Regional Emergency Operations Centre (PEOC),
- Develop specific capabilities to manage threats that exist in the province/region,
- Perform such other functions as may be assigned by the Provincial/Regional Commission,
- Declaring State of Emergency
- Accessing and stabilizing the environment

DDMA

- Formulate district disaster risk management plan, based upon local risk assessment, and coordinate its implementation
- Review development plans of government departments and provide guidance on mainstreaming disaster risk reduction measures in these plans
- Continuously monitor hazards, risks and vulnerable conditions within the district, municipality, or cantonment areas
- Prepare guidelines and standards for local stakeholders on disaster risk reduction
- Conduct education, training and public awareness programs for local officials, stakeholders and communities
- Encourage involvement of community groups in disaster risk reduction and response by providing them necessary financial and technical assistance for implementing community level initiatives

- Examine construction in the area and if hazard safety standards have not been followed, direct the relevant entities to secure compliance of such standards,
- Invest in specific capabilities according the requirement to manage all types of threats peculiar to local area
- Undertake appropriate preparedness measures at district level; e.g. maintain an early warning system, identify buildings to be used as evacuation sites, stockpile relief and rescue materials and identify alternative means for emergency communications
- In the event of a disaster, organize emergency response through the District Emergency Operations Centre (DEOC)
- Maintain linkages with the Provincial Disaster Management Authority and the Relief Department, and perform such other functions as the Provincial Authority may assign to it.
- Assessing emergency services, supplies and equipment
- Obtaining emergency services, supplies and equipment
- Ensuring the public safety during an emergency
- Training of Staff and awareness to Public as how to deal during emergency situations

TDMA

- Give Awareness among public of different disasters and cope with it.
- Organizing Emergency Response and Relief
- Damage and Loss assessment in case of disaster
- Provide Emergency Services in collaboration with other departments and DDMA in case of Disaster

Union Councils

- Demand to DDMA for availability of local resources needed for disaster management
- Develop local policies and guidelines for vulnerability reduction.

7.4.7. EPA- Punjab

EPA-Punjab with representatives at district level is an environmental regulatory agency and responsible for the preparation of environmental legislation and to ensure their compliance. Being regulatory agency, EPA will ensure compliance of PEPA, 1995 (Amended 2012) and NEQS applicable to the Project. For this purpose, EPA representatives will make site visits as and when required or on the complaint of any stakeholder.

7.5. Environmental Mitigation Management Matrix

The environmental protection and enhancement are achieved in various ways. These approaches should begin right at the developing stage, i.e. i) Project location, ii) Design, specifications and tender/contract documents, iii) Construction activities and iv) Post completion activities i.e. operation and maintenance stage. Appropriate environmental management measures are required to be exercised in a cascade order by the Project proponent at each stage of the Project. All the stages of the Project have to be managed by adopting the proposed environmental mitigation measures, where, besides engineering aspects, due importance is to be accorded to mitigation measures which make a perfect blending with the surrounding ecosystem.

The key environmental and social issues, which have already been discussed in impacts and mitigation chapter, are as under:

- Land acquisition, resettlement and relocation of private and public infrastructure.
- Soil erosion and soil contamination at construction and operation stages.
- Contamination of water and air during the construction and operation stages.
- Generation of noise by vehicles, machinery and equipment during the construction stage.
- Accessibility to common resources during the construction stage, safety of locals and work force as a result of accident hazards during the construction and operation of the project.
- Traffic management during the construction stage.
- Waste disposal during the construction and operation stages.
- Cultural issues.
- Gender Issues.

MMM is provided at the end of this chapter, which establishes the linkages between the environmental and social impacts, mitigation strategy and the agencies responsible for execution. The MMM identifies the following:

- The required mitigation measures recommended in EIA.
- The person/organization directly responsible for adhering to or executing the required mitigation measures.
- The person/organization responsible for ensuring and monitoring adherence to the mitigation measures.
- The parameters which will be monitored to ensure compliance with the mitigation measures.
- The timing at which the mitigation or monitoring has to be carried out.

7.6. Environmental Monitoring Program

EMMP provides important information that allows more effective planning and adaptive response based on the assessment of the effectiveness of mitigation measures. This is extremely important in a development Project.

Environmental Monitoring is required to assess, whether the various mitigation measures as suggested are effective in attaining the goals of environmental protection. Without any environmental monitoring program, it is not possible to determine, whether the environment is being protected or not and any modification or further mitigation is required.

7.6.1. Objectives

The objectives of environmental monitoring will be as follows:

- To check compliance with the requirements of the EMMP by monitoring activities of the Project Contractors, which will be called Activity Monitoring.
- To monitor actual impacts of the Project Activities on physical, ecological and socio-economic receptors of the Project Area so that any impacts not anticipated in the EIA or impacts which exceed the levels anticipated in the EIA, can be identified and appropriate mitigation measures adopted in time. This objective will be achieved through effects monitoring.

- To ascertain the residual impacts during the operation, post-Project monitoring will be carried out.

To achieve these objectives the following monitoring program will be implemented.

7.6.1.1. Activity Monitoring

Activity monitoring will be carried out to ensure compliance with the requirements of the EIA. Inspection will be done using checklists developed specifically for the Project by the LDA, SC and the Contractors as per their roles and responsibilities.

Activity monitoring will be the responsibility of all organizations involved in the implementation and operation i.e. DAM, SC and the Contractors and hence it will be done at three levels.

- Activity Monitoring by the Contractor's staff
- Activity Monitoring by SC field monitors
- Activity Monitoring by LDA/PMU.

EO of LDA will visit the Project activities regularly during the construction. SC will supervise the monitoring through full time supervision. Any non-compliance observed by SC will be recorded in non-compliance recording forms and discussed during the environmental meetings. In addition, compliance monitoring protocol for physical environment is given in Table 8.1.

7.6.1.2. Effects Monitoring

For Effects Monitoring, EO will be responsible to monitor the effects as described in the monitoring requirements. Outline monitoring requirements have been recommended in the EMMP; however, a detailed monitoring program will be prepared by the EO of LDA/PMU. The monitoring program will describe in detail the resources and methodology that will be adopted for the purpose of Effects Monitoring. Effects monitoring will be carried out for the following parameters:

7.6.1.3. Physical Environment

This monitoring will be targeted at identifying the project impacts on:

- Soil

- Water
- Ambient air and stacks

Effects monitoring protocol is provided in Table 8.2.

7.6.1.4. Ecological Environment

Effects on ecological environment will be monitored by LDA with the help of forest department, who will conduct quarterly survey during construction and subsequently during the operation of the Project. For the monitoring purpose, wildlife and flora surveys will be conducted to determine the effects of different project activities on wildlife and flora. A compliance register will also be maintained for the effects and compliance monitoring.

7.6.1.5. Socioeconomic Environment

Effects on socio-economic environment will be monitored by conducting monthly survey during construction and final post Project survey by EO. The survey will be structured to ascertain the levels of impacts during the course of the project and the implementation of mitigation measures prescribed in the EIA such as hiring of local employees, payments of land compensation, health and safety of communities, mobility of local women etc. The EO supported by social inspector will also verify the maintenance of social complaints register by SC.

7.6.1.6. Post-Project Monitoring

After completion of the Construction, post-Project monitoring will be carried out. The objective of this monitoring will be to determine the levels of residual impacts of the Project on physical, ecological and socio-economic receptors of the Project Area. The monitoring may be carried out within one month after the end of all activities in the Project Area. The post-Project survey report will be submitted within two weeks after completion of the survey. As part of the post-Project monitoring, field monitors will also check restoration of sites restored at the time according to the requirements of the EIA.

Table 7 .1Recommended Compliance Monitoring Protocol for Physical, Ecological and Social Environment

Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Soil Erosion	▪ Construction sites, camp sites, water quality (especially road, industrial site, residential sites)	Visual observations	▪ Daily during routine monitoring by activity monitors and reported on a weekly basis.
Water Quality	▪ Points where effluents is being discharged into drains, nullahs, canals and river ▪ Surface drainage channels ▪ Concrete preparation plants ▪ Worker's camp ▪ Disposal areas of earthfill or solid waste ▪ Fuel (Petrol. Oil and Grease) products storages ▪ Vehicle and machine repairing and servicing yards. ▪ Discharge points from Commercial and Residential Areas	Discrete grab sampling and laboratory testing of water samples.	▪ Sampling and laboratory testing should be done on Monthly basis during the construction and biannually during the operational stage. ▪ Discharges from the construction sites should be tested for temperature, pH, turbidity and dissolved oxygen. ▪ Treated effluent discharges from the worker's camp to be tested for BOD_5. ▪ Outlet and drains from the mechanical repair units include testing for pH, turbidity, lead, hydrocarbons, and oil.
Dust Emissions	▪ Tracks along the earth roads. ▪ At communities close to the access roads.	Visual checks	▪ Weekly during routine monitoring by activity monitors and reported on a monthly basis during the construction period.
Noise Levels	▪ Camp sites, ▪ Selected locations along the access tracks ▪ Construction sites of health, education and commercial buildings. ▪ Sensitive receptors like schools, hospitals and community centers along the roads and commercial buildings during the operation stage	Noise meter	▪ Once prior to the start of construction and then on a monthly basis throughout the construction period. ▪ Quarterly during the operational stage.
Ambient Air and Stack	Ambient air (w.r.t. proposed land use plan), Silencers of heavy machinery, trucks and other vehicles (especially on main, connecting and site way roads,. Stack monitoring from Asphalt Plants.	LANCOM-III emissions monitoring system. Monitoring of ambient air quality in ppb.	▪ Monthly monitoring of air pollution parameters including PM, NO_X, SO_X, CO, Hydrocarbons during the construction period and biannually during the operation stage only for ambient air

Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Ecological Environment			
Cutting of trees	In all Project Area generally and at construction sites particularly during the construction stage and Project Area during the operation stage	Periodic visits at site to ensure that only those trees should be cut, which are demarcated for cutting. Surprise visits to campsite and to check the fire wood availability at camp. Regeneration rate and growth of new plants.	▪ Weekly during routine monitoring and reported on monthly basis during the construction period and once a year monitoring and reporting during the operation period. ▪ Monthly Reporting during the construction stage and quarterly during operation.
Hunting of animals and birds	In all Project Area generally and at construction sites particularly	Periodic visits of Project Area and in consultation with community to get feed back on hunting by Contractor as well as outsiders	▪ Monthly during routine monitoring and reported on monthly basis. ▪ Biannually during the operation period.
Socio-cultural Environment			
Land acquisition and relocation of private and public infrastructure	Project Area	Consultations with PAPs/stakeholders	• Monthly during land acquisition and relocation of infrastructure and reported on monthly basis.
Inconvenience to community	All around the Project Area	Consultations with community to get feed back for inconvenience due to the construction activities to perform their daily routine chores.	• Monthly reporting and monitoring during the construction period.

Table 7 .2Recommended Effects Monitoring Protocol

Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Soil Erosion	Area of occurrence, Entire Project Area.	Standard soil erosion and conservation techniques to check severity of damage, loss of soil cover and protection measures to be adopted.	▪ Prior to start of works. ▪ Monthly during the construction works ▪ Comprehensive report after completion of works. ▪ Monthly during the rainy months of July, August, December and January and monthly during the remaining year.

Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Water Quality	▪ Sampling from the points located at a greater distance from the construction sites to ensure they show the influence on wider range of receiving body.	▪ Sampling and laboratory testing of water samples from the receiving body.	▪ Sampling and laboratory testing should be done on quarterly basis during the construction stage and biannually during the operation stage.
Air Quality	▪ Existing hotels premises, residential colonies, schools, hospitals, etc. along the roadsides ▪ In project areas at specified points	▪ Ambient air quality monitoring in ppb.	▪ Quarterly air quality monitoring for NO_X, SO_X, CO, PM_{10} during the construction stage. ▪ Once a year during the operation stage.
Tree Cutting	▪ Construction sites and near camp site at construction stage and plantation sites during the operation stage	▪ Visual checking and consultations with locals ▪ Generation rate of new plantation	▪ Monthly during construction and once a year during operation stage.

7.7. Communication and Documentation Plan

7.7.1. Kick-off Meeting

A kick off meeting will take place at the main camp of the Contractor before the start of construction. The purpose of the kick off meeting will be to demonstrate to the regulator and monitors that all the requirements prior to the start of the individual Project activities have been met and the LDA (through EO) and the concerned department, SC, and contractor(s) are ready to start the Project as per the requirements of the EIA/EMMP.

7.7.2. Meetings and Reports

Monthly meetings will be held during the construction stage. The meeting will be held at the Contractor's camp during construction. The purpose of the meeting will be to discuss the conduct of the operation, non-compliances noted by SC/EO and their remedial measures. The meeting will be chaired by the representative nominated by LDA/PMU. The meeting will be recorded in the form of a Monthly Environmental Report (MER) prepared by SC and will be submitted to DAM and PMU. The report as a minimum will include:

- Summary of Project activities during the last month;
- SC monitors and Contractor's environmental representatives present onsite;
- Summary of monitoring activities;
- Non-compliances observed and mitigation measures taken or required.
- Record of social complaints
- Record of change managements
- Record of water consumption
- Record of fuel consumption

7.7.3. Social Complaints Register

The SC will maintain a register of complaints received from the local communities and measures taken to mitigate these concerns. SC will report the status of the

complaints in his monthly report to the PMU and DAM, for information and further action. Quarterly environmental report to be submitted to LDA/PMU will also reflect the status of the social complaints.

7.7.4. Change Record Register

All changes to the EMMP or the Project will be handled through the Change Management Plan provided in Section 8.8 of the EMMP.

7.7.5. Non-Compliance Record Register

The SC will maintain a non-compliance record register to record all non-compliances observed during the construction activities. A copy of the register will be appended with each MER.

7.7.6. Final Monitoring Report

A final monitoring report will be prepared by SC after the completion of the construction activities at each site. The report should address the following:

- Introduction;
- Details of the Project Activities;
- Natural Resource Used by the Project;
- Record of Non-compliances;
- Recommendations for future Projects.

After thorough review, PMU will submit a final monitoring report to LDA/PMU, District Departments and EPA-Punjab.

7.7.7. Photographic Record

SC will maintain a photographic record of all the areas to be used during the Project. As a minimum the photographic record will include the photographs of residential and commercial structures relocated/compensated, parking areas, access track, camp sites, and activity monitoring of different categories during the construction stage.

7.8. Change Management Plan

The EIA for the proposed operation recognizes that changes in the operation or the EMMP may be required during the operation and therefore provides a Change Management Plan to manage such changes. The management of changes is discussed under two separate headings, Additions to the EMMP and changes to the Operation of the EMMP.

7.8.1. Additions to the EMMP

This EIA including EMMP have been developed based on the best possible information available at the time of the EIA study. However as at the conducting of EIA study, project is at master planning stage, so it is possible that during the conduct of the proposed Project, additional mitigation measures based on the findings of the environmental monitoring during construction and operation may have to be included in the EMMP. In such cases following actions will be taken:

- A meeting will be held between LDA/PMU, SC and the concerned Contractor. During the meeting, the proposed addition to the EMMP will be discussed and agreed upon by all parties. Based on the discussion during the meeting, a change report will be produced collectively, which will include the additional EMMP clause and the reasons for the addition.

- The report will be signed by all parties and will be finalized at the site office. A copy of the report will be sent to LDA/PMU, Contractor and SC head offices. Prior to the start of activities as per changes made in EMMP, approval will have to be taken from EPA, Punjab. All relevant Project personnel will be given information of the addition. These additions will be reported in the MER by SC. Copy of approved additions from EPA, Punjab will be sent to LDA by PMU for their record.

7.8.2. Changes to the Operation

The change management system recognizes three orders of changes:

7.8.2.1. First Order

A first order change is one that leads to a significant departure from the Project described or the impacts assessed in the EIA and consequently require a

reassessment of the environmental impacts associated with the change. Action required in this case will be that the environmental impacts of the proposed change will be reassessed by EO and SC and sent to the EPA for approval.

Examples of such changes include:

Changes in the waste disposal methods such that contamination of the soil or water in the protected areas may be anticipated. Deviations from the minimum requirements for Effects Monitoring specified in the EMMP.

Changes in the documentation, communication, or stakeholder's consultation program such that the overall objective of documenting compliance with the EMMP and its communication to LDA, PMU, SC and the Project Contractor(s) or interested stakeholders at regular intervals is not being met.

7.8.2.2. Second Order

A second order change is one that does not result into change in the Project description or impacts that are significantly different from those in the EIA.

Action required for such changes will be that EO will reassess the impact of the activity on the environment and specify additional mitigation measures, if required, and report the changes to the LDA through PMU.

Examples include:

Change in the location of Project components like parks, parking plazas, commercial centers or any other important project components.

Increase in natural resource usage particularly water such that the increase can be accommodated without having any effects on the natural resource or the local communities, which are using that resource.

Increase in the area or change in levels of the camp sites or access track such that it does not significantly change the assessment made in the EIA with regard to the impacts on vegetation, wildlife and communities.

Changes in the waste disposal methods such that contamination of soil or water will not occur.

Changes in the documentation, communication, or stakeholder's consultation program such that the overall objective of documenting compliance with the EMMP and its communication to LDA, PMU, SC and the Project Contractors or interested stakeholders at regular intervals is being met.

7.8.2.3. Third Order

A third order change is one that does not result in impacts above those already assessed in the EIA, rather these may be made on site to minimize the impact of an activity such as re-alignment of a particular road section to avoid cutting of a tree, relocation of construction camp sites to minimize clearing of vegetation etc. The only action required for such changes will be to record the change in the Change Record Register.

7.8.3. Disaster Management Plan

In this section each disaster that can occur in areas of Lahore division has been discussed with its preventive and mitigation measures.

7.8.3.1. Flood

- The project sites include two rivers i.e. Ravi and Sutlej and number of canals and drains so there is chance of flood hazard to occur at the project sites. According to the PDMA-DRP, the River Ravi belongs to the category B flooding (medium Level Flood). Two categories of flood can occur in the project area i.e. urban and riverine. The recent flood noted in River Ravi is at Shahdara Gauging Station is 250,000 cusecs and considered as medium flood level. This is the highest flood level noted in River Ravi after year 2000 as construction of Thein Dam on Indian side greatly reduces the flows in River Ravi while the highest flood that observed in River Ravi is in 1988 which was around 586,000 cusecs.
- In Sutlej River Most of the flow is yielded by heavy monsoon rains. The maximum recorded flood discharge occurred in 1955, when the river flowed at nearly 600,000 cubic feet (17,000 cubic metres) per second. The risk of floods has drastically reduced since construction of series of dams on Sutlej River on Indian side.
- Flood is considered as most drastic and re-occurring hazards in Pakistan. Roughly 1.84 million people across Pakistan have been affected by floods triggered by heavy monsoon rains. At least 346 people have been killed and 620 others have been injured in flood-related incidents, according to the latest figures released by the National Disaster Management Authority (NDMA).

- The most recent flood was occurred in current year of 2014 and considered as one of the biggest flood in the history of Pakistan. According to the National Disaster Management Authority (NDMA) almost 312 people have died, with 2,275,000 affected and nearly 1.7 million acres (687,965 hectares) of crops lost due to this recent flood. The most affected were in Punjab Province and declared a state of emergency.
- Some of the areas proposed in the Master Plan are prone to floodfor which mitigation are proposed in this report. Still if due to unusual event if flood came thenfollowing mitigations will be adopted:-
- Flood Warning Centre would analyze situation before 1 or 2 days in accordance with the travelling time of flood with coordinating Pak-Metrological Department, Irrigation Department, WAPDA, Indus water commission and Police telecommunication (Head works and barrages) and accordingly flood warning should announce and information should sent to PDMA and related agencies.
- When flood warning should announce PDMA would implement state of emergency in the area and evacuation would be done in accordance with DPRP.
- DDMA, TDMA and DRC will do their responsibilities in accordance with DPRP
- The peoples would ask to move at safer place and accordingly temporary camps should be provided.
- Rescue and Emergency activities in accordance with DPRP should start soon after the flood hits the area. The objective of Rescue and Emergency activities is to save life of each and every individual who not been moved to safer place rather than property or valuables.
- Temporary hospitals should be made at camp area. Ensure the supply of food and portable water in the camps.

7.8.3.2. Earthquake

Earthquake is also an inevitable disaster lead to thousands of life loss and property whenever it hits any part of world. Although the project area lies in moderate level of seismicity still there are chances of earth quake to occur. The worst Earth quake in the history of this region was in 1827 where almost thousands life was lost. The Pakistan most deadly earthquake of 8th October 2005 also caused few casualties in this area with a measurement of 7.6 on Rector Scale.

Whenever the earth quake comes there are very less chance of getting out of earthquake because it comes with in no time. Earthquake may lead to certain other hazards like Fire, Dust emissions storm and explosions.

The most serious thing about the earth quake is that it cannot be predicted in advance. But preventive measure and preparations should be done in order to minimize the disastrous effects of earth quake.

The preventive measures for earth quake are given as under-:

- Incorporating earthquake resistant features in all low rise and high rise buildings to be manufacture in new city accordance with buildings' codes, guidelines, manuals and byelaws.
- Making all public utilities like water supply systems, communication networks, electricity lines etc. earthquake-proof. Creating alternative arrangements to reduce damages to infrastructure facilities
- Preparation of disaster related literature in local languages with dos and don'ts for construction.
- Getting communities involved in the process of disaster mitigation through education and awareness.
- Practice an extensive community program of mass drills for earthquake damage reduction
- Inculcate basic know-how amongst school kids on earthquake dos and donts along with safety drills.
- Awareness among public and school children to have precautionary measures in event of Earthquake.

The measures that should be part of DPRP in event of an earth quake are given below-:

- Maintenance of law and order, prevention of trespassing, looting etc.
- Evacuation of people.
- Recovery of dead bodies and their disposal.
- Medical care for the injured.
- Supply of food and drinking water.
- Temporary shelters like tents, metal sheds etc.
- Repairing lines of communication and information.
- Restoring transport routes.
- Quick assessment of destruction and demarcation of destroyed areas, according to the grade of damage.
- Cordoning off severely damaged structures that are liable to collapse during aftershocks.

7.8.3.3. Out-Break of Diseases

Flood and Earth Quake after effects result in the outbreak of certain diseases. The epidemic and communicable diseases also poses threat to global health. The communicable and epidemic accounts for most of the reported death in the world (WHO)

Lahore is also not safe form epidemic. Recent outbreak of dengue virus in 2011 takes about 200 lives and was most serious viral attack in Lahore. Other reported communicable and epidemic that exists in Lahore is given below-:

Malaria, TB, Polio, Measles, Diphtheria, Pertussis, Tetanus, Hepatitis, AIDS, ARI, Diarrhoeal Diseases, Typhoid, Meningitis, Hemorrhagic Fever, Dengue Fever, Leishmaniasis, Rabies, Plague, Influenza, Bird Flu, SARS

In order to assess the disease incidence and prevalence, the prevention and control of disease outbreaks require a thorough understanding of the environmental and host factors, the transmission pattern and other characteristics of causative organisms.

Government is already doing so much effort for control of epidemic and communicable diseases. The health departments of Punjab in connections with other departments and laboratories have launched many preventive and regulatory programs in order to control of such epidemics and communicable diseases. The major programs are given below-:

- Prevention and control of communicable diseases
- Prevention & control of epidemics
- Emergency Preparedness & Response.
- Maternal Neonatal and Child Health including Family Planning.
- Health Education & Nutrition Development
- Epidemic Forecasting
- Epidemic Control
- Epidemic Response

The preventive and control epidemic programs that already running by the health department will remain as such for the master plan but also additional programs will launched by DDMA and PDMA in connection with health department. Further DDMA

will prepare detail DPRP in consultation with health department, EPA- Punjab and other stakeholders for control outbreak of any epidemic and communicable diseases.

7.8.3.4. Terrorist Activity

Pakistan at present is facing the most unique, difficult and gruesome faces of terrorism. No other country in the world is so deeply entangled in this problem as the Pakistan of today. There are so many reasons for Terrorist Activities. One main reason is American influence in Afghanistan in expression of "War against Terrorism". Another reason is the Tribal Taliban who supports Afghanistan and in reaction of War against Terrorism they do terrorist activities in Pakistan.

The Lahore is also not saved from terrorist activities and in past there are so many terrorist activities in form of bomb blasts, attacks on major buildings and attacks on high profile peoples. So it is important to have a security plan for new city in order to tackle this problem.

Security Plan should be made by LDA in consultation with Police department, Army, PDMA, DDMA and TDMA. The security plan can be but not limited to the followings-:

1. Cameras should be placed in entire city which will be controlled by common control room
2. Well communication system should be there between police and control room
3. All vehicles that enter in to the city form major roads should check from scanners.
4. Bomb disposal squad and emergency police should be active at all times
5. Special Checking of police in all hotels and guest houses and well communication system should be placed between all hotels, guest houses and police.
6. Guards will be placed at all important locations in entire city

Still with above preventive measures, if there is the event of bomb blast or any terrorist activity then measures should be taken in accordance with DPRP.

7.8.3.5. Fire

Fire is also considering as most devastating hazard that can destroy objects and buildings within span of time. Fire occurs at any place and virtuously due to the

negligence of person. Some of the causes and common fire hazards are given as under-:

- Kitchen fire due to cooking
- Overload of Electrical Systems, wiring connections etc.
- Combustibles materials near heat or flame
- Flammable Liquids solvents and Aerosols
- Battery Leaking
- Negligence in use of household appliances like ovens, dryers, cookers etc.
- Smoking inside cigarettes cigar etc.
- Overheating of Equipment's like computers, TV etc.

The best way to protect from fire is the prevention techniques i.e. prevent the fire from happening. The most effective way to do this is to eliminate or minimize all fire hazards however if fire does occur then immediate steps should be taken to control it, and prevent it from spreading. Fire prevention and controls which should be part of DPRP is given below-:

- A Fire safety plan should be developed for the division by LDA in coordination with Rescue department 112 and DDMA
- All high rise and commercial buildings that will construct in accordance with Master Plan should obey fire safety codes as per building by laws
- Regular drills of fire safety awareness should be required by all occupants of the buildings
- Regular Inspections of LDA to check that all buildings are in compliance with fire safety codes and per building by laws. High fine should be imposed if buildings found in violation.

7.8.4. TRAFFIC MANAGEMENT PLAN (TMP)

The map of current existing and proposed road network is provided in chapter-3, Project Description. A comprehensive phase wise traffic and transportation management plan needs to be developed by LDA through TEPA and other concerned local department**.**

The traffic management and control should be completed before the development phase. This can be done by LDA through the Design Consultant and SC in consultation with Traffic Police Department prepared a comprehensive Traffic Management Plan once the implementation of project has been confirmed. The

traffic management plan is needed for smooth flow of traffic at all major roads during the construction activities of the Project

7.8.5. MATERIAL TRANSPORTATION PLAN (MTP)

Material Transportation Plan is required to specify the routes for material transportation for the development activities. These routes be developed is such a way that there is minimum hindrance or disturbance to the local communities and flow of normal traffic. This will also become part of Traffic Management Plan.

7.8.5.1. Material Transportation HSE Arrangements

- Transportation timings should preferably be at night time to minimize the traffic conflicts.
- Filled trucks should be covered with tarpaulin to avoid fugitive dust and should be visually inspected for proper loading, sealing and decontamination.
- Bulk solid debris should be removed from the trucks with shovels and implements before leaving the site. Where necessary, trucks should be pressure washed before leaving the site. Pressure washing should only be used if other methods do not work.
- Vehicles should have passed an annual inspection and carry the fitness certificate.
- A summary chart representing the load and maps showing the proposed route to the disposal facility will be accompanied by each truckload. In the event of an accident involving the transported material, it will immediately be notified to SC, LDA and Traffic Police.
- The truck drivers will be strictly instructed not to play music and do not use horns at night time to minimize disturbances.

7.8.5.2. Material Transportation Documentation

- A field logbook will be maintained for the documentation. This logbook will additionally serve to document observations, personnel onsite, equipment arrival, and departure times, a truck exit inspection checklist and other project information.
- Field logbooks will document where, when, how, and from whom any vital project information is obtained. Logbook entries will be completed and accurate enough to permit reconstruction of field activities. Logbooks will be bound with consecutively numbered pages. Each page will be dated and the time of entry notice. All entries will be legible, written in black ink, and signed

by the individual making the entries. Language will be factual, objective, and free of personal opinions or inappropriate terminology. If an error is made, corrections will be made by crossing a line through the error and entering the correct information. Correction will be dated and initialed. No entries will be obliterated or otherwise rendered unreadable.

- Entries in the field logbook will include at a minimum the following for each field work date:
- Site name and address
- Recorder's name
- Time of site arrival/entry on site and time of site departure
- A summary of any onsite meetings
- Description of transport vehicle(s)
- Quantity of excavated soils in truckloads (approximate percentage of full load)
- Names of waste transporters and proposed disposal facilities
- Quantity of import fill material in truckloads
- Levels of safety protection

The HSE officer of the Contractor will communicate HSE requirements and tailgate safety meetings to all drivers and on-site workers. He will provide information related to contaminant descriptions, and requirements for the containment and cleanup of an accidental release along with basic safety requirements, name of personnel in charge, contact information and a map and directions to the nearest hospital.

7.8.6. Archaeological Chance Find Procedure

The purpose of these guidelines is to address the possibility of archaeological deposits, finds and features becoming exposed during earth excavation and ground altering activities associated with the development and to provide procedures to follow in the event of a chance archaeological find.

The objective of these procedures is to identify and promote the preservation and recording of any archaeological material that may be discovered at the construction site.

7.8.6.1. Procedure

During the Project development, all Contractors will be made aware of the presence of an on Site In-Charge who will monitor earthmoving and excavation activities. The following procedure is to be executed in the event that archaeological material is discovered:

- All construction activity in the vicinity of the find/feature/site will cease immediately;
- The discovered find/feature/site will be delineated;
- Record the find location and all remains are to be left in place;
- Secure the area to prevent any damage or loss of removable objects;
- The on-site HSE In-charge will assess record and photograph the find/feature/site;
- The on-site HSE In-charge will undertake the inspection process in accordance with all Project health and safety protocols;
- The Project Manager will inform the concerned provisional department i.e. Archaeology and Tourism Department Punjab;
- In consultation with the statutory authorities, the on-site in-charge and Archaeologist will determine the appropriate course of action to take;
- Finds retrieval strategy: All investigation of archaeological soils will be undertaken by hand all finds, osteological remains and samples will be kept and submitted to the National Museum as required. In the event that any artefacts need to be conserved, the relevant licence (Licence to Alter) will be sought from the concerned authorities;
- An on-site office and finds storage area will be provided, allowing storage of any artefacts or other archaeological material recovered during the monitoring process;
- In the case of human remains, in addition to the above, the concerned authorities will be contacted and the guidelines for the treatment of human remains will be adhered to. If skeletal remains are identified, an osteo archaeologist will be made available to examine the remains;
- Conservation: A conservator will be made available to the Project, if required;
- The on-site archaeologist will complete a report on the findings; and
- Once authorisation has been given by the responsible statutory authorities, the client will be informed when works can resume.

7.9. Training Program

Environmental training for construction period will form part of the environmental management system. The training will be directed towards all personnel for general environmental awareness as depicted in Table 8.3.

7.9.1. Objectives

The key objective of training program is to ensure that the requirements of the EMMP are clearly understood and followed throughout the Project.

7.9.2. Roles and Responsibilities

EO will primarily be responsible for arranging environmental training to all the Project personnel on potential environmental issues of the Project. Contractors will be responsible to arrange training and ensure the presence of targeted staff. EO will prepare a Project specific training manual for this purpose. Contractors on their part

will be required to provide induction training/briefing to all their staff before the start of any activity in the Project Area. This will be followed by training arranged by EO to all the targeted staff.

7.9.3. Training Log

A training log will be maintained by EO. The training log will include;

- Topic
- Date, time and location
- Trainer
- Participants

7.9.4. Training Needs Assessment

In addition to the training specified in the training log special/ additional trainings will be provided during the Project activity. The criteria to assess the need of training will be based on the following:

- When a specified percentage of staff is newly inducted in the Project.
- When any non-compliance is repeatedly reported, refresher training will be provided regarding that issue.
- Arrival of new Contractor/sub-contractor
- Start of any new process/activity

7.9.5. Training Material

EO will develop and prepare training material regarding the environmental awareness, EIA and EMMP. Separate training material will be prepared for each targeted staff and training program provided in Table 8.3 will be followed:

Table 7 .3 Training Program Material

Staff	Contents	Timing
Selected management staff of LDA/PMU, concerned departments, SC staff and the construction Contractor staff	▪ Environmental sensitivity of the Project area ▪ Wildlife, vegetation issues and related mitigation ▪ EMMP communication, documentation and monitoring	Prior to the start of any major Project activity

Staff	Contents	Timing
	requirements ▪ Air and noise pollution control ▪ Waste disposal ▪ Traffic management ▪ Emergency response plan	
Construction supervisors and survey crew	▪ Environmental sensitivity of the Project Area ▪ Wildlife, vegetation & community issues and related mitigation ▪ EMMP communication, documentation and monitoring requirements. ▪ Good construction practices ▪ Preservation of flora and fauna ▪ Community relations ▪ Air and noise pollution control	Before the start of construction activities
Drivers	▪ Road safety ▪ Road restrictions ▪ Vehicle restrictions ▪ Waste disposal ▪ Defensive driving	Prior to the start of start of construction activities
Mechanics and Vehicle Repair Personnel	▪ Environmental control of vehicles and equipment ▪ Waste disposal	Prior to the start of construction activities
Camp Staff	▪ Camp operation ▪ Waste disposal ▪ Water consumption ▪ House keeping	Prior to the start of construction activities
Restoration and Clean-up team	▪ Restoration requirements	Prior to start of restoration activity

Training for the operation period will be planned by LDA in future.

7.10. Environmental Management and Monitoring Cost

7.10.1. Environmental Management Cost

The proposed Project is at planning stage, therefore, costing for land acquisition, compensation and resettlement will be the sole responsibility of LDA and Revenue Department and compensation will be paid as per LDA Strategy.

Environmental management cost related to the mitigation measures of environmental parameters related to the location of camp site facilities, construction activities, borrow materials, etc. will be the sole responsibility of the Contractor and he will take care of cost implications as it will be a part of his contract agreement.

Operation and Maintenance cost of the environmental mitigation infrastructure will be borne by the LDA as well as the concerned departments responsible for operation and maintenance of the relevant facilities.

7.10.2. Environmental Monitoring Cost

As the proposed project is at planning stage and no details of subprojects related with topographic surveys, design, number of contractors, sub-contractors, camp sites, etc. are available, so it is difficult to estimate the monitoring cost. However, as environmental monitoring at pre-construction stage and other in-house monitoring to be carried out by the Contractor(s), so it will be part of his contract agreement. SC will supervise the monitoring activities.

Similarly, because at this stage, location of facilities like contractor's camp, asphalt plants, borrow areas, disposal pints, etc is not known, so cost for internal monitoring by LDA staff/PMU cannot be estimated. However, cost for Internal Monitoring to be carried out by the LDA staff/PMU will be allocated by the Project as per requirements prescribed in Table 8.1 and 8.2.

7.10.3. Training Cost

The Project training will be imparted at different stages of the Project at different staff levels. DAM will be mainly responsible for the arrangement of these trainings.

7.11. Mitigation Management Matrix (MMM)

Following is the Mitigation Management Matrix (MMM) for this project.

DC:	Design Consultants	CC:	Construction Contractor
LDA:	Lahore Development Authority	SC:	Supervision Consultants
PMU:	Project Management Unit	CD:	Concerned Department

Table 7 .4 Environmental Management Plan for Lahore Master Plan Project

Sr. #	Parameter	Anticipated Impacts	Mitigation Measures	Responsibility	
				Execution	Monitoring
A.	**Planning Stage**				
a.	**Physical Environment**				
1	Ground Water Resources	▪ Proposed urbanization and industrialization has the tendency to reduce the ground water recharge, as a significant part of the land has become impermeable ▪ With increasing water demand with increase in population the Lahore ground water level has been declining rapidly at the rate of 2.5-3.0 feet per year. ▪ Existence of saline groundwater in the nearby areas of Raiwind and Kasur is a potential threat to the aquifer under the Lahore City.	▪ Measures should be taken to control demand by reducing per capita water availability by using water efficient technologies ▪ Housing societies should be made aware of the problem and their ground water extraction quota. Special recharge zones may be developed to facilitate ground water recharge. ▪ Usage of high efficiency irrigation for agriculture use such as drip irrigation etc should be promoted ▪ In order to promote the culture of water conservation, a mentoring system should be introduced to charge water on a volumetric basis. ▪ An integrated water resources management approach should be adopted by involving all stakeholders. ▪ Awareness campaigns and community mobilization should be	CC	LDA/PMU

			regulated for water conservation and efficient usage.		
2	Surface Water Resources and Quality	▪ The high pollution load is River Ravi has created overall negative impact on ground water as well as on agriculture which is being done on adjacent to the river and where river water is directly used for irrigation. ▪ With the potential to increase in the residential areas, housing schemes and industrial area, pollution level and quantities of wastewater is likely to increase many folds which may have negative impacts.	▪ Water quality challenges need to be addressed in an integrated manner and by adopting pollution prevention strategies by LDA along with other concerned agencies like EPA. ▪ Water pollution can be reduced by eliminating contaminants at source and should discharge the water that meets the NEQS. ▪ Waste Water Treatment plant should have installed on all the outfalls or drains that falls in to River Ravi. ▪ A sustainable pollution control strategy needs to be devised in order to reduce wastewater volumes. ▪ Proper education and awareness campaigns about the importance of water quality need to be launched.	CC	LDA/PMU
3	Flood	▪ As project sites include two rivers i.e. Ravi and Sutlej and drains so there is chance of flood hazard to occur at the project site. The settlement which may subject to potential risk of flooding include Bhai Pheru, Bhucheki, Mandi Faizabad, Mor Khunda, Muridke and Syed Wala. ▪ The settlement Ferozwala is under potential threat of flooding due to Deg Nallah.	▪ Channelization and modification of River area from only where there is chance of flood hazard to occur. ▪ Develop large retention ponds in between river and flood prone identified areas. ▪ Dike/Bund should be developed precise to the identified flood porn areas along the side of the rivers in order to prevent flood.	DC	LDA/PMU

4	Climate Change	▪ Due to global anthropogenic activities, Pakistan is 10 most vulnerable countries to climate change. Which will lead towards increasing variability of Moonsoon, Increasing risks of Extreme Events (floods, drought etc..), Sever water and heat stressed conditions, Increase in deforestation and health risks.	▪ Pakistan Climate Change Policy and Framework needs to be implemented properly. ▪ Detail Climate Change venerability assessment study is need for Lahore Division. ▪ The infrastructure should be designed in respect to the extreme climate events in order to prevent urban flooding and urban heat island effect	LDA/PMU	Ministry of Climate Change/ EPA
5	High Voltage Transmission Lines	▪ The high voltage transmissions line are passing and planned to be passed form some of the project areas. These transmissions line if not been buffered have variety of health impacts on human	The National Transmission and Dispatch Company (NTDC) should share the plan with Lahore Development Authority (LDA) for new transmission lines that are proposed to pass from the project area. The LDA will mark the area in master plan and adequate buffer zone at least 50 meters will be provided where the transmission passing or planned to be passed	LDA/SPU/NTDC/DC	NTDC/LDA
6	Solid Waste	▪ 20,000 tons per day of municipal solid waste will be	The jurisdiction of LWMC should	LWMC/LDA/DC	LDA/EPA/Health Department

		generated if not managed properly, will cause aesthetic problems and also produce odor along with the spread of many diseases. Similarly, medical waste produced from medical facilities etc. if not properly managed and disposed, it can result in injury by contaminated sha;rp material and infection with Hepatitis B, C, and HIV etc.	increase in other districts as well. The LWMC has already suggested landfill sites and transfer stations in Lahore and Kasur region. The Landfill Sites for other districts such as Nankana and Shiekhpura should also be studied and develop and included in the master plan. The municipal waste should be managed in accordance with waste management hierarchy which is currently lacking in society and waste management company. Medical waste need to be segregated and collected in house in accordance with the Hospital Waste Management		

			Rules, 2005 and management given to LWMC. The incineration of medical waste should be stopped		
6	Transportation	▪ The major growth of traffic volume in Lahore due to increase in urban population with a large number of vehicle owners and relative small capacity of roads causing multiple of problems like congestion, more energy consumption, pollution, traffic crashes, wastes time, delay, decreases productivity and imposes costs on society.	▪ The public transport should have been improved through inter and intra city mass transit that can be faster, cheaper, and more relaxing. It also helps minimize environmental damage caused by excessive car use. ▪ Private cars on road should be discouraged by increasing parking fee and vehicle tax on owners. ▪ Improve bicycle and pedestrian facilities and programs.	TEPA/DC	LDA

b.	**Ecological Environment**				
1	Flora & Fauna	▪ Various developmental activities will require clearing of vegetation and may threaten the existing fauna causing an adverse environmental impact.	▪ In case of existing roads, if possible, widening should be carried out on both sides to minimize the cutting of trees. ▪ A massive tree plantation programme shall be initiated, along the road, in public buildings and in proposed towns to compensate for the tree loss and to improve the existing landscape of the tract. ▪ Restoration and Rehabilitation Projects should be initiated to overcome the adverse impacts on flora and fauna.	DC	LDA/PMU
c.	**Socio-Cultural Environment**				
1	Land Acquisition	▪ LDA will require land acquisition for different development related to the road infrastructure, public parks and public buildings etc.	▪ Utmost efforts should be made to minimize the acquisition of land by reducing the width of proposed roads or by improving the condition of the existing roads instead of their widening. ▪ For the acquisition of land, the affectees should be compensated as per Rules. Affectees should be either compensated on market value or they should be provided plots at proposed residential areas on equitable basis in case of disruption of their residential plots.	DC	LDA/PMU

B.	**Development Stage**				
a	**Physical Environment**				
1	Land Resources	The contractors will require temporary acquisition of land for: ▪ Establishment of Contractor's camp and other facilities, disposal sites for safe disposal of surplus construction and excavated spoil material. ▪ Potential conflicts may emerge with landowners regarding the restoration of temporarily acquired areas for establishing contractor's facilities. ▪ Soil erosion may aggravate in the workshop areas as a result of improper runoff.	▪ Land required for establishing contractor's facilities including borrowing earth material (if required) and dumping excess spoil will be leased directly from private landowners by the contractor. ▪ Construction camps and workshop will be located at a minimum distance of 250 m from existing plantation and settlements, etc. This limit will be 500 m in case of batching plant. ▪ Prior to the commencement of construction activities, the contractor will submit a layout and location plan of the facilities to the Engineer-in-charge, LDA and PMU, for its scrutiny and approval. ▪ Main drainage courses should be lined to avoid soil erosion. Steep bed slopes should be avoided.	CC	SC/LDA

		▪ Quarrying of stones from sandstone bed or picking from the nullah beds lead to destabilization of the slopes. ▪ Scarified/scraped materials, if not disposed of properly, may contaminate soils. ▪ The possible contamination of soil by oils and chemicals may limit the future use of land. ▪ Potential conflicts may emerge with landowners regarding the restoration of temporarily acquired areas for establishing contractor's facilities, particularly those for borrow and spoil disposal areas.	▪ Barren lands or natural depressions should be used for dumping the excavated spoil material. ▪ All the lands to be identified for disposal of spoil may be acquired on temporary basis on lease after its needful, the land would be given back to owner. ▪ The contractor will be required to train its workforce in the storage and handling materials, like furnace oil, diesel, petrol and chemicals. The contractor will be required to prepare training manual and module for all the construction related activities. ▪ Soil contamination by asphalt and other obnoxious material will be minimized by placing all containers in caissons or dumped into pits lined with impervious liners.		
2	Water Resources	▪ Surface water resources may be contaminated by spillage of fuel and chemical, or by dumping of waste material and effluents generated by the kitchens and toilets at construction campsites. ▪ Natural streams and hill torrents may be contaminated with chemicals, oil, lubricants, detergents, etc. through runoff. ▪ Soil erosion may occur at quarry	▪ Availability of water for campsite facilities and construction purposes will be ensured by the Contractor prior to start of construction activities. ▪ The Contractors will be required to liaise closely with local communities to ensure that any potential conflicts related to common resource utilization for Project purposes are resolved quickly. ▪ The wastewater effluent from	CC	SC/LDA

		areas, and it may contaminate the surface water resources if uncontrolled blasting is carried out. ▪ Cutting of shrubs and trees will also accelerate the soil erosion and land sliding.	contractor's workshops and equipment washing-yards will be passed through gravel/sand beds to remove oil/grease contaminants before discharging it into surface water sources. ▪ Borrow pits and natural depressions with pre-laid impervious liners will be used to dispose of scarified/scraped material, and then covered with soil. ▪ At appropriate locations proper outfalls for the road side drains to divert surface run-off from the carriageway will be provided to prevent the flooding of streams and nullahs. ▪ A proper solid waste management plan (including storage, collection, transportation and disposal) should be developed to avoid contamination of the surface water resources.		
3	Solid and Liquid Waste	▪ Solid waste generated by the town is mainly being disposed of in nearby areas. Establishment of construction camps will enhance the solid waste generation.	▪ Proper solid waste management system has to be prepared by the Contractor. ▪ Contractor should instruct his work force not to throw solid waste here and there.	CC	SC/LDA
4	Ambient Air Quality	▪ Air quality will be affected by dust and emissions from the construction machinery, and vehicular traffic during the construction activities.	▪ The existing quarries sites will be used to borrow the aggregate materials. ▪ Asphalt plants should be located at least 500 m downwind from populated areas, wildlife habitats, and Contractors' camp ▪ Asphalt and concrete batching	CC	SC/LDA

			plants should be equipped with dust control equipment such as fabric filters or wet scrubbers. ▪ Vehicles and other construction machinery should be properly tuned and maintained. ▪ Where dust emissions are high, will be reduced by a regular sprinkling of water.		
5	Noise Level	▪ Noise generated by the construction machinery during the construction to affect the Project Area particularly the sensitive receptors. ▪ Noise generated by the construction machinery during the construction of shopping complexes and Parking Plazas is likely to affect the sites situated in congested areas of the city.	▪ Thick tree plantation will be carried out towards the roadside, where there is enough space available between the boundaries of schools and roads. ▪ In order to avoid the noise pollution in the congested areas as far as possible contractor should plan the construction activities in the off peak hours.	CC	SC/LDA
b	**Ecological Environment**				
1	Flora	▪ Various developmental activities such as widening of existing roads, construction of new roads, public buildings, shopping complexes, bus and truck terminals and other community development projects will involve cutting and leveling of land, including removal of trees and vegetation from the project areas. ▪ Cutting of large number of trees will also enhance soil erosion. Without the branches and leaves to break the velocity of downpour, the rain can quickly wash away the soil from even a gentle slope. Cutting down of trees also takes away the roots, which help in binding the soil together.	▪ Efforts should be undertaken to keep the number of trees to be felled as minimum as possible. ▪ Along the roads to be widened or constructed, border line trees of the ROW on both sides shall be retained and if the trees are of suitable species.	CC	SC/LDA

		▪ Establishment of contractor's camp and warehouses for storage of equipment material shall involve clearing of vegetation from the area. ▪ During the construction activities, workers may use trees as firewood to fulfill the camp's requirements.	▪ Similarly, in case of public buildings only those trees shall be felled, which come within the covered area of the proposed building plans. ▪ In case of public parks, only the trees which are deformed, ugly or belonging to undesirable species shall be removed. ▪ Camp sites shall be located in areas with minimum vegetation cover. ▪ Gas cylinders should be provided by the Contractor for kitchen and heating requirements in the camps. ▪ Avoiding dumping of dredged spoil in other ecological habitats adjacent to the site ▪ Protection of other habitats with fences and barriers ▪ Minimization of barging disturbance to wildlife ▪ Restoration of native vegetation on Railroad and Roadside verges and river and canal banks ▪ Identification and conservation of areas important for priority animal species ▪ Strategic planning for nature conservation through the restoration of ecological networks ▪ Urban agriculture and kitchen gardening		

2	Fauna	▪ On account of various construction activities such as operation of heavy earth moving machinery and the noise generated through it, the fauna living in the area shall be scared and tend to move to the adjoining areas. ▪ Avifauna shall be disturbed both in the urban and rural area development projects and scared away due to disturbance of habitat. ▪ Personnel and labour hired by the Contractor shall have the tendency to catch or shoot the birds and animals.	▪ There should be a clear order to the staff and labour to refrain from hunting, shooting or harassment of wildlife. ▪ Vehicular speed should be controlled. ▪ Construction activities should be avoided during the night to minimize impact on wild life. ▪ Noise control measures should be enforced during the construction phase. ▪ Blasting and other noise generating activities will be avoided during the night and in thickly vegetated areas. ▪ Camps will be located at least 500 m away from the thickly vegetated areas.	CC	SC/LDA
c.	**Socio-Culture Environment**				
1	Local Communities/Workforce	▪ During the construction stage, noise and dust problems will affect the health of locals. ▪ Similarly, general mobility of the locals will be disturbed during this stage of the project. ▪ Construction of the road as well as the widening of the nullah may create problems for the local residents as the drainage pattern may disrupt. Similarly, due to the disruption of the	▪ Effective construction controls should be used by the Contractor to avoid inconvenience to the locals due to noise, smoke and fugitive dust. ▪ Proper arrangements in the form of alternative routes should be made to ensure that mobility of locals should not be disturbed. ▪ After consultation with the traffic police, a proper traffic management plan should be prepared roads specifically by the Contractor in order to avoid	CC	SC/LDA

		drainage pattern local's shortest way to reach the Bank road will also affect. ▪ During the construction stage, improper traffic management can create problems of traffic flow and accidents on Domail-Chella Bandi and Bank roads. ▪ Usage of the Community's common resources like potable water, fuel wood, etc. by the Contractor workforce may create conflicts between the community and the Contractor. ▪ Improper arrangement of the disposal of construction material may create problems for the local residents during the construction stage of the project. ▪ Blasting near residential area like Gulshan Colony, Chella-Bandi Neelum road may create problems for the locals. ▪ Relocation/disturbance to existing utilities like electric poles, telephone poles, etc. may affect the routine life of the community. ▪ Accidents/incidents during the construction stage may occur to the workers and the local community. ▪ Slippage of the Contractor's staff while working at steep hill slopes may occur.	accidents. ▪ The Contractor will take care of the local communities water sources so that these should be escaped from destruction. ▪ The Contractor will take due care related to the disposal of construction material as well as solid waste disposal from the site. ▪ Blasting should be avoided near the settlements, and if unavoidable, it should be carried out during the fixed hours (preferably during the mid-day). The timing will be made known to all the people within 500 m from the blasting site in all directions and prior to blasting thorough inspection should be conducted. ▪ Safety lookouts should be built to prevent people and vehicles from passing at the time of blasting. ▪ The management and use of blasting materials should be in strict conformity with the safety requirements. ▪ Haul-trucks carrying concrete, aggregate and sand fill materials will be kept covered with tarpaulin. ▪ In construction camps, clean food, water and sanitation facilities should be provided and Contractor		

			should arrange first aid boxes at camps.		
2	Loss of Livelihood	▪ During the construction stage, the business of shopkeepers working in the vicinity of proposed projects may be affected due to the non-accessibility of vehicles. ▪ During the construction stage, squatters sitting along nullah side road may be affected. In this way, the business of the squatters will suffer a lot.	▪ During construction, accessibility of vehicles to the workshops should be ensured so that the business of shopkeepers will not be disturbed. ▪ Construction activities should be carried out during night time, as most of the markets are closed at sunset. ▪ Affectees along with their children losing their agricultural land should be given employment opportunities on preference basis during the construction stage of the development of satellite towns.	CC	SC/LDA
3	Disruption of Cultural and Historical Properties	▪ During the construction stage, a few archeological/historical sites may get affected.	▪ The construction/development activities near such sites should be avoided. Similarly, by adopting protection measures, during construction, any negative impacts on Fort may be minimized. In this regard, it is recommended that the Contractor should prepare a site specific management plan.	CC	SC/LDA
4	Cultural Issues	▪ Induction of the foreign Contractor and outside labour may cause cultural issues with the local community.	▪ The Contractor will warn the workers not to involve in any theft activities otherwise they will be penalized. Similarly, at the time of employing, the Contractor has to take care that the workers should be of good repute. The Contractor camp will be properly fenced and the main gate will be locked at night with a security guard to check the theft issues from the	CC	SC/LDA

			community side. ▪ To avoid the cultural issues, the Contractor will facilitate the local labour during the construction activities.		
5	Gender Issues	▪ As the Project activities are being carried out within the residential/agricultural/commercial areas of the local community, as a result of it, women activities in the field may be affected during the construction stage particularly in case of satellite towns. ▪ The induction of outside Contractor labour may create social and gender issues due to the unawareness of local customs and norms. It may also cause hindrance to the mobility of the local women.	▪ The Contractor will have to select the specific timings for the construction activities so as to cause least disturbance to the local population particularly women. ▪ The Contractor will take due care of the local community and sensitivity towards local customs and traditions.	CC	SC/LDA
C	**Operation Stage**				
a	**Physical Environment**				
		▪ Surface run-off from the impervious surface of the carriageway or slopes can aggravate the drainage problem. ▪ If cross-drainage structures are not adequately maintained and cleaned, natural nullahs tend to become choked. ▪ During the operation stage of all projects, noise and air pollution problems for the nearby residing community as well as for the area may increase. ▪ Spillage of oil and other lubricants at bus terminal and truck stand will contaminate the soil as well as	▪ For air and noise quality, a monitoring system will be established by LDA to ensure that ambient air and noise levels are within permissible limits. ▪ In order to cater the solid waste problems waste bins should be placed at different places in the satellite town. ▪ Wastewater treatment plant(s) should be constructed. ▪ In order to avoid the soil contamination, a fully paved area should be designated for vehicles	CD	LDA

		surface water resources. ▪ During the operation stage of facilities, it is expected that more quantity of solid waste will be generated.	maintenance in each bus terminal/truck stand. ▪ In order to avoid air pollution generated by the incinerator suitable pollution control device should be used. ▪ It will be ensured by the LDA/Highway Department of roads/highways that storm water drains and road drainage system are periodically cleared to maintain water flow.		
b	**Ecological Environment**				
1	Flora & Fauna	During operational phase; there may be ▪ Impacts of urban development on biodiversity ▪ Change in land use pattern ▪ Habitat degradation due to higher pollutants ▪ Habitat Fragmentation ▪ Bird Collisions and strikes ▪ Change in groundwater recharge capacity	To mitigate the operational impacts and for restoration of natural features; strategies and implementation plan should be adopted fallowed as ▪ Use of native species ▪ EIA of all new developments ▪ Groundwater recharge ▪ Rain water harvesting ▪ Pollution control by following NEQS ▪ Solid waste management ▪ Wastewater treatment plants ▪ Urban agriculture and kitchen gardening ▪ Farm mechanization for increased agricultural productivity ▪ Tunnel Farming ▪ Green roofs and walls ▪ Policy Framework for green infrastructure ▪ Biotope/habitat opportunity mapping and making ecological action plans for individual cities.	CD	LDA

3	Horticulture	▪ As the fruit trees are in limited numbers, and mostly fruit is imported from other areas, there will be no significant impact of various development activities on fruit culture.	▪ As the impacts are negligible on horticulture during the operation phase, no mitigation measures are required.	CD	LDA
4	Fishery	▪ Increased population of the city due to various housing projects and increased inflow of tourist, will add to pollution of the rivers, causing a negative impact on fishery.	▪ People should be imparted knowledge, about hazards of pollution in the rivers and the resultant set back to fishery. ▪ Sign boards should be setup at important places, especially near the bridges, on the two rivers, informing people to refrain from throwing the liter in the river. ▪ Proper waste management techniques should be used instead of throwing the waste into rivers.	CD	LDA
c.	**Socio-Cultural Environment**				
		▪ Increased number of visitors may become a threat to the available natural resources. This may also create uneasiness to the locals. ▪ Noise generated by vehicles will further increase which will disturb the local communities, school staff and students, etc. existing near roads. ▪ Fire hazards may increase in shopping complexes and parking areas. ▪ The arrival of affectees of different projects under LDA to the proposed areas may create a positive impact on the local business. However, this may become a threat to the available	▪ The visitors should be briefed about not distorting the natural resources. ▪ Traffic police should ensure that vehicles are properly tuned up to minimize the air and noise pollution. ▪ Fire fighting arrangements should be provided in the operation stage of shopping complexes and parking plazas and bus terminals, etc. ▪ To resolve any kind of disputes during operation stage between the affectees and people of planned areas, a committee may be organized consisting of	CD	DAM

		natural resources including water, fire wood, etc. ▪ There may be some cultural conflicts due to the arrival of affectees of different projects under LDA to the proposed satellite towns. However, the diffusion of cultures may result in some sort of development in the form of language, dress, education, life style etc.	representatives from areas, local administration and public representatives. ▪ Proper arrangement of the cleanliness of toilets and waiting rooms should be provided for the passengers at bus terminals.		

CHAPTER 8

STAKE HOLDERS CONSULTATION

Public & Stakeholders consultation is a systematic process, which provides an opportunity for planners, citizens, managers and selected representatives to share their experience, knowledge and concerns and perceptions about any proposed development. The objectives of the public consultation for the proposed Project are to:

- Share information with the stakeholders' on the proposed Project works and their expected impact on the socio-economic environment of the Study Area.
- Understand the stakeholder's concerns regarding the various aspects of the Project, including the existing condition of the Study Area, upgrade requirements, and the likely impacts of the construction related activities and operation of the Project.

8.1. IDENTIFICATION OF STAKEHOLDERS

First setup for the stakeholder consultation is the identification of stakeholders. LDA is the Project Proponent. The project has both primary as well as secondary stakeholders. As per definition, stakeholder is an entity which is concerned with the proposed project in any way. Direct stakeholders are those entities which are directly concerned with the project.

The primary stakeholders include in the project are the affected households/persons according to the loss of assets and conditions, Provincial Environmental Protection Department and District level concerned departments whereas the secondary stakeholders include the public and private agencies involved in the implementation of the project.

Following is the list of major stakeholders of the Project:

- Water and Sanitation Agency (WASA)
- Environmental Protection Agency (EPA-Punjab)
- Forest Department
- River Ravi Commission
- World Wildlife Fund (WWF)
- Lahore Waste Management Company (LWMC)
- Parks and Horticulture Authority (PHA)
- Lahore Chamber of Commence
- Urban Unit Punjab
- Community residing in towns of Project Area
- Small industrial Associations in Project Area

Twenty Five (25) comprehensive consultations including scoping sessions and focus group discussions were held. In addition, a few consultations were also held in the form of detailed interviews of individuals including men and women at project area. Table-9.1 provides the information about consultations carried out at different locations with the community and government stakeholders including date, venue and number of participants.

Table 8 . 1 List of Scoping Sessions/Group Discussions carried out with the Stakeholders

Sr. No.	Date	Venue	No. of Participants
1	22-12-15	Community at Sultan Park- Muredke	07
2	22-12-15	Community at Sach Soda Farooqabad	10
3	22-12-15	Community at Feroz wattwan	04
4	28-12-15	Community at Mala Ram Lahore South East	05
5	29-12-15	Community at Hera Coat Kasur	03
6	04/1/16	Centaury Paper and Boad Mill – Industry- Kasur	03
7	04/1/16	Panther Tyres – Industry- Lahore Shiekhpura Road	03
8	1/1/16	Ahmad Rafy Alam – Advocate and Sectary RRC	01
9	19/1/16	Prof. Dr. Obaid- UET Lahore	01
10	18/1/16	Dr Nasir and team- Urban Unit Punjab	06
11	9/1/16	GM Operation Office – Lahore Waste Management Company	04

8.2. MAIN VIEWS AND CONCERNS OF THE STAKEHOLDERS

During consultations, the people of the Study Area expressed their views and concerns about the Project. Findings of the consultations and main views and concerns about the Master Plan Lahore Division are summarized below:

8.2.1. Views and Concerns of Lahore Waste Management Company

The Project was discussed with Asif Iqbal (GM-Operation-LWMC) the project briefing was given to LWMC staff and some recommendations of EIA report related to solid waste management and landfill sites was discussed. The GM operation LWMC mentioned the following

- LWMC already investigated and studiedand proposedtwo new landfill sites (other than Lakhodair and Mehmood Boti) in Lahore and one in Kasur. These landfill sites should be marked on master plan.
- Regional landfill sites should be developed for Lahore Division with transfer stations in districts.
- New landfill sites should be explored for Shiekhpura and Nankana District.
- Hospital Waste Management Study is also in process with advance technology of disposing hospital waste through auto claving.
- Hospital Waste Management should be given to LWMC in consultation with Health Department.
- Some projects from waste to energy, bio gas generation, electricity from landfill gas, Compost from organic waste have already in operational phase from which there will ultimate help in managing solid waste of cities.

The landfill sites and transfer station that LWMC has proposed has been marked on map and attached as Annex I

8.2.2. Views and Concerns of Urban Unit Punjab

The Project was discussed and briefed to Dr. Nasir (Chairman Urban Unit) and his team, who mentioned the following concerns.

- The per capita water requirement for master plan till 2035 should reduce from 80 gallons per capita to 35 gallons per capita.

- The sewerage and drainage should be separated. The collected drain water then used as ground water recharge and other purposes like gardening, car washing and cleaning.
- Slum areas need to address in master plan with proper planning.
- Ground recharge should be done through rain water harvesting.
- Stick enforcement for the proposed urban plans should be ensured to stop Urban Sprawl.

8.2.3. Views and Concerns of Community Sultan Park-Muredke

- The project is very much beneficial as we could also have facility of developed infrastructure like big city. With the implementation of master plan Lahore division 2035 brings prosperity in our area.

8.2.4. Views and Concerns of Community at Sach Soda Farooqabad

- The project is good as we got the basic facilities, but Govt. should also look to provide job opportunity to unemployed youth of this area

8.2.5. Views and Concerns of Community at Mala Ram Lahore South East

- The project is good as it will bring infrastructure in our area which ultimate increase the price of our land.

8.2.6. Views and Concerns of Centaury Paper and Boad Mill – Industry- Kasur

The project is good in terms of notified industrial area. The only concern is to separate our industrial area with residential area with the buffer zone. The residential area on back of our industry keeps on increasing and one day it will touch with our boundary wall which then becomes problem to the industry and residencies as well

8.2.7. Views and Concerns of Panther Tyres – Industry- Lahore Shiekhpura Road

The project is good but residential area should be separated from industrial area. The Lahore-Shiekhpura road belongs to the industrial area but still at this road there are approved housings. This practice should have been stopped.

8.2.8. Views and Concerns of Dr. Obaid UET Lahore

The master plan should be evaluated based upon the yield in agriculture fields. The lower yield areas should be chosen for the development

The climate change impacts have been evaluated based upon temperature increase from last 50 years.

CHAPTER 9

CONCLUSIONS AND RECOMMENDATIONS

9.1. Conclusions and Recommendations

EIA Study was conducted for the proposed Master Plan for Lahore Division, which included field surveys, investigations, verification and possible quantification of anticipated impacts together with their mitigation measures.

By the development and implementation of the Master Plan for the Lahore division, though there will be a relief for availability of planned facilities to the locals. The project is very much needed in order to have orderly future urban growth which will reduce pressure on our natural resources. Planned urban development has variety of positive impacts including intact natural resource with urban development, Public utilities and infrastructure facilities at their own places rather coming towards main district (Lahore), enhanced green areas through housing and building control guidelines, aesthetic uplifting, improved industrial sector and non-quantifiable socio economic benefits.

Apart from the positive impacts of the project, it will also generate some negative impacts during the planning, implementation and operational stages. Most of construction impacts are of temporary nature. These temporary impacts can be avoided or mitigated by adopting suitable mitigation or remedial measures as mentioned in this report. However, following are some major significant impacts that require specific targeted mitigation measures.

9.1.1. Ground Water

The sole supply of water to the Lahore Division depends upon the abstraction of groundwater. The use of ground water in residential commercial and industrial sector with increase in population up till 2035 will result in decline in ground water aquifer with threat to deplete the ground water resource. Further the paved surfaces will

ultimate reduce the ground water recharge. The impact can be mitigated by reducing per capita water availability by educating households to use water more wisely, provision of surface water supply after treatment, water usage metering system, efficient irrigation practices, rain water harvesting in residential, commercial and industrial units and large lakes in parks to facilitate the ground water recharge.

9.1.2. Surface Water Resources and Quality

With the potential of increase in population with development of residential areas, housing schemes and industrial areas in districts of Lahore division, the pollution level and quantities of wastewater is likely to worsen manifolds which may have direct negative impact on our surface water resource (River Ravi and Sutlej) and indirectly on agriculture, ground water and human health. The river Ravi is already converted in to the shape of sewage carrier due to large quantities of waste water being received from urban area. The situation would become more intense if specific solutions regarding waste water treatment are not executed. The impact can be mitigated by adopting pollution prevention strategies by LDA along with other concerned agencies like EPA. Industries have to install wastewater treatment plant at source and should discharge the water that meets the NEQS being enforced by the EPA, Wastewater treatment plant should be installed on all the outfalls or drains that falls in to the river Ravi for that recommendations of River Ravi Commission should be followed which include development of constructed wetlands on drains before discharge into the river Ravi and provision of septic tanks in new housings, the recommendation of WWTP study for Ravi Riverfront Urban Development Project (RRUDP) should also be followed which include establishment of WWTP on all major outfalls.

9.1.3. Flood

Following settlements of project area have a potential risk of flooding in river Ravi for 100 years return period in accordance with short term hydrological study attached as Appendix III. The settlements including Bhai Pheru, Bucheki, Mandi Faizabad, Mor Khunda, and Syed Wala may be subjected to flooding. The settlement Ferozwala is under potential threat of flooding due to Deg Nallah. The settlement Muridke is under potential threat of flooding due to Nikki Deg Drain. The flood hazard can be mitigated by channelization and modification of river area from only where there is chance of

flood hazard to occur, develop large retention ponds in between river and flood prone identified areas which also facilitate ground water recharge and dikes/bund should be developed precise to the identified flood prone areas along the side of the rivers.

9.1.4. Climate Change

Pakistan is rated among the top 10 most vulnerable countries to climate change. The major concerns of climate change in reference to our project site areas are increased variability of Monsoon, increased risks of Extreme Events (floods, droughts, cyclones, extreme high / low temperatures etc.), severe water- and heat-stressed conditions in arid and semi-arid regions leading to reduced agricultural productivity, Increase in Deforestation with Loss of Biodiversity and health risks. The climate change poses the serious threat in project areas if not mitigated or without an adaptive capability for the extreme climatic events. The impact can be mitigated by implementation of Climate Change Policy and its Framework at sectorial, institutional and departmental level on urgent basis. Detail Climate Change Vulnerability Assessment related to the Lahore Division is also needed.

9.1.5. Land Resources

The LDA will require land acquisition for widening and improvement of the existing roads, development of bypass roads for various existing town/villages etc, development of inter town and villages roads, development of new main roads, connecting roads, accessibility roads, sewerage systems including pumping stations, disposal stations, treatment plants, development of recreational areas, public utilities, buildings, administration buildings, toll stations and weighing stations. The land acquisition should be done in accordance with the land acquisition act 1897 and its amendments. Compensation against land, structure, disturbance allowance should be provided to the affectees as per market price

9.1.6. High Voltage Transmission Lines

The high voltage transmissions line are passing and planned to be passed form some of the project areas. These transmission lines if not been buffered, have variety of health impacts on humans. The short term health impacts include Headaches, Fatigue, Anxiety, Insomnia, Prickling and/or burning skin, Rashes and Muscle pain. The long term health impacts include risk of damaging DNA, risk of

cancer, risk of leukemia, risk of neurodegenerative disease and risk of miscarria. The impact can be mitigated by providing adequate buffer zone of at least 50 meters from High Voltage Transmission Line.

9.1.7. Transportation

The infrastructure facilities such as under passes, wide roads, bridges, signal free corridor etc. have been made in Lahore but increasing population with traffic volume rapidly overburden these facilities and vigorously worsen in future also. The situation will be in worst position if long-term planning of transportation in master plan has not been done. The major impact would be seen on our economy if high efficiency transport system will not be designed for Lahore division. The impact can be mitigated by utilizing and relaying on public transport that should have been improved through inter and intra city mass transit, increasing parking fee to discourage private cars and improve bicycle and pedestrian facilities and programs.

9.1.8. Solid Waste

About 20,000 tons/day of municipal solid waste will be generated from Lahore division that if not managed properly will cause aesthetic problems and also produce odor along with the spread of many diseases. Similarly, medical waste produced from medical facilities etc. if not properly managed and disposed, it can result in injury by contaminated sharp material and infection with Hepatitis B, C, and HIV etc. The impact can be mitigated by increasing jurisdiction of Lahore Waste Management Company from Lahore district up to Lahore divisional level. Develop regional based landfill sites, adopting waste management hierarchy, not to mix medical waste with municipal waste and medical waste need to be segregated separately in accordance with the Hospital Waste Management Rules, 2005 and should be given to LWMC for safe disposal in Landfill site after autoclaving. The incineration of medical waste should have been stopped.

Apart from above other recommendation related to the planning and implementations of master plan are given as under-:

- Master Plan should check trends based on the past and present practices and should device strong legislation for the implementation of the proposed land

uses in the Master Plan. In this regards, recommendation for the ineffective implementation of the previous IMPL should be kept in the mind.

- Major loss by the implementation of this master plan is that of agricultural land that will negatively impact food supply and can result in high prices of food items from being supplied from distant places. This loss can just only in part compensated by promoting urban agriculture and kitchen gardening. But this will has to be incorporated in the developmental policy of the proposed project at the planning stage. It is also recommended that for the compensation of the lost agricultural land there is a need to increase agricultural production by using modern technology and seeds of high yielding crop varieties. Farmers in the area shall be provided assistance in getting loans for the purchase of farm machinery and seeds.
- Living roofs and walls are other options to adopt which are important components of the sustainable urban design. The roof gardens provide beautiful and pleasant environment to live and work, to help improve air quality, especially in populated areas. Green roofs of buildings perform the important functions of trapping dust, producing oxygen and providing cooling affect in the hot summer months leading to energy conservation. They also provide habitat for the urban biological diversity and are one of the ways to ensure food security.
- Habitats and species of conservation value shall be protected that include many reptile and bird species. It is therefore important to set aside areas that act as their breeding grounds or nesting habitats. It is strongly recommended that areas along both banks of River Ravi and River Sutlej shall be acquired and declared as buffer zones to protect the native wildlife from human onslaughts and disturbance. In this regard help can be taken from experts of Wildlife Department and WWF-P.
- Native species restoration should be carried out to enhance biodiversity and conservation in the area
- Incentive for the locals involved in the agriculture activities should be given in terms of facilities so that the shifting trend from agriculture to other business should not take pace.

- Affectees along with their children losing their agricultural land and livelihood should be given employment opportunities on preferential basis during the construction stage and operational stage.
- The vulnerable social groups including the women headed households, widows, poor people, etc. losing their residences and agriculture land should be given compensation on replacement cost basis and separate business opportunity should be provided to them.
- It is suggested that at policy level that local government should support the use of alternate energy resources for the individual units such as housing schemes, industrial states, use of solar lights for the street lights etc.
- It is recommended that mitigation measures proposed in impacts and mitigation chapter and EMMP should be adequately implemented at design, construction and operation stages.
- Recommendations of Ecological Study should also be followed during the detail design, implementation and operation of the project

After the detail environmental assessment, it is concluded that the project is environmentally feasible at proposed site only if the mitigation measures suggested in this EIA report are adopted during planning, construction and operational stages of the project. The mitigations suggested in the report are sufficient to successfully complete and run the project in an environment friendly manner.

Further, the key studies which need to be carried out at planning level are given as under;

- Climate Change Vulnerability Assessment
- Ground Water Quality and Aquifer Assessment
- Surface water Quality Assessment and its use
- Hydrological Study and Modeling of River Ravi
- Rainwater harvesting potential and implementation
- Detail Socio- Economic Study of Project Areas
- Social Impact Assessment
- Transportation and Modeling Study
- Action Areas Plans and Subject Plans for each sector of development should also be prepared

APPENDICES

Appendix-I

Ecological Study Report

MASTER PLAN FOR LAHORE DIVISION PROJECT

Districts Lahore, Kasur, Sheikhupura & Nankana Sab

Ecological Study Report

Lahore Development Authority (LDA), Lahore.

Acknowledgements

Help and support provided by the local community members and Departments of Wildlife, Forest and Fisheries for conducting this ecological study is greatly acknowledged. We are highly thankful to Mr. Waqas Ali, Lecturer, Department of Wildlife, University of Veterinary and Animal Sciences, Lahore for his expert advice in finalizing the lists of herpetofauna.

EXECUTIVE SUMMARY

Master Plan for Lahore Division includes districts of Lahore, Nankana Sahib, Kasur, and Sheikhupura which referred to as “the Project Area”. Total Project area includes forty eight different sites allocated in four districts. This project is important in a way that urbanization is happening around the globe and in such case if the same urban expansion is planned and organized it will result in sustainable living approach. With world population forecast to increase from 7 billion today to more than 9 billion by 2050, humanity’s urban footprint will take up 1.5 million more square kilometers of land by 2030 at current rates. Cities place tremendous strains on natural resources and the environment. New ways of thinking about how to make cities more self-sufficient and sustainable, along with advances in a wide range of technologies and heightened environmental awareness is leading to a reformulation of urban planning and development. In such scenario the current project deals with the planning of expanding living areas sustainably. This ecological study is carried-out as part of an Environmental Impact Assessment (EIA) to gather ecological data of the said project. The proposal may have an impact on the natural environment including existing fauna, flora and their wild habitats. This assessment includes both aquatic and terrestrial ecology of the study area. The guiding principle for this part of the EIA report is to conserve major habitats of flora and fauna in the area. This section of the report includes identification, prediction and evaluation of existing habitats, flora and fauna. The baseline ecological study was of 30 days in which tours of the area were arranged to assess plant and animals in different times of the day present in different habitats. After a vigorous literature review, certain criteria were established to evaluate animal and plant species in different habitats. Keeping in view international and national legislation, protection status of species found in all habitats was determined. This helped in proposing conservation of respective habitats of protected species. Significantly many birds and reptile species were found to be protected as they were either under threat as per IUCN Red list (1 bird and 2 reptile species) or were protected under Punjab Wildlife Act (22 bird and 6 reptile

species). One bird (Otus bakkamoena) and 5 reptile species (Ptyas mucosa, Xenochrophis piscator, Varanus bengalensis, Pangshura smithii and Lissemys punctata Adersoni) are protected either under CITES appendix I, II or III. Two mammal species (Felis chaus and Herpestes mungo) are also protected under Punjab Wildlife Act. Project sites had significantly higher biodiversity richness which was 101 species of fauna and 146 species of flora. Fauna includes 70 species of birds, 13 of mammals, 15 of reptiles and 3 of amphibians. None of the native plant species are under threat as per IUCN Red list but they are under serious threat locally as they have been exterminated due to habitat loss, overuse or are replaced with other more economically important species. Same is the case with native fish species among that only Mully (Wallago attu) is 'near threatened' in IUCN Red Data Lists but there are other fish species like Rita rita (Ravi Khagga) that also suffer from serious threat and decline due to over exploitation, water pollution and introduction of invasive species. The potential ecological impacts from the project's planning, implementation (construction and operation) were identified and their possible mitigation measures are proposed for enactment of habitat and species. The negative impacts expected from the implementation, construction and operation of this Master plan are; loss of agricultural land, loss of biodiversity, habitat loss and fragmentation, water, noise, air and light pollutions and change in groundwater recharge capacity. The positive impacts include increased economic activity, livelihood opportunities, reducing pressure on other megacities like Lahore, better transportation, education, healthcare, sewer and municipal water supply facilities, increased land and property values and initiation of secondary development. Negative impacts of this development can be mitigated by; minimizing biodiversity loss by developing Green Infrastructure, restoration of native vegetation on railroad and roadside verges and river and canal banks, Identification and conservation of areas important for priority animal species, planning for nature conservation through the restoration of ecological networks, urban agriculture and kitchen gardening. It is strongly recommended from this ecological impact assessment report that (i) the biodiversity should be conserved by protecting species and their habitats (ii) secondly more green areas should be

developed with native plants as a compensation of lost vegetation (iii) there will be dire need to develop infrastructure and policies to reduce water, noise, light and solid waste pollutions (iv) design ground water recharge and rain water harvesting mechanisms and to (iv) promote urban agriculture for assuring food security.

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CHAPTER 1

BACKGROUND & INTRODUCTION

It is well said that “cities are ecosystems of people and infrastructure” with always increasing population of Lahore, it has become an area which is “land starved” in focusing future population. The current Lahore Division Master Plan is a project that envisioned pressure of urbanization and future development in this area. There is huge need to better plan and develop our urban areas; 50% of the world’s population is considered urban and urban areas are increasing in their size, density and number. A key problem in urban planning is that the rate of development far exceeds the rate of research output and policy implementation, meaning that urban development often ignores its full environmental impact.

Various concepts have been coined to describe how complex interactions can impact on urban living as shown in Figure 1. The 'urban metabolism' refers to the flows necessary to satisfy the needs of those living in cities. 'Grey infrastructure', such as roads, metros, railways, buildings and utilities, determines a city's layout. Yet without integrated urban planning, this urban 'engineering' generates soil sealing, fragments natural systems, increases mobility and associated pollution, energy and material consumption. ‘Green infrastructure’ is a way to work with nature to provide social, ecological and economic benefits to the urban population such as air filtration, temperature regulation, noise reduction, flood protection and recreational areas. The high concentration of people and economic activities in cities cause environmental pressures. Yet cities can be planned, designed, managed and governed in an increasingly efficient way.

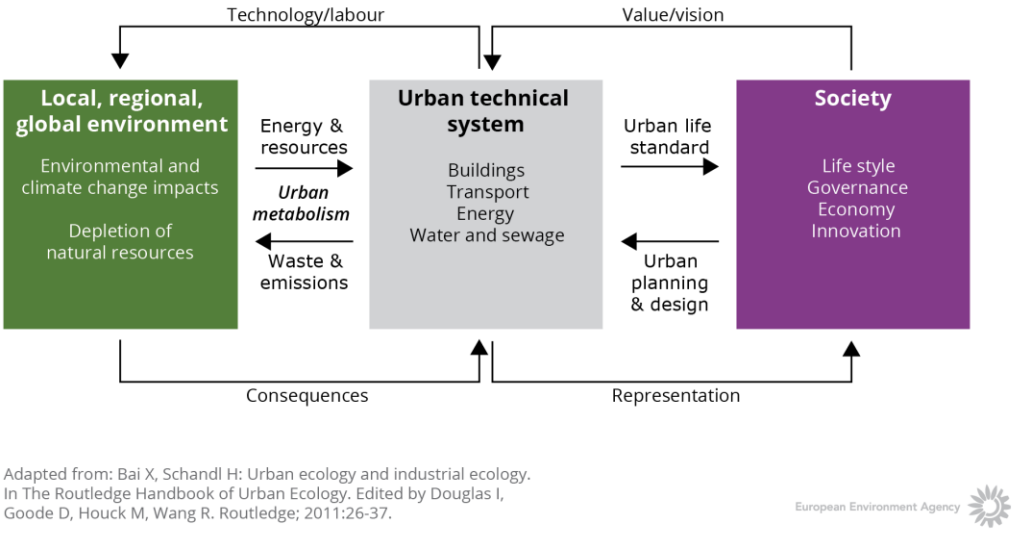


Figure 1 . 1 Relationship between society, urban technical system and environment

With half the world's population now living in urban regions, the future of cities is arguably the most important social and environmental issue of the twenty-first century. The design and planning of green spaces in cities has been central to urban development since the beginning of civilization. Planning which will focus urban ecology has a sustainable way to go. Keeping this in view, Ecological assessment of the Lahore Division was carried-out which includes four Districts namely; Lahore, Kasur, Sheikhupura and Nankana Sahb. The Project site is geographically located between 30°38’31.93”E to 32°03’37.99” and 73°17’37.86” to 74°42’05.83”. This ecological impact assessment was carried-out as part of Environmental Impact Assessment (EIA) to gather ecological data of the Lahore Division Project that may have impacts on the natural environment including existing fauna, flora and wildlife habitats. This assessment includes both aquatic and terrestrial ecology of the study area. The guiding principle for this part of the EIA report is to conserve major habitats of flora and fauna in the planning and management of the area. This chapter includes identification, description and evaluation of existing habitats of study area (Fig. 1). The baseline ecological study was carried-out in 30 days and included the assessment of different habitats in the project area and identification of diversity of local flora and fauna. The potential ecological impacts from the project’s planning and implementation were identified and possible mitigation measures are proposed for enactment of habitat and species present at the study site.

1.1. Objectives of the Ecological Impact Assessment Study

The objectives of this ecological study were to

- Identify important ecological habitats present within the proposed project area
- Determine floral and faunal diversity of the proposed project site.
- Assess the potential impacts of the master plan of the proposed area on the ecological resources.
- Provide practical mitigation measures to combat, minimize or avoid impacts from the proposed master plan.

1.2. Methodology to conduct Ecological Impact Assessment

The current study was carried-out in following steps:

i. Documentation of important ecological resources, i.e surveys were conducted to gather data about habitat, flora and fauna in the region, in addition to it, available literature (published reports, research papers etc.) were searched and used in compiling ground observations.

ii. Evaluation of significance of ecological resources

iii. Prediction of ecological impacts on the resources due to project development and

iv. Provision of mitigation measures which will reduce or minimize impacts identified on ecological resources.

1.3. Legislation and Guidelines

This Ecological impact assessment was carried-out in consideration of national and international legislations which Pakistan is abided by. The list of guidelines and conventions is as follows:

1.3.1. International Legislations

Pakistan is signatory to many international conventions and treaties

1.3.1.1. Ramsar Convention

This is intergovernmental Convention on Wetlands of International Importance; Pakistan is ratified to this convention on November 23, 1976. The main objective of this convention is to conserve world's wetlands and their resources.

1.3.1.2. Bonn Convention

Convention on the Conservation of migratory Species of Wild Animals, June 1979 and came into force in Pakistan in 1987. The main aim of this convention is to conserve terrestrial, aquatic and avian migratory species throughout their range.

1.3.1.3. Convention on Biological Diversity (CBD)

Pakistan ratified to CBD in 1994; it recognizes the intrinsic value of biological diversity and ecological, genetic, social, economic, cultural, educational, recreational, and aesthetic values of biodiversity and its components.

1.3.1.4. IUCN Red List of threatened species

The International Union for Conservation of Nature and Natural resources (IUCN) Red List of Threatened Species provides taxonomic, conservation status and distribution information on plants, fungi and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction (i.e. those listed as Critically Endangered, Endangered and Vulnerable). It also includes information on plants, fungi and animals that are categorized as Extinct or Extinct in the Wild; on taxa that cannot be evaluated because of insufficient information (i.e., are Data Deficient); and on plants, fungi and animals that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme (i.e., are Near Threatened).

1.3.1.5. CITES

The Convention on International Trade in Endangered Species of Wild Fauna and Flora is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The species covered by CITES in the project area are listed in Appendix-1.

1.3.2. National Legislation, Acts and Rules

Following national laws and acts are in force in Pakistan for the protection of Environment and biological diversity.

- Pakistan Forest Act 1927; Forest (Amended) act 2001
- Punjab Wildlife (Protection, Preservation, Conservation and Management) (Amendment) Act, 2007. The detail of animals and birds protected under the three schedules of this act is attached in Appendix-2.
- Pakistan Environmental Protection Act, 1997
- Pakistan National Conservation Strategy (1992)
- Biodiversity Action Plan (2000)

1.4. Study Team

The details of ecological study team members is as given below;

Table 1 . 1 The Ecological Study Team

Sr. No.	Name of the Member	Specialization	Qualification
1	Dr. Faiza Sharif	Conservation Biologist/Restoration Ecologist	Ph. D. Botany (GCU Lahore)
2	Dr. Sumbal Nazir	Zoologist	Ph.D Environmental Science (GCU Lahore), M. Phil. Zoology (GCU Lahore).
3	Ms. Laila Shahzad	Environmentalist	M. Phil. Environmental Science (GCU Lahore), PhD Scholar Environmental Science (LCWU Lahore)
4	Ms. Asma Mansoor	Ecologist	BSc (Hons.) Environmental Science (GCU Lahore), MPhil. Student Environmental Science (GCU Lahore)

CHAPTER 2

OBSERVATIONS AND INTERPRETATIONS

This part deals with baseline study based on ecological assessment of habitats in the project area.

2.1. Ecological Baseline Study of the proposed project

2.1.1. Project Study Area

The area of Lahore Division is about 11413.5 km² with the population of 14 million in accordance with 1998 population census. With average growth rate of 3.20, the current population of Lahore division is estimated as 25 million. A projection is that by year 2035 there will be almost 50 million people living in the division. The cited area is diverse mix of agricultural land, settlements in the form of towns and villages, orchards, rivers, canals, railway lines etc.

2.1.2. Steps in Ecological baseline study

The ecological baseline study was carried-out in three steps

a. identifying habitat types in the project area,

b. identifying species of flora and their protection status

c. identifying species of fauna and their protection status

2.1.2.1. Detail of different Habitats in the project area

Agriculture and Orchards

Out of many identified habitats, major area in the project sites was under Agriculture. Most of the agriculture land will be plunged in new development. Current agricultural area of the project site is 285,875 acres, most of that lies in Kasur (Bhai Pheru

21800 Acres, Kasur 11044 Acres and Pattoki 13353 Acres) and Lahore (Raiwind and Multan road 46230 Acres) Districts. After the implementation of the proposed Master Plan 192,602 acres (55.26%) of this productive agricultural land will be lost causing a great threat to food security. Wheat and rice are the major staple crops of the study area, while maize, sugarcane and seasonal vegetables are also cultivated. The crops observed during the visit were wheat, potatoes, sugarcane, radish, onion, carrot, spinach, mustard, clover etc. After agriculture the other prominent area in the project site was Orchards, most of which are privately owned. According to the master plan of the project site, most of these orchards will be converted in residential areas in new development. There was significant number of orchards present in study area. These orchards were mainly of Guava while a few of oranges and mangoes were also sighted. Besides cultivation of croplands, orchard plantation is common practice for commercial purposes. These orchards were also the habitat of many birds, mammals and plant species. Common bird species were Streptopelia tranquebarica, Acridotheres tristis, and Passer domesticus. Following species of mammals were there ratus ratus, Mus musculus, and Suncus murinus. Some grasses and herbs were also present there. Most common plant species were Dalbergia sisso, Albizia lebbeck, Eucalyptus, Ficus religiosa and Acacia nilotica.

Railway/ roadside verges/ greenbelts

After agriculture and orchards, second category of habitat was railways, roadsides and greenbelts. Some abundant species here were Melia azedarach, Dalbergia sisso, Albizia lebbeck, Ficus religiosa, Populus euphratica, F. banglensis and Acacia nilotica. It was observed that the pattern of vegetation changed when we move from suburbs to urban residential areas. Suburbs /countryside were populated with native species like Morus alba, Ricinus communis, Calotropis procera, Parkensonia spp, Ficus spp, Dalbergia sissoo and A. nilotica etc. Whereas towards the urban residential areas, species of horticultural importance as well as ornamental plants were common like many plam species Ficus variegata, Jatropha hastata, Polyalthia longifolia, Nerium oleander, Rosa indica, Bougainvillea spectabilis wild. On roadsides and wastelands invasion of Leucaena leucocephala, Lantana camara and Parthenium was observed.Among the invasive species Prosopis julifloa and Parthenium hysterophorus were very common on railroad and roadside verges.

Residential/ Office areas

In this category of habitats included settlements, industrial areas and offices. The commercial value was very high due to presence of many industries. It also includes towns, villages with major settlements. Most of the industries have spacious well-maintained green lawns. Ornamental plants and plants of horticultural importance were also common in this habitat. Some fruit trees like Papaya, orange, banana, guava, mango, jaman (Syzygium cumini) and lemon were common in this area. Species of ornamental palms and trees were more abundant in this habitat type like Cycas revoluta, Butia capitate, Caryota urens, Phoenix roebelenii, Phoenix dactylifera, and Roystonea regia.

River/ Canal Banks

The banks of the river Ravi and river Sutlej are vegetated with tree species like Dalbergia sissoo, Eucalyptus, Populus euphratica and Acacia nilotica where ever riparian forests exist. Many grasses and sedges are common on the river bank as Saccharum munja, S. spontaneum, Cyperus difformis and C. iria, Phragmites karka etc.

River/ Ponds

In the project site, two important rivers are river Ravi and river Sutlej with six canals; Bambanwala Ravi, Bedian Link Canal, Qadirabad-Bulloki Link Canal, Balloki – Sulemanki Link, Lower Bāri Doāb Canal, Upper Chenab Canal and Lower Chenab Canal. Ravi and Sutlej have considerable value for fishing, important fishes of the two rivers were Thaila, Mori, Rohu, Singharee and Carp etc. The river Ravi is highly polluted river of Punjab with untreated industrial and municipal waste ending up in it. The situation is further worsened by dumping of municipal solid waste on its banks. There were also wastewater ponds around villages and low lying waterlogged areas. There are also few fish ponds in the area owned by the locals. There were four exotic fish species identified in the project site; Ctenopharyngodon idella, Cyprinus carpio, Hypopthalmichthys molitrix, and Hypophthalmichthys nobilis. Mnay birds, amphibians and reptiles were observed around these aquatic habitats. The following bird species were observed in ponds Egretta intermedia, Streptopelia tranquebarica, Acridotheres tristis, Dicrurus macrocersus vieillot, Egretta garzetta, Corvus

splendens. Common fish species were Labeo rohita, Catla catla and Cirrhinus mrigala. One Amphibian specie Euphlyctis cyanophlyctis was common there. From the aquatic plants, Polygonum spp. and Potamogeton spp. were less common as compared to abundant exotic species Eichhornia and Pistia.

From the proposed 48 project sites in Lahore Division, identified habitat types with species richness of flora and fauna in each habitat are given in Table 1. A total of 148 plant species, 70 bird, 13 mammal, 15 reptile and 3 amphibian species are reported from the study area.

Table 2 . 1 Species richness of fauna and flora of the habitat types in the study area

Habitat types	Birds	Mammals	Reptiles	Amphibians	Plants
Agriculture and Orchards	61	13	10	2	89
Railway/Road sides/Green Belts	27	11	8	2	120
Residential/Offices	8	5	6	2	65
River/Canal Banks	38	13	6	3	50
River	-	-	-	-	4
Pond	28	-	5	1	4
Total species	70	13	15	3	146

2.1.2.2. Survey for the Floral Inventory and other details in the project area

Plants species in the study area were surveyed by the team in the designated area of the project. The Species richness of fauna and flora of the habitat types in the study area surveys were carried out along the main and side roads of the proposed area. . Plant species on the main and side roads, railway embankments, orchards, grasslands and agricultural fields were carried out using 100 m long transects. Samples of un-identified plants species were collected for the purpose of identification which were then identified using Floras of Lahore, Punjab and Pakistan. Help from eflora of Pakistan, IUCN's red list and global invasive species database websites was also taken. Number and types of trees, shrubs, and herbs were recorded during the surveys and their IUCN status was noted afterwards. Few

common trees were shisham, kikar, peepal, beri, toot, derak, phulai etc. List of plant species identified from different habitats is presented in Table-2.

Table 2 . 2 List of plant species identified from different habitats

SCIENTIFIC NAMES	COMMON NAMES	A+O	R/R. V/G. B	R+O	R /C. B	ABUNDANCE CLASS	IUCN STATUS
TREES							
Acacia nilotica	Egyptian Thorn/Kikar	+	+	+	+	**A**	Not Evaluated
Albizia lebbeck	Rain Tree/ shreen	+	+	+	+	**A**	Not Evaluated
Alstonia scholaris	White Cheesewood	-	+	+	-	**D**	**Least Concern**
Azadirachta indica	Neem Tree	+	+	+	-	**B**	Not Evaluated
Bombax ceiba	Cotton Tree/ sambal	+	+	+	-	**C**	Not Evaluated
Bauhinia variegate	Kachnar	-	-	+	-	**E**	**Least Concern**
Carica papaya	Papaya	-	-	+	-	**E**	Not Evaluated
Citrus sinensis	Orange	-	-	+	-	**E**	Not Evaluated
Cupressus sempervirens	Italian Cypress/Saru	-	-	+	**-**	**E**	Not Evaluated
Dalbergia sissoo	Sissoo Tree	+	+	+	+	**A**	Not Evaluated
Erythrina suberosa	Corky Coral Tree	+	+	-	-	**E**	Not Evaluated
Eucalyptus camaldulensis	Red Gum	+	+	+	**+**	**A**	Not Evaluated
Ficus benghalensis	Banyan Fig	+	+	+	**-**	**B**	Not Evaluated
Ficus religiosa	Peepul Tree	+	+	+	**+**	**A**	Not Evaluated
Ficus variegata	True Fig Shell	-	+	+	**-**	**C**	Not Evaluated
Jatropha hastata	Spicy Jatropha	-	+	+	**-**	**E**	Not Evaluated
Leucaena leucocephala *	White lead tree	+	+	-	-	**C**	Not Evaluated
Heterophragma quadriloculare	Waras	-	+	+	-	**E**	Not Evaluated
Mangifera indica	Mango	+	-	+	**-**	**C**	**Data Deficient**
Melia azedarach	China Berry	+	+	+	**+**	**A**	Not Evaluated
Moulsari Bonsai	Spanish Cherry	-	+	+	**-**	**B**	Not Evaluated
Morus alba	White Mulberry	+	+	+	**+**	**B**	Not Evaluated
Morus nigra	Black Mulberry	+	+	+	+	**C**	Not Evaluated

Pinus roxburghii	Pine	-	-	+	**-**	**E**	**Least Concern**
Polyalthia longifolia	Ashok	-	+	+	**-**	**D**	Not Evaluated
Populus euphratica	Salt Poplar	+	+	+	+	**B**	Not Evaluated
Prosopis cineraria	Jand	-	+	+	**-**	**E**	Not Evaluated
Prosopis juliflora*	Mesquite	+	+	+	**+**	**A**	Not Evaluated
Psidium guajava	Guava	+	-	+	**-**	**C**	Not Evaluated
Salvadora oleoides	Peelu	-	+	+	**-**	**E**	**Least Concern**
Syzygium cumini	Black Plum	+	+	+	+	**B**	Not Evaluated
Tamarix aphylla	Athel Pine	-	+	-	-	**E**	Not Evaluated
Tamarix dioica	Salt cedar	-	-	-	+	**E**	Not Evaluated
Terminalia arjuna	Arjun Tree	-	+	+	**-**	**D**	Not Evaluated
Thuja occidentalis	Mor Pankh	-	-	+	**-**	**E**	**Least Concern**
PALMS							
Bismarkia nobilis	Bismarck palm	-	+	+	**-**	**E**	Not Evaluated
Butia capitata	Jelly Palm	-	-	+	**-**	**E**	Not Evaluated
Caryota urens	Wine palm	-	-	+	**-**	**E**	**Least Concern**
Chamaedorea elegans	Parlour Palm	-	-	+	**-**	**E**	Not Evaluated
Chamaerops humilis	Fan Palm	-	-	+	**-**	**E**	Not Evaluated
Livistona chinensis	Chinese Fan Palm	-	-	+	**-**	**E**	Not Evaluated
Musa paradisiaca	Banana	+	-	+	**-**	**E**	Not Evaluated
Phoenix dactylifera	Date Palm	+	+	+	**-**	**E**	Not Evaluated
Phoenix roebelenii	Miniature Date Palm	-	-	+	**-**	**E**	Not Evaluated
Roystonea regia	Cuban royal palm	-	-	+	**-**	**E**	Not Evaluated
SHRUBS							
Abutilon bidentatum	Velvetleaf	**+**	**+**	**-**	**-**	**E**	Not Evaluated
Abutilon hybridum	Chinese Bellflower	**-**	**+**	**+**	**-**	**E**	-
Acacia farnesiana	Mimosa Bush		**+**		**-**	**E**	Not Evaluated

Ageratum conyzoides	Floss Flower	**+**	**+**	**+**	**-**	**C**	Not Evaluated
Atriplex crassifolia	Saltbush	**+**	**+**	**+**	**-**	**D**	Not Evaluated
Bougainvillea spectabilis wild	Bougainvillea	**-**	**+**	**+**	**-**	**E**	Not Evaluated
Callistemon citrinus	Bottle Brush	**-**	**+**	**+**	**-**	**E**	Not Evaluated
Calotropis procera	Rubber bush/ Aak	+	+	**+**	+	**B**	Not Evaluated
Capparis decidua	Kuler	-	+	-	-	**E**	Not Evaluated
Cestrum nocturnum	Night Blooming Jasmine	-	+	+	-	**E**	Not Evaluated
Cuscuta gronovii	Common Dodder	+	+	-	-	**E**	Not Evaluated
Cycas revoluta	Sago palm	-	+	+	-	**E**	**Least Concern**
Hibiscus rosa sinensis	Shoe Flower	**-**	+	+	**-**	**E**	Not Evaluated
Ipomoea carnea	Bush Morning Glory	+	+	+	+	**B**	Not Evaluated
Jasminum officinale	Jasmine	-	+	+	**-**	**E**	Not Evaluated
Lantana camara*	Big Sage	-	+	+	+	**C**	Not Evaluated
Murraya exotica	Orange Jasmine	-	+	+	**-**	**E**	Not Evaluated
Nerium oleander	Oleander	+	+	+	**-**	**D**	**Least Concern**
Parkinsonia aculeata	Cambron	-	+	+	**-**	**C**	Not Evaluated
Ricinus communis	Castor Oil Plant	+	+	+	+	**A**	Not Evaluated
Rosa indica	Rose Bed	-	+	+	**-**	**E**	Not Evaluated
Sida cordifolia	Country Mallow	-	-	+	+	**E**	Not Evaluated
Tamarix dioca	Salt Cedar	-	+	-	+	**D**	Not Evaluated
Thevetia peruviana	Yellow Oleander	-	+	+	-	**E**	Not Evaluated
Withania somnifera	Indian Ginseng	+	-	+	+	**C**	Not Evaluated
HERBS							
Agave americana	Century Plant	**-**	**+**	**+**	**-**	**D**	Not Evaluated
Achyranthes aspera	Prickly Chaff Flower	**+**	**+**	**-**	**-**	**C**	Not Evaluated
Alhagi maurorum	Camelthorn	-	-	-	+	**E**	Not Evaluated
Alternanthera sessilis	Sessile Joyweed	**+**	**+**	-	**+**	**C**	**Least Concern**

Amaranthus viridis	Slender Amaranth	**+**	**+**	-	**-**	**B**	Not Evaluated
Boerhavia diffusa	Red Spiderling	**+**	**+**	-	**+**	**C**	Not Evaluated
Canna indica	Canna	**-**	**+**	-	**-**	**E**	Not Evaluated
Cassia absus	Tropical Sensitive Pea	**+**	**+**	-	**-**	**D**	**Least Concern**
Chenopodium album	Lambsquarters	**+**	**+**	-	**+**	**B**	Not Evaluated
Chenopodium murale	Goose Foot	**+**	**+**	-	-	**D**	Not Evaluated
Chrozophora tinctoria	Dyer's Litmus	**+**	**+**	-	-	**E**	**Least Concern**
Convolvulus arvensis	Field Bindweed	**+**	**+**	-	-	**C**	Not Evaluated
Conyza ambigua	Rough Conyza	**+**	**+**	-	**+**	**B**	Not Evaluated
Conyza canadensis	Horseweed	**+**	**-**	-	**-**	**E**	Not Evaluated
Croton sparsiflorus	Ban Tulasi	**+**	**+**	-	**+**	**B**	Not Evaluated
Croton tiglium	Purging Croton	**-**	**+**	-	**-**	**E**	Not Evaluated
Digera muricata	False Amaranth	+	+	-	+	**C**	Not Evaluated
Datura metel	Devil's Trumpet	-	+	-	-	**E**	Not Evaluated
Eclipta alba	Eclipte Blanche	+	+	-	+	**B**	**Data Deficient**
Euphorbia hirta	Asthma Weed	+	+	-	-	**C**	Not Evaluated
Euphorbia prostrata	Prostrate Sandmat	+	+	-	+	**B**	Not Evaluated
Launaea procumbens	Country Dandelion	+	+	-	+	**B**	Not Evaluated
Malvastrum coromandelianum	False Mallow	+	+	-	-	**C**	Not Evaluated
Mazus Rugosus	Creeping Mazus	-	+	-	-	**E**	Not Evaluated
Opuntia ficus indica	Tuna Cactus	-	+	-	-	**E**	**Data Deficient**
Origanum vulgare	Marwa	-	+	-	-	**E**	**Least Concern**
Oxalis corniculata	Sleeping Beauty	+	+	-	+	**A**	Not Evaluated
Parthenium hysterophorus*	Whitetop Weed	+	+	-	+	**A**	Not Evaluated
Phyla nodiflora	Turkey Tangle Frogfruit	+	+	-	+	**A**	**Least Concern**
Physalis divaricata	Ground Cherry	+	+	-	-	**B**	Not Evaluated
Polygonum persicaria	Redshank	+	+	-	+	**B**	**Least Concern**

Polygonum plebejum	Small Knotweed	+	+	-	-	**B**	Not Evaluated
Solanum nigrum	Black Nightshade	+	+	-	+	**A**	Not Evaluated
Sonchus asper	Spiny Milk Thistle	+	+	-	-	**C**	Not Evaluated
Suaeda fruticosa	Shrubby Seablite	-	+	-	-	**E**	Not Evaluated
Trianthema portulacastrum	Wild Water Melon	+	+	-	+	**B**	Not Evaluated
Xanthium strumarium	Cocklebur	+	+	-	-	**B**	Not Evaluated
GRASSES							
Acrachne racemosa	Goosegrass	+	+	-	-	**C**	Not Evaluated
Bothriochloa laguroides	Silver Beardgrass	+	+	-	+	**C**	Not Evaluated
Brachiaria reptans	Creeping Panic Grass	+	+	-	+	**C**	**Least Concern**
Cenchrus ciliaris	Buffel Grass	+	+	-	-	**D**	Not Evaluated
Cenchrus setigerus	Birdwood Grass	+	+	-	-	**C**	Not Evaluated
Cynodon dactylon	Bermuda Grass	+	+	+	+	**A**	Not Evaluated
Dactyloctenium aegyptium	Egyptian Crowfoot Grass	+	+	-	-	**C**	Not Evaluated
Dactyloctenium scindicum	-	+	+	-	+	**B**	Not Evaluated
Desmostachya bipinnata	Halfa Grass	+	+	-	+	**A**	**Least Concern**
Digitaria ciliaris	Southern Crabgrass	+	+	-	+	**B**	Not Evaluated
Echinochloa colonum	Jungle Rice	+	+	-	+	**B**	**-**
Echinochloa crusgalli	Barnyardgrass	+	+	-	-	**C**	**Least Concern**
Eleusine indica	Wiregrass	+	+	-	-	**D**	**Least Concern**
Eragrostis cilianensis	Candy Grass	+	+	-	-	**D**	Not Evaluated
Eriochloa procera	Spring Grass	+	+	-	-	**D**	**Least Concern**
Hemarthria compressa	Whip Grass	+	+	-	+	**C**	**Least Concern**
Imperata cylindrica	Blady Grass	+	+	-	-	**C**	Not Evaluated
Leptochloa panicea	Mucronate Sprangletop	+	+	-	-	**C**	**Least Concern**
Panicum antidotale	Blue Panicgrass	+	+	-	-	**C**	Not Evaluated
Paspalum distichum	Gingergrass	+	+	-	-	**D**	Not Evaluated

Phragmites karka	Tall Reed	-	-	-	+	**C**	**Least Concern**
Saccharum munja	Plume Grass	+	+	-	+	**B**	Not Evaluated
Saccharum ravennae	Canne D'italie	+	+	-	-	**C**	**Least Concern**
Saccharum spontaneum	Wild Cane	+	+	-	+	**B**	**Least Concern**
Setaria glauca	Yellow Foxtail	+	+	-	-	**D**	Not Evaluated
Setaria pumila	Pigeon Grass	+	+	-	+	**C**	Not Evaluated
Sorghum halepense	Johnson Grass	+	+	-	-	**C**	Not Evaluated
Sporobolus coromandelianus	Madagascar Dropseed	+	+	-	-	**D**	Not Evaluated
SEDGES							
Carex fedia ness.	Carex	+	+	-	+	**C**	Not Evaluated
Cyperus difformis	Smallflower Umbrella Sedge	+	+	-	-	**E**	**Least Concern**
Cyperus iria	Rice Flat Sedge	+	+	-	+	**B**	**Least Concern**
Cyperus rotundus	Nut-Grass	+	+	-	+	**B**	**Least Concern**
Pycreus flavidus	-	+	+	-	-	**E**	**Least Concern**

"+" = Present, "-" = Absent, * = Invasive, A+O = Agriculture + Orchards, R/R.V/G.B. = Railway/Road Verges/Green Belts, R+O = Residential + Offices, R/C.B = River/ Canal Banks, A = very Common, B = Common & Widespread, C = Less Common, D = Uncommon, E = Rare

Detail of aquatic plants identified from the river Ravi, river Sutlej, canals and pond areas is presented in Table-3.

Table 2 . 3 List of aquatic plant species identified from different habitats

AQUATIC PLANTS	COMMON NAMES	Habitats		Abundance class	IUCN STATUS
		River/ Canal	Pond		
ANGIOSPERMS					
Eichhornia crassipes*	Water Hyacinth	+	+	A	Not Evaluated
Hydrilla verticillata	Water thyme	+	-	D	Least Concern
Pistia stratiotes*	Tropical Duck-Weed	+	+	B	Least Concern
Potamogeton sp.	Pondweed	+	-	E	Not Evaluated
Polygonum	Knot Grass	-	+	D	-
Typha angustata	Lesser Indian reed mace	-	+	C	Not Evaluated

In the project area, flora and fauna species were identified and their status was evaluated on the basis of following information.

Table 2 . 4 Status of plant species recorded within the study area

Criteria	Remarks
Protection Status	No plant species was protected under IUCN Red List of Threatened Species.
Distribution	15 are very common, 28 are common and wide spread, 34 are less common, 18 are uncommon and 53 are rare in the study area.
Rarity	No plant species was protected under IUCN Red List of Threatened Species.

In the project area, plant species richness is calculated from the details of all plants in different habitats. Species richness is the number of different species represented in an ecological community, landscape or region. Species richness is simply a count of species, and it does not take into account the abundances of the species or their relative abundance distributions. Species diversity takes into account both species richness and species evenness. There were 35 tree, 12 palm, 25 shrub, 37 herb, 28 grass, 5 sedge and 6 species of aquatic plants reported from the study area to give of a total of 148 species (Table 5).

Table 2 . 5 Overall species richness of all plants recorded within the study area

Plant Type	Richness
Trees	35
Palms	10
Shrubs	25
Herbs	37
Grasses	28
Sedges	5
Aquatic	6
Total	**146**

2.1.2.3. Survey for inventory of faunal diversity in the project site

Extensive surveys were carried-out in the project area and data was gathered for mammals, reptiles, birds and amphibians. A checklist of the species that might be expected in the study area was prepared by searching published literature. Both direct observation and indirect methods were used to gather information. Community surveys were carried out and data was gathered from the local people regarding information of animals in the area using field guides and colored photographs. The detailed survey included ecological importance of species, their niche and their IUCN conservation status; like endangered, threatened, vulnerable etc.

Bird survey

Birds were surveyed in early morning and late afternoon of the same day with the help of transects and walkovers in the study sites. Identification of species was done using binoculars. Effective sampling distance was 200 m from transects. The recorded data of birds was about species identity and their relative abundance in each of the habitat. Table 7 and Figures 2-6 show details of the birds found in the project area.

Mammal survey

Mammals were surveyed during the visits and were identified from field observations of paw prints, scats and their burrows. Table 6 and Figure 7 show details of the mammals found in the project area.

Table 2 . 6 List of mammals recorded within the project area

Mammals' Species	Common name	Habitats					AC	IUCN status	Punjab Wildlife Act	CITES
		A+O	R/R./G. B	R+O	R./C. B	P				
Rattus rattus	House rat	+	+	+	+	-	A	LC		
Golunda ellioti	Indian Bush rat	+	+	-	+	-	B	LC		
Millardia meltada	soft furred field rat	+	+	-	+	-	B	LC		
Mus musculus	House mouse	+	+	+	+	-	A	LC		
Suncus murinus	Asiatic House shrew	+	+	+	+	-	A	LC		
Megaderma lyra	Indian false vampires	+	+	+	+	-	B	LC		
Funambulus pennantii	Palm squirrel	+	+	+	+	-	A	LC		
Hystrix indica	Indian crested porcupine	+	+	-	+	-	B	LC		
Lepus nigricollis	Indian hare	+	+	-	+	-	C	LC		
Felis chaus	Jungle cat	+	+	-	+	-	B	LC	✓	
Herpestes mungo	Indian mongoose	+	+	-	+	-	B	LC	✓	
Sus scrofa	Wild boar	+	-	-	+	-	B	LC		
Canis aureus	Asiatic Jackal	+	-	-	+	-	D	LC		

**=Migratory, A+O = Agriculture + Orchards, R/R.V/G.B = Railway/Road Verges/Green, R/C.B = River/Canal Bank, R+O = Residential+Offices, P = Ponds, AC = abundance class, LC=Least concern, VU=Vulnerable, NE=Not evaluated, NT = Near Threatened, A=very common, B= common & wide spread, C= less common, D= Uncommon, E = Rare*

Table 2 . 7 List of Bird species recorded within the project area

Birds Species	Common name	Habitats					AC	IUCN status	Punjab Wildlife Act
		A+O	R/R/G. B	R+O	R. / C. B	P			
Egretta intermedia	Intermediate Egret	+	-	-	+	-	B	LC	✓
Streptopelia tranquebarica	Red turtle dove	+	+	+	+	+	A	LC	✓

Acridotheres tristis	Common Myna	+	+	+	+	+	A	LC	✓
Passer domesticus	House Sparrow	+	+	+	+	+	A	LC	✓
Dicrurus macrocersus vieillot	Black Drongo	+	+	-	-	-	B	LC	
Corvus splendens	House Crow	+	+	+	+	+	A	LC	
Pyconotus cafer	Red vented bulbul	+	-	-	+	-	D	LC	
Bubulcus ibis	Cattle egret	+	-	-	+	+	C	LC	✓
*Upopa epops**	Hoopoe	+	-	-	+	+	D	LC	
*Hoplopterus indicus**	Red-Wattled Lapwing	+	+	-	+	+	B	LC	
Merops orientalis	Green bee eater	+	+	-	-	-	D	LC	
Acridotheres ginginianus	Bank Myna	+	+	-	+	+	C	LC	
*Anas Platyrhynchos**	Mallard	+	-	-	-	+	C	LC	✓
*Gallinula chloropus**	Common moorhen	+	-	-	+	-	D	LC	✓
Ceryle rudis	Pied kingfisher	+	-	-	+	+	C	LC	
Callacanthis burtoni	Spectacle Finch	+	+	-	+	-	D	LC	
Milvus migrans migrans	Black kite	+	-	+	+	+	A	LC	✓
Psittacula krameri	Rose-ringed Parakeet	+	+	+	-	-	B	LC	✓
Columba livia	Wild rock dove	+	+	+	+	+	A	LC	
Halcyon smyrnensis	White-breasted Kingfisher	+	-	-	+	+	B	LC	
Treron phoenicoptera	yellow-footed green pigeon	+	-	-	-	-	E	LC	
*Merops philippinus**	Blue tailed bee eater	+	-	-	+	+	D	LC	
Saxicoloides fulicata	Indian robin	+	-	-	-	-	E	LC	
*Actitis hypoleucos**	Common Sand piper	+	-	-	+	+	E	LC	
Motacilla alba	White wagtail	+	-	-	+	+	D	LC	
Gracupica contra	Pied myna	+	+	-	+	+	B	LC	
Cinnyris asiaticus	Purple sunbird	+	-	-	-	-	E	LC	
Spilopelia senegalensis	little brown dove	+	+	-	+	+	D	LC	✓
Dinopium benghalense	golden backed woodpecker	+	+	-	-	-	E	LC	

Saxicola caprata	Bush chat	+	+	-	+	-	C	LC	
Petronia xanthocollis	yellow throated sparrow	+	-	-	-	-	E	LC	
*Anas crecca**	Common teal	+	-	-	+	+	C	LC	✓
Amaurornis phoenicurus	white breasted hen	+	-	-	+	+	C	LC	✓
Streptopelia capicola	Ring necked dove	+	-	-	-	-	E	LC	
Coracias benghalensis	Indian roller	+	+	-	-	-	D	LC	
*Hirundo rustica**	Common swallow	+	-	-	+	-	D	LC	
Galerida cristata	Crested lark	+	-	-	-	+	D	LC	
Turdoides caudate	Common babbler	+	+	-	-	-	C	LC	✓
Accipiter badius	Shikra	+	-	-	-	-	E	LC	
*Lanius schach**	long tailed shrike	+	+	-	-	-	C	LC	
*Coturnix coturnix**	Common Quail	+	-	-	-	-	E	LC	✓
*Egretta garzetta**	little egret	+	-	-	+	+	B	LC	✓
Ardeola grayii	Indian pond Heron	+	-	-	+	+	C	LC	✓
*Himantopus himantopus**	Black winged stilt	-	-	-	+	+	D	LC	
Orthotomus sutorius	Common tailor bird	+	-	-	-	-	E	LC	
Ploceus philippinus	baya weaver	+	-	+	+	-	D	LC	
Copsychus saularis	Magpie robin	+	-	-	-	-	E	LC	
Zosterops palpebrosus	Oriental white eye	+	-	-	-	-	E	LC	
*Phalacrocorax niger**	Cormorant	-	-	-	+	+	C	LC	
*Egretta alba**	Large Egretta	-	+	-	+	-	C	LC	✓
Aquila rapax nipalensis	Tawny Eagle	-	-	-	-	-	D	LC	✓
Francolinus francolinus	Black Partridge	+	-	-	+	+	B	LC	✓
Francolinus pondicerianus	Grey Partridge	+	+	-	-	-	B	LC	✓
Centropus sinensis	Large Indian Parakeet	+	+	-	-	-	E	LC	
Otus bakkamoena	Indian Scops Owl	+	+	-	-	-	E	LC	✓
*Alcedo atthis**	Common Kingfisher	-	-	-	+	+	D	LC	

Eremopterix grisea	Ashy Crowned Lark	-	-	-	+	-	E	LC	
Anthus novaeseelandiae	Richard'Pipit	+	+	-	-	-	D	LC	
Dendrocopos assimilis	Sindh Pied Woodpecker	-	-	-	+	-	E	LC	
Tephrodornis pondicerianus	Common Wood Shrike	+	-	-	-	-	E	LC	
Pycnonotus leucogenys	White-cheeked Bulbul	+	-	-	-	-	E	LC	✓
*Cisticola juncidis**	Fan-tail Warbler	+	-	-	+	+	C	LC	
Prinia gracilis	Streaked Long-tail Warber	+	+	-	-	-	C	LC	
Chrysomma sinense	Yellow-eyed Babbler	-	+	-	+	-	D	LC	
Chrysomma altirostre	Sindh Babbler	+	-	-	+	-	E	V	
Turdoides caudatus	Common Babbler	+	-	-	-	-	E	LC	
*Lanius vittatus**	Bay-backed Shrike	+	+	-	-	-	E	LC	
*Lanius excubitor**	Great Grey Shrike	+	-	-	-	-	E	LC	
Passer pyrrhonotus	Sindh Jungle Sparrow	-	+	-	-	-	D	LC	
Prinia socialis	Long Tailed Grass Warber	+	-	-	-	-	B	LC	

**=Migratory, A+O = Agriculture + Orchards, R/R.V/G.B = Railway/Road Verges/Green, R/C.B = River/Canal Bank, R+O = Residential+Offices, P = Ponds, AC = abundance class, LC=Least concern, VU=Vulnerable, NE=Not evaluated, NT = Near Threatened, A=very common, B= common & wide spread, C= less common, D= Uncommon, E = Rare*

Reptile and Amphibian survey

These field surveys were carried out to locate species and their habitats within the study area. The morning surveys were conducted in the bright day light and evening surveys of the same place were also carried out. List of the species is shown in table 8 and figures 8 and 9.

Bird species were more abundant along the river/canal banks, agricultural fields and orchards. Most common species were Passer domesticus, Corvus splendens, Acridotheres tristis, Egretta intermedia, and Dicrurus macrocersus vieillot. Wild boars and jackals were reported from the study area. Mostly small size mammals which included porcupines, rat and bat species were there. Mammals were mostly found in where thick vegetation cover was present along the canal banks, roadsides and agriculture fields. Among the reptiles, Varanus bengalensis, Bungarus caeruleus, Xenochrophis piscator, Calotes versicolor and Hemidactylus flaviviridisetc were common. Eight species of snakes and two species of turtles are reported. According to the IUCN red list of threatened species, Echis carinatus is vulnerable and Pangshura smithii is near threatened so they need to be protected. Only three Amphibian species were found in the study area. Among them, Hoplobatrachus tigrinus and Bufo stomaticus were very common. None of the species of birds, mammals and amphibians were found rare in the IUCN lists.

Table 2 . 8 List of Reptile and Amphibian species recorded within the project area

Animal Species	Common name	Habitats					AC	IUCN status	Punjab Wildlife Act	CITES
		A+O	R/R. V/GB	R+O	R. / C. B	P				
Reptiles										
Bungarus caeruleus	Indian crate	+	-	-	+	+	A	LC		
Amphiesma stolatum	buff striped keelback	-	-	-	+	+	C	NE	✓	
Lycodon aulicus	Indian wolf snake	+	+	-	-	-	C	NE	✓	
Ptyas mucosa	Oriental/Indian rat snake	-	+	+	-	-	D	NE	✓	II
Typhlops porrectus	Slender Worm Snake, blind	+	-	+	-	-	E	NE		
Eryx johnii	Indian sand boa (do-muha)	+	+	-	-	-	C	NE		
Xenochrophis piscator	Checkered keelback	-	-	-	+	+	A	NE	✓	III
Echis carinatus	Saw-scaled viper	+	-	-	-	-	E	V		
Varanus bengalensis	Indian monitor lizard	+	+	+	+	+	A	LC	✓	I
Calotes versicolor	Oriental/Indian garden lizard	+	+	+	-	-	A	LC		
Hemidactylus flaviviridis	Yellow-bellied House Gecko	+	+	+	-	-	A	NE		
Ablepharus grayanus	Minor snake-eyed skink	+	+	+	-	-	B	NE		
Eutropis macularia	Bronze grass skink	+	+	-	-	-	C	NE		
Pangshura smithii	Brown roofed turtle	-	-	-	+	-	E	NT		II
Lissemys punctata Adersoni	Indian flapshell turtle	-	-	-	+	+	B	LC	✓	II
Amphibians										
Hoplobatrachus tigrinus	Indian bull frog	+	+	+	+	-	A	LC		
Bufo stomaticus	Indus toad	+	+	+	+	+	A	LC		
Euphlyctis cyanophlyctis	Indian skipper frog	-	-	-	+	-	C	LC		

=Migratory, A+O = Agriculture + Orchards, R/R.V/G.B = Railway/Road Verges/Green, R/C.B = River/Canal Bank, R+O = Residential+Offices, P = Ponds, AC = abundance class, LC=Least concern, VU=Vulnerable, NE=Not evaluated, NT = Near Threatened, A=very common, B= common & wide spread, C= less common, D= Uncommon, E = Rare

Fish survey

Fish surveys were carried-out in the main channel of river Ravi and river Sutlej using monofilaments nylon gills net. These nets were deployed at different sites on 0.5 m depth from the surface for 30 minutes to one hour during the vegetation survey in nearby community. Fishermen were also interviewed to collect information on the fish present in the rivers. The list of the species present in the two rivers is given in Table 9

Table 2 . 9 List of fish species found in the rivers of the project area

Scientific Names	Common Names	IUCN status
Catla catla	Thaila/Indian carp	LC
Channa marulius	Saul	LC
Channa punctate	Daula	LC
Cirrhinus mrigala	Mori	LC
Ctenopharyngodon idella †	Grass carp	NE
Cyprinus carpio†*	Common carp/Gulfam	VU
Hypopthalmichthys molitrix †	Silver carp	NT
Hypophthalmichthys nobilis †	Big head carp	DD
Labeo rohita	Rohu	LC
Macrognathus pancalus	Groj	LC
*Oreochromis aureus**	Tilapia	NE
Rita rita	Khagga/Tirkanda	LC
Sperata sarwari	Singharee	LC
Wallago attu	Mullee	NT
LC=Least concern, VU=Vulnerable, NT=Near threatened, DD= Data deficient, NE= Not evaluated, * = invasive, † exotic		

In the current study 14 species were found to be present in river Ravi and Sutlej. Among the fish species found grass carp (Ctenopharyngodon idella), bighead carp (Hypophthalmichthys nobilis), silver carp (Hypophthalmichthys molitrix), common carp (Cyprinus carpio) and tilapia (Oreochromis aureus) are exotic that were introduced into freshwater reservoirs of Pakistan for aquaculture, sport fishing or biological control of weeds. But now these species are competing with native species for food, breeding grounds and are preying upon them thus causing a decline in their population. These exotic species are becoming invasive in the freshwater biomes of the Punjab and other provinces of Pakistan by reason of their potent reproductive potential and feeding competitions with the native freshwater fish fauna. Resultantly

the native fish species viz; Channa marulius, Wallago attu, Rita rita, Sperata sarwari, Catla catla, Cirrhinus mrigala and Labeo rohita, which are of economic value are reported to be under threat (Khan et al. 2008, 2011). IUCN threat status of the species showed that Hypopthalmichthys molitrix is near threatened and Cyprinus carpio is vulnerable but both species are introduced and not native to this area and the later one is an invasive exotic.


Egretta intermedia


Corvus splendens


Merops orientalis

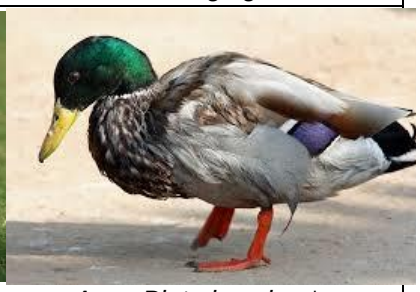

Streptopelia tranquebarica


Pyconotus cafer


Acridotheres ginginianus


Acridotheres tristis


Bubulcus ibis


*Anas Platyrhynchos**


Passer domesticus


*Upopa epops**


*Gallinula chloropus**



Dicrurus macrocersus vieillot



*Hoplopterus indicus**



Francolinnus francolinus

*=Migratory birds, Source: Avibase- the world bird database www.avibase.bsc-eoc.org/avibase.jsp, Data Zone www.birdlife.org/datazone

Figure 2 . 1 Birds of study area



Ceryle rudis



Halcyon smyrnensis



Motacilla alba



Callacanthis burtoni



Treron phoenicoptera



Gracupica contra



Milvus migrans migrans



*Merops philippinus**



Cinnyris asiaticus



Psittacula krameri



Saxicoloides fulicata



Spilopelia senegalensis


Columba livia


*Actitis hypoleucos**


Dinopium benghalense


Saxicola caprata


Coracias benghalensis


Accipiter badius


Petronia xanthocollis


*Hirundo rustica**


Lanius schach


*Anas crecca**


Centropus sinensis


*Coturnix coturnix**


Amaurornis phoenicurus


Galerida cristata


*Egretta garzetta**



Streptopelia capicola



Turdoides caudate



Ardeola grayii

*=Migratory birds, Source: Avibase- the world bird database www.avibase.bsc-eoc.org/avibase.jsp, Data Zone www.birdlife.org/datazone

Figure 2 . 2 Birds of Study Area



*Himantopus himantopus**



Phalacrocorax niger



Eremopterix grisea



Orthotomus sutorius



Egretta alba



Anthus novaeseelandiae



Ploceus philippinus



Aquila rapax nepalensis



Dendrocopos assimilis



Copsychus saularis



Francolinus pondicerianus



Tephrodornis pondicerianus

		
Zosterops palpebrosus	*Otus bakkamoena*	*Pycnonotus leucogenys*

*=Migratory birds, Source: Avibase- the world bird database www.avibase.bsc-eoc.org/avibase.jsp, Data Zone www.birdlife.org/datazone

Figure 2 . 3 Birds of study area

		
Alcedo atthis	*Turdoides caudatus*	*Chrysomma sinense*
		
Cisticola juncidis	*Lanius vittatus*	*Passer pyrrhonotus*
		
Prinia gracilis	*Lanius excubitor*	*Chrysomma altirostre*



Prinia socialis

*=Migratory birds, Source: Avibase- the world bird database www.avibase.bsc-eoc.org/avibase.jsp, Data Zone www.birdlife.org/datazone

Figure 2 . 4 Birds of Study Area



Rattus rattus



Megaderma lyra



Herpestes mungo



Golunda elliota



Funambulus pennantii



Sus scrofa



Millardia meltada



Hystrix indica



Canis aureus



Mus musculus



Lepus nigricollis



Suncus murinus



Felis chaus

Source: The IUCN Red list of threatened species www.iucnredlist.org

Figure 2 . 5 Mammals of Study Area



Bungarus caeruleus



Eryx johnii



Hemidactylus flaviviridis



Amphiesma stolatum



Xenochrophis piscator



Ablepharus grayanus



Lycodon aulicus



Echis carinatus



Eutropis macularia



Ptyas mucosa



Varanus bengalensis



Pangshura smithii



Typhlops porrectus



Calotes versicolor



Lissemys punctata Adersoni

Source: The IUCN Red list of threatened species www.iucnredlist.org

Figure 2 . 6 Reptiles of Study Area



Hoplobatrachus tigerinus



Bufo stomaticus



Euphlyctis cyanophlyctis

Data Source: The IUCN Red list of threatened species www.iucnredlist.org, http://amphibiaweb.org/species/4703 , and http://eol.org/

Figure 2 . 7 Amphibians od Study Area

2.1.3. Protection status of all Animals found in the area

After evaluating habitats and developing inventory of fauna species, status of protection was evaluated for the species of mammals, amphibians, reptiles and birds according to the criteria described.

Following is the detail of mammals in the study area those are evaluated on their distribution, protection status and rarity (Table 10).

Table 2 . 10 Status of Mammals Species recorded within the Study Area

Criteria	Remarks
Protection Status	*Herpestes mungo* and *Felis Chaus* are protected under Punjab Wildlife Act.
Distribution	*Rattus rattus, Funambulus pennantii, Mus musculus* and *Suncus murinus* are very common. 7 species are common in the study area. *Lepus nigricollis* and *Canis aureus* are less common and uncommon, respectively. There are no endemic species.
Rarity	None of them are threatened according to IUCN red data list.

The detail of amphibian species evaluated on the basis of their distribution, protection status and rarity is given in table 11.

Table 2 . 11 Status of Amphibian Species recorded within the Study Area

Criteria	Remarks
Protection Status	None of the species are particularly protected.
Distribution	2 species are very common (*Hoplobatrachus tigrinus* and *Bufo stomaticus*), 1 species (*Euphlyctis cyanophlyctis*) is common and wide spread. There are no endemic species.
Rarity	None of them are rare locally or are threatened according to IUCN red data list.

In case of reptiles, the details of their distribution, protection status and rarity are listed in table 12.

Table 2 . 12 Status of Reptile Species recorded within the Study Area

Criteria	Remarks
Protection Status	*Amphiesma stolatum, Lycodon aulicus, Ptyas mucosa* and *Xenochrophis piscator* are protected under Punjab Wildlife Act Schedule Three. *Varanus bengalensis* and *Lissmeys punctata adersoni* are also protected under this wildlife act. These two species are also recorded in CITES Appendix list I and II respectively. *Pangshura smithii* is listed only in CITES Appendix II.
Distribution	5 species are very common in the study area. *Ablepharus grayanus* and *Lissemys Punctata* are common and wide spread. 4 species are less common and only 1 species (*Pytas mucosa*) is uncommon.

	Othter 3 species knowns as *Typhlops porrectus, Echis carinatus*, and *Pangshura smithii* are rare. There are no endemic species present in this area.
Rarity	*Echis carinatus* and *Pangshura smithii* are graded as vulnerable and near threatened, respectively on IUCN Red List of threatened species.

The distribution, protection status and rarity of birds evaluated in the study area is provided in Table 13.

Table 2 . 13 Status of Birds Species recorded within the Study Area

Criteria	Remarks
Protection Status	*Egretta Intermedia, Streptopelia tranquebarica, Bubulcus ibis, Anas platyrhynchos, Milvus migrans migrans, Amaurornis phoenicurus, Ardeola grayii, Egretta garzetta* and *Egretta alba* are listed in Punjab Wildlife Act Schedule III. *Francolinus francolinus* and *Francolinus pondicerianus* are present under Schedule I. *Himantopus himantopus* is protected under UNEP's Agreement on the Conservation of African-Eurasian Migratory Water birds of 'Convention on migratory species'
Distribution	6 species are very common, 10 species are common and widespread, 14 species are less common, 18 are uncommon species. Remaining are rare. There is no endemic species in this area.
Rarity	Only one species *Chrysomma altirostre* is vulnerable according to IUCN red data list.

2.2. Assessment of Ecological Impacts from the planning of new Development in the project area

This section of the report deals with the impacts on ecological resources of project area. The above identified habitats, species and other resources can have potential impacts from proposed master plan. Evaluation of these impacts has been carried-out for planning, implementation, construction and operation phases of the proposed Master Plan. To reveal the potential impacts on resources, visits were carried-out in the area in addition vigorous literature surveys were conducted to compile this section. Keeping legislations and guidelines in consideration and researching literature, the potential impacts on the ecological resources due to the planning in the project area have been identified as follows

2.2.1. Implementation and construction impacts

2.2.1.1. Permanent loss of agricultural land/orchards

As in the planning of many sites, orchards and agriculture land will be totally converted into residential and other areas which will result in loss of some important habitats along with affecting food production. Agriculture is backbone to the Punjab plains and the current project will have strong impact on agricultural productivity and loss of livelihood opportunities of rural communities. Around 100,000 Acres of agricultural land will be effected due change in land use with implementation of master plan. Direct loss of productive capacity, the successive land conversions that have taken place in the past has also negatively influenced the flora and fauna of proposed area. These externalities were generally reported to have taken several forms which imposed additional burdens on existing farming conditions.

2.2.1.2. Removal of native vegetation and habitat loss

During implementation and construction of the project, many habitats will be totally diminished e.g. many agricultural fields. There will be removal of native vegetation and loss of habitat for the native animal species. There will be more fragmentation in the natural habitats due to extensive road network in the area.

2.2.1.3. Effects of land conversion on rural communities

The migration of a large proportion of non-farming population has generally reduced the overall profitability of farming by restricting certain farming operations. This will lead to a reduction in farm net income, Great loss of agricultural lands for built surfaces not only affects the population food balance, but also changes the lifestyle of rural population used to an agricultural one, causing their migration to the city or changing the economic activities profile. Overall loss of biodiversity and agricultural production as a consequence to the insertion of built spaces. Most important impact to mention will be the loss of livelihood opportunities for the local people, land owners, shop keepers etc. due to changes in land use pattern and agricultural dependent families.

2.2.1.4. Habitat damage

Due to the construction in the project site, direct, indirect or temporary damages will occur from site excavation and clearance, spoils in other habitat. Transportation during construction process will also destroy wilderness of the area. Most of the agricultural land will be damaged due to construction in the sites especially Kasur and Nankana's agricultural land.

2.2.1.5. Wildlife disturbance and Noise pollution

Wilderness is a trait of wild areas which are far from the urban areas. Urban areas display lots of population, roads traffic, congestion, sounds of machines, etc. Due to construction and development in this area, human disturbance to ecosystems will be highest to the wild animals and birds especially. The severity of this disturbance totally depends upon duration of activity in the site, intensity and frequency. Many mammals and birds can be more disturbed by presence of workers, loud noises and operational construction plants.

2.2.1.6. Soil erosion

Due to excavation and site clearance, soil will be exposed and eroded. As a result of this soil erosion, there will be more soil deposition with runoff in canals and riverbeds which will cause siltation and sedimentation. Aquatic life can face stress from the high turbidity of suspended soil particles which will reduce light penetration. Furthermore a higher eutrophication can deplete dissolve oxygen of the water bodies providing more stress to fish and other aquatic macrophytes.

2.2.2. Operational impacts

2.2.2.1. Impacts of urban development on biodiversity

Research published by the Royal Society shows that cities retain only 8% of the native bird species and 25% of the plant species of comparable undeveloped land (Aronson et al. 2014). As supported by the published literature, broadly three things can affect urban biodiversity in the project area:

- the quality, amount, and patch size of conserved open space;
- how open space and nearby built areas are managed; and

- the degree of open space connectivity.

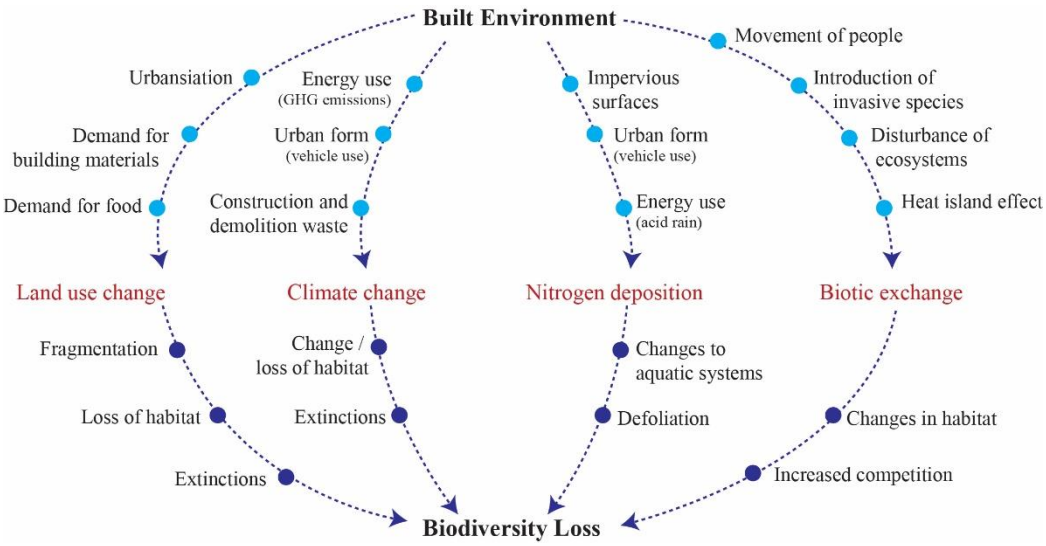


Figure 2 . 8 Impacts of Urban Development on Biodiversity

The growth of cities may cause biodiversity to decline by fragmenting or destroying large areas of natural habitat on which many species depend. The rising human population is driving the expansion of urban areas and increasing the demand for natural resources such as timber and fossil fuels. This inevitably leads to habitat destruction which has been called “the largest factor contributing to the current global extinction event as shown in Figure-10.

2.2.2.2. Change in land use pattern

Educational, commercial and Institutional offices are proposed as residential areas which will bring an overall change in land use pattern. The environmental and social consequences of the traffic bottlenecks arising from the land use complication as a result of heavy commercialization and business activities in the area. It should be noted that effective solution to traffic problems in the area cannot be found in a strait jacket application of a particular solution but a combination of efforts. These will result in the loss of wilderness of many habitats.

2.2.2.3. Habitat degradation due to higher pollutants

Water pollution

Urbanization has adverse impacts on the air and water quality, as well as climatic conditions of the region. This poses a risk to the health of local community.

Development of more industrial units in area will result in serious water pollution in the region.

Noise pollution due to urbanization

Due to the development in the area, urban life will create big burden on natural resources. Human interruption in form of business centers and residential colonies etc. will degrade naturalness of the wild. Therefore more noise pollution will result.

Light pollution

Another important operational impact of the project on wildlife will be from lights in urban areas. Wild animals are used to conditions of wild that is low noise, low lights and naturalness. With this mega development in the area, and lots of lights from urban, residential, commercial and transportation pressure, many wild animals will be forced to leave their wild sites.

Air pollution

Increase in the settlement is directly linked with increase in vehicles and more fuel combustion. Vehicles are mobile source of pollution and fuel combustion in stationary sources, including residential, commercial, and industrial heating and cooling also release air pollutants. Air pollutants and particulates can penetrate deep into lungs and have adverse health effects along with affecting the biological diversity.

2.2.2.4. Habitat Fragmentation

Closely related to habitat loss is habitat fragmentation which can be defined as the transformation of a large and continuous habitat into many smaller, isolated habitats. The expansion of cities causes the fragmentation of large areas of natural habitat through the construction of roads, houses and industry. The project will simply increase fragmentation in different habitats due to change in land-use pattern.

2.2.2.5. Bird Collisions and strikes

There are special problems posed for birds living in or flying through cities. Research has documented that buildings and windows are the top killer of wild birds. Between one and five percent of the total migratory population die in window crashes annually (Klem, 2009). Building collisions pose further risk to endangered or threatened

species whose populations are already declining due to habitat loss, toxin loads, and other severe environmental pressures. Collision hazards include vehicles, bridges, transmission towers, power lines, and turbines, but the majority of avian deaths and injuries occur from impacts with building components such as transparent or reflective glass. Night-time lighting also interferes with avian migrations.

2.2.2.6. Change in groundwater recharge capacity

Construction closer to irrigation channels, rivers and canals affects the transport of water and sediment, so that the local hydrological equilibrium will be upset, and the effects spread through the community, causing a general ecological transition. Groundwater recharge capacity will be affected by making buildings, constructing roads and other concrete and paved structures.

2.2.3. Social Impacts of urban growth due to new development and planning

Impacts of urban growth due to new development and planning are summarized in table 14

Table 2 . 14 Impacts of urban growth due to new development and planning

Parameters	Positive effects	Negative effects
Economic production	Will be enhanced by new development in many sectors	Agricultural productivity will be reduced but few areas can be still utilized for this purpose
Population growth	Today, a majority of the world's population lives in cities. By 2050, two-thirds of all people on the planet are projected to call urbanized areas their home. in such case new areas are needed to reduce pressure on already existing mega cites	Planning of the area will reduce negative impacts of urban population growth.
Pressure on megacities	There is already much pressure on resources and life of mega cities like Lahore, in this particular case, nearby cities' development will reduce pressure and will shift a big population back to their own cities.	Keeping future growth in mind, this will have more positive impact than negative.
Livelihood	It will provide many livelihood	-

opportunities	opportunities in their regions for which people are travelling to mega cities on daily basis.	
Employment	Will increase employment chances for population of Lahore city	More employment will be generated in Sheikhupura, Nankana and Kasur cities.
Security	New housing societies will have improved security system	With an implementation of this master plan, all three cities will be urbanized which will cause people of the surrounding villages to move into these areas for better job, education and healthcare facilities. This may increase security risks in the area.
Environmental scenario	Planned development makes more room for green spaces--trees, parks and yards--which help minimize both air and water pollution.	Unplanned growth poses higher impact on natural resources. Therefore, when these areas will be developed
Lifestyle	Will be improved	-
Services Transportation Education Healthcare Sewer & water system	New development will provide better services of infrastructure; better transport system in form of wider concrete roads, better educational and healthcare services, better water, and sewerage system in new housing	-
Attract tourist	It attract more tourist activities	-
Land and property value	It will raise land and property value of nearby society as well	-
Touch of global feel	Such improvements provide a global feel to the citizens	-
Triggers secondary development	It will enhance secondary development in the region	It should be planned as well.

2.3. Mitigation Measures to lessen the impacts of development

The mitigation priorities for the project are avoidance or minimization, restoration and compensation. The aims of providing mitigation measures are to provide environmentally friendly options which can minimize the losses

2.3.1. Impact avoiding/ minimizing

First measure to reduce the impacts of construction and operation of the project, are in form of avoiding and minimizing the impacts.

2.3.1.1. Minimizing biodiversity loss by developing Green Infrastructure

It is supported by literature that to enhance biodiversity of an area sustainable use of region's resources is needed as shown in Figure 11. There is a need to develop good green infrastructure in the urban areas to minimize biodiversity loss. It is noted that design is important both for the conserved areas and the landscape matrix surrounding the conserved areas must be managed appropriately. Any green infrastructure can dramatically lose its biological integrity over time due to lack of appropriate management for both built and conserved lands therefore all development should be carried-out keeping in view importance of green spaces and linked biodiversity.

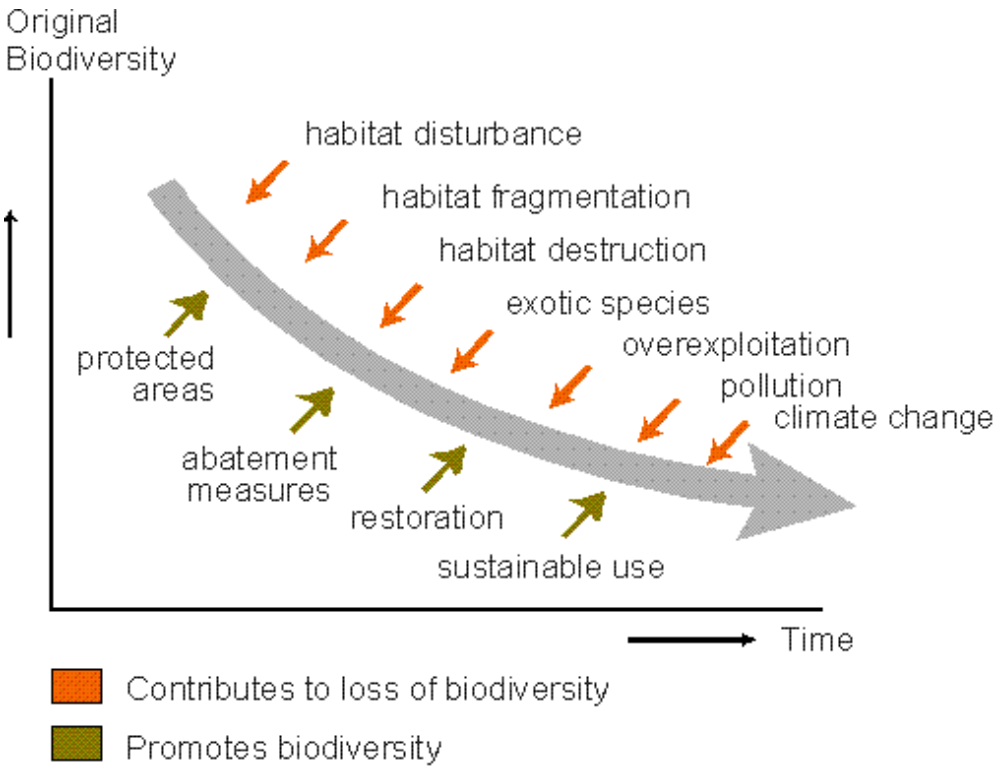


Figure 2 . 9 Pattern of Biodiversity loss and gain (Source: UNEP Global Environment 1997)

2.3.1.2. Green Infrastructure (GI)

Green Infrastructure is 'a network of multi-functional green space, urban and rural, which is capable of delivering a wide range of environmental and quality of life

benefits for local communities'(Department for Communities and Local Government (2012) National Planning Policy Framework (http://www.communities.gov.uk/documents/planningandbuilding/pdf/2116950.pdf).

Green space is taken to include rivers, standing waters, coastal waters and estuaries.

Types of GI include

- Natural and semi-natural rural and urban green spaces, including woodland, grassland, running water bodies and community forests.
- Urban parks and gardens, private gardens and institutional grounds e.g. school or college ground.
- Amenity green spaces – informal recreation spaces, play areas, outdoor sports facilities, housing green spaces, domestic gardens, community gardens, roof gardens, village greens, commons, living roofs and walls, hedges, civic spaces, and highway trees and verges.
- Urban farms, orchards, and suburban and rural farmlands.
- Graveyards and shrines.
- Green corridors – rivers and canals (including their banks), road verges and rail embankments.
- Archaeological, historic and biologically protected sites.
- Built structures in the urban areas like green roofs and walls.



Figure 2 . 10 Examples of green urban infrastructure



(a) Canal water and bank



(b) Graveyard



(c) Railroad verges



(d) Agricultural fields and private plantations



(e) Roadside vegetation (f) Guava Orchard

Figure 2 . 11 Examples of some of the green infrastructures present at the study site

2.3.1.3. Avoiding dumping of dredged spoil in other ecological habitats adjacent to the site:

During construction and developmental phases of the project, the dredged spoil will be created. It should be avoided to dump such spoil in closer habitats. As excess material will degrade other habitats too.

2.3.1.4. Protection of other habitats with fences and barriers:

During construction phase, a fence should be used as a barrier to protect vegetation in closer area as well as agricultural land as much as possible. So that such habitats and their wildlife remain undisturbed.

2.3.1.5. Minimization of barging disturbance to wildlife:

Noise and disturbance may increase while barging spoil and would have effects on birds. Although this impact arising from spoil barging will not be significant, the following mitigation measures should be adopted to protect birds against excessive noise and disturbance:

- the construction workers on the barge should avoid making sudden loud noises or disturbing birds
- barging of more spoil should be scheduled in the summer to avoid the migratory period of birds in winter as far as possible.

2.3.2. Restoration and Compensation

Secondly restoration and compensation are mitigation measures to be followed if impacts are to be minimized. Restoration can be important measure in this project to value ecological resources of the area and restoring the degraded habitats is the best option available. Whereas Compensation in this project refers to rehabilitation of lost or used habitat in favorable condition. *Restoration of native vegetation on Railroad and Roadside verges and river and canal banks*

Railroad and roadside verges are considered as wastelands and are always underutilized. During the construction phase of the project many trees will be cut down. Unfortunately the native thorn forest tree species (*Salvadora oleoides, Prosopis cineraria, Tamarix aphylla* and *Capparis decidua*) have been totally removed from the area due to land clearance for agricultural purposes. Moreover riparian vegetation (*Dalbergia sisso, Tamarix aphylla, Acacia nilotica* and *Populus euphratica*) have also suffered a significant decline and some of the reasons are habitat loss, overexploitation and preference for fast growing exotic species like *Eucalyptus.* It is therefore strongly recommended to revegetate railroad and roadside verges with thorn forest species and river and canal banks with native riparian species to compensate for the loss of trees and to provide biodiversity habitat to wild animal species. This will provide compensation to the lost habitat and species.

2.3.2.1. Trees Plantation close to schools and hospitals

It will compensate for the lost trees and will also reduce Noise pollution in these sensitive urban areas.

2.3.2.2. Identification and conservation of areas important for priority animal species

There is a need to take the help of the experts for the identification and selection of areas for the conservation of native animal species that are locally of internationally threatened. This includes habitats of many reptiles and bird species including migratory birds.

2.3.2.3. Strategic planning for nature conservation through the restoration of ecological networks

For reversing habitat and species decline it is important to maintain and improve ecological connectivity between different habitat patches of a landscape. There is a need to plan for the establishment of resilient 'ecological networks' through which movement of biota and materials can take place.

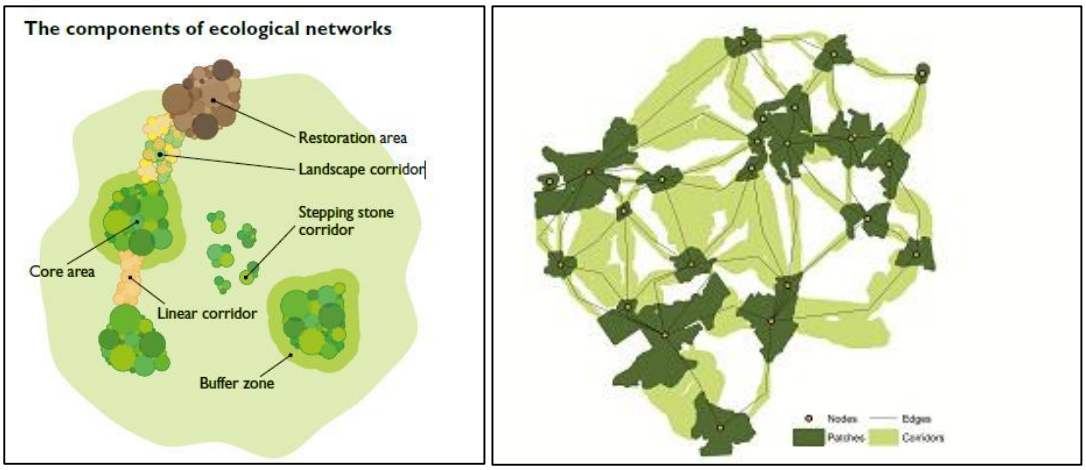


Figure 2 . 12 The components of ecological networks (Town & Country Planning Association 2012)

Figure 14 shows hypothesized ecological networks where green corridor can be defined as, 'an area of significant green space (100 m2 or greater) with a maximum separation of 100 metres'(http://www.betterbuildingspartnership.co.uk/ecological-master-plan-london) and stepping stones as, 'areas of land that provide stop over points in transit between core areas'. Core areas are, 'existing areas, features, or resources of importance for biodiversity, often made up of existing designated sites' (http://www.planvu.co.uk/mdc/written/cpt6.htm).

2.3.2.4. Urban agriculture and kitchen gardening

Urban agriculture or urban farming is the practice of cultivating, processing, and distributing food in or around a village, town, or city. Urban agriculture can also involve animal husbandry, aquaculture, agroforestry, urban beekeeping, and horticulture. In the developing countries, food security, nutrition, and income generation are key motivations for the practice. Direct access to fresh vegetables, fruits, and meat products through urban agriculture can improve food security and food safety and can in part compensate for the loss of agricultural land. But this is

only possible when receiving formal institutional support, becoming integrated into local town planning.



Figure 2 . 13 Urban agriculture and kitchen gardening

2.3.3. Conclusion and Recommendations

It is therefore concluded that development in this area will have less impacts on the ecological resources of the area if the following recommendations will be considered during planning and implementation phases of the project

2.3.3.1. Use of native species

The removal of native species from urban areas and their replacement with non-native species drastically alters the composition of urban biological communities. The ecology of cities is therefore very different from the surrounding undeveloped areas and is dominated by exotic ornamental species. It is therefore important to promote use native plant species in urban landscaping.

2.3.3.2. EIA of all new developments

It is strongly recommended that every developmental activity in this region e.g. a housing scheme or industry should conduct prior environmental impact assessment of the proposal including its effects on local biodiversity and ecosystems.

2.3.3.3. Groundwater recharge

There should be ground water recharge zones in the area to save the aquifer depletion due to large scale construction of concrete structures. These areas should be kept pollution free to avoid contamination of the ground water.

2.3.3.4. Rain water harvesting

Rain water harvesting should be adopted by the locals in the new development plan to avoid water shortages and further sustainable use of water resources. It is a technique of collection and storage of rainwater into natural reservoirs or tanks, or the infiltration of surface water into subsurface aquifers (before it is lost as surface runoff). One method of rainwater harvesting is rooftop harvesting.

2.3.3.5. Pollution control by following NEQS

Industry in the area shall strictly follow the NEQS to avoid air and water pollutions that can affect the local biota and degrade both aquatic and terrestrial ecosystems.

2.3.3.6. Solid waste management

Increased urbanization is associated with increased solid waste generation. Solid waste generated from the residential areas should be segregated at source and properly recycled and disposed.

2.3.3.7. Wastewater treatment plants

Industrial effluents and domestic sewage shall be treated before releasing into aquatic water bodies to ensure healthy aquatic ecosystems. For this purpose wastewater treatment plants are required to be installed.

2.3.3.8. Urban agriculture and kitchen gardening

Major loss by the implementation of this master plan in the proposed study area is that of agricultural land that will negatively impact food supply and can result in high prices of food items from being supplied from distant places. This loss can just only in part compensated by promoting urban agriculture and kitchen gardening. But this will has to be incorporated in the developmental policy of the proposed project at the planning stage.

2.3.3.9. Farm mechanization for increased agricultural productivity

It is highly recommended that for the compensation of the lost agricultural land there is a need to increase agricultural production by using modern technology and seeds of high yielding crop varieties. Farmers in the area shall be provided assistance in getting loans for the purchase of farm machinery and seeds.

2.3.3.10. Tunnel Farming

Tunnel farming is a low-tech, but highly unconventional vegetable growing technique that started in the early 2000s in Pakistan. Currently, it is centered in the districts of Arifwala, Vehari and Mailsi in central Punjab with little emerging pockets in Faisalabad, Jhang, Multan and Rahim Yar Khan. According to estimates of the Punjab Agricultural Department, there are more than 200,000 acres of tunnel farms in Punjab and the trend is growing. A very high urbanization rate in Pakistan keeps creating greater demand for vegetables in the urban centers. Tunnel farmers routinely achieve an astonishing 500% yield over conventional farmers. Surprisingly, it's not done by using exotic seeds or fertilizers. Instead, tunnel farmers adopt low-tech methods. The vegetables from tunnel farms arrive two to three months earlier than the same varieties grown conventionally in the open. Off-season arrival ensures that the farmers command higher prices and get economic benefits.

2.3.3.11. Green roofs and walls

Living roofs and walls are other options to adopt which are important components of the sustainable urban design. The roof gardens provide beautiful and pleasant environment to live and work, to help improve air quality, especially in populated areas. Green roofs of buildings perform the important functions of trapping dust, producing oxygen and providing cooling affect in the hot summer months leading to energy conservation. They also provide habitat for the urban biological diversity and are one of the ways to ensure food security.

2.3.3.12. Policy Framework for green infrastructure (GI)

Following is the suggested policy framework for developing green infrastructure in an urban context (Town & Country Planning Association 2012).

- Strategic planning of green infrastructure for the provision of a comprehensive and integrated network
- Green infrastructure should be planned using up-to date and sound ecological evidence regarding green infrastructure.
- Wherever possible green infrastructure shall be designed to provide multiple functions, e.g. biodiversity, amenity and other social benefits can be derived

from public parks. An ecosystem-approach shall be applied to get multi-functionality of green infrastructure.

- Green infrastructure needs to be central to the development's design and must reflect and enhance the area's locally distinctive character. They must be integrated in the design of the development including gardens, open spaces in the built environment.
- Green infrastructure should contribute to biodiversity gain by safeguarding, enhancing, restoring, and creating wildlife habitats and by integrating biodiversity into the built environment. GI should be designed to reduce isolation and fragmentation by increasing connectivity and assuring movement of biota and materials across different habitat patches in a landscape.
- GI needs to include accessible spaces and facilitate physically active travel. GI within a development should include attractive, engaging and safe outdoor spaces which meet a variety of social, health and well-being needs for local people, including contact with nature, recreation, education, active travel (including walking and cycling), water management, landscape amenity, and temperature regulation
- Planning of the green infrastructure is required to be integrated with other policy initiatives like groundwater recharge and rainwater harvesting etc.

2.3.3.13. Biotope/ habitat opportunity mapping and making ecological action plans for individual cities.

Biodiversity and green infrastructure opportunity mapping using high resolution satellite images, aerial photographs and finding ground realities with the help of wildlife experts could feature as part of the Local Plan. Opportunity mapping uses data on existing biodiversity interests, coupled with information about land use, topology, soils, hydrology and other physical parameters to identify areas where appropriate management can lead to the restoration or creation of new wildlife-rich areas, as well as enhancing land or townscape characters. This will help in developing ecological action plans for individual cities for mitigating biodiversity loss. City ecological action plan shall have following objectives (Table 15).

Table 2 . 15 Objectives of city ecological action plan

Category	Objective
Native vegetation	• Protect, expand and improve condition of naturally occurring native vegetation, including possible remnants. • Use of marginal land like railway embankments and road verges for the restoration of native vegetation and identification and maintenance of sites that are in good condition (figure 16).
Fauna	• Identification, protection and enhancement of the sites that provide habitat for priority fauna species. • Steps should be taken to increase the distribution and abundance of priority fauna species across the landscape.
Habitat connectivity	• Improve habitat connectivity across the landscape, particularly between priority sites, and between identified adjacent habitat areas.



Figure 2 . 14 Railroad and roadside vegetation provides excellent corridors for the movement of biota and increase connectivity among landscape patches

2.3.3.14. Disturbance to migratory species

Due to the construction and development in the area, many migratory birds of the area will be disturbed or maybe they leave this site to visit in the future. It is therefore important to avoid or reduce construction activities during that time of the year in particular areas so as not to disturb their right-of-way. A list of birds along with their migratory season is given in table 16

Table 2 . 16 Detail of migratory birds in the project area shown in table below

Scientific names	Common names	Migration season	Months
Upupa epops	Hoopoe	Winter	Oct-Feb
Anas Platyrhynchos	Mallard	Winter	Nov-Feb

Gallinula chloropus	Common moorhen	Winter	Sept-May
Merops philippinus	Blue tailed bee eater	Summer	March-Sept
Actitis hypoleucos	Common Sand piper	Winter	Aug-Mar
Anas crecca	Common teal	Winter	Nov-Mar
Hirundo rustica	Common swallow	Winter	Oct-Mar
Coturnix coturnix	Common Quail	Winter	Sep-Mar
Egretta garzetta	little egret	Winter	Oct-May
Himantopus himantopus	Black winged stilt	Winter	Oct-Mar
Phalacrocorax niger	Cormorant	Winter	Nov – March
Egretta alba	Large Egretta	winter	Dec – April
Cisticola juncidis	Fan-tail Warbler	Winter	Nov – Feb
Lanius vittatus	Bay-backed Shrike	Winter	Dec – Feb
Lanius schach	long tailed shrike	Winter	Nov- March
Lanius excubitor	Great Grey Shrike	Summer	April – July
Alcedo atthis	Common Kingfisher	Winter	Oct – Feb

2.3.3.15. Habitat and species conservation

Habitats and species of conservation value shall be protected that include many reptile and bird species. It is therefore important to set aside areas that act as their breeding grounds or nesting habitats. It is strongly recommended that areas along both banks of River Ravi and River Sutlej shall be acquired and declared as buffer zones to protect the native wildlife from human onslaughts and disturbance. In this regard help can be taken from experts of Wildlife Department and WWF-P.

2.3.3.16. Avoiding bird collision and strikes

To avoid bird collisions following measures can be taken

- Bird-safe glazing treatments should be included like fritting, netting, permanent stencils, frosted glass, exterior screens, physical grids placed on the exterior of glazing or UV patterns visible to birds.
- Awareness campaigns for developers, architects, planners, property owners, businesses, residents and youth groups should be arranged.

- Interior plants should be moved from the window so as not to be visible from the outside to the birds.
- Consider limiting nighttime building use by combining motion operated light sensors with daytime cleaning services. This combination will reduce light pollution and increase energy conservation.
- Where interior lighting is used at night, window coverings should be closed to block light transmission adequately.
- Consider seasonal migration needs. Unneeded interior and exterior lighting should be turned off from dusk to dawn during this period.

2.3.3.17. Restoration of native vegetation

Native species restoration should be carried out to enhance biodiversity and conservation in the area. In this regard help can be taken from Restoration Ecology Research Group of Sustainable Development Study Centre, GC University Lahore

2.3.3.18. Reducing the effects of light pollution on biological diversity

Following are some of the recommendations for reducing effects of light pollution (Florida Fish and Wildlife Conservation Commission http://myfwc.com/conservation/you-conserve/lighting/pollution/, IDA (International Dark Sky association) Practical Guide: PG1 Introduction to light pollution (www.darksky.org)

- Keeping the light LOW (mounting the fixture as low as possible).
- Lower the wattage of all outdoor lighting—both municipal and private. Over lighting reduces the eye's ability to see outside of the lit area. In addition, excess light can produce glare, which also reduces visibility. Selecting the correct lamp wattage increases safety and reduces costs.
- Place motion sensors on essential outdoor lamps. Lighting on demand trumps a manual switch or timer. Motion sensitive switches light walkways when need.
- SHIELDED (fully shielding the light so bulbs and/or glowing lenses are not visible) cuts down on the amount of glare and light visible to the animals, so

that there is less opportunity for them to get trapped, repelled, or have their day/night patterns altered.

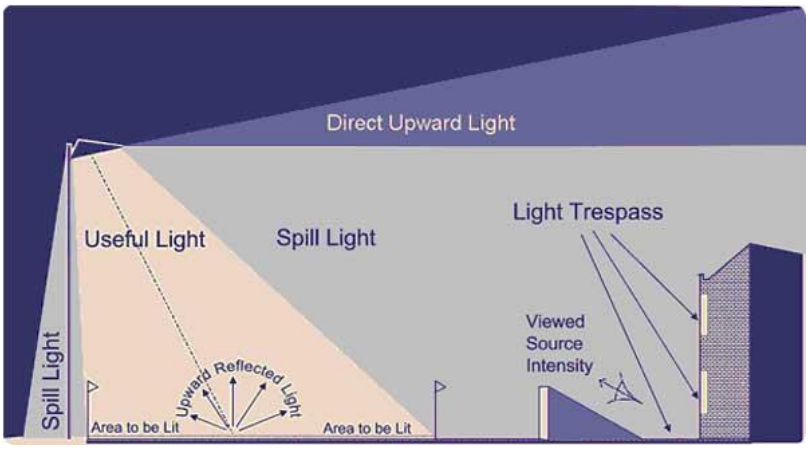


Figure 2 . 15 Useful and other types of light from a light source
http://www.askaboutireland.ie/enfo/irelands-environment/noise/light/

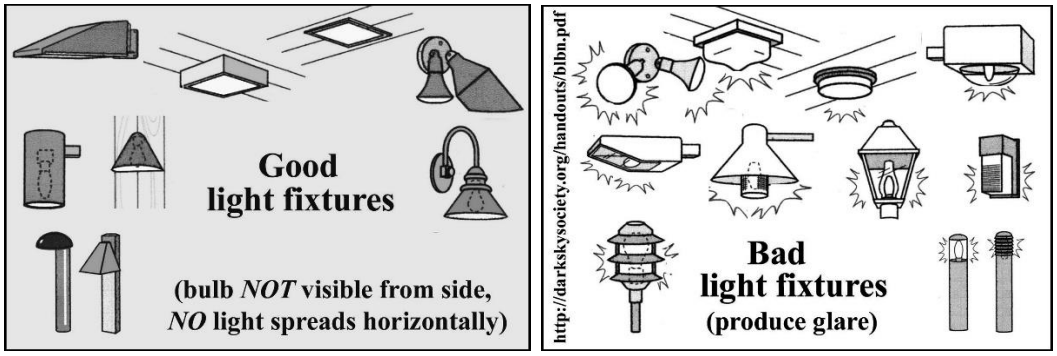


Figure 2 . 16 Fixtures that enhance and reduce light pollution (Source: http://victoria.rasc.ca/night-lighting/)

- Keeping it LONG wavelength (ambers and reds) actually makes the light that is visible seem dimmer to nocturnal animals that primarily use rod vision. Some long wavelength light sources such as low pressure sodium lights and amber and red LEDs use a fraction of the energy of their mercury halide, incandescent and even fluorescent counterparts and cut down greenhouse gas emissions.
- Closing curtains at night to keep indoor light in, especially in a multi-storied building will prevent bird crashes

2.3.3.19. Reducing ecological footprint

Following are the recommendations to reduce ecological footprint:

- Development of mass transit system will cut down carbon emissions.

- Energy efficient buildings and building codes should be introduced in the urban construction to reduce energy use by heating and cooling.
- Vegetation restoration and enhancement to capture and fix carbon dioxide.
- Street and other lights in the public areas should be on solar energy.
- Use of alternative energy resources will reduce ecological footprint.
- Setting aside areas for agriculture in the project for urban agriculture and vegetables production to meet the needs of the local residents will reduce ecological foot print.

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APPENDICES

Appendix – I

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA

Appendices I	Appendices II	Appendices III
Pterocnemia pennata (Except *Pterocnemia pennata pennata* which is included in Appendix II)	***Pterocnemia pennata pennata*** ***Rhea americana***	
SPHENISCIFORMES		
Spheniscidae Penguins		
Spheniscus humboldti	***Spheniscus demersus***	
STRIGIFORMES Owls		
	STRIGIFORMES spp. (Except the species included in Appendix I)	
Strigidae Owls		
Heteroglaux blewitti ***Mimizuku gurneyi*** ***Ninox natalis*** ***Ninox novaeseelandiae undulata***		
Tytonidae Barn owls		
Tyto soumagnei		
Sauromalus varius		
Lacertidae Lizards		
Gallotia simonyi	***Podarcis lilfordi*** ***Podarcis pityusensis***	
Scincidae Skinks		
	Corucia zebrata	
Teiidae Caiman lizards, tegu lizards		
	Crocodilurus amazonicus ***Dracaena* spp.** ***Tupinambis* spp.**	
Varanidae Monitor lizards		
Varanus bengalensis ***Varanus flavescens*** ***Varanus griseus*** ***Varanus komodoensis*** ***Varanus nebulosus***	***Varanus* spp.** (Except the species included in Appendix I)	
Xenosauridae Chinese crocodile lizard		

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I	Appendices II	III
	Elachistodon westermanni ***Ptyas mucosus***	***Xenochrophis piscator*** (India)
Elapidae Cobras, coral snakes		
	Hoplocephalus bungaroides ***Naja atra*** ***Naja kaouthia*** ***Naja mandalayensis*** ***Naja naja*** ***Naja oxiana*** ***Naja philippinensis*** ***Naja sagittifera*** ***Naja samarensis*** ***Naja siamensis*** ***Naja sputatrix*** ***Naja sumatrana*** ***Ophiophagus hannah***	***Micrurus diastema*** (Honduras) ***Micrurus nigrocinctus*** (Honduras)
Melanochelys tricarinata ***Morenia ocellata*** ***Pangshura tecta***	***Notochelys platynota*** ***Orlitia borneensis*** ***Pangshura*** **spp.** (Except the species included in Appendix I) ***Siebenrockiella crassicollis*** ***Siebenrockiella leytensis***	***Ocadia glyphistoma*** (China) ***Ocadia philippeni*** (China) ***Sacalia bealei*** (China) ***Sacalia pseudocellata*** (China) ***Sacalia quadriocellata*** (China)
Platysternidae Big-headed turtle		
	Platysternon megacephalum	
Podocnemididae Afro-American side-necked turtles		
	Erymnochelys madagascariensis ***Peltocephalus dumerilianus*** ***Podocnemis*** **spp.**	

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Trionychidae Softshell turtles, terrapins		
Apalone spinifera atra ***Aspideretes gangeticus*** ***Aspideretes hurum*** ***Aspideretes nigricans***	***Amyda cartilaginea*** ***Chitra* spp.** ***Lissemys punctata*** ***Lissemys scutata*** ***Pelochelys* spp.**	 ***Palea steindachneri*** (China) ***Pelodiscus axenaria*** (China) ***Pelodiscus maackii*** (China) ***Pelodiscus parviformis*** (China) ***Rafetus swinhoei*** (China)

Appendix – II

THE PUNJAB WILDLIFE (PROTECTION, PRESERVATION, CONSERVATION AND MANAGEMENT) (AMENDMENT) ACT, 2007

FIRST SCHEDULE

See Section 2(d)

PART - 1

Wild birds and animals which may be hunted on an ordinary shooting licence.

A – BIRDS

Name of species	Bag limit or number allowed per gun	Time and season when hunting permitted
Category one		
1. All the ducks within the family anatidae, including the tree ducks, diving ducks, surface feeding ducks except those ducks listed under the Third Schedule as protected or listed hereunder in the First Schedule.	Not more than ten ducks of all species per day.	1st October to 31st March on Saturday & Sunday
Category Three		1st October to 1st March
Snipes, Plovers, Waders and allied Waterfowl		
4. Fantail Snipe *(Capella gallinage)*	Eight only per day	Ditto
5. Jack Snipe, (*Capella minima)*	-do-	Ditto
6. Purple moor hen, *(Porphyrio porphyrio)*	Two only per day	Ditto
7. Moor hen, *(Gallinu chloropus)*	Four only per day	Ditto
8. Coot, *(Fulica atra)*	Twelve only per day	Ditto
9. Red wattled lapwing (*Vanellus indicus)*	Two only per day	Ditto
10. White Tailed Lapwing, (*Vanelus leucurus)*	Two only per day	Ditto
11. Grey plover or black bellied plover	Two only per day	Ditto

Category Four

Pheasianids

20.	See See (*Ammoperdix griseogularis)*	Not more than five per day	15th November to 15 February on Sunday only
21.	Black partridge (*Francolinus francolinus)*	Not more than six per day	-do-
22.	Grey partridge (*Francolinus pondicerianus)*	-do-	-do-
23.	Common quail, (*Conturnix coturnix)*	Fifty only per day	15th August to 15th April
24.	Black Breasted or Rain Quail (*Coturnix coromandelica)*	Not more than six per day	1st August to 30th September

Category Five

Pigeons and doves

25.	Blue rock pigeon, Columba livia	Ten only per day	1st October to 1st March
26.	Common ring dove, (*Streptopelia decaocto)*	Six only per day	-do-

Category Five

Pigeons and doves

25.	Blue rock pigeon, Columba livia	Ten only per day	1st October to 1st March
26.	Common ring dove, (*Streptopelia decaocto)*	Six only per day	-do-

27.	Rufous turtle dove, (*Streptopelia orientalis)*	Ten only per day	-do-
28.	Little brown dove or Senegal dove, (*Streptopelia senegalensis)*	Six only per day	1st October to 1st March
29.	Long tailed persian dove (*Strepterelia turtur arenicola)*	-do-	1st October to 1st March

33(i)	Psittacidae *(Parakeets)* (excluding Rose Ringed Parakeet)	Three birds per day except Alexandrine Parakeet	1st August to 31st January
33 (ii)	Cuculidae *(Cuckoos)*	Three birds per day	1st August to 31st January
Category Seven			
Birds of Prey			
34	Hawks	Three birds per day	1st November to 1st March
35	Buzzards	-do-	-do-
36	Harriers	-do-	-do-
37	Falcons	-do-	1st September to 31st December
38	Lugger Falcon	-do-	15th June to 15th December
38 (i)	Strigidae *(Owls)*	-do-	1st August to 31st January
Category Eight			
39.	House Sparrow *(Passor domesticus)*	No limit	1st August to end of February
40.	Estrilidae *(Munias)* (excluded)	-	-
41	Plocidae *(Bayas, Weaver bird)* (excluded)	-	-
42	Sturnidae *(Mynas)*	Three birds per day	1st August to 31st January
43	Motacillidae *(Wagtails)*	-do-	-do-
44	Timaliidae *(Babblers)*	-do-	-do-
45	Sylvidae *(Warblers)*	-do-	-do-
46	Pycnonotidae *(Bulbuls)*	-do-	-do-
47	Phipiduridae *(Fly catchers)*	-do-	-do-

Third Schedule

Category Six

Egrets and herons

26. All Egrets, Herons, Night herons and Bitterns of the family *Ardeidae* including Purple heron *(Ardea purpurea)* Chestnut bittern *(Ixobrychus cinnamomeus)* and Common Bittern *(Botaurus stellaris)*, Cattle egret *(Bubulcus ibis)* and Large egret *(Egretta alba)*

Category Seven

Storks

27. All storks of the family *Ciconiidae* including White stork *(Ciconia ciconia)*, White necked stork *(Ciconia episcopus)*, Black stork *(Ciconia nigra)* Black necked stork *(Ephippiorhynchus asiaticus)* and Painted stork *(Mycteria leucocephala)*.

Category Eleven

Plovers, Stone curlews, Waders, Water birds and Gallinules

32. Water rail (*Rallus aquaticus)*

33. White breasted water hen (*Amaurornis phoenicurus)*

34. Water cock (*Gallicrex cinerea)*

35. Pheasant tailed Jacana (*Hydrophasianus chirurgus)*

52. Wood pigeon (*Columba palumbus)*

53. Green pigeon (*Treron Phoenicoptera)*

54. Spotted Dove (*Streptopelia chinensis)*

55. Red turtle dove (*Streptopelia tranquebarica)*

Category Thirteen

Birds of Prey

56. Eagles, Vultures and Kites

Mammals

61. Leopard cat (*Felis benghalensis)*

62. Caracal (*Felis caracal)*

63. Desert cat (*Felis libyca)*

64. Jungle cat (*Felis chaus)*

65. Fishing cat (*Felis viverrina)*

66. Himalayan palm civet (*Paguma larvata)*

75. Small Indian mongoose (*Herpestes auropunctatus)*

76. Common Indian mongoose (*Herpestes mungo)*

77. Ruddy mongoose (*Herpestes smithi)*

C: REPTILES

85. All momitor lizards of the genus *Varanus* and Spiny tailed lizards of the genus *Uromastix*

86. All Snakes of the family *Colubridae* containing non-poisonous and beneficial snakes and the genus *Python*

87. All Crocodiles including Mugger, *Corcodilus palustris* and the fish eating crocodile or gavial *Gavialis gangeticus*

88. All Species of Order *Chelonia*

PLATES

Plate 1



A: Wastewater pond having aquatic species and grasses in a village near Muredke



B: Wastewater pond showing abundant growth of exotic *Eichhornia crassipes*

Plate 2



A : Wastewater pond having aquatic species and grasses



B: A brick kiln near Sultan Town Muredke

Plate 3



A: Master Plan of Lahore Division can help in better management of these areas.



B: Graveyards are part of green infrastructure that provide biodiversity habitat

Plate 4



A: Railroad verges can provide excellent sites for the restoration of native vegetation



B: *Calotropis, Suaeda* and grasses along a railway tract near Changa Manga

Plate 5



A: Railroad verges act as landscape corridors that allow the movement of biota across different habitat patches (near Pattoki)



B: Roadside verges act as landscape corridors that allow the movement of biota across different habitat patches (Faizpur)

Plate 6



A: Better planning is required to manage towns and villages in the study area



B: Wastelands in the urban areas provide biodiversity habitat

Plate 7



A: Potato fields around Shikhupura



A: Mustard fields around Shikhupura

Plate 8



A: Wheat and sugarcane are important crops in the study area



B: Agroforestry using bamboo plantation and seasonal vegetables and mustard

Plate 9



A: Mixed farming using potato crop and Bamboo and Eucalyptus plantations near Kasur



B: Trees in fields act as shelter belts and provide habitat to biodiversity

Plate 10



A: Native tree species like *Dalbergia sissoo* and Acacia nilotica are needed to be planted on a larger scale



B: Native vegetation on canal bank

Plate 11



A: *Eucalptus* plantation around Farooqabad canal



B: Vegetated banks of upper Gugera branch canal providing wildlife corridors

Plate 12



A: Natural vegetation is a source of livelihood for local people. *Ckick* making from *Saccharum* Near Farooqabad



B: *Polygonum sp.* growing in canal water

Plate 13



A: Guava and mango orchards



B: Exotic *Pistai* growing in River Sutlej

Plate 14



A: Along with providing fish rivers provide many services to local community (River Sutlej near Kasur)



B: Aesthetic appeal is one of the services provided by the rivers to people

Appendix-II

Environmental Monitoring Report

Environmental Monitoring Report

Lahore Division Master Plan



To

Harris Engineering and Management Consultants (HEMC)

by

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DISCLAIMER

This report is produced in compliance with the Client Request for M/S Harris Engineering and Management Consultants (HEMC) via letter No: HEMC/SEAL/LMP/ENV/01. The information contained in this report was collected and produced from site visit and monitoring data. The information supplied and contained in this report is, to the best of our knowledge, correct and up to date. Solution Environmental & Analytical Laboratory (SEAL) accepts no responsibility for changes made to this document by any third party once report is submitted to the client.

ABBREVIATIONS

AA:	Ambient Air
AM:	Angle Marker
APHA:	American Public Health Administration
BDL:	Below Detection Limit
CO_2:	Carbon Dioxide
CO:	Carbon Monoxide
DW:	Drinkingwater
EPA:	Environmental Protection Agency
GW:	Groundwater
MW:	Megawatt
NO:	Nitrogen Oxide
NO_2:	Nitrogen Dioxide
NOx:	Oxides of Nitrogen
NEQS:	National Environmental Quality Standards
NL:	Noise Level
NTDC:	National Transmission and Despatch Company
PEPA:	Pakistan Environmental Protection Act 1997
PM:	Particulate Matter
PID:	Photo Ionization Detector
SO_2:	Sulphur Dioxide
SOP:	Standard Operating Procedures
SEAL:	Solution Environmental & Analytical Laboratory
SW:	Surface water
T/L:	Transmission Lines
USEPA:	United states Environmental Protection Agency
VOC:	Volatile Organic Compounds
WHO:	World Health Organization
WW:	Wastewater

UNITS

m:	Meter
°C:	Degree Celsius
sec:	Seconds
ppm:	Parts per Million
mg/l:	Milligram per Litre
mg/Nm^3:	Milligram per Normal cubic meter
$\mu g/m^3$:	Microgram per cubic meter

CHAPTER - I

INTRODUCTION

1. Introduction

This section describes the project location and scope of services performed by SEAL.

1.1 Project Background

Lahore commands a strategic, political and administrative role as the capital of the Punjab Province and the second largest city of Pakistan. It is situated in the north eastern part of Pakistan with its center lying within 25 km of the international border with India and occupies a focal position in the Upper Indus Plain located along the left bank of River Ravi. The city has grown along the historic route linking central Asia with sub-continent. In terms of cultural, recreational, commercial, educational and health services, Lahore's area of influence is well beyond its metropolitan boundaries and extends deep into the province and the international sphere between 1951 and 1965 the population and built up area of the city increased two folds. The city continued to grow up and by 1998; Lahore was transformed into a metropolis with a population of about 5.18 million and a developed area of about 300 square km. At present the developed area has been increase up to 469 SQ KM with population almost 10 million. The prevailing master plan of Lahore Metropolitan Area was notified in the year 2004 for the period up to 2021. The study area, for the purpose of Integrated Master Plan of Lahore follows Lahore Metropolitan Area boundaries under the jurisdiction of LDA. The completion of different developmental projects and expansion of the city due to rapid urbanization has changed the overall character of the area. Moreover this IMP 2021 is only for the Lahore city. The situation in division due to rapid urbanization, the industries and residencies are growing without any plan. Therefore, considering the whole division as Project Area and available planning documents, as a single Plan Master Plan of Lahore Division is prepared by earmarking the existing and proposed areas for industrial, residential, special development zones and allied land uses. The project area map is shown in figure below-:

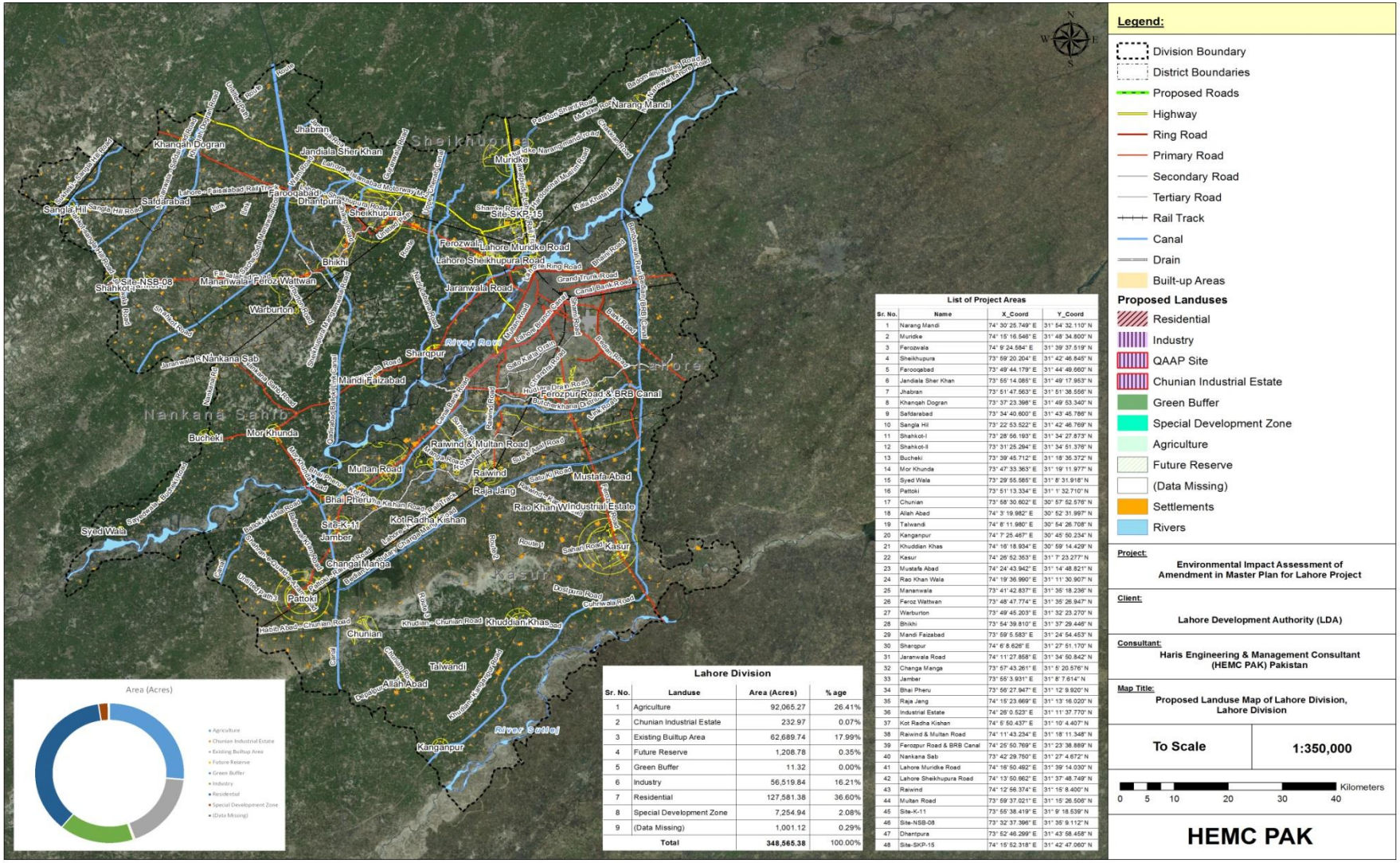


Figure 1-1: Proposed Project Area Map

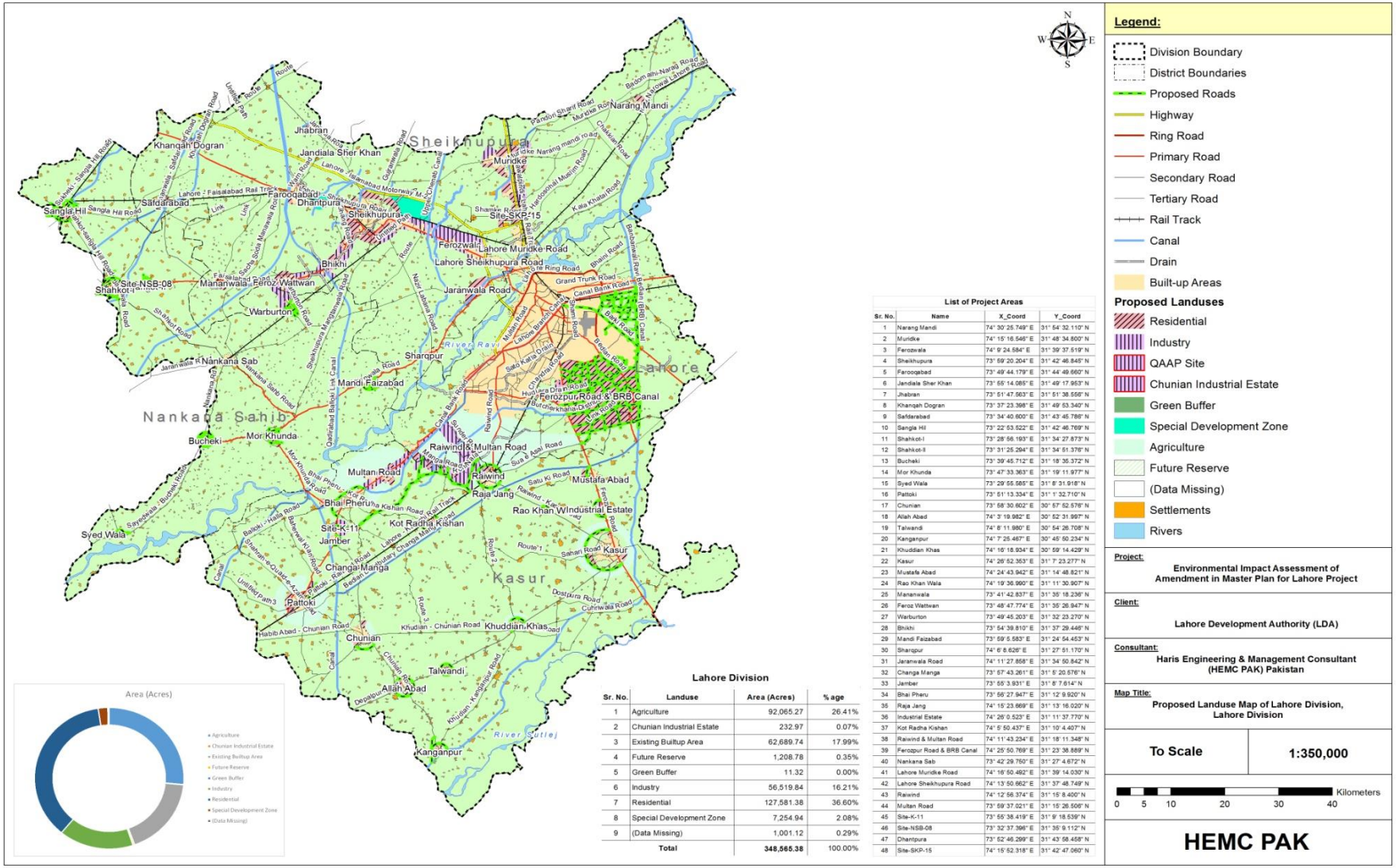


Figure 1-2: Project Area Map

Lahore Division is an administrative division of Punjab Province, Pakistan and called the third tier of government.Lahore statistical division contains the districts of Lahore, Nankana Sahib, Kasur, and Shekhupura.

1.2 Objectives

The objective of the study is to:

- Comply with the regulatory requirements of the project;
- Monitor air, water, and noise level in study area/survey area;

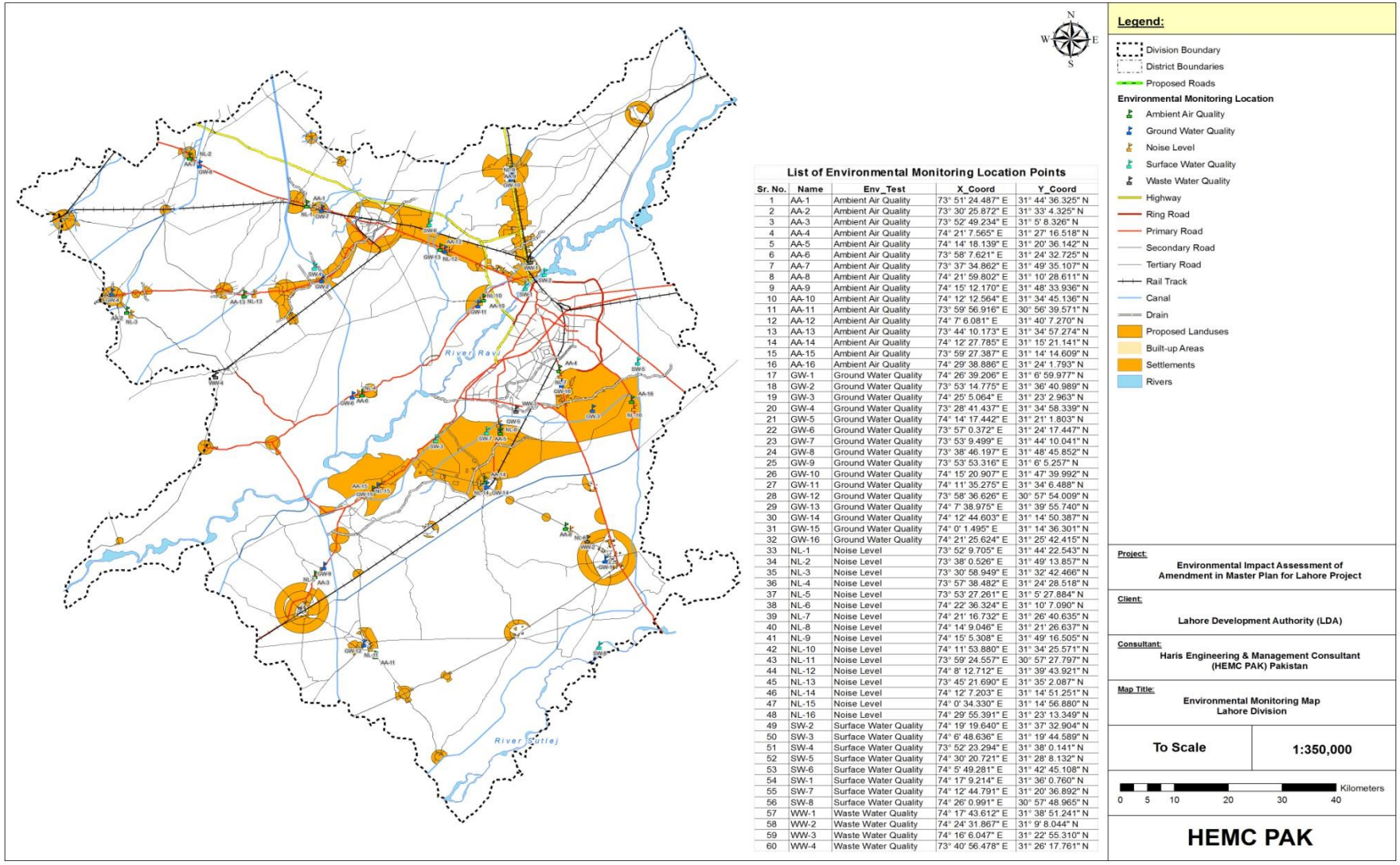
1.3 Scope of Services

The environmental monitoring was conducted at advised locations master plan for following environmental parameters.

- Noise Level Monitoring
- Ambient Air Quality Monitoring
- Water Quality Sampling and Analysis

1.4 Project Location

Locations for sampling and monitoring of required environmental parameters were identified by the HEMC representatives on master plan in 4 districts of Lahore division i.e. of Lahore, Nankana Sahib, Kasur, and Shekhupura. The sampling points of air, noise and waster sampling is shown in map below-:



List of Environmental Monitoring Location Points

Sr. No.	Name	Env_Test	X_Coord	Y_Coord
1	AA-1	Ambient Air Quality	73° 51' 24.487" E	31° 44' 36.325" N
2	AA-2	Ambient Air Quality	73° 30' 25.872" E	31° 33' 4.325" N
3	AA-3	Ambient Air Quality	73° 52' 49.234" E	31° 5' 8.326" N
4	AA-4	Ambient Air Quality	74° 21' 7.565" E	31° 27' 16.518" N
5	AA-5	Ambient Air Quality	74° 14' 18.139" E	31° 20' 36.142" N
6	AA-6	Ambient Air Quality	73° 58' 7.621" E	31° 24' 32.725" N
7	AA-7	Ambient Air Quality	73° 37' 34.862" E	31° 49' 35.107" N
8	AA-8	Ambient Air Quality	74° 21' 59.802" E	31° 10' 28.611" N
9	AA-9	Ambient Air Quality	74° 15' 12.170" E	31° 48' 33.936" N
10	AA-10	Ambient Air Quality	74° 12' 12.564" E	31° 34' 45.136" N
11	AA-11	Ambient Air Quality	73° 59' 56.916" E	30° 56' 39.571" N
12	AA-12	Ambient Air Quality	74° 7' 6.081" E	31° 40' 7.270" N
13	AA-13	Ambient Air Quality	73° 44' 10.173" E	31° 34' 57.274" N
14	AA-14	Ambient Air Quality	74° 12' 27.785" E	31° 15' 21.141" N
15	AA-15	Ambient Air Quality	73° 59' 27.387" E	31° 14' 14.609" N
16	AA-16	Ambient Air Quality	74° 29' 38.886" E	31° 24' 1.793" N
17	GW-1	Ground Water Quality	74° 26' 39.206" E	31° 6' 59.977" N
18	GW-2	Ground Water Quality	73° 53' 14.775" E	31° 36' 40.989" N
19	GW-3	Ground Water Quality	74° 25' 5.064" E	31° 23' 2.963" N
20	GW-4	Ground Water Quality	73° 28' 41.437" E	31° 34' 58.339" N
21	GW-5	Ground Water Quality	74° 14' 17.442" E	31° 21' 1.803" N
22	GW-6	Ground Water Quality	73° 57' 0.372" E	31° 24' 17.447" N
23	GW-7	Ground Water Quality	73° 53' 9.499" E	31° 44' 10.041" N
24	GW-8	Ground Water Quality	73° 38' 46.197" E	31° 48' 45.852" N
25	GW-9	Ground Water Quality	73° 53' 53.316" E	31° 6' 5.257" N
26	GW-10	Ground Water Quality	74° 15' 20.907" E	31° 47' 39.992" N
27	GW-11	Ground Water Quality	74° 11' 35.275" E	31° 34' 6.488" N
28	GW-12	Ground Water Quality	73° 58' 36.626" E	30° 57' 54.009" N
29	GW-13	Ground Water Quality	74° 7' 38.975" E	31° 39' 55.740" N
30	GW-14	Ground Water Quality	74° 12' 44.603" E	31° 14' 50.387" N
31	GW-15	Ground Water Quality	74° 0' 1.495" E	31° 14' 36.301" N
32	GW-16	Ground Water Quality	74° 21' 25.624" E	31° 25' 42.415" N
33	NL-1	Noise Level	73° 52' 9.705" E	31° 44' 22.543" N
34	NL-2	Noise Level	73° 38' 0.526" E	31° 49' 13.857" N
35	NL-3	Noise Level	73° 30' 58.949" E	31° 32' 42.466" N
36	NL-4	Noise Level	73° 57' 38.482" E	31° 24' 28.518" N
37	NL-5	Noise Level	73° 53' 27.261" E	31° 5' 27.884" N
38	NL-6	Noise Level	74° 22' 36.324" E	31° 10' 7.090" N
39	NL-7	Noise Level	74° 21' 16.732" E	31° 26' 40.635" N
40	NL-8	Noise Level	74° 14' 9.046" E	31° 21' 26.637" N
41	NL-9	Noise Level	74° 15' 5.308" E	31° 49' 16.505" N
42	NL-10	Noise Level	74° 11' 53.880" E	31° 34' 25.571" N
43	NL-11	Noise Level	73° 59' 24.557" E	30° 57' 27.797" N
44	NL-12	Noise Level	74° 8' 12.712" E	31° 39' 43.921" N
45	NL-13	Noise Level	73° 45' 21.690" E	31° 35' 2.087" N
46	NL-14	Noise Level	74° 12' 7.203" E	31° 14' 51.251" N
47	NL-15	Noise Level	74° 0' 34.330" E	31° 14' 56.880" N
48	NL-16	Noise Level	74° 29' 55.391" E	31° 23' 13.349" N
49	SW-2	Surface Water Quality	74° 19' 19.640" E	31° 37' 32.904" N
50	SW-3	Surface Water Quality	74° 6' 48.636" E	31° 19' 44.589" N
51	SW-4	Surface Water Quality	73° 52' 23.294" E	31° 38' 0.141" N
52	SW-5	Surface Water Quality	74° 30' 20.721" E	31° 28' 8.132" N
53	SW-6	Surface Water Quality	74° 5' 49.281" E	31° 42' 45.108" N
54	SW-1	Surface Water Quality	74° 17' 9.214" E	31° 36' 0.760" N
55	SW-7	Surface Water Quality	74° 12' 44.791" E	31° 20' 36.892" N
56	SW-8	Surface Water Quality	74° 26' 0.991" E	30° 57' 48.965" N
57	WW-1	Waste Water Quality	74° 17' 43.612" E	31° 38' 51.241" N
58	WW-2	Waste Water Quality	74° 24' 31.867" E	31° 9' 8.044" N
59	WW-3	Waste Water Quality	74° 16' 6.047" E	31° 22' 55.310" N
60	WW-4	Waste Water Quality	73° 40' 56.478" E	31° 26' 17.761" N

Figure 1-3: Monitoring Locations (Source: Monitoring Locations given by HEMC)

1.4.1 Ambient Air Quality Locations:

Following sites were selected ambient air on Master Plan:

Table 1-1: Location sites for Ambient Air Quality

Sr. No.	District	X Coordinate	Y Coordinate
AA 01	Sheikhopura	73°51’24.487’’E	31°44’36.325’’N
AA 02	Nankana sahib	73°30’25.872°E	31°33’4.325’’N
AA 03	Kasur	73°52’49.234’’E	31°5’8.326’’N
AA 04	Lahore	74°21’7.565’’E	31°27’16.518’’N
AA 05	Lahore	74°14’18.139’’E	31°20’36.142’’N
AA 06	Nankana sahib	73°58’7.621’’E	31°24’32.725’’N
AA 07	Sheikhopura	73°37’34.862’’E	31°49’35.107’’N
AA 08	Kasur	74°21’59.802’’E	31°1028.611’’N
AA 09	Sheikhopura	74°15’12.170’’E	31°48’33.968’’N
AA 10	Sheikhopura	74°12’12.564’’E	31°34’45.146’’N
AA 11	Sheikhopura	73°59’56.916’’E	30°56’39.571’’N
AA 12	Sheikhopura	74°7’6.081’’E	31°40’7.270’’N
AA 13	Sheikhopura	73°44’10.173’’E	31°34’57.274’’N
AA 14	Lahore	74°12’27.785’’E	31°15’21.141’’N
AA 15	Lahore	73°59’27.387’’E	31°14’14.609’’N
AA 16	Lahore	74°29’38.886’’E	31°241.793’’N

1.4.2 Noise Monitoring Locations

Following sites were selected noise monitoring for master plan of Lahore Division

Table 1-2: Location sites for Noise Monitoring

Sr. No	District	X Coordinate	Y Coordinate
NL 01	Sheikhopura	73°52’9.705’’E	31°44’22.543’’N
NL 02	Sheikhopura	73°38’0.526’’E	31°49’13.857’’N

NL 03	Nankana Sahib	73°30’58.949’’E	31°32’42.466’’N
NL 04	Nankana Sahib	73°57’38.482’’E	31°24’28.518’’N
NL 05	Kasur	73°53’27.261’’E	31°5’27.884’’N
NL 06	Lahore	74°22;36.324’’E	31°10’7.090’’N
NL 07	Lahore	74°21’16.732’’E	31°26’40.635’’N
NL 08	Kasur	74°14’9.046’’E	31°21’26.637’’N
NL 09	Sheikhopura	74°15’5.308’’E	31°49’16.505’’N
NL 10	Lahore	74°11’53.880’’E	31°34’25.571’’N
NL 11	Kasur	73°59’24.557’’E	30°57’27.797’’N
NL 12	Sheikhopura	74°8’12.712’’E	31°39’43.921’’N
NL 13	Sheikhopura	73°45’21.690’’E	31°35’2.087’’N
NL 14	Kasur	74°12’7.203’’E	31°14’51.251’’N
NL 15	Kasur	74°0’34.330’’E	31°14’56.880’’N
NL 16	Lahore	74°29’55.391’’E	31°23’13.349’’N

1.4.3 Surface water Sampling Locations

The sites selected for Surface water sampling were as follow:

Table 1-3: Location Sites for Surface water Sampling-Canal

Sr. No.	Water Channel	X Coordinate	Y Coordinate
SW 03	Lahore Branch Canal	74°6’48.636’’E	31°19’44.589’’N
SW 04	Qadirabad Abad Balloki Link Canal	73°52’23.294’’E	31°38’0.141’’N
SW 05	Lahore BRB Canal	74°30’20.721’’E	31°28’8.132’’N
SW 06	Upper Chenab Canal	74°5’49.281’’E	31°42’45.108’’N
SW 07	ButcherKhana Distributary	74°12’44.791’’E	31°20’36.892’’N

Table 1-4: Location Sites for Surface water Sampling- River

Sr. No.	River	X Coordinate	Y Coordinate
SW 01	Down Stream Of Ravi River	74°17'9.214''E	31°36'0.760''N
SW 02	Upper Stream Of Ravi River	74°19'19.640''E	31°37'32.904''N
SW 08	River Sutlej	74°26'0.991''E	30°57'48.965''N

1.4.4 Wastewater Sampling Locations

The sites selected for Wastewater sampling were as follows:

Table 1-5: Location Sites for Wastewater Sampling

Sr. No.	Location/Drainage Name	X Coordinate	Y Coordinate
WW 1	Near Sheikhupura (near RWP-LHR Rail track)	74°17'43.612''E	31°38'51.241''N
WW 2	Drain Near Kasur (near Raiwind Kasur Road)	72°24'31.867''E	31°9'8.044''N
WW 3	Hudyara Drain	74°16'6.047''E	31°22'55.310''N
WW 4	Nanakana Sahib (near Bucheki)	73°40'56.478''E	31°26'17.761''N

1.4.5 Groundwater Sampling Locations

Groundwater samples were collected from following sampling locations:

Table 1-6: Location sites for Groundwater Sampling

Sr. No.	District	X Coordinate	Y Coordinate
GW 01	Kasur	74°26'39.206''E	31d24'1.793''N
GW 02	Sheikhopura	73°53'14.775''E	31°36'40.989''N
GW 03	Lahore	74°25'5.064''E	31°23'2.963''N
GW 04	Nankana sahib	73°28'41.437''E	31°34'58.339''N
GW 05	Lahore	74°14'17.442''E	31°211.803''N
GW 06	Nankana sahib	73°57'0.372''E	31°24'17.447''N
GW 07	Sheikhopura	73°53'0.372''E	31°44'10.041''N
GW 08	Sheikhopura	73°38'46.197''E	31°48'45.852''N

GW 09	Kasur	73°53’53.316’’E	31°6’5.257’’N
GW 10	Sheikhopura	74°15’20.907’’E	31°47’39.992’’N
GW 11	Sheikhopura	74°11’35.275’’E	31°34’6.488’’N
GW 12	Kasur	73°58’36.626’’E	30°57’54.009’’N
GW 13	Sheikhopura	74°7’38.975’’E	31°39’55.740’’N
GW 14	Lahore	74°12’44.603’’E	31°14’50.387’’N
GW 15	Lahore	74°0’1.495’’E	31°13’36.301’’N
GW 16	Lahore	74°21’25.624’’E	31°25’42.415’’N

CHAPTER – II

METHODOLOGY

2. Methodology

Following is the brief description of methodology adopted for this environmental monitoring:

2.1 Survey Planning

The project started with a planning of project activities with a management of the HEMC.

2.1.1 Identification of Monitoring Locations

Locations for the sampling and monitoring of required environmental parameters were identified and finalized by the HEMC representatives in consultation with SEAL team. Following criterion was used to finalize the sampling locations:

- Area where there will be project activities;
- Present environmental conditions at the site.

2.1.2 Monitoring Plan

On the basis of identified sampling locations a monitoring plan was developed in order to achieve precision and accuracy in the monitoring and sampling of the required environmental parameters. The monitoring plan was developed in consultation with HEMC representatives. Plan of 7 days was formulated including travelling time. Project was started on Wednesday2-12-2015 and completed on Tuesday- 08-12-2015

2.2 Sampling and Analysis Methods

The sampling and testing methods are given in following sections of the report.

2.2.1 Ambient Air Quality Monitoring

Ambient air quality monitoring was conducted at advised sampling locations to assess the concentration of priority pollutants (Carbon monoxide, Oxides of Nitrogen (NO_x),Sulphur dioxide (SO_2), $PM_{2.5}$ and PM_{10}). Selection of sampling location was based on the environmental factors including wind direction on the particular day and amount of turbulence in the air etc. The sampling is conducted for the period of 24 hour.

Reference method used for the measurements are included as **Table 2.2** while the description is provided in subsequent sections.

Table 2-1: Methodology of Ambient Air Quality Monitoring

Air Pollutant	Monitoring Technique	Instrument Used	Reference Method	Measurement Range	Lowest Detection Limit	Sampling Duration
Carbon monoxide (CO)	Non Dispersive Infrared Absorption (NDIR)	HORIBA APNA 360 CO Analyzer	40 CFR Part 50, App. C (US-EPA)	0 – 100 ppm	0.02 ppm	24 hour
Sulfur Dioxide (SO_2)	UV fluorescence (UVF)	HORIBA APNA 360 SO_2 Analyzer	EQSA-0197-114 (US-EPA)	0-0.5 ppm	0.5 ppb	24 hour
Nitrogen Dioxide (NO_x)	Reduced Pressure Chemiluminescence (CLD)	HORIBA APNA 360 NO_x Analyzer	40 CFR Part 50, App F (US-EPA)	0-0.5 ppm	0.5 ppb	24 hour
Particulate Matter (PM_{10}) and $PM_{2.5}$	Integrated Sampling Technique	High Volume Air Sampler	40 CFR Part 50, App J (US-EPA)	0 – 1000 µg/m³	2 µg/m³	24 hour

2.2.1.1 Carbon monoxide (CO)



Carbon monoxide (CO) was monitored using HORIBA APNA 360 CO Analyzer. The APNA-360 CO analyzer measures CO concentration using a non-dispersive infrared absorption method that is based on the nature of CO in that it absorbs special infrared light. Measurement range of the analyzer is 0-100 ppm. Continuous data was recorded for duration of 24 hour

2.2.1.2 Oxides of Nitrogen (NOx)



Oxides of Nitrogen (NOx) was monitored using HORIBA APNA 360 NO_x Analyzer. The APNA-360 NOx analyzer measures NO,

$NO_2$and NOx using chemiluminescence (CLD) method with the help of chemical reaction between NO_2 and O_3. Measurement range of the analyzer is 0-0.5 ppm. Continuous data was recorded for period of 24 hr.

2.2.1.3 Sulphur dioxide (SO2)

SO_2Sulphur dioxide was monitored using HORIBA APNA 360 SO_2 Analyzer. The APNA-360 SO_2 analyzer measures SO_2 using UV fluorescence method that operates on the principle that when the SO_2 molecules contained in the sample gas are excited by ultraviolet radiation they emit a characteristic fluorescence in the range of 220- 240 nm. This fluorescence is measured and the SO_2 concentration is obtained from changes in the intensity of the fluorescence. Measurement range of the analyzer is 0-0.5 ppm. Continuous data was recorded for duration of 24 hrs



2.2.1.4 Particulate Matter (PM_{10} and $PM_{2.5}$)

Particulate matter concentration in terms of $PM_{10}$and $PM_{2.5}$ was monitored in the ambient air with the help of High Volume Air Sampler. Measurement range of the equipment is 2-1000 µg/m³ with lowest detection range of 2 µg/m³. $PM_{10}$and $PM_{2.5}$sampling was conducted for period of 24 hour at identified sampling locations with the help of fiberglass filters. The filters were properly stored and placed in the vacuum zipper bag in order to avoid moisture and transported to SEAL Laboratory for detection of PM_{10}.

2.2.1.5 Weather Station

A weather station was installed on each point measurement to assess the environmental parameters like Ambient Temperature, Relative Humidity, Wind Speed and direction and other weather conditions.



2.2.2 Noise Level

A noise level monitoring was conducted at identified locations using portable Digital Sound Meter (TM, 103). All noise monitoring was conducted in accordance with the guidance set out in BS 7445:2003. Measurements were made using Class 1 Integrating-Averaging Sound Level Meters as defined in IEC 61672:2003. Meters were calibrated and checked before and after each measurement period by using sound level calibrator.



2.2.3 Water

Following methodology was adopted for water sampling and analysis:

2.2.3.1 Sample Collection

The water samples were collected from identified sampling points. The sampling was carried out in accordance to the Standard Operating Procedures (SOP) based on the recognized methods of United State Environmental Protection Agency (USEPA), World Health Organization (WHO) and American Public Health Administration (APHA) for water sampling and analysis.

2.2.3.2 Measurement of Field Parameters

Parameters that quickly degrade after they are sampled must be tested in the field. Following parameters were measured in field that can significantly change during storage and transportation. These includes:-

- ✓ pH (Measured at site)
- ✓ Odor
- ✓ Color
- ✓ Clarity
- ✓ TDS
- ✓ Temperature
- ✓ DO (Dissolve Oxygen)

2.2.3.3 Preservation

Preservation is important in order to minimize the changes in the sample. The collected water samples were preserved in appropriate containers as per APHA Guidelines, the method of which is given as under-:

For COD, organics and nitrates sample is preserved below pH -2 by addition of sulphuric acid. For metals sample is preserved below pH-2 by adding nitric acid. For BOD and inorganic sample is stored below 4 ^{0}C.

2.2.3.4 Sample Identification and Chain of Custody

The collected samples were labeled and assigned a unique sample identification number, sampling date and time of collection to collected samples. All the relevant information (sample location, time of collection, sample identification, temperature, pH, collected by, preservation techniques etc) was recorded immediately on the Chain of Custody form signed by SEAL field Analyst.

2.2.3.5 Transportation

A shipping container (Ice box with eutectic cold packs instead of ice) with maintained temperature of 4° C ±5 °C was used for transporting the sample from the collection site to the environmental laboratory.

2.2.3.6 Parameters

Parameters provided in the scope of work for the testing include following:

- **Groundwater**

Drinkingwater samples were collected from identified sampling points. The collected samples were given to laboratory for analysis of following parameters:-

- ✓ pH (Measured at site)
- ✓ Temperature
- ✓ Color (Measured at site)
- ✓ Total Dissolved Solids (TDS) (Measured at site)
- ✓ Total Suspended Solids (TSS) (Measured at site)
- ✓ Taste and Odor (Measured at Site)
- ✓ Total Hardness
- ✓ Nitrate as NO_3
- ✓ Ammonia
- ✓ E-Coli
- ✓ Arsenic
- ✓ Turbidity
- ✓ Chlorides as Cl^-
- ✓ Fluoride as F^-
- ✓ Sulphate as SO_4^{2-}
- ✓ Iron as Fe^{3+}
- ✓ Sodium
- ✓ Iodine
- ✓ Zinc as Zn^{2+}
- ✓ Total Coliform

- **Surface & Wastewater**

Surface and wastewater samples were collected from identified sampling locations. Testing parameters for surface &Wastewater is given below:-

- ✓ pH (Measured at site)
- ✓ Temperature (Measured at site)
- ✓ Biochemical Oxygen Demand (BOD5)
- ✓ Chemical Oxygen Demand (COD)
- ✓ TSS
- ✓ TDS (Measured at site)
- ✓ Grease & Oil
- ✓ Phenolic Compound as Phenols
- ✓ Chloride as CI^-
- ✓ Fluoride as F^-
- ✓ Cyanide total as CN^-
- ✓ An-Ionic Detergents as MBAs
- ✓ Sulphate as SO_4^{2-}
- ✓ Sulphide as S^-
- ✓ Ammonia
- ✓ Pesticides
- ✓ Phosphorous
- ✓ Potassium
- ✓ Dissolve Oxygen (DO)
- ✓ Cadmium
- ✓ Chromium trivalent and hexavalent
- ✓ Copper
- ✓ Lead
- ✓ Mercury
- ✓ Selenium
- ✓ Nickel
- ✓ Sliver
- ✓ Total toxic metals
- ✓ Zinc
- ✓ Arsenic
- ✓ Barium
- ✓ Iron
- ✓ Manganese
- ✓ Boron
- ✓ Chlorine
- ✓ Nitrogen as Nutrient
- ✓ Turbidity

2.2.3.7 Methods of Analysis

Methods used for the testing of above mentioned parameters are included as **Table 2.3**

Table 2-2: Water Testing Methods

Sr.No.	Parameter	Method / Technique	Reference
1.	TDS	Conductivity Method, TDS meter	APHA 2510 B
2.	pH	By pH meter	APHA-4500 H^+ B
3.	TSS	Photometric	HACH Method 8165
4.	Temperature	Celsius thermometer	APHA-2550 B
5.	BOD5	Respirometric Method	HACH Method 10099
6.	COD	Dichromate Reactor Digestion	HACH Method 8000
7.	Taste and Odour	By Sensory	-
8.	Oil and Grease	Hexane Extractable Gravimetric Method	HACH Method 10056
9.	Phenolic Compounds as Phenols	4-Aminoantipyrine Method	HACH Method 8047
10.	Chloride Cl^-	Argentrometriy Titration	APHA 4500 Cl^- B
11.	Fluoride Fl^-	SPANDS Method	HACH Method 8209
12.	Arsenic Ar	Silver Diethyldithiocarbamate Method	HACH Method 8103
13.	Sulphate SO_4^{-2}	Sulpha Ver 4 Method	HACH Method 8051
14.	Sulfide S^-	Methylene Blue Method	HACH Method 8131
15.	Ammonia NH_3	Salicylate Method	HACH Method 8155
16.	Pesticides	Micro Extraction and Gas Chromatography	ASTM-D5175
17.	Total Hardness	EDTA Titration	APHA-2340 C
18.	Nitrate No_3^-	Cadmium Reduction Method	APHA-4500-NO_3 B
19.	Turbidity	Nephlometric Method	HACH Method 8219
20.	Iron as Fe^{+3}	Ferrozine Method	HACH Method 8147
21.	Sodium Na^+	Flame Emission Photometric	APHA-3500-Na-B
22.	Zinc as Zn^{+2}	Zincon Method	HACH Method 8009
23.	Cyanide as CN^-	Pyridine-Pyrazalone Method	HACH Method 8027
24.	An Ionic detergent as MBAs	Methylene Blue Active Substance (MBAS) method	APHA 5540 C
25.	Total Coli forms	Microbiology	APHA - 9222 B
26.	Faecal Coli forms (E.Coli)	Microbiology	APHA - 9222 D
27.	Cadmium Cd	Dithizone Method	HACH Method 8107
28.	Chromium Trivalent and Hexavalent	1,5 Diphenylcarbohydrazide Method	HACH Method 8023
29.	Copper Cu^{+2}	Porphyrin Method	HACH Method 8143
30.	Lead Pb^{+2}	Dithizone Method	HACH Method 8033
31.	Mercury Hg	Mercury Extraction Method	HACH Method 10066
32.	Selenium Se	Diaminobenzidine Method	HACH Method 8194
33.	Nickle Ni	1-(2 Pyridilazo)-2-Nephthol PAN Method	HACH Method 8150
34.	Silver Ag	Colorimetric Method	HACH Method 8120

Sr.No.	Parameter	Method / Technique	Reference
35.	Boron B	Carmine Method	HACH Method 8015
36.	Manganese Mn	PAN Method	HACH Method 8149
37.	Barium Ba	Turbidimetric Method	HACH Method 8014
38.	Phosphorous	Membrane Filter Method	APHA 4500 P
39.	Pottasium	Flame Emission Photometric	APHA 2340 B
40.	Dissolve Oxygen (DO)	Electrometric Method	APHA 4500-OA

Note: *APHA=American Public Health Association, ASTM = American Society for Testing and Materials*

CHAPTER – III

RESULTS AND DISCUSSION

3. Results and Discussion

This section of the report presents the testing results of Ambient Air (CO, NO_x, SO_2, PM_{10}, $PM_{2.5}$) Ambient Noise, Groundwater, Surface water and Wastewater monitoring and analysis. Ambient air monitoring were carried out at 16 different locations, Noise Level were monitored at 16 different locations whereas, Surface water sampling was carried out at 07 different locations, wastewater sampling was carried out 04 locations and ground water sampling was carried out at 16 different locations.

3.1 Ambient Air Quality

Concentration of CO, NO_x, SO_2, PM_{10} and $PM_{2.5}$were measured at 16 sampling locations in the project area to get an overview of the air quality. The results of measure concentration at each sampling location are given in **Tables** below.

Table 3-1: Ambient Air Quality Monitoring at Different Locations in Section I

Sr. No.	Coordinates	Location	Humidity	Wind speed	Temp	CO	NO_2	NO	NOx	SO_2	PM_{10}	$PM_{2.5}$
			%	m/sec	°C	mg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
Lahore												
AA 04	74°21'7.565"E 31°27'16.518"N	Ferozpur Road near Chungi	42.1	2.8	8.1	5.6	23.7	4.4	28.1	33.3	161	32
AA 05	74°14'18.139"E 31°20'36.142"N	Raiwind Road Near Lake City	40.1	2.9	9.2	5.1	22.2	4.3	26.5	32.1	240	37
AA 14	74°12'27.785"E 31°15'21.141"N	Sundar Road Raiwind	42.3	2.7	8.6	1.4	15.7	2.4	18.1	15.3	85	09
AA 16	74°29'38.886"E 31°241.793"N	Baddian Road near Hera Village	42.1	2.6	8.4	3.7	28.6	4.6	33.2	37.3	215	28
Sheikhupura												

AA 01	73°51'24.487"E 31°44'36.325"N	Sargodha Road near Farooqaabad	45.5	2.8	10.1	6.1	21.3	4.1	25.4	34.0	201	40
AA 07	73°37'34.862"E 31°49'35.107"N	Sargodha Road near Khanka Dogra	43.5	2.8	9.4	1.4	14.7	2.6	16.3	19.8	92.1	12
AA 09	74°15'12.170"E 31°48'33.968"N	GT Road near Mureedka	46.5	2.6	9.5	3.2	25.0	4.7	29.7	36.2	151	26
AA 10	74°12'12.564"E 31°34'45.146"N	Ranabhat near Jarranwala Road	42.3	2.7	8.7	1.7	13.7	1.6	15.3	17.4	86	14
AA 12	74°76.081"E 31°40'7.270"N	Sheikhupura Road near Tiba Rehan Khan	42.6	2.5	10.2	1.3	15.3	2.6	17.9	18.3	89	11
AA 13	73°44'10.173"E 31°34'57.274"N	Faisalabad Road near Marawal Village	45.9	2.8	9.2	1.2	14.8	2.6	17.4	16.5	90	13
Kasur												
AA 03	73°52'49.234"E 31°5'8.326"N	Nai Abbadi Near Multan Road	44.7	2.5	8.2	1.1	14.6	1.8	16.4	18.5	78	11
AA 08	74°21'59.802"E 31°1028.611"N	Raiwind Near Kasur Road	46.7	3.1	9.3	5.3	24.6	4.4	28.9	35.1	187	33

AA 11	73°59'56.916"E 30°56'39.571"N		41.5	2.6	8.3	1.6	14.2	1.3	15.5	17.4	93	12
AA 15	73°59'27.387"E 31°14'14.609"N	Village Ganai Chamba Near Multan Road	48.3	2.6	9.7	1.0	13.2	2.2	15.4	09.3	68	10
Nankana Sab												
AA 02	73°30'25.872°E 31°33'4.325"N	Village IslamKot near Nankana Sab Road	43.2	2.7	8.4	1.3	15.3	2.1	17.4	21.4	81	13
AA 06	73°58'7.621"E 31°24'32.725"N	Jarranwal Road Near QB Cannal	44.7	3.0	8.9	4.6	23.4	3.7	27.1	31.5	196	31
PAK NEQs						**10**	**80**	**40**	**-**	**120**	**150**	**35**

The results show that the ambient air quality on all the measured location is within NEQS except Particulate Matter which is higher on road sides. The CO is also litter bit higher on road sides in comparison with clean ambient air for which CO level should be less than 2.0 ppm.

3.2 Noise

The noise levels were determined at the identified locations. Results vary in noise levels from 45.1 to 80.4 dBA. Wind speed was also measured on same locations. The results of the noise measurement are presented below.

Table 3-2: Noise Monitoring at Different Locations in Section II

Sr. No	Locations	Coordinates	Wind Speed m/s	Average Noise Level d BA
Lahore				
NL 7	Chungi Near Ferozpur Road	74°21'16.732''E 31°26'40.635''N	2.8	69.8
NL 8	Raiwind Road near orai umra	74°14'9.046''E 31°21'26.637''N	3.1	73.1
NL 14	Manga Road Raiwind	74°12'7.203''E 31°14'51.251''N	2.7	63.7
NL 16	Baddian Road Near BRB Canal	74°29'55.391''E 31°23'13.349''N	2.6	71.9
Kasur				
NL 5	Nai Abbadi Near Multan Road	73°53'27.261''E 31°5'27.884''N	2.9	61.4
NL 6	Raiwind Kasur Road	74°22;36.324''E 31°10'7.090''N	3.0	73.6
NL 11	Chunnian	73°59'24.557''E 30°57'27.797''N	2.6	64.2
NL 15	Multan Road near Dinnanat	74°0'34.330''E 31°14'56.880''N	2.6	72.6
Sheikhupura				
NL1	Sargodha Road near Jhang	73°52'9.705''E 31°44'22.543''N	2.8	72.4
NL 2	Khanka Dogra	73°38'0.526''E 31°49'13.857''N	2.7	61.7
NL 9	GT Road Near Rakka	74°15'5.308''E 31°49'16.505''N	2.6	72.6
NL 10	Jarranwala Road near Burj Attari	74°11'53.880''E 31°34'25.571''N	2.7	74.0
NL 12	Sheikhupura Road near Tiba Rehmat Khan	74°8'12.712''E 31°39'43.921''N	2.5	73.8
NL 13	Faisalabad Road near Marawal	73°45'21.690''E 31°35'2.087''N	2.8	75.1
Nankana Sab				
NL3	Village Kullanwala	73°30'58.949''E 31°32'42.466''N	2.5	62.4
NL 4	Near QB Canal	73°57'38.482''E 31°24'28.518''N	2.8	59.5
NEQS				65 dB A

The result shows that the measured noise levels on are higher than NEQS on road sides.

3.3 Water Sampling

Surface, waste and Groundwater samples were collected from identified locations on study area. The result and discussion is given in following sections:

3.3.1 Groundwater

Thirteen Groundwater samples were taken from different district locations that fall within the master plan. 20 Parameters were analyzed; the results are presented in below **Tables**

Table 3-3: Groundwater Sampling at Different Locations (Lahore)

Sr. No.	Parameter	Unit	WHO Standards	Location			
				GW-03	GW-05	GW-14	GW-16
				Near Village Alha	Near Lake City	Sundar Road near Raiwind	Near Pak Arab,Ferozpur Road
				74°25'5.064"E 31°23'2.963"N	74°14'17.442"E 31°211.803"N	74°12'44.603"E 31°14'50.387"N	74°21'25.624"E 31°25'42.415"N
1	pH	-	6.5-8.5	7.4	7.1	7.9	7.7
2	Temperature	^{0}C	-	18	19	21	19
3	Color	TCU	15	0	0	0	0
4	Total Dissolved Solids (TDS)	mg/l	1000	1080	1302	1212	1405
5	Total Suspended Solids (TSS)	mg/l	-	05	15	06	17
6	Total Hardness as $CaCO_3$	mg/l	500	501	522	460	670
7	Taste and Odor	-	Obj-Unobj	obj	Obj	Obj	Obj
8	Nitrate (as NO_3^-)	mg/l	50	31	34	28	29
9	Ammonia (NH_3)	mg/l	1.5	BDL	BDL	BDL	BDL
10	Arsenic (As)	mg/l	0.010	0.05	0.12	0.05	0.11
11	Turbidity	NTU	5	0	0	0	0
12	Chloride (as Cl^-)	mg/l	250	288	244	214	302
13	Fluoride (as F^-)	mg/l	1.50	0.06	1.60	1.30	1.44
14	Sulphate (as SO_4^{2-})	mg/l	250	208	320	275	288
15	Iron (as Fe^{2+})	mg/l	0.3	0.02	0.04	0.01	0.02
16	Sodium	mg/l	200	310	302	269	344
17	Iodine	mg/l	-	BDL	0.06	0.01	0.05

18	Zinc (as Zn^{2+})	mg/l	03	0.04	1.2	0.8	1.4
19	Total Coliform	Number	0/100 ml	04	12	08	15
20	E-Coli	Number	0100 ml	0	02	01	04

The results shows that the samples taken from Lahore is contaminated with heavy metal, high in TDS, hardness and is biologically contaminated

Table 3-6: Groundwater Sampling at Different Locations (Shiekhupura)

Sr. No.	Parameter	Unit	WHO Standards	Location					
				GW-02	GW-07	GW-08	GW-10	GW-11	GW-13
				Near QB Link Canal	Village Dhant Pura	Khanka Dogra	GT Road near Murredka	Buraj Attari	Tiba Rehmat Khan
				73°53'14.775"E 31°36'40.989"N	73°53'0.372"E 31°44'10.041"N	73°38'46.197"E 31°48'45.852"N	74°15'20.907"E 31°47'39.992"N	74°11'35.275"E 31°34'6.488"N	74°7'38.975"E 31°39'55.740"N
1	pH	-	6.5-8.5	7.2	7.4	7.9	7.8	7.4	7.8
2	Temperature	^{0}C	-	20	21	24	21	20	21
3	Color	TCU	15	0	0	0	0	0	0
4	Total Dissolved Solids (TDS)	mg/l	1000	607	544	540	708	602	670
5	Total Suspended Solids (TSS)	mg/l	-	02	01	01	05	01	04
6	Total Hardness as $CaCO_3$	mg/l	500	240	220	210	302	280	286
7	Taste and Odor	-	Obj-Unobj	Unobj	Unobj	Unobj	Obj	Unobj	Unobj
8	Nitrate (as NO_3^-)	mg/l	50	26	12	10	16	21	24
9	Ammonia (NH_3)	mg/l	1.5	0	0	0	0	0	0
10	Arsenic (As)	mg/l	0.010	0.002	0.005	0.005	0.0012	0.005	0.005
11	Turbidity	NTU	5	0	0	0	0	0	0
12	Chloride (as Cl^-)	mg/l	250	112	99	95	130	120	144
13	Fluoride (as F^-)	mg/l	1.50	0.44	0.67	0.65	1.20	0.51	0.66

14	Sulphate (as SO_4^{2-})	mg/l	250	104	101	96	134	124	136
15	Iron (as Fe^{2+})	mg/l	0.3	0.02	0.01	0.01	0.08	0.02	0.03
16	Sodium	mg/l	200	167	144	140	167	154	160
17	Iodine	mg/l	-	0.04	0.01	0.01	0.05	0.01	0.04
18	Zinc (as Zn^{2+})	mg/l	03	0.05	0.06	0.06	0.7	0.2	0.4
19	Total Coliform	Number	0/100 ml	0	0	0	0	0	0
20	E-Coli	Number	0100 ml	0	0	0	0	0	0

The results show that the sample taken from district Shiekhupura has no contamination in form of biological, chemical and toxic. The water can be used for drinking purposes

Table 3-7: Groundwater Sampling at Different Locations (Kasur)

Sr. No.	Parameter	Unit	WHO Standards	Location			
				GW-01	GW-09	GW-12	GW-15
				Near Railway Station	Kulanwala Village	Bus Station	Village Chamba
				74°26'39.206"E 31d24'1.793"N	73°53'53.316"E 31°6'5.257"N	73°58'36.626"E 30°57'54.009"N	74°0'1.495"E 31°13'36.301"N
1	pH	-	6.5-8.5	7.2	7.4	7.1	7.7
2	Temperature	^0C	-	18	20	19	20
3	Color	TCU	15	0	0	0	0
4	Total Dissolved Solids (TDS)	mg/l	1000	2506	1809	3017	1509
5	Total Suspended Solids (TSS)	mg/l	-	25	18	24	13
6	Total Hardness as $CaCO_3$	mg/l	-	1001	899	1617	766
7	Taste and Odor	-	Obj-Unobj	Obj	Obj	Obj	Obj
8	Nitrate (as NO_3^-)	mg/l	50	78	60	85	55
9	Ammonia (NH_3)	mg/l	1.5	0	0	0	0
10	Arsenic (As)	mg/l	0.010	0.56	0.12	1.1	0.10
11	Turbidity	NTU	5	0	0	0	0
12	Chloride (as Cl^-)	mg/l	250	455	388	544	337
13	Fluoride (as F^-)	mg/l	1.50	3.1	2.5	3.4	1.9
14	Sulphate (as SO_4^{2-})	mg/l	250	488	407	506	377
15	Iron (as Fe^{2+})	mg/l	0.3	0.24	0.10	0.31	0.04
16	Sodium	mg/l	200	667	603	704	302

17	Iodine	mg/l	-	0.4	0.1	0.5	0.02
18	Zinc (as Zn^{2+})	mg/l	03	0.6	0.4	1.9	0.2
19	Total Coliform	Number	0/100 ml	19	15	20	05
20	E-Coli	Number	0100 ml	0	0	01	0

The results show that the sample taken from Kasur City is contaminated with heavy metal, high in TDS, hardness and biological contaminated.

Table 3-8: Groundwater Sampling at Different Locations (Nankana Sab)

Sr. No.	Parameter	Unit	WHO Standards	Location	
				GW-04	GW-06
				Near Shahkot North	Jarranwala Road near QB Canal
				73°28'41.437"E 31°34'58.339"N	73°57'0.372"E 31°24'17.447"N
1	pH	-	6.5-8.5	7.2	7.4
2	Temperature	^0C	-	20	20
3	Color	TCU	15	0	0
4	Total Dissolved Solids (TDS)	mg/l	1000	455	607
5	Total Suspended Solids (TSS)	mg/l	-	01	02
6	Total Hardness as $CaCO_3$	mg/l	-	188	302
7	Taste and Odor	-	Obj-Unobj	Unobj	Unobj

8	Nitrate (as NO_3^-)	mg/l	50	12	16
9	Ammonia (NH_3)	mg/l	1.5	0	0
10	Arsenic (As)	mg/l	0.010	0.001	0.001
11	Turbidity	NTU	5	0	0
12	Chloride (as Cl^-)	mg/l	250	45	66
13	Fluoride (as F^-)	mg/l	1.50	0.4	0.5
14	Sulphate (as SO_4^{2-})	mg/l	250	88	102
15	Iron (as Fe^{2+})	mg/l	0.3	0.01	0.02
16	Sodium	mg/l	200	87	132
17	Iodine	mg/l	-	0.01	0.04
18	Zinc (as Zn^{2+})	mg/l	03	0.21	0.25
19	Total Coliform	Number	0/100 ml	0	0
20	E-Coli	Number	0100 ml	0	0

The results show that the sample taken from Dist. Nankana Sab is fit for drinking purposes

3.3.2 Surface Water Sampling (Canals)

Surface water sample was collected from canals at identified sampling locations. 37 Parameters were analyzed for these samples; results have been shown in **Tables** below.

Table 3-4: Surfacewater and Wastewater Sampling at Various Location

Sr. No.	Parameter	Unit	NEQS * **	Locations				
				SW-05	SW-06	SW-04	SW-03	SW-07
				Banbarwali Ravi Bedian Canal (BRB) Lahore	Upper Chenab Canal Shiekhpura	QadirabadBalloki Link Canal Shiekhpura	Lahore Brach Canal Lahore	ButcherKhana Distributary Lahore
1	pH	-	6-10	7.05	7.6	7.8	7.7	7.6
2	Temperature	^0C	40	24	18	19	18	16
3	Biochemical Oxygen Demand (BOD_5)	TCU	80	06	04	06	06	04
4	Chemical	mg/l	150		08	14	12	10

Sr. No.	Parameter	Unit	NEQS * **	Locations				
				SW-05	SW-06	SW-04	SW-03	SW-07
				Banbarwali Ravi Bedian Canal (BRB) Lahore	Upper Chenab Canal Shiekhpura	QadirabadBall oki Link Canal Shiekhpura	Lahore Brach Canal Lahore	ButcherKhana Distributary Lahore
	Oxygen Demand (COD)			09				
5	TSS	mg/l	150	130	125	86	140	144
6	TDS	mg/l	3500	128	124	635	343	150
7	Grease & Oil	-	10	0	0	0	0	0
8	Phenolic Compound as Phenols	mg/l	0.1	BDL	BDL	BDL	BDL	BDL
9	Chloride (as CI^-)	mg/l	1000	22	24	54	46	26
10	Fluoride (as F^-)	mg/l	20	0.3	0.1	0.6	0.4	0.2
11	Cyanide total (as CN^-)	NTU	2	BDL	BDL	BDL	BDL	BDL
12	An-Ionic Detergents as MBAs	mg/l	20	BDL	02	01	01	03
13	Sulphate (as SO_4^{2-})	mg/l	600	26	30	78	73	34
14	Sulphide (as S^-)	mg/l	1.0	BDL	BDL	BDL	BDL	BDL
15	Ammonia (NH_3)	mg/l	40	01	02	0.01	05	01
16	Pesticides	mg/l	0.15	BDL	BDL	BDL	BDL	BDL
17	Cadmium	mg/l	0.1	BDL	BDL	BDL	BDL	BDL
18	Chromium as (trivalent and hexavalent)	mg/l	1.0	BDL	BDL	BDL	BDL	BDL
19	Copper	Number	1.0	0.04	0.02	0.18	0.01	0.01
20	Lead	Number	0.5	0.01	0.001	BDL	0.001	BDL
21	Mercury	mg/l	0.01	BDL	BDL	BDL	BDL	BDL
22	Selenium	mg/l	0.5	BDL	BDL	BDL	BDL	BDL
23	Nickel	mg/l	1.0	BDL	BDL	BDL	BDL	BDL
24	Sliver	mg/l	1.0	BDL	BDL	BDL	BDL	BDL

Sr. No.	Parameter	Unit	NEQS * **	Locations				
				SW-05	SW-06	SW-04	SW-03	SW-07
				Banbarwali Ravi Bedian Canal (BRB) Lahore	Upper Chenab Canal Shiekhpura	QadirabadBall oki Link Canal Shiekhpura	Lahore Brach Canal Lahore	ButcherKhana Distributary Lahore
25	Total toxic metals	mg/l	2.0	0.06	0.023	0.21	0.04	0.01
26	Zinc	mg/l	5.0	0.21	0.02	0.14	0.07	0.12
27	Arsenic	mg/l	1.0	0.001	0.002	0.03	0.03	0.001
28	Barium	mg/l	1.5	BDL	BDL	BDL	BDL	BDL
29	Iron	mg/l	2.0	0.22	0.44	0.05	0.04	0.01
30	Manganese	mg/l	1.5	BDL	BDL	BDL	BDL	BDL
31	Boron	mg/l	6.0	BDL	BDL	0.4	0.4	0.1
32	Chlorine	mg/l	1.0	BDL	BDL	BDL	BDL	BDL
33	Turbidity	NTU	-	120	110	124	160	110
34	Total Nitrogen	mg/l	-	1.2	1.4	1.5	1.6	1.1
35	Phosphorous	mg/l	-	0.66	0.76	0.88	0.87	0.55
36	Potassium	mg/l	-	1.2	1.2	1.3	1.3	1.4
37	Dissolve Oxygen	mg/l	-	06	05	04	04	05

All the surface water (canal) samples are found in compliance with NEQS.

Table 3-5: Wastewater Sampling from Drains

Sr. No.	Parameter	Unit	NEQS* **	Waste Water			
				WW-01	WW-02	WW-03	WW-04
				74°17'43.612"E 31°38'51.241"N (Nala Daig, Shiekhpura)	72°24'31.867"E 31°9'8.044"N (Drain near Khara, Kasur)	74°16'6.047"E 31°22'55.310"N (Hyderia Drain near Khayban e Ameen, Lahore)	73°40'56.478"E 31°26'17.761"N (Village Shingi Kot, Nankana Sab)
1	pH	-	6-10	8.29	7.9	8.54	7.70

Sr. No.	Parameter	Unit	NEQS* **	Waste Water			
				WW-01	WW-02	WW-03	WW-04
				74°17'43.612"E 31°38'51.241"N (Nala Daig, Shiekhpura)	72°24'31.867"E 31°9'8.044"N (Drain near Khara, Kasur)	74°16'6.047"E 31°22'55.310"N (Hyderia Drain near Khayban e Ameen, Lahore)	73°40'56.478"E 31°26'17.761"N (Village Shingi Kot, Nankana Sab)
2	Temperature	^{0}C	40	30	28	29	26
3	Biochemical Oxygen Demand (BOD_5)	TCU	80	180	164	336	120
4	Chemical Oxygen Demand (COD)	mg/l	150	344	260	620	234
5	TSS	mg/l	150	144	124	146	110
6	TDS	mg/l	3500	1506	1819	1216	889
7	Grease & Oil	-	10	04	BDL	05	01
8	Phenolic Compound as Phenols	mg/l	0.1	BDL	BDL	BDL	BDL
9	Chloride (as Cl^-)	mg/l	1000	244	288	188	178
10	Fluoride (as F^-)	mg/l	20	1.1	0.12	0.05	0.02
11	Cyanide total (as CN^-)	NTU	2	0.04	BDL	0.09	BDL
12	An-Ionic Detergents as MBAs	mg/l	20	09	07	12	01
13	Sulphate (as SO_4^{2-})	mg/l	600	340	344	301	222
14	Sulphide (as S^-)	mg/l	1.0	BDL	BDL	0.1	BDL
15	Ammonia (NH_3)	mg/l	40	34	24	32	18
16	Pesticides	mg/l	0.15	0.10	BDL	BDL	BDL
17	Cadmium	mg/l	0.1	BDL	BDL	BDL	BDL

Sr. No.	Parameter	Unit	NEQS* **	Waste Water			
				WW-01	WW-02	WW-03	WW-04
				74°17'43.612"E 31°38'51.241"N (Nala Daig, Shiekhpura)	72°24'31.867"E 31°9'8.044"N (Drain near Khara, Kasur)	74°16'6.047"E 31°22'55.310"N (Hyderia Drain near Khayban e Ameen, Lahore)	73°40'56.478"E 31°26'17.761"N (Village Shingi Kot, Nankana Sab)
18	Chromium as (trivalent and hexavalent)	mg/l	1.0	1.4	0.05	1.6	BDL
19	Copper	Number	1.0	1.1	0.01	1.4	0.01
20	Lead	Number	0.5	0.6	BDL	0.9	BDL
21	Mercury	mg/l	0.01	BDL	BDL	BDL	BDL
22	Selenium	mg/l	0.5	BDL	BDL	BDL	BDL
23	Nickel	mg/l	1.0	0.21	BDL	0.12	BDL
24	Sliver	mg/l	1.0	BDL	BDL	BDL	BDL
25	Total toxic metals	mg/l	2.0	4.75	0.07	5.52	0.01
26	Zinc	mg/l	5.0	2.1	1.1	2.4	0.6
27	Arsenic	mg/l	1.0	1.4	0.01	1.5	BDL
28	Barium	mg/l	1.5	BDL	BDL	BDL	BDL
29	Iron	mg/l	2.0	0.02	0.04	0.13	0.01
30	Manganese	mg/l	1.5	BDL	BDL	BDL	BDL
31	Boron	mg/l	6.0	BDL	BDL	BDL	BDL
32	Chlorine	mg/l	1.0	BDL	BDL	0.23	BDL
33	Turbidity	NTU	-	76	54	88	34
34	Total Nitrogen	mg/l	-	42	24	48	28
35	Phosphorous	mg/l	-	3.1	2.2	3.9	1.8
36	Potassium	mg/l	-	1.5	1.1	2.1	1.1
37	Dissolve Oxygen DO	mg/l	-	0	0	0	0

The waste water sample of hyderia drain and Deg Nullah found high in pollution load with contamination of heavy metals.

Table 3-6: Surfacewater Sampling at Various Location (Rivers)

Sr. No.	Parameter	Unit	NEQS***	Locations		
				SW-01	SW-02	SW-08
				Down Stream of River Ravi Lahore	Upper Stream of Ravi River	River Sutlej, near Baddian Kasur
1	pH	-	6-10	7.86	7.71	7.44
2	Temperature	^{0}C	40	20	18	16
3	Biochemical Oxygen Demand (BOD_5)	TCU	80	46	19	08
4	Chemical Oxygen Demand (COD)	mg/l	150	102	32	15
5	TSS	mg/l	150	155	144	122
6	TDS	mg/l	3500	180	168	196
7	Grease & Oil	-	10	0	0	0
8	Phenolic Compound as Phenols	mg/l	0.1	BDL	BDL	BDL
9	Chloride (as CI^-)	mg/l	1000	24	22	31
10	Fluoride (as F^-)	mg/l	20	0.02	0.02	0.04
11	Cyanide total (as CN^-)	NTU	2	BDL	BDL	BDL
12	An-Ionic Detergents as MBAs	mg/l	20	05	02	02
13	Sulphate (as SO_4^{2-})	mg/l	600	30	28	36
14	Sulphide (as S^-)	mg/l	1.0	BDL	BDL	BDL
15	Ammonia (NH_3)	mg/l	40	BDL	BDL	BDL
16	Pesticides	mg/l	0.15	BDL	BDL	BDL
17	Cadmium	mg/l	0.1	BDL	BDL	BDL

Sr. No.	Parameter	Unit	NEQS***	Locations		
				SW-01	SW-02	SW-08
				Down Stream of River Ravi Lahore	Upper Stream of Ravi River	River Sutlej, near Baddian Kasur
18	Chromium as (trivalent and hexavalent)	mg/l	1.0	BDL	BDL	BDL
19	Copper	Number	1.0	0.04	0.01	BDL
20	Lead	Number	0.5	BDL	BDL	BDL BDL
21	Mercury	mg/l	0.01	BDL	BDL	BDL BDL
22	Selenium	mg/l	0.5	BDL	BDL	BDL
23	Nickel	mg/l	1.0	BDL	BDL	BDL
24	Sliver	mg/l	1.0	BDL	BDL	BDL
25	Total toxic metals	mg/l	2.0	0.041	0.01	0.061
26	Zinc	mg/l	5.0	0.21	0.20	0.42
27	Arsenic	mg/l	1.0	0.001	0.001	0.001
28	Barium	mg/l	1.5	BDL	BDL	BDL
29	Iron	mg/l	2.0	0.02	0.02	0.03
30	Manganese	mg/l	1.5	BDL	BDL	BDL
31	Boron	mg/l	6.0	0.1	0.1	BDL
32	Chlorine	mg/l	1.0	BDL	BDL	BDL
33	Turbidity	NTU	-	120	120	141
34	Total Nitrogen	mg/l	-	1.2	1.2	1.5
35	Phosphorous	mg/l	-	0.89	0.88	0.88
36	Potassium	mg/l	-	1.4	1.3	1.2
37	Dissolve Oxygen DO	mg/l	-	03	04	06

*National Environmental Quality Standards

** There are no Standard for surfacewater in Pakistan

The river Ravi surface water sample found litter higher in pollution load on downstream side however River Sutlej sample found no contamination.

ANNEXURE – I

PHOTO LOG

ANNEXURE – I: PHOTO LOG



Fig1: Ambient Air Monitoring near Multan Road Pattoki



Fig2: Ambient Air Monitoring near shahkot Road



Fig3: Ambient Air Monitoring at farooqabad



Fig4: Ambient Air Monitoring near farooqabad



Fig5: Noise Level Monitoring near Shahkot Road



Fig6: Noise Level Monitoring near Farooqabad



Fig7: Noise Level Monitoring neat Lahore Shiekhpura Road



Fig8: Noise Level Monitoring Lahore Shiekhpura Road

	
Fig9: Groundwater Sampling at Goth Hashim Dhakhna	Fig10: Groundwater Sampling from Lahore South East
	
Fig11: Groundwater Sampling at Nawa Kot Shiekhpura	Fig12:Groundwater Sampling at Kasur



Fig13: Surface water Sampling at



Fig14: Surface water Sampling at BRB Canal

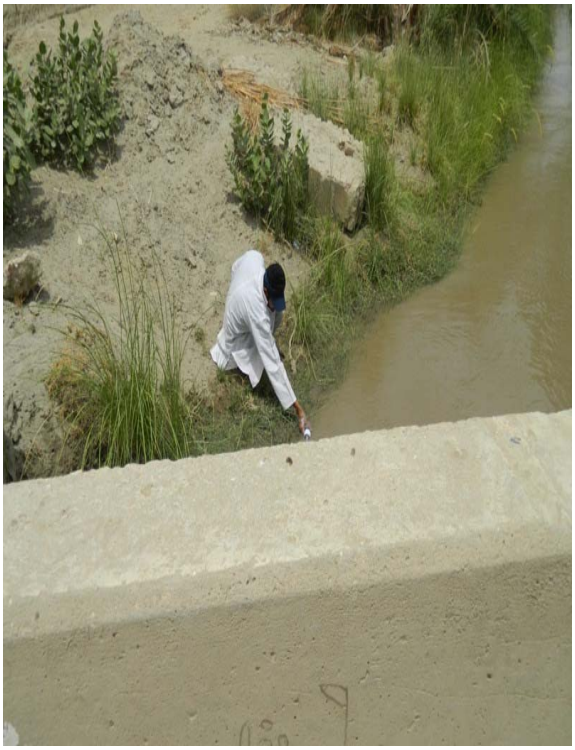


Fig15: Wastewater Sampling at Upper Chenab



Fig16: Surface water Sampling at Canal

	
Fig17: Surface Water Sampling at River Ravi	Fig18: Surface Water Sampling at River Ravi

APPENDIX – I

STANDARDS

APPENDIX – I: STANDARDS

AMBIENT AIR QUALITY STANDARDS

Pollutants	USEPA		WHO		World Bank		NEQS	
	Averaging Time	Standard	Averaging Time	Standard	Averaging Time	Standard	Averaging Time	Standard
CO	8 HRS 1 HR	10 mg/m3 (9 ppm) 40 mg/m3 (35 ppm)	8 HRS 1 HR	10mg/m3 (9 ppm) 30 mg/m3 (25 ppm)	-	-	8 HRS 1 HR	5 mg/m3 10 mg/m3
NO2	ANNUAL MEAN	100µg/m3 (50 ppb)	ANNUAL MEAN 1 HR	40 µg/m3 (20 ppb) 200µg/m3 (105 ppb)	ANNUAL MEAN 24 HRs	100µg/m3 (53 ppb) 200µg/m3 (105 ppb)	ANNUAL MEAN 24 HRS	40 µg/m3 80 µg/m3
SO2	24 HRS ANNUAL MEAN	365µg/m3 (140 ppb) 80µg/m3 (30 ppb)	24 HRS ANNUAL MEAN 10 MIN	125 µg/m3 (48 ppb) 50µg/m3 (20 ppb) 500µg/m3 (190 ppb)	ANNUAL MEAN 24 HRS	80µg/m3 (30ppb) 300µg/m3 (115 ppb)	ANNUAL MEAN 24 HRS	80 µg/m3 120 µg/m3
TSP	24-HRS	260 µg/m3	24-HRS	150-230 µg/m3	Annual Mean 24-HRS	80 µg/m3 200 g/m3	ANNUAL MEAN 24 HRS	400 µg/m3 360 µg/m3
PM10	24 HRS Annual Mean	150µg/m3 50µg/m3	ANNUAL MEAN 24 HRs	20 µg/m3 50 µg/m3	ANNUAL MEAN 24 HRs	50 µg/m3 150 µg/m3	ANNUAL MEAN 24 HRS	200 µg/m3 250 µg/m3

WHO WATER QUALITY STANDARDS

A. Bacteriological Qualities

Source/Organisms'	Guideline Value
a. All water intended for drinking (E Coli or thermo tolerant Coliform bacteria)	Must not be detectable in any 100ml Sample
b. Treated water entering the distribution system (E coli or thermo tolerant Coliform and Total Coliform Bacteria)	Must not be detectable in any 100ml Sample
c. Treated water in the distribution system (E .Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100ml Sample In the case of large supplies, where sufficient samples are examined ,must not be present in 95% of samples taken throughout any 12-month period

B. Chemicals of Health Significance

Inorganic	mg/l	Inorganic	mg/l	Inorganic	mg/l
Antimony	0.005	Copper	2.000	Molybdenum	0.070
Arsenic	0.010	Cyanide	0.070	Nickel	0.020
Barium	0.700	Fluoride	1.500	Nitrate(NO3)	50.00
Boron	0.300	Lead	0.010	Nitrate(NO3)	03.00
Cadmium	0.003	Manganese	0.500	Selenium	0.010
Chromium	0.050	Mercury	0.001		

C. Other Parameters

Inorganic	mg/l	Inorganic	mg/l	Inorganic	mg/l
Colour	15 TCU	1,2 dichlorobenzene	1-10	Hardness, pH, Do	-
Taste, Odour	-	1-4 dichlorobenzene	0.3-30	Hydrogen Sulfide	0.05
Turbidity	5 NTU	Dichlorobenzene	5-50	Iron	0.3
Toluene	24-170	Synthetic detergents	-	Manganese	0.1
Xylenes	20-1800	Aluminum	0.2	Sodium	200
Ethyl-benzene	24-200	Ammonia	1.5	Sulfate	250
Styrene	4-2600	Chloride	250	TDS	1000
Monochloro Benzene	10-120	Copper	1	Zinc	3

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PART II

Statutory Notifications (S. R. O.)

GOVERNMENT OF PAKISTAN

MINISTRY OF ENVIRONMENT

NOTIFICATIONS

Islamabad, the 18th October, 2010

S. R. O. 1062(I)/2010.—In exercise of the powers conferred under clause (c) of sub-section (1) of section 6 of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency, with the prior approval of the Pakistan Environmental Protection Council, is pleased to establish the following National Environmental Quality Standards for Ambient Air.

National Environmental Quality Standards for Ambient Air

Pollutants	Time-weighted average	Concentration in Ambient Air		Method of measurement
		Effective from 1st July, 2010	Effective from 1st January 2013	
Sulphur Dioxide (SO_2)	Annual Average*	80 $\mu g/m^3$	80 $\mu g/m^3$	-Ultraviolet Fluorescence method
	24 hours**	120 $\mu g/m^3$	120 $\mu g/m^3$	
Oxides of Nitrogen as (NO)	Annual Average*	40 $\mu g/m^3$	40 $\mu g/m^3$	- Gas Phase Chemiluminescence
	24 hours**	40 $\mu g/m^3$	40 $\mu g/m^3$	

[2944(2010)/Ex. Gaz.] *Price: Rs. 5.00*

Pollutants	Time-weighted average	Concentration in Ambient Air: Effective from 1st July, 2010	Concentration in Ambient Air: Effective from 1st January 2013	Method of measurement
Oxides of Nitrogen as (NO_2)	Annual Average*	40 $\mu g/m^3$	40 $\mu g/m^3$	- Gas Phase Chemiluminescence
	24 hours**	80 $\mu g/m^3$	80 $\mu g/m^3$	
O^3	1 hour	180 $\mu g/m^3$	130 $\mu g/m^3$	-Non dispersive UV absorption method
Suspended Particulate Matter (SPM)	Annual Average*	400 $\mu g/m^3$	360 $\mu g/m^3$	- High Volume Sampling, (Average flow rate not less than 1.1 m3/minute).
	24 hours**	550 $\mu g/m^3$	500 $\mu g/m^3$	
Respirable Particulate Matter, PM_{10}	Annual Average*	200 $\mu g/m^3$	120 $\mu g/m^3$	-β Ray absorption method
	24 hours**	250 $\mu g/m^3$	150 $\mu g/m^3$	
Respirable Particulate Matter, $PM_{2.5}$	Annual Average*	25 $\mu g/m^3$	15 $\mu g/m^3$	-β Ray absorption method
	24 hours**	40 $\mu g/m^3$	35 $\mu g/m^3$	
	1 hour	25 $\mu g/m^3$	15 $\mu g/m^3$	
Lead Pb	Annual Average*	1.5 $\mu g/m^3$	1 $\mu g/m^3$	- ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	2 $\mu g/m^3$	1.5 $\mu g/m^3$	
Carbon Monoxide (CO)	8 hours**	5 mg/m^3	5 mg/m^3	- Non Dispersive Infra Red (NDIR) method
	1 hour	10 mg/m^3	10 mg/m^3	

*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

** 24 hourly /8 hourly values should be met 98% of the in a year. 2% of the time, it may exceed but not on two consecutive days.

S. R. O. 1063(I)/2010.— In exercise of the powers conferred under clause (c) of sub-section (1) of section 6 of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency, with the prior approval of the Pakistan Environmental Protection Council, is pleased to establish the following National Standards for Drinking Water Quality.

National Standards for Drinking Water Quality

Properties/Parameters	Standard Values for Pakistan	Who Standards	Remarks
Bacterial			
All water intended for drinking (e.Coli or Thermotolerant 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 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 mooth period.	Most Asian countries also follow WHO standards
Physical			
Colour	≤ 15 TCU	≤ 15 TCU	
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable	
Odour	Non objectionable/Acceptable	Non objectionable/Acceptable	
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/Parameters	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/Litre*	*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	
Nitrate (NO_3)*	≤ 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

* indicates priority health related inorganic constituents which need regular monitoring.

Properties/Parameters	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 South Punjab and 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 centres 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.

S. R. O. 1064(I)/2010.—In exercise of the powers conferred under clause (c) of sub-section (1) of section 6 of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency, with the prior approval of the Pakistan Environmental Protection Council, is pleased to establish the following National Environmental Quality Standards for Noise.

National Environmental Quality Standards for Noise

S. No.	Category of Area / Zone	Effective from 1st July, 2010		Effective from 1st July, 2012	
		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.

[No. F. I(12)/2010-11-General.]

MUHAMMAD KHALIL AWAN,
Section Officer (PEPC).

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ISLAMABD, THURSDAY, AUGUST 10, 2000

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PART-II

Statutory Notification (S.R.O)

GOVERNMENT OF PAKISTAN

MINISTRY OF ENVIRONMENT, LOCAL GOVERNMENT AND
RURAL DEVELOPMENT

NOTIFICATION

Islamabad, the 8th August 2000

S.R.O. 549 (I)/2000.___ In exercise of the powers conferred under clause (c) of sub-section (1) of section of 6 of the Pakistan environmental Protection Act. 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency, with the prior approval of the Pakistan Environmental Protection Council, is pleased to direct that the following further amendments shall be made in its Notification No. S.R.O. 742(I)/93, dated the 24th August, 1993, namely: ___

In the aforesaid Notification, in paragraph 2._____

[4138(2000)/Ex.GAZ]

Price : Rs. 5.00

(1) for Annex, I the following shall be substituted, namely:_____

Annex-I

"NATIONAL ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND LIQUID INDUSTRIAL EFFLUENTS (mg/I, UNLESS OTHERWISE DEFINED)

S. No.	Parameter		Revised Standards		
		Existing Standards	Into Inland Waters	Into Sewage Treatment (5)	Into Sea ( )
1	2	3	4	5	6
1.	Temperature or Temperature Increase *	40^0C	≤3°C	≤3°C	≤3°C
2.	pH value (H^+) .	6-10	6-9	6-9	6-9
3.	Biochemical Oxygen Demand $(BOD)_5$ at 20^0C (1)	80	80	250	80**
4.	Chemical Oxygen Demand (COD) (1)	150	150	400	400
5.	Total Suspended Solids (TSS)	150	200	400	200
6.	Total Dissolved Solids (TDS)	3500	3500	3500	3500
7.	Oil and Grease	10	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.1	0.3	0.3
9.	Chloride (as $C1^-$)	1000	1000	1000	SC***
10.	Fluoride (as F^-)	20	10	10	10
11.	Cyanide (as CN^-) total ..	2	1.0	1.0	1.0
12.	An-ionic detergents (as MBAS) (2)	20	20	20	20
13.	Sulphate (SO_4^{2-})	600	600	1000	SC***
14.	Sulphide (S^{2-})	1.0	1.0	1.0	1.0
15.	Ammonia (NH_3)	40	40	40	40
16.	Pesticides (3)	0.15	0.15	0.15	0.15

1	2	3	4	5	6
17.	Cadmium [4]	0.1	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent [4].. ..	1.0	1.0	1.0	1.0
19.	Cooper [4]	1.0	1.0	1.0	1.0
20.	Lead [4]	0.5	0.5	0.5	0.5
21.	Mercury [4]	0.01	0.01	0.01	0.01
22.	Selenium [4]	0.5	0.5	0.5	0.5
23.	Nickel [4]	1.0	1.0	1.0	1.0
24.	Silver [4]	1.0	1.0	1.0	1.0
25.	Total toxic metals	2.0	2.0	2.0	2.0
26.	Zinc	5.0	5.0	5.0	5.0
27.	Arsenic [4]	1.0	1.0	1.0	1.0
28.	Barium [4]	1.5	1.5	1.5	1.5
29.	Iron	2.0	8.0	8.0	8.0
30.	Manganese	1.5	1.5	1.5	1.5
31.	Boron [4]	6.0	6.0	6.0	6.0
32.	Chlorine	1.0	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 Federal Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.

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 BOD_5=80mg/I 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/I

*** Discharge concentration at or below sea concentration (SC).

Note:_____ 1. Dilution of liquid effluents to bring them to the NEQS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.

2. The concentration of pollutants in water being used will be substracted from the effluent for calculating the NEQS limits" and

(2) for Annex-II the following shall be substituted, namely:____

Annex-II

"NATIONAL ENVIRONMENTAL QUALITY STANDARDS FOR INDUSTRIAL GASEOUS EMISSION (mg/Nm^3, UNLESS OTHERWISE DEFINED)."

S. No.	Parameter	Source of Emission	Existing Standards	Revised Standards
1	2	3	4	5
1.	Smoke	Smoke opacity not to exceed	40% or 2 Ringlemann Scale	40% or 2 Ringlemann Scale or equivalent smoke number
2.	Particulate malter	(a) Boilers and Furnaces		
	(1)	(i) Oil fired	300	300
		(ii) Coal fired	500	500
		(iii) Cement Kilns	200	300
		(b) Grinding, crushing, Clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas.	500	500
3.	Hydrogen Chloride	Any	400	400

1	2	3	4	5
4.	Chlorine	Any	150	150
5.	Hydrogen Fluoride	Any	150	150
6.	Hydrogen Sulphide	Any	10	10
7.	Sulphur Oxides [2] [3]	Sulfuric acid/Sulphonic acid plants		
		Other Plants except power Plants operating on oil and coal	400	1700
8.	Carbon Monoxide	Any	800	800
9.	Lead	Any	50	50
10.	Mercury	Any	10	10
11.	Cadmium	Any	20	20
12.	Arsenic	Any	20	20
13.	Copper	Any	50	50
14.	Antimony	Any	20	20
15.	Zinc	Any	200	200
16.	Oxides of Nitrogen	Nitric acid manufacturing unit.	400	3000
	(3)	Other plants except power plants operating on oil or coal:		
		Gas fired	400	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 National Environmental Quality Standards (NEQS) 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. Allowable ground level increment to ambient (ug/m^3) (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 NEQS limiting value is not permissible through excess air mixing blowing before emitting into the environment.

[File No. 14(3)/98-TO-PEPC.]

HAFIZ ABDULAH AWAN
DEPUTY SECRETARY (ADMN)

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Appendix-III

Hydrological Study Report

MASTER PLAN FOR LAHORE DIVISION PROJECT

Districts Lahore, Kasur, Sheikhupura & Nankana Sab

Hydrological Study Report

Lahore Development Authority (LDA), Lahore.

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HYDROLOGY OF THE PROJECT AREAS

1.1. General

This Chapter provides an overview of the hydrological condition and hydraulic activities in the subject area. The report is focused on studying the impacts of planned settlements on hydrology of area. The report will be helpful in understanding the present and future conditions of groundwater aquifer, canals and hydraulic structures in Lahore Division. This chapter further discuss the possibilities of flood risk and mitigation measures to be adopted.

The planned area is rich in hydrological assets, which is further supplemented by hydrological flows of link canals. It is important to keep all these elements under consideration for an integrated planning, without missing any important parameter.

1.2. Description of Planned Area

A master plan is prepared for Lahore Division by Lahore Development Authority, which includes Lahore, Shiekhupura, Kasur and Nankana Sahib Districts. This division is a part of Punjab Province of Pakistan. Geologically, this area is a part of lower Indus Basin. The name “Punjab” itself is an indicative of healthy presence and importance of rivers in this area. This word “Punjab” comes from 'punj-aab', meaning five rivers. The five rivers of Punjab were Sutlej, Bias, Ravi, Jehlum and Chenab Rivers; Bias River of which have discontinued to flow in Pakistan, as discussed later. This blessing of rivers has resulted in cultivation on mast part of land in Punjab as well as in the study area.

Two main rivers pass from Lahore Division, Ravi River and Sutlej River. The slope of the land in planned area is to the south-west, which directs the rivers to flow in this path. Average slope of the area is 0.32m/km.

These rivers have a major contribution in glorious history of the Lahore Division. All the "historical assets" of Lahore, including but not limited to Lahore Fort, Badshahi Mosque and Kamran ki Baradari, were built adjacent to Ravi River.

As per the Indus basin treaty of 1960, six major rivers were divided among Pakistan and India. The rights of Eastern Rivers (Sutlej, Bias and Ravi) were allocated to India, while the rights of Western Rivers (Chenab, Jehlum and Indus) were reserved with Pakistan. Since the Indus basin treaty, India has completed series of structures on eastern rivers to store and divert water from upstream and use it for generation of electricity and irrigation. These interventions have put a stop to ecological and sustainable flows in these rivers, thereby depriving the downstream areas of Pakistan, including Lahore Division from naturally available water for irrigation. Two of the rivers, Ravi and Sutlej, allocated to India, still flows seasonally through the study area. While Bias River have discontinued to flow. The old bed of Bias River still exists in Kasur. To meet the irrigation demands, Pakistan constructed multiple link canals which divert water from western rivers to Eastern Rivers.

The following link canals pass through the planned area:

i. Bambanwala Ravi Bedian Link Canal
ii. Qadirabad-Bulloki Link Canal
iii. Balloki – Sulemanki Link
iv. Lower Bāri Doāb Canal
v. Upper Chenab Canal
vi. Lower Chenab Canal

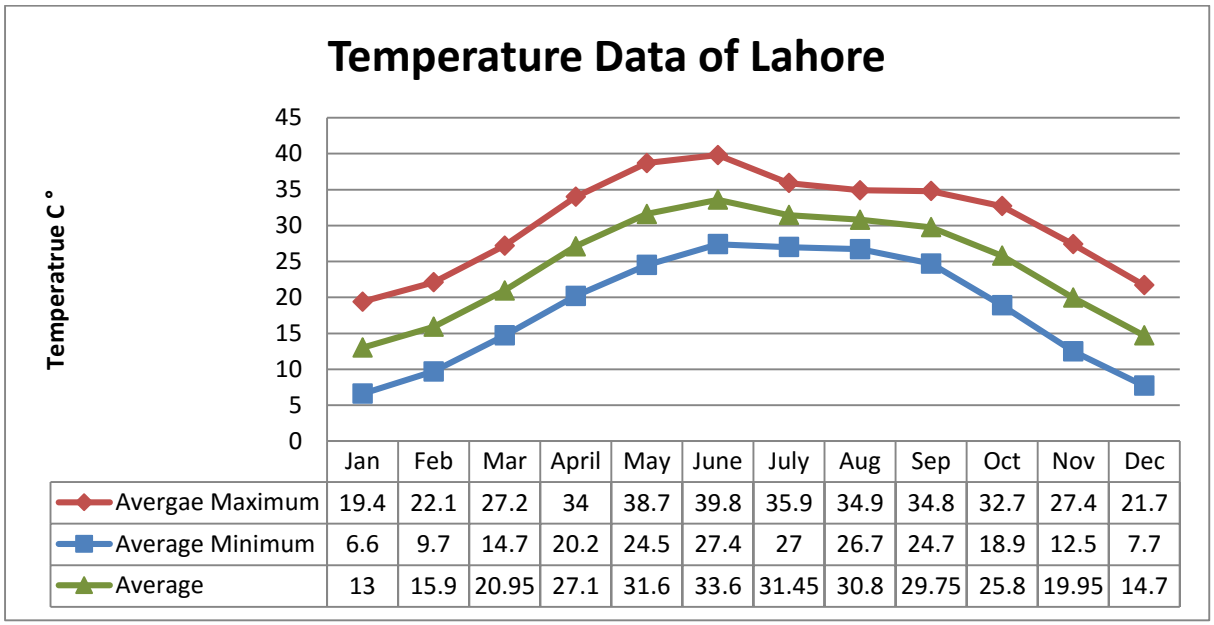
In addition, the following hydraulic structures lie inside our study area

i. Balloki Barrage
ii. BRB-Ravi Siphon

The planned area also have abundance of water in the form of groundwater aquifer.

1.3. Climate of Lahore Division

Lahore Division experiences wide variation in temperature. The coldest month is January in which the mean maximum temperature is 19.4 °C and the mean minimum temperature is 6.6 °C. June is the hottest month with the mean maximum temperature near 39.8 °C and the mean minimum temperature as 27.4 °C. Mean temperature of the region during the last 20 years (1991-2010) is given in Figure (1).



	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Avergae Maximum	19.4	22.1	27.2	34	38.7	39.8	35.9	34.9	34.8	32.7	27.4	21.7
Average Minimum	6.6	9.7	14.7	20.2	24.5	27.4	27	26.7	24.7	18.9	12.5	7.7
Average	13	15.9	20.95	27.1	31.6	33.6	31.45	30.8	29.75	25.8	19.95	14.7

Figure 1 Temperature Data of Lahore Region (Data Source: Climatic Data Processing Centre (CDPC), Pakistan Meteorological Department, Karachi)

The average annual rainfall during the last 20 years period from (1991-2010) is calculated to be 55.25 mm. Nearly 70% of it is received in the form of high intensity showers during the monsoon (July, August, September) and the remaining in winter. One daily Max rainfall was recorded in 2014, equal to 213mm. The average monthly rainfall at Lahore during the last 20 years (1991-2010) is also shown in Figure (2).

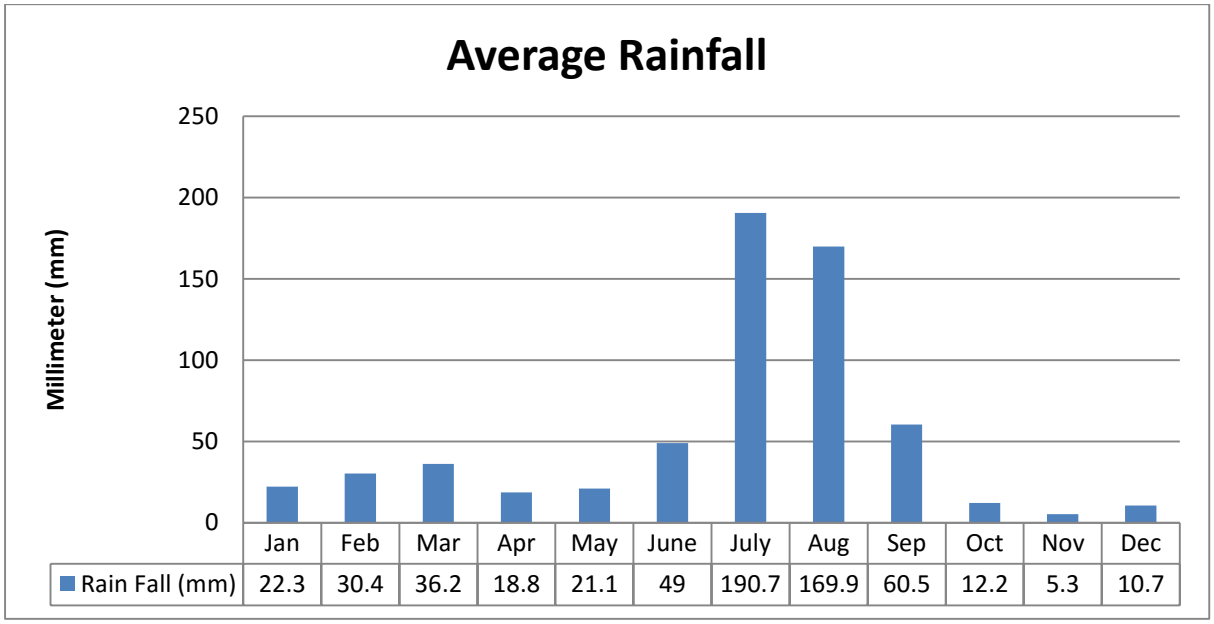


Figure 2 Average Rainfall of Lahore Region (Data Source: Climatic Data Processing Centre (CDPC), Pakistan Meteorological Department, Karachi)

The most humid period is the month of August with maximum average relative humidity of 85.3% and minimum average relative humidity of 61.2%. The average relative humidity of Lahore region for last 20 years (1991-2010) recorded is shown in Figure (3).

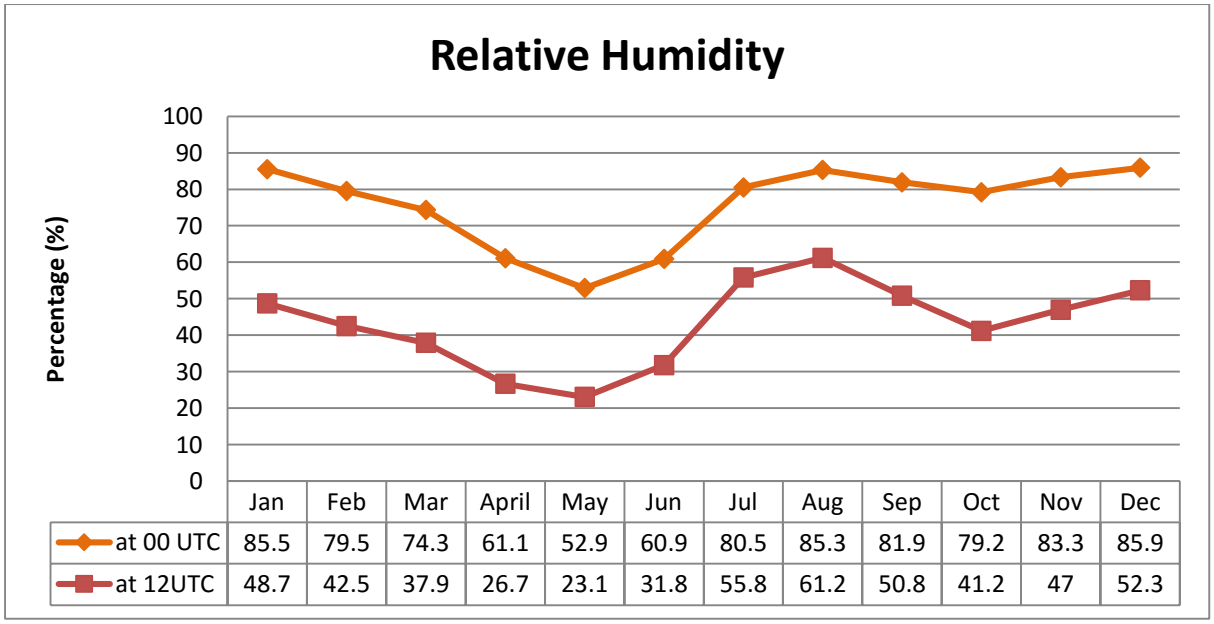
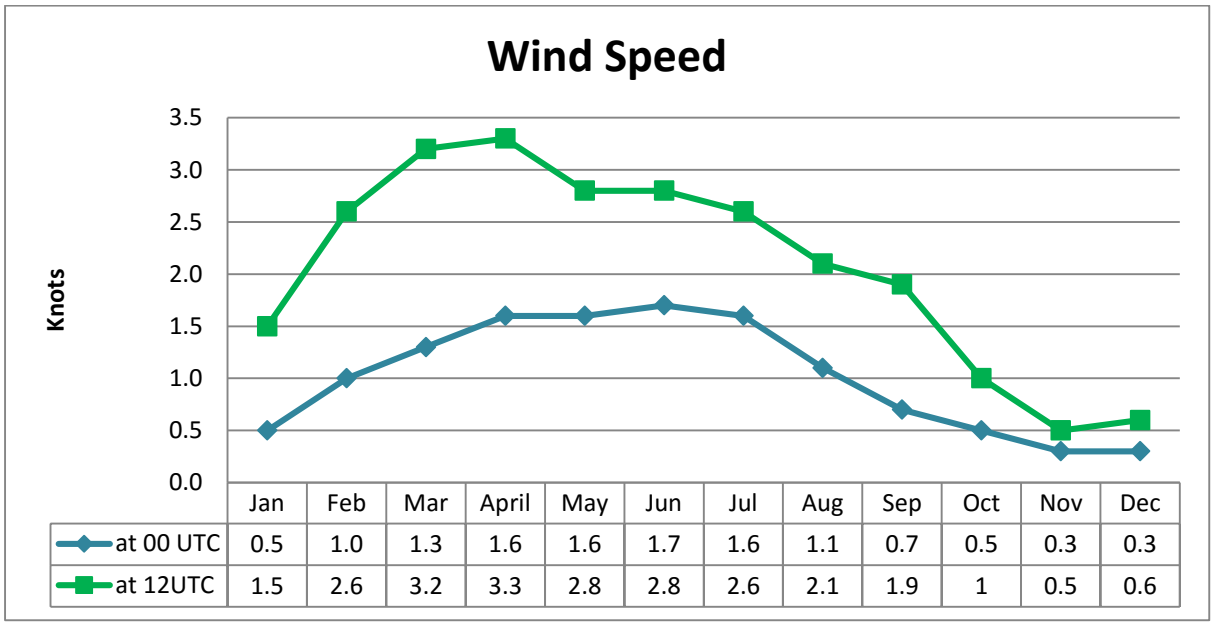


Figure 3 Average Relative Humidity of Lahore Region (Data Source: Climatic Data Processing Centre (CDPC), Pakistan Meteorological Department, Karachi)

During cold seasons of the year northern winds prevail and during hot seasons southern winds. Monthly mean velocity of the wind (Knots) taken for the period 1991-2010 are shown in Figure (4).



	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
at 00 UTC	0.5	1.0	1.3	1.6	1.6	1.7	1.6	1.1	0.7	0.5	0.3	0.3
at 12UTC	1.5	2.6	3.2	3.3	2.8	2.8	2.6	2.1	1.9	1	0.5	0.6

Figure 4 Average wind speed of Lahore Region (Data Source: Climatic Data Processing Centre (CDPC), Pakistan Meteorological Department, Karachi)

1.4. Surface Water Availability:

1.4.1. Rivers

As discussed earlier, two main Rivers pass from the planned area, Ravi River and Sutlej River.

1.4.1.1. Ravi River

The Ravi River originates in the Himalayas in the Multhan Tehsil of Kangra District of Himachal Pradesh, India and is mostly fed by snow melt. Many tributaries join Ravi River downstream of its source. It then flows along the Indo–Pak border for 80 kilometres (50 mi) before entering Pakistan and flows past Lahore City. South of the town of Ahmadpur, Ravi River finally joins the Chenab River. The total length of the river is about 725 kilometres.

According to Indus Water treaty (1960), rights of River Ravi belongs to India. India diverts water of the river for generation of electricity and cultivation of its agricultural

lands. Due to construction of series of headworks on Ravi River in the past decade, its flow path and pattern and intensity has changed tremendously, with its course shifting towards west. (Thomas and Sharma, 1998)

The following hydraulic structures are constructed on Ravi River which affects flow pattern in Lahore Division.

Thein Dam

Thein Dam was completed and put into operation in __ in India, Thein Dam is constructed for generation of electricity and to supply water for irrigation. Thein Dam has spillway capacity of 870,047 cusecs.

Shahpur Kandi Dam

Shahpur Kandi Dam lies downstream of Thein Dam and currently under construction. It is being constructed to provide a balancing reservoir, to have uniform water releases for canals, make excess water available for diversion into canals and for generation of electricity. Shahpur Kandi Dam has spillway capacity of 7,50,400 cusec.

Madhopur Headwork I

Madhopur Headwork lies further downstream of Shahpur Kandi Dam and is built to divert water for the purpose of irrigation.

Balloki Barrage

Balloki Barrage lies in planned area of Lahore Division, which lies at a distance of 29km from Lahore City. Two important canals, Balloki Sulemanki Link Canal and Lower Bari Doab offtakes from Balloki Barrage. Balloki Barrage has spillway capacity of 385,000 cusecs.

Ravi River is supplemented by the four natural drains inside border of Pakistan, namely Ujh, Bein, Basantar and Deg Nullahs.

A number of fresh water input in the form of link canals also increases the river flow and canals taking off at head works reduce the flows in the river. In the vicinity of Lahore Divisions, three link canals are very important.

- Marala-Ravi (M-R) link canal joins the river about 40km upstream of Lahore. The canal is mainly used to divert the flood flows and as such does not contribute to the river flows during the low flow period. M-R Link Canal has design capacity of 22,500 cusecs.
- Upper Chenab (U.C) canal with the capacity of 7770 cusecs at the tail and joins the river at 42km downstream of Lahore.
- Qaderabad (Q.B) link canal with the capacity of 14,480 cusecs joins the river at 60km downstream of Lahore.

Water is diverted from Ravi into B.S. link canal and L.B.D. Canals at Balloki head work. The combined capacity of these canals is to the tune of 29,000 cusecs. These canals reduce the flow in the river downstream of Balloki head works.

1.4.1.2. Deg Nallah:

Deg Nallah is another tributary of Ravi River, which originates from Indian held Kashmir. After entering into Pakistan, Deg Nallah crosses M-R Link Canal and BRBD Canal, where cross drainage structures are provided. It joins Ravi River 18Km downstream of Shahdara Town.

The nallah is of special importance due to its flood risk in some parts of Sheikhupura. Main effectees of Deg Nallah are currently estimated to be around 0.5 million farmers. Deg Nallah has flow capacity of only 25,000 cusecs, which is less than flood of 10 years return period in this nallah.

The following areas are under threat from flooding in Deg Nallah

- Ferozwala
- Jaranwala Road
- Muridke

The following bridges are present on Ravi River in Lahore District (Table 1):

Table 1 List of Bridges on River Ravi

Bridge	Clear width (ft)	Hydraulic Capacity
Railway Bridge	1450	250,000 cusecs

Old Ravi Bridge	1450	250,000 cusecs
New Ravi (Shahdara) Bridge	1660	350,000 cusecs
Saghian Bridge	2150	450,000 cusecs
Motorway Bridge	2225	450,000 cusecs
Head Balloki Bridge	1635	385,000 cusecs

1.4.2. Flows in Ravi River:

1.4.2.1. Average flows

Investigations indicates that flows in the river are highly variable with time during the year which is directly resultant of structural interventions from Indian side and Monsoon Rainfalls.The inflows in Ravi River are measured by gauging stations installed on Railway Bridge near Shahdara and at Ravi Siphon.

Monthly averages flows (cusecs) at Shahdara and Ravi Syphon are tabulated in Table (1) for the period 2000 to 2013. Monthly average flows are also listed in Table (1). It indicates that flow available from October to March is very less. The average flow in these six months is 1,638 cusecs with low value of 1371 cusecs that was observed in the month of November. Flows are available in abundance for the Kharif season, 12,315 cusecs in these six months from 2001 to 2013. The maximum flow could reach to 18000 cusecs in the month of July while it may come to very low value (1,200 cusecs) in the month of December (Figure 5).

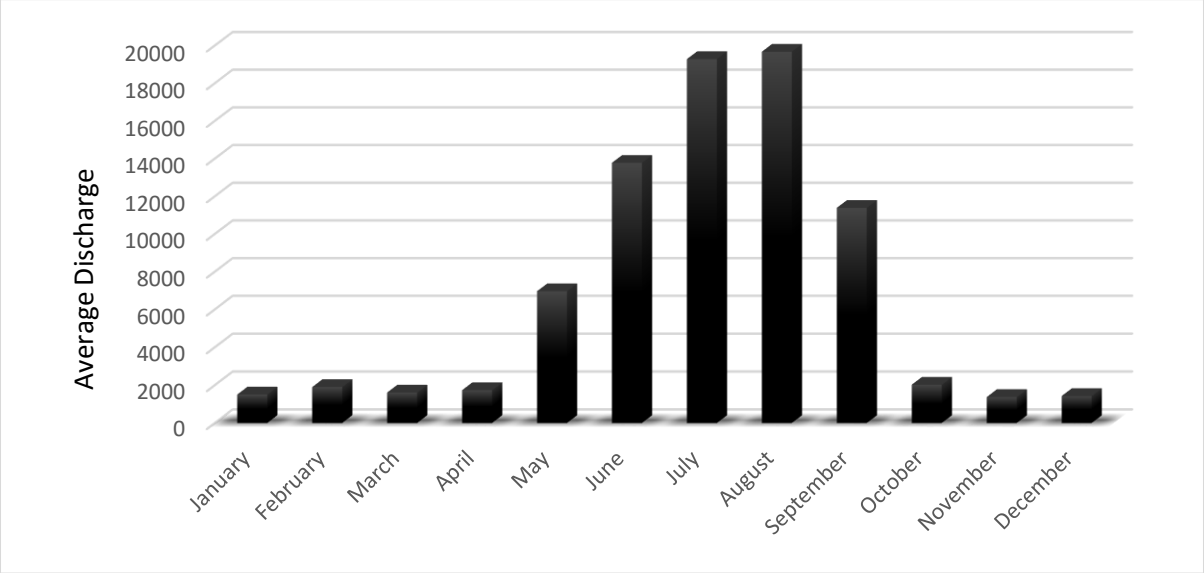


Figure 5 Average Discharge (cusecs) in Ravi River in each month from 2000 to 2013

The temporal distribution of the mean annual flows at the Shahdara site is given in Figure (6) from 2001-2013. The Figure shows that mean annual flow was highest in 2003 having a value of 10,518 cusecs and minimum mean annual flow in 2010 with a value of 4,128 cusecs.

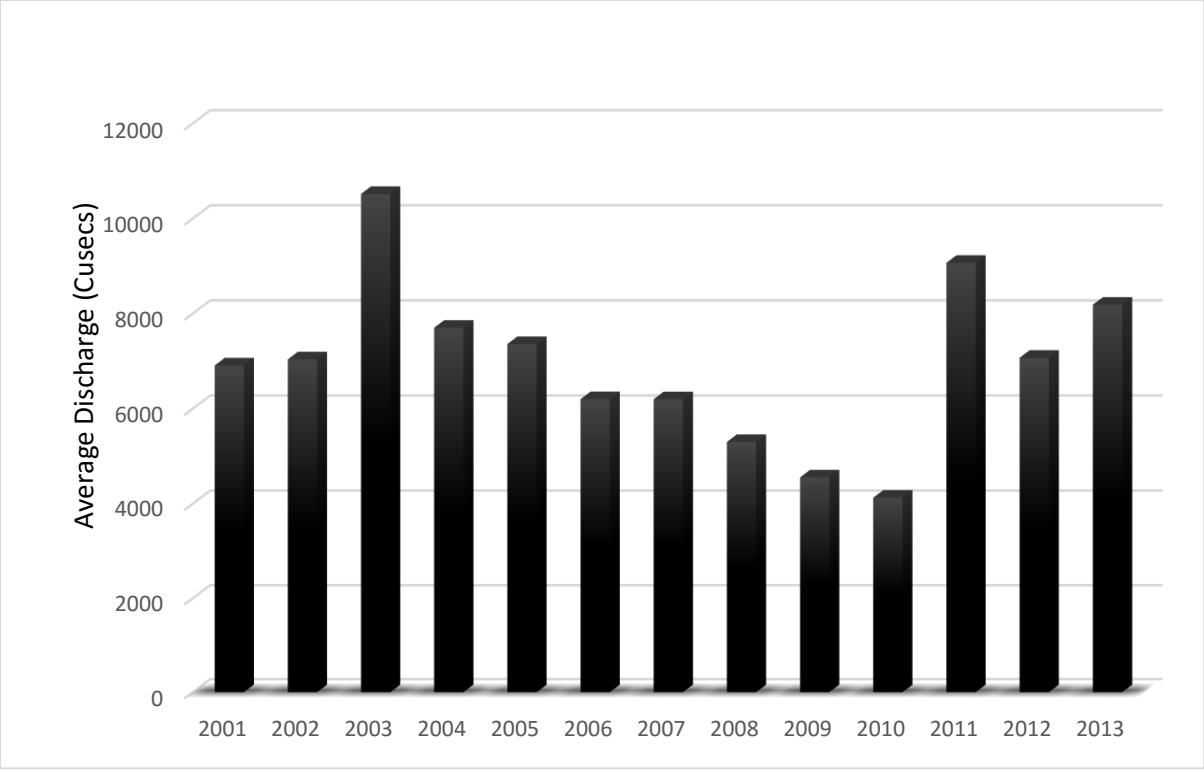


Figure 6 Average Annual Discharge (cusecs) in Ravi River from 2000 to 2013

1.4.2.2. Floods:

The flood of 1988, with magnitude of 570,000 cusecs at Shahdara, was the worst flood of 20th century to hit Lahore City. The flood claimed 731 lives and displaced 1,250,000 people. The Shahdara Distributary bund was breached causing heavy flooding of the area between Shahdara and Kala Shah Kaku. Downstream, the Balloki and Sidhnai head works were subjected to discharges far in excess of their design capacities, and embankments were breached to save the structures.

The 1955 flood is the second highest on record flood for the Ravi River, with peak discharges of 5,59,000 cusecs at Ravi Siphon. It breached the flood embankments of the Bambanwala–Ravi–Bedian–Dipalpur Link Canal, upstream from Ravi Siphon, and at Shahdara Bridge. The Punjab Irrigation Department estimated that flood discharges of 259,000 cusecs passed through the breaches at Ravi Siphon and 300,000 m^3/s through the breaches at Shahdara Bridge.

A flood frequency analysis was performed by Gumble (extreme value Type-I method) using annual peak flood data for Lahore at Shahdara. The analysis gives following results:

Table 2 Flood Frequency Analysis

Return Period (T)	Probability of occurrence	Discharge
(Years)	(%)	(cusecs)
2	50.00	73,303
5	20.00	152,280
10	10.00	204,569
20	5.00	254,726
25	4.00	270,637
40	2.50	303,924
50	2.00	319,650
100	1.00	368,301
200	0.50	416,774
500	0.20	480,725
1,000	0.10	529,058

As per international practice, safety for cities and barrages are checked against a design flood of 100 years return period, which comes out to be 368,301 cusecs. The peak floods of 5,59,000 cusecs and 570,000 cusecs were recorded before construction of Thein Dam and Shahpur Kundi Dam on Ravi River.

The following settlements can come under threat for a flood of more than 100years return period.

i. Bucheki
ii. Mor Khunda
iii. Mandi Faizabad

For establishment of industrial area, further detailed hydraulic analysis is required to assess probability, nature and magnitude of flood at a specific site.

1.4.2.3. Water Quality:

The quality of Ravi River has deteriorated heavily with increase in urbanization around it; both in Indian and Pakistan. A decreasing trend in DO levels and an increase trend in BOD, TDS, total and Faecal Coliforms has been observed in Ravi over time. The discharge of untreated wastewater from the city and nearby industrial estates into the river is the main cause of deterioration in its water quality. (Ahmad and Ali, 1997).

The river acts as a domestic wastewater and industrial effluent carrier from Kala Shah Kaku, Lahore-Shiekhupura Road, Kot Lakhpat Industrial Estate and Multan Road. Further, the entire municipal waste from Lahore city is collected through a network of 14 main drains and discharged into the River Ravi without any treatment. The industrial waste is directly discharged into the canal system by 271 industrial units. These industries include textile, chemical, food processing, pulp and paper, poultry, dairy, plastic, paint, pesticides, leather, tanneries and pharmaceuticals.

Another source of pollution is the Hudiara Drain. All along its route in India and Pakistan wastewater, sewage, and industrial pollutants are discharged into the drain without proper prior treatment. In India, Amritsar and many smaller towns and

villages besides industries, discharge untreated wastewater into this drain. Currently, there are around 100 industries located along the Hudiara Drain, which discharge wastewater directly into the River Ravi. (JICA, 2010).

The wastewater discharged into the River Ravi contains liquid and solid waste from domestic, industrial, and commercial premises, including but not limited to toilet waste, grey water (household wastewater of kitchens, bathrooms and laundries), sludge, trade wastes and gross solids. According to very conservative estimates, approximately 730 tons/day of Biological Oxygen Demand load is added to the River Ravi.

Municipal and industrial toxicants, such as metals pose serious risk to living species. Heavy metals not only affect health and wellbeing of nearby societies, but is also affecting ground water quality of Lahore due to seepage. (Shakir and Qazi 2013).

1.4.3. Sutlej River

Sutlej River is also a part of Indus Basin Rivers which flows past Kasur District. The source of the Sutlej River is near Lake Rakshastal in Tibet. From there, it flows at first west-northwest for about 260 kilometres (160 mi) to the Shipki La pass, entering India in Himachal Pradesh state. It then turns slightly, heading west-southwest for about 360 kilometres (220 mi) to meet the Beas River near Makhu, Firozpur district in Punjab state of India. Continuing west-southwest, the Sutlej enters Pakistan about 15 kilometres (9.3 mi) east of Bhedian Kalan, Kasur District, Punjab Province, continuing southwest to join Indus River.

The waters of the Sutlej River are also allocated to India under the Indus Waters Treaty between India and Pakistan, and are mostly diverted to irrigation canals within India.

1.4.3.1. Structures on Sutlej River:

In year 1963, India completed Bhakra Dam on Sutlej River to store and use water for production of electricity and divert water for irrigation purpose. The dam is operational and has spillway capacity of 400,000 cusecs.

Just upstream of border, where Sutlej River enters Pakistan, Hussainwala Headwork is present on river. This headwork was constructed in 1926 and currently has spillway capacity of 4,50,000 cusecs.

Within or upstream of Lahore District, the Sutlej River is not supplemented by any link canal.

1.4.3.2. Floods

Most of the flow in Sutlej River is yielded by heavy monsoon rains. The winter flow is substantially lower when there is little rain or snowmelt from the Himalayan glaciers. The risk of floods has drastically reduced since construction of series of dams on Sutlej River by India. The flood in Sutlej River during floods of August 2015 was estimated to be between 45,000 Cusecs to 55,000 Cusecs.

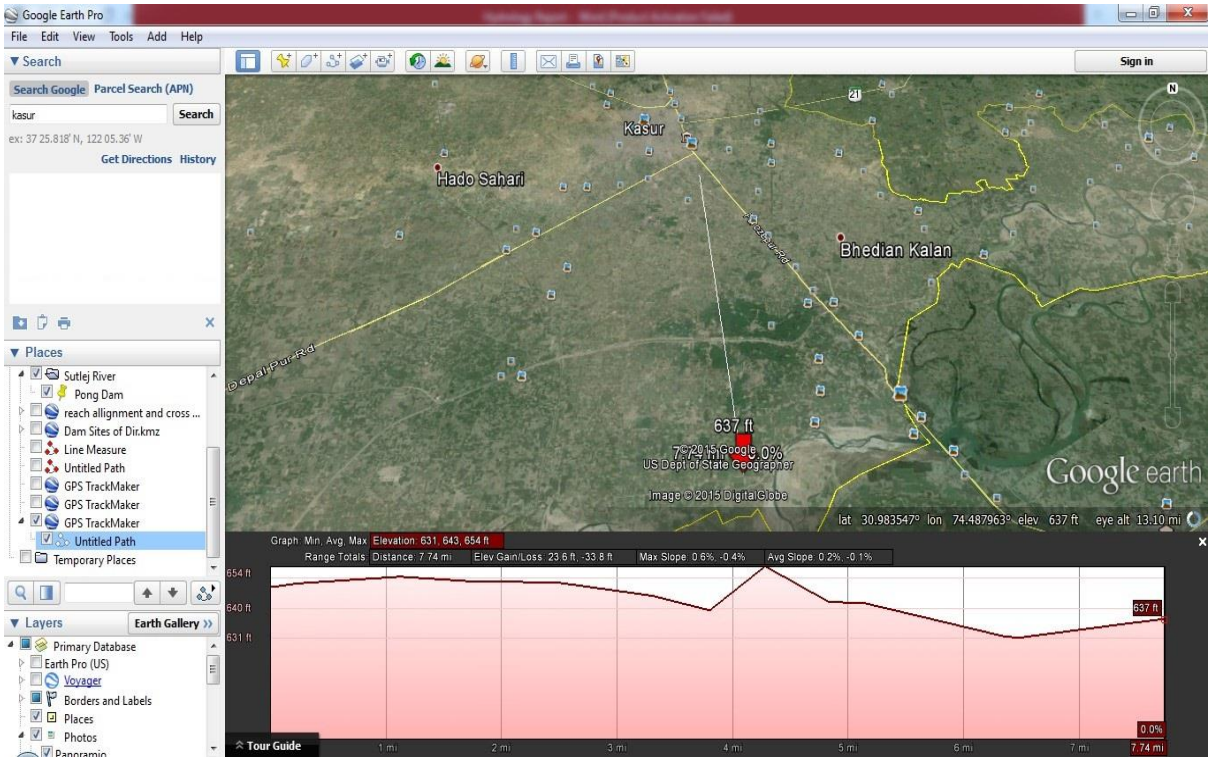


Figure 7 Vertical Level Difference between Kasur and River Sutlej

The planned settlements of Lahore Division are generally safe from moderate floods in Chenab River. The metropolitan area of Kasur is roughly 10km away from Sutlej River. Further, the BRBD Canal, lying between Kasur and Sutlej River, is acting as protection bund. Similar is the case with the settlement of Khuddian Khas and Kanganpur. All settlements in planned area were safe during the floods of 2015.

1.4.3.3. Water Quality

Water quality of Sutlej River inside Pakistan have not been determined. The water coming from Indian side contains toxic chemicals and heavy metals which makes it unsafe for drinking.

1.4.4. Canals

The total surface water diverted to Lahore for irrigation is 6.02 MCM/day. However, water available for agricultural use is only 3.0 MCM/ day as the rest is lost en-route as seepage from main and distributary canals, percolation losses from watercourses and farmer fields.

Following are the canals which pass through Lahore Division;

1.4.4.1. Marala Ravi Link Canal

Marala Ravi Link Canal originates from Chenab River at Marala Headwork and meets Ravi River, 59Km upstream of Railway Bridge. MR Link Canal has design capacity of 22,500 cusecs.

1.4.4.2. Upper Chenab Canal

Upper Chenab Canal originates from Chenab River at Marala Headwork and meets Ravi River, 32Km upstream of Balloki Barrage. Upper Chanab Canal has design capacity of 7770 cusecs. The Deg Nallah also meets Upper Chenab Canal, 22Km upstream from its confluence with Ravi River.

1.4.4.3. Banbawali Ravi Bedian Canal

Banbawali Ravi Bedian Canal offtakes from Upper Chenab Canal, which was constructed for defense purposes. Multiple Branch Canals also originate from Upper Chenab Canal for irrigation.

1.4.4.4. Lower Chenab Canal

Lower Chenab Canal offtakes from Chenab Canal at Khanki Headwork and is used for irrigation in Punjab Region.

1.4.4.5. Qadirabad-Bulloki Link Canal

Qadirabad-Balloki Link Canal originates from Chenab River at Qadirabad Barrage. The canal is used to supplement water from Chenab River into Ravi River. The Q-B

Link Canal meets Ravi River 15Km upstream of Balloki Barrage. QB Link Canal has design capacity of 14,480cusecs.

1.4.4.6. Lower Bari Doab Canal

Lower Bari Doab Canal originates from Ravi River and is mainly used for irrigation purpose.

1.4.4.7. Balloki – Sulemanki Link Canal

Balloki-Sulemanki Link Canal originates from Ravi River at Balloki Barrage and is used to divert water towards Sutlej River.

Lower Bari Doab Canal and Balloki – Sulemanki Link Canal have combined design capacity of around 29000 cusecs.

1.5. GROUND WATER

The groundwater has been the only source of domestic water supply since British Era. It is still used to meet industrial, commercial and agricultural demands. This vast usage of groundwater determines its vital position in long term sustainability of future developments. The Lahore.

The aquifer of Lahore District is broadly viewed as a single contiguous, unconfined aquifer. The presence of alluvial soil, frequent flooding and excessive rains in this region for hundreds of years have enriched this aquifer with abundance of water. This aquifer is about 1310ft deep with high transmission of about 22,604 ft2/day (assuming 262.5ft thickness contributing to groundwater flow). The aquifer extends from Lahore to the Piedmont area of foothills in Jammu and Kashmir in a north eastern direction (about 100 km). In the downstream direction it extends to the Arabian Sea at a distance of about 1,000 km (WAPDA, 1980).

Groundwater is extracted from a depth of 400-1300ft. Pumped water is widely used for irrigation, domestic, industrial and commercial purposes. Despite presence of link canals, the famer falls short of water to irrigate crops. In order to meet the demands, more than 10,000 tube wells have been installed for agricultural purposes. Only for Lahore, the total groundwater discharge from the aquifer for domestic, industrial and agricultural purposes is 5813 Acre-ft/day (253.2 million Cft/day)

As estimated by WWF, in Lahore District, the industrial sector consumes 13 per cent, agriculture uses 24 per cent and the remaining 10 per cent is consumed by the institutional sector. The average recharge to groundwater is 5269.6 acre-ft/day (229.55 million Cft/day). The recharge from the River Ravi is estimated to be 4302 acre-ft/year along its length, from canals 329 acre-ft/day, from rainfall 304.3 acre-ft/day and groundwater return flow 334 acre-ft/day.

1.5.1. Ground Water Quality:

Regular groundwater water quality monitoring is carried out by Water and Sanitation Agency (WASA), Punjab Irrigation Department (PID), Pakistan Council of Research in Water Resources (PCRWR) and the Environmental Protection Agency (EPA).

A national study on water quality which was conducted in 2001 by the Pakistan Council of Research in Water Resources (PCRWR) noted such issues as high arsenic and fluoride concentrations in WASA bore holes in **Lahore**. The highly arsenic contaminated groundwater is found at shallow water-table depths of up to 100ft While in **Shiekhupura**, Motorway to Muridkey road is dense with varied nature of industries. The waste water generated from these industries contain various hazardous chemicals, including heavy metals and oils which have reported to contaminate the groundwater in this area. The same problem is persistent in **Kasur District**, where more than 300,000 Cft of heavily polluted waste water is being discharged. Dumping of this water without proper treatment, has resulted in contamination ground water of Kasur to poisonous level.

In general, the groundwater quality is good near the River Ravi and canals and gradually deteriorates in the south and south-western direction. Many studies have found higher arsenic levels (>50 parts per billion) in pumped groundwater in Lahore. The quality of shallow groundwater is generally considered poor as these tube wells are adversely effected.

1.5.2. Groundwater Challenges:

Lack of coordination between inter-departments has been one of the major bottlenecks in successful and effective implementation of various management strategies. Data between WASA, Department of Punjab Irrigation, WAPDA and

PCRWR is not shared timely and efficiently to allow adaptation of mitigation measures before the problems transform into crisis.

The shallow aquifer of Lahore city has become highly polluted due to intrusion of sewage water and the contamination level of faecal E. coli has crossed the recommended limits of WHO (Ahmad et al., 2012). The deep aquifer is still safe from sewage water intrusion. Lahore canal is also polluted and recharges contaminated water into the shallow aquifer.

The difference between recharge and discharge is 23,660,826.7 Cft/day, which is equivalent to a 21.6inch (0.55m) per year drop in aquifer levels.

Extensive groundwater withdrawal has formed a groundwater depression zone in the central part of the city where the water table has dropped below 130ft. Continuous groundwater pumping from this depression zone is likely to induce a negative groundwater hydraulic gradient, which can accelerate the intrusion of saline groundwater from neighbouring Raiwind and Pattoki areas where groundwater is saline. This would be disastrous for local communities and industries as there is no quick and simple way available to clean the polluted aquifer. The groundwater contours as published by Department of Irrigation, Punjab are given in Annex – A.

In 1960, the groundwater table depth was 15ft. The extensive use of groundwater has led to the lowering of the water table by about half a metre per year during the last 30 years. In 1987, the depth of the water table ranged from 25 to 65ft, which has lowered to 165ft in 2011 (Khalid et al., 2013). The increasing depth of the groundwater table in different parts of Lahore is replete with serious consequences.

1.5.3. Conservation of Groundwater:

As discussed earlier, the groundwater table of Lahore Division is depleting with alarming rate, which desperately calls for regulations to monitor and control ground water extraction. Currently, no regulation exists in any of the districts, with respect to installation of boreholes and the amount of water extracted by any individual, or even community and industry. In the absence of any municipal water act or water-right law, groundwater is pumped indiscriminately by private housing schemes and industry. Private housing societies pump more than 13,000,000 Cft/day to supply

water to their residents. In areas where the water supply network is not available, estimated extraction is more than 12,400,000 Cft/day. Therefore, the total groundwater extracted by private housing schemes is more than 25,400,000. In the absence of any municipal water act or water-right law, groundwater is pumped indiscriminately by private housing schemes and industry. Private housing societies pump 13066426.7 Cft/day to supply water to their residents. In areas where the water supply network is not available, estimated extraction is 12360133 Cft/ day. Therefore, the total groundwater extracted by private housing schemes is approximately 25073414 Cft/day. Increase in urbanization and industrialization will place an extra pressure on the ground water resources that is already depreciating. The water extraction should be controlled and only permitted for certain uses that would place a vital pressure on the water system or cannot be accommodated such as high water demand industries.

Groundwater quality monitoring carried out by WASA (2011) shows that most of the parameters (except arsenic) are within acceptable limits of WHO. The highly arsenic contaminated groundwater (up to 2,400 ppb) is found in shallow water table depths of up to 30m (Farooqi et al., 2007). The main anthropogenic source of arsenic is air pollutants derived from kiln factories, with fertilizers a possible secondary source. Minor amounts of sulphate (SO4) are also derived from air pollutants and fertilizers. Household wastewater also contains SO4 but not arsenic.

To protect quantity and quality of groundwater resources, the following suggestions may be helpful:

i. Water conservation should be educated at household level.
ii. For long-term sustainability of drinking water supplies, the possibility of supplementing groundwater supplies with surface water supplies should be explored, wherever possible.
iii. Water harvesting at the household level and the local level should be promoted to maximize benefits of storm water and free up domestic water supply sources. This option will also reduce magnitude of urban storm.
iv. Quota of groundwater extraction for new housing societies should be fixed based on specified per capita demand.

v. Define groundwater protection zones according to the safe yield of the aquifer. In Lahore, for example, central parts of the city where a groundwater depression zone is being developed should be defined as a "groundwater protection zone" and pumping should be regulated.

vi. In order to promote the culture of water conservation, a metering system should be introduced to charge water on a volumetric basis. This will help in reducing water use, in the same way as is being done for electricity, gas and other utilities.

vii. WASA, LDA and EPA should enforce environmental laws to restrict industries not to dispose of their waste in drains, canals or other water bodies without treatment.

viii. Maximize the use of treated wastewater for irrigation purposes.

ix. Water should be treated as an economic good and its exploitation rights be given through a proper permit system and compatible prices especially to the industrial sector.

x. For long-term sustainability of drinking water supplies, the possibility of supplementing groundwater supplies with surface water supplies should be explored, wherever possible. For Lahore, provision of surface water supply from the River Ravi or BRBD canal system may be considered after addressing quality concerns.

1.5.4. Ground Water Recharge:

The average annual rainfall of Lahore District is 715 mm. However, its recharge to groundwater in urban areas is minimal due to urbanization. In general, groundwater discharge is higher than recharge, which is the main reason for the rapid depletion of groundwater in the urban areas. The situation is likely to get worse with increase in urban development. In agricultural areas, the rain water infiltrating in ground is allowing percolation of harmful soluble chemicals used in irrigation, in the form of pesticides and insecticides.

A sound mechanism is required to recharge the depleting groundwater with safe and clean surface water.

1.6. Discussion on Each Site:

1.6.1. Allah Abad

Location: 74° 3' 19.982" E, 30° 52' 31.997" N

Nearest Surface Water: Gehlan Branch Canal

Groundwater Quality: Unfit to be used directly for water supply

Flood Hazard: safe from flood hazards of 100 years return period in Sutlej River.

1.6.2. Bhai Pheru

Location: 73° 59' 49.223" E, 31° 15' 30.033" N

Nearest Surface Water: Ravi River and Lahore Brach Canal

Groundwater Quality: The groundwater quality of Bhai Pheru is unfit to be used directly for water supply. The seepage of polluted water from Ravi River have contaminated groundwater quality of Bhai Peru, making it unfit for direct water supply.

Flood Hazard: Bhai Pheru is located at a distance of around 4km from Ravi River, which makes it susceptible to floods.

1.6.3. Bhikhi

Location: 73° 54' 39.810" E, 31° 37' 29.446" N

Nearest Surface Water: Qadirabad-balloki Link Canal

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.4. Bucheki

Location: 73° 39' 45.712" E, 31° 18' 35.372" N

Nearest Surface Water: Ravi River

Groundwater Quality: fit for drinking with minor treatment

Flood Hazard: Bucheki is protected by the elevated road of Syedwala – Baraghar – Bucheki Road from flood hazards. Any part of Bucheki settlement, on south of Syedwala – Baraghar – Bucheki Road can be subjected to flooding hazards from Ravi River.

1.6.5. Changa Manga

Location: 73° 57' 43.261" E, 31° 5' 20.576" N

Nearest Surface Water: Balloki Sulemanki Link Canal

Groundwater Quality: Unfit for drinking

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.6. Chunian

Location: 73° 58' 30.602" E, 30° 57' 52.576" N

Nearest Surface Water: Balloki Sulemanki Link Canal.

The old bed of Bias River also passes from Chunian

Groundwater Quality: Unfit for drinking

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.7. Farooqabad

Location: 73° 49' 44.179" E, 31° 44' 49.660" N

Nearest Surface Water: Qadirabad-Balloki Link Canal

Groundwater Quality: unfit for drinking

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.8. Feroz Wattwan

Location: 73° 48' 47.774" E, 31° 35' 26.947" N

Nearest Surface Water: Lower Chenab Canal on west and Qadirabad-Balloki Link Canal on east

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.9. Ferozpur Road & BRB Canal

Location: 74° 25' 50.769" E, 31° 23' 38.889" N

Nearest Surface Water: BRB Canal on east and Lower Chenab Canal on west

Groundwater Quality: Unfit for drinking

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.10. Ferozwala

Location: 74° 9' 24.584" E, 31° 39' 37.519" N

Nearest Surface Water: Deg Nallah on west and minor canal on east

Groundwater Quality: fit for drinking with minor treatment.

Flood Hazard: under potential threat of flooding due to Deg Nallah.

1.6.11. Industrial Estate

Location: 74° 26' 0.523" E, 31° 11' 37.770" N

Nearest Surface Water: Athilpur Minor Canal

Groundwater Quality: extremely poor and requires high level of cleaning before it can be supplied for drinking

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.12. Jamber

Location: 73° 55' 1.814" E, 31° 8' 36.791" N

Nearest Surface Water: Balloki – Sulemanki Link Canal

Groundwater Quality: Unfit for drinking

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.13. Jandiala Sher Khan

Location: 73° 55' 14.085" E, 31° 49' 17.953" N

Nearest Surface Water: Qadirabad-Bulloki Link Canal and Lower Chenab Canal

Groundwater Quality: fit for drinking with minor treatment

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.14. Jaranwala Road

Location: 74° 11' 27.858" E, 31° 34' 50.842" N

Nearest Surface Water: Shahdara Distributary

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: Safe from flooding hazards from floods of 100 years return period in Ravi River. Any higher flood can be hazardous.

1.6.15. Jhabran

Location: 73° 51' 47.563" E, 31° 51' 38.556" N

Nearest Surface Water: Qadirabad-Bulloki Link Canal and Lower Chenab Canal

Groundwater Quality: Unfit for drinking.

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.16. Kanganpur

Location: 74° 7' 25.467" E, 30° 45' 50.234" N

Nearest Surface Water: kanganpur Minor Canal

Groundwater Quality: fit to be used as drinking water, with minor treatment.

Flood Hazard: Sutlej River is located 6Km east of Kanganpur. The Kanganpur Settlement is safe from 100 year flood in Sutlej River due to presence of BRB Canal Road.

1.6.17. Kasur

Location: 74° 26' 52.353" E, 31° 7' 23.277" N

Nearest Surface Water: BRB Canal

Groundwater Quality: highly polluted due to dumping of untreated or semi-treated water from tanneries.

Flood Hazard: Safe from floods of 1000 years return period.

1.6.18. Khanqah Dogran

Location: 73° 37' 23.398" E, 31° 49' 53.340" N

Nearest Surface Water: Lower Chenab Canal, Qadirabad-Bulloki Link Canal and Jhung Branch Canal.

Groundwater Quality: unfit for direct supply as drinking water.

Flood Hazard: No flood hazard below flood of 1000 years return period in any river.

1.6.19. Khuddian Khas

Nearest Surface Water: Jora Branch Canal

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.20. Kot Radha Kishan

Location: 74° 5' 50.437" E, 31° 10' 4.407" N

Nearest Surface Water: Turkwind Distributary Canal

Groundwater Quality: Unfit for direct water supply

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.21. Lahore Muridke Road

Location: 74° 16' 50.492" E, 31° 39' 14.030" N

Nearest Surface Water: Shahdara Distributary Canal and Bhed Nalla

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: No flood hazard below 100 years return period. Flood of higher magnitude in Ravi River can cause flooding in this settlement.

1.6.22. Lahore Sheikhupura Road

Location: 74° 13' 50.662" E 31° 37' 48.749" N

Nearest Surface Water: Bhed nalla

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: Potential threat from No flood hazard below 100 years return period. Flood of higher magnitude in Ravi River can cause flooding in this settlement.

1.6.23. Mananwala

Location: 73° 41' 42.837" E, 31° 35' 18.236" N

Nearest Surface Water: Lower Chenab Canal

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.24. Mandi Faizabad

Location: 73° 59' 5.583" E, 31° 24' 54.453" N

Nearest Surface Water: Qadirabad-Bulloki Link Canal and Ravi River

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: The settlement is present in north and south of Jaranwala Road. Northern part is safe from flood hazards from Ravi River below flood of 100years return period. Northern part, however, have no protection against floods and even a moderate flood in Ravi River can cause flooding hazard.

1.6.25. Mor Khunda

Location: 73° 47' 33.363" E 31° 19' 11.977" N

Nearest Surface Water: Minor Canal

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: The settlement is present in north and south of Jaranwala Road. Northern part is safe from flood hazards from Ravi River below flood of 100years return period. Northern part, however, have no protection against floods and even a moderate flood in Ravi River can cause flooding hazard.

1.6.26. Muridke

Location: 74° 15' 16.546" E 31° 48' 34.800" N

Nearest Surface Water: Muridke Distributary

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: Muridke settlement lies between Deg Nallah and Nikki Deg Drain, both of which spread out water during flood season.

1.6.27. Mustafa Abad

Location: 74° 24' 43.942" E 31° 14' 48.821" N

Nearest Surface Water: Bedian Distributary Canal

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: No flood hazard below flood 1000 years return period.

1.6.28. Nankana Sab

Location: 73° 42' 29.750" E 31° 27' 4.672" N

Nearest Surface Water: Lower Chenab Canal

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.29. Narang Mandi

Location: 74° 30' 25.749" E 31° 54' 32.110" N

Nearest Surface Water: BRB Canal

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: Higher level of BRB Canal provides safety against floods in Ravi River upto a flood of 100 years return period.

1.6.30. Pattoki

Location: 73° 51' 13.334" E 31° 1' 32.710" N

Nearest Surface Water: Wan Distributary Canal

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: None

1.6.31. Raiwind & Multan Road

Location: 74° 11' 43.234" E 31° 18' 11.348" N

Nearest Surface Water: Bedian Distributary and Lahore Branch Canal

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.32. Raja Jang

Location: 74° 15' 23.669" E 31° 13' 16.020" N

Nearest Surface Water: Bedian Distributary

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.33. Rao Khan Wala

Location: 74° 19' 36.990" E 31° 11' 30.907" N

Nearest Surface Water: Bedian Distributary

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.34. Safdarabad

Location: 73° 34' 40.600" E 31° 43' 45.786" N

Nearest Surface Water: Lower Chenab Canal, Qadirabad Balloki Link Canal and Jhang Branch Canal

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.35. Sangla Hil

Location: 73° 22' 53.522" E 31° 42' 46.769" N

Nearest Surface Water: Jhang Branch Canal

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: : Higher elevation level of Faisalabad Motorway provides safety against floods in Chenab River, upto a flood of 100 years return period.

1.6.36. Shahkot-I

Location: 73° 28' 56.193" E 31° 34' 27.873" N

Nearest Surface Water: Lower Chenab Canal

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.37. Shahkot-II

Location: 73° 32' 33.676" E 31° 35' 8.292" N

Nearest Surface Water: Lower Chenab Canal

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.38. Sharqpur

Location: 74° 6' 8.626" E 31° 27' 51.170" N

Nearest Surface Water: Upper Chenab Canal and Ravi River

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: After the flood of 1988, a protective bund was constructed to save Sharaqpur from future floods. The bund height is sufficient to save Sharaqpur Settlement from flood of 100 years return period in Ravi River.

1.6.39. Sheikhupura

Location: 73° 59' 20.204" E 31° 42' 46.845" N

Nearest Surface Water: Upper Chenab Canal, Qadirabad-Bulloki Link Canal and Lower Chenab Canal

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.6.40. Syed Wala

Location: 73° 29' 55.585" E 31° 8' 31.918" N

Nearest Surface Water: Ravi River

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: Can be subjected to floods in case of flooding in Ravi River.

1.6.41. Talwandi

Location: 74° 8' 11.980" E 30° 54' 26.708" N

Nearest Surface Water: BRB Canal

Groundwater Quality: Fit for drinking with minor treatment

Flood Hazard: The higher level of BRB Canal provides safety against floods of 100 years return period in Sutlej River.

1.6.42. Warburton

Location: 73° 49' 45.203" E 31° 32' 23.270" N

Nearest Surface Water: Qadirabad Balloki Link Canal and Lower Chenab Canal

Groundwater Quality: Unfit for drinking. Proper treatment is required to be used as drinking water.

Flood Hazard: No flood hazard below flood 1000 years return period in any river.

1.7. Floods

According to the PDMA- DRP, the River Ravi belongs to the category B flooding (medium Level Flood). Two categories of flood can occur in the planned area i.e. urban and riverine. Flood is considered as most drastic and re-occurring hazards in Pakistan. Roughly 1.84 million people across Pakistan have been affected by floods triggered by heavy monsoon rains. At least 346 people have been killed and 620 others have been injured in flood-related incidents, according to the latest figures released by the National Disaster Management Authority (NDMA).

The most recent flood was occurred in current year of 2014 and considered as one of the biggest flood in the history of Pakistan. According to the National Disaster Management Authority (NDMA) almost 312 people have died, with 2,275,000

affected and nearly 1.7 million acres (687,965 hectares) of crops lost due to this recent flood. The most affected were in Punjab Province and declared a state of emergency. The situation of rivers during this recent flood is given in Figure 8 as under-:

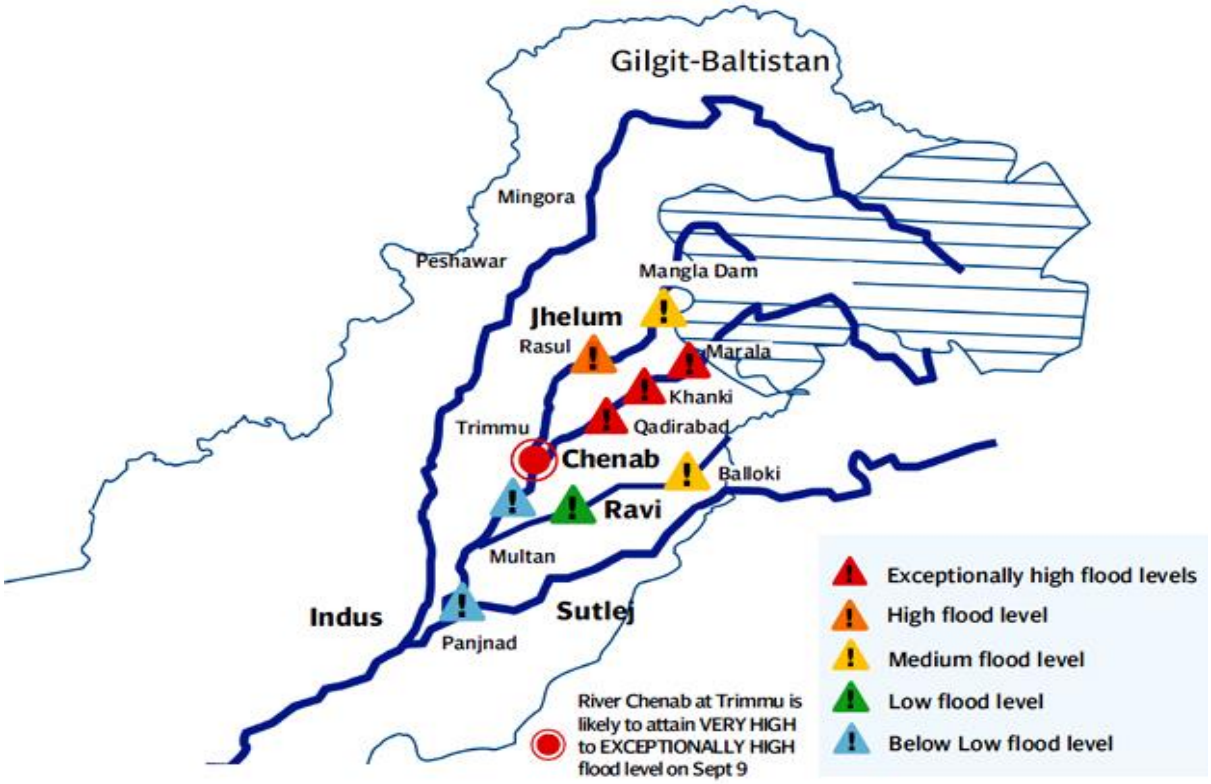


Figure 8 Flood in Rivers of Pakistan-2014, NDMA

As discussed in section 1.3.1.1 and section 1.3.1.2, the planned areas are generally safe from moderate floods. However, safety measures have to be taken against heavy flooding if flash discharge is released from Indian dams after heavy rainfall.

The recent flood noted in River Ravi is at Shahdara Gauging Station is 250,000 cusecs and considered as medium flood level. This is the highest flood level noted in River Ravi after year 2000 as construction of Thein Dam on Indian side greatly reduces the flows in River Ravi while the highest flood that observed in River Ravi is in 1988 which was around 586,000 cusecs. Further detailed hydrological study is required to calculate magnitude of future flood risk and resulting area inundation, especially after construction of Thein Dam and Shahpur Kundi Dam in India.

Due to unusual event, if flood exceeds the level of 5,86,000 cusecs then following mitigations will be adopted:-

- Flood Warning Centre would analyze situation before 1 or 2 days in accordance with the travelling time of flood with coordinating Pak-Metrological Department, Irrigation Department, WAPDA, Indus water commission and Police telecommunication (Head works and barrages) and accordingly flood warning should announce and information should sent to PDMA and related agencies.

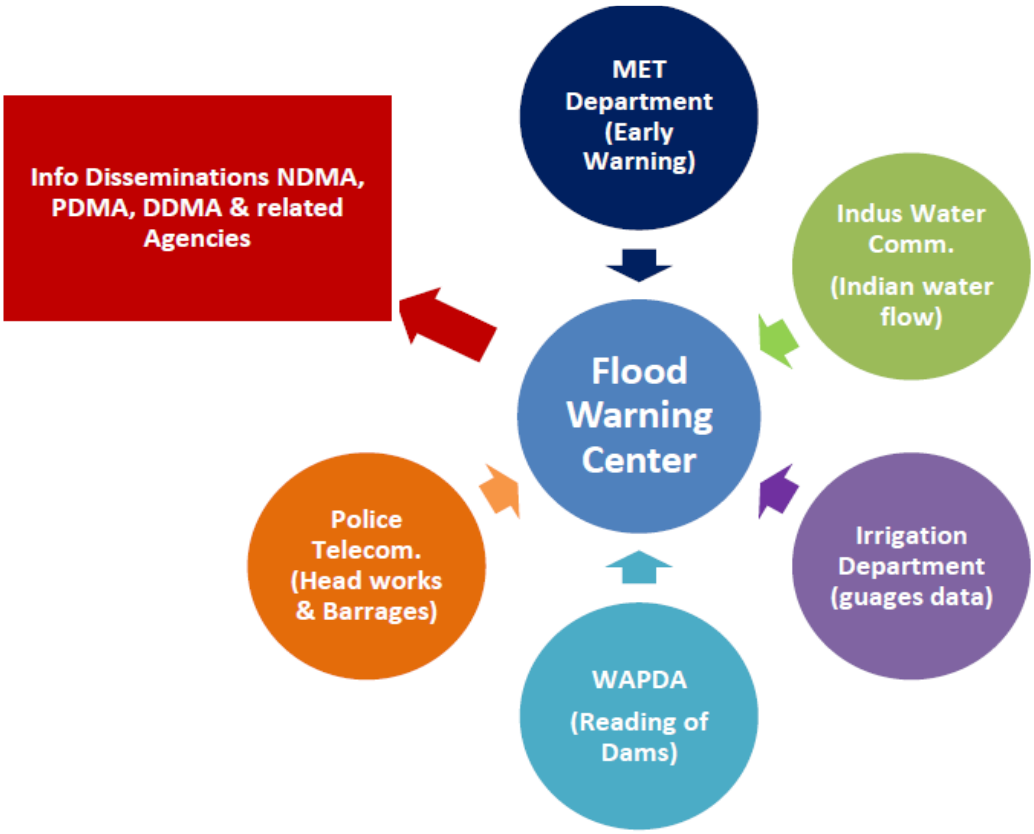


Figure 9 Flood Early Warning Centre (Source- DRP-2013)

- When flood warning should announce PDMA would implement state of emergency in the area and evacuation would be done in accordance with DPRP.
- DDMA, TDMA and DRC will do their responsibilities in accordance with DPRP

- The peoples would ask to move at safer place and accordingly temporary camps should be provided.
- Rescue and Emergency activities in accordance with DPRP should start soon after the flood hits the area. The objective of Rescue and Emergency activities is to save life of each and every individual who not been moved to safer place rather than property or valuables.
- Temporary hospitals should be made at camp area. Ensure the supply of food and portable water in the camps.

The following options should be considered to minimize flooding in settlements:

i. Existing drains should be restored into original shape by desilting and removal of all encroachments, to allow passage of more flow of water before overflowing.

ii. The settlements of Bucheki, Mor Khunda and Mandi Faizabad may be considered to be expanded only in north of Jaranwala Road. In case of extension towards south, protection bund will be mandatory to avoid flood water to enter the settlement.

iii. Water of Deg Nallah can be partially diverted into Basanter Nallah in flood season.

iv. Tree plantation around Ravi River, specially upstream of Lahore should be encouraged, which will reduce risk of flooding to great extent.

1.8. Conclusion

Lahore is in constant danger of health and environmental risks and ecosystem challenges due to huge discharges of untreated domestic and industrial waste. The River Ravi is considered as the most polluted river among the main rivers in Punjab. Recent water quality monitoring has shown the presence of faecal coliforms in drinking water. Presence of toxic heavy metals in irrigation water, especially downstream of the River Ravi, is also causing serious damage to animal life in surrounding areas. A direct economic impact of untreated wastewater is the loss of fishery catches, which affects incomes and has nutritional and health impacts on

consumers. The use of contaminated surface water from Ravi for irrigation and recreational purposes is also replete with serious consequences as this will have a direct impact on the ecosystem and human health. In peri-urban areas of Lahore farmers are using untreated sewage/industrial water for vegetable production and water-related diseases such as typhoid, cholera, dysentery and hepatitis are very common. Evidence also shows that, in Lahore, vegetables and fruits grown with wastewater are also prone to heavy metal contamination.

Seepage from rivers, lined or unlined channels, rainfall and agricultural fields is vital to recharge groundwater, which is the major source of drinking water for most cities including Lahore. The exact estimation of recharge to groundwater from these water bodies is a complex procedure and not much has been done on this subject in Pakistan. Recharge to groundwater in urban areas is relatively insignificant due to large scale infrastructure development without any provisions for groundwater recharge zones.

The annual rainfall in Lahore is reasonable enough to recharge the groundwater aquifer. However, the existing landscape does not allow any recharge to groundwater in urban areas of Lahore and most rainwater is lost to drains due to fast runoff. By creating favourable conditions, about one-fourth of the average annual rainfall (178 mm) can be recharged to groundwater.

The substantial contribution of the River Ravi in recharging the Lahore aquifer suggests that we should stop discharging untreated wastewater into the river as it can have serious consequences for millions of people in and around the city that rely on groundwater as their principal source of drinking water.

Pakistan needs to prepare itself for the possibility of future changes in climate. Current water management practices may not be robust enough to cope with the impacts of climate change on water supply reliability, flood risk, health, agriculture, energy and aquatic ecosystems. Therefore, improving water management is the best strategy to cope with projected climate changes and their impact on the agricultural economy, water supply to cities and the environment.

Appendix-IV

Framework/ Guidelines for Strategic Environmental Assessment (SEA)



(A Guidance Document)

for

Master Planning of Lahore Division

Document developed by:
M.Mansoor Khan (EIA and SEA practitioner)

Information Class: StandardStandardStandard

This document is prepared, developed, organized for the party which contracted the consultant solely for this activity. This document is inclusive /collection of literature taken from all over the world including training literatures, articles, reports or any other text sought useful for making this study for further actions or guidance. This report should only be used for guidance purpose only.

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Abbreviations used

CSIR: Council of Scientific & Industrial Research

CDF: Critical Factors for Decision Making

EIA: Environmental Impact Assessment

ESF: Environment Sustainability Factors

IAIA: International Association for Impact Assessment

IUCN: International Union for Conservation of Nature

IWRMD: Integrated Water Resources Management and Development

MCA: Multi Criteria Analysis

NGO: Non-Governmental Organization

OECD: Organization for Economic Cooperation and Development

SEA: Strategic Environmental Assessment

SI: Strategic Issues

SD: Sustainable Development

SEP: Stakeholder Engagement Plan

SWOT: Strength, Weakness, Opportunities and Threats

UNEP: United Nations Environment Programme

WB: World Bank

Preamble

This guidance document focuses on the Strategic Environment Assessment. As SEA is not mandatory in Pakistan, but taking this an opportunity, this guidance document is carved out considering the practices done so far specially in Portugal and Vietnam in order to motivate environmental practitioners, organizations, institutions and decision makers to look into environmental matters in a broad spectrum i.e; planning level.

Strategic Assessments have been undertaken in Pakistan for few developments including two pilot SEAs (one for Gilgit City Master Plan and the other for Hydropower Sector Planning of AJ&K) and legislated in some provinces of Pakistan as an outcome of efforts made under National Impact Assessment Programme. Being part of this programme and SEA initiatives performed, know-how of SEA is well-understood and it is privilege being considered to develop a guidance document for Master Planning of Lahore Division of this newly introduced concept in the world. Since, SEA has no hard and fast rules so far, hence, it is quite a flexible methodology in terms of selection and application.

This document would present an understanding of the subject, core aspects, future propositions for this Master Planning and will provide a platform to the experts for further studies and decision making.

Special credits are paid to the institutions/organizations (IAIA, OECD, CSIR, WB, ADB, SMEC, IUCN, gtz, Ramboll, Swiss Agency for Development and Cooperation, etc etc), Maria Rosário Partidário and all others whose inputs/publications in this subject (SEA) have been quoted in this document.

Section One: Understanding the SEA

Background of SEA

This part of the section would narrate the background of origination of SEA. Different scientists/researchers/institution narrated understanding of SEA in their own way, as and when they have quoted. Thus, this part should not be assumed as a benchmark for concluding the results, rather it must be considered as a pathway of developing an understanding of the background.

In 1989 SEA was introduced as a concept, and a term, in the context of a European research project as "the environmental assessments appropriate to policies, plans and programs of a more strategic nature than those applicable to individual projects likely to differ from them in several important respects" (Wood and Djeddour,1989)

(Ref: Strategic Environmental Assessment Better Practice Guide- methodological guidance for strategic thinking in SEA by *Maria Rosário Partidário)*

During the last decade the world has witnessed a rapid, though controversial, evolution of the environmental policy agenda. Increasingly, traditional environmental decision-making is being questioned, not because it has not developed sufficient legal mechanisms or methodological tools, or because it did not seek to find solutions for critical environmental degradation, but essentially because it is not efficiently responding to the new challenges of the late 20th century, as confirmed and proclaimed by the United Nations Conference on Environment and Development in 1992. In particular, it is not fully achieving the initially expected results regarding environmental soundness and integration with economic and social issues.

Despite this apparently negative trend, much effort is dedicated to improving environmental performances, to increasing environmental awareness across development sectors, in public, governmental, or private decision-making, in inviting and guiding change in decisional attitudes and its supporting values. Significant environmental policy evolution is occurring not only in the developed world but also in the developing and transitional economies.

Strategic Environmental Assessment (SEA) has been emerging in this context. May be not surprisingly, there is an increasing complexity behind and around current development and decision-making processes derived from the explosion of electronic communications, the speediness of information production and outdateness, the emerging societal values of equity and fairness, the urgency of rational decisions supported by scarce or defective information and conflictual priorities, all development vectors that call for new forms of proactive intervention in more strategic contexts.

Project' Environmental Impact Assessment (EIA), as currently practiced, has been unable to respond to this increasing complexity and provide for global, sustainable and sound decision-making. Such desilusion with the capacity of project' EIA to assist, as a single tool, sound environmental decision-making in a tiering system was the strongest argument that determined the need for SEA in its early days (Lee and Walsh, 1992; Therivel et al., 1992; Wood and Djeddour, 1992; Sadler and Verheem, 1996). The reasons are various and can be summarized as (Partidário, 1999):

• the timing of decisions: project's EIA takes place at a stage when it is too late to consider the effects of policy and planning critical decisions; these happen in the absence of a systematic impact assessment process, which outcome could subsequently influence project planning and design;

• the nature of decisions: the less concrete and more vague nature of policy and planning decisions, often its incremental nature, through small, sequential and iterative decisions that challenge rational and systematic processes was seen as a significant constraint to the operation of a pragmatic, technically focused, and rationally oriented tool such as EIA; a new impact assessment tool, inherently adaptable to more strategic, and often incremental, levels of decision-making, was therefore needed;

• the level of information: at the policy and planning level often there are serious limitations in the availability of information, and a reasonable uncertainty regarding action implementation and respective timings; this impeded the satisfaction of project EIA needs, in terms of required detailed levels of information and certainty.

(Ref: IAIA Training Course, "*SEA current practices, future demands and capacity building needs" by Maria Rosário Partidário*)

Defining SEA

Strategic Environmental Assessments (SEAs) have been developed by the environment community as "*instruments to bring environmental concerns into the strategic levels of decision making – policies, legislation, strategies, plans, and programs (PLSPP)*". SEAs were developed to tackle concerns that Environmental Impact Assessments (EIAs) were not fully effective because many of the environmental issues resulted from earlier, strategic decisions.

SEAs have been used for a variety of purposes, including developing a shared understanding of environmental issues, building a consensus on the way to tackle these issues, identifying issues to be tackled in depth in project-level EIAs, developing investment plans, in national, regional and transboundary settings. Essentially SEAs

allow decision makers to take advantage of environmental and social opportunities while managing environmental and social risks in a strategic setting.

(Ref: *"SEA and IWRMD" World Bank, 2007*)

Thus, SEAs are considered as Instrument (process) that assists and facilitates decision-making, acts at strategic levels of decision-making and focuses on few relevant issues for decision making. (conceived from Partidário 2007)

Importance & Objectives

There are several reasons why SEA is important (based on Partidario, 1999; CSIR, 2000; IAIA, 2002):

1. Promotes and helps to understand sustainability challenges, incorporating an integrated perspective earlier in policy-making and planning processes;

2. Supports strategic decision-making, setting enabling development conditions;

3. Facilitates identification and discussion of development options and provides guidelines to help development to follow sustainability trajectories;

4. Informs planners, decision makers and affected public on the sustainability of strategic decisions, ensuring a democratic decision making process, enhancing the credibility of decisions;

5. Encourages political willingness, stimulates changes to mentalities and create a culture of strategic decision-making.

In its understanding as a strategic thinking model, SEA applies to the strategic component of decision-making processes in (i) public policies, (ii) sectorial development plans and programmes, (iii) territorial development plans and programmes (iv) and also to major structural investment projects that have long-term strategic objectives (such as new international airports, new forms of energy production (ethanol, wind-based, water-based) in relation to their strategic concept).

SEA has been widely promoted by international development agencies (World Bank, 2011; UNEP, 2009; OECD, 2006). However more than the assessment of development proposals, SEA is an important instrument to help face development challenges generated by:

a) Adaptation and mitigation to climate changes;

b) Poverty eradication and overcome of social and regional inequalities;

c) Enhancement and maintenance of biodiversity values, ecosystem services and human well-being;

d) Social and territorial cohesion;

e) Promotion of regional development potential;

f) Innovation and cultural diversity of the population;

g) Promotion of environmental quality, landscape and cultural heritage and sustainable use of natural resources.

(Ref: Strategic Environmental Assessment Better Practice Guide- methodological guidance for strategic thinking in SEA by *Maria Rosário Partidário*)

SEA Performance Criteria

IAIA narrates that an SEA must be:

- Integrated
- Sustainability-led
- Focused
- Accountable
- Participative
- Iterative

(Ref: IAIA 2002)

Key stakeholders in SEA

Key stakeholders in SEA are usually institutions (not individuals) because the institutions have the authority and capacity to execute or in case implement the SEA.

Key authorities:

- Agencies assigned to formulate Policy, Plan or Programme
- Authorities that are responsible for approval of the Policy, Plan or Programme

- Authorities responsible for establishing SEA review councils (in some countries)
- Authorities responsible for implementation of Policy, Plan or Programme

Other authorities usually consulted:

- other authorities with environmental mandates (EPAs etc.)
- relevant authorities with social mandate
- relevant authorities with economic mandate
- relevant ministries & ministerial level agencies

Other stakeholders in SEA

High-level or general Policy, Plan or Programme could raise interest of:

- Academic organizations
- Professional associations
- Business groups
- NGOs

Local or detailed Policy, Plan or Programme could raise interest of:

- Local NGOs
- Institutions that represent interests of affected citizens (e.g. social welfare organizations, any committee/union of minorities etc)

Relating EIA and SEA

- SEAs may broadly follow basic analytical steps in EIA but have much larger boundaries in terms of time, space and subject coverage
- SEAs should provide an overview of trends without the Policy, Plan or Programme and with the Policy, Plan or Programme
- SEAs can recommend (i) changes within the proposed Policy, Plan or Programme, (ii) improvements in coordination between relevant agencies, or (iii) new cross-sectoral interventions
- SEAs can also provide suggestions for EIAs of future projects and improve their quality

Following table below represents in a very brief way the major differences between an EIA and SEA.

Features	**EIA**	**SEA**
Considered alternatives	Locations and technologies	Development directions (objectives and scenarios) and multiple actions to achieve them
Impacts	Specific impacts on the local state of environment – compared with local env. quality	Long-term trends (often related to env/SD objectives) – comparison against env./SD objectives Specific impacts often assessed only if Policy, Plan or Programme contains specific project proposals
Assessment	More quantitative	More qualitative (expert judgements)
Public concerned	Affected public and organized groups	Mainly organized "publics" – interest groups, think-tanks
Quality review	Quality of EIA report and process management	Quality of assessments and sound process + due account of SEA in the Policy, Plan or Programme

Section Two: Conducting SEA for Master Plan of Lahore

Step One: Developing the context

The first step of developing an SEA for the said master planning of Lahore would be to develop the context. Following key indicators would help to draw a framework for onward conducting an SEA and facilitating the decision-making process viable and sustainable.

Creating Baseline

The desk studies must be done prior initializing the SEA process. Collecting enviro-social baselines, organizing them, review already present literature of the project area and project influence area. The baseline must be developed considering all inter-linked factors that may cause hindrance in further process.

A review and analysis of all prevalent polices, laws and regulations must be carried out in order to understand the prevalent legal and administrative structure. Focus can specially be given to the related polices, laws, regulations etc which are directly or indirectly linked to this development.

Identification of the loop holes, conflict of interest, gaps, or any other matter that can alter or create hurdle in the development or the suggested outputs and decisions must be pointed out and suggestions must be given as how to tackle those legal/legislative areas.

Identification of Strategic Issues (SI)

Identifying the key concerns/strategic issues is next step of an SEA. The fate of an SEA relies upon identification of these issues. In other words, it can be called as "scoping" of SEA. It needs to be assessed that what are the basic concerns/issues that are or can be resulted in case of pursuing a certain project, plan or programme. Such as, in case of "Master Planning of Lahore" the key strategic issues that need to be tackled/dealt with can be broadly classified as social, environmental and economic.

This is the stage of an SEA which would identify as well as prioritize the needs that must be addressed at the strategic level. Developing a master plan involving much districts of Lahore would raise certain environmental and social impacts which must be prioritized according to the sensitivity, nature and size. An example of the proposed strategic issues is presented below, which is only for a general understanding which can be changed/modified while conducting an SEA for this initiative:

1) Environmental resources (ground water, surface water, air quality, forest cover, climate change etc)
2) Social resources (population, traffic, employment, businesses, etc)
3) Any Other…….(Administration, institutions, inter-departmental coordination etc)

Identification of key strategic issues may or may not lead to Critical Factors for Decision Making (CFD) that might be assessed at the same time. CFD would revolve around the strategic issues (SI), environment sustainability factors (ESF) and sustainability reference framework (SRF).

- Strategic issues (SI) : Express the intended strategy in the plan, policy or programme
- Environment sustainability factors (ESF): Express the relevant environmental and sustainability scope
- SRF: basically establishes an assessment referential based on relevant major environmental, sectoral and sustainable development policy objectives.

Setting the targets

As for the master plan of Lahore, a drastic change in the infrastructure would occur in the next 30-50 years. So, setting the targets would be of utmost importance as "what to achieve in the next 30-50 years?" Decision makers should set the targets as per achievement of environmental and social sustainable targets.

For this, as an example, the motive should be, but not limited to target the aspects, such as:

- ✓ Reforms in the polices
- ✓ Reforms in the plans
- ✓ Environmental Sustainability
- ✓ Social Sustainability
- ✓ Economic Sustainability
- ✓ Etc etc……



Identification of decision makers

The "decision makers" would bear the sole responsibility of determining, analyzing, approving and implementing the suggested policies, plans and programmes. The key decision makers could be the key departments that will also be the stakeholders to this development such as:



- ✓ Planning and Development
- ✓ Environment Protection Department
- ✓ Board of Revenue Punjab
- ✓ Communication and Works
- ✓ Housing, Urban Development and Public Health Engineering
- ✓ Industries, Commerce and Investment
- ✓ Law and Parliamentary Affairs
- ✓ Local Government and Community Development
- ✓ Etc etc

Furthermore, it can only be possible if higher dignitaries of the government, who can actually take decisions, approve them and make reforms (if any) as per proposed recommendations/suggestions in the SEA report.

Identification of stakeholders

Identifying stakeholders is yet another step of "involving" the institutions, organizations, people or interested groups in Strategic process. In this case, the stakeholders can be, but not limited to:

- ✓ Government Departments (as listed above and others who can be directly or indirectly affected or can make input)
- ✓ Semi-Government/Autonomous bodies (Only relevant institutions)
- ✓ Private Organizations (very specific organizations who have interest, or else can be affected through amendments/initialization of the master plan)
- ✓ National and International NGOs (NGOs related to environmental and social mandate)
- ✓ Social/Community Groups (ethnic, indigenous, native and other groups or unions that can be impacted/affected either directly or indirectly)
- ✓ Etc (any other as per the scenario)

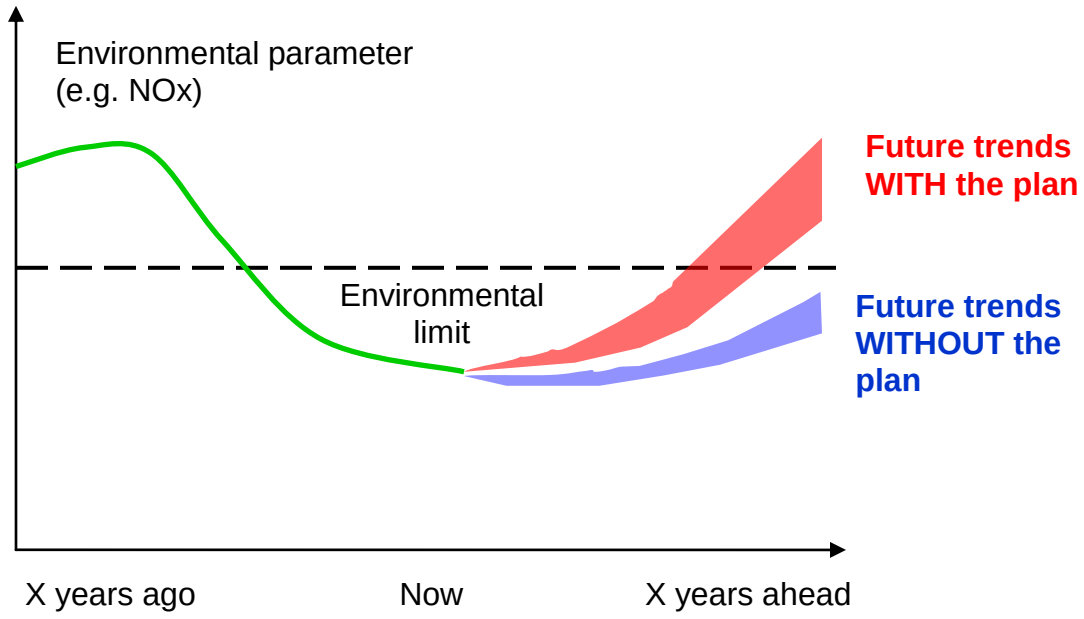
A Stakeholder Engagement Plan (SEP) is suggested that would be a part of the SEA report and included as a chapter or section.

Step Two: Developing the strategy

Depending on the background work as discussed above (identification), a strategy should be carved out/built on the same grounds as identified. Development of strategy would be based on the key Strategic Issues and Targets.

Selecting the analytical methods

- Many methods exist (e.g. short survey by Ramboll & YEPB in China identified over 20 methods that could be possibly applied in SEA)
- Their application in SEA depends on whether they:
  - Can analyze long-term trends and implications (e.g. 5-20 years ahead – depending on the type of the policy, plan or programme)
  - Are robust enough to cope with uncertainties and data gaps
  - Can be used within the time & resources available for the SEA
  - SEA methods should consider long-term trends



Most common analytical methods in SEA

Key methods:

- Collective expert judgements
- Matrices showing key risks and opportunities
- GIS or other spatial analyses
- Trend analyses, etc.

Less frequent methods:

- SWOT
- Scenarios
- Network & system diagrams
- Modeling (simulations)
- Multi-criteria analysis, etc.

Expert judgment

Expert judgment is a process for obtaining data directly from experts in response to a specific question.

Expert judgments are inevitable part of any SEA process and of each SEA methodology.

Well organised expert judgments can reflect a life-long experience and expertise of participating experts. Such judgments can be - especially in situations of significant data gaps - more precise than quantitative predictions based on incomplete data.

It does not mean 'guessing'. The most sophisticated means of collective expert judgement is the Delphi technique.

Expert judgement should clearly explain

Assumptions on which the judgment is based (when would the risk/impact occur and what it is caused by);

Future trends and issues which should be considered when judging this risk/impact);

Character of the predicted risk/impact (e.g. probability, nature & scale; duration & reversibility)

Key affected geographic areas, ecosystems or groups

Concerns associated with the risk/impact and its relative importance when compared with the baseline situation; Magnitude of key uncertainties in this judgment.

Matrices

Matrices enable identification or presentation of:

- impacts of proposed developments on various environmental issues (matrices of impacts), or
- synergies or conflicts between proposed development and the relevant environmental objectives (matrices of conflicts or synergies).
- They visually summarize these effects in user-friendly way. As such can be used to quickly compare pros and cons of proposed development options.

A simple matrix can help to identify various effects of a single intervention. More complex matrices can show cumulative effects of numerous projects on various environmental issues or objectives.

Basic matrices can mark the existence of impacts or conflict/synergy using simple symbols (e.g. X, XX). More elaborate matrices use various characters, numerical scores, colours or even textual descriptions to outline the nature, scale, importance and duration or reversibility of each effect.

Presented information should be easy to verify - matrices thus needs to be accompanied by a text explaining the nature of specific effects.

Example of a matrix

Summary of Appraisal of Strategy against Environmental Objectives

Strategic Environmental Objectives	Sub-Objectives	Indicators	Do-nothing	Components of the draft Strategy				Schemes with strategic context or impacts	Overall Strategy
				Hold the line	Managed Realignment	Flood Storage & Washlands	Maintenance		
To protect and, where possible, enhance **flora and fauna (biodiversity)**	To minimise adverse effects on the European Site(s) and ensure direct losses are compensated (3:1 ratio, subject to review)	Area of inter-tidal SPA/pSAC habitat lost (or gained) due to proposal	- - 50 years + + + >100 years	- - -	+ +	+ / -	- -	- - (Easington) + + (Hilton)	-
	To address the adverse effects of 'coastal squeeze' on the European Site(s)	Area of habitat creation sufficient to replace losses identified in the CHaMP	+ +	- - -	+ + +	+ / -	-	+ + (Wint'ham & Hilton)	+ + +
To protect the **historic environment**	To minimise adverse effects on undiscovered or buried archaeology	Area and quality of 'potential' archaeological assets threatened	+ / -	+ / -	+ / -	+ / -	+ / -	0	+ / -
	To protect designated archaeological and historic features within the floodplain	Numbers of SMs and other designated features protected from adverse effects of flooding	- - -	+ + +	+ / -	+ / -	+ +	0	+ +
To respond to **natural processes** and to avoid contamination and erosion	To ensure proposals do not have adverse effects on wider estuarine processes	Indirect inter-tidal habitat losses and / or adverse effects on navigation	- -	+ +	-	+ /-	+ / -	0	+ +
	To ensure that 'contaminated sites' are prevented from having an adverse effect on the Estuary	Potential for pollution of estuary from contaminated sites	- - -	+ +	+ / -	+ / -	+ +	0	+ +
To protect and where possible enhance **landscape, amenity and recreational** values	To ensure characteristic and valuable landscapes are protected & enhanced and that recreational or amenity features are protected & promoted where possible	Damage/loss OR creation/enhancement of valuable features	- -	+	+	-	+	0	+
To protect and, where possible, provide opportunities for **economic development and employment** (including protection of existing land uses where appropriate)	To protect high quality agricultural land from flooding	Area of land agricultural land protected.	- - -	+ + +	-	- -	+ +	- - - - (Hilton)	+ + +
	To protect areas of employment from the adverse effects of flooding and provide a secure environment for economic activity and development	Numbers of commercial business and jobs protected	- - -	+ + +	+ + +	+ +	+ + +	0	+ + +
To protect existing **transport infrastructure** (land and sea)	To ensure there are no adverse effects on navigation (e.g. on channels, deepwater docks and beacons etc)	Adverse effects on navigable channels / dredging requirements etc	+ / -	+ + +	+ / -	+ / -	+ +	0	+
	To prevent adverse impacts of flooding on road and rail infrastructure	Length of road and rail and accesses protected	- - -	+ + +	+	+ / -	+ + +	- (Wint'ham)	+ + +
To maintain and, where possible, enhance public **safety, health and security**	To protect people and their property from the adverse effects (physical and psychological) of flooding	Numbers of people protected	- - -	+ + +	+ +	+ +	+ + +	- - (Kilnsea)	+ + +

Key to the table: significance of impacts			
---	Major negative	+++	Major positive
--	Moderate negative	++	Moderate Positive
-	Minor negative	+	Minor Positive
-/+	Negligible impact or minor positives and negatives	0	Not Applicable

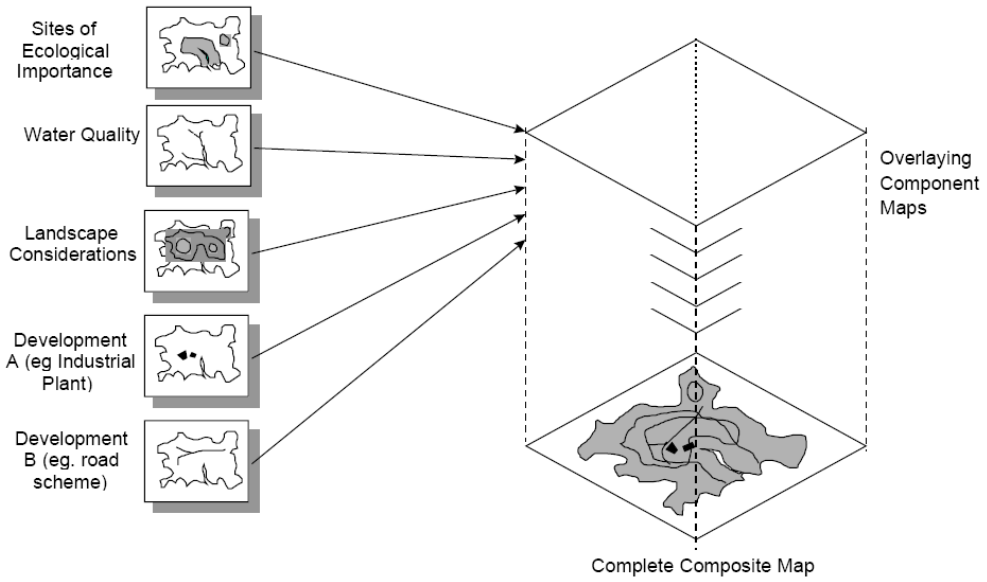
Spatial analyses: Overlay Mapping and Geographical Information Systems (GIS)

These methods illustrate the spatial distribution of relevant issues and impacts.

They are undertaken through a preparation of maps with different information which is relevant to the SEA. These maps are then laid over each other

Spatial analyses can be based on manual elaboration of transparent maps (overlay mapping) or elaboration and processing of electronic maps (Geographical Information Systems, GIS).

Example of spatial analyses



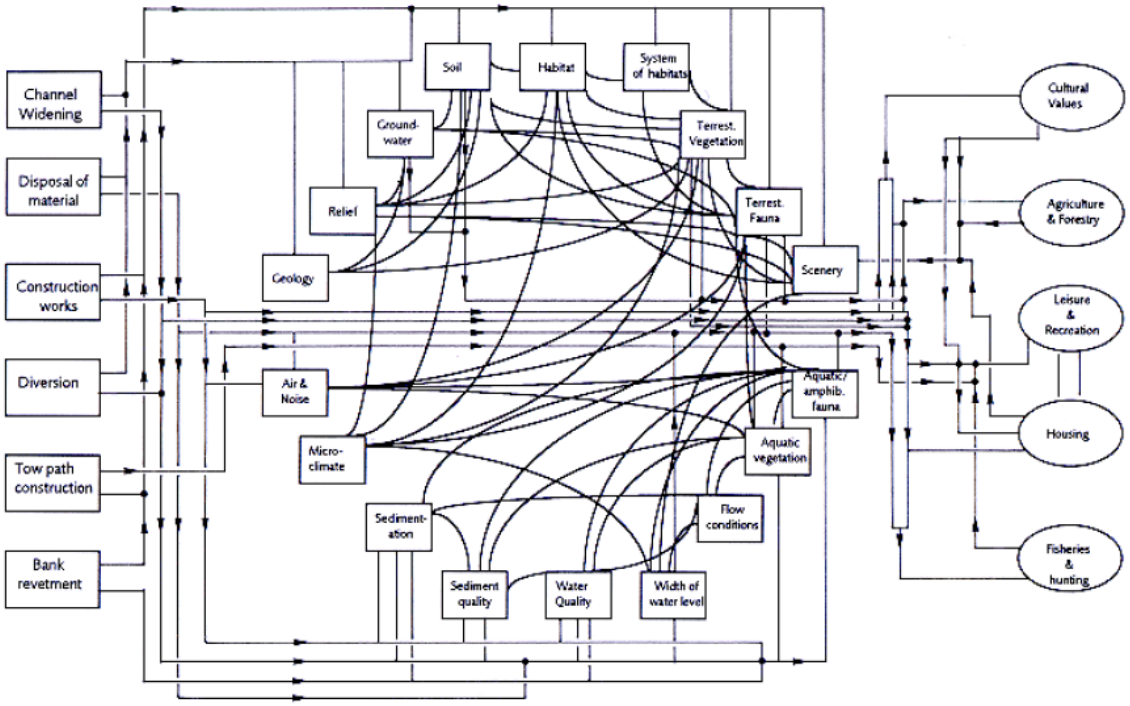
Networks and system diagrams

Networks and system diagrams can be in SEA used to illustrate:

- implications of the proposed decisions on the subsequent decisions and knock-on effects on other developments (decision-trees); or
- a gradual progression from direct immediate effects to indirect or longer-term or delayed effects (effect networks).
- They do not illustrate spatial or temporal scales of impacts and can become too complex

Example of a system diagram

Effects of Channel Widening on Water Quality



Models (simulations)

Models facilitate simulation of environmental impacts.

Developing a new model is generally very costly. Established and accepted models can be used if they are carefully calibrated to ensure that the simulation fits the specific features of the study area.

Modelling generally tends to be used in SEA only when other suitable models and information are available and when use of models would not be too costly

Environmental modeling typically includes the following basic steps:

1. Define the specific issues and interactions that need to be simulated;
2. Define key assumptions and boundaries of the simulation;
3. Identify the suitable model and fine-tune it to fit the local situation and data availability;

4. Collect the basic data on the local environment (e.g. topography, wind speed & direction, flow regimes, etc.)
5. Collect the input data for the past and current situations (e.g. emission levels) and run the model to enable its verification and calibration;
6. Run the model for the different scenarios that are considered in the assessment.

Multi-criteria analysis

Multi-criteria analysis (MCA) numerically evaluates all alternative options against several criteria, and combines these separate evaluations into one overall evaluation.

It can be used to identify a single most preferred option, to rank options, or simply to distinguish acceptable and unacceptable solutions so that a limited number of options can be short-listed for a detailed appraisal.

MCA requires:

- Carefully identified assessment criteria reflecting the key environmental consequences of all proposed alternative options
- Judgments on relative importance/weights of these criteria
- Judgments on performance of each option with regard to all criteria
- MCA – if improperly used – may not facilitate consensus on very controversial decisions;
- By presenting quantitative information (aggregated scores) MCA may create a false impression of accuracy. This sometimes hides the fact that all MCAs heavily depend on a value judgment;
- MCA may be easily manipulated by those who perform it (this unlikely but the risk exists)
- It may reduces rational discussion into often meaningless debate about numbers

Trend analysis and extrapolation

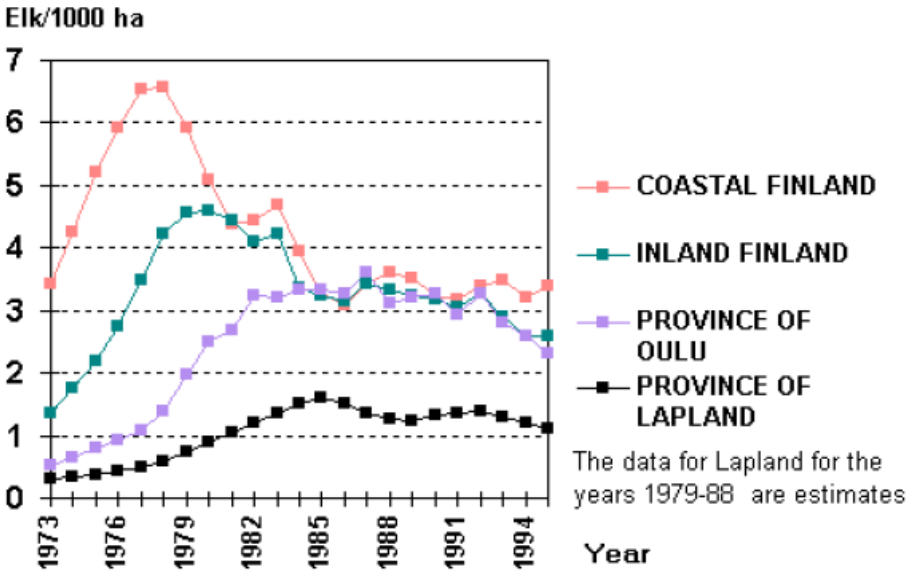
Trend analysis and extrapolation helps to interpret environmental pressures and changes over time.

Trends should be analyzed over a correct temporal scale. The presentation of trends can be fairly simple, e.g. a line graph, or complex graphs correlating trends in the environment with the changes in their drivers

It can also assist predictions of future impacts as some trends can be safely extrapolated on the assumption that the trend is going to continue in the same dynamic.

Be however careful of oversimplified extrapolation that does not consider how the trend will evolve given the different driving forces, counter-trends or once they reach a breaking point

Example of simple trend analysis



SWOT

SWOT can be used in diagnosis of the current/instantaneous situation.

It highlights the key internal issues (strength and weaknesses) and the key external issues (opportunities and threats) that should be considered in the policy, plan and programme making process or in the assessment process.

	Positive	Negative

Present & internal issues	Strengths	Weaknesses
Future & external issues	Opportunity	Threats

SWOT – key strengths

- reduces a large quantity into simple overview of key issues that could be considered in the policy, plan and programme making process or assessment.
- useful method for obtaining various viewpoints on the current situation and can be very well used in participatory processes.
- depends only on personal knowledge and insights of participating experts - small demand for data
- can be done as a quick exercise by single person or as a rapid appraisal process of current situation that involves a large number of stakeholders.
- ability to analyze uncertainties
- high transparency

SWOT – key weaknesses

SWOT has a tendency to oversimplify the situation.

- simple presentation of strengths and weaknesses does not explain why these strengths and weaknesses occur (their root causes) and whether there are any linkages between them.

Scenarios concept

Scenarios are acceptable descriptions on how the future may happen, based on propositions *what if…???*

Scenarios are not predictions of the future, they outline possible future situations that reflect present and future developments.

Scenario building

Scenario building considers the key driving forces and uncertainties that affect the future development.

It focuses on the following questions:

- ✓ What are the key driving forces?
- ✓ What are the key uncertainties?
- ✓ What is inevitable (given the driving forces)?
- ✓ What would happen (if the key uncertainties materialize)?

Use of Scenarios in environmental matters

Always include:

- a representation of the initial state of the environment and
- a description of the driving forces and changes that determine the future of the environment
- an identification of the key uncertainties that may determine a different evolution of the future
- An outline of possible future situations

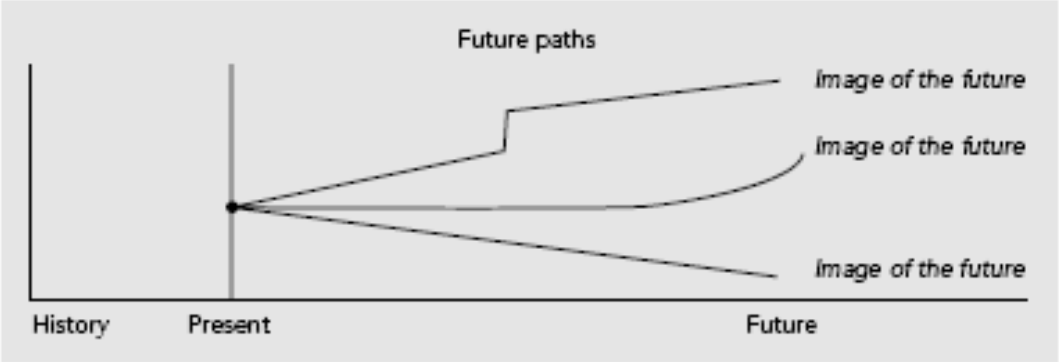
Types of Scenarios

- ➢ Forecasting;
- ➢ Backcasting;
- ➢ Qualitative;
- ➢ Quantitative.

Forecasting scenarios

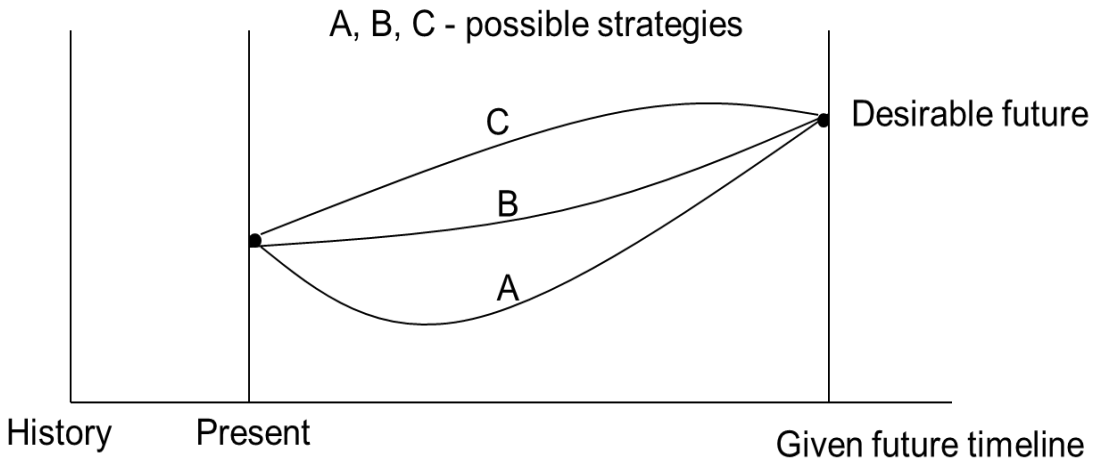
Start with the current situation and explore alternative future developments considering certain assumptions.

Figure 2.1 Elements in scenarios and the time horizon



Backcasting scenarios

Start with a vision of the future (optimistic, pessimistic, neutral, wishful-thinking, etc.) and analyse the different strategies to achieve such situation.



Qualitative scenarios (storylines)

- Exclusively based in narratives.
- Easy to understand and enable the representation of the view points of the different stakeholders.
- Easier way to communicate about the future (comparatively with numerical data, tables, etc).
- Often assumptions are not explicit and do not satisfy the need for numerical information.

Quantitative scenarios (numerical models)

- Normally based on models;
- Assumptions are more explicit (through variables and equations as considered);
- More difficult to understand by non-experts;
- Numerical information may be misunderstood and take scenarios as if they were predictions;
- Normally used for specific environmental problems (e.g. Climate Changes).

Recommendation/Suggestion as per Current Project:

- Accept the fact that you will never have a precise knowledge about the future trends
- It is enough to have information on key impacts in terms of their: Probability, nature & scale
- This information will enable you to compare alternatives and to design mitigation and enhancement measures
- Select the simplest available methods which provide you with sufficiently reliable information
- Always acknowledge uncertainties in these predictions

Integrating SEA in decision making

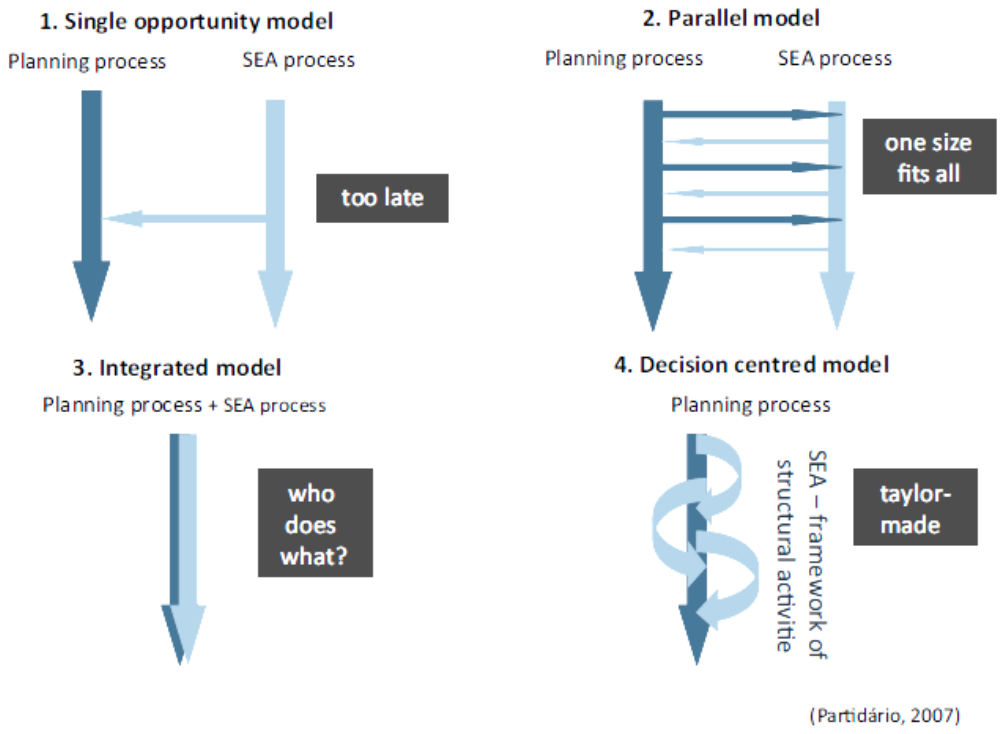
Several aspects need to be considered when deciding on how to link SEA and the planning process. Having a separate but well-articulated coordination may be better than a totally separate or totally integrated coordination, because the interconnectedness of the SEA and planning processes is crucial for their overall success. Totally separated coordination would make such connection more difficult. Full integration may risk making SEA, or planning, dominant in relation to each other. The same happens to reporting and teams. It is important to separate functions and responsibilities, should this separation be enabled by the availability of technical and financial resources.

But it is very important that SEA and policy-making/planning processes share several activities, such as fact-finding, information, stakeholder's engagement and public participation.

Different models on how SEA and the policy-making/planning processes may link were identified some years ago (Partidário, 2004) (Figure below) and serve as an illustration of possible linkages.

The first two models (1 and 2) relate more closely to the EIA-based SEA approaches, the parallel model (2) being the most frequently used. Models 3 and 4 relate to more integrated and strategic approaches in SEA.

While the integrated model (3) may eventually represent the best SEA model in the long-term, the decision-centred model (4) seems to be the most flexible and adaptable but that is totally on the one's disposal.



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Conclusion of the Guidance document

As per the above elaborative discussion on the SEA and SEA guidance for Master Plan of Lahore, several items are concluded and suggested which are as below:

1- Strategic Environmental Assessment (SEA) is a must-to-do approach for any mega intervention in Pakistan

2- SEA must be carried out well before the time so as to integrate its results into the decision making process

3- SEA for master plan of Lahore should be conducted well before time so as to grip the critical factors at the right stage and right time

4- Analytical approaches that might be used to carry out the SEA may depend on the availability of the experts and their capacity to do such tasks in Pakistan or international experts can be engaged in order to undertake assessment

5- Ideally model 3 and 4 (SEA and the policy-making/planning models) must have been used but since now the planning process has gone a long way ahead hence model 1 and 2 are suggested for further development/assessment process

6- Policy reforms, as deemed necessary may be applied timely to mitigate future development loop holes

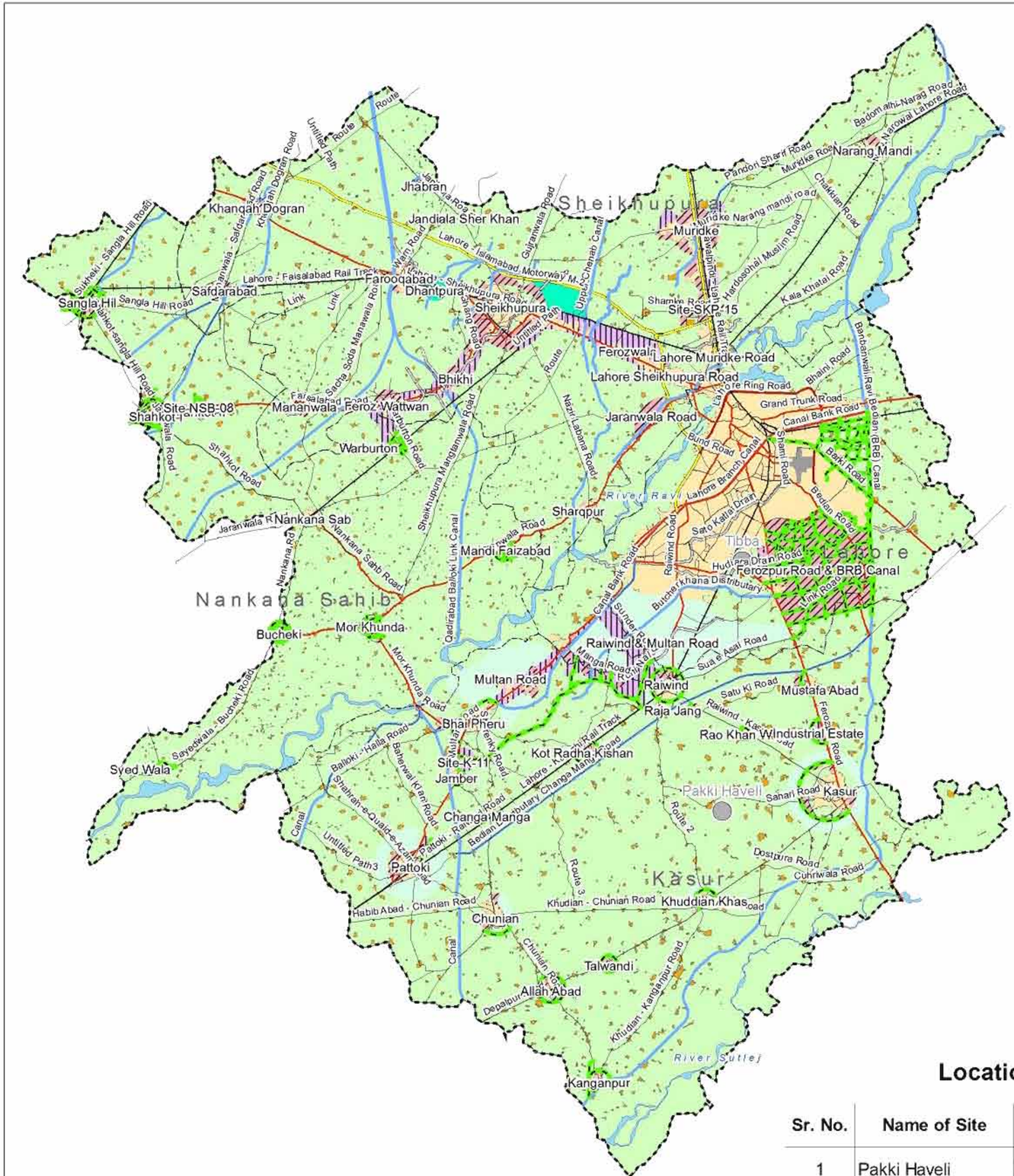
7- EIA would be required for each development under this master plan and as per Punjab Environmental Protection Act, SEA would govern as an umbrella for all the assessment at global level (national and international)

8- Authorities should now look more into the strategic decisions rather than isolated independent scenarios for mega level development

ANNEXURES

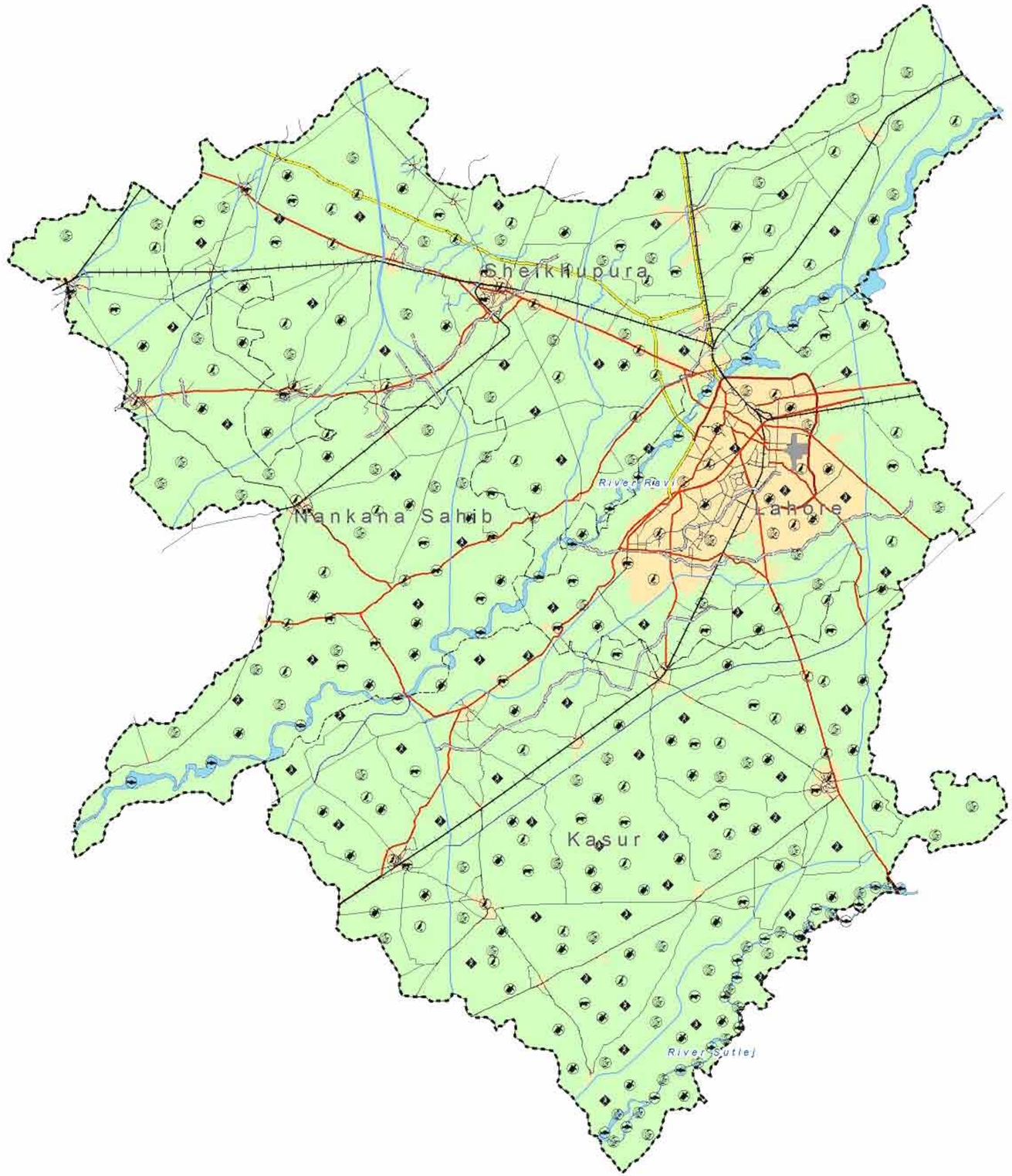
Annex-I

Map of Proposed Landfill Sites


Sheikhupura
Nankana Sahib
Kasur
Lahore
Jhabran
Khanqah Dogran
Jandiala Sher Khan
Muridke
Narang Mandi
Farooqabad
Dhantpura
Sheikhupura
Safdarabad
Sangla Hil
Site-SKP-15
Ferozwala
Lahore Muridke Road
Lahore Sheikhupura Road
Bhikhi
Site-NSB-08
Shahkot
Manawala Feroz-Wattwan
Warburton
Jaranwala Road
Sharqpur
Nankana Sab
Mandi Faizabad
Tibba
Ferozpur Road & BRB Canal
Bucheki
Mor Khunda
Raiwind & Multan Road
Multan Road
Raiwind
Raja Jang
Mustafa Abad
Rao Khan Windustrial Estate
Bhai Pheru
Kot Radha Kishan
Site-K-11
Jamber
Syed Wala
Pakki Haveli
Kasur
Changa Manga
Pattoki
Khuddian Khas
Chunian
Talwandi
Allah Abad
Kanganpur
River Ravi
River Sutlej
Grand Trunk Road
Canal Bank Road
Lahore Ring Road
Lahore Islamabad Motorway M-2
Lahore Faisalabad Rail Track
Lahore Branch Canal
Sato Kalra Drain
Hudiara Drain
Bambanwali Ravi Bedian (BRB) Canal
Lahore - Kasur Rail Track
Sheikhupura Mangtanwala Road
Nankana Sahib Road
Mor Khunda Road
Multan Road
Raiwind Road
Kasur - Pattoki Road
Habib Abad - Chunian Road
Khudian - Chunian Road
Dostpura Road
Cuhriwala Road
Sahari Road
Ferozpur Road
Kala Khatai Road
Chakdian Road
Narowal Lahore Road
Badomahi-Narag Road
Pandori Sharif Road
Muridke Road
Muridke Narang mandi road
Hardosohal Muslim Road
Bhaini Road
Baki Road
Bedian Road
Link Road
Sahiwal Road
Sua e Asal Road
Satu Ki Road
Rawind - Kasur Road
Dostpura Road
Route 1
Route 2
Route 3
Unfilled Path
Unfilled Path3
Sangla Hill Road
Shahkot Road
Jaran

Annex-II

Biodiversity Map of Project Site



N
W E
S

Legend:

- Amphibians
- Birds
- Fish
- Mammals
- Plants
- Reptiles
- Division Boundary
- District Boundaries
- Highway
- Ring Road
- Primary Road
- Secondary Road
- Tertiary Road
- Rail Track
- Canal
- Drain
- Built-up Areas
- Settlements
- Rivers
- Agriculture Area

Project:
Environmental Impact Assessment of Amendment in Master Plan for Lahore Project

Client:
Lahore Development Authority (LDA)

Consultant:
Haris Engineering & Management Consultant (HEMC PAK) Pakistan

Map Title:
Biodiversity Map with Flora/ Fauna Species, Lahore Division

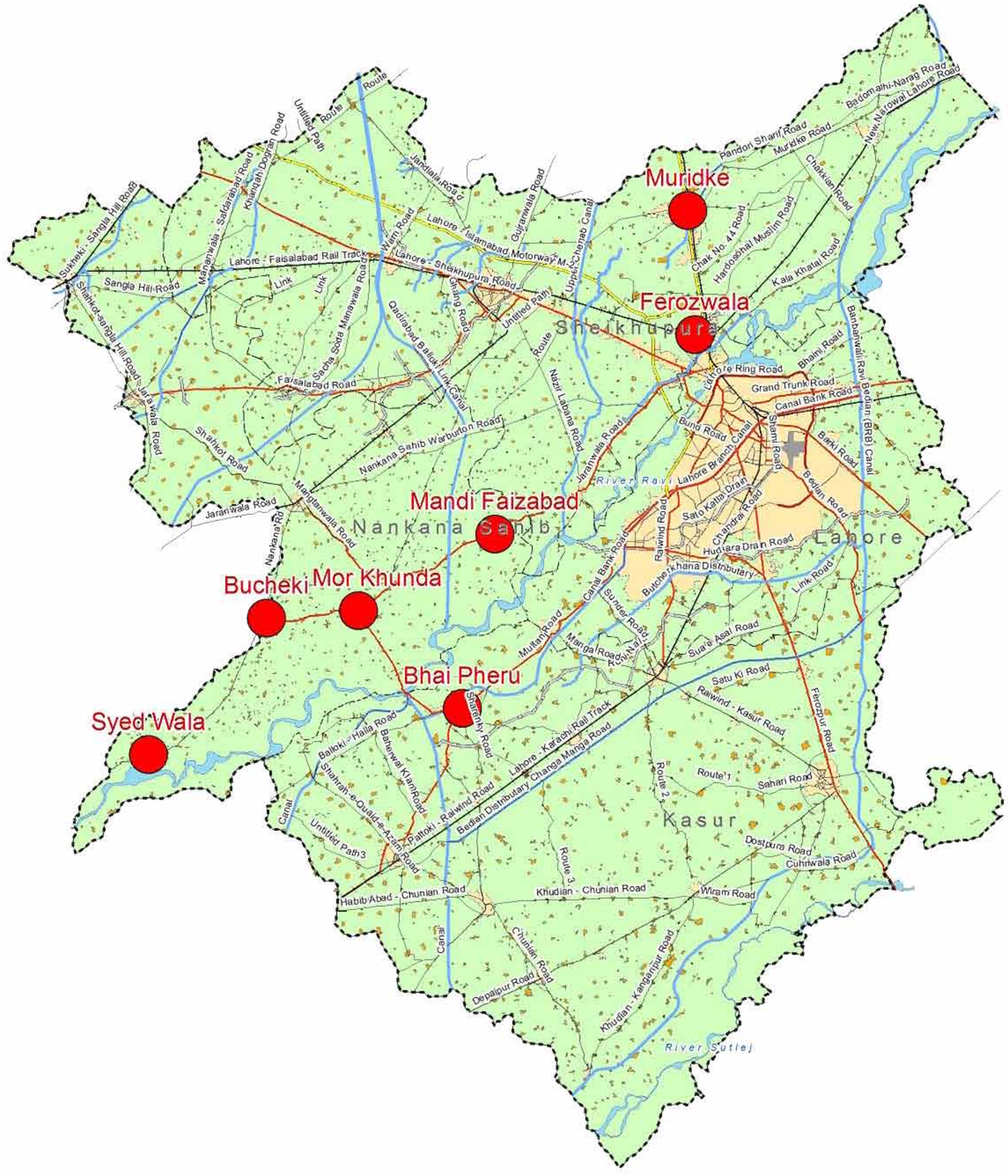
To Scale	1:350,000

Kilometers
0 5 10 20 30 40

HEMC PAK

Annexure-III

Map of Flood Prone Areas





Legend:

- Flood Prone Areas
- Division Boundary
- District Boundaries
- Highway
- Ring Road
- Primary Road
- Secondary Road
- Tertiary Road
- Rail Track
- Canal
- Drain
- Built-up Areas
- Settlements
- Rivers

Project:
Environmental Impact Assessment of Amendment in Master Plan for Lahore Project

Client:
Lahore Development Authority (LDA)

Consultant:
Haris Engineering & Management Consultant (HEMC PAK) Pakistan

Map Title:
Map of Flood Prone Areas falling, Lahore Division

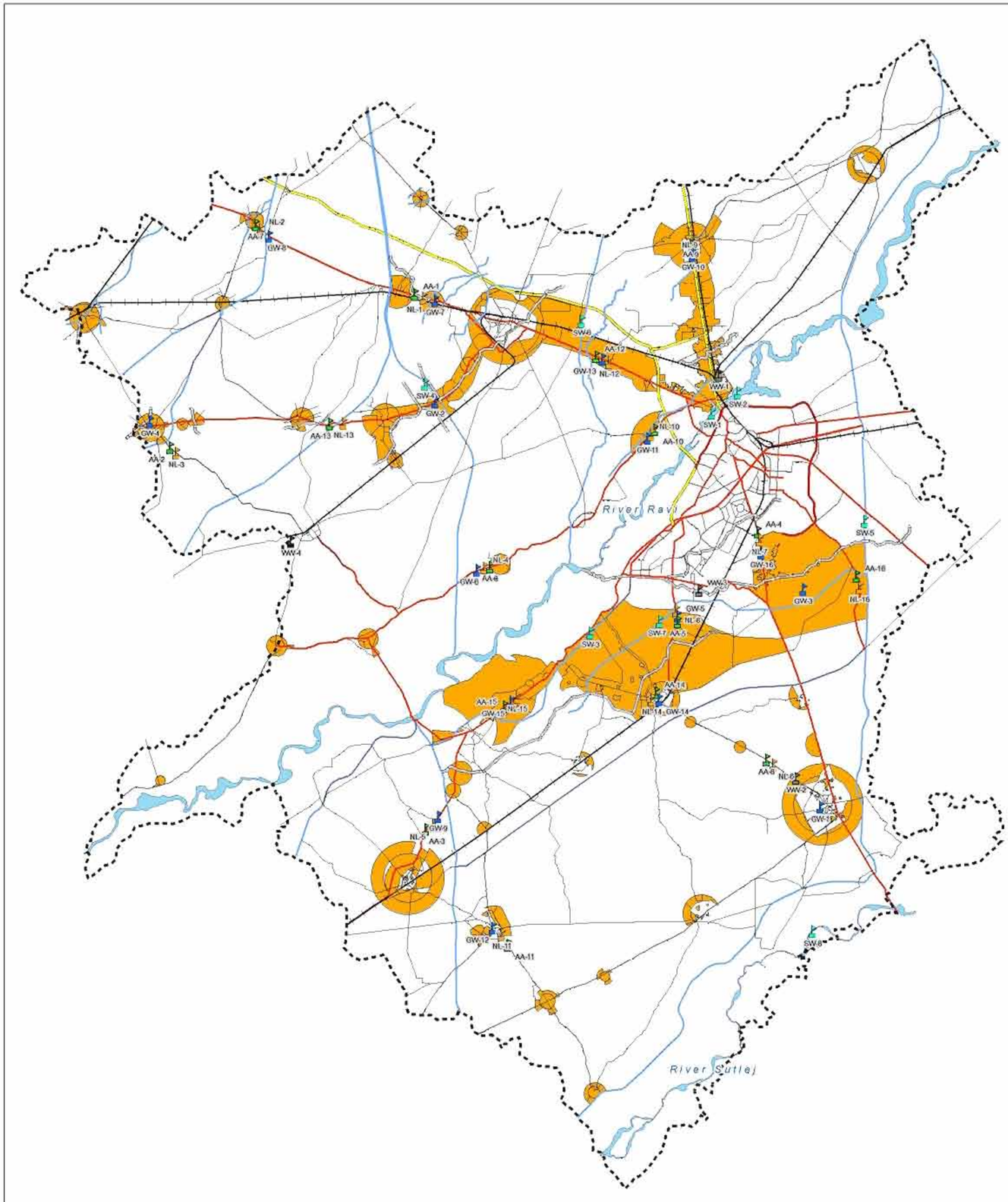
To Scale	1:350,000

Kilometers
0 5 10 20 30 40

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Annexure-IV

Map of Environmental Locations



N
W E
S

List of Environmental Monitoring Location Points

Sr. No.	Name	Env_Test	X_Coord	Y_Coord
1	AA-1	Ambient Air Quality	73° 51' 24.487" E	31° 44' 36.325" N
2	AA-2	Ambient Air Quality	73° 30' 25.872" E	31° 33' 4.325" N
3	AA-3	Ambient Air Quality	73° 52' 49.234" E	31° 5' 8.326" N
4	AA-4	Ambient Air Quality	74° 21' 7.565" E	31° 27' 16.518" N
5	AA-5	Ambient Air Quality	74° 14' 18.139" E	31° 20' 36.142" N
6	AA-6	Ambient Air Quality	73° 58' 7.621" E	31° 24' 32.725" N
7	AA-7	Ambient Air Quality	73° 37' 34.862" E	31° 49' 35.107" N
8	AA-8	Ambient Air Quality	74° 21' 59.802" E	31° 10' 28.611" N
9	AA-9	Ambient Air Quality	74° 15' 12.170" E	31° 48' 33.936" N
10	AA-10	Ambient Air Quality	74° 12' 12.564" E	31° 34' 45.136" N
11	AA-11	Ambient Air Quality	73° 59' 56.916" E	30° 56' 39.571" N
12	AA-12	Ambient Air Quality	74° 7' 6.081" E	31° 40' 7.270" N
13	AA-13	Ambient Air Quality	73° 44' 10.173" E	31° 34' 57.274" N
14	AA-14	Ambient Air Quality	74° 12' 27.785" E	31° 15' 21.141" N
15	AA-15	Ambient Air Quality	73° 59' 27.387" E	31° 14' 14.609" N
16	AA-16	Ambient Air Quality	74° 29' 38.886" E	31° 24' 1.793" N
17	GW-1	Ground Water Quality	74° 26' 39.206" E	31° 6' 59.977" N
18	GW-2	Ground Water Quality	73° 53' 14.775" E	31° 36' 40.989" N
19	GW-3	Ground Water Quality	74° 25' 5.064" E	31° 23' 2.963" N
20	GW-4	Ground Water Quality	73° 28' 41.437" E	31° 34' 58.339" N
21	GW-5	Ground Water Quality	74° 14' 17.442" E	31° 21' 1.803" N
22	GW-6	Ground Water Quality	73° 57' 0.372" E	31° 24' 17.447" N
23	GW-7	Ground Water Quality	73° 53' 9.499" E	31° 44' 10.041" N
24	GW-8	Ground Water Quality	73° 38' 46.197" E	31° 48' 45.852" N
25	GW-9	Ground Water Quality	73° 53' 53.316" E	31° 6' 5.257" N
26	GW-10	Ground Water Quality	74° 15' 20.907" E	31° 47' 39.992" N
27	GW-11	Ground Water Quality	74° 11' 35.275" E	31° 34' 6.488" N
28	GW-12	Ground Water Quality	73° 58' 36.626" E	30° 57' 54.009" N
29	GW-13	Ground Water Quality	74° 7' 38.975" E	31° 39' 55.740" N
30	GW-14	Ground Water Quality	74° 12' 44.603" E	31° 14' 50.387" N
31	GW-15	Ground Water Quality	74° 0' 1.495" E	31° 14' 36.301" N
32	GW-16	Ground Water Quality	74° 21' 25.624" E	31° 25' 42.415" N
33	NL-1	Noise Level	73° 52' 9.705" E	31° 44' 22.543" N
34	NL-2	Noise Level	73° 38' 0.526" E	31° 49' 13.857" N
35	NL-3	Noise Level	73° 30' 58.949" E	31° 32' 42.466" N
36	NL-4	Noise Level	73° 57' 38.482" E	31° 24' 28.518" N
37	NL-5	Noise Level	73° 53' 27.261" E	31° 5' 27.884" N
38	NL-6	Noise Level	74° 22' 36.324" E	31° 10' 7.090" N
39	NL-7	Noise Level	74° 21' 16.732" E	31° 26' 40.635" N
40	NL-8	Noise Level	74° 14' 9.046" E	31° 21' 26.637" N
41	NL-9	Noise Level	74° 15' 5.308" E	31° 49' 16.505" N
42	NL-10	Noise Level	74° 11' 53.880" E	31° 34' 25.571" N
43	NL-11	Noise Level	73° 59' 24.557" E	30° 57' 27.797" N
44	NL-12	Noise Level	74° 8' 12.712" E	31° 39' 43.921" N
45	NL-13	Noise Level	73° 45' 21.690" E	31° 35' 2.087" N
46	NL-14	Noise Level	74° 12' 7.203" E	31° 14' 51.251" N
47	NL-15	Noise Level	74° 0' 34.330" E	31° 14' 56.880" N
48	NL-16	Noise Level	74° 29' 55.391" E	31° 23' 13.349" N
49	SW-2	Surface Water Quality	74° 19' 19.640" E	31° 37' 32.904" N
50	SW-3	Surface Water Quality	74° 6' 48.636" E	31° 19' 44.589" N
51	SW-4	Surface Water Quality	73° 52' 23.294" E	31° 38' 0.141" N
52	SW-5	Surface Water Quality	74° 30' 20.721" E	31° 28' 8.132" N
53	SW-6	Surface Water Quality	74° 5' 49.281" E	31° 42' 45.108" N
54	SW-1	Surface Water Quality	74° 17' 9.214" E	31° 36' 0.760" N
55	SW-7	Surface Water Quality	74° 12' 44.791" E	31° 20' 36.892" N
56	SW-8	Surface Water Quality	74° 26' 0.991" E	30° 57' 48.965" N
57	WW-1	Waste Water Quality	74° 17' 43.612" E	31° 38' 51.241" N
58	WW-2	Waste Water Quality	74° 24' 31.867" E	31° 9' 8.044" N
59	WW-3	Waste Water Quality	74° 16' 6.047" E	31° 22' 55.310" N
60	WW-4	Waste Water Quality	73° 40' 56.478" E	31° 26' 17.761" N

Legend:

- Division Boundary
- District Boundaries
- Proposed Roads

Environmental Monitoring Location

- Ambient Air Quality
- Ground Water Quality
- Noise Level
- Surface Water Quality
- Waste Water Quality
- Highway
- Ring Road
- Primary Road
- Secondary Road
- Tertiary Road
- Rail Track
- Canal
- Drain
- Proposed Landuses
- Built-up Areas
- Settlements
- Rivers

Project:
Environmental Impact Assessment of Amendment in Master Plan for Lahore Project

Client:
Lahore Development Authority (LDA)

Consultant:
Haris Engineering & Management Consultant (HEMC PAK) Pakistan

Map Title:
Environmental Monitoring Map
Lahore Division

To Scale	1:350,000

Kilometers
0 5 10 20 30 40

HEMC PAK

Annexure-V

Photo Log of Project Site

Social Baseline Data and Public Consultation








Coca-Cola







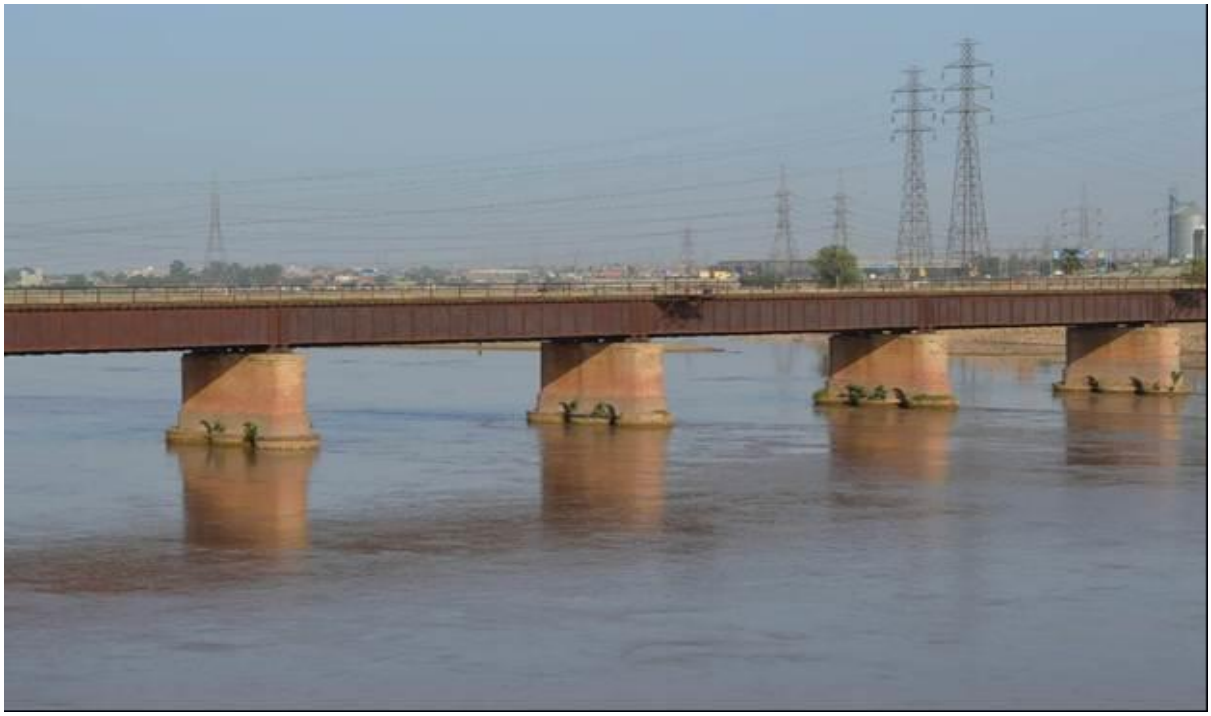


View of River Ravi









View of Rice Fields



Lakhu Der Proposed Landfill Site



Housing Societies in Project Site



View of Railway Track near Sheikhupura



Site Area Photographs








Pakistan State

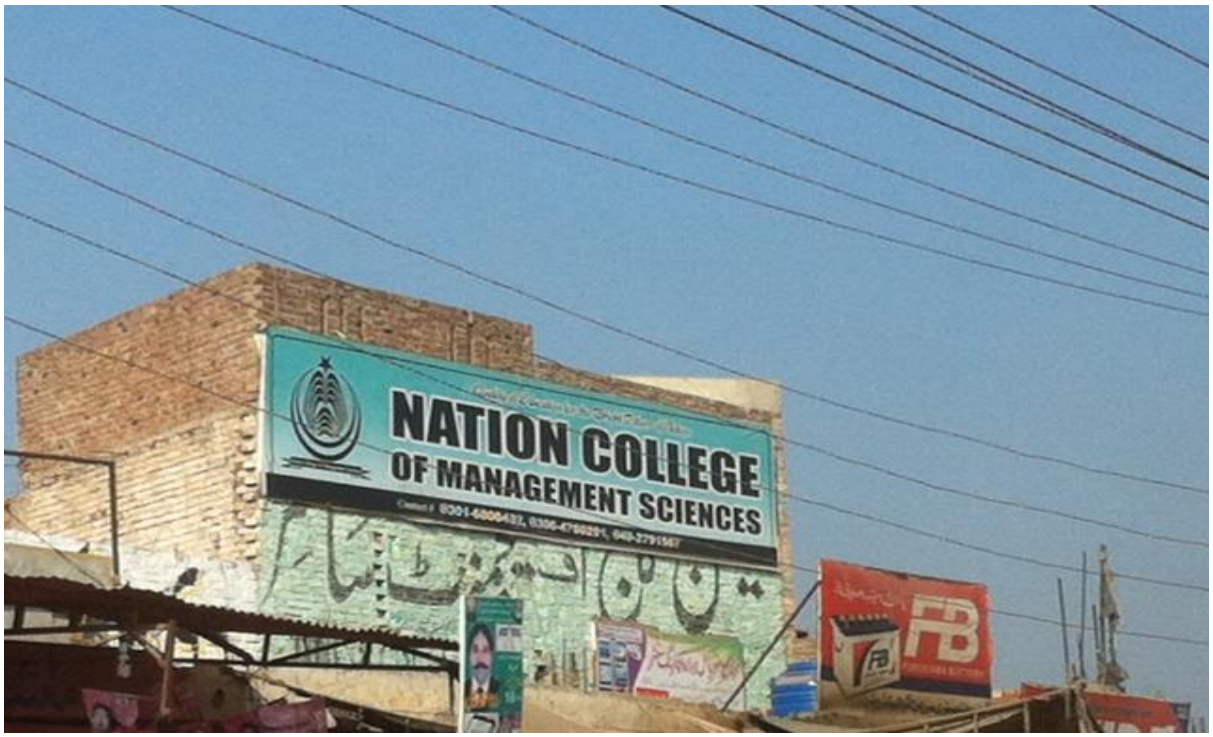







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NATION COLLEGE
OF MANAGEMENT SCIENCES





Annexure-VI

Environmental & Social Baseline Data Sheets

SOCIO-ECONOMIC ENVIRONMENT

i). Human & Economic Development

a. Industries

- Does the project area has any industries big / small _____
- Are there some home industries in the area _____

b. Infrastructure facilities

Infrastructure facilities available to the people:

Facility	Yes	No
Roads		
Sanitation		
Water Supply		
Heath facilities		
Educational facilities		
If any other (Specify)		

c. Mode of Transportation

- Do the people of the area use conservative/modern modes of transportation:

  _____ (Specify)

- Is there any special trade of transportation in project area, etc.

Yes No

e. Power Sources & Transmission

- Is there any grid station/ sub-station present in the project area?
- Is electric supply available to every commercial/ Yes ? No

Yes No

- Do people use other sources of power like generators?

Yes No

ii). Quality of Life Values/Socioeconomic Values

a. Income

- Are most of people living below/above poverty line? _____
- Does the population comprises of Katcha Abadi/Pucca Abadi? _____
- Do people have basic needs of life in their houses? _____
- Do people are well off_____

b. Employment and Occupation

- What are major sources of employment

_____

c. Education

- Is literacy level of the area low/medium/high _____

d. Religion

- Is the religion of majority population Islam _____
- Any other _____ (Specify)

e. Gender Ratio

- Is population of women more than men _____
- Is population of men more than women _____
- Ratio of population of men to population of women in the area (%)
  1. Men _____2. Women_____
- Population density of the area is low/medium/high _____

f. Role of Women

- Either women of the area involve in

Activity	**Yes**	**No**
Household activities		
Business Activities		
Private/Government service		

Electoral activities		
Any other (specify)		

g. Public Health

- Are sanitation, water supply facilities available _____
- Any hospitals, dispensaries available in the area _____
- Any social health workers available _____
- Any particular diseases reported in the area_____

h. Recreational Resources & Development

- Parks/Swings get together areas / festivals arrangements _____
- If any other _____ (Specify)

i. Aesthetic Values

- Any sources of visual pollution _____
- Sources which add to the visual beauty _____
- If any other _____ (Specify)

i. Archeological or Historical Treasures

- Does the area any archeological or historical monuments

Yes	No

- If yes, _____ (Specify)

j. Cultural Values

- Is the culture of area modernized/conservative or a blend of both_____
- Is the community agree to absorb outsider visitors

Yes	No

k. Indigenous People

- Is there any group of indigenous people in project area?

Yes | No

- Is there relocation of such a group is involved.

Yes | No

- Anything special

4. STATUS OF LAND

- Does the area fall under government proprietorship

Yes | No

- Is it a private land

Yes | No

- The extent of land which is to be acquired (if any)

_____

5. EXISTING STRUCTURES

Sr.No	Category	Nos.
1	Residences	
2	Commercial	
3	Communal property	
4	Religious building	
5	Any other	

6. Respondent's Views about Project

6.1 In your opinion, how will you be affected by construction/operation of this project?

_____

_____

6.2 Is this project beneficial for the community?

Yes | No

6.3 Will you feel any disturbance from noise generated by the operation of ropeway system?

Yes | No

6.4 Do you think it will disturb your privacy?

Yes	No

6.5 Would you like to be associated with the project as a worker?

Yes	No

8. General Observations of Interviewer

_____

_____

_____

_____

Name & Signature of Interviewer: _____ Date:_____

Scoping Session/Public Consultation Record

1. **Project :**_____

	Name	Occupation	Age	Address	Income	Marital status	ID no.
1.	_____	_____	_____	_____	_____	_____	_____
2.	_____	_____	_____	_____	_____	_____	_____
3.	_____	_____	_____	_____	_____	_____	_____
4.	_____	_____	_____	_____	_____	_____	_____
5.	_____	_____	_____	_____	_____	_____	_____
6.	_____	_____	_____	_____	_____	_____	_____
7.	_____	_____	_____	_____	_____	_____	_____
8.	_____	_____	_____	_____	_____	_____	_____
9.	_____	_____	_____	_____	_____	_____	_____
10.	_____	_____	_____	_____	_____	_____	_____
11.	_____	_____	_____	_____	_____	_____	_____
12.	_____	_____	_____	_____	_____	_____	_____
13.	_____	_____	_____	_____	_____	_____	_____
14.	_____	_____	_____	_____	_____	_____	_____

	Name	Occupation	Age	Address	Income	Marital status	ID no.
15.							
16.							
17.							
18.							
19.							
20.							
21.							
22.							
23.							
24.							
25.							
26.							
27.							
28.							
29.							
30.							

BASELINES CONDITIONS AND IMPACTS

1. TYPE OF AREA

- Arid
- Semi-arid
- Populated
- Densely populated
- Any other _____specify)

2. PHYSICAL ENVIRONMENT

a. geological conditions

- Is the origin of rocks a) Sedimentary b) Igneous c) Metamorphic
- Any other _____ (specify)

b. seismology

- Is there any record of earthquakes in the past 50 years | Yes | No |
- Presence of faults/fractures | Yes | No |
- Any other details _____ (specify)

c. topography & soils

- Are the soils mixtures of sand /silt/clay/gravel/clayey silt_____
- Any other _____ (specify)

d. Climate

Temperature (^{o}C) (Min - Max)		Winds	Relative humidity	Precipitation	Wind speed
Summer	Winter				

Does the project area has any previous records of flooding?

Yes | No

e. Surface and Ground water

Yes | No

- Is groundwater potable
- If surface water available, what is its quality? _____

f .Air Quality

- Is the area visually pollution free Yes No
- Is the source of pollution traffic (cars, trucks, etc.) Or any other _____ (specify)
- Is the project area is highly; a) populated b) commercial

g .Liquid effluents

- Are there any liquid effluents due to industries/household Yes No
- If any other reason _____(specify)
- Is there exists proper drainage system? Yes No
- Is there any effluent treatment system exists? Yes No
- How much quantity of wastewater generated per day

h. Solid Waste

- Is solid waste management of the area poor/nominal/good_____
- Is poor management due to lack of awareness among people/authority is not responsible enough _____
- What type of solid waste management system exists? _____
- What is approximate quantity of solid waste generated from the project area/study area per day?
- What type of solid waste generated from the project area?

- Is there any hospital waste generated in the project/study area Yes No

- If yes, what are the management/disposal system

---

i. Noise

- Any sources of noise like traffic/industry/commercial activities or other _____(specify)

- Was any instrumental monitoring carried out to observe the noise levels?
- If yes, provide details

j. Buffer Zone

- Are there any protected areas/park in close vicinity of the project area/study area _____

i). ECOLOGICAL ENVIRONMENT

a. Flora & Fauna

- Aquatic ecosystems (if exists)_____

- Prevailing non fruit trees_____
- Prevailing fruit trees_____
- Is there presence of any endangered or rare species of plants

  _____
- Is there presence of any endangered or rare species of animals

  _____
- Is there any removal of trees involved
- Is the project area falls under route of migratory birds?

Yes	No

- Common wild animals in study/project area

  _____

- Is there any threaten national park, reserved forest or wildlife sanctuary in close vicinity of the project route.

Yes	No

- Common birds species in study/project area

- Anything special

Serial No. _____

COMMERCIAL ACTIVITIES

(SHOPS)

Interviewer's Name _____

Date _____

Q.1 Name of the Respondent _____

Q.2 Father's Name _____

Q.3 Age (years) _____

Q.4 Education _____

Q.5 Income _____

Q.6 Marital Status _____

Q.7 No. of family member _____

Q. 8 How many shop(s) do you have to run your business?

(a) Self Owned _____ (b) Rented _____

Q. 9 what is the nature of your business in your shops.

(a) Grocery Shop	☐	(b) Medical Store	☐	(c) Medical Clinic	☐
(d) Driver Hotel	☐	(e) Cloth/Garments	☐	(f) Shoes Store	☐
(g) Fertilizers/Pesticides	☐	(h) Grains/Flour Shop	☐	(i) Fruit/Vegetables	☐
(j) P.C.O.	☐	(k) Gold Smith	☐	(l) Black Smith	☐
(m) Driver Hotel	☐	(n) Auto Workshop	☐	(o) Dry Fruits Store	☐
(p) Precious Stones	☐	(q) General Store	☐	(r) Other_____.	

Q. 10 What is the approximate distance of your shop from Base Station/Landing Station?
_____ feet.

Q. 11 What is the size of plot, nature of construction and the estimated cost of your shop(s)?

_____feet.

Shop No.	Size of Plot (sq. ft)	Nature of Construction 1. Pucca	Estimated Cost (Rs)

		2. Semi-Pucca 3. Kachha 4. Wooden Cabins	
1			
2			
3			

Q. 12 For how many years are you running your business here? _____ years.

Q. 13 What is the estimated value of your present stock of goods in your shop? Rs._____

Q. 14 How many persons are working in your shops? No._____

Q. 15 What is the dominant mode of payment of your goods & services?

(a) Cash Payment ☐ (b) Deferred / Credit Payments ☐

(c) Kind ☐ (d) All ☐

Q. 16 How much is your estimated daily sale of goods / services on an average? Rs._____

Q. 17 How much do you earn profit on an average in a month? Rs._____

--- END ---