



# **Environmental Impact Assessment (EIA)**

## **RIVER RAVI TRAINING AND CHANNELIZATION PROJECT**

### **(PHASE-I)**

**June-2021**



# **RIVER RAVI TRAINING AND CHANNELIZATION PROJECT**

## **Environmental Impact Assessment (EIA)**

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## S1 EXECUTIVE SUMMARY

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River Ravi Training and Channelization Project is the sub project of Ravi Riverfront Urban Development Project (RRUDP) and aimed to channelize the 46 KM stretch of River Starting from Syphon and end at Mohlanwal. It also includes construction of three barrages; one near old Ravi bridge, second near M-2 crossing and third will be constructed near Mohlanwal at lower end of this channelization stretch of 46 km. However, this EIA has been prepared for only Phase-I, which contains one barrage near Old Ravi Bridge as mentioned below and channelization of River Ravi over length of about 14km.

Sr. No.	Proposed Barrage	Coordinates	Location	Phase
1	Barrage-1	31° 36' 56.355" N 74° 18' 25.28" E	Near Old Ravi Bridge	Phase-I

The objective of River Training and channelization is to protect a River Ravi from 1000 years Average Recurrence Interval (ARI) flood and also the channel is designed in a way that it would retain the character of a fresh water body and it should have adequate capacity to pass 1000 years return period.

### S.1.2 NAME OF THE PROJECT PROPONENT

River Ravi Urban Development Authority (RUDA) on behalf of Government of Punjab is the proponent for proposed River Ravi Training and Channelization Project.

### S.1.3 NAME OF THE ORGANIZATION PREPARING THE REPORT

RUDA has engaged M/s Engineering Consultancy Services Punjab (ECSP) Pvt. Ltd. for preparation of Environmental Impact Assessment (EIA) of the proposed project.

### S.1.4 A BRIEF OUTLINE OF THE PROPOSAL (TYPE, PROCESS, TECHNOLOGY AND LAND REQUIREMENT)

In first Phase, the river Ravi will be channelized with the width of about 01 km (1000 m) for a length of 14 km. The bed will be raised about 9 meters. In this way, the total project area is about 14,000,000 m<sup>2</sup> (3459.5 acres).

The design flood used for river training works and estimation of barrage/control structures is considered as 5,86,000 cusecs as the flood above 5,00,000 cusecs was already witnessed twice in 89 years. Detailed

analysis for the phase I was carried out to determine the width and depth of the channel. The width of the channel is 3280.84 ft (1000 m) with wall height of 33 ft including the free board.

The ultimate goal to carry out river channelization is to make a perennial water body with temporary storage /detention that will flow throughout the year. Once this temporary storage is filled, the outflows that would be kept equal to inflows. The maximum temporary storage is estimated to be about 0.22 Million Acre Feet (MAF) with 1000 m wide and 14km long water body.

The project area starts about 6.39 km from Ravi Syphon. The proposed development of channelization will reduce impact of the upstream flow of the project area in case of flooding. The upstream area will require protection from floods and appropriate measures have been taken. For this protection, Dykes will be provided for 6.39 Km stretch.

The proposed project route passes through the agriculture, flood plain, settlements, forest and river area. Some small industrial and commercial units are also present in the vicinity of project area. Almost 40.78% of the land that falls in the project boundary is the agriculture covering an area of 1,410.83 acres. All the agriculture land will be submerged in new development. The total area of the River Ravi present in the project boundary of Phase-I is about 795.7 acres. Total two settlements are also falling in the Project Area and the details of land use are tabulated as under:

Sr. No.	Land use	Area (Acres)	Percentage
1.	Agriculture	1,410.83	40.78
2.	Barren Land	14.5	0.42
3.	Bund or Spurs	8.2	0.24
4.	Creek	153	4.42
5.	Drainage	7.3	0.21
6.	Flood Plain	899.5	26.00
7.	Forest	138.76	4.01
8	Planned	6.6	0.19
9	River	795.7	23.00
10	Settlements	25.11	0.73
<b>Total Area</b>		<b>3,459.50</b>	<b>100.00</b>

### **S.1.5 THE MAJOR IMPACTS**

This environmental assessment process has identified the major negative and positive impacts that will be created during project pre-construction, construction and then operation phases. The proposed mitigation measures will increase the positive impacts of the project.

#### **S.1.5.1 Pre-construction/Design Phase Impacts**

The major impact to be occur in this phase is relocation of two settlements covering an area of 25.11 acres of land. These settlements contain 634 households with population of 4,271. These will lose their assets as well as livelihood due to the implementation of this sub project. It is a major impact as it may involve resettlement of population along with their assets. Both government and private land exist in the project area and private land needs to be acquired. The other major impact is submerging of two forests (Anno Bhatti and Shahdarah Reserve Forest) covering an area of 138.76 Acres which will be compensated under Project Plantation Plan.

#### **S.1.5.2 Project Construction Phase Impacts**

There will be impact on soil condition due to construction activities such as excavation, filling, development of access roads, construction camps, River Training and disposal of materials (both solid and liquid). These activities may likely to lead temporary changes in the existing drainage pattern and may have a significant adverse impact on the environment. Construction Camps will generate about 100 kg domestic solid waste (200\*0.5 kg/person/day) of which inappropriate disposal methods will have a negative impact on the physical environment of the project area. The use of chemicals, fuel and lubricants and their storage at site may have negative impact on soil. The construction activities like drilling, concreting, excavation and dumping of soil, chemicals, oil, lubricants, and detergents can deteriorate surface water quality which will be avoided by good housekeeping. Sewage generated from construction camps may deteriorate ground and surface water. Due to operation of construction machinery including Batching plants, excavators, dump trucks, road rollers, graders, haul trucks and transport vehicles dust and emission problems are being generated as most of these are using diesel engines, which generate noise and exhaust emissions. A major part of dust generated will be fugitive dust which can be a problem for the nearby community.

Due to the construction and site clearance, few habitats will be totally lost e.g., the river shoreline. This will totally diminish the plant species growing on the shoreline of River Ravi. The shoreline (Land-water interface) is also important for many amphibians' species. The construction activities may also cause fragmentation, isolation and damage of existing habitat and there

might be disturbance to ecosystems especially to wild animals and birds. There might be disturbance to migratory birds as well during winter season.

During construction activities, the population residing in and the surroundings of the Project Area will be affected in terms of general mobility of the local residents and their livestock, insecurity and theft problems due to the Contractor's workers, noise and dust problems and traffic jams on major roads. There might get disturbance to public properties due to dust and noise. The most significant impact on socio-economic environment is the loss of livelihood. About 1,410.83 acres of agricultural land will be lost that is one of the main asset and source of income for the local people. There might be public health and safety hazards to local residents and workers due to construction activities and movement of construction vehicles.

#### **S.1.5.3 Project Operation Phase Impacts**

The construction of the proposed barrage across the Ravi, may encounter sediment deposition due to relatively very low flow-velocities that are generated because of high increase in flow areas due to artificially increased water level, as compared to those in the original condition of the river. The drop in flow-velocity decreases the sediment transport capacity of the stream which may causes deposition of the sediment in the River.

Due to aquatic weeds formation, there will be negative impacts on Entire River and its related ecosystem. An aquatic weed reduces the effectiveness of river water body for fish production. Aquatic weeds can assimilate large quantities of nutrients from the river water reducing their availability for planktonic algae. They may also cause reduction in oxygen levels and present gaseous exchange with river water resulting in adverse fish production.

Due to increase in volume of water and flow velocity, it will be managed by the designed barrages in different phases of the project. That is how, the downstream flow to barrage i.e., Balloki Barrage will be well managed.

#### **S.1.5.4 Positive Impacts**

The current project will help in entire ecological uplifting of the river. The abundance of fresh water will have overall positive impact on ecosystem and its functions. The proposed artificial island provided in the river will be habitat for many birds and native species. The Ecological uplifting will have direct benefit of providing food resources and indirect benefit in increasing aesthetic beauty of the river.

The development of proposed Ravi River Front Urban Development Project opens the doors for tourism and recreational activities like boating, sport fishing, hoteling, visiting and wildlife viewing. The project has state of the art

parks and floating island which will be worthwhile for watching, visiting and picnics, spaces and new places to visit, admire and enjoy.

During the design, construction and operational phases of the project, there will be a demand for workers, both skilled and unskilled. This will include opportunities for all relevant local people directly on the construction site and also indirectly in related service works such as supply of construction materials etc.

The riverfront development will give economic benefits to local people and business establishments, that it will attract public and private establishments and will boost investment activity and economic regeneration. In addition, it will increase the city's value in economic competitiveness, will attract more investment, will lead to more spending and will offer substantial premiums to developers, landowners and local government.

This Project is designed to cater the maximum flood that occurs in the history of River Ravi. The maximum flood observed in river Ravi is in 1988 which was around 5,76,000 cusecs. The river now been channelized that will cater the 1000 year return period flood of 586,000 cusecs. So, this is one of the important benefits that will avoid the flow of flood water in to the developed areas.

## **S.1.6 RECOMMENDATIONS FOR MITIGATION MEASURES**

### **S.1.6.1 Pre-Construction Phase Mitigations**

For the purpose of resettlement, only those villages will be relocated which are falling in the riverbed, while all other settlements and houses will be retained. Various options (like apartments, model villages, land for land) have been explored to resettle these settlements which are given in Social/Resettlement Framework provided in chapter 7.

The forests especially Anno Bhatti will be avoided either by converting it into island or by diverting/realigning the river channelization. The forest cover coming under project area will require sensitive monitoring according to given plans.

The mature trees falling in the land to be used for various developmental purposes under this project will be shifted to dedicated green areas/gardens with the help of tree transplanting machines instead of cutting.

The small industrial units will be resettled in the allocated industrial areas by the Government while big industrial units will be retained.

### **S.1.6.2 Construction Phase Mitigations**

The Soil contamination can be curtailed by reducing the oil spill and by well maintaining the construction vehicles. Soil contamination by asphalt and other obnoxious material should be minimized by placing all containers in caissons or dumped into temporary 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 by LWMC. Sewage from construction camp will be disposed off by using septic tanks. Construction camps should be established in areas with adequate natural drainage channels in order to facilitate flow of the effluents. Trainings should be given to workers for managing liquid and solid waste. Tuning of vehicles should be made mandatory to reduce the noise and emissions of NO<sub>x</sub>, SO<sub>x</sub>, CO and PM<sub>10</sub>. Emissions and noise from the batching plants and other construction machinery should be controlled with appropriate control equipment. Fugitive dust can be mitigated by sprinkling water.

In order to mitigate permanent loss of habitat, embankment slopes planted with grasses, sedges and herbs should be given along with the river. This will provide a compensation for the vegetation and land-water interface for the movement of reptile and amphibian species. The dredged spoil should properly be disposed in order to avoid habitat damage or amplified fragmentation. Loud noise must be avoided. The construction activities related to river should be avoided in winter as to avoid disturbance to migratory birds. Buffer belt of native species should be planted along the roads and railway tracks in order to extend the wild life habitat and compensation for loss of trees in the area. The degraded forests should be planted with species *Dalbergia*, *sissoo*, *Tamarix aphylla*, *Acacia nilotica* and *Populus euphratica* etc. Forest restoration program will be launched for existing forests like Shahdara, Jhuggian Arazi and other reserve forests.

Effective construction controls should be placed by the Contractor to avoid inconvenience to the population 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 will not disturb. A proper Traffic Management Plan should be prepared in consultation with Traffic Police Department to reduce the problems of traffic jams during construction especially on Shahdara-Bund Road, Kala Khatai-Narang Mandi Road. The land acquisition and resettlement program will be completed prior to the commencement of the construction to ensure that suitable replacement provision is made for loss of assets. Compliance with the Public and worker safety is mandatory in accordance with International Labor Organization (ILO) Convention No. 62 that will be ensured by the Contractor.



### **S.1.6.3 Operation Phase Mitigations**

Regular Flushing of river is required to flush out the deposited sediments. Natural flushing can happen during the flooding season but steps must be taken in a case if natural flushing is not being happening. The flushing will have positive impact on life of the project water body and downstream ecosystem.

The aquatic weeds can be controlled biologically by the introduction of various herbivorous species. Introduce grass carp with common carp, turtles, Ducks and Geese which are well known for aquatic weed feeders. The grass carp and turtles are very much effective in controlling aquatic weed because they feed directly on these weeds. The common carp feed on bottom dwelling plants and sediments and important to root out of these plants.

### **S.1.7 PROPOSED MONITORING**

A comprehensive, Environmental Management Plan (EMP) has been developed for the Project. An environmental Mitigation Management Matrix (MMM) has been prepared considering impacts on different components of physical, ecological and socio-cultural environment. In addition, a comprehensive monitoring program has been proposed.

The EMP includes Review of regulatory requirements and applicable standards, MMM Institutional Arrangements for Implementation of EMP, Roles and Responsibilities of different agencies, Environmental Monitoring Plan, Change Management Plan (CMP), Communication and Documentation, Traffic Management Plan (TMP), Disaster Management Plan (DMP), Material Transportation Plan (MTP), Training Program and a Resettlement Policy Framework (RPF).

## SECTION - 1: INTRODUCTION

### 1.1 PURPOSE FOR THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

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 purpose of the EIA study is to identify the possible beneficial and adverse environmental impacts of the project as presently envisaged and propose the appropriate mitigation measures to be implemented during the construction and operational stages of the project 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:

- a) Punjab Environmental Protection Amendment Act (PEPA), 2012.
- b) Pakistan Environmental Protection Agency Regulations, 2000 for review of IEE and EIA.
- c) Pakistan Environmental Impact Assessment procedures, 2000.

### 1.2 IDENTIFICATION OF THE PROJECT AND THE PROPONENT

The Ravi Riverfront Urban Development Project (RRUDP) is the proposed development project that converts dying River Ravi into perennial fresh water body along with high quality urban development on both banks of the River (5Km each) for a stretch of approximately 46 KM from Ravi Syphon to Mohlanwal to be developed in three phases. Under Phase-I, River Training works and channelization of about 14 KM stretch is planned with one barrage near old Ravi bridge. The objective of River Training and Channelization is to protect River Ravi front from 1000 years ARI flood and also the channel is designed in a way that it would retain the character of a fresh water body and it should have adequate capacity to pass 1000 years return period. River Ravi Urban Development Authority (RUDA) is the proponent of the project on behalf of Government of the Punjab.

The Phase-I Project site is geographically located between 31° 41'40.33" N, 74° 24'49.13"E upstream and 31° 36'53.75" N and 74° 18' 25.28" E downstream.

### 1.3 DETAILS OF THE CONSULTANTS

RUDA, Government of the Punjab has engaged M/s Engineering Consultancy Services Punjab (Pvt.) Ltd. (ECSP) for preparation of Environmental Impact Assessment (EIA) report for this sub project under Ravi strategic developmental plan. The study team collaborated during a comprehensive survey of the project site, discussions with the proponents and collection and analysis of data collected from stakeholders, 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 secondary physical and socio-economic data of the project area was also compiled. This EIA has been prepared by the core team of experts given in **Appendix-6**.

### 1.4 BRIEF DESCRIPTION OF NATURE, SIZE AND LOCATION OF THE PROJECT

Lahore, the capital of the Punjab Province is rapidly being urbanized as it is a regional urban center of key commercial, financial, industrial and socioeconomic activities. The city is located in the most upstream reach of the Ravi River. All the domestic, commercial and industrial activities from the City population of about 12 million generate wastewater, which is discharged directly into the River Ravi without any treatment and ultimately becomes the biggest pollution source in the river. At present, the major downstream use of the River Ravi is for irrigation. However, the population and economic activities in the immediate areas along the river from Lahore to Balloki Barrage are affected at various degrees by pollution in the river Ravi. To deal with this issue of untreated sewage, it is the necessity of time to rehabilitate the river Ravi which is heart of Lahore and currently been known as river of dead. Currently, the river is flowing with very low flow rate (Average 1500-2,000 cusecs) throughout the season except during monsoon. This low water flow contains high level pollution and the water is contaminated with organic, inorganic and heavy metals from industrial, commercial, livestock and domestic activities. In addition, the Water and Sanitation Agency (WASA) discharges wastewater of entire city directly into the River Ravi through its twelve disposal stations. All this waste into river impose threat for river ecosystem as well as for ground water source.

To deal with Water pollution issue of the River, Government of the Punjab (GoPb) has planned Ravi River Front Urban Development project and the river training and channelization is the sub-project. The objective of this sub project is to protect the River Ravi front from 1000 years ARI flood and design of channel in a way that it would retain the character of a fresh water body and should have adequate capacity to pass 1000 years return period.

### 1.5 SCREENING

The proposed Project of River Ravi Training and Channelization falls under Schedule- II of subsection E of IEE/EIA Regulations, 2000 as per section 12 of

Environmental Protection Act and thus requires Environmental Impact Assessment (EIA). Environmental Impact Assessment has been prepared by taking project as a whole in order to obtain Environmental Approval /NOC from Environmental Protection Agency (EPA), Punjab.

## **1.6 SCOPING**

### **1.6.1 Spatial and Temporal Boundaries of Environmental Assessment**

The boundary considered for environmental assessment includes river stretch of 14 km starting from Syphon and ending at proposed Barrage-I near Old Ravi Bridge. Although the major construction activities of the project will remain confined within the project boundaries along the bank of the river (5 Km stretch), there are some areas where construction related activities may extend further. These will include areas required for; (a) establishment of construction camps and erection of asphalt plants on temporarily acquired land and, (b) construction of haul tracks for transportation of construction materials. In addition, 200 m has been taken as an area of impact zone on either side of the river channel.

### **1.6.2 Important Issues and Concerns raised during Consultation**

The major issue raised during consultation is the resettlement of two settlements located in the riverbed and loss of livelihood of the displaced persons. In addition, the loss of forests falling in the riverbed is another ecological issue which requires special attention and mitigation. Afforestation plans will be an addition for the project.

### **1.6.3 Significant Impacts and Factors to be Determined**

The significant impact is resettlement of two settlements and submerging of about 138.76 acres of forest areas falling in the riverbed. Both these issues will be essentially investigated and mitigated according to plans.

## **1.7 APPROACH ADOPTED TO CONDUCT THE STUDY**

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

### **1.7.1 Review of Available Data**

A detailed review of the available documents of the project was conducted. These included; The Feasibility Report, TOR's, Geotechnical Investigations Report, Preliminary Design Report, Construction Drawings and Social & Ecological Baseline Survey Report.

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 implementation and operation of the proposed project activities.

### **1.7.2 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. Despite the fact that major construction activities of the project will remain confined within the project boundaries along the bank of the river (5 Km stretch), there are some areas where construction related activities may extend further. These will include areas required for:

- Establishment of construction camps and erection of asphalt plants on temporarily acquired land.
- Construction of haul tracks for transportation of construction materials.

The project construction as well as operation activities 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 for construction 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 is not a wellplanned city, 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.

### **1.7.3 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.

#### **A) Physical Environment**

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

- a. Land Resources (that include land use, soil composition, topography, geology, contamination of soil and soil erosion, etc.).
- b. Water Resources (that include 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, EPA certified Third Party Laboratory Environmental monitoring was carried out at different sites in the Project Area.

## **B) 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).

## **C) 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.
- 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.

### **1.7.4 Public and Stakeholders Consultation**

In addition to recording the baseline conditions of the Project Area and awareness about the project, public and stakeholder's consultations were also carried out including potential Project Affected Persons (PAPs); general population residing in the Project Area; World Wild Life Fund (WWF); International Union for Conservation of Nature (IUCN), Forest Department, Water and Sanitation Agency (WASA), Local NGOs etc.

### 1.7.5 Analysis of Data

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

### 1.7.6 Screening of Potential Environmental Impacts and Mitigation Measures

After a thorough review of the field notes, collected data, extent of the proposed project activities and detailed discussions with the stakeholders, the potential impacts of the Project were assessed and 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.

### 1.7.7 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.

## 1.8 STRUCTURE OF THE REPORT

This document is structured as follows:

**Chapter 1** provides an introduction to the report and project; **Chapter 2** gives analyses of the various alternatives considered; **Chapter 3** describes the legislative and policy framework governing the project; **Chapter 4** provides an overall description of the project; **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 and institutional arrangements; and **Chapter 8** summarizes the main concerns raised by the stakeholders during the various public consultations.



## SECTION - 2: ANALYSIS OF PROJECT ALTERNATIVES

### 2.1 GENERAL

This chapter deals with an analytical overview of the different alternatives that have been considered while planning of the proposed project. The analysis has been carried out critically so as to justify the need of the Project. The following alternatives considered during the conduct of the study are given as below:

- No Project Option (NPO).
- Location/Site Alternatives, their selection and rejection criteria.
- Design/Technology alternatives, their selection and rejection criteria.
- Environmental Alternatives, their selection and rejection criteria.
- Economic Alternatives, their selection and rejection criteria.

### 2.2 NO PROJECT OPTION (NPO)

Lahore, the city of gardens, is one of the largest cities of world and second largest in Pakistan. Urban growth in Lahore continues to ascend according to 1981-98 population census but at a slower rate on average by comparison to previous census 1972-81 because much of the population shift involves movement away from concentrated urban centers to vast, sprawling metropolitan regions or to small and intermediate size cities. With its explosive growth, which is under way at 4% per year, this trend is projected to continue for several decades and is expected to be about 90 % urban by 2025. Lahore harbors huge numbers of the urban poor who are shut off from the benefits of economic growth. In spite of number of vacant planned developed housing schemes, many live in vast squatter settlements. This situation creates pressure on surrounding lands and natural resources. Unplanned urbanization in outskirts regions of Lahore have resulted in intolerable congestion, air pollution, water shortages and traffic problem. Apart from the rapid urbanization, the only river which is called vain of Lahore is now dead due to industrial and sewage pollution. The life that once thrived in the river has all gone by the dumping of millions of tons of toxic industrial effluent in the water along with huge amounts of raw sewage.

Under these circumstances, the planned sustainable housing having improved infrastructure and basic facilities is the need of time along with the revival of river Ravi. The Ravi River Front Urban Development Project is the first of its kind that has high quality planned urban development with conversion of dying river Ravi into perennial fresh water body. The revival of river Ravi will have overall positive impacts on entire ecosystem with increase in environmental benefits and recreational activities. The planned sustainable

housing with all basic facilities in the center of city has overall positive impact in terms of land in order to stop the urban sprawl and reduce pressure on natural resources. The River Training and Channelization is the sub project of Ravi Riverfront Urban Development Project and being developed for the restoration of River Ravi and to improve the ecological, recreational, and economic value of the River. The River Channelization and Training works is designed to maintain proper flood control mechanisms. The goals of River Training and Channelization is revival of ecosystem to make it more suitable for aquatic wildlife and to provide residents and visitors of Ravi Riverfront Urban Development Project (RRUDP) with access to more aesthetically pleasing river to enjoy recreationally. Therefore, in the light of the above discussion, the current development project with proposed site is very much needed and NPO is not acceptable for the project.

## 2.3 LOCATION/SITE ALTERNATIVES

The areas of total two (02) forests are coming into the river trainings. The reserve forests coming under Area of Influence will be properly planned and the affected area will be properly dealt according to the proposed plans. Some of the protected area, however, the ecological study shows that it is the degraded forest which can be replenished.

### 2.3.1 Alternative I- To Save Anno Bhatti Forest

- The width of the river at upstream at the location of Anno Bhatti Forest is 700 while the other end of island it is 300 meter. If location of Island can be reversed with 300-meter from Anno Bhatti and 700 meter from the other end, then almost 85 % of the impact on this forest can be avoided. The area of this forest towards river side then can be utilized as an Eco-zone. It will increase the overall recreational and aesthetics of the area.
- Another option is to align the channel of the river island in a way that the forest can be saved. If overall width of island is reduced, then this protected area of Anno Bhatti Forest could be saved.

## 2.4 DESIGN/TECHNOLOGY ALTERNATIVES

By analysing the main factors which are important in the maintenance of a well-balanced river habitat, when looking at its restoration, it has to be chosen not only, which materials are to be used, but also to make a proper evaluation of design methodologies. A natural river course is characterized both from plan and elevation and dictated by the need to maintain environmental biodiversity. The solution must supply the immediate required stabilization and promote a positive evolution of the new ecosystem created

from the river training works. Following could be the design alternatives for river training works:

### 2.4.1 Longitudinal Structures

The term longitudinal structures is used to define structures with their length parallel to the river flow. These structures are often built on existing natural banks and they usually extend for a considerable distance. They are used for a variety of purposes, such as erosion control, control of meanderings, containment of the normal flow channel and flood protection. This option has been adopted in this project.



### 2.4.2 Revetments

When an erosion process that does not affect the global stability creates slope instability, then revetments can be a possible solution. The choice of the most suitable type of revetment is made on the basis of a comparison between the acting stresses and the serviceability limits of the material used. The approach to be



considered is always made under the term of Bioengineering, based on a combination of live and inert materials where the limitations of both must be taken into consideration. This option is not viable, as the purpose of River Ravi Channelization is not only river ecosystem protection, it is aimed to establish new cities and new economic activities. Therefore, only solid structures can be adopted.

### 2.4.3 Gabion Gravity Structures

A bank stabilization may involve the construction of a retaining structure that should not only affect the natural filtration between the watercourse and the bank, but must also guarantee the required consolidation. Gabion structures are the ideal solution on account of their



flexibility, natural drainage capacity due to the stone filling, and high structural resistance.

Such solutions normally involve huge stone works and are suitable for hilly areas. As the river Ravi is located in plain areas further the proposed channelization is aimed to develop new cities, therefore, this option is not viable.

#### **2.4.4 Reinforced Soil Structures**

The development of new technologies such as reinforced soil structures using the combined strength of the soil and the reinforcing elements has opened up new methods for the stabilization of riverbanks. This approach will be used in this project for lining purposes.

### **2.5 ENVIRONMENTAL ALTERNATIVES**

Historically, the main purpose of river-training works has been flood control. But, presently, the planners and environmentalists have decided to incorporate environmental conservation to river training policies, which involves water quality, landscape, and diversity of wildlife habitats. This approach has been applied on the Ravi Channelization Project. The 1km lining and route of channelized river has been selected in a way that minimum loss to forest take place. For instance, Anno Bhatti forest has been retained by altering the river direction in new channelized route.

### **2.6 ECONOMIC ALTERNATIVES**

The least cost analysis compared economic costs of technically, environmentally, and socially viable project options and selected the one with the lowest present value of economic costs. Analysis of the river channelization component adopted cost-effective engineering design options for river dike structures, cross-sections, barrage structure and landscaping and for river training works. Better protection and enhancement of the river environments was emphasized. The options for the river training works included maintaining a natural river flow, creating lakes, channelization of river and using barrage structures for maintaining flow. For the project's Barrage component, cost-effectiveness analysis emphasized eco-friendly cross-section designs; the selection of the most efficient alternative sites, initial cost, operation and maintenance (O&M) cost; and the function of the barrage.

The economic costs included; (i) the capital cost, including those for land acquisition, resettlement, and environmental mitigation and monitoring; (ii) the cost for capacity development and institutional strengthening; (iii) physical contingency costs; and (iv) O&M costs, including the replacement cost of depreciated equipment.

## SECTION - 3: POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

### 3.1 GENERAL

This chapter provides an overview of the policy framework and legislation that applies to manage/ control the environmental consequences as a result of a project implementation and operation. The project needs to comply with all the applicable environmental policies, laws, regulations, guidelines of Government of Pakistan and Government of the Punjab. According to Punjab Environmental Protection Act, 2012, an environmental and social assessment study is required prior to commencement of any development project. The present document complies with this requirement.

### 3.2 APPLICABLE NATIONAL AND PROVINCIAL GOVERNMENT REGULATIONS

The national and provincial legislation applicable to the project are given in **Table 3.1**.

**Table 3.1: Applicable Legislation and Policies in Pakistan**

Legislation/ Regulation/ Conventions/ Standards	Theme and General Objective	Relevance with the Proposed Project
<b>Applicable Legislation</b>		
Punjab Environmental Protection Act, 1997 (Amended 2012)	In this act of 2012, the legislative powers related to environment and ecology are given to provincial government. After 18th constitutional amendment, the provinces are required to enact their own legislation for environmental protection. Other amendments include increasing the penalties for violations. The Punjab Environmental Protection Act, 1997 (Amended, 2012) is comprehensive legislation and provides the legislative framework for protection, conservation, rehabilitation and improvement of the environment. The 'environment' has been defined in the Act as: (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the interrelationships between	The provision of the act is applicable to the project for conducting an IEE/EIA according to section 12 and to obtain environmental approval from the EPD/EPA. The section 11 of the act is applicable in term of compliance with Punjab Environmental Quality Standards (PEQS). Similarly, section 13 of the act prohibits the import of hazardous waste. The provisions of section 16 are also applicable to



	<p>any of the factors specified in sub-clauses 'a' to 'f'. The notable points of the law are:</p> <p>No proponent of a project shall commence construction or operation unless an EIA has filed with the concerned Provincial EPA, and has obtained an approval;</p> <p>Establishment and formation of the Punjab Environmental Protection Council;</p> <p>Prohibition of certain discharges or emissions;</p> <p>Punjab Environmental Quality Standards (PEQS) for wastewater, air emissions and noise; and</p> <p>Provincial Government can issue notices and enforce them to protect the environment. For the project, Environmental Protection Department (EPD)/Environmental Protection Agency (EPA) of GoPb is the concerned authority. The regulatory institutions for environmental management are ultimately responsible for the success of environmental assessments to ensure that development projects are environmentally sound and sustainable.</p>	<p>comply with the discharge or emission of any effluent, waste, air pollutant or noise or disposal of waste or handling of hazardous substance. Under section 17, penalties will apply if anyone fails to comply with the provisions of section 11, 12, 13 and 16.</p>
Review of IEE and EIA Regulations, 2000	<p>The Pakistan Environmental Protection Agency Review of IEE and EIA Regulations 2000, provide the necessary details on the preparation, submission, and review of the IEE and EIA. Under these Regulations, projects are classified on the basis of expected degree of adverse environmental impacts. Project types listed in Schedule-II of the regulations are designated as potentially serious damages to the environment, and those listed in Schedule-I as having potentially less adverse effects.</p> <p>Schedule-I projects require an IEE to be conducted, rather than a full-fledged EIA, provided that the project is not located in an environmentally sensitive area with insignificant environment impacts. The projects listed in Schedule-II are generally major projects and have significant adverse environmental impacts. For Schedule-II projects, conducting an EIA is obligatory. These regulations set out:</p> <p>Key policy and procedural requirements for filing an EIA;</p> <p>The purpose of environmental assessment;</p>	<p>The provisions of these regulations are applicable for environmental screening of project, which implies that the proposed project falls under Schedule (II) thus requires an EIA.</p> <p>An EIA has been prepared by following the regulations. The process described in the regulation will be useful for the RUDA to follow the procedures to file an EIA with EPA-Punjab and to understand its review process along with timelines to be followed.</p>

	<p>The goals of sustainable development;</p> <p>The requirement that environmental assessment be integrated with feasibility studies;</p> <p>The jurisdiction of the Federal and Provincial EPA's and Planning &amp; Development (P&amp;D) Departments;</p> <p>The responsibilities of proponents;</p> <p>Duties of responsible authorities;</p> <p>Provides schedules of proposals that the project requires either IEE or an EIA;</p> <p>The environmental screening process of the projects under schedule I, II and III; and</p> <p>The procedure for the environmental approval for filing the case with the concerned Environment Protection Agency/Environment Protection Department (EPA/EPD) for the granting of NOC.</p>	
<p>Punjab Environmental Quality Standards (PEQS), 2016</p>	<p>PEQS promulgated in 2016. Specified standards under PEQS are for:</p> <p>Drinking Water;</p> <p>Ambient Air;</p> <p>Noise;</p> <p>Industrial Gaseous Emissions;</p> <p>Municipal and Liquid Industrial Effluents;</p> <p>Motor vehicle exhaust and noise; and</p> <p>Treatment of Liquid and Bio-Medical Waste.</p>	<p>The project to be commenced in Punjab must conform to PEQS during all phases i.e., construction and operation.</p>



The Ravi Urban Development Authority Act, 2020	The Ravi Urban Development Authority Act 2020 (the "Act 2020") was promulgated to establish Ravi Urban Development Authority (the "Authority") for carrying out the purposes of the Act ibid. The preamble of the Act 2020 is exhaustive in nature pointing out the entire actions in public interest for the purpose of comprehensive system of planning and development in the area specified in Master Plan of the Project so as to improve the quality of life as per legislative objectives and further to establish an integrated modern and regional development approach and a continuing process of planning and development to achieve the highest environmental standards, quality of life and modern standard facilities so as to make a healthy and prosperous community in the designated area duly determined by the Government to rehabilitate water aquifer and the dying Ravi River into fresh perennial water body with a state-of-the-art water front and urban development on reclaimed and adjoining lands.	As RUDA is the proponent of this project, which is established under this act, and RUDA has to fulfill all its responsibilities for implementing this project as laid down in this act.
The Parks and Horticulture Authority Act, 2012 (Act XLVII of 2012)	The Parks and Horticulture Authority Act 2012 (the "Act 2012") was promulgated to establish the Parks and Horticulture Authority (the "PHA") in the Punjab for the regulation, development and maintenance of public parks, green belts and green areas in the Punjab; regulation of billboards, sky signs and outdoor advertisements; to promote open and unrestricted views of the Punjab; and, to provide for the connected matters.	The PHA established under this act will work in close coordination with RUDA on this project for establishing green belts, green areas etc.
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 the environment, the Penal Code empowers local authorities to control noise, toxic emissions and disposal of effluents	Penal Code empower tehsil/district administration to check measures to control noise, toxic emissions and disposal of effluents.

<p>The Punjab Firewood and Charcoal (Restriction) Act 1964</p>	<p>This act is to prohibit and regulate the burning of firewood and charcoal in West Pakistan. This act extends to the whole of Pakistan, except the tribal areas. Use of firewood is still very common in the area and for this reason the act is applicable for the entire project area.</p>	<p>Use of firewood is very common in the project area and for this reason, the act is applicable to the contractor for the entire project area.</p>
<p>The Provincial Motor Vehicles Ordinance, 1965 and Rules, 1969, GoPb</p>	<p>The law and rules deal with the licensing requirement for driving; powers of licensing authority, Regional Transport Authority and those of Court vis-à-vis disqualification for license and registration requirements to control road transport; compensations for the death of or injury to a passenger of public carrier; traffic rules, power to limit speed, weight, use of vehicles; power to erect traffic signs; specific duties of drivers in case of accident and powers of police officers to check and penalize traffic offenders.</p>	<p>All vehicles used for project by construction supervisor consultants and the contractors will be subject to this Motor Vehicle Ordinance 1965 and rules 1969.</p>

Legislation/ Regulation/ Conventions/ Standards	Theme and General Objective	Relevance with the Proposed Project
Pakistan Antiquities Act 1975 & Punjab Antiquities Amendment 2012	<p>The Punjab Antiquities Amendment Act, 2012 is adopted from the Pakistan Antiquities Act of 1975 with a few minor changes. The Antiquities Act, 1975 (amended in 1990) states the following:</p> <p>"Ancient" is any object that is at least 75 years old;</p> <p>All accidental discoveries of artefacts must be reported to the Federal Department of Archaeology;</p> <p>The Government is the owner of all buried antiquities discovered on any site, whether protected or otherwise;</p> <p>All new construction within a distance of 60.96m (200 feet) from protected antiquities is forbidden;</p> <p>No changes or repairs can be made to a protected monument, even if it is owned privately, without approval of the responsible authorities; and</p> <p>The cultural heritage laws of Pakistan are uniformly applicable to all categories of sites regardless of their state of preservation and classification as monuments of national or world heritage.</p>	<p>The law will be applicable to the project mainly due to its provision:</p> <p>The provisions of this act would be applicable, if any accidental archaeological discoveries may occur during the excavation works during the construction.</p> <p>In case of archaeological discoveries, the construction activity within 61 m or 200 ft. of protected antiquities, would be prohibited.</p>
Highway Safety Ordinance, 2000	<p>This Ordinance includes provisions for licensing and registration of vehicles and construction equipment; maintenance of road vehicles; traffic control offences, penalties and procedures; and the establishment of a police force for motorways and national highways to regulate and control the traffic as well as keep the highways clear of encroachments.</p>	<p>This Ordinance will have an impact on the road network leading to the Project area during the construction phase of the project.</p>
Punjab Plantation and Maintenance	<p>The Punjab Plantation and Maintenance of Trees Act, (1974) regulates tree plantations</p>	<p>The forests in the project area belong</p>

Legislation/ Regulation/ Conventions/ Standards	Theme and General Objective	Relevance with the Proposed Project
of Trees Act, 1974	and enforces measures for their protection.	to Punjab Forest Department so could not be cut/uprooted without approval of provincial Forest Department and compensatory tree plantation.
Punjab Forest Act 1927 and Punjab Forests (Amendment) Ordinance 2016	<p>The Act prohibits any person from: setting fires in the forest; quarrying stone; removal of any forest produce; or causing any damage to the forest by cutting trees or clearing areas for cultivation or any other purpose.</p> <p>The Forest Act, 1927 was largely based on previous Indian Forest Acts implemented under the British. The first and most famous was the Indian Forest Act of 1878. Both the 1878 act and the 1927 one sought to consolidate and reserve the areas having forest cover, or significant wildlife, to regulate movement and transit of forest produce, and duty leviable on timber and other forest produce.</p> <p>The said act has since been amended and replaced by the provincial Forest (Amendment) Act 2010, after forestry became into the provincial domain under the 18th amendment to the Constitution of Pakistan. However, the main applicable clauses still hold true in essence.</p> <p>The Government of Punjab amended the Forest Act, 1927 (XVI of 1927) to further amend the Forest Act, 1927 to make appropriate provisions for the use of reserved or protected forest land, where inevitable, for national projects of strategic importance.</p>	<p>This Act will be relevant in case any part of the proposed intervention is located on a land previously prescribed as forest land by the Government of Punjab. In such cases, land acquisition will be governed under this Act, and the provincial department responsible for execution of the project, will need to negotiate with the provincial Forest Department.</p>

Legislation/ Regulation/ Conventions/ Standards	Theme and General Objective	Relevance with the Proposed Project
Punjab fisheries ordinance 1961	<p>Punjab Fisheries Department is responsible for the Conservation, Management and Development of Natural Fisheries resources through the enforcement of Punjab Fisheries Ordinance and Rules in Punjab province. Punjab Fisheries department is also responsible for promoting aquaculture practices in private sector to bridge gap of protein deficiency in the diet and to increase our share in the national economy. Following sections of Punjab Fisheries Ordinance are particularly important for the job.</p> <p>Section-6 Destruction of fish by explosives No person shall use any dynamite or other explosive substance in any water with intent thereby to catch or destroy any of the fish that may be therein.</p> <p>Section-7 Destruction of fish by poisoning water No person shall put any poison, lime or noxious material into any water with intent thereby to catch or destroy any fish that may be therein.</p> <p>Section-8 Fish that shall not be taken No person shall kill, capture, or possess any species of fish specified in the second column of the First Schedule, of a size less than that specified in the third column of the said Schedule against such species.</p> <p>Section-(9A) Quality Control The Government may prescribe standards and quality of fish and require inspection of fish. A person shall not sell or commercially transfer a fish unless it conforms to the prescribed standards and quality.</p>	This Act will be equally applicable to project stakeholders as well as to the Contractor's personnel.

<p>Punjab Wildlife Act 2015</p>	<p>Government of Punjab has certain rules and regulations for the conservation and protection of wildlife under the Punjab Wildlife Act (amended 2015). Under the amended wildlife act, private parties could also set up wildlife breeding farms, wildlife parks and zoological gardens. The amended act says in any of the wildlife breeding farm owned by the government, no shooting, hunting, trapping, killing and capturing of animals would be allowed. In a government owned game reserve, hunting and shooting would not be allowed except under special permission that would specify the quantity of animals which could be killed.</p>	<p>The winter migrants particularly ducks (including endangered white head duck) from Siberia while flying over the Indus Flyway also diverge to project area. The Punjab Wildlife Act prohibits shooting of migratory birds more than a specified number. This Act will be applicable to the Contractor's personnel during project execution.</p>
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<p>Land Acquisition Act 1894 and Punjab Land Acquisition Rules, 1983 (1983 Rules)</p>	<p>The primary law for acquisition of private land for public purposes in Punjab is the "Land Acquisition Act, 1894" (hereinafter referred as the Act). The Act facilitates the provincial government and project executing / implementing agencies (EAs/IAs) in development projects that involve acquisition of private land for public purposes. The Act does not inherently mandate specifically for resettlement assistance and rehabilitation provisions benefiting the non-title holders and other vulnerable groups, or severely affected persons (APs), nor directly provides for rehabilitation of income/livelihood losses or resettlement costs. The Act mandates only for titleholders and registered tenants of land and associated assets attached to affected land such as structures, crops and trees. The Act will be applied for the land acquisition and compensation payments to the titleholders and registered non-titleholders (tenants) for loss of land and associated assets in this Project.</p> <p>The detailed procedures for the purposes of acquisition of land, the Government of Punjab has also framed the Punjab Land Acquisition Rules, 1983 (1983 Rules) under Section 55 of the Act and the Act and the 1983 Rules have to be read together.</p>	<p>This Act and 1983 rules are relevant to the project, as the land will be acquired by applying LAA.</p>
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The Punjab Land Revenue (Amendment) Act 2012	According to this act, the Board of Revenue is the controlling authority in all matters connected with the administration of land, collection of land revenue, preparation of land records and other matters relating thereto.	All payments for land acquisition shall be made through District Land Acquisition Collector of Lahore and Sheikhupura districts under the provisions of this Act.
Provision in the Constitution of Pakistan on Labor Laws	The Constitution of Pakistan contains a range of provisions with regards to labor rights, in particular: Article 11 of the Constitution prohibits all forms of slavery, forced labor and child labor;	Applicable to the project as it would deal with labor rights under the constitution of Pakistan.

Legislation/ Regulation/ Conventions/ Standards	Theme and General Objective	Relevance with the Proposed Project
	<p>Article 17 provides a fundamental right to exercise the freedom of association and the right to form unions;</p> <p>Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and</p> <p>Article 37(e) makes provision for securing just and human conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment.</p>	

Labor Laws of GOPb	<p>The labor laws deal with the following aspects:</p> <ul style="list-style-type: none"> <li>Contract of Employment;</li> <li>Termination of Contract;</li> <li>Working Time and Rest Time;</li> <li>Working Hours;</li> <li>Paid Leave;</li> <li>Maternity Leave and Maternity Protection;</li> <li>Other Leave Entitlements;</li> <li>Minimum Age and Protection of Young Workers;</li> <li>Equality</li> <li>Pay Issues;</li> <li>Workers' Representation in the Enterprise;</li> <li>Trade Union and Employers Association Regulation; and other Laws.</li> </ul>	<p>All labor laws will be applicable to the project as it would deal with employment of labor for the construction works.</p>
Factories Act, 1934 (amended 2012 by GoPb)	<p>This Act was originally in the Federal ambit, however, pursuant to the 18th Amendment in the Constitution, it was formally adapted, with amendments, for the Province of Punjab by the Factories (Amendment) Act 2012. The clauses relevant to the project are those which concern health, safety and welfare of workers, disposal of solid wastes and effluents, and damage to private and public property. The Factories Act also provides regulations for handling and disposal of toxic and hazardous materials. As construction activity is classified as 'industry', these regulations will be applicable to the construction contractors.</p>	<p>The provisions of this act will be applicable to personnel of all project entities including the construction contractor.</p>
Punjab Restriction on Employment of Children Act 2016	<p>This act deals with child labor in the commercial and industrial sectors of Punjab. The Act prohibits the employment of children and to restrict the employment of adolescents in certain occupations and processes; and, to deal with ancillary matter.</p>	<p>The relevance of this act to the project will be to prohibit child employment for construction of the proposed project.</p>



The Protection Against Harassment of Women at the workplace Act, 2010 and Rules 2013	The Protection Against Harassment of Women at the Workplace Act (2010) refers to sexual harassment at the workplace. It extends to whole of the Punjab.	This Act will be applicable to all females working in the Project Director office, CSC and contractor's staff of the project.
The Punjab Occupational Health and Safety Act 2019	This act deals with occupational safety and health of the persons at workplace and to protect them against risks arising out of the occupational hazards; to promote safe and healthy working environment catering to the physiological and psychological needs of the employees at workplace and to provide for matters connected therewith or ancillary thereto.	The provisions of this act will be applicable to personnel of all project entities including the construction contractor to protect all workers and employees against occupational health and safety risks of the project related activities.
<b>B. Guidelines of Government of the Punjab</b>		
Guidelines for Public Consultation, 1997	The guidelines for public consultation are issued by the Pak-EPA and are presented in "Pakistan Environmental Protection Ordinance 1997 and policy and procedures for filling, review and approval of environmental assessment"	The guidelines apply for stakeholder consultations that were conducted during EIA of project feasibility stage.
Guidelines for Sensitive and Critical Areas, 1997	Specifying the sensitive and critical areas in Pakistan, these guidelines apply to both the natural environment and cultural aspects of Pakistan.	The issue of natural and cultural aspects of the project areas would be dealt by these guidelines.

C. Policies		
National Conservation Strategy, 1992	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. 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 during construction, increasing irrigation water availability, conserving biodiversity and supporting forestry and plantation.
National Environment Policy 2005	Government of Pakistan has notified National Environment Policy 2005, for different projects/aspects in which guidelines/priorities have been given to undertake/commence the projects having significant environmental impacts. The Policy provides a framework for addressing the environmental issues (particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification etc.) confronting Pakistan. It recognizes the goals and objectives of the Pakistan National Conservation Strategy (PNCS, 1992), National Environmental Action Plans, and other existing environment related national policies, strategies, and action plans. It also provides broad guidelines to the Federal Government, Provincial Governments, federally administrated territories and local governments to address their environmental concerns and to ensure effective management of their environmental resources.	Clause (b) of subsection 5.1 will also apply, which states that EIA related provisions in Environmental Protection Act, 1997, will be diligently enforced for all developmental projects.
National Water Policy 2018	The objective of the National Water Policy is to take cognizance of the emerging water crisis and provide an overall policy framework and guidelines for a comprehensive plan of action. Pakistan has a federal system of government and the provinces enjoy a considerable degree of autonomy. Thus, this policy is a national framework within which the provinces can develop their master plans	The project is in line with the policy objective No. 2.3 aiming at improving availability, reliability and quality of fresh water resources to meet critical

	for sustainable development and management of water resources. The water resource is a national responsibility but irrigation and agriculture, as well as rural and urban water supply, environment and other water related sub-sectors are provincial subjects.	municipal, agriculture, and environmental needs.
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National Biodiversity Strategy and Action Plan 2017 – 2030	Pakistan ratified Convention on Biological Diversity (CBD) in 1994. The Convention requires countries to prepare a national biodiversity strategy and action plan for achieving Aichi Biodiversity Targets and Sustainable Development Goals. It focuses on causes and consequences of biodiversity loss such as deforestation, grazing, fishing, pollution etc. It also provides legal and institutional framework. The strategies have been drafted for biodiversity awareness, terrestrial ecosystem, forest ecosystem, wetlands, coastal and marine ecosystem, and agrobiodiversity.	The strategies and plan would be applicable to the project to conserve biodiversity in the project area.
Water Apportionment Accord (1991)	<p>In 1991, the Water Apportionment Accord was signed between the representatives of all the four provinces of Pakistan to allocate supplies to the existing projects and future developments of the Indus River System. The need for storage wherever feasible on the Indus and other rivers was also recognized for planning future agricultural developments. The Water Apportionment Accord also included the following provision for Indus Delta:</p> <p>"The need for certain minimum water escape to the sea below Kotri Barrage to check sea intrusion was recognized. An optimum level of 12335m<sup>3</sup> (10 Million Acre Feet) was discussed. It was decided that further studies would be undertaken to establish the minimal escape needs downstream of Kotri Barrage."</p> <p>Indus River System Authority (IRSA) was established to implement the Water Apportionment Accord with representation from all four provinces and the Federal Government. The system-wise allocations would also be worked out on a 10-day basis</p>	The project is being designed in accordance with Water apportionment accord by IRSA.

	with actual average system uses for the post Tarbela period 1977-82 providing guidelines for developing future regulation pattern.	
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Legislation/ Regulation/ Conventions/ Standards	Theme and General Objective	Relevance with the Proposed Project
Pakistan Labor Policy, 2010	The main objective of the Labor Policy, 2010 is the social and economic well-being of the labor of Pakistan. The Labor Policy, 2010 has following 4 parts: i. Legal Framework; ii. Advocacy: rights of workers and employers; iii. Skill development and employment; and iv. Manpower export.	The labor will be employed for construction activities of the project. The provision of policy will apply to all the labor employed.
Punjab Labor Policy 2018	The Labour policy identifies policies concerned with relations between employers and workers and those concerned with the employment, training and distribution of workers in the labour market and resolution of their disputes preferably through tripartite forums, so it may easily be deduced that maintenance of industrial peace and harmony is directly related to the effective implementation of a well thought-out policy document on the subject. This Policy covers the key thematic areas in a redefined format with primary focus and emphasis on effective implementation of labour standards, social dialogue, improvements in workplace safety, living wages, child/ bonded labour, awareness raising, excellence in labour inspections regime, imparting quality technical trainings	The labor will be employed for construction activities. The provision of policy will apply to all the labour employed.

	<p>through well-improved Training Centres, simplification of labour laws, medical facilities for secured workers even after retirement, establishment of labour colonies and schools for workers' children, efficient disbursement of welfare grants and gradual extension of labour protection framework. It is expected that the Labour Policy in hand would augur well with the objectives conceived by the GoPb.</p>	
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### 3.3 INTERNATIONAL TREATIES AND CONVENTIONS SIGNED BY PAKISTAN

Pakistan is a signatory to a number of international environment-related treaties, conventions, declarations, and protocols. The International treaties and conventions relevant to the project are described in **Table 3.2**.

**Table 3.2: Applicable International Treaties, Conventions, Declaration and Protocols**

Treaty/ Convention	Description	Relevance with the proposed Project
Indus Water Treaty, 1960	The Indus Waters Treaty is a water sharing treaty between Pakistan and India, brokered by the World Bank (then the International Bank for Reconstruction and Development). The treaty, under Article 5.1, envisages the sharing of waters of the rivers Ravi, Beas, Sutlej, Jhelum and Chenab which join the Indus River on its left bank (eastern side) in Pakistan. According to this treaty, Ravi, Beas and Sutlej, which constitute the eastern rivers, are allocated for exclusive use by India before they enter Pakistan. However, a transition period of 10 years was permitted in which India was bound to supply water to Pakistan from these rivers until Pakistan was able to build the canal system for utilization of waters of Jhelum, Chenab and the Indus itself, allocated to it under the treaty. Similarly, Pakistan has exclusive use of the western rivers Jhelum, Chenab and Indus but with some stipulations for development of projects on these rivers in India. Pakistan also received one-time financial compensation for the loss of water from the eastern rivers. Since March 31, 1970, after the 10-year moratorium, India has secured full rights for use of the waters of the three rivers allocated to it. The treaty resulted in partitioning of the rivers rather than sharing of their waters.	As per Indus Water Treaty, the water of Ravi River had been allocated to India. According to this Treaty India is bound to inform Pakistan about any extra ordinary water releases in the Ravi River so that precautionary measures against flood during project execution be taken well in advance.

<p>United Nations Convention on Biological Diversity (CBD) 1993 Web Link: <a href="https://www.cbd.int/">https://www.cbd.int/</a></p>	<p>Pakistan signed this treaty in 1992 and it was ratified by cabinet in 1994.</p> <p>Convention on Biological Diversity, known informally as the Biodiversity Convention covers ecosystems, species, and genetic resources and the field of biotechnology. The Convention has three main goals:</p> <p>Conservation of biological diversity; Sustainable use of its components; Fair and equitable sharing of benefits arising from genetic resources.</p> <p>The objective of the convention is to conserve biological diversity, promote the sustainable use of its components, and encourage equitable sharing of the benefits arising out of the utilization of genetic resources. Such equitable sharing includes appropriate access to genetic resources, as well as appropriate transfer of technology, taking into account existing rights over such resources and such technology. In other words, its objective is to develop national strategies for the conservation and sustainable use of biological diversity.</p>	<p>The law is relevant as the project is proposed intervention on natural resource management and it surrounds natural habitats.</p> <p>The project is planned to minimize the negative impacts of the project on the biological resources. The EMP under the EIA provided a set of mitigation measures to mitigate impacts on the biological resources.</p>
<p>The Rio Declaration, 1992<sup>1</sup></p>	<p>Pakistan signed the treaty on 13 Jun 1992 and ratified on 1 June 1994. The Rio Declaration comprises 27 principles which address important issues such as; sustainable development to integrate environmental protection into the development process; common but differentiated responsibilities to conserve, protect and restore the earth's ecosystems; public participation and information access at the national level, reduce and eliminate unsustainable patterns of production and consumption.</p>	<p>The principles of Rio Declaration are applicable to the project with a focus on protection of natural environment.</p>

<sup>1</sup> <https://www.jus.uio.no/lm/environmental.development.rio.declaration.1992/portrait.a4.pdf>

Treaty/ Convention	Description	Relevance with the proposed Project
Kyoto Protocol, 1992 <sup>2</sup> to the Convention United Nations Framework on Climate Change	Pakistan has ratified <sup>3</sup> Kyoto Protocol in 2005. The Kyoto Protocol is a protocol to reduce Greenhouse gasses that cause climate change. It was agreed on 11 <sup>th</sup> December, 1997 at the 3rd Conference of the countries to the treaty when they met in Kyoto, and entered into force on 16th February, 2005. As of November 2007, 175 countries have ratified the protocol.	Pakistan has no obligation beyond monitoring and reporting emissions. Under the project, the monitoring and reporting will be done on emission of gasses.
UNESCO Convention on the Protection of the World's Cultural and Natural Heritage, 1972 Web Link: <a href="http://whc.unesco.org/en/">http://whc.unesco.org/en/</a>	Pakistan ratified this Convention on 23 <sup>rd</sup> July 1976. Convention concerning the Protection of the World Cultural and Natural Heritage - requires parties to adopt a general policy on the protection of the natural and cultural heritage, to set up services for such protection, to develop scientific and technical studies, to take appropriate legal, technical, scientific and administrative measures and to foster training and education for such protection.	The ESU of the Project Director office and ES of CSC and Contractor will pay due attention to cultural and national heritage during implementation of the project.
Bonn Convention on the Conservation of Migratory Species of Wild Animals, 1979	Pakistan ratified this Convention in 1987. It aims to conserve terrestrial, marine and avian migratory species throughout their range. It is concerned with the conservation of wildlife and habitats on a global scale.	Owing to abundance of Sambar (wild deer) and Nilgai (blue bull) in areas that border Pakistan and the Occupied Kashmir, together with the growing trend of hunting, the animals instinctively run away from places where they feel threatened. As a result, they enter Kasur, Lahore and Sialkot to save their lives. As per Bonn convention, they are protected in Pakistan. The injured animals are given proper food and care. Their wounds are treated and a balanced diet is provided to

<sup>2</sup> <https://unfccc.int/resource/docs/convkp/kpeng.pdf>;

<sup>3</sup> [https://unfccc.int/kyoto\\_protocol](https://unfccc.int/kyoto_protocol)



		them to help them get healthy <sup>4</sup> . The same practice will be adopted if any such animal from India enters in the project area.
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International Plant Protection Convention, 1951/52	Pakistan ratified this Convention in 1954. This Convention (1997 Revised Text) is to prevent the international spread of pests and plant diseases. It requires maintenance of lists of plant pests, tracking of pest outbreaks, and coordination of technical assistance between member nations.	The provisions of this Convention will be applicable if locust attacks the project area
Stockholm Convention on Persistent Organic Pollutants (POPs)	It is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of humans and wildlife, and have harmful impacts on human health or on the environment. Exposure to Persistent Organic Pollutants (POPs) can lead to serious health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and damages to the central and peripheral nervous systems.	Under this convention the contractor is bound not to use asbestos and lead based compounds; banned pesticides and insecticides. He will also not dispose of PCB containing items in open.
International Covenant on Economic, Social and Cultural Rights	It ensures the enjoyment of economic, social and cultural rights, including the rights to:	The Contractor, subcontractors, service providers and other

<sup>4</sup> Daily Tribune, February 15, 2020. Indian wild deer enter Pakistan to save their lives.  
<https://tribune.com.pk/story/2157129/indian-wild-deer-enter-pakistan-save-lives>

Treaty/ Convention	Description	Relevance with the proposed Project
	Education fair and just conditions of work an adequate standard of living the highest attainable standard of health social security	employers will comply ensure compliance with this convention at their workplace.
International Labor Organization's (ILO) Core Labor Standards	The core labor standards are the elimination of all forms of forced or compulsory labor; the abolition of child labor; elimination of discrimination in respect of employment and occupation; and freedom of association and the effective recognition of the right to collective bargaining, as per the relevant conventions of the International Labor Organization.	The labor will be employed for construction activities of the project. The Contractor and other project implementing parties will comply with Core Labor Standards.
Freedom of Association and Protection of the Right to Organize Convention (087), 1948	Pakistan ratified this Convention in 1951. This Convention outlines the rights of both worker and employers to "join organizations of their own choosing without previous authorization." Rights are also extended to the organizations themselves to draw up rules and constitutions, vote for officers, and organize administrative functions without interference from public authorities. They are required, in the exercise of these rights, to respect the law of the land. In turn, the law of the land, "shall not be such as to impair, nor shall it be so applied as to impair, the guarantees provided for in this Convention."	The workers and employers will be engaged in the project management and all entities involve in project implementation and operation will ensure freedom of association and protection of the rights to organize.
<sup>5</sup> Forced Labor Convention (29), 1930 and Abolition of Forced Labor Conventions (105) and occupation (conventions 100 & 111)	These Conventions ensure that a work relationship should be freely chosen and free from threats aimed at eliminating all forms of discrimination in respect of employment and occupation. The scope covers access to vocational training, access to employment and to particular occupations and terms and conditions of employment.	The Contractor and all other employers will strictly prohibit forced labor and conventions.

<sup>5</sup> "Forced or compulsory labor" is defined as "all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily"

Treaty/ Convention	Description	Relevance with the proposed Project
Abolition of child labor (conventions 138 and 182)	The obligations under these conventions are to respect, promote and realize the abolition of child labor and prohibit the worst forms of child labor to be eliminated as a matter of priority.	No child shall be employed or permitted to work in any project related activities.
United Nations Convention on the Rights of the Child	<p>This Convention set out children's rights and how governments should work together to make them available to all children. Under the terms of the convention, governments are required to meet children's basic needs and help them reach their full potential. Central to this is the acknowledgment that every child has basic fundamental rights. These include the right to:</p> <p>Life, survival and development; Protection from violence, abuse or Neglect. An education that enables children to fulfil their potential; Be raised by, or have a relationship with, their parents; Express their opinions and be listened to.</p>	RUDA will ensure that none of the children from the affected families will deprive of their rights as a result of adverse impacts of land acquisition and resettlement by ensuring timely disbursement of compensation.

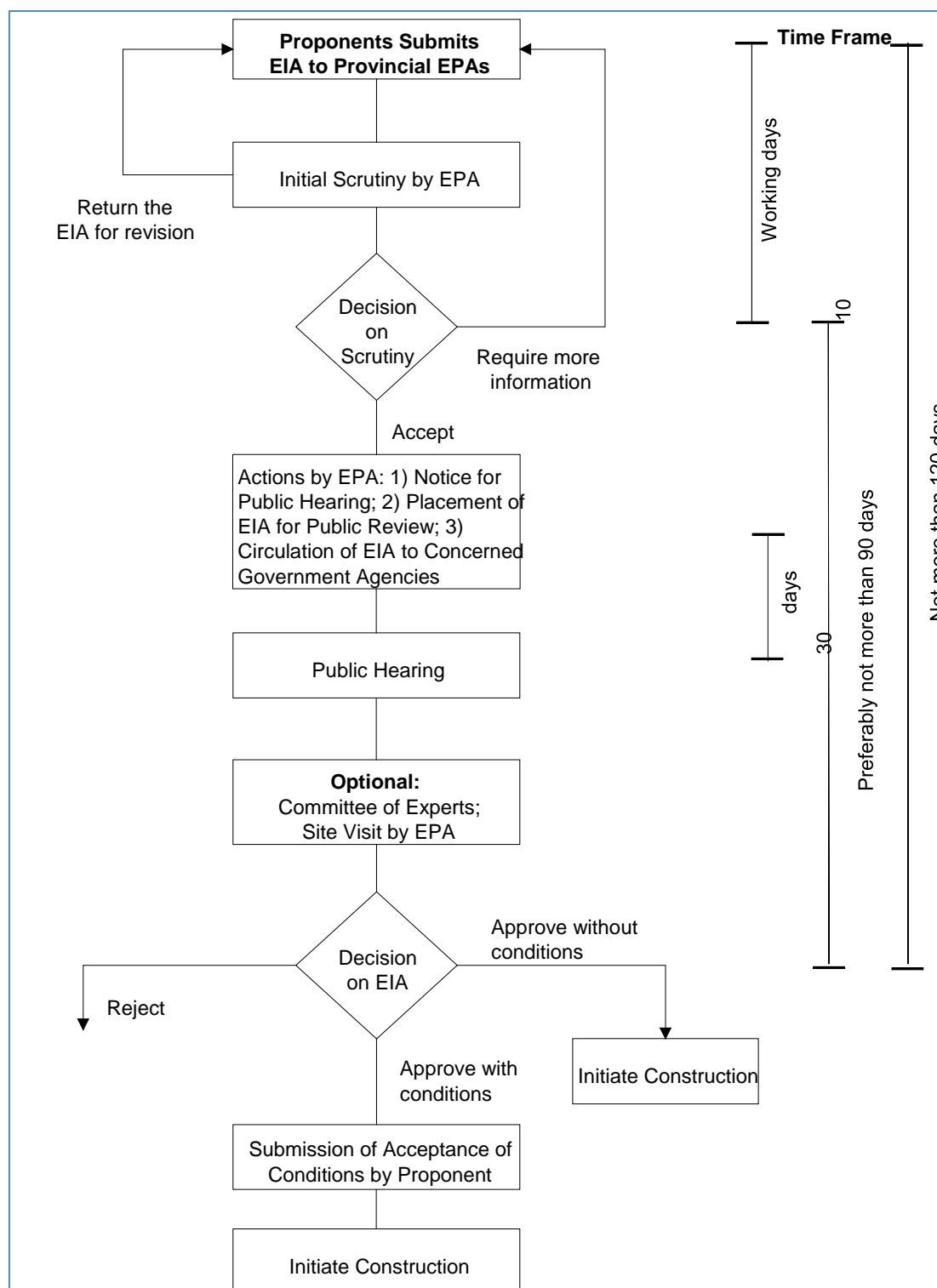
### 3.4 REQUIREMENTS FOR STATUTORY CLEARANCES

Prior to construction, the Project Director (PD) appointed by RUDA and contractor will be responsible to obtain various clearances and approvals from the following government departments (if required):

- Environmental Protection Agency
- Punjab Irrigation Department
- Forest Department
- Works and Service Department
- National Transmission and Dispatch Company (NTDC)
- Lahore Electric Supply Company (LESCO)
- Pakistan Telecommunication Company Limited (PTCL)
- Sui Northern Gas Pipelines Limited (SNGPL)
- Punjab Archaeological Department

### 3.5 ENVIRONMENTAL APPROVAL REQUIREMENTS OF THE PROJECT

The requirements to issue 'No Objection Certificate' (NOC) by the Punjab Environmental Protection Agency to the proponent are very comprehensive. Proponent submits detailed Environment Impact Assessment (EIA) report to EPA along with request to issue NOC. The EPA will review and find any gaps or shortcomings in the submitted EIA and provides comments for improvements. Proponent reviews comments made by EPA and re-submit the revised version. After addressing all the comments, EPA issues notice for public hearing and disclose report for public review. EPA also circulate the report in different government agencies and other stakeholders for any objection or clarification. After commencement of successful public hearing, EPA issues NOC. This overall procedure will take not more than 120 days. The flowchart diagram is given **Figure 3.1.** shows the procedure to get environmental approval.



**Figure 3.1: Flow Chart Diagram Depicting Procedure to get Environmental Approval**

## SECTION - 4: PROJECT DESCRIPTION

### 4.1 GENERAL

This Chapter provides a brief description of the Phase-I of River Ravi Training Works & Channelization project including but not limited to; objectives of the project, location and site layout of the project, land use on the site, road access, vegetation features of the site, restoration and rehabilitation plan, construction aspects etc. It also details about the cost and magnitude of the project and schedule of implementation.

The details of the proposed Project, project components, design considerations, construction aspects, and operation and maintenance activities are discussed below.

### 4.2 OBJECTIVES OF THE PROJECT

The objective of River Training and channelization is to protect River Ravi front from 1000 years ARI flood and also the channel is designed in a way that it would retain the character of a fresh water body and it should have adequate capacity to pass 1000 years return period.

### 4.3 PROJECT ADMINISTRATIVE JURISDICTION

The proposed project falls under administrative jurisdiction of the District Lahore of Punjab Province.

### 4.4 LOCATION AND SITE LAYOUT OF THE PROJECT

The Phase-I Project site is geographically located between 31° 41'40.33" N, 74° 24'49.13"E upstream and 31° 36'53.75" N and 74°18' 25.28" E downstream. The Project is located on both bank of River Ravi in a stretch of approximately 14 KM long from Ravi Syphon to Old Ravi Bridge. In addition, one barrage is also the component of this channelization project. It will be located near old Ravi Bridge at lower end of this first Phase of channelization stretch of 14 km. The project location map is given in **Figure 4.1**.

### 4.5 LAND USE ON THE SITE

The proposed project route passes through the agriculture, flood plain, settlements, forest and river area. Some small industrial and commercial units are also present in the vicinity of project area. Almost 40.78% of the land that falls in the project boundary is the agriculture covering an area of 1,410.83 acres. All the agriculture land will be submerged in new development. The total area of the River Ravi present in the project boundary of Phase-I is about 795.7 acres. Total two settlements are also falling in the Project Area and **Table 4.1** and **Figure 4.2** show the details of the land use.

**Table 4.1: Land use on the Site**

Sr. No.	Land use	Area (Acres)	Percentage
1.	Agriculture	1,410.83	40.78
2.	Barren Land	14.5	0.42
3.	Bund or Spurs	8.2	0.24
4.	Creek	153	4.42
5.	Drainage	7.3	0.21
6.	Flood Plain	899.5	26.00
7.	Forest	138.76	4.01
8	Planned	6.6	0.19
9	River	795.7	23.00
10	Settlements	25.11	0.73
<b>Total Area</b>		<b>3,459.50</b>	<b>100.00</b>

There are two forests in the proximity of project corridor, however, the proposed Phase-I of channelization project will partially pass through Shahdara Reserve Forest. **Table 4.2: Details of Forests Area**

Sr. No.	Forest Name	Area (Acers)
1.	Anno Bhatti Forest	117.43
2.	Shahdara Reserve Forest	21.33
<b>Total Area</b>		<b>138.76</b>

The map of the total project boundary showing the total forests in the area and forests falling in corridor of channelization project is shown in **Figure 4.3** and detail is given in Ecological baseline (Chapter 5).

#### 4.6 ROAD ACCESS

The proposed project site is accessible through Grand Trunk (GT) Road, Sagian Wala Bypass Road, Khaju Ranwali Road, Bund Road – Shahdara and Kala Kahtie-Narang Mandi Road. Accessibility map of the project area is also provided as **Figure 4.4**.







Figure 4.1: Ravi River Training and Channelization Project Location Map

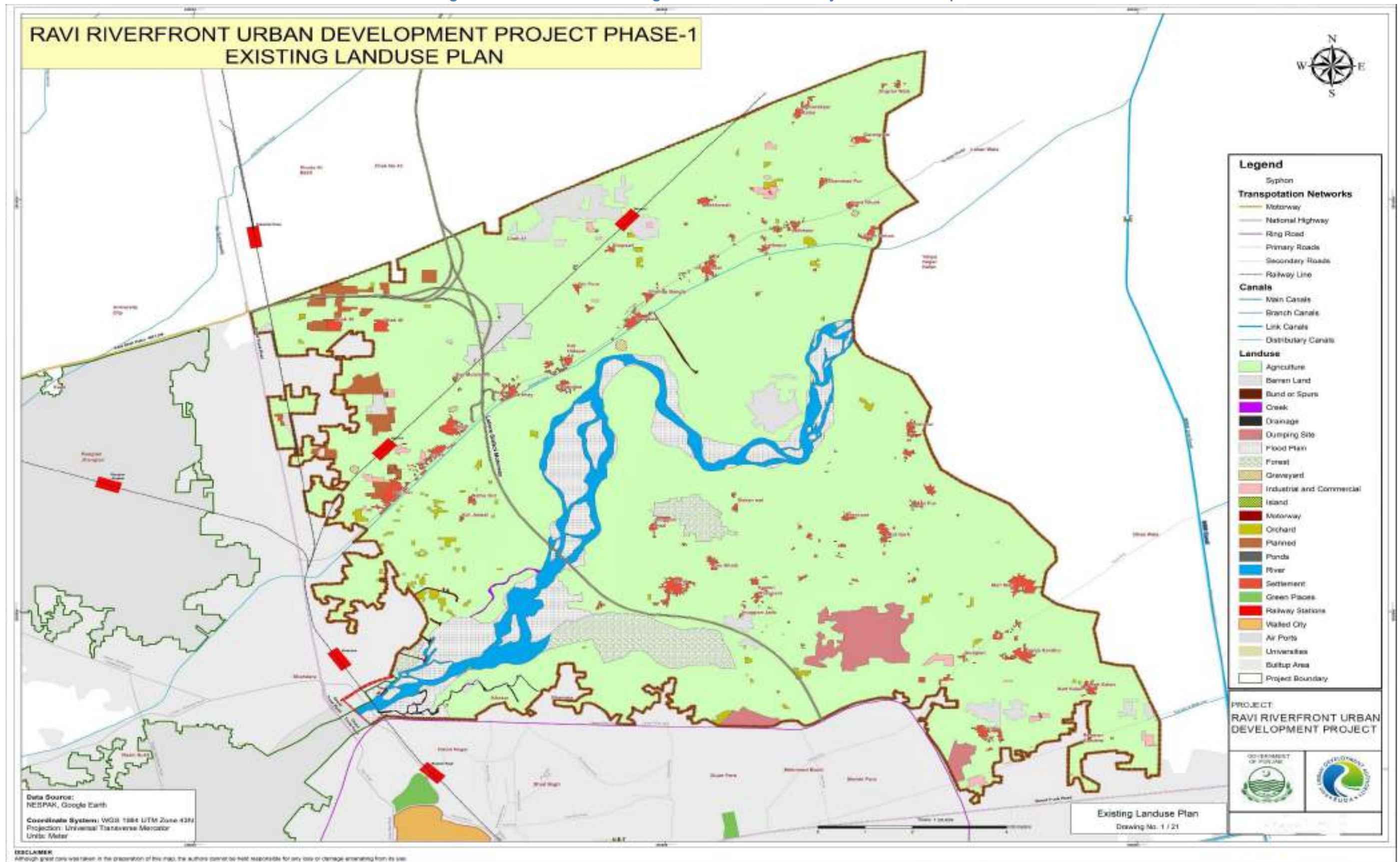




Figure 4.2: Land Use Map of Phase-I of River Training and Channelization Project

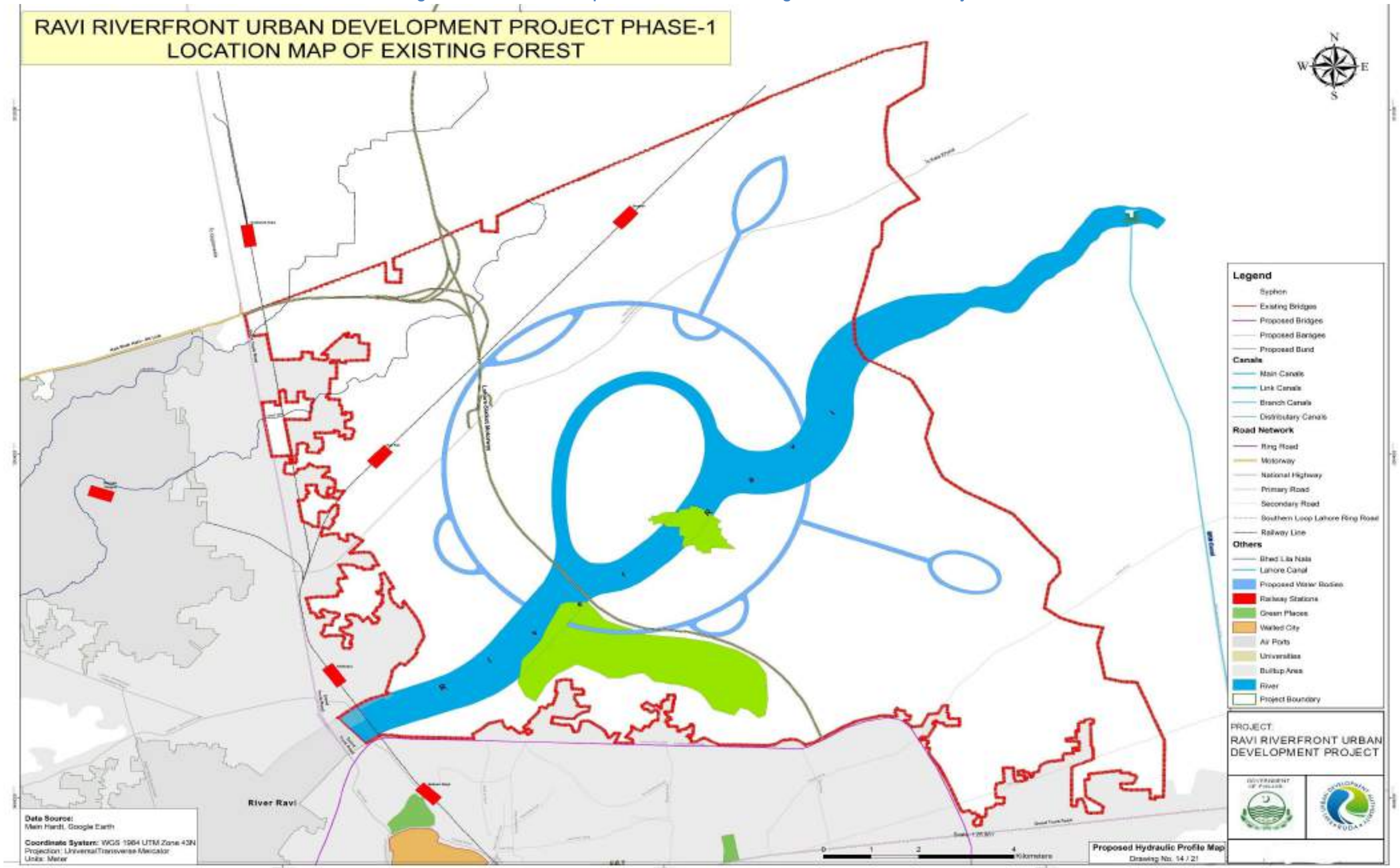




Figure 4.3: Forests in the Project Area

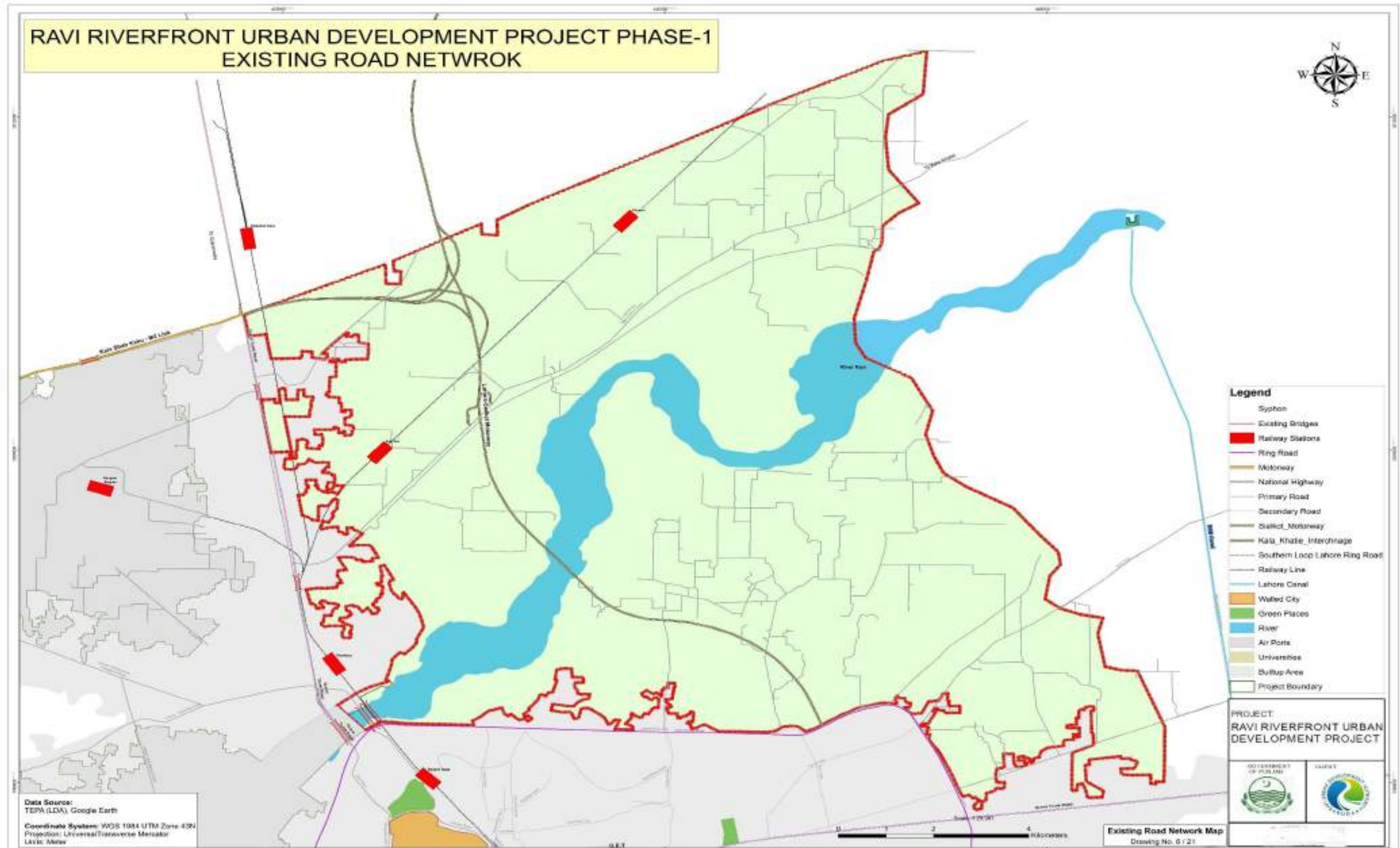


Figure 4.4: Existing Roads in Project Area

## 4.7 VEGETATION FEATURES OF THE SITE

In first phase, this riverfront urban development will take place on 14 km Long River with a stretch of 5 km on each side of the riverbank. The cited area is diverse mix of forests, agriculture, ponds, lowlands and wasteland etc.

Total area of the River Ravi present in the project boundary of Phase-I is about 795.7 acres. The banks of the River Ravi are vegetated with tree species like *Dalbergia sissoo*, *Eucalyptus* and *Acacia nilotica* etc. where ever riparian forests exist. Many grasses and sedges are common on the river bank such as *Cynodon dactylon*, *Saccharum munja*, *S. spontaneum*, *Cyperus difformis* and *C. iria*. There are two (02) forests in the project area with a total area of 138.76 acres. The tree species planted in these forests comprise mainly of *Eucalyptus*, *Sheesham*, *Kikar*, *Willow*, *Simbal* and *Mulberry* etc. There are few low-lying grassland areas within the study area. The lowland areas are inundated by the river when water level is high after monsoon and during the dry season agriculture is practiced on some parts of them. Common species were *Croton sparsiflorus*, *Polygonum plebejum* and *Saccharum spontaneum*. Some invasion of *Parthenium hysterophorus* was also observed.

Most of the project area is agricultural land and commonly grown crops include; rice, wheat, *Sorghum bicolor* and corn while seasonal vegetables were also grown there. There are many privately owned orchards present in the project area. These orchards were of guava, lychee, strawberry and only a few of mango.

## 4.8 COST AND MAGNITUDE OF OPERATION

The total development cost of the river channelization project is estimated as PKR 61 billion.

## 4.9 SCHEDULE OF IMPLEMENTATION

The total project completion time for Phase-I is estimated 10 years' period. It will include River Channelization over stretch of 14km and development of one barrage near Old Ravi Bridge.

## 4.10 DESCRIPTION OF THE PROJECT

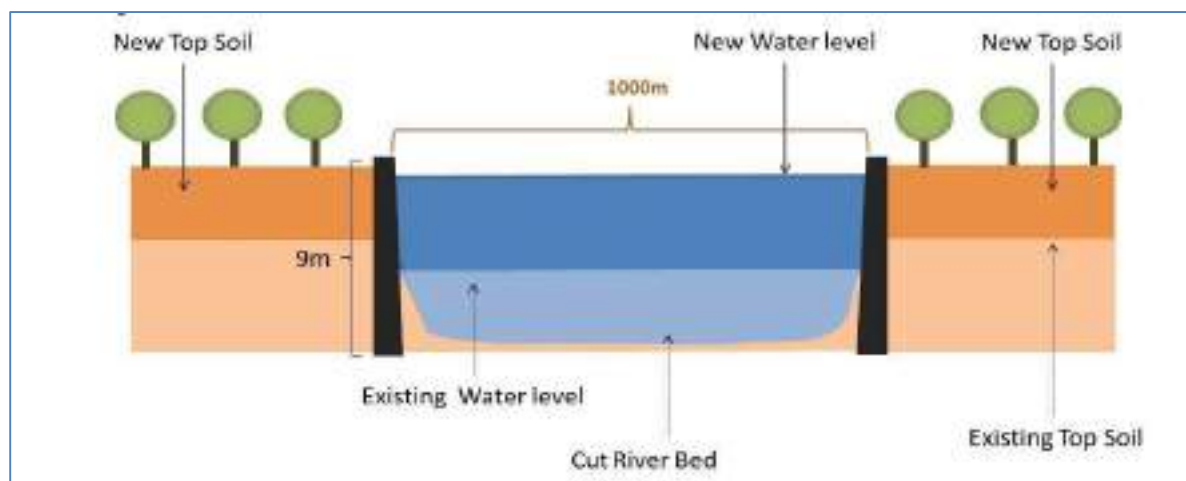
### 4.10.1 Channelization & Restructuring of River Ravi

The river Ravi will be channelized with the width of about 1 km (1000) for a length of 14 km in first Phase. The bed will be raised about 9 meters. The path and specific length of channelization is shown in Master Plan Figure 4.5 while the cross-sectional view of the river is shown in Figure 4.6.



The map illustrates the urban layout of Ludhiana, Punjab, India, showing the city's expansion and infrastructure. Key features include:

- Geographical Context:** The city is located near the India-Pakistan border and the Rajasthan state. The Ludhiana River and Kanals (canals) are prominent water bodies.
- Urban Layout:** The city is divided into various zones, including residential, commercial, and industrial areas. The map shows the city's expansion from its core towards the north and west.
- Infrastructure:** The map details the railway network (R.R. I, R.R. II, R.R. III), major roads (e.g., Canal Bank Road, G.T. Road, Durgam Road), and the city's proximity to the Ludhiana Airport.
- Administrative Boundaries:** The map shows the city's boundaries and its proximity to the Ludhiana District and the Punjab state.
- Scale and Orientation:** The map is oriented with North (N) at the top. A scale bar at the bottom right indicates a scale of 1:60,000.



**Figure 4.6: Proposed River Section**

#### 4.10.2 Design Parameters for River Training & Channelization Works

The design flood used for river training work and estimation of barrage/control structures is considered as 586,000 cusecs as the flood above 500,000 cusecs was already witnessed twice in 89 years. Detailed analysis for the phase I was carried out to determine the width and depth of the channel. The width of the channel is 3280.84 ft (1000 m) with wall height of 33 ft including the free board.

#### 4.10.3 Temporary Storage Water Requirement

The ultimate goal to carry out river channelization is to make a perennial water body with temporary storage /detention that will flow throughout the year. Once this temporary storage is filled, the outflows that would be kept equal to inflows. The maximum temporary storage is estimated to be about 0.22 million acre feet with 1200 m wide and 14 km long water body.

#### 4.10.4 Ecological Water Flows

When the water is available in abundance in Ravi River itself, then there will be no problem in meeting the refreshing requirements of the lake. However, if requirement is more than the flows available in the river, then the options to divert the flows from other rivers/sources are to be checked.

The raising of water level in the river by constructing a gated/regulating structure would cause the flow depths to increase and velocity of flow to reduce. The freshening in a stream is directly related to the depths and velocity of flow. The Barrage may lower the water quality particularly when the flows in the river are low.

The important aspects are quality of influent (DO and BOD), addition of biological load by the water entering the river along the length of the water body and the processes that are expected to take place in the water body.

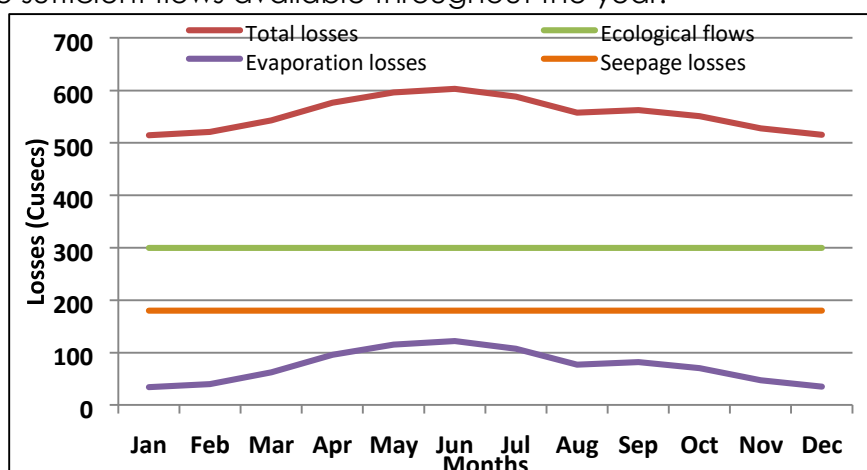


USEPA (1985) has recommended a minimum concentration of 3-5.0 mg/l for healthy water bodies to sustain fish and aquatic life. National Conservation Strategy (NCS) recommends DO concentration of 4 mg/l to protect and conserve aquatic life.

Minimum ecological flow requirement to keep the lake fresh depends upon the season, and water body operating levels. The minimum environmental flow in different months will be investigated using water quality modelling. However, the initial estimate is about 300 cusecs and losses due to evaporation and seepage. **Figure 4.6** shows expected losses due to seepage and evaporation to be held during the year.

The analysis for minimum daily recorded flow in various months indicates that the additional flow will be required in the months from October to May. The flow required ranges between 100 to 450 Cusecs from October to May. The maximum flow required is 450 cusecs in the months of December as shown in **Figure 4.7** (- sign shows additional flow required). It should be noted that this analysis is carried out for minimum monthly flows from 2001 to 2013.

**Figure 4.6** presents worst possible scenario of minimum recorded flow about additional flows that may prevail from one day to 10 to 15 days in the months ranging from October to May. However, analysis was carried out for 90% of flow available time, that shows there will no additional flows required as there are sufficient flows available throughout the year.



**Figure 4.7: Mean Monthly Losses due to Seepage and Evaporation**

#### 4.10.5 Upstream Protection of the Project Area

The project area starts about 6.39 km from Ravi Syphon. The proposed development of channelization will have impact on the upstream of the project area in case of flooding. The upstream area will require protection from floods and following measures has been taken. Dykes to be provided for 6.39 Km stretch as shown in **Figure 4.8** and typical section of dyke is shown in **Figure 4.9**.

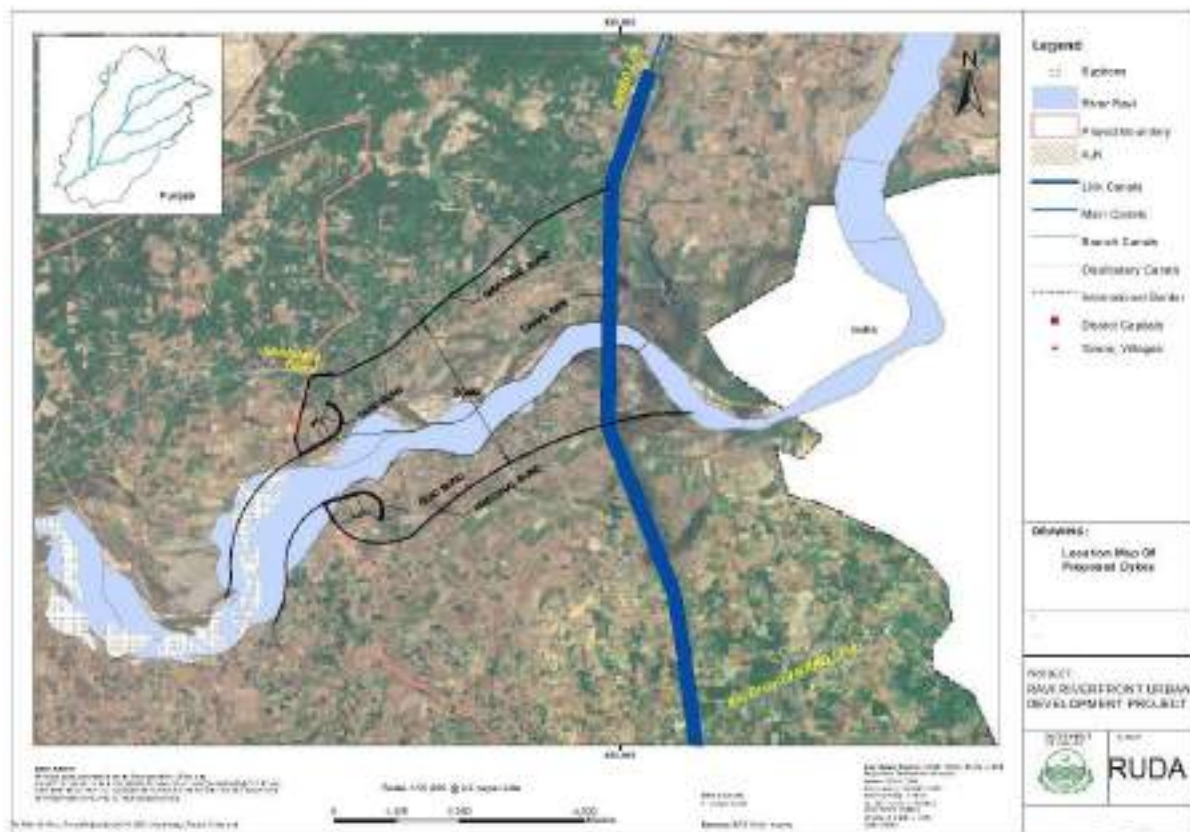


Figure 4.8: Proposed dykes for the River Ravi urban Development Project

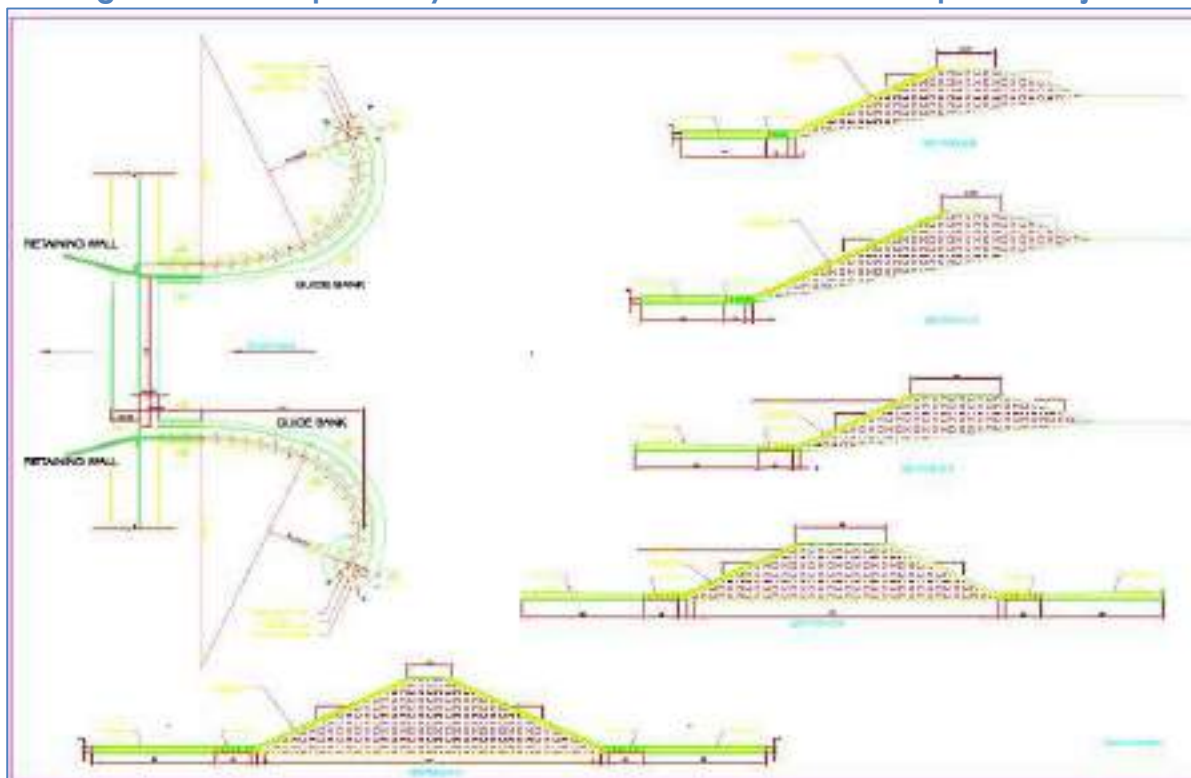


Figure 4.9: Typical Section of Dyke and Bund designed for the Project

#### 4.10.6 Basic Criteria for Barrage

The Barrage and appurtenant structures will be designed on the basis of standard design criteria established for other barrages and allied structures, already constructed on the Ravi River. Basically, the design criteria given in the following sections in general will follow the design principles practiced for the design of existing Barrages founded on permeable bed of Ravi and other rivers.

#### 4.10.7 Design Return Period

A return period of 100 years is generally adopted in the design of important and costly barrage structures where possible consequences of failure are very serious. Accordingly, the estimation of design flood has been carried out for various return periods of 100 years, 200, 500 and 1000 years as desired by Client. However, the actual recorded peak flood discharge has been reviewed for design as it exceeds the discharge calculated for the concerned return period of 100 years. The discharge of 586,000 cusecs has been used as per HECRAS Model and historical discharge observed during past years which is very near to 1000 years return period.

#### 4.10.8 Salient Features of the Barrage

Salient features and design parameters of the proposed barrage are given in **Table 4.3**. The proposed barrage will be constructed on these parameters.

**Table 4.3: Design Parameters of Barrage**

Description	Quantity
Design discharge	5,86,000 cfs
Normal pond level	695.00 ft
Maximum pond level	698.45 ft
Width of all bays of barrage	40 ft
Maximum discharge intensity	325.56 cfs / ft
Number of bays in main weir Left portion	22
Number of central bays (Under sluice)	10
Number of bays in main weir Right portion	22
No of Fish Ladders (L & R)	2
No of Navigation Lock (L & R)	2
No of Divide Walls (L & R)	2
Width of each Pier	6 ft

Width of Divide Wall	10 ft
Width of Navigation Lock	40 ft
Designed retrogression	3.0 ft
Design flood level u/s (with 4.92 ft afflux)	701.15 ft
Description	Quantity
Design flood level d/s (with 2 ft retrogression)	692 ft
Lacey's silt factor for $cd_{50} = 0.323\text{mm}$	0.90
Looseness factor	1.3

**Table 4.4: Established Parameters – Main Barrage**

Parameter	Left Main Weir	Under sluice (Centre)	Right Main Weir
Crest level	676 (ft)	671 (ft)	676 (ft)
u/s floor level	672.0 (ft)	671.0 (ft)	672.0 (ft)
u/s concrete floor length (ft)	40.0 (ft)	40.0 (ft)	40.0 (ft)
Stilling basin length (ft)	85.0 (ft)	85.0 (ft)	85.0 (ft)
Stilling basin level	667 (ft)	667 (ft)	667 (ft)
Clear width (ft)	880 (ft)	400 (ft)	880 (ft)
Width between abutments (ft)	2651.58		

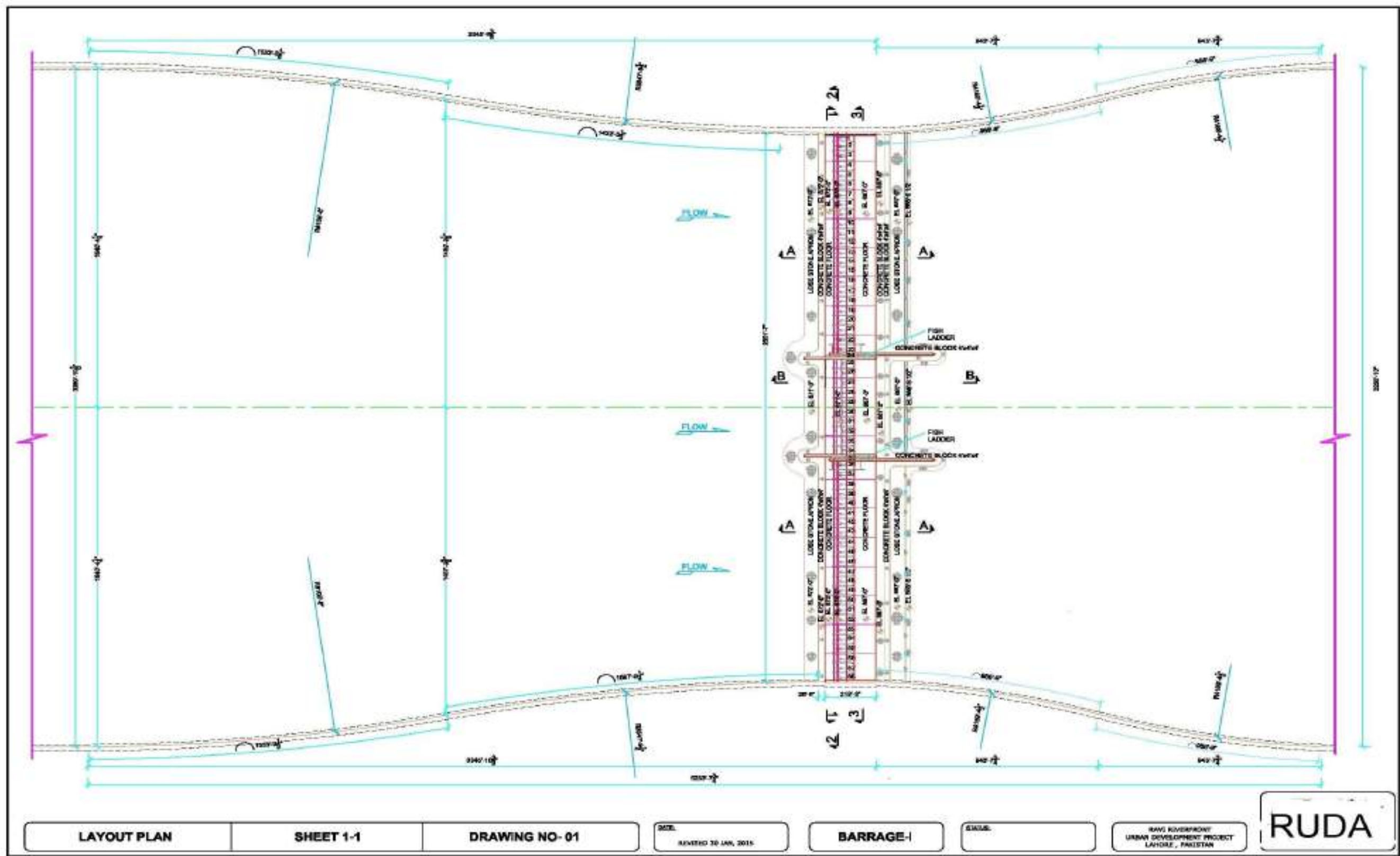
#### 4.10.9 Establishment of Barrage

The plan of the barrage (typical) and its cross sections are shown in **Figures 4.10 to 4.12**. In first Phase, one (01) barrage is proposed having length of approximately 1 km. The height of barrage is set at 25 ft. There are 54 total gates in the barrage, out of which 4 gates are given for navigation and fish ladder. The location and coordinates of proposed barrage is shown in **Figure 4.1**.

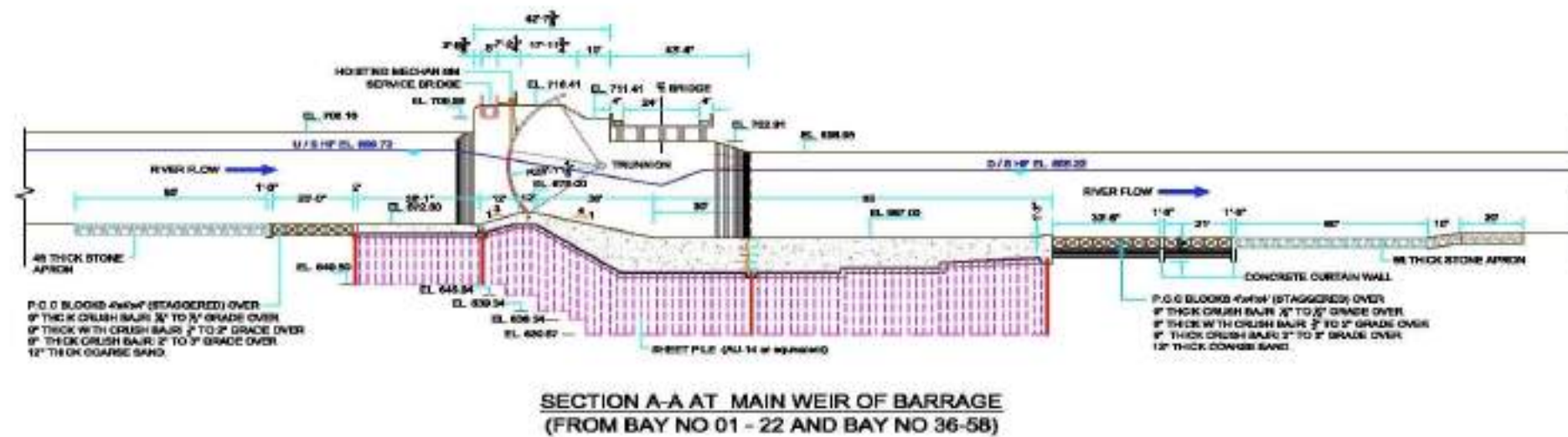
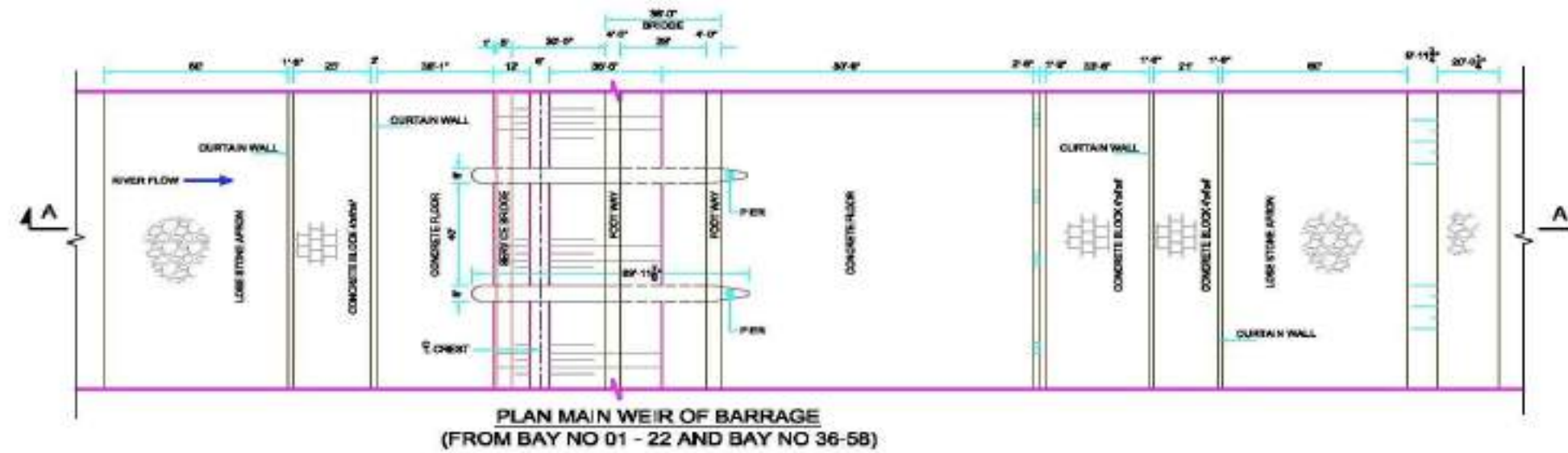
**Table 4.5: Location of Barrage**

Sr. No.	Proposed Barrage	Coordinates	Location
1	Structure 3	31°-36'-56.35" N 74°-18'-25.28" E	Near Old Ravi Bridge



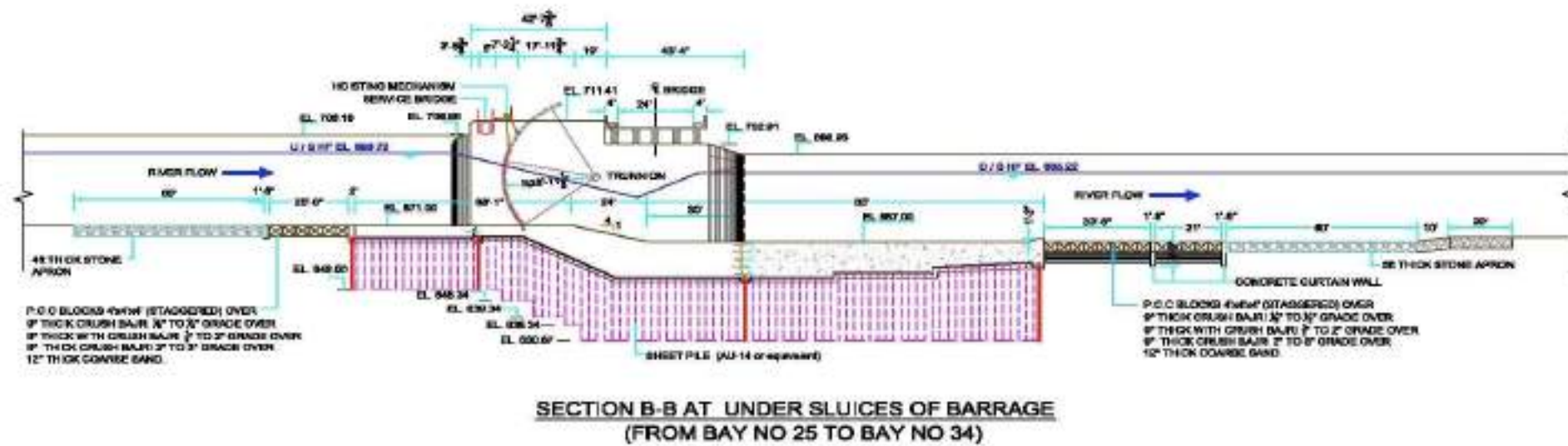
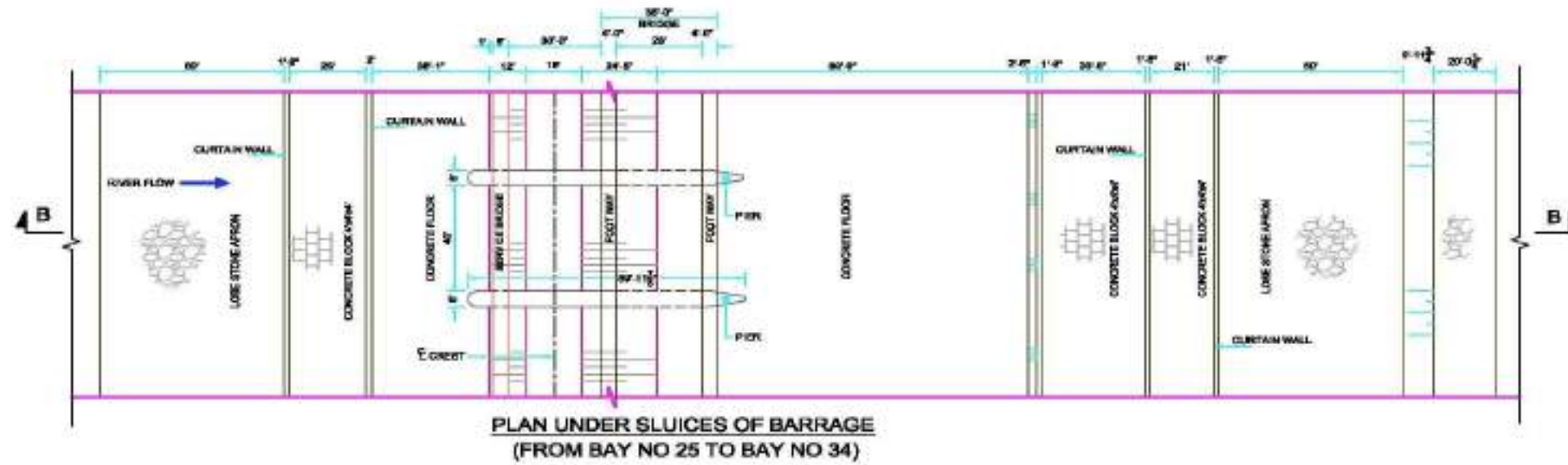


### Figure 4.10: Layout Plan of Barrage



PLAN AND SECTION	SHEET 1-1	DRAWING NO- 02	DATE: REVISED 30 JAN, 2015	BARRAGE-I	DATE:  	RAVI RIVERSHIELD URBAN DEVELOPMENT PROJECT LAROKI, PAKISTAN	
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### Figure 4.11: Section of Barrage



PLAN AND SECTION

SHEET 1-1

DRAWING NO- 03

DATE:  
REVISED 30 JAN, 2019

BARRAGE-I

REVISION

RAVI RIVERFRONT  
URBAN DEVELOPMENT PROJECT  
LAHORE, PAKISTAN

RUDA

Figure 4.12: Plan and Section of Barrage



## **4.11 CONSTRUCTION ASPECT**

### **4.11.1 Construction Materials**

Extensive quantities of building and road construction materials will be required for construction of the proposed project.

The materials mainly required include: Coarse and fine aggregate for concrete works, Sandy gravel (free draining materials) for backfilling, embankment raising, etc., Cement, Steel, Bitumen, Kerb Stones, and other materials.

### **4.11.2 Construction Machinery**

The following list, but not limited, of construction equipment required by the Contractor to undertake this work and meet the prescribed schedule will be required:

- Bulldozer.
- Vibratory Roller.
- Dump Trucks.
- Mobile Water Tanker.
- Hydraulic Excavator.
- Concrete Batching Mixer.
- Pneumatic Drilling Machine.
- Diesel Generators.
- Jeeps.
- Asphalt Plant
- Asphalt Distributor
- Vibratory Roller
- Wheel Loaders
- Motor Grader.

### **4.11.3 Construction Camps**

The construction camps have to be built by the selected contractor to accommodate construction staff, machinery and batching plants. The Location of the camps will be selected in a way that there should be minimum disturbance to the surrounding community, access to motor-able roads is available and it is close to the site of work. Camp has been properly fenced and guarded. The area of the camp has been kept sufficiently large to accommodate parking areas for machinery, construction materials and



workshops. Final location of the construction camps will be selected by the contractor with assistance of Supervision Consultants, which will be finalized after the approval from Project Director of RUDA, Punjab. For the drinking water and other domestic uses of the camp, groundwater will be used after testing.

#### **4.11.4 Work Force and Machinery**

The project will involve professional, administrative, skilled and unskilled labor, which will be deployed for the construction activities. It has been estimated that the Project will employ about 200 skilled, semi-skilled and unskilled workforce for its construction. The Contractor will be advised to hire unskilled labor from the local communities. A training program will be conducted for unskilled workers.

### **4.12 RESTORATION AND REHABILITATION PLAN**

The implementation of the proposed Project would involve construction workers' camp for staff and laborers, establishment of fences around construction sites, over usage of access roads for movement of heavy machinery/motor vehicles linking to various components of project, offices, borrow/quarry areas, etc. During construction, these activities could also result in accumulation of large amount of unused or spoil material at various sites such as at access roads, muck dumping sites, quarry sites, colonies, offices, etc. which will change the existing land cover in the project area. After completion of the construction work, it is required to restore the disturbed area to its original conditions wherever it is possible that is the sole responsibility of the Contractor. Various engineering and biological measures have been suggested for the restoration of these areas:

- Top soil should be stored at designated areas before performing excavation activities at quarry sites (if these are agriculture land) and after the completion of all the construction activities, quarry sites (if applicable) and construction sites should be covered with the top soil to support the growth of plant species;
- The area should be planted with indigenous vegetation that would require the initial establishment of fast growing grasses along with annuals and perennials, nitrogen fixing herbaceous legumes and nonlegume shrubs to increase the soil conditioning and to stabilize the project site;
- Material stockpiles shall be removed as soon as the construction work will be completed;
- All the construction, toxic and hazardous chemicals/materials shall be completely removed from the site;

- All fencing and gates shall be removed and pits shall be backfilled;
- The reconstruction of interrupted drainage channels and pipes shall be carried out;
- Rehabilitation of affected roads should be carried out to avoid any inconvenience to the road commuters; and
- A clearance certificate from the supervisory or the external monitoring consultant has to be taken by Contractor in this regard.

To achieve the above objectives, the Contractor will prepare a Site Restoration & Rehabilitation Plan well before the completion of the construction activities and submit to RUDA through the SC for approval. Finally, after the completion of the restoration process, RUDA through the representatives of the Environmental Management and Monitoring Cell and other community members will inspect the site and give restoration clearance to the Contractor.

## SECTION - 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. Identification of physical, ecological and social aspects of environment and collection of relevant data is essentially important for the evaluation of impacts as well as for the suggestion of adequate mitigation measures which forms the basis of the Environmental Impact Assessment (EIA) implementation.

Information has been collected from variety of sources including; published literature, field observations and surveys conducted specifically for this project. Consultations were also held with the general public and stakeholders of the project area in order to seek the public opinion on the implementation of the proposed project.

### 5.2 STUDY AREA

For an EIA study, it is imperative to delineate the area where the potential significant impacts of the proposed Project are envisaged. The Study Area is the area within which the potentially significant adverse environmental and social impacts of the proposed intervention are envisaged. In the light of this, potential impacts on the existing environment have to be considered in a larger geographical area than the proposed “Project Area” depending upon the extent of direct/indirect impacts.

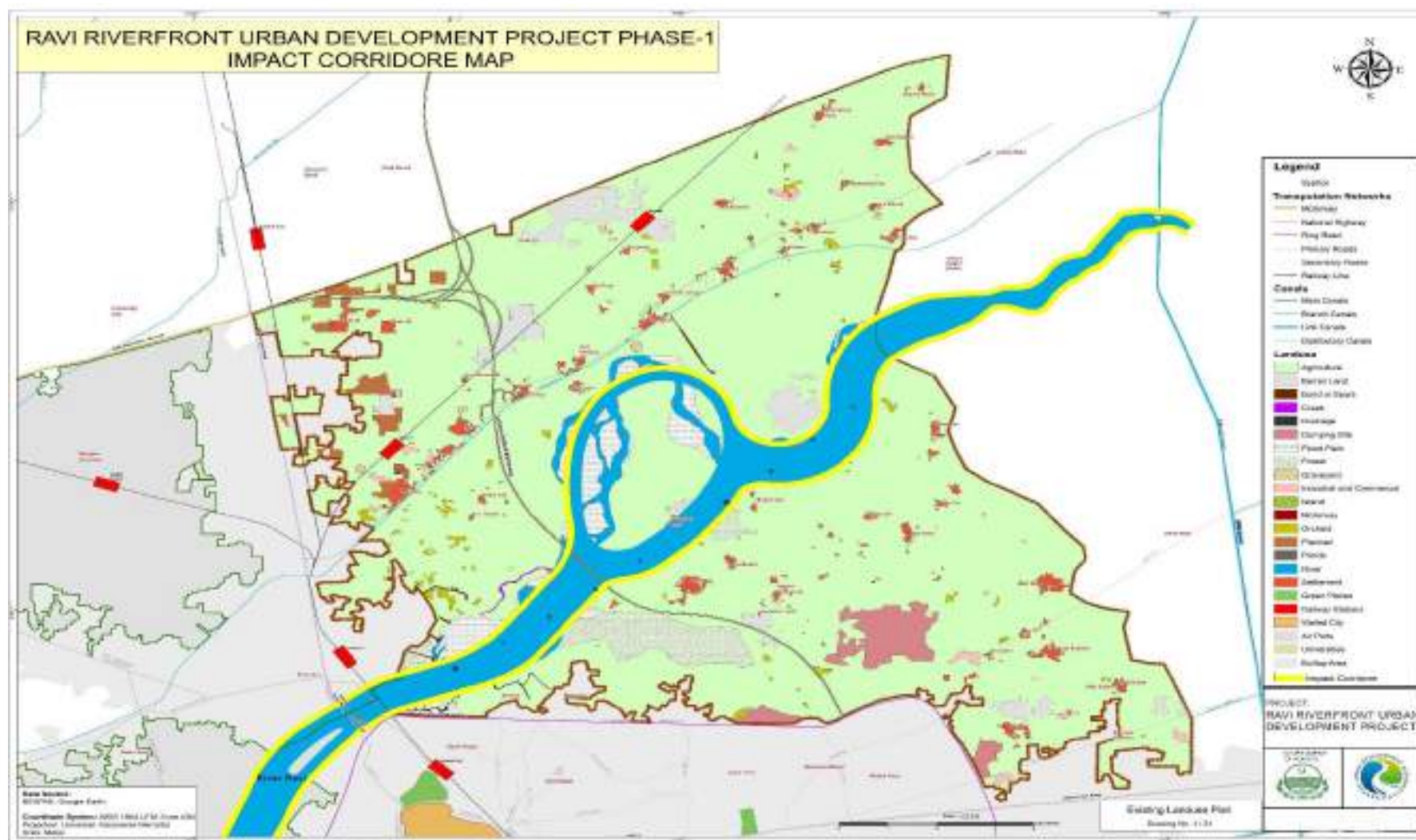
Based on the experience of the Consultant, the available secondary information of the proposed Project Area, and technical details of the proposed project, criteria were developed to delineate the Study Area of about 200 meters buffer from the edge of project boundary on either side. In the criteria, critical parameters of physical (wind direction and speed, topography), ecological and social (location of settlements, other receptors and existing land use resources) domains of the environment for the proposed Project have been considered. Study Area includes the actual proposed Project boundary or the area which is considered to be acquired for the Project, as well as the area in the surroundings in which potential adverse impacts may be foreseen due to the implementation of the proposed Project like location of construction camp, residential and non-residential buildings, workshops etc.

So the “Study Area” includes the Project Area, nearby land having settlements, agriculture fields, River Ravi etc. The Study Area map has been shown in **Figure 5.1**.

### 5.3 SITE VISITS

A team of experts carried out field visits to the proposed project site (Project and Study Area), adjoining areas from August, 2014 to October, 2014 and January, 2021 in order to collect the baseline data on physical, ecological and socio-economic aspects.

Primary data was collected from various sources. The people living around the proposed project were interviewed to have their views about the proposed project and the perceived impacts on the natural environment around the proposed project. This included information on land, surface water, groundwater, air, vegetation, animals and human.



**Figure 5.1: Project Study Area/Project Impact Area Map**

Following is the description of baseline conditions of the Study Area.

## 5.4 PHYSICAL ENVIRONMENT

Physical environment covers topography, soil, geology, water resources, seismicity and climatic data. These are elaborately described as under:

### 5.4.1 Topography

The project site is located in the suburbs of Lahore along both banks of Ravi River starting from Ravi Syphon to Old Ravi Bridge. Project site has a flood history and was flooded back in 1988 last time. The terrain of the project area is generally flat with few undulations present in the stretch while the general trend of the slope is towards River Ravi. It is divided into two parts i.e. the low lying area along River Ravi and the comparatively upland area in the east away from Ravi. The low lands are generally inundated by the river water during intense rainfall events. The natural slope of land is around south side.

**Figure 5.2** represents the topography of the study area.

### 5.4.2 Geology

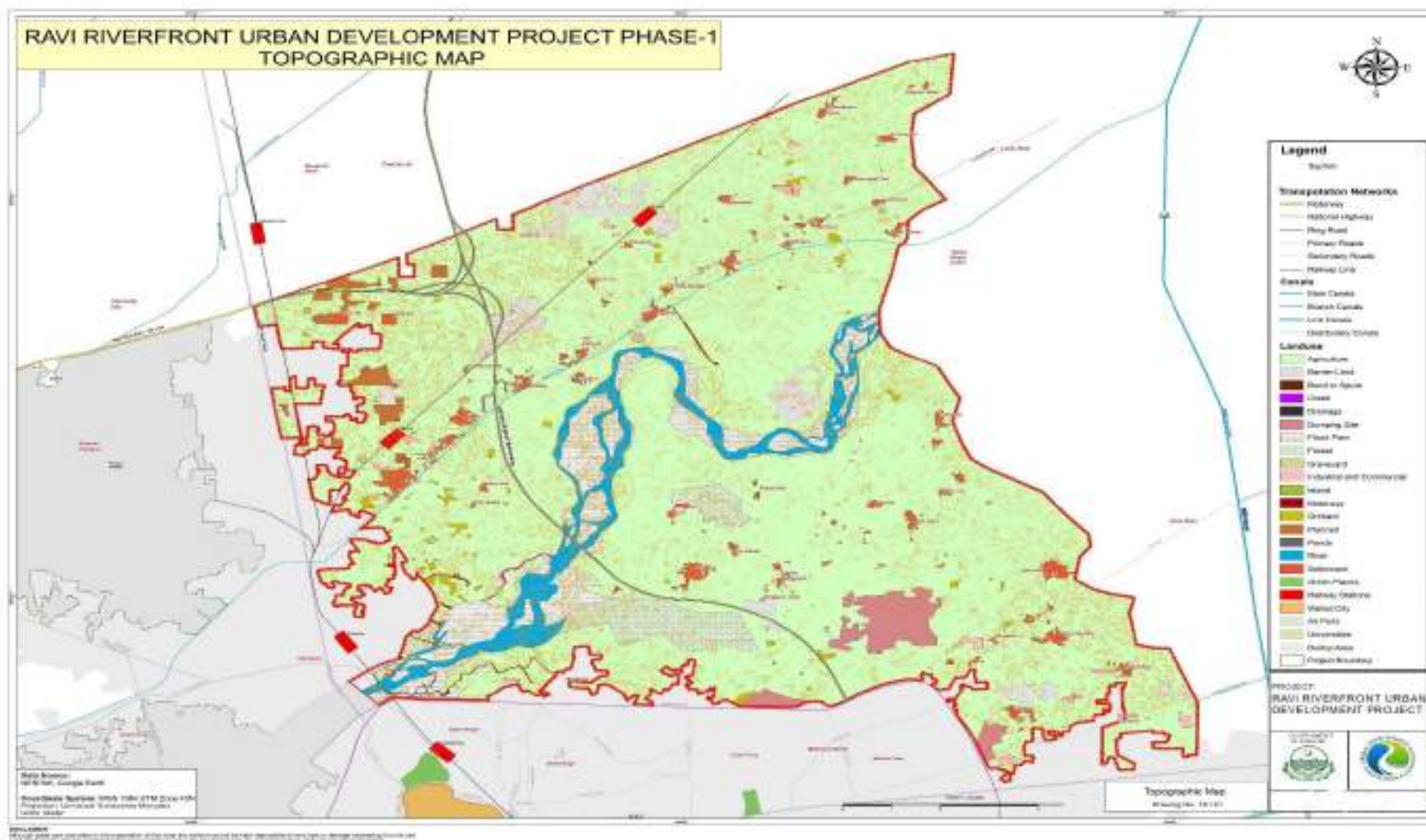
The proposed project site is a vast plain of alluvial material, deposited by Indus basin and five main river crossing the Punjab Plain. The alluvial deposits underlying the site are deposited by the river Ravi and its tributaries.

Lahore city lies on the alluvial plain called Bari Doab<sup>7</sup>. Doab is a local word for area between rivers. The thickness of alluvial deposits in Lahore is reported to be more than 300 meter. These alluvial deposits 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. The thickness of alluvial deposits in Lahore 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. Geological map of the Study Area is given in **Figure 5.2**.

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<sup>7</sup> Kadwai, S.U. and Siraj, A. (1964), "The Geology of Bari Doab, West Pakistan", WAPDA Water and Soil Investigation Division (Bulletin No. 8)

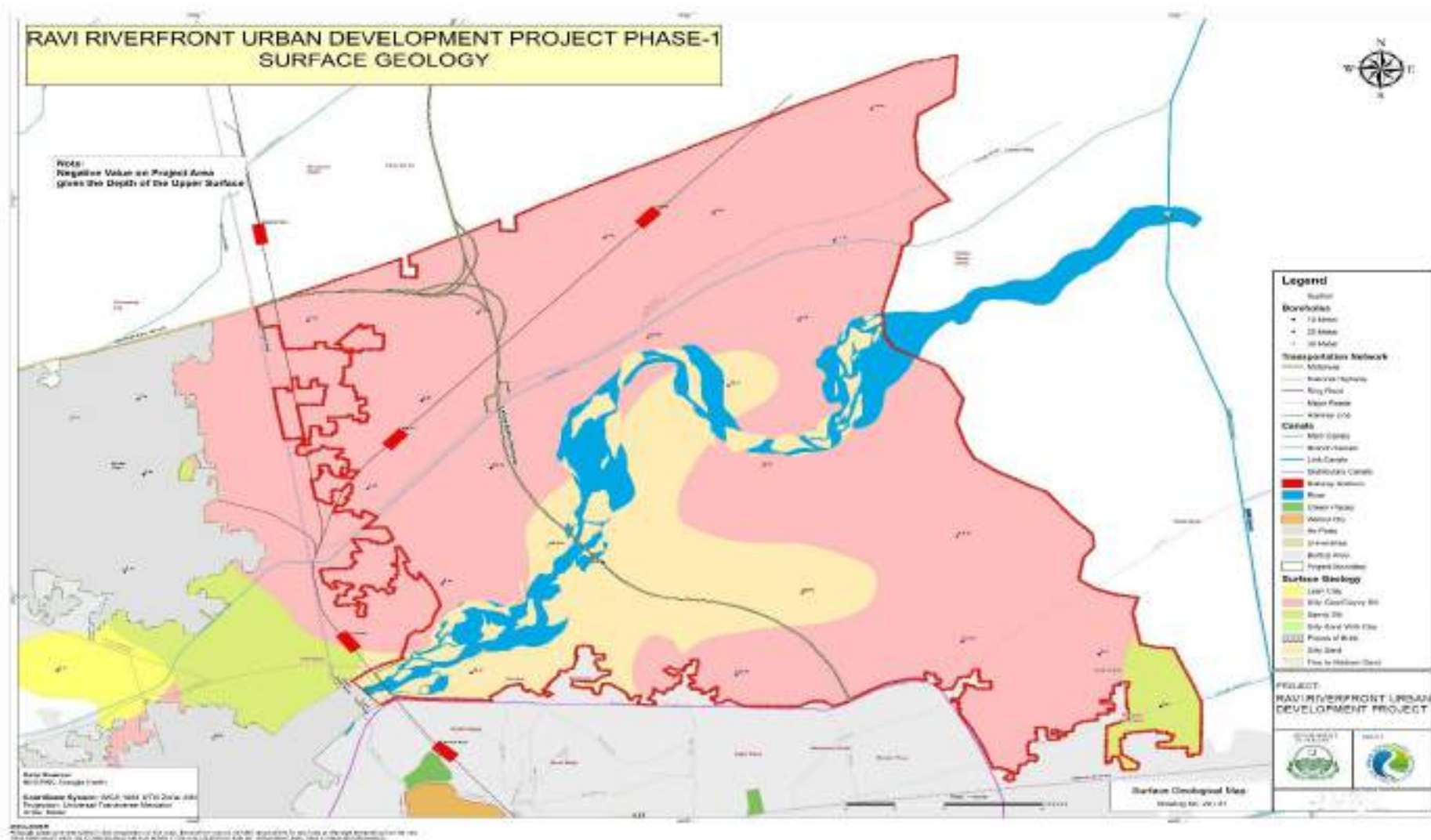




### Figure 5.2: Topography of the Project Area

## Section - 5: Description of Baseline Environment

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**Figure 5.3: Surface Geological Map of the Project Area**

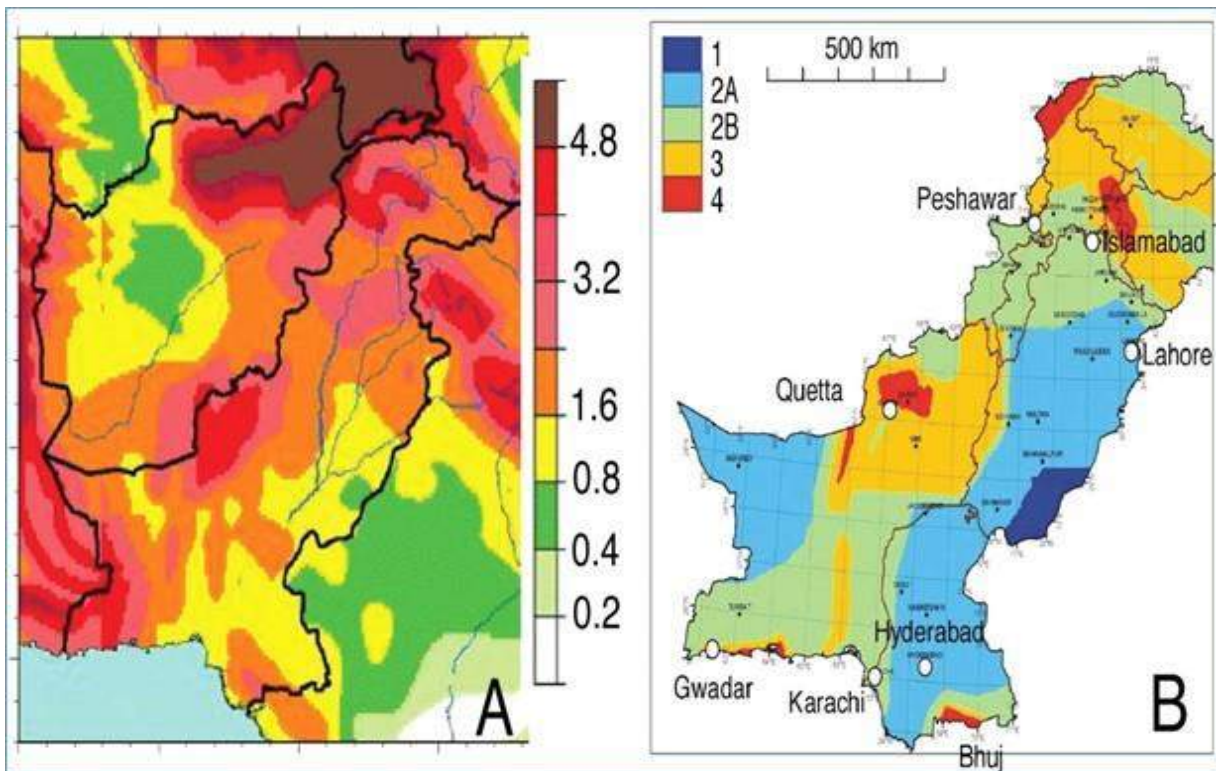


### 5.4.3 Seismicity

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.

On the basis of Peak Ground Acceleration (PGA) values obtained through Probabilistic Seismic Hazard Assessment (PSHA), Pakistan is divided into five (05) seismic zones in line with the Uniform Building Code (UBC), 1997 of the Pakistan. The proposed project area falls in Zone 2A (Lower limit of moderate damage) with Peak Ground Acceleration (PGA) from 0.08 to 0.16 g. Seismic zone of Pakistan is shown in **Figure 5.4**.

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 PGA with 10% probability of exceedance in 50 years.

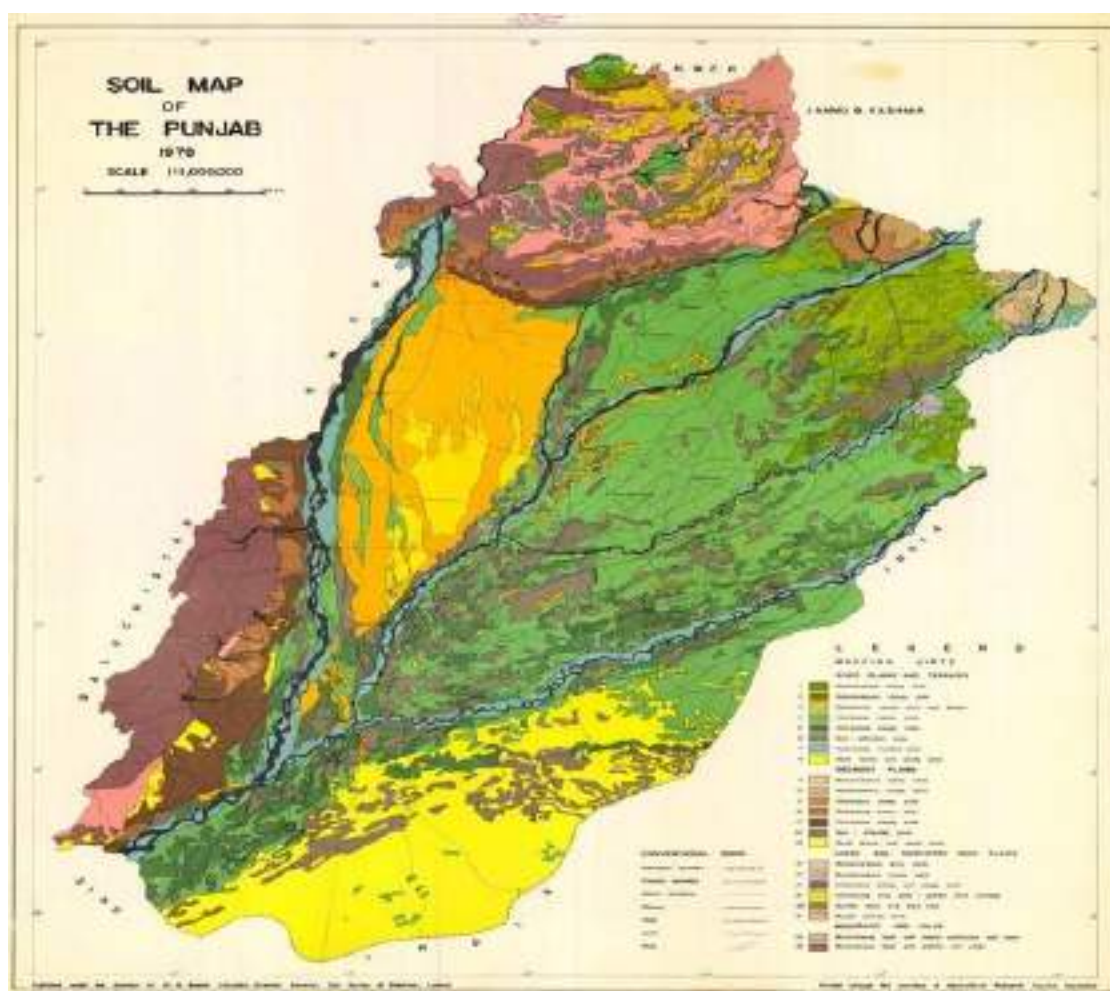


**Figure 5.4: Seismic Zone of Pakistan (Geological Survey of Pakistan)**

#### 5.4.4 Soil

The soil in the project area, 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 ponding in some places. The minimum depth of ground water table observed at site is about 1 meter but it varies from 3.0 to 6.0 meter below NSL. Soil map of the project area is given in **Figure 5.5**.



**Figure 5.5: Soil Map of the Study area (Source CDGL)**

#### 5.4.5 Climate and Meteorology

Seasonal climatic conditions must be considered for the design and execution of the project. The climate including air, temperature, precipitation and humidity is an influencing factor, affecting the construction and other

engineering structures. However, to determine the overall effect of the climatic stresses, daily and seasonal temperature changes and precipitation must be considered. The project area has extreme climate: it has hot summer and cold winters. The summer starts from April and lasts till September. May, June, and July are the hottest months. The mean maximum and minimum temperature ranges from 40.4° C and 27.3° C<sup>6</sup> respectively for these months.

The winter seasons lasts from November to March. December, January and February are the coldest months. The mean maximum and mean minimum temperature ranges from 19.8° C to 5.9° C in January. Temperatures in the project area vary from 5.9 ° C to 40.4 ° C.

The project area receives rains in all the seasons but monsoon rain is pronounced and constitutes a definite rainy season between the month of July and September. The average rainfall is about 629 millimeters per year. **Table 5.1, Table 5.2 & Table 5.3** summarizes month-wise temperature, precipitation, relative humidity, and wind speed, wind direction and rainfall while **Figure 5.6, Figure 5.7** and **Figure 5.8** show the graphical presentation of humidity, precipitation and temperature in the study area.

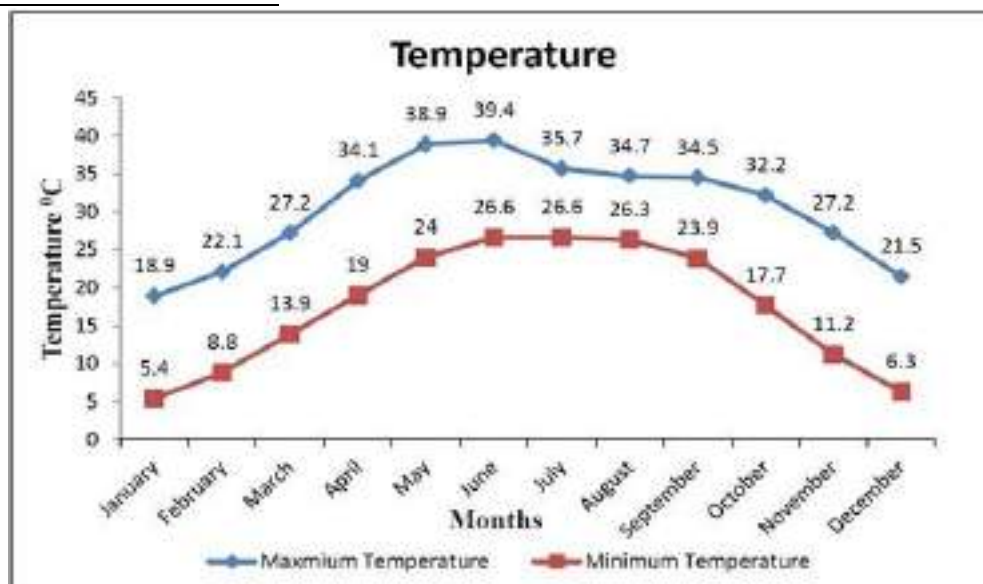
**Table 5.1: Average Monthly Temperature and Relative Humidity (1981-2010)**

Month	Mean Temperature		Relative	Relative	Relative
	Maximum	Minimum	Humidity (%)	Humidity (%)	Humidity (%)
			00 UTC*	03 UTC	12 UTC
January	18.9	5.4	87.9	86.9	51.6
February	22.1	8.8	82.5	79.3	44.8
March	27.2	13.9	79.6	69.5	40.7
April	34.1	19.0	66.2	51.2	28.9
May	38.9	24.0	57.7	44.3	24.8
June	39.4	26.6	65.0	53.1	32.6
July	35.7	26.6	83.8	75.1	56.2
August	34.7	26.3	88.1	79.5	63.3
September	34.5	23.9	86.4	76.3	53.7
October	32.2	17.7	84.4	72.8	42.7
November	27.2	11.2	85.6	80.5	46.7

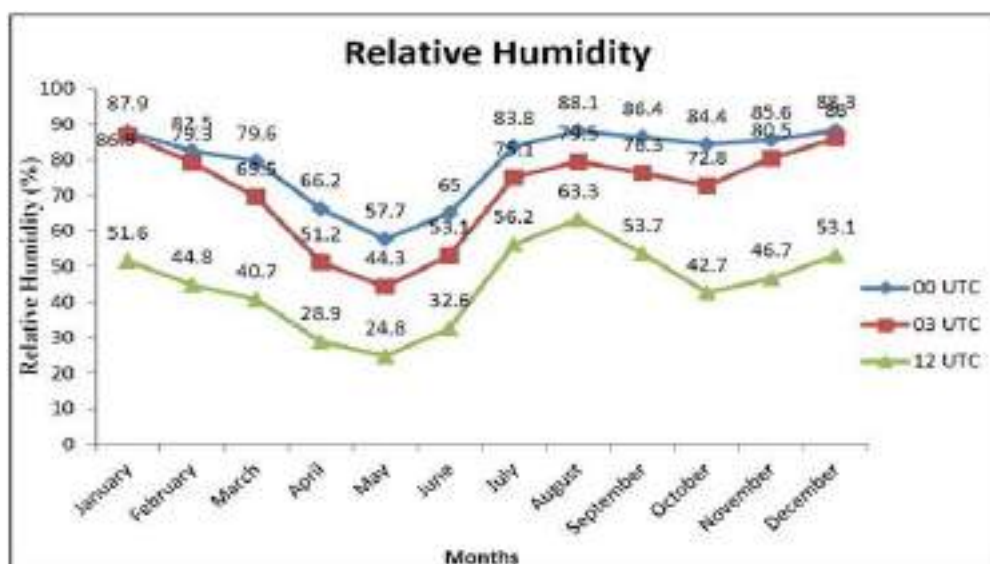
<sup>6</sup> District Census Report Lahore, 1998

December	21.5	6.3	88.3	86.0	53.1
Annual	30.3	17.5	81.4	72.7	46.5

**Source:** Climate Data Processing Centre Pakistan Meteorology Department Karachi, 2013; UTC\*: Co-Ordinated Universal Time



**Figure 5.6:** Maximum and Minimum Temperature in the Project Area (1981-2010)



**Figure 5.7:** Relative Humidity in the Project Area (1981-2010)



**Table 5.2: Average Monthly Temperature, Wind Speed and Wind Direction (1981-2010)**

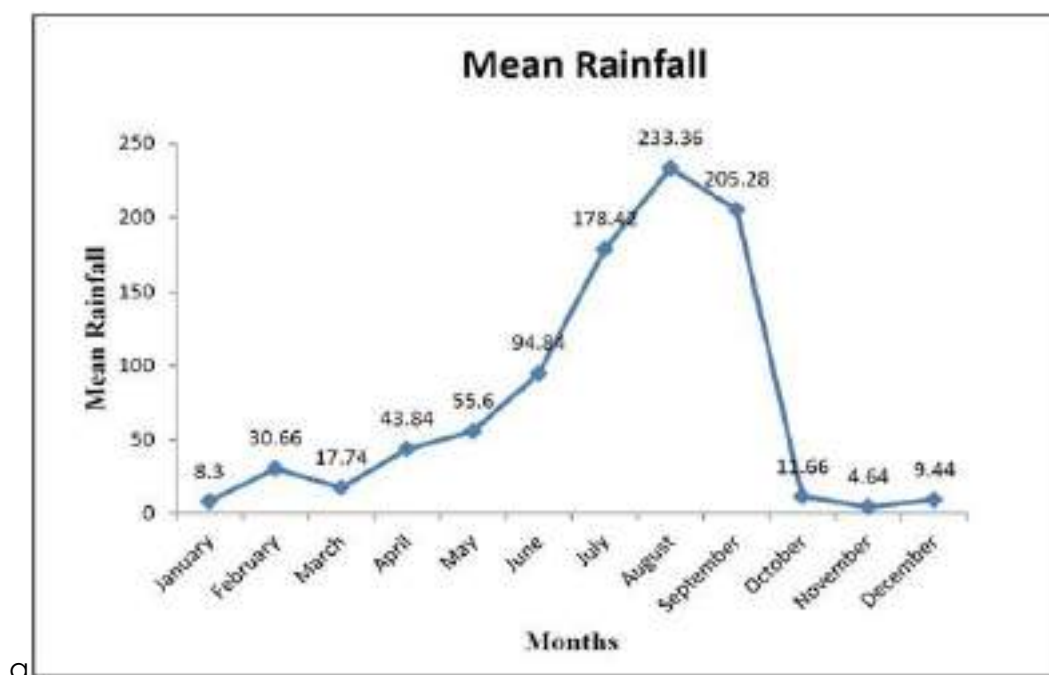
Month	Mean Temperature	Wind Speed (knots)			Wind Direction		
		00	03	12	00	03	12
		UTC*	UTC	UTC	UTC	UTC	UTC
January	18.9	1.5	1.4	3.7	N49W	50W	N51W
February	22.1	2.4	2.1	6.2	N41W	N43W	N47W
March	27.2	2.5	3.3	7.1	N29W	N25W	N41W
Month	Mean Temperature	Wind Speed (knots)			Wind Direction		
		00	03	12	00	03	12
		UTC*	UTC	UTC	UTC	UTC	UTC
April	34.1	3.4	4.6	6.8	N18W	N	N49W
May	38.9	3.8	5.7	6.8	N16E	N53E	N72W
June	39.4	3.6	6.5	6.9	S77E	S57E	S23W
July	35.7	3.4	5.7	6.3	S74E	S61E	S55E
August	34.7	2.3	4.5	5.5	S67E	S56E	S54E
September	34.5	1.6	3.0	5.0	E	S57E	W
October	32.2	1.1	1.7	3.5	N	N56E	N45W
November	27.2	1.1	1.0	2.1	N38W	N34W	N58W
December	21.5	1.1	1.0	2.2	N48W	N45W	N63W
<b>Annual</b>	<b>30.3</b>	<b>1.9</b>	<b>3.1</b>	<b>4.9</b>	<b>N</b>	<b>N67E</b>	<b>N57W</b>

**Source:** Climate Data Processing Centre Pakistan Meteorology Department Karachi, 2001; UTC\*: Co-Ordinated Universal Time

**Table 5.3: Average Monthly Precipitation (2010-2014)**

Month	Maximum	Minimum	Rainfall (mm) Mean
January	4.84	0	8.3
February	11.3	0	30.66
March	6.26	0	17.74
April	26.1	0	43.84
May	5.56	0	55.6
June	47.36	0	94.84
July	68.2	0	178.42
August	78.8	0	233.36
September	87.1	0	205.28
October	10.62	0	11.66
November	4.02	0	4.64
December	8.04	0	9.44
<b>Total</b>	<b>358.2</b>	<b>0</b>	<b>893.78</b>

**Source:** Climate Data Processing Centre Pakistan Meteorology Department, Karachi



**Figure 5.8: Mean Rainfall in the Project Area (2010-2014)**

**A) Pre-monsoon Season**

Pre-monsoon refers to the period from April to June prior to the setting in of the monsoon. This is the hottest and the driest season, with persistent dry and hot winds. Day time temperature rises to 40.4°C. The flows in the river begin to rise simultaneously due to snow-melt water in the high mountains. The water table falls to the maximum depth.

**B) Monsoon Season**

Monsoon is the main rainy period, which starts at the beginning of July, reaches its climax in August and gradually, subsides in September. High intensity Rainfall causes soil erosion which is a function of erosivity and erodibility. The cool monsoon winds followed by heavy showers lower the temperature to great extent. The part of rain percolates into the soil and is conserved in the subsoil and part ads to the groundwater.

The conserved moisture in the soils is generally sufficient to rejuvenate the vegetation. All plants grow rapidly and mature towards the end of the season. With the start of monsoon season, the rivers flow at their peak level. The groundwater level is improved toward the end of the season in September and October.

**C) Post-monsoon Season**

Post monsoon season refers to autumn (October-November). The temperature starts falling but the extreme aridity prevents plants to flower early and set seed toward mid-seasons. Groundwater level rises as a result of infiltration from rainfall.

**D) Winter Season**

Winter refers to the period from December to January. The lowest temperatures (< 2°C) and cold winds characterize this season. The plants become dormant and most of them dry out. Most of the trees shed their leaves and few remain green or partly green. Sometimes this season becomes severe due to cold Siberian winds. Groundwater level declines in this season due to low flows in the rivers and no or little rains which usually fall in light showers causing little soil erosion.

**E) Spring Season**

Spring refers to the period from February to March. Temperatures become pleasant. The mean maximum temperature is 2°C with the highest precipitation of 41.2 mm and relative humidity of 57.6 percent. Some light showers of rain may also fall without generating run-off. The vegetation sprouts again because of conserved moisture from winter and spring rains, if any. The water table starts falling.

#### 5.4.6 Hydrology

A hydrology/hydraulic study was carried out for River Ravi Project to make a perennial water body. A hydrology modelling was conducted to compute design flood, Hydraulic modelling for existing and proposed options for river training work, low flow water requirement and sediment analysis.

The design flood used for river training work and estimation of barrage/control structures is considered as 586,000 cusecs as the flood above 500,000 cusecs was already witnessed twice in 89 years. Detailed analysis for the phase I was carried out to determine the width and depth of the channel. The width of the channel is 3280.84 ft (1000 m) with wall height of 33 ft including the free board. Dykes will be provided upstream of the project area to protect it from the flood. The dimension of the dykes will be 10 ft to 30 ft with side slope 3 to 1 and 2 to 1 on inner and outer side. The top level will be determined with the water level of maximum flood and free board of 6 ft as recommended by Federal Flood Commission. Guide bank will be provided at the start of the project with usual nose having a radius of 1200 ft and top width of 30 to 40 ft and side slope of 3:1 to 2:1 with stone pitching at the nose and river side.

There are two discharge measuring stations on the Ravi River in the vicinity of the project. One is at Ravi Syphon, which is far upstream end of the project and the other at Shahdara Bridge.

Analysis was carried out to assess the flows at two gauging stations. The results reveals that Ravi Syphon flows are in reasonable agreement to downstream gauging station Shahdara bridge. The little difference may be due to inclusion of drains in the Ravi River between Syphon and Shahdara, seepage loss or measuring errors.

The mean monthly flow of the Shahdara gauging station indicates that flow available from October to March is very less. The average flow in these six (06) months is 1,638 cusecs with low value of 1,371 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 monthly flow availability varies to a great extent. The maximum flow could reach to 18,000 cusecs in the month of July while it may come to very low value (12,00 cusecs) in the month of December.

#### 5.4.7 Ground Water

Groundwater was encountered at around 1-3 m depth below the NSL as per Geotechnical Investigation Report. Given a margin for seasonal fluctuations, the groundwater may be considered to rise/fall beyond this depth by about 1 m.



#### 5.4.8 Surface Water and Drainage

River Ravi which is the major natural surface water resource located in the northern part of the district. River Ravi receives huge amount of wastewater from the city of Lahore and other industrial discharges from different sources especially Hudiyara Drain, a natural drain which carries pollution loads from both Pakistan and India. Most wastewater discharge reaches to Ravi in the 60km stretch between Balloki and Lahore. These wastewater discharges, along with reduction in available water in River Ravi for dilution, has greatly deteriorated the quality of river water. River Ravi runs merely as a sullage carrier near Lahore during low flow season.

Besides, there are 76 minor drains which finally fall in eight (8) major drains namely Sattu Kattla Drain, Lakshami Drain, Suk Nehar Drain, Upper Chota Ravi Drain, Siddique Pura Drain and Shahdara Drain. Nowadays, all these drains collect wastewater from different areas of Lahore and finally fall into River Ravi.

#### 5.4.9 Solid Waste and Wastewater Situation

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 Ravi, drains/nullahs and in streets also. Most of the solid waste is found to be stored in the form of heaps at various locations near the villages and drains and open burning of waste is a common practice. The remaining organic and livestock waste is collected in the designated area which is used to prepare compost utilized by local farmers in their agriculture fields as a fertilizer. Similarly, no proper sewerage system exists in the study area.

### 5.5 BASELINE ECOLOGICAL ENVIRONMENT

The ecological study focus mainly on aquatic and terrestrial ecology. The total project area was surveyed and data was gathered for the habitat information on the basis of various parameter including; Identifying types of habitats, observing existing condition in each habitat and its ecological characteristics and providing overview of other distinct characters of the site. The study area is curbed to 14 km river Ravi starting from Syphon to Old Ravi Bridge. The project area has diverse kinds of habitats ranging from forested area, agriculture fields, lowland grasslands, orchards, wastelands etc. The project site is significant due to its biodiversity richness of fauna and flora species. The ecological baseline data was collected from field surveys conducted from August to October, 2014 and January, 2021 to assess plants and animals present in different habitats. The summary of the ecological environment is given below:

### 5.5.1 Habitat Information

#### A) Forests

There are only two forests falling in close proximity of the project corridor with a total area of 1087.83 acres. However, out of these two, Shahdara Reserve Forest falls partially (21.33 acres) in the project area, while, Anno Bhatti Forest is near (117.43 acres). The tree species planted in these forests comprise mainly of Eucalyptus, Sheesham, Kikar, Willow, Simbal and Mulberry etc. Following Table shows the Details of the forest areas within the project boundary.

**Table 5.4: Details of the forest areas within the Project Boundary**

Sr. No.	Name	Area (Acre)	Affected Areas
1	Shahdara Reserve Forest	854.1	21.33
2	Anno Bhatti Forest	233.73	117.43
	<b>Total</b>	<b>1087.83</b>	<b>138.76</b>

#### B) Low-lying Grasslands

There are few low-lying grassland areas within the study area. The lowland areas are inundated by the river when water level is high after monsoon and during the dry season agriculture is practiced on some parts of them. One such large grassland is situated adjacent to Dhanna Bhaini forest. This area was dominated by *Cynodon dactylon* and other herbs and grasses. Common species were *Croton sparsiflorus*, *Polygonum plebejum* and *Saccharum spontaneum*. Some invasion of *Parthenium hysterophorus* was also observed. Many ephemeral pools appear during rainy season that add up to their wildlife and habitat diversity. These areas are used by the people for livestock grazing. Besides flora, there were bird species like *acridoeheres tristis*, *hoplopterus indicos*, and *easer domesticus* etc. Other animal species included *Hystrix indica*, and *Golunda elliota*.

#### C) Agriculture and Roadside

Most of the area in project boundary is agricultural land which is almost 40.78% of the land covering the area of 1,410.83 acres. These lands have an extensive network of side roads and because of their closeness to the roads they are kept in a single habitat type. The most common crops grown over there were rice, *Sorghum bicolor*, wheat and corn while seasonal vegetables were also grown there. There were many species of both native and exotic trees like *Acacia nilotica*, *Eucalyptus camaldulensis*, *Melia azedarach* and *D. sissoo*. Shrubs like *Calotropis procera*, *Ricinus communis*, herbs and grasses like *Amaranthus viridis*, *Conyza ambigua*, *Paspalum distichum*, *Echinochloa colonum*, *Cynodon dactylon*, sedges like *Cyperus iria* and *Cyperus rotundus*. Among invasive species *Prosopis juliflora* and *Parthenium hysterophoru* were

more common. The agriculture land is valuable for birds like *Acridoeheres tristis*, *Hoplopterus indicos* etc. Other animal species are *Felis chaus*, *Hystrix indica*, and *Golunda elliota* etc.

**D) Orchards**

There are no orchards in the project area, however, some fruit trees are present in the agriculture land. These are habitats of various birds. Bird species were *Acridotheres ginginianu*, *Dicrurus macrocerus*, *Passer domesticus*, and *Corvus splendens*. Mammals species were *Hystrix indica*, *Funambulus pennantii*, *Golunda elliota* and *Herpestes mungo*. Some grasses and herbs were also present there.

**E) Ponds**

The area has wastewater ponds around towns and villages. There will be no wastewater ponds after the development. Fresh water ponds are seasonal in the area and are created due to collection of water in depressions after the rainy season. Following bird species were observed around the ponds *Egretta intermedia*, *Streptopelia tranquebarica*, *Acridotheres tristis*, *Dicrurus macrocerus vieillot*, *Egretta garzetta* and *Corvus splendens*. One amphibian specie *Euphlyctis cyanophlyctis* was common there. Some aquatic plants were also there.

**F) River**

There are many good fish species of high food and economic value known to this river. Tree species on river banks in the area of the forests were mostly *Eucalyptus canaldulensis*, *Acacia nilotica* and *Dalbergia sissoo*. The aquatic species *Eichhornia crassipes* and *Pistia stratiotes* were also seen on the water surface. Birds on the embankments were mainly *Egretta intermedia*, *Haplopterus indicus*, *Acridotheres ginginianus* and *Columbia livia*. These river banks are important for many migratory birds for example, *Anas crecca*, *Egretta garzetta* and *Gallinago Gallinago*. Fishing activities were observed both upstream and downstream of River Ravi.

**G) Island**

There are islands in the study area that are created when water level in the River goes down, while they inundate when water level rises. No crop is cultivated in summer because of the risk of flood damage so at that time they are converted into grasslands. Shrubs found there were *Calotropis procera*, herbs are *Eclipta alba*, *Parthenium hysterophorus*, *Phyla nodiflora*, *Polygonum plebejum*, grasses are *Cynodon dactylon*, *Dactyloctenium scindicum*, *Echinochloa colonum*, *Saccharum spontaneum* and sedges are *Cyperus rotundus*. Out of these species, there are three (03) invasive species (*Parthenium hysterophorus*, *Lantana* and *Prosopis juliflora*).

## H) Wasteland

There were wastelands in the area, which were with very little vegetation cover. Sand dredging was carried out at one of such sites near the River Ravi. After the development there will be no wasteland. Salt crust was seen on the surface of soil at a couple of places indicating land salinization.

### 5.5.2 Flora Information

Plants species in the study area were surveyed by the team using all the major roads travelling upstream and downstream of River Ravi. Plant species on the main and side roads, orchards, grasslands and agricultural fields were carried out using 100 m long transects. Quadrats of 20 m<sup>2</sup> were taken in the forests. Long walks along the bank of the river at various locations helped in describing shore line vegetation. Islands were reached through boats. Few common trees were eucalyptus, sisham, kikar, beri, toot, dherak, phulai etc. Invasive species included Lantan camara, Prosopis juliflora and Parthenium in terrestrial ecosystems while Pistia and Eichhornia crassipes were invasive species of aquatic ecosystems. List of aquatic plant species present in River Ravi or pond is given in **Table 5.5** while list of plants from all other habitats is given in Table 5.3.

**Table 5.5: List of Aquatic Plant Species Collected from Ponds and River**

AQUATIC PLANTS	COMMON NAMES	Habitats		Abundance class	IUCN STATUS
		R	P		
<b>ANGIOSPERMS</b>					
Eichhornia crassipes*	Water Hyacinth	+	+	A	Not Evaluated
Lemna minor	Common Duckweed	-	+	B	Least Concern
Pistia stratiotes*	Tropical Duck-Weed	+	+	B	Least
AQUATIC PLANTS	COMMON NAMES	Habitats		Abundance class	IUCN STATUS
		R	P		
					Concern
Potamogeton sp.	Pondweed	-	+	D	Not Evaluated
Typha angustata	Lesser indian reed mace	-	+	C	Not Evaluated
<b>PTERIDOPHYTES</b>					
Marsilea villosa	Villous Waterclover	-	+	B	Not Evaluated
<b>BRYOPHYTE</b>					

Marchantia sp.	Liverwort	+	-	D	Not Evaluated
"+" = Present, "-" = Absent, * = Invasive, R = River, P = Pond, A = Very Common, B = Common & Widespread, C = Less Common, D = Rare, E = Very Rare					



**Table 5.6: List of Plant Species Collected from Different Habitats in the Project Area**

SCIENTIFIC NAMES	COMMON NAMES	HABITATS								ABUNDANCE CLASS	IUCN STATUS
		F	A + R	R. B.	O	L	W	K	I		
<i>TREES</i>											
<i>Acacia nilotica</i>	Egyptian Thorn	+	+	-	+	-	-	+	-	A	Not Evaluated
<i>Albizia lebbeck</i>	Rain Tree	+	+	-	-	-	-	+	-	C	Not Evaluated
<i>Albizia procera</i>	Tall Albizia	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Alstonia scholaris</i>	White Cheesewood	-	-	+	-	-	-	+	-	D	Least Concern
<i>Azadirachta indica</i>	Neem Tree	+	-	-	-	-	-	+	-	C	Not Evaluated
<i>Bombax ceiba</i>	Cotton Tree	+	+	+	-	-	-	+	-	C	Not Evaluated
<i>Broussonetia papyrifera*</i>	Paper Mulberry	+	+	+	-	-	-	-	-	D	Not Evaluated
<i>Conocarpus spp</i>	Mangrove tree	+	+	-	-	-	-	+	-	D	-
<i>Cordia myxa</i>	Assyrian Plum	+	+	-	-	-	-	-	-	D	Not Evaluated
<i>Cupressus sempervirens</i>	Italian Cypress	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Dalbergia sissoo</i>	Sissoo Tree	+	+	+	+	-	-	+	-	A	Not Evaluated
<i>Ehretia serrata</i>	Koda Tree	+	-	-	-	-	-	-	-	E	Not Evaluated
<i>Erythrina suberosa</i>	Corky Coral Tree	+	-	-	-	-	-	-	-	E	Not Evaluated
<i>Eucalyptus camaldulensis</i>	Red Gum	+	+	+	+	-	-	-	-	B	Not Evaluated
<i>Eucalyptus citriodora</i>	Spotted Gum	+	-	-	-	-	-	+	-	D	Not Evaluated
<i>Eucalyptus largiflorens</i>	Flooded Gum	+	-	-	-	-	-	+	-	D	Not Evaluated
<i>Ficus benghalensis</i>	Banyan Fig	-	+	-	-	-	-	+	-	C	Not Evaluated
<i>Ficus carica</i>	Fig	+	+	-	+	-	-	-	-	C	Least Concern
<i>Ficus infectoria</i>	White Fig	-	-	+	+	-	-	-	-	D	Not Evaluated

SCIENTIFIC NAMES	COMMON NAMES	HABITATS								ABUNDANCE CLASS	IUCN STATUS
		F	A + R	R. B.	O	L	W	K	I		
<i>Ficus racemosa</i>	Cluster Fig	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Ficus religiosa</i>	Peepul Tree	+	+	+	+	-	-	+	-	C	Not Evaluated
<i>Mangifera indica</i>	Mango	-	+	-	-	-	-	+	-	D	Data Deficient
<i>Melia azedarach</i>	China Berry	+	+	+	+	-	-	+	-	B	Not Evaluated
<i>Mimusops elengi</i>	Spanish Cherry	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Morus alba</i>	White Mulberry	+	+	+	+	-	-	+	-	B	Not Evaluated
<i>Morus nigra</i>	Black Mulberry	-	+	-	-	-	-	-	-	E	Not Evaluated
<i>Musa paradisiaca</i>	Banana	-	+	-	-	-	-	-	-	E	Not Evaluated
<i>Nerium oleander</i>	Oleander	-	+	-	-	-	-	+	-	E	Least Concern
<i>Parkinsonia aculeate</i>	Cambron	+	+	+	-	-	-	-	-	C	Not Evaluated
<i>Phoenix dactylifera</i>	Date Palm	+	-	+	-	-	-	+	-	C	Not Evaluated
<i>Platanus orientalis</i>	Chinar	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Pongamia pinnata</i>	Indian Beech	+	+	+	-	-	-	+	-	C	Least Concern
<i>Polyalthia longifolia</i>	Ashok	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Populus euphratica</i>	Salt Poplar	-	+	-	+	-	-	-	-	D	Not Evaluated
<i>Prosopis cineraria</i>	Jand	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Prosopis juliflora*</i>	Mesquite	+	+	+	+	-	-	+	-	B	Not Evaluated
<i>Psidium guajava</i>	Guava	+	+	-	+	-	-	-	-	C	Not Evaluated
<i>Salix tetrasperma</i>	Indian Willow	+	-	-	-	-	-	-	-	D	Not Evaluated

<i>Syzygium cumini</i>	Black Plum	-	+	-	+	-	-	+	-	C	Not Evaluated
<i>Tamarix aphylla</i>	Athel Pine	+	-	-	-	-	-	-	-	D	Not Evaluated
<i>Terminalia arjuna</i>	Arjun Tree	+	-	-	-	-	-	+	-	D	Not Evaluated
<i>Ziziphus jujuba</i>	Chinese Date	+	+	+	-	-	-	-	-	C	Least Concern

SCIENTIFIC NAMES	COMMON NAMES	HABITATS								ABUNDANCE CLASS	IUCN STATUS
		F	A + R	R. B.	O	L	W	K	I		
<i>Ziziphus nummularia</i>	Jujube	+	+	+	-	-	-	-	-	C	Not Evaluated
SHRUBS											
<i>Abutilon bidentatum</i>	Velvetleaf	-	+	-	-	-	-	-	-	E	Not Evaluated
<i>Abutilon hybridum</i>	Chinese Bellflower	+	+	-	-	+	-	-	-	C	-
<i>Acacia farnesiana</i>	Mimosa Bush	-	+	-	-	-	-	-	-	E	Not Evaluated
<i>Atriplex crassifolia</i>	Saltbush	-	+	-	-	-	-	-	-	E	Not Evaluated
<i>Bougainvillea spectabilis wild</i>	Bougainvillea	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Calotropis procera</i>	Rubber bush/ Aak	+	+	+	+	-	-	+	-	B	Not Evaluated
<i>Hibiscus rosa sinensis</i>	Shoe Flower	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Ipomoea carnea</i>	Bush Morning Glory	+	+	+	-	+	-	-	+	C	Not Evaluated
<i>Jasminum officinale</i>	Jasminum	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Lantana camara*</i>	Big Sage	+	-	+	-	-	-	+	-	C	Not Evaluated
<i>Murraya exotica</i>	Orange Jasmine	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Ricinus communis</i>	Castor Oil Plant	+	+	-	-	-	-	+	-	C	Not Evaluated
<i>Rosa indica</i>	Rose Bed	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Sida cordifolia</i>	Country Mallow	+	-	-	-	-	-	-	-	E	Not Evaluated

<i>Tamarix dioca</i>	Salt Cedar	-	+	+	-	-	-	-	+	D	Not Evaluated
<i>Withania somnifera</i>	Indian Ginseng	+	+	+	+	-	-	-	-	C	Not Evaluated
HERBS											
<i>Agave Americana</i>	Century Plant	+	-	-	-	-	-	-	-	E	Not Evaluated
<i>Achyranthes aspera</i>	Prickly Chaff Flower	+	+	-	+	-	-	-	-	C	Not Evaluated
<i>Alhagi maurorum</i>	Camelthorn	+	-	+	+	-	+	-	-	C	Not Evaluated
<i>Alternanthera sessilis</i>	Sessile Joyweed	+	+	+	-	-	-	-	-	C	Least Concern

SCIENTIFIC NAMES	COMMON NAMES	HABITATS								ABUNDANCE CLASS	IUCN STATUS
		F	A + R	R. B.	O	L	W	K	I		
<i>Amaranthus viridis</i>	Slender Amaranth	+	+	-	+	-	-	-	-	B	Not Evaluated
<i>Ammannia baccifera.</i>	Blistering Ammania	-	+	-	-	-	-	-	-	E	Least Concern
<i>Boerhavia diffusa</i>	Red Spiderling	+	+	+	-	-	-	-	-	C	Not Evaluated
<i>Cannabis sativa</i>	Marihuana	+	+	-	-	-	-	-	+	C	Not Evaluated
<i>Cassia absus</i>	Tropical Sensitive Pea	+	+	-	-	-	-	-	-	D	Least Concern
<i>Chenopodium ambrosioides</i>	Mexican Tea	+	+	-	-	-	-	-	+	C	Not Evaluated
<i>Chenopodium album</i>	Lambsquarters	+	+	+	-	-	-	-	-	B	Not Evaluated
<i>Chrozophora tinctoria</i>	Dyer's Litmus	-	+	-	-	-	-	-	-	E	Least Concern
<i>Citrullus lanatus</i>	Watermelon	+	+	+	+	-	-	-	+	D	Not Evaluated
<i>Convolvulus arvensis</i>	Field Bindweed	+	+	-	+	-	-	-	-	C	Not Evaluated
<i>Conyza ambigua</i>	Rough Conyza	+	+	+	+	-	+	-	-	B	Not Evaluated

<i>Conyza Canadensis</i>	Horseweed	+	-	-	-	-	+	-	-	D	Not Evaluated
<i>Croton sparsiflorus</i>	Ban Tulasi	+	+	+	-	+	+	-	-	B	Not Evaluated
<i>Croton tiglium</i>	Purging Croton	-	-	-	-	-	+	-	-	E	Not Evaluated
<i>Digera muricata</i>	False Amaranth	+	+	+	+	-	-	-	-	C	Not Evaluated
<i>Datura metel</i>	Devil's Trumpet	-	-	-	-	-	-	+	-	E	Not Evaluated
<i>Eclipta alba</i>	Eclipte Blanche	+	+	+	+	-	+	-	+	B	Data Deficient
<i>Euphorbia hirta</i>	Asthma Weed	+	+	-	+	-	-	-	-	C	Not Evaluated
<i>Euphorbia prostrata</i>	Prostrate Sandmat	+	+	+	+	-	+	-	-	B	Not Evaluated
<i>Launaea procumbens</i>	Country Dandelion	+	+	+	-	+	-	-	-	C	Not Evaluated
<i>Leptochloa panacea</i>	Mucronate Sprangletop	+	+	-	+	-	+	-	-	C	Least Concern



SCIENTIFIC NAMES	COMMON NAMES	HABITATS								ABUNDANCE CLASS	IUCN STATUS
		F	A + R	R. B.	O	L	W	K	I		
<i>Malvastrum coromandelianum</i>	False Mallow	+	+	-	+	-	-	-	-	C	Not Evaluated
<i>Nicotiana plumbaginifolia</i>	Tex-Mex Tobacco	-	+	+	-	-	-	-	-	E	Not Evaluated
<i>Oxalis corniculata</i>	Sleeping Beauty	+	+	+	+	-	+	-	-	B	Not Evaluated
<i>Oxystelma esculentum</i>	Rosy Milkweed Vine	+	-	-	-	-	+	-	-	D	Least Concern
<i>Parthenium hysterophorus*</i>	Whitetop Weed	+	+	+	-	+	+	-	+	B	Not Evaluated
<i>Phyla nodiflora</i>	Turkey Tangle Frogfruit	+	+	+	+	-	-	-	+	B	Least Concern
<i>Physalis divaricate</i>	Ground Cherry	-	+	-	-	-	-	-	-	E	Not Evaluated
<i>Polygonum persicaria</i>	Redshank	+	+	+	+	-	-	-	-	C	Least Concern
<i>Polygonum plebejum</i>	Small Knotweed	+	+	-	-	+	+	-	+	B	Not Evaluated
<i>Portulaca oleracea</i>	Little Hogweed	+	-	-	-	-	-	-	-	E	Not Evaluated
<i>Solanum nigrum</i>	Black Nightshade	+	+	+	-	-	-	-	-	C	Not Evaluated
<i>Solanum xanthocarpum</i>	Thai Eggplant	+	-	-	-	-	+	-	-	D	Not Evaluated
<i>Sonchus asper</i>	Spiny Milk Thistle	+	+	-	-	-	+	-	-	C	Not Evaluated
<i>Sphenoclea zeylanica</i>	Gooseweed	-	+	-	-	-	-	-	-	E	Least Concern
<i>Suaeda fruticosa</i>	Shrubby Seablite	+	-	-	-	-	+	-	-	E	Not Evaluated
<i>Trianthema portulacastrum</i>	Wild Water Melon	+	+	+	+	-	-	-	-	C	Not Evaluated

<i>Tribulus terrestris</i>	Bullhead	-	+	-	-	-	-	-	-	E	Not Evaluated
<i>Verbena officinalis</i>	Herb Of The Cross	+	-	-	-	-	-	-	-	E	Not Evaluated
<i>Xanthium strumarium</i>	Cocklebur	+	+	-	+	-	-	-	-	B	Not Evaluated

SCIENTIFIC NAMES	COMMON NAMES	HABITATS								ABUNDANCE CLASS	IUCN STATUS
		F	A + R	R. B.	O	L	W	K	I		
GRASSES											
<i>Acrachne racemosa</i>	Goosegrass	-	+	-	-	-	-		-	E	Not Evaluated
<i>Bothriochloa laguroides</i>	Silver Beardgrass	-	+	+	-	-	-	-	-	D	Not Evaluated
<i>Brachiaria ramosa</i>	Browntop Millet	+	-	+	-	-	-	-	-	D	Least Concern
<i>Brachiaria reptans</i>	Creeping Panic Grass	+	+	+	+	-	-	-	-	C	Least Concern
<i>Cenchrus ciliaris</i>	Buffel Grass	+	+	-	-	-	-	-	-	D	Not Evaluated
<i>Cenchrus setigerus</i>	Birdwood Grass	+	+	-	+	-	-	-	-	C	Not Evaluated
<i>Cenchrus pennisetiformis</i>	Cloncurry	+	-	-	-	-	-	-	-	E	Not Evaluated
<i>Cynodon dactylon</i>	Bermuda Grass	+	+	+	+	+	+	-	+	A	Not Evaluated
<i>Dactyloctenium aegyptium</i>	Egyptian Crowfoot Grass	-	+	-	-	-	-	-	-	D	Not Evaluated
<i>Dactyloctenium scindicum</i>	Crowfoot Grass	-	+	+	+	-	-	-	+	B	Not Evaluated
<i>Desmostachya bipinnata</i>	Halfa Grass	+	+	+	+	-	+	-	-	B	Least Concern
<i>Digitaria ciliaris</i>	Southern Crabgrass	-	+	+	+	-	-	-	-	C	Not Evaluated

<i>Dichanthium annulatum</i>	Marvel Grass	+	-	-	+	-	-	-	-	D	Not Evaluated
<i>Echinochloa colonum</i>	Jungle Rice	+	+	+	+	-	-	-	+	B	-
<i>Echinochloa crusgalli</i>	Barnyardgrass	-	+	-	+	-	+	-	-	C	Least Concern
<i>Eleusine indica</i>	Wiregrass	-	+	-	-	-	-	-	-	E	Least Concern
<i>Eragrostis cilianensis</i>	Candy Grass	-	+	-	-	-	-	-	-	E	Not Evaluated

SCIENTIFIC NAMES	COMMON NAMES	HABITATS								ABUNDANCE CLASS	IUCN STATUS
		F	A + R	R. B.	O	L	W	K	I		
<i>Eriochloa procera</i>	Spring Grass	+	+	-	-	-	-	-	-	D	Least Concern
<i>Hemarthria compressa</i>	Whip Grass	+	+	+	+	-	-	-	-	C	Least Concern
<i>Imperata cylindrical</i>	Blady Grass	+	+	-	+	-	-	-	-	C	Not Evaluated
<i>Panicum antidotale</i>	Blue Panicgrass	-	+	-	-	-	-	-	-	E	Not Evaluated
<i>Paspalidium flavidum.</i>	Yellow Watercrown Grass	+	-	-	-	-	-	-	-	E	Least Concern
<i>Paspalum distichum</i>	Gingergrass	+	+	-	+	-	+	-	-	B	Not Evaluated
<i>Perotis hordeiformis</i>	Bottle-brush grass	-	-	-	-	-	+	-	-	E	Not Evaluated
<i>Phragmites karka</i>	Tall Reed	+	-	-	-	-	-	-	-	E	Least Concern
<i>Saccharum munja</i>	Plume Grass	+	+	+	-	-	+	-	-	B	Not Evaluated
<i>Saccharum ravennae</i>	Canne D'italie	+	+	-	+	-	-	-	-	C	Least Concern
<i>Saccharum spontaneum</i>	Wild Cane	+	+	+	+	+	+	-	+	B	Least Concern
<i>Setaria glauca</i>	Yellow Foxtail	+	+	-	-	-	-	-	-	D	Not Evaluated
<i>Setaria pumila</i>	Pigeon Grass	+	+	+	+	-	-	-	-	C	Not Evaluated
<i>Sorghum halepense</i>	Johnson Grass	+	+	-	+	-	-	-	-	C	Not Evaluated

<i>Sporobolus coromandelianus</i>	Madagascar Dropseed	-	+	-	-	-	+	-	-	D	Not Evaluated
<b>SEDGES</b>											
<i>Carex fedia ness.</i>	Carex	-	+	+	-	+	+	-	-	C	Not Evaluated
<i>Cyperus difformis</i>	Small flower Umbrella Sedge	-	+	-	-	-	-	-	-	E	Least Concern
<i>Cyperus iria</i>	Rice Flat Sedge	+	+	+	+	-	+	-	-	B	Least Concern
<i>Cyperus rotundus</i>	Nut-Grass	+	+	+	+	-	-	-	+	B	Least Concern
SCIENTIFIC NAMES	COMMON NAMES	HABITATS								ABUNDANCE CLASS	IUCN STATUS
		F	A + R	R. B.	O	L	W	K	I		
<i>Fimbristylis dichotoma</i>	Two Rowed Rush	+	-	-	-	-	+	-	-	D	Least Concern
<i>Pycnus flavidus</i>	-	-	+	-	-	+	-	-	-	E	Least Concern
"+" = Present, "-" = Absent, * = Invasive, F = Forest, A + R = Agriculture + Roadside, R. B. = River Bank, R = River, O = Orchard, P = Pond, L = Lowland, W = Wasteland, K = Kamran Bara dari, I = Island, AC = Abundance class, A = Very Common, B = Common & Widespread, C = Less Common, D = Rare, E = Very Rare											

### 5.5.3 Fauna Information

The survey was done in the project area and data was gathered for mammals, reptiles, birds, amphibians, insects and zooplanktons. 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.

#### A) Survey of Birds

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 5.7** shows the details of birds found in the project area. Bird species were more abundant along the river banks, agricultural fields and in forest areas. Most common species were *Passer domesticus*, *Corvus splendens*, *Acridotheres tristis*, *Egretta intermedia* and *Dicrurus macrocerus vieillot*.

#### B) Survey of Mammals

Mammals were surveyed during the visits and were identified from field observations of paw prints, scats and their burrows. **Table 5.7** shows details of the mammals found in the project area. Wild boars and jackals were present in the study area. Mostly small size mammals which included porcupines, rat and bat species were there. Mammals were mostly found in forests and agriculture fields.

#### C) Survey of Reptiles and Amphibians

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 5.7**. Among the reptiles, *Varanus bengalensis*, *Uromastyx hardwickii* and *Naja naja* etc. were common. Three (03) species of snakes and two (02) species of turtles are reported. According to the IUCN red list of threatened species, *Nilssoniana gangetica* is vulnerable and it needs 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 5.7: List of Mammals, Birds, Reptiles and Amphibians of the Project Area**

Animal Species	Common name	Habitats							AC	IUCN status	Punjab Wildlife Act	CITES
		A+ R	W	P	R	O	L	F				
Birds												
Egretta intermedia	Intermediate Egret	+	-	+	+	-	+	+	B	LC	<input type="checkbox"/>	
Accipiter badius	Shikra	+	-	-	-	-	-	+	D	LC		
Acridotheres ginginianus	Bank Myna	+	+	-	-	+	+	+	B	LC		
Acridotheres tristis	Common Myna	+	+	+	+	+	+	+	A	LC		
Actitis hypoleucos*	Common Sand piper	+	+	-	+	-	+	+	B	LC		
Amaurornis phoenicurus	White breasted hen	-	-	-	+	-	+	-	D	LC	<input type="checkbox"/>	
Anas crecca*	Common teal	-	-	-	+	-	-	-	D	LC		
Anas Platyrhynchos*	Mallard	-	+	-	-	+	+	+	C	LC	<input type="checkbox"/>	
Ardeola grayii	Indian pond Heron	+	-	-	-	+	-	+	C	LC	<input type="checkbox"/>	
Bubulcus ibis	Cattle egret	+	-	-	+	+	+	+	C	LC	<input type="checkbox"/>	
Callacanthis burtoni	Spectacle Finch	-	-	+	+	+	+	+	D	LC		
Centropus sinensis	Crow pheasant	+	-	-	-	+	-	+	C	LC		
Ceryle rudis	Pied kingfisher	+	-	-	+	+	+	+	C	LC		
Cinnyris asiaticus	Purple sunbird	+	-	-	-	+	-	+	D	LC		
Columba livia	Wild rock dove	+	-	-	+	+	+	+	B	LC		
Copsychus saularis	Magpie robin	+	-	-	-	+	-	+	C	LC		

Coracias benghalensis	Indian roller	+	+	-	-	-	-	+	B	LC		
Corvus splendens	House Crow	+	+	+	+	+	+	+	A	LC		
Coturnix coturnix*	Common Quail	-	-	-	+	-	-	+	D	LC		
Dicrurus macrocercus vieillot	Black Drongo	+	-	+	+	+	-	+	B	LC		
Dinopium benghalense	Golden backed woodpecker	+	+	-	-	+	-	+	C	LC		

Animal Species	Common name	Habitats							AC	IUCN status	Punjab Wildlife Act	CITES
		A+ R	W	P	R	O	L	F				
Egretta garzetta*	little egret	+	-	+	+	+	+	+	B	LC	<input type="checkbox"/>	
Francolinus pondicerianus	Black Partridge	+	-	-	-	-	-	+	E	LC		
Francolinus pondicerianus	Grey Partridge	+	+	-	+	+	+	+	C	LC		
Galerida cristata	Crested lark	+	-	-	-	+	+	+	C	LC		
Gallinago gallinago*	Common snipe	-	-	-	+	-	-	-	E	LC		
Gallinula chloropus*	Common moorhen	-	+	-	+	-	-	+	C	LC		
Gracupica contra	Pied myna	+	+	-	+	+	+	+	D	LC		
Halcyon smyrnensis	White-breasted Kingfisher	+	-	-	+	+	+	+	B	LC		
Himantopus himantopus*	Black winged stilt	+	-	+	+	-	-	-	C	LC		
Hirundo rustica*	Common swallow	-	-	-	+	-	-	-	D	LC		
Hoplopterus indicus*	Red-Wattled Lapwing	+	+	-	+	+	+	+	B	LC		
Hydrophasianus chirurgus*	white pheasant jacana	-	-	+	-	-	+	-	E	LC	<input type="checkbox"/>	

Lanius schach	long tailed shrike	+	-	-	-	-	-	+	C	LC		
Merops orientalis	Green bee eater	+	+	-	-	-	-	+	C	LC		
Merops philippinus*	Blue tailed bee eater	-	-	-	+	+	+	+	C	LC		
Milvus migrans migrans	Black kite	+	-	+	+	+	+	+	A	LC	☐	
Motacilla alba	White wagtail	+	-	-	+	-	+	+	C	LC		
Orthotomus sutorius	Common tailor bird	+	-	-	-	-	-	+	C	LC		
Passer domesticus	House Sparrow	+	+	+	+	+	+	+	A	LC		
Petronia xanthocollis	yellow throated sparrow	+	-	-	-	-	-	+	C	LC		
Ploceus philippinus	baya weaver	+	-	-	+	+	-	+	B	LC		
Pyconotus cafer	Red vented bulbul	+	-	-	+	+	+	+	B	LC		
Saxicola caprata	Bush chat	+	-	-	-	+	-	+	C	LC		

Animal Species	Common name	Habitats							AC	IUCN status	Punjab Wildlife Act	CITES
		A+ R	W	P	R	O	L	F				
Saxicoloides fulicata	Indian robin	+	+	-	+	+	+	+	C	LC		
Spilopelia senegalensis	little brown dove	+	-	-	-	+	-	+	B	LC		
Streptopelia capicola	Ring necked dove	+	-	-	-	-	+	+	C	LC		
Streptopelia tranquebarica	Red turtle dove	+	-	-	+	+	+	+	C	LC	☐	
Treron phoenicoptera	yellow-footed green pigeon	-	-	-	+	+	+	+	C	LC		
Tringa nebularia	Common Greenshank	+	-	+	+	-	+	+	B	LC		

Turdoides caudata	Common babbler	+	+	-	-	-	-	+	B	LC		
Upopa epops*	Hoopoe	+	-	-	+	+	+	+	B	LC		
Zosterops palpebrosus	Oriental white eye	-	-	-	-	+	-	+	D	LC		
Mammals												
Canis Aureus	Asiatic Jackal	+	-	-	+	+	+	+	C	LC		III
Felis chaus	Jungle cat	+	+	-	+	+	+	+	D	LC	☐	
Funambulus pennantii	Palm squirrel	+	+	+	+	+	+	+	A	LC		
Golunda elliota	Bush rat	+	-	-	-	+	+	+	B	LC		
Herpestes edwardsi	Indian mongoose	+	+	-	+	+	+	+	B	LC	☐	III
Hystrix indica	Indian crested porcupine	+	+	+	+	+	+	+	A	LC		
Lepus nigricollis	Indian hare	+	+	-	-	-	-	+	D	LC		
Megaderma lyra	Indian false vampires	+	+	-	-	+	+	+	B	LC		
Millardia meltada	soft furred field rat	+	+	+	+	+	+	+	B	LC		
Mus musculus	House mouse	+	+	+	+	+	+	+	A	LC		
Rattus Rattus	roof rat	+	+	-	+	+	+	+	B	LC		
Suncus Murinus	Asiatic House shrew	+	+	-	+	+	+	+	B	LC		
Sus scrofa	Wild boar	+	-	-	-	-	+	+	C	LC		
Animal Species	Common name	Habitats							AC	IUCN status	Punjab Wildlife Act	CITES
		A+ R	W	P	R	O	L	F				
Reptiles												

Nilssoniana gangetica	Indian soft-shell turtle	-	-	-	+	-	+	+	C	VU	□	I
Bungarus caeruleus	Indian cobra	+	+	-	+	+	+	+	B	LC		
Calotes versicolor	Indian garden lizard	+	+	+	+	+	+	+	A	LC		
Chamaeleo zeylanicus	Ceylon Chameleon	+	-	-	-	+	+	+	C	NE		II
Lissemys punctate	Indian flapshell turtle	-	-	-	+	-	+	+	C	LC	□	II
Naja naja	Indian cobra	-	-	-	+	-	+	+	C	LC		II
Uromastix hardwickii	Spiny tail lizard	+	+	+	+	+	+	+	B	LC	□	II
Varanus bengalensis	Indian monitor lizard	+	+	+	+	+	+	+	B	LC	□	I
Xenochrophis piscator	Checkered keelback	+	+	+	+	+	+	+	B	NE	□	III
Amphibians												
Bufo stomaticus	Indus toad	+	+	+	+	+	+	+	A	LC		
Euphlyctis cyanophlyctis	Indian skipper frog	-	+	-	-	-	+	-	B	LC		
Hoplobatrachus tigrinus	Indian bull frog	+	+	+	+	-	+	+	A	LC		II
*=Migratory, A+R= Agriculture and roadside, W= wasteland, P=Pond, R= Riverbank, O=Orchard, L=Lowland, F=Forest, AC = abundance class, LC=Least concern, VU=Vulnerable, NE=Not evaluated, A=very common, B= common & wide spread, C= less common, D= Rare, E =very rare.												

#### D) Survey of zooplanktons

Water samples from river and ponds were collected and brought into the laboratory. Zooplanktons were observed under compound and stereo microscopes. List of zooplanktons is given in **Table 5.8**.

**Table 5.8: List of Zooplanktons and Protoctists Found in the Ponds and River of The Study Area**

Sr. No.	Scientific name	Group
1.	Paulinella nidulus	Amoeboid
2.	Centropyxis aculeta	Amoebozoa
3.	Diffugia lobostoma	Arcellinida
4.	Plumatella fruticosa	Bryozoon
5.	Fredericella sultana	Bryozoon
6.	Diaptomus castor	Crustacean
7.	Cyclops varicans	Crustacean
8.	Mesocyclops leuckerti	Crustacean
9.	Mesocyclops hyalinus	Crustacean
10.	Parastenocaris lacustris	Crustacean
11.	Daphnia ambigua	Crustacean
12.	Ceriodaphnia reticulata	Crustacean
13.	Moinodaphnia malcayii	Crustacean
14.	Daphnia smilis	Crustacean
15.	Bosmina longirostris	Crustacean
16.	Macrothrix rosae	Crustacean
17.	Polyarthra vulgaris	Rotifer
18.	Keratella quadrata	Rotifer
19.	Keratella cochlaeris	Rotifer
20.	Asplancha priodonta	Rotifer
21.	Epiphanes branchionus	Rotifer
22.	Euclanis dilatata	Rotifer
23.	Trochosphaera solstitialis	Rotifer



24.	Philodina roseola	Rotifer
25.	Filina longiseta	Zooplankter
26.	Protoctists	
27.	Euglena	Protoctist
28.	Paramecium	Protoctist

#### E) Fish survey

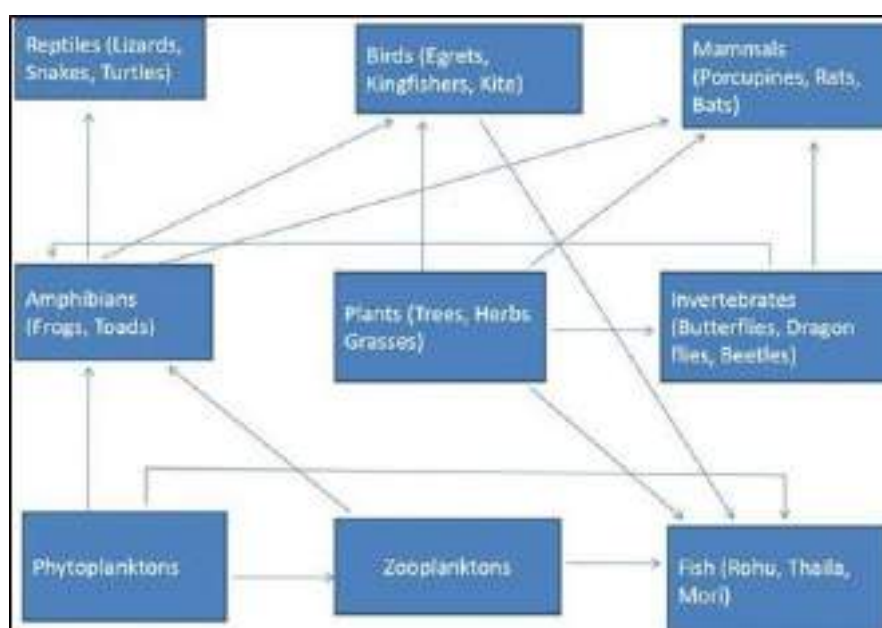
Fish surveys were conducted in the main channel of River Ravi with the help of local fishermen using nets. These nets were deployed at different sites for 30 minutes to one hour during the vegetation survey of the nearby community. Fishermen were also interviewed to collect information on the River Ravi fish in the study site. List of fish species found in the River Ravi are shown in **Table 5.9**.

**Table 5.9: List of the Fish Species found in the River Ravi**

Scientific Names	Common Names	IUCN status
<i>Catla catla</i>	Thaila/Indian carp	LC
<i>Channa marulius</i>	Saul	LC
<i>Channa punctate</i>	Daula	LC
<i>Cirrhinus mrigala</i>	Mori	LC
<i>Ctenopharyngodon idella †</i>	Grass carp	NE
<i>Cyprinus carpio*†</i>	Common carp/Gulfam	VU
<i>Hypophthalmichthys molitrix †</i>	Silver carp	NT
<i>Hypophthalmichthys nobilis †</i>	Big head carp	DD
<i>Labeo rohita</i>	Rohu	LC
<i>Macrornathus pancalus</i>	Groj	LC
<i>Oreochromis aureus*</i>	Tilapia	NE
<i>Rita rita</i>	Khagga/Tirkanda	LC
<i>Sperata sarwari</i>	Singharee	LC
<i>Wallago attu</i>	Mullee	VU
LC=Least concern, VU=Vulnerable, NT=Near threatened, DD= Data deficient, NE= Not evaluated, * = invasive, † exotic		

#### 5.5.4 Ecological Mapping of the Study Area

From the data gathered in the project area, there are two important ecosystems identified, one is in form of aquatic ecosystem provided by the river and ponds whereas the other one is terrestrial ecosystem. Terrestrial ecosystem included forest areas, grasslands, orchards, agricultural fields, islands and wasteland. The two forms of biomes are interconnected and have developed vital linkages from land to water and water to land. In rainy seasons, water, sediments, pollutants, nutrients, and other materials flow from terrestrial environments to aquatic one. The nutrients in form of droppings of the amphibiotic animals move from water to land. Such connections develop important food chains and food webs in both ecosystems. An illustration of such possible food web is provided for the study area.



**Figure 5.9: Simplified Food Web in the Project Area**

These conceptual models show trophic levels of producers, herbivores, omnivores and carnivores which existed in the area. e.g., birds are omnivorous as they eat invertebrates and plants. In an ecosystem, energy and nutrients flow from a low trophic level to a higher trophic level. As the river gets polluted the pollutants from water and sediments travel into the food chain and get bioaccumulated into the bodies of the animals. The area surrounding river Ravi is mostly agricultural where high pesticides usage exists. These pesticides are reported from the water and sediments of river (Syed et al. 2014). Organochlorines have been reported to be present in the eggshells of cattle egret (Malik et al. 2011). There is a need to clean the river from pollution loads to save the whole of the ecosystem.

### 5.5.5 Ecological flow

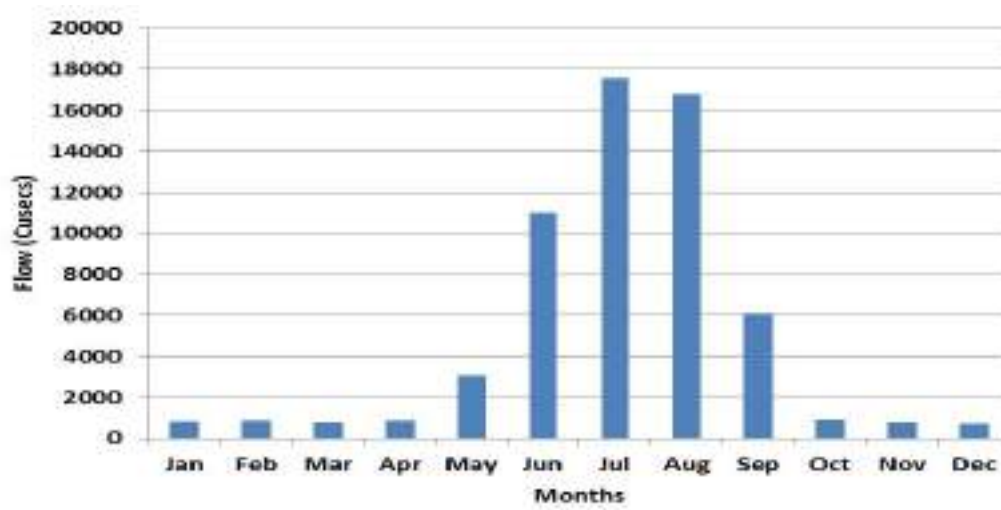
The raising of water level in the river by constructing a gated/regulating structure would cause the flow depths to increase and velocity of flow to reduce. The freshening in a stream is directly related to the depths and velocity of flow. The Barrage may lower the water quality particularly when the flows in the river are low.

The important aspects are quality of influent (DO and BOD), addition of biological load by the water entering the river along the length of the water body and the processes that are expected to take place in the water body. USEPA (1985) have recommended a minimum concentration of 3-5.0 mg/l for healthy water bodies to sustain fish and aquatic life. National Conservation Strategy (NCS) recommends DO concentration of 4 mg/l to protect and conserve aquatic life.

Minimum ecological flow requirement to keep the lake fresh depends upon the season, and water body operating levels. The minimum environmental flow in different months will be investigated using water quality modelling in hydrological study; the result depicts the initial estimate of about 300 cusecs and losses due to evaporation and seepage.

The analysis for minimum daily recorded flow of river Ravi in various months indicates that additional flow will be required in the months from October to May. The flow required ranges between 100 to 450 Cusecs from October to May. The maximum flow required is 450 cusecs in the month of December

However, analysis was carried out for 90% of flow available time that shows there will no additional flows required as there are sufficient flows available throughout the year as depicted in Figure 5-10.



**Figure 5.10: Net Available Flows for 90% Exceedance Flow Condition**

## 5.6 SOCIO ECONOMIC ENVIRONMENT

The main purpose of the socioeconomic baseline survey is to understand and document the prevailing socioeconomic conditions of respondents and environment in project areas prior to implementation of the project activities.

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 August, 2014 to October, 2014 and January, 2021.

### 5.6.1 Objectives

The specific objectives of a socioeconomic baseline survey are to:

- Collect socio-economic data or information pertaining to respondents and environment prior to the project execution;
- Analyse the collected data and interpret the analysed data and present a meaningful discussion of the variables pertaining to the respondents and environment in question;
- Put out the baseline results in environmental reports; and
- Define magnitude of acceptability level, identifying perceived impacts and suggested measures to mitigate those impacts.

### 5.6.2 Approach & Methodology

The essence of survey method can be explained as “questioning individuals on a topic or topics and then describing their responses” (Jackson, 2011, p.17). Survey method can be broadly divided into three categories: mail survey, telephone survey and personal interview. In this EIA Study individual interviews were conducted where the list of questions was asked face to face by sociologists to know the responses regarding proposed project.

### 5.6.3 Data Collection Tools

There are various data collection tools used in research are:

- Interview Schedule.
- Questionnaire.
- Focus Group Discussions.
- Checklist.
- Observation.

In this EIA Study, an interview schedule was developed which is used in field survey for primary data collection. An interview schedule is basically a list containing a set of structured questions that have been prepared, to serve as a guide for interviewers, researchers and investigators in collecting information or data about a specific topic or issue.

The summary of the socio-economic environment statistics is given below:

#### 5.6.4 Household and Population

The field surveys conducted in the Project Area and data collected from the relevant agencies indicate that there are 14,351 households in all three phases of River Ravi Urban Development project area with total built up area 1199 acres and total population of 95,277. Further there is additional 2343 households' units with built-up area 71 acres due to change in river alignment from Shahdara side for passage of 586,000 cusec flood.

For the purpose of Phase-I of River Training and Channelization project, the only settlements falling in the riverbed will be relocated. There are only two settlements in the riverbed and contain 634 households with total built up area of 25.11 acres and total population of 4, 271 (**Table 5.10**).

#### 5.6.5 Villages in Project Area

To establish baseline of the whole area, 89 villages have been surveyed, out of which 20 villages fall in Tehsil City & Cantonment of the Lahore District, and remaining 69 villages fall in Tehsil Muridkey, Ferozewala, and Narang & Sharaqpur of Sheikhpura District. Four semi urban settlements fall in Shahdara district Lahore.

So far as resettlement/relocation is concerned, there are total two settlements which fall in project area of Phase-I. Administratively, both these settlements / villages fall in Tehsil City & Cantonment of the Lahore District. The detail of this village, number of houses with built-up area and population is shown in **Table 5.10**.

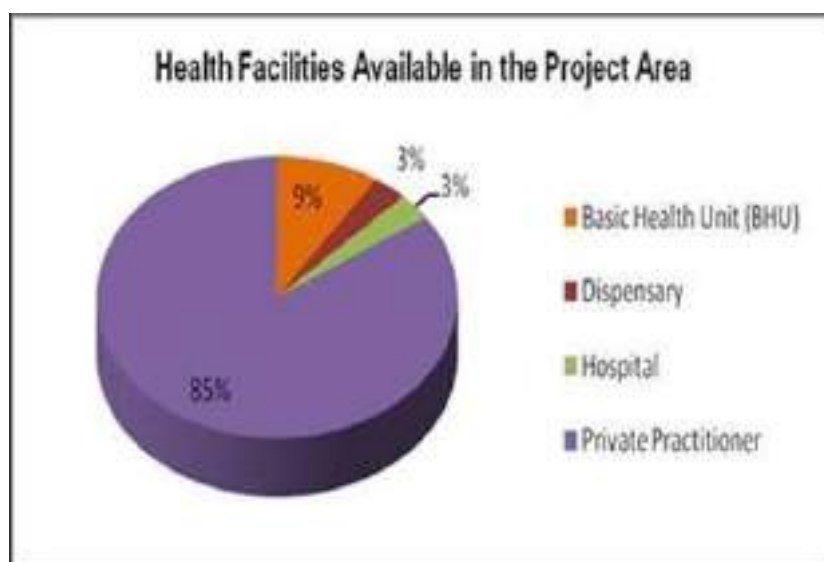
**Table 5.10: Detail of the Villages to be Resettled**

Sr. No.	Village Name	UC	District	No. of Houses	Population	Built-up Area (Acres)
1	Jhuggian Arazi	Kot Abdul Malik	Lahore	300	2,100	11.44
2	Mustafa Abad	Shahdara	Lahore	334	2,171	13.67
<b>Total (Phase-I)</b>				<b>634</b>	<b>4,271</b>	<b>25.11</b>

### 5.6.6 Health

The survey indicates that there are only 6 Basic Health Units (BHU) in Project area, 2 villages have facility of Dispensaries and 55 private practitioners (not qualified doctors but dispensers, quacks, etc.) are practicing as health facility provider in different villages. There are only 2 hospitals in the project area.

The available health facility in the project area is shown in **Figure 5.11** below:



**Figure 5.11: Available Health Facilities in Project Area**

### 5.6.7 Education

Survey indicates that, 81 % villages have education facility from primary to higher secondary levels. In 19% villages, there is no educational facility, even of primary school level. The parents send their children to nearby village for schooling. **Figure 5.12** presents the availability of educational facility in Project area. Girl' s schools are far less than schools for boys in the project area. Therefore, it is difficult for the girls to have access to educational institution. Traveling long distance to access the school for girls is the main cause of illiteracy.



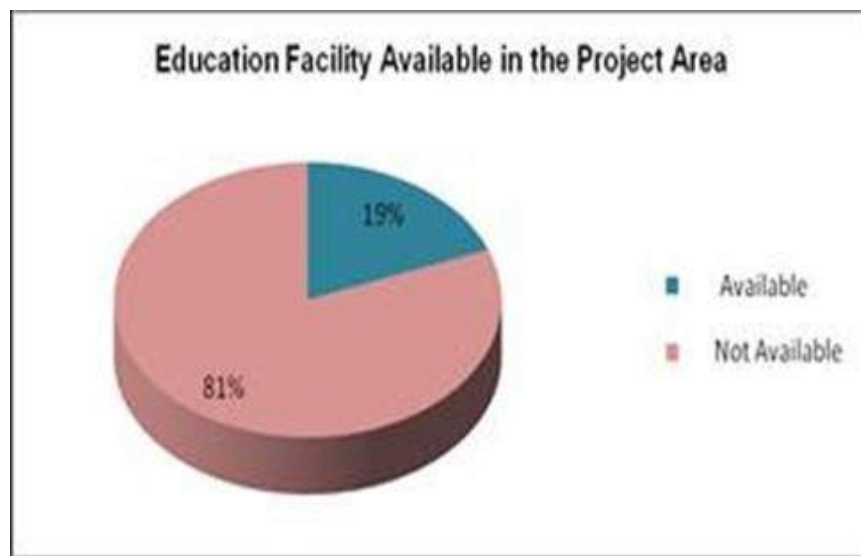


Figure 5.12: Availability of Education Facility

#### 5.6.8 Electricity

It is evident from the survey results that 96% villages have electricity facility, whereas 4% lack this facility. The villages, where electricity facility is not available, people use kerosene oil as a source of light. **Figure 5.13** reveals the availability of electricity in the Project Area.

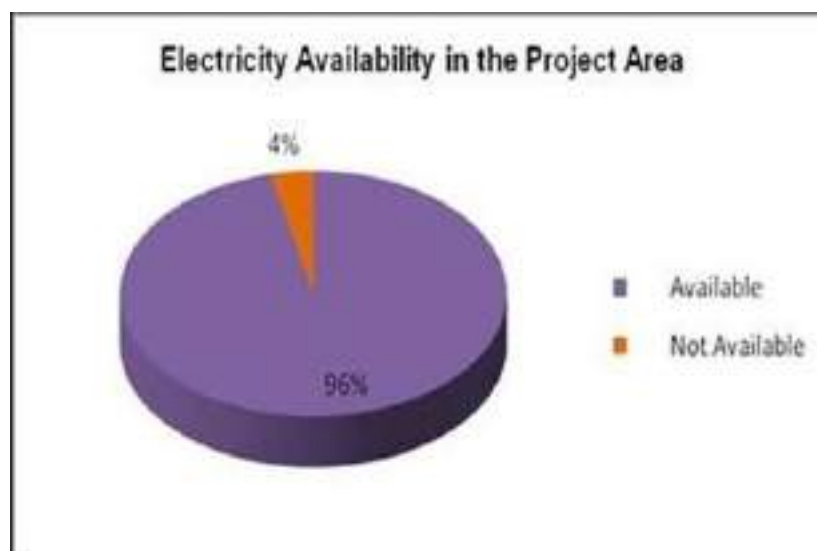
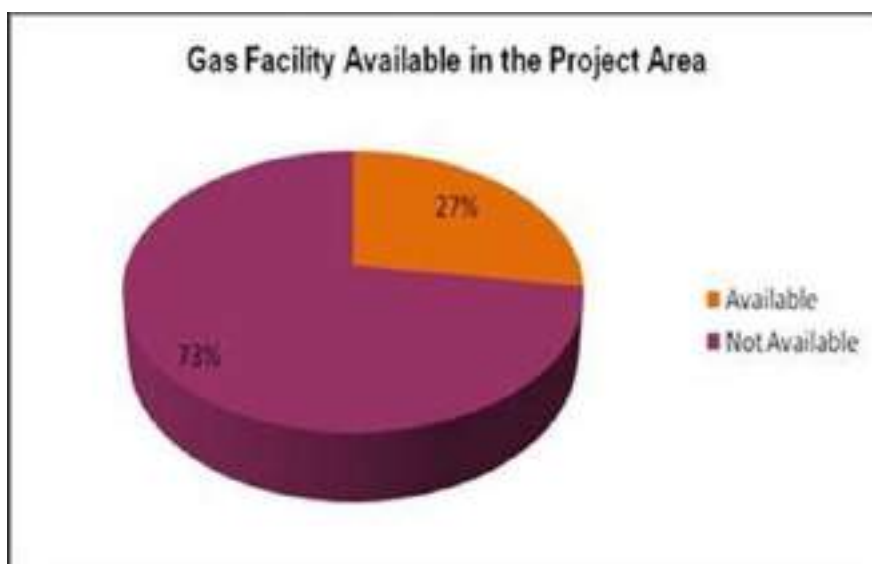


Figure 5.13: Availability of Electricity in Project Area

#### 5.6.9 Natural Gas Supply

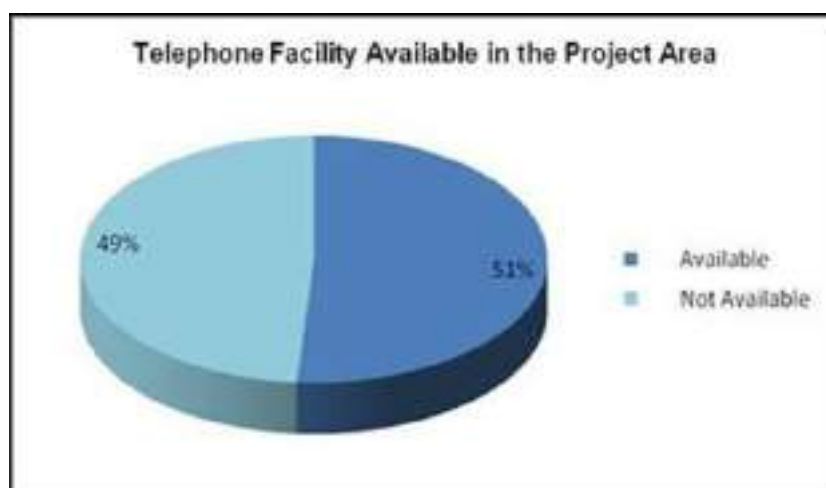
The survey reveals that only 27% villages of the total project area are enjoying the natural gas facility provided by government; while, significant number of villages (i.e. 73%) have to use wood or gas cylinders for fuel purpose. Figure 5-10 reveals the availability of gas facility in the Project Area.



**Figure 5.14: Availability of Gas Facility in the Project Area**

#### 5.6.10 Telephone Facility

Most of the people use mobile telephone facility; however, the availability of landline telephone facility in the surveyed villages indicates that 51% villages have telephone facility and 49% villages do not have telephone facility. In 49% 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. **Figure 5.15** reveals the availability of landline telephone facility in Project Area.

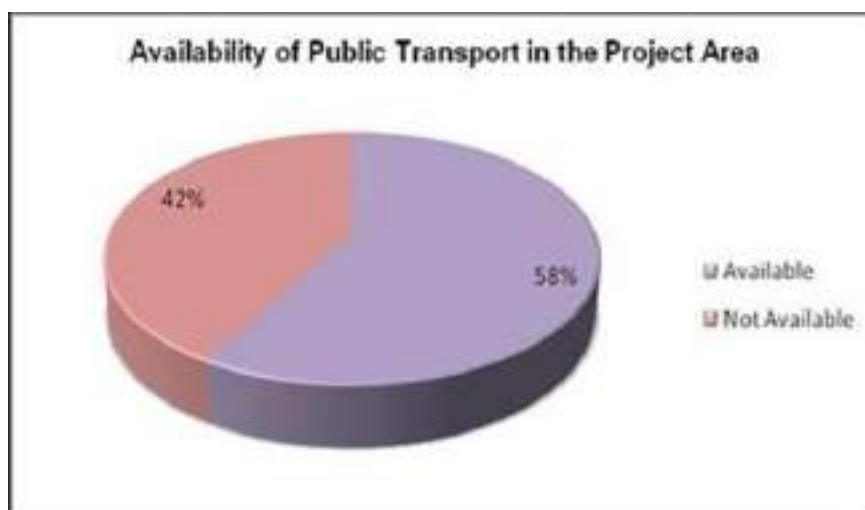


**Figure 5.15: Availability of Landline Telephone Facility**

#### 5.6.11 Transport

The survey results indicate that people of 58% villages have access to public transport e.g.,s bus, van and Rickshaw (Chingchi) etc. for traveling purpose. The remaining 42% villages do not have public transport and they use private

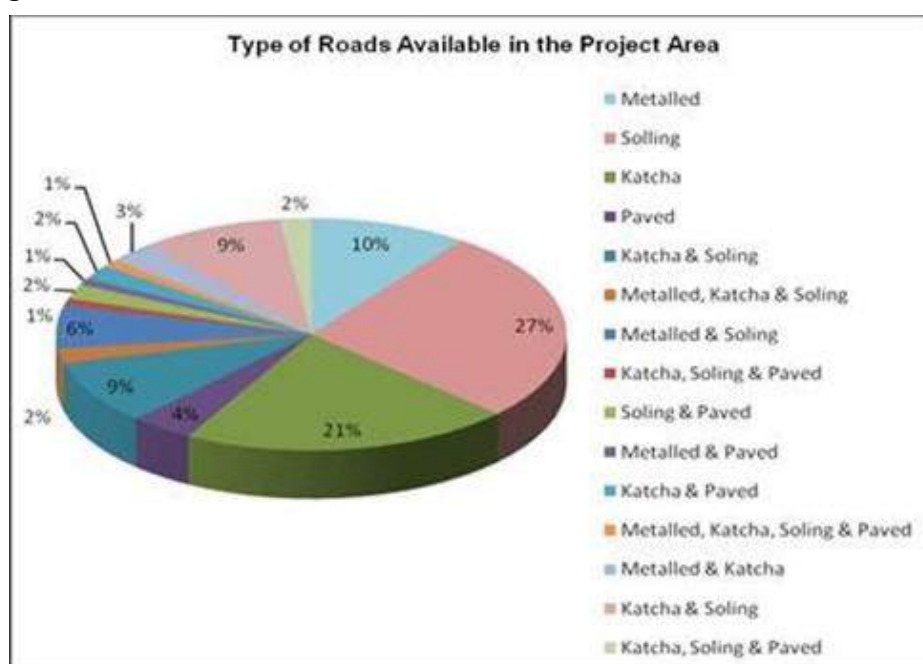
transport such as Motor Car, Motor Cycle, Bicycle or travel by foot. **Figure 5.16** shows the availability of transport facility in Project Area.



**Figure 5.16: Availability of Public Transport in Project Area**

#### 5.6.12 Access Roads

Survey results indicates that a large number of the villages have either soling (27%) or katcha (21%) roads/track. 10% villages have only Metalled roads. Furthermore, 38% of the villages have mixed types of roads as presented in **Figure 5.17**.



**Figure 5.17: Type of Access Roads in the Project Area**

#### 5.6.13 Bank Facility

The survey reveals that Bank facility is available in only 01 village of the project area; whereas other villages lack this facility due to which the residents have

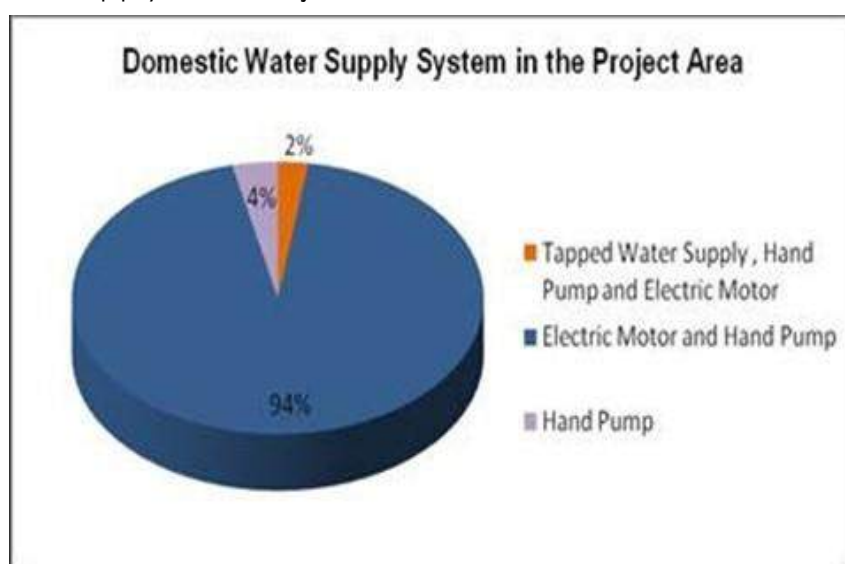
to travel to access the banking facility to the nearest urban commercial center

#### 5.6.14 Post Office

Survey results indicated that 34% villages have Post Office facility at their door step; while, (66%) 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

#### 5.6.15 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 (i.e. 94%) use both hand pumps and electric motor pumps to extract ground water for domestic water usage. The remaining 4% of villages extract groundwater through hand pumps as they have no access to electricity facility. **Figure 5.18** reveals different sources of water supply in the Project Area.



**Figure 5.18: Domestic Water Supply System in the Project Area**

#### 5.6.16 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.

#### 5.6.17 Archaeological and Historical Monuments/Sites

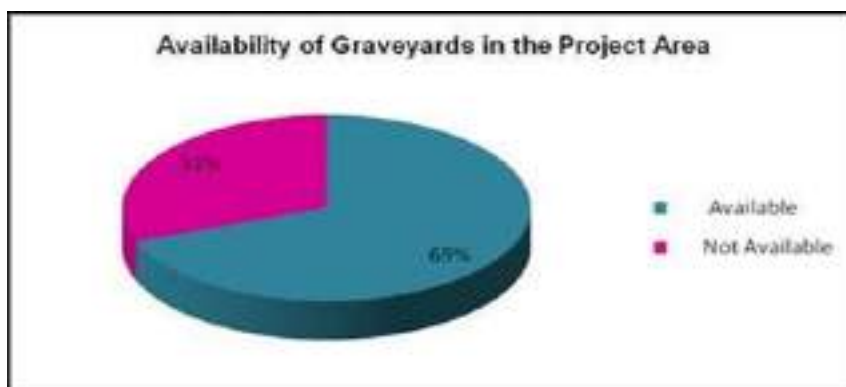
- a. Mosques: Survey indicates that 93 % of villages have mosques while non-availability in only 7% villages. **Figure 5.19** presents the available mosques in the Project Villages.

Availability of Mosques in the Project Area



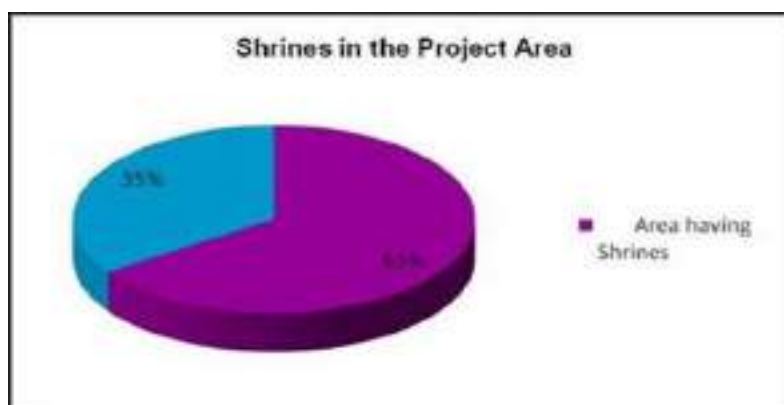
**Figure 5.19: Availability of Mosques in the Project Villages**

- b. Graveyards: 69% villages have graveyard out of total 86 surveyed villages. However, 31% villages do not have graveyards. **Figure 5.20** presents the available graveyards in the Project Villages.



**Figure 5.20: Availability of Graveyards in the Project Villages**

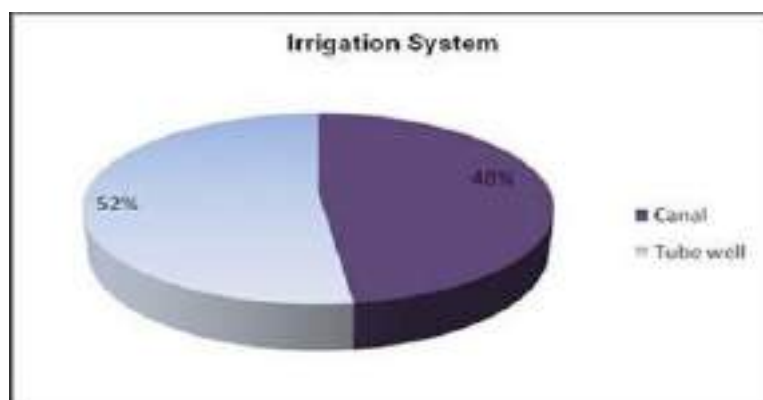
- c. Shrines: 65% villages have shrines whereas, 35% villages do not have shrines. **Figure 5.21** reveals number of present shrines in the surveyed villages.



**Figure 5.21: Number of Shrines present in the surveyed Villages**

### 5.6.18 Irrigation System

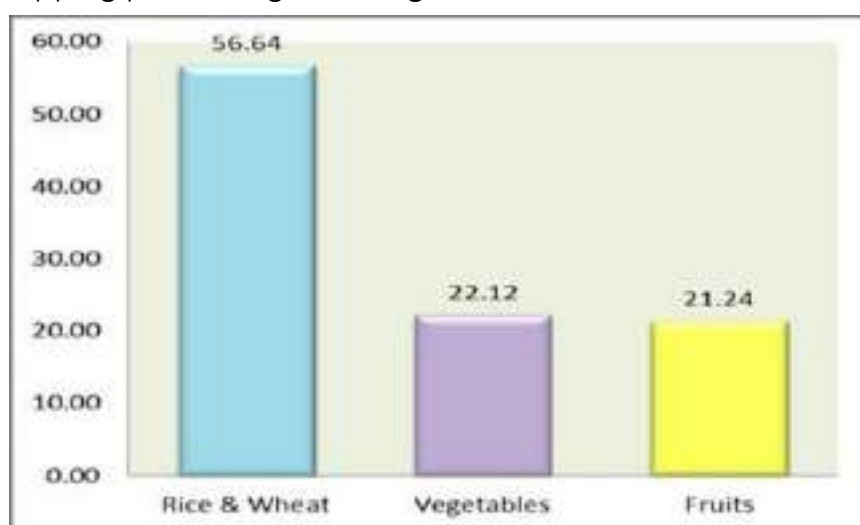
Study revealed that 52% villages depend upon tube well (ground water) for irrigation purpose and 48% villages use canal water for their agriculture lands. Multiple Responses were recorded in each village due to availability of more than one option. **Figure 5.22** shows irrigation system within the Project Area.



**Figure 5.22: Graphical Presentation of Irrigation System in Project Area**

### 5.6.19 Cropping Pattern and Average Yield

The major crops grown in project area are rice and wheat. A few number of villages sow vegetables (Potato, Onion, Carrot, Radish, Peas, Pumpkin, Brinjal etc.), strawberry 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. The graphical presentation of cropping pattern is given in **Figure 5.23**.



**Figure 5.23: Cropping Pattern in Project Area**

### 5.6.20 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 6.4% are katcha, and 12.2% are semi-pacca. During the field visit, the katcha housing pattern was only observed in the proposed urban areas of few villages of Kala Khatai road.

#### **5.6.21 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 Ravi, drains/nullahs and in streets also.

#### **5.6.22 Language Spoken**

Main language spoken in the Project Area is Punjabi. While few people speak Urdu it is the official language. Few Pashto speaking people were also found and consulted in the Project Area.

#### **5.6.23 Settlements Pattern**

The settlement pattern of the Project Area has a mixed origin i.e., urban, semi-urban and rural. Few areas of Lahore and Sheikupura districts are urban or semi urban such as Shahdara, Kala Khatai Road, project Area near Baigum kot etc. Large number of all types industries small, medium and large scale exist within and outside the project Area (Detail of industries are provided in next chapter). The central part of the Project Area is urban, while the peripheral part of the Project Area is semi-urban and the site which for from the project area is rural.

#### **5.6.24 Gender Ratio**

According to the survey 53 % population in the project area are males while 47 % are the females.

#### **5.6.25 Gender Issues**

As the Project activities are being carried out within the residential/agricultural areas of the local community, as a result of it, women activities in the field are being affected during the construction stage. The induction of outside labor may create social and gender issues due to the unawareness of local customs and norms. It will also cause hindrance to the mobility of the local women. Disturbance was observed to the privacy of the local women residing along the boundary of the Project Area particularly where no boundary walls are available at homes.

#### **5.6.26 Resettlement Issues**

As per criteria and after efforts to minimize resettlement at this initial stage of the Project, it is estimated that only two (2) settlements, which fall in riverbed will need to be resettled for Phase-I, while all other will be retained.

Administratively, both these villages fall in Tehsil City & Cantonment of the Lahore District. These two settlements contain 634 households with total built up area of 25.11 acres and total population of 4,271. The criterion used in accordance with the master plan of the project is that the only settlements which fall in the riverbed will be resettled.

## 5.7 ENVIRONMENT MONITORING, SAMPLING AND TESTING

To establish baseline conditions for various physical parameters like surface water, ground water, waste water, ambient air and noise levels, instrumental environmental monitoring was done and details are described as under and environmental monitoring/sampling location map is shown in **Figure 5.24**.

### 5.7.1 Surface Water and Waste Water Analysis

In order to access the quality of surface water, Environmental Sampling & Analysis form 3rd party Environmental Laboratory has been carried out at 9 different locations along River Ravi and 7 major drains in the project area. In 2014, Pakistan Council of Scientific and Industrial Research (PCSIR) also conducted sampling for same project from 5 different locations of surface water and 6 locations of waste water.

Surface water samples were tested for 32 parameters in accordance with PEQS. The detailed results are attached in Appendix 9 while comparison analysis of river water from upstream to downstream and with Pakistan Council of Scientific and Industrial Research Reports (PCSIR) for the same project is given in **Table 5.11**. Comparison analysis of drains at project site with Pakistan Council of Scientific and Industrial Research Reports (PCSIR) for the same project in 2014 is given in **Table 5.12**.



**Table 5.11: Comparison Analysis of River Water Upstream to Downstream at the Project Site**

Parameters	Unit	PEQS	Babakwal Kala Khatai (PSCIR-2014)	Babakwal Kala Khatai (East Bank) (AES-2021)	Chung Forest (PSCIR-2014)	Chung Forest (Jaranwala East Bank) (AES-2021)	Near Motorway (PSCIR -2014)	Near Motorway (Mid-Point) (AES-2021)	Near Sagian Bridge (PSCIR -2014)	Near Sagian Bridge Near Motorway) (AES-2021)	Near Shahdrah Bridge (PSCIR-2014)	Babakwal Kala Khatai (West Bank) (AES-2021)	Babakwal Kala Khatai (Mid-Point) (AES-2021)	Chung Forest (Jaranwala (Mid-Point) (AES-2021)	Chung Forest (West Bank) (AES-2021)	Near LHR- ISB Motorway (West Bank) (AES-2021)
Temperature	°C	--	32.0	18.0	33.0	19.0	34.0	20.0	33.0	18.0	32.0	16.0	18.0	19.0	20.0	18.0
pH value at 25 oC	--	6-10	7.38	7.57	6.89	7.44	7.10	7.43	7.26	7.54	6.87	6.98	7.74	7.52	7.49	7.46
COD	mg/L	150 mg/L	92.4	64	98.0	170.0	89.0	234.0	80.0	455	71.0	129	49	174	146.0	827.0
BOD at 200C	mg/L	80 mg/L	48.0	40	56.0	72.0	48.0	120.0	38.0	213	39.0	66.0	28	86	68.0	388
Oil &Greases	--	10 mg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pesticides/Herbicides	--	0.15 mg/L	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	-	-	-	-
Phenolic Compounds	--	0.1 mg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanide	mg/L	2.0 mg/L	0.05	0.0	0.03	0.0	0.04	0.0	0.02	0.02	0.03	0.0	0.0	0.0	0.0	0.02
Chlorides	mg/L	1000 mg/L	8.10	11.9	9.6	13.9	28.10	69.9	5.90	89.9	16.20	44.9	24.9	19.9	29.9	22.5
Sulphates	mg/L	600 mg/L	26.0	22.0	24.0	26.0	30.0	36.9	23.0	82.26	52.0	46.0	18.0	32.36	33.12	36.0
Cadmium	--	0.1 mg/L	0.0	<0.006	0.0	<0.006	0.0	<0.006	0.0	0.007	0.0	0.006	0.007	<0.006	<0.006	0.009
Chromium	--	1.0mg/L	0.0	<0.004	0.0	<0.004	0.0	<0.004	0.0	0.005	0.0	0.007	<0.004	0.005	0.007	0.006

Parameters	Unit	PEQS	Babakwal Kala Khatai (PCSIR-2014)	Babakwal Kala Khatai (East Bank) (AES-2021)	Chung Forest (PSCIR-2014)	Chung Forest (Jaranwala East Bank) (AES-2021)	Near Motorway (PCSIR -2014)	Near Motorway (Mid-Point) (AES-2021)	Near Sagian Bridge (PCSIR -2014)	Near Sagian Bridge Near Motorway) (AES-2021)	Near Shahdrah Bridge (PSCIR-2014)	Babakwal Kala Khatai (West Bank) (AES-2021)	Babakwal Kala Khatai (Mid-Point) (AES-2021)	Chung Forest (Jaranwala (Mid-Point) (AES-2021)	Chung Forest (West Bank) (AES-2021)	Near LHR-ISB Motorway (West Bank) (AES-2021)
Copper	mg/L	1.0 mg/L	0.150	<0.16 <sub>4</sub>	<0.016 <sub>4</sub>	<0.16 <sub>4</sub>	0.012	<0.16 <sub>4</sub>	0.0	<0.16 <sub>4</sub>	0.03	<0.16 <sub>4</sub>	<0.16 <sub>4</sub>	<0.16 <sub>4</sub>	<0.16 <sub>4</sub>	<0.16 <sub>4</sub>
Mercury	--	0.01mg/L	0.0	<0.00 <sub>1</sub>	0.0	<0.00 <sub>1</sub>	0.0	<0.00 <sub>1</sub>	0.0	0.001	0.0	0.002	<0.00 <sub>1</sub>	0.001	<0.00 <sub>1</sub>	0.001
Lead	--	0.5 mg/L	0.0	<0.00 <sub>5</sub>	0.0	<0.00 <sub>5</sub>	0.0	<0.00 <sub>5</sub>	0.0	<0.00 <sub>5</sub>	0.0	<0.00 <sub>5</sub>	<0.00 <sub>5</sub>	<0.00 <sub>5</sub>	<0.00 <sub>5</sub>	<0.00 <sub>5</sub>
Silver	mg/L	1.0 mg/L	0.023	0.022	0.034	0.036	0.0	<0.00 <sub>2</sub>	0.0	0.004	0.0	<0.00 <sub>2</sub>	0.032	0.003	<0.00 <sub>2</sub>	0.005
Selenium	--	0.5 mg/L	0.0	<0.01	0.022	0.02	0.026	0.021	0.015	0.015	0.015	0.017	0.012	0.003	0.020	0.013
Nickel	mg/L	1.0 mg/L	0.011	<0.02	0.02	<0.02	0.0	<0.02	0.02	<0.02	0.01	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	--	1.0 mg/L	0.0	0.027	0.0	0.018	0.0	0.026	0.0	0.023	0.0	0.024	0.025	0.016	0.020	0.023
Barium	mg/L	1.5 mg/L	0.086	0.003 <sub>5</sub>	0.078	0.003 <sub>8</sub>	0.0	0.003 <sub>6</sub>	0.002	0.003 <sub>5</sub>	0.003	0.003 <sub>7</sub>	0.003 <sub>9</sub>	0.004 <sub>0</sub>	0.003 <sub>5</sub>	0.003 <sub>7</sub>
Iron	mg/L	8.0 mg/L	1.03	1.04	1.11	1.28	1.03	1.19	1.38	1.40	1.59	1.82	1.16	1.10	1.05	1.69
Manganese	mg/L	1.5 mg/L	0.463	0.458	0.045	0.046	0.128	0.142	0.04	0.05	0.156	0.14	0.018	0.126	0.06	0.04
Zinc	mg/L	5.0 mg/L	0.022	0.028	0.015	0.030	0.02	0.038	N.D	<0.01 <sub>5</sub>	0.012	0.018	0.019	0.010	0.026	0.014
Boron	mg/L	6.0 mg/L	0.089	0.084	0.072	0.064	0.03	0.038	0.05	0.06	0.04	0.06	0.040	0.05	0.027	0.062
Total Toxic Metals	mg/L	2.0 mg/L	0.224	0.347	0.242	0.342	0.069	0.291	0.098	0.308	0.098	0.311	0.314	0.277	0.276	0.312
Ammonia	--	40 mg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Parameters	Unit	PEQS	Babakwal Kala Khatai (PCSIR-2014)	Babakwal Kala Khatai (East Bank) (AES-2021)	Chung Forest (PSCIR-2014)	Chung Forest (Jaranwala East Bank) (AES-2021)	Near Motorway (PCSIR -2014)	Near Motorway (Mid-Point) (AES -2021)	Near Sagian Bridge (PCSIR -2014)	Near Sagian Bridge Near Motorway) (AES-2021)	Near Shahdrah Bridge (PSCIR-2014)	Babakwal Kala Khatai (West Bank) (AES-2021)	Babakwal Kala Khatai (Mid-Point) (AES-2021)	Chung Forest (Jaranwala (Mid-Point) (AES-2021)	Chung Forest (West Bank) (AES-2021)	Near LHR-ISB Motorway (West Bank) (AES-2021)
Anionic Detergents	--	20 mg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluorides	--	20 mg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sulphides	--	1.0 mg/L	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Dissolved Solids	mg/L	3500mg/L	126.0	148.0	154.0	180.0	288.0	198.0	130.0	458.0	195.0	164.0	138.0	182.0	184.0	195.0
Total Suspended Solids	mg/L	200 mg/L	268.0	258.0	28.0	54.0	25.0	22.0	33.0	33.0	24.0	34.0	176.0	58.0	49.0	52.0
Chlorine	--	1.0 mg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Faecal Coliform	MPN/100 ml	--	140.0	-	110.0	-	110.0	-	80.0	-	220.0	-	-	-	-	-
Total Coliform	MPN/100 ml	--	170.0	-	140.0	-	170.0	-	110.0	-	170.0	-	-	-	-	-



**Table 5.12: Comparison Analysis of Drains at Project Site**

Parameters	Unit	PEQS	Shalimar Escape Channel Downstream (PCSIR 2014)	Shalimar Escape Channel Downstream (AES 2021)	Canit Drain Downstream (PCSIR 2014)	Canit Drain Downstream AES	Lower Ravi 2014	Lower Ravi AES	Farukh Abad Drain 2014	Farukh Abad Drain PCSIR	Farukh Abad Drain AES	Upper Chhoti Ravi Drain 2014	Upper Chhoti Ravi Drain PCSIR	Shogda Ravi AES	Ranaj DS AES
Temperature	°C	--	34.0	19.0	34.0	20.0	32.0	22.0	33.0	20.0	32.0	21.0	20.0	21.0	
pH value at 25 °C	--	6-10	7.99	7.33	6.88	7.45	6.60	7.30	6.57	7.36	7.07	7.30	7.33	7.38	
COD	mg/L	150 mg/L	4139.0	775.0	101.6	486	314.0	834.0	194.0	690.0	221.70	827	1420	1356	
BOD at 20°C	mg/L	80 mg/L	1540.0	372.0	70.0	232.0	198.0	398.0	120.0	334.0	130.0	388.0	658.0	632.0	
Oil &Greases	--	10 mg/L	0.0	0.0	5.0	2.0	0.0	0.0	5.0	1.2	0.0	0.0	0.8	0.6	
Pesticides/Herbicides	mg/L	0.15 mg/L	<0.10	-	0.0	-	< 0.05	-	0.0	-	0.0	-	-	-	
Phenolic Compounds	--	0.1 mg/L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cyanide	mg/L	2.0 mg/L	4.6	0.6	1.6	0.8	0.4	0.2	1.8	0.9	0.4	0.3	0.6	0.7	
Chlorides	mg/L	1000 mg/L	36.2	55	71.60	77.5	67.90	98	131.50	158	47.30	38	60.9	84.9	
Sulphates	mg/L	600 mg/L	60.0	52.0	61.0	55.0	53.0	48.0	77.0	66.0	64.0	52.0	58.0	48.0	
Cadmium	--	0.1 mg/L	0.0	0.006	0.0	0.007	0.0	0.006	0.0	0.007	0.0	<0.006	0.006	0.008	
Chromium	mg/L	1.0mg/L	0.35	0.04	0.65	0.12	0.32	0.24	0.28	0.32	0.13	0.22	0.26	0.24	
Copper	mg/L	1.0 mg/L	0.483	0.283	0.08	0.08	0.12	0.12	0.18	0.18	0.077	0.077	0.16	0.20	
Mercury	--	0.01mg/L	0.0	0.001	0.0	<0.001	0.0	0.001	0.0	0.001	0.0	<0.001	0.001	<0.001	

Parameters	Unit	PEQS	Shalimar Escape Channel Downstream (PCSIR 2014)	Shalimar Escape Channel Downstream (AES 2021)	Canit Drain Downstream (PCSIR 2014)	Canit Drain Downstream AES	Lower Chhola Ravi 2014 PCSIR	Lower Chhola Ravi 2021 AES	Farukh Chhola Drain 2014 PCSIR	Farukh Chhola Drain 2021 AES	Uper Chhola Ravi Drain 2014 PCSIR	Uper Chhola Ravi Drain 2021 AES	Shogga Ravi 2014 AES	Roz DS 2021 AES
Lead	--	0.5 mg/L	0.0	0.005	0.017	0.016	0.036	0.034	0.0	<0.005	0.046	0.052	<0.005	0.046
Silver	mg/L	1.0 mg/L	0.06	0.06	0.06	0.06	0.03	0.03	0.015	0.015	0.015	0.018	0.017	0.016
Selenium	mg/L	0.5 mg/L	0.082	0.078	0.015	0.018	0.0	<0.01	0.01	0.02	0.023	0.024	0.019	0.020
Nickel	mg/L	1.0 mg/L	0.08	0.07	0.01	0.04	0.03	0.04	0.022	0.024	0.08	0.07	0.005	0.06
Arsenic	--	1.0 mg/L	0.0	0.052	0.018	0.049	0.015	0.046	0.0	0.051	0.0	0.026	0.032	0.028
Barium	mg/L	1.5 mg/L	0.23	0.0038	0.12	0.14	0.13	0.11	0.23	0.19	0.96	0.98	0.11	0.13
Iron	mg/L	8.0 mg/L	1.29	0.94	1.16	1.28	1.31	1.18	2.11	2.04	1.16	1.22	1.76	1.84
Manganese	mg/L	1.5 mg/L	0.163	0.158	0.101	0.099	0.136	0.128	0.215	0.199	0.170	0.179	0.141	0.153
Zinc	--	5.0 mg/L	0.0	0.025	0.029	0.032	0.164	0.058	0.453	0.0241	0.227	0.032	0.063	0.057
Boron	mg/L	6.0 mg/L	0.69	0.18	0.82	0.74	0.88	0.68	0.68	0.76	0.68	0.20	0.71	0.68
Total Toxic Metals	mg/L	2.0 mg/L	1.76	0.779	1.790	1.271	1.561	1.317	1.255	1.573	2.011	1.674	1.325	1.429
Ammonia	mg/L	40 mg/L	16.8	8.4	10.0	6.8	7.84	5.98	8.96	6.88	0.0	0.0	0.0	0.0
Anionic Detergents	mg/L	20 mg/L	3.2	2.8	1.8	0.8	3.2	2.8	2.3	1.6	6.2	4.6	2.0	1.6
Fluorides	mg/L	20 mg/L	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sulphides	mg/L	1.0 mg/L	6.70	4.52	3.30	2.26	3.30	2.18	5.30	4.11	4.0	3.88	2.6	3.0
Total Dissolved Solids	mg/L	3500mg/L	852.0	808.0	722.0	746.0	633.0	758.0	796.0	954.0	397.0	492.0	738.0	742.0
Total Suspended Solids	mg/L	200 mg/L	248.0	232.0	214.0	210.0	28.0	38.0	20.0	32.0	24.0	36.0	270.0	236.0

Parameters	Unit	PEQS	Shalimar Escape Channel Downstream (PCSIR 2014)	Shalimar Escape Channel Downstream (AES 2021)	Can't Drain Downstream (PCSIR 2014)	Can't Drain Downstream AES	Lower Chhota Ravi PCSIR	Lower Chhota Ravi AES	Farukh Abad Drain PCSIR	Farukh Abad Drain AES	Upper Chhota Ravi Drain PCSIR	Upper Chhota Ravi Drain AES	Shogd Bagh AES	Reservoir AES
Chlorine	mg/L	1.0 mg/L	0.8	0.0	0.4	0.0	0.5	0.0	0.6	0.0	1.2	0.0	0.0	0.0
Faecal Coliform	MPN/100ml	--	1600.0	-	500.0	-	220.0	-	280.0	-	350.0	-	-	-
Total Coliform	MPN/100ml	--	>1600	-	900.0	-	350.0	-	500.0	-	500.0	-	-	-

After detail analysis, it is evident that the river Ravi has high levels of COD and BOD in accordance with surface water quality standards for sustaining aquatic life. The river water also found high number of Faecal coliform & E-coli in PCSIR results.

All the waste water samples have high COD and BOD values which is non-compliance with Punjab Environmental Quality Standards (PEQS).

### 5.7.2 Ground Water

In order to check the quality of ground water, six samples have been taken by 3<sup>rd</sup> party Environmental Laboratory from different locations at which project is proposed to be constructed. In 2014, Pakistan Council of Scientific and Industrial Research (PCSIR) also conducted sampling for same project from five different locations of ground water.

Groundwater samples were tested for 35 selected parameters as per World Health Organization (WHO). The detail of the results of the samples are attached as Appendix 9 while comparison analysis of ground water on different locations at project site is given in **Table 5.13**.

**Table 5.13: Ground Water Analysis at Project Site**

Parameters	Unit	WHO Standards	Village Misra (AES)	Village Misra (AES)	Village Misra (AES)	Village Misra (AES)	Chung Motor Pump (PCSIR 2014)	Chung Motor Pump (AES)	Rehman Garden Motor Pump Jaranwala Road (PCSIR 2014)	Rehman Garden Motor Pump Jaranwala Road (AES 2021)	Lakhu Deer	Lakhu Deer (AES)	Village Misra (AES)
Temperature	°C	--	32.0	30.0	32.0	29.0	31.0	31.0	32.0	30.0	32.0	29.0	28.0
Colour	Pt-Co Hazen	≥ 15 Pt-Co Hazen	5.0	2.0	8.0	0.0	5.0	0.0	5.0	0.0	5.0	1.0	0.0
Turbidity	--	5 NTU	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Odour	--	Non-Objectionable/ Acceptable	Acceptable	NonObjectionable/ Acceptable	Acceptable	NonObjectionable/ Acceptable	Acceptable	NonObjectionable/ Acceptable	Acceptable	NonObjectionable/ Acceptable	Acceptable	Non-Objectionable / Acceptable	Non-Objectionable / Acceptable
Taste	--	Non-Objectionable/ Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
pH at 25 °C	--	6.5 – 8.5	7.44	7.45	7.21	7.49	7.33	7.67	6.66	7.78	7.3	7.15	7.76
Chlorides	mg/L	250 mg/l	39.10	144.95	53.90	50.9	72.4	9.0	3.0	6.99	55.0	18.9	7.99
Hydrogen Sulphide (H <sub>2</sub> S)	--	0.05 mg/l	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	-
Sulfate	mg/L	--	99.0	168.0	108.0	99.7	59.0	42.8	23.0	32.7	24.0	110.8	39.6
Total Hardness	mg/L	--	192.0	326.0	304.0	286.0	180.0	110.0	192.0	98.0	264.0	398	126.0
Calcium	mg/L	--	48.0	82	78.0	71	42.0	28.5	48	24.5	66	99.5	31.5
Nitrate	mg/L	50 mg/l	0.3	2.2	0.2	0.14	0.1	0.08	1.0	2.24	1.0	1.39	1.03

Parameters	Unit	WHO Standards	Village Misra Sheikhupura PCSIR	Village Misra Sheikhupura AES	Shahdipur PCSIR	Shahdipur AES	Chung Motor Pump (PCSIR 2014)	Chung Motor Pump AES	Rehman Garden Motor Pump Jaranwala Road (PCSIR 2014)	Rehman Garden Motor Pump Jaranwala Road (AES 2021)	Lakkar Deer PCSIR	Lakkar Deer AES	Shahdipur AES
Nitrite	--	3 mg/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium as Na <sup>+</sup>	mg/L	200 mg/l	27.0	110	22.0	42	39.0	8.2	17.0	5.6	42.0	16.8	17.6
Zinc	--	3 mg/l	0.0	0.024	0.0	0.018	0.0	0.026	0.0	0.029	0.0	0.022	0.028
Copper	--	2 mg/l	0.0	0.164	0.0	0.165	0.0	0.166	0.0	0.164	0.0	0.165	<0.164
Barium	--	0.7 mg/l	0.0	<0.0035	0.0	<0.0035	0.0	<0.0035	0.0	<0.0035	0.0	<0.0035	<0.0035
Boron	--	0.3 mg/l	0.0	<0.02	0.0	<0.02	0.0	<0.02	0.0	<0.02	0.0	<0.02	<0.02
Iron	mg/L	0.3 mg/L	0.13	0.15	0.11	0.13	0.12	0.18	0.22	0.19	0.26	0.22	0.20
Arsenic	mg/L	0.01 mg/L	0.05	0.052	0.0	0.048	0.07	0.034	0.04	0.045	0.028	0.042	0.048
Lead	--	0.01 mg/l	0.0	<0.005	0.0	<0.005	0.0	<0.005	0.0	<0.005	0.0	<0.006	0.005
Manganese	--	0.5 mg/l	0.0	0.016	0.0	0.024	0.06	0.017	0.05	0.025	0.058	0.018	0.054
Mercury	--	0.001 mg/l	0.0	<0.001	0.0	<0.001	0.0	<0.001	0.0	<0.001	0.0	<0.001	<0.001
Nickel	--	0.02 mg/l	0.0	<0.02	0.0	<0.02	0.0	0.02	0.0	<0.02	0.0	<0.02	<0.02
Antimony	--	0.02 mg/l	0.0	<0.005	0.0	<0.005	0.0	<0.005	0.0	<0.005	0.0	<0.005	<0.005
Aluminum	--	0.2 mg/l	0.0	<0.005	0.0	<0.005	0.0	<0.005	0.0	<0.005	0.0	<0.005	<0.005
Cadmium	--	0.003 mg/l	0.0	0.006	0.0	<0.006	0.0	0.006	0.0	<0.006	0.0	0.006	<0.006
Chromium	--	0.05 mg/l	0.0	0.004	0.0	<0.004	0.0	0.004	0.0	<0.004	0.0	0.004	<0.004
Cyanide	--	0.07 mg/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fluorides	--	1.5 mg/L	0.0	0.0	0.0	0.0	2.9	2.2	0.0	0.04	0.2	0.09	0.05
Ammonia	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Dissolved Solids	mg/L	1000 mg/l	549.0	890.0	487.0	554.0	866.0	238.0	229.0	182.0	1119.0	616.0	220.0



Parameters	Unit	WHO Standards	Village Misra Sheikhupura PCSIR	Village Misra Sheikhupura AES	Sharaqpur PCSIR	Sharaqpur AES	Chung Motor Pump (PCSIR 2014)	Chung Motor Pump AES	Rehman Garden Motor Pump Jaranwala Road (PCSIR 2014)	Rehman Garden Motor Pump Jaranwala Road (AES 2021)	Lakho Dair PCSIR	Lakho Dair AES	Sharaqpur AES
Total Suspended Solids	--	--	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Coliform	--	N.D/100ml	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.0	0.0	0.0
E-Coli	--	N.D/100ml	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	+ve	+ve	0.0

As per Analysis, high concentration of Arsenic was found in most of the drinking water samples. The drinking water sample of Lakho dair is unfit for drinking due to the microbiological and heavy metal contamination. The drinking water sample of Chung also found high concentration of fluoride and arsenic. Only one sample i.e., Sharaqpur out of 5 samples is in compliance and fit for drinking in accordance with WHO standard guidelines.

### 5.7.3 Ambient 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.

In 2014, Ambient air quality was monitored by PCSIR in accordance with PEQS at 12 selected locations close to the project sites.

In 2021, ambient air monitoring was again carried at 06 identified locations for period of 24 hours in accordance with the PEQS. The monitored parameters included Carbon mono-oxide (CO), Nitrogen dioxide (NO<sub>2</sub>), Sulphur dioxide (SO<sub>2</sub>), Particulate Matter (PM<sub>10</sub>) and Particulate Matter (PM<sub>2.5</sub>).

The detailed results of ambient air quality are attached as Appendix 9 while comparison analysis is given in tables 5.13.

**Table 5.14: Comparison Analysis of Ambient Air Quality at Project Site**

Parameters	Units	PEQS	Mohlanwala 2014 PCSIR	Thokar 2014 AES	Misan-Sheikhupura (PCSIR 2014)	Misra 2014 AES	Km Jaranwala Road (PCSIR 2014)	Jaranwala Road 2014 AES	Tradaywala 2014 PCSIR	Shahdara Railway Station (AES 2021)	Mohlanwala 2014 AES	Mohlanwala 2014 AES	Near LWM 2014 AES	Latke 2014 AES
CO	mg/m <sup>3</sup>	10 mg/m <sup>3</sup>	4.84	1.50	7.59	1.47	8.49	0.67	3.59	1.68	4.84	0.88	13.28	1.46
NO	µg/m <sup>3</sup>	40 µg/m <sup>3</sup>	36.69	14.67	11.29	8.32	4.12	7.74	7.44	13.50	36.69	10.19	55.0	14.39
NO <sub>2</sub>	µg/m <sup>3</sup>	80 µg/m <sup>3</sup>	7.77	23.42	11.04	17.39	10.53	14.68	4.23	20.84	7.77	18.67	12.80	20.70
NO <sub>x</sub>	µg/m <sup>3</sup>	---	44.46	28.39	22.33	25.71	14.65	22.69	11.67	34.35	44.46	28.85	67.83	35.09
SO <sub>2</sub>	µg/m <sup>3</sup>	120 µg/m <sup>3</sup>	18.21	28.27	37.50	22.84	29.57	17.01	28.90	19.21	18.21	22.96	62.39	21.22
PM 2.5	µg/m <sup>3</sup>	35 µg/m <sup>3</sup>	25.0	61.5	30.0	59.3	45.0	61.7	30.0	59.3	25.0	57.2	40.0	64.2
PM 10	µg/m <sup>3</sup>	150 µg/m <sup>3</sup>	140.0	173.2	135.0	169.7	140.0	170.2	160.0	164.8	140.0	153.6	180.0	173.4

#### 5.7.4 Noise Level Monitoring

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 42 locations (by PCSIR-2014) that are close to the project sites. The monitoring was carried out for a period of 1 hour and average is reported.

In 2021, noise levels were monitored at 06 different points for 24 hours. The results show that the noise levels on all major roads are much higher than PEQS but the noise levels are in compliance in village settlements, orchards and forests. The results of noise level at identified locations are given in Appendix 9.

#### 5.7.5 Baseline Monitoring Team

All laboratory tests for water, noise and ambient air were conducted by AES (Asian Environmental Services Pvt. Ltd.) which is certified laboratory form EPA-Punjab. The testing team of expertise is presented in Table

**Table 5.15: Testing Team**

1	Dilbar Hussain	Chief Chemist	M.Phil. Analytical Chemistry, University of The Punjab M.Sc. Chemistry, University of The Punjab
2	Sajjad Hussain	Lab Analyst/ Chemist	M.Sc. Applied Chemistry, UET Lahore
3	Abid Farooq	Chemist	M.Sc. Chemistry, University of The Punjab
4	Bilal Hameed	Field Environmentalist	M.Sc. Environmental Sciences – University of Gujrat

### 5.8 SUITABILITY OF THE SITE

#### 5.8.1 Wetlands

There are no wetlands or Ramsar site in the project area.

#### 5.8.2 Endangered Species

There are no endangered species of flora and fauna in the project area.

### **5.8.3 Wildlife Sanctuaries and Game Reserves**

No wildlife sanctuary or game reserves are located in the vicinity of the project area.

### **5.8.4 Critical Habitats**

No wildlife sanctuary or game reserve (Critical Habitats) exists in the project area, however, there are two (02) forests fall partially in the project area. It is recommended that NOC must be taken from the Forest Department prior to start of construction.

### **5.8.5 Cultural Heritage and Community Structure**

During field survey it was observed that two cultural/historical/archaeological properties are present in the proximity of Phase-I of River Channelization Project. One is Kamran Baradari, which is a monument declared as “Special Premises” by Punjab Government under Punjab Special Premises (Preservation) Ordinance, 1985. It is also an archaeological site / monument protected by the Federal Government located in Punjab Province under Guidelines for Protected Areas, 1997. This site is about 1.5km downstream to the project area. Second is Jahangir’s Tomb, which is also protected by the Federal Antiquities Act 1975. The site was also inscribed on the tentative list for UNESCO World Heritage Site status in 1993. It is also 0.5km away from the construction areas.

In addition to above, should any such other 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.

## SECTION - 6: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This chapter identifies the potential impacts related with location, design, construction and operation phases of the Project on the physical, ecological and socio-economic domains of the environment. Accordingly, mitigation measures have been proposed to mitigate the negative impacts and to enhance the positive impacts.

### 6.1 APPROACH AND METHODOLOGY

For impact identification, various EIA methodologies are available including the checklists, interaction matrices, networks and overlays. Among these four methods, following two are used in EIA of River Training Works and Channelization.

- Project Interaction Matrix
- Overlays- GIS based

#### 6.1.1 Project Interaction Matrix

Interaction matrix is a two dimensional matrix wherein the project actions are placed along one axis (i.e., along y-axis) and on the other axis there are different environmental parameters likely to be affected by the proposed project actions grouped into categories i.e. Physical, Ecological & Socioeconomic Environment. Interaction matrix is used in this project due to the following reasons:

- It provides cause-effect relationship between the project actions and resulting consequences impacts.
- It provides nature (+ve or -ve) and weighting of different impacts.
- It provides cumulative impacts of a project.
- Matrix grouped project actions into temporal phases.

For the impact assessment, project interaction matrix is used by dividing the project action into different phases (location, design, construction and operation). The environmental impacts are divided into three main categories including physical, ecological and socio-economic domains.

The environmental impacts of the project actions are identified and weighed into the following categories:

HA = Highly Adverse  
MA = Medium Adverse  
LA = Low Adverse



HB = Highly Beneficial  
MB = Medium Beneficial  
LB = Low Beneficial  
0 = None/Insignificant

The assignment of significance is based on the previous knowledge and professional judgment of EIA team experts. The project impact matrix has been developed for “without” and “with mitigation” is attached as **Appendix-10**. It may be noted that the environmental parameters, which are not related to the implementation of the projects, have not been considered in the matrix.

Prior to the mitigation of the obvious negative impacts, it was seen that the project activities have a negative impact on the physical environment affecting the water quality, soil, air quality & generation of noise levels during the construction stage. The other ecological medium negative impacts include tree removal and effects on fauna. There will be impact on social environment as local communities in project area will be resettled.

Apart from some negative impacts the project will have far more positive impacts during operational stage. The positive impacts include restoration of River and its ecological uplifting, flood protection, Recreational Activities, job opportunities and economic uplifting of the region.

After executing the proposed mitigation measures, the significant negative impacts during construction stage and operational stage shall be reduced. Employment shall boom in the construction as well as operational stage, which shall be the most beneficial impact of the project.

Reviewing the results of the project impact matrix, it was concluded that after the reduction/elimination of the negative impacts, the proposed project will be lucrative and beneficial for the economic development of the area.

### 6.1.2 Overlays- GIS based

Overlays are the spatial operation, in which two or more maps or layers registered to a common coordinate system and are superimposed, either digitally or on a transparent material, for the purpose of showing the relationships between features that occupy the same geographic space. Overlays are effective visual aid, useful for documentation of environmental conditions existing before and after the project implementation. It describes both biophysical and social aspects of area under study.

The existing land use map of the area has been overlaid with the new master plan of the proposed Ravi Riverfront Urban Development Project. The impacts on social and bio-physical environment have been analyzed through the development of new map.

## 6.2 ADVERSE IMPACTS DURING PRE-CONSTRUCTION PHASE

### 6.2.1 Land Acquisition and Resettlement

The major impact during Pre-Construction Phase is Land Acquisition and Resettlement. Both Private and Govt. owned land exist in the Project Area. A summary listing the main impacts related to land acquisition and resettlement during the pre-construction phase of the River Channelization Project is given in **Table 6.1**.

**Table 6.1: Loss of Assets, Land Population and Houses**

Item No.	Item	Quantity
1	Agriculture Land	1410.83 Acres
2	Creek	153 Acres
3	River	795.7 Acres
4	Barren Land	14.5 Acres
5	Forest	138.76 Acres
6	Flood Plain	899.5 Acres
7	Settlements in Riverbed	02 (25.11 Acres)
8	Households	634 Nos.
9	Population	4,271 Nos.

**Table 6.2: Details of Settlements falling in Riverbed**

Sr. No.	Village Name	UC	District	No. of Houses	Population	Built-up Area (Acres)
1	Jhuggian Arazi	Kot Abdul Malik	Lahore	300	2,100	11.44
2	Mustafa Abad	Shahdara	Lahore	334	2,171	13.67
<b>Total (Phase-I)</b>				<b>634</b>	<b>4,271</b>	<b>25.11</b>

Further, there are the forests with total area of 138.76 acres, which may be affected. The other forest land outside the channelization will be saved and taken into the development of overall urban front project. According to the social survey, small, medium and large bridges, tube-wells, government and private schools, commercial markets, graveyards, mosques, shrines, and BHUs are also located in the project area.

#### Mitigation:

- For the purpose of resettlement, only those villages will be relocated which are falling in the riverbed, while all other settlements and houses

will be retained. Various options (like apartments, model villages, land for land) have been explored to resettle these settlements which are given in social/resettlement framework provided in chapter 7. The settlements location map requiring resettlement is given as Figure 6.1.

- The payment of full, fair and prompt compensation to the affected people should be made in accordance with LAA, 1894 and the proposed RPF.
- The forests will be avoided either by converting it into proposed island or by diverting/realigning the river channelization.
- The mature trees falling in the land to be used for various developmental purposes under this project will be shifted to dedicated green areas/gardens with the help of tree transplanting machines instead of cutting.
- The small industrial units will be resettled in the allocated industrial areas by the Government while big industrial units will be retained.



### **Strategic Level Measures to Improve Agricultural Produce as an Offset to Agri Loss.**

- The agriculture productivity can be increased by providing modern agricultural inputs to farming community. These inputs are diversified and include approved or certified seed, good quality water for irrigation, fertilizers, weedicides and pesticides.
- Loans may be provided on soft term basis to the farmers for spending on inputs for agriculture production. Subsidies may be proposed to farmers on agricultural machineries, like laser tractors, solar/electric tube wells. The subsidies may also be provided to farmers to install drip irrigation equipment in fields instead of flood irrigation system. It will save lot of water, which can be used to further expand agriculture land.
- The irrigation system requires drastic reforms to make sure uninterrupted irrigation water supply through canals. The barren areas should be converted into agriculture land by constructing new canals and water bodies. Furthermore, alternative policies and investments are needed in water storage and distribution, including canal rehabilitation, maintenance, and drainage, to keep water flowing, protect against severe floods, and meet the country's changing water needs.
- The Government must fortify its agriculture sector against weather extremes including droughts, floods, heat, and cold, and against pests and diseases. This will require public investment and substantive policy reforms in agricultural research, extension, seed systems, and agricultural input markets to support farmers.
- The agriculture should be adaptive to climate change. The crops should be made resistant to droughts, floods, pests and diseases.

#### **6.2.2 Impact due to Diversion of River**

Before the start of the construction of the barrage structure, a River diversion arrangement has to be made. The River diversion will be accomplished by the construction of upstream and downstream cofferdams. Failure of the Cofferdam during construction includes a partial or total Failure of the Cofferdam resulting delay in the Project schedule, loss or damage to equipment, temporary or permanent damage to structures, serious injury, or even loss of life and/or the release of sediment and/or debris downstream. This impact is Site-specific, Possible and Medium Significant.

#### **Mitigation**

Standard acceptable engineering design considers and accounts for the associated loadings or stresses which will be imposed on the Cofferdam.

Mitigation measures include, but are not limited to, designing the Cofferd Dam to relevant codes and scheduling of activities to accommodate weather interruptions, and regular inspections by the Project Engineer of the Cofferd Dam.

Daily inspections of the Cofferd Dam will identify potential weakness or soft spots in the Cofferd Dam which would lead to the Failure of the Cofferd Dam itself. Debris would be caught in the fine trash rack system and removed. Suspended sediments would be monitored in the downstream flow and in case of a sudden change, notification would be made for necessary measures.

The safety of the cofferdams will be checked for the various combinations of load, as per international design practices. The constructions method & construction planning of these will also be deliberated upon.

### **6.3 IMPACTS AND MITIGATIONS MEASURES DURING THE PROJECT CONSTRUCTION**

Following is the brief description of impacts and their mitigation envisaged during the construction phase:

#### **6.3.1 Physical Environment**

##### **A) Soil Erosion and Contamination**

Due to the proposed construction activities such as construction of barrage and river channelization, soil erosion and contamination may occur. Soil erosion may occur on River Ravi and at contractors' camps as a result of uncontrolled run-off from equipment washing yards and excavation of earth/cutting operations. Whereas contamination of the soil may be caused by oil and chemical spills at equipment washing yards, camp sites and temporary construction site office. This impact is, however, temporary and low adverse in nature.

##### **Mitigations**

- Site proposed for barrage and overhead structures where embankments are more susceptible to erosion by water runoff, stone pitching or riprap will be provided on the embankment slopes.
- Plantation will be carried out at the toe of the embankment for slope protection constituting fast growing indigenous trees with deep root system for anchoring in the soil material.
- Soil contamination can be curtailed by reducing the oil spill in the camp and at project construction areas by well maintaining the construction vehicles as well as bitumen/other contaminants in storage tanks/places.



•

Confining excavations to the specified locations as per the approved engineering drawings and unnecessary excavations should be avoided;

- Excess soil should be reused where possible and residual soil can be disposed of at designated site to prevent erosion;
- Septic tanks of adequate capacities should be constructed for receiving and treating wastewater from all temporary worksite toilets and construction camps to avoid soil contamination; and
- Regular inspection of the wastewater disposal from construction camps.

## **B) Traffic Problems**

The proposed project site is accessible through Grand Trunk Road, Saggian Wala Bypass Road, Khaju Ranwali Road, Bund Road Shahdara and Kala Khatai-Narang Mandi Road. These roads serve as main approach roads to the proposed Project Area and due to the proposed construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling to the proposed areas. The problems will include traffic jams and inconvenience to the public passing through the Project Area. It will also increase traffic load on the existing road network or access roads ultimately deteriorating the existing condition of the roads. The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions, vibrational impacts, etc. Considering these consequences, this impact can be categorized as direct, moderate, site-specific, medium term, temporary, medium probability and irreversible.

### **Mitigation**

- Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime to reduce traffic load and inconvenience to the local population.
- Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary congestions along the major roads.
- The speed of the vehicles will be controlled to reduce the probability of severe accidents, soil erosion, debris flows due to vibrations and dust emission.
- Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work.
- Proper sign boards will be provided for smooth flow of traffic.

- Period of construction and area / location of construction site shall be informed to public in general and specifically to local residents.
  - Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays.

### C) Air Quality

The air quality of the project area will be affected by the exhaust emissions ( $\text{NO}_2$ ,  $\text{SO}_2$ ,  $\text{CO}$  and  $\text{PM}_{10}$ ) produced from operation of construction machinery and equipment 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. All these including  $\text{PM}_{10}$  are considered as pollution indicators.

Potential impacts on the air quality during the construction stage will be due to the fugitive dust and the exhaust gases generated in and around the construction site. Dust is a major component of air pollution, generated mainly from the following construction activities:

- Site clearance and use of heavy vehicles and machinery/equipment etc. at construction site;
- Procurement and transport of construction materials such as sand, cement, etc. to the construction site;
- Other Gaseous emissions during construction result from operating of construction vehicles, plant and equipment;
- Increase in air pollution levels without project and with project during construction period (for mobile & stationary sources) is predicted from construction machinery, equipment, which reveals that there shall not be significant contribution towards pollution due to the construction activity of the project if mitigation plan will be implemented and monitored in proper sense; and
- Asphalt heating.

This impact is temporary and moderate in nature.

#### Mitigation

- All vehicles, machinery and equipment to be used during construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions;
- All vehicles, machinery and equipment to be used for the construction should be plugged off or switched off immediately after completion of their work to avoid idling condition;
- Open burning of solid waste from the contractor's camps should be strictly banned;

Only good quality oils, petroleum products and additives should be used in the machinery, generators, and the construction vehicles. Usage of used oil should be strictly prohibited;

- PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works;
- Air emission monitoring program for NO<sub>x</sub>, SO<sub>x</sub>, CO and PM<sub>10</sub> should be undertaken according to the program specified in the EMMP.
- Vehicle and equipment engines should be properly maintained to reduce exhaust emissions of CO, VOCs, and Particulate Matter. Equipment that is in good condition will also reduce fuel consumption. Equipment should be inspected prior to the start of a project. While equipment is on site, a daily inspection should be conducted and parts and hoses showing signs of wear should be promptly replaced. Damaged parts should also be repaired or replaced.
- The fugitive dust emission will be a problem for the nearby settlements, flora and fauna which will be mitigated by sprinkling of water. Also main access roads and exposed terrain should be sprayed by water trucks to minimize the dust.
- Construction workers should be provided with masks for protection against the inhalation of dust.
- During times of windy conditions, where feasible, construction operations that generate greater levels of dust may be avoided or reduced. Instead, these activities can be conducted when more favourable weather conditions occur. Increased application of other dust suppressant techniques may also be considered in times of very windy weather.

#### **D) Noise and Vibration**

The noise and vibration will be produced due to the operation of construction machinery and equipment like 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. Noise and vibration are perceived as one of the most undesirable consequences of construction activity. The above machinery is expected to generate noise levels that would be severe in the project area. This impact is temporary and moderate in nature.

### **Mitigation**

- For the construction machinery generating noise level in excess of that prescribed in PEQS, 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.
- Providing the construction workers with suitable hearing protection like ear cap, or earmuffs and training them in their use.
- Use of low noise machinery, or machinery with noise shielding and absorption.
- Contractors shall comply with submitted work schedule, keeping noisy operations away from sensitive points; implement regular maintenance and repairs; and employ strict implementation of operation procedures.

### **E) Impact on Water Resources (Surface and Groundwater Contamination)**

The proposed project includes the River Training works and Channelization of River Ravi. During construction of proposed barrage and Channelization works, surface water resource may get contaminated by sediments, fuel and chemical spills, or by solid waste and effluents generated by the kitchens and toilets at the construction camp sites. The impact on these water bodies will be only for the period of construction and will vanish as the construction work is over. In addition to that, construction waste, if left unattended will result in forming leachate which may percolate through the soil strata and will reach underground water table and hence, will end up contaminating it. This impact is temporary and adverse in nature.

### **Mitigation**

- Construction camps will be established in areas with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met.
- The surface and groundwater reserves will be adequately protected by installing screens and barriers to protect the source of contamination such as construction and oily waste that will degrade its potable quality.

- The proponent will ensure that the construction work is confined and water bodies are prevented from pollution during construction.
- Suspended sediments would be monitored in the downstream flow and in case of a sudden change for necessary measures.
- The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements.
- Regular water quality monitoring according to determined sampling schedule.
- The contractor will ensure that construction debris do not find their way into the River Ravi which may get clogged.
- Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond.
- Wastes will be collected, stored and taken to approved disposal site. Similarly, if the sewage after treatment is to be discharged on to the land it will meet the requirements of the PEQS for disposal of wastewater.



#### **F) Change in Hydrologic Regime**

The proposed project will involve the construction of a Barrage and Channelization works on River Ravi. There might be change in water flow pattern and disturbance to water flow, which will cause impact on downstream of this water. This impact is moderate in nature.

##### **Mitigation**

Barrage on River Ravi and Channelization works shall be properly designed to accommodate design flows. Provision of culverts to control flood damages and provision of safety of embankments will be considered during the design of these arrangements.

#### **G) Borrow/ Open Pits**

Borrow/ open pits and its excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation and landscape degradation. Borrow/ Open pits may also become potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the Project Area. This impact is permanent and moderate negative in nature.

##### **Mitigation**

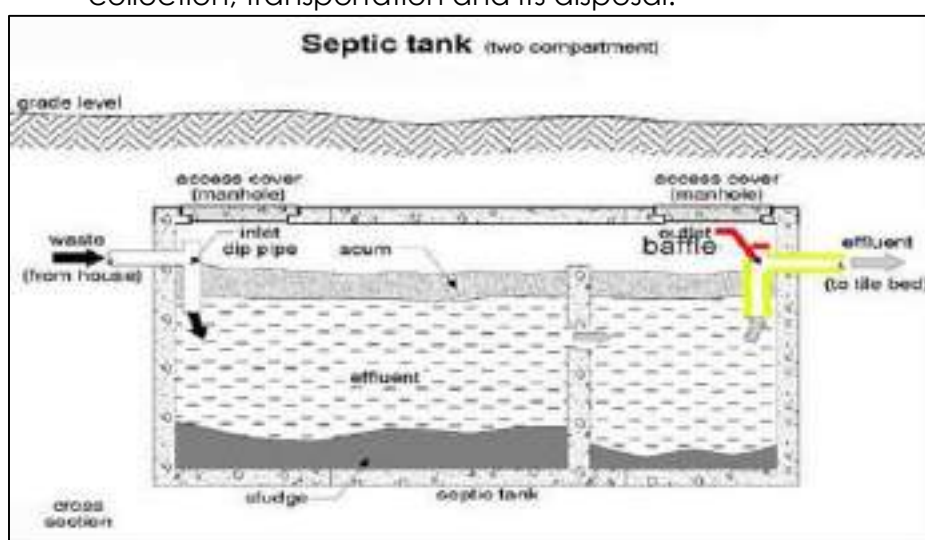
- Necessary permits will be obtained for any borrow pits from the competent authorities;
- In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4;
- Soil erosion along the borrow pit will be regularly checked to prevent/ mitigate impacts on adjacent lands;
- In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and
- Borrow pits will be used for construction waste, but during the excavation, 6 inch top soil cover will be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.

#### **H) Wastewater Generation**

Wastewater will be generated at the construction camps by the workers. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources apart from soil contamination. The estimated wastewater to be generated from construction camps project assuming that on average the water demand per person is 100 liters per day (estimated) and that 80% of the water demand will become wastewater. This impact is temporary and adverse in nature.

## Mitigation

- Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e., septic tanks (as shown in Figure 6.2).
- Proper monitoring to check the compliance of PEQS will be carried out;
- Sewage from construction camps will be disposed of after proper pre-treatment.
- The Contractor(s) will be responsible to submit details of site-specific wastewater management plan along with details of wastewater collection, transportation and its disposal.



**Figure 6.2: Septic Tank**

### I) Solid Waste (Municipal and Construction)

Different type of waste is likely to be generated during the construction phase of the project. The municipal waste will be in the form of food, cans and paper from construction camps toilets and washing yards. Considering the laborers (about 200 in numbers) residing in the construction camp and the locally available labor, an average solid waste generation rate of 0.5 kg/capita/day<sup>9</sup> is adopted for the estimation of solid waste generation. Based on this assumption, a total of about 100 kg of solid waste will be generated from construction camps on daily basis. Construction waste may include excavated soil, sand, gravel, pieces of concrete, bricks, wood, metal pieces and electrical waste. All these, if left unattended, can become a source of nuisance and environmental pollution in the project area. Insecure and unhygienic disposal of the solid wastes particularly garbage and trash may cause degradation of soil and land. Insecurely disposed of heaps of

wastes containing kitchen garbage and food waste can serve as breeding grounds for the disease spreading vectors and rodents. Throwing away of solid wastes into water channels and the wastewater network can result into choking of the latter.

These impacts are temporary and moderate adverse in nature.

### **Mitigation**

- Solid waste generated during construction and camp sites should be safely disposed of at designated waste disposal sites.
- Proper labelling of waste containers, including the identification and quantity of the contents should be carried out.
- Construction workers and supervisory staff should be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste.
- Waste disposal plan must be reviewed during the entire construction phase in the light of changing weather conditions.
- Close coordination should be carried out between RUDA, construction contractor and LWMC / concerned department for the proper disposal of construction waste.

## **J) Discovery of Heritage Sites/ Structures during Excavation**

During construction activities, there is a chance of finding archaeological site. In case of finding any artefact, the contractor shall immediately report through Supervision Consultant to Directorate General (DG) of Archaeology Department, Government of Punjab to take further suitable action to preserve those antiques or sensitive remains. This impact is site specific.

### **Mitigation**

Project may involve deep excavation. Therefore, the possibility of chance find is not ignorable. In case of any chance find, the contractor will immediately report through Supervision Consultant to Directorate General (DG) of Archaeological Department, Punjab, to take further suitable action to preserve those antique or sensitive remains. Representative of the DG will visit the site and observe the significance of the antique, artefact and Cultural (religious) properties and significance of the project. The report will be prepared by representative and will be given to the DG. The documentation will be completed and if required, suitable action will be taken to preserve those antiques and sensitive remains. In case any artefact, antiques and sensitive remains are discovered, chance find procedures should be adopted by contractor's workers as follows:

- Stop the construction activities in the areas of chance find; Delineate the discovered site or area;

- Consult with the local community and provincial Archaeological Department.
- The suggestion of the local communities and the concerned authorities will be suitably incorporated during taking the preventive measures to conserve the antique, artefact and cultural (religious) properties.
- Secure the site to prevent any damage or loss of removable objects. In case of removable antiquities or sensitive remain, a night guard shall be arranged until the responsible local authorities take over.
- After stopping work, the contractor must immediately report the discovery to the Supervision Engineer.

#### **K) Emergency Response**

The construction of the proposed project may encounter emergencies. In addition, disasters such as earthquakes and fires may occur. Lack of Emergency Response Plan (ERP) or an inefficient response plan may lead to an accident or critical injury. This impact is negative, temporary and moderate in nature.

##### **Mitigation**

- An ERP for earthquakes and manmade disasters should be developed by contractor in coordination with supervisory consultant and RUDA. It should be implemented in close consultation with the RESCUE Services and other concerned departments;
- Training of the staff and employees regarding the emergency procedures and plans should be regularly conducted, the nature of emergency will be determined as per designated plans;
- Emergency numbers should be clearly posted at all disposal stations; and Minor incidents and near misses should be reported, and preventive measures should be formulated accordingly by the RUDA Management.

#### **6.3.2 Ecological Environment**

##### **A) Permanent Loss of Habitat**

Due to the construction of a Barrage and Channelization of River Ravi, few habitats may be affected e.g., the river shoreline. This will totally diminish the plant species growing on the shoreline of river Ravi at specific place. In addition, water-land interface is necessary for many amphibians which may be destroyed due to formation of concrete walls. Many reptiles like freshwater turtles use these areas as their nesting sites and doing so will seriously affect

the population of species that are already under threat. As planned in the new development that the width of the river will be fixed whereas in natural flow the rivers do not have a uniform width. This will bring an extra 2.32% area under the river that will be achieved by clearing many adjacent habitats. The forest along the project area which might be affected. Similarly, large area of agriculture and orchard will be lost due to the proposed project. This impact will be permanent and compensated by modern techniques.

### **Mitigation**

- Embankment slopes should be given along with the river. The slope is then planted with grasses, sedges and herbs. This will mitigate the permanent loss of habitat for the threaten species of fresh water turtle. Planting on such bank slopes would increase the value of habitat by providing vertical structural diversity and will provide a compensation for the lost land-water interface for the movement of reptile and amphibian species. It also provides compensation for clearance of vegetation along banks of river.
- NOC must be taken from Forest and Wildlife Departments prior to start of construction in Reserve Forests / Forest Areas.
- Ten (10) trees against each fallen tree of similar floral function on both sides of the proposed Alignment should be planted that will help in rehabilitating the floral and faunal activities of the project area.
- Forests restoration should be done with native species, e.g., *Dalbergia sissoo*, *Tamarix aphylla*, *Acacia nilotica*, *Populus euphratica*, *Prosopis cineraria* and *Tamarix dioca* etc. It will enhance the site value and in part will provide compensation for the lost habitat for the species.
- Compensation should be given to the affectees for agriculture and orchard areas based on current market price.
- The mobility of construction machinery should be planned to minimize the loss of habitat.
- Incorporate technical design measures to minimize removal of trees, if possible such as change in the alignment.
- The construction camp management plan during the planning stage must consider fencing and gating to check the entry of animals in search of eatable goods.
- Similarly, waste management plan of the camps must be considered at the planning stage to prevent wild animals and birds.

### **B) Impact on Aquatic Life**

Various construction phase activities like; controlling the flow of water while creating islands in the river body, construction of a barrage and river

channelization wall to change water flow, will ultimately affect the aquatic life. Many studies have proved that creation of barrages or dams in river channels effect ecology of river, especially fish. As fish needs particular instream flow of water which is disturbed by barrage and hence affect spawning and food activities of this fauna. The construction of a Barrage and the transport of water and sediment will upset the local hydrological equilibrium, and the effects spread through the community, causing a general ecological transition. These responses are an important focus of modern river ecology. Juvenile fish would be affected by altered flow of water.

Fish ladders can also be provided as a useful structure for the fish mobility path, depending on the success of the design. Those fish that successfully negotiate the barrage structure, would then pass into the calmer basin where the change in current flows, sedimentation, directional clues and predation could either benefit or dis-benefit differing species (The Severn Barrage, 2007). There are two categories of threats to fish:

- **Direct:** injury and mortality due to strikes and water conditions (for example water pressure) resulting in damage or disorientation.
- **Indirect:** loss and degradation of habitat which may be important for feeding and spawning; and disruption to movement.

The current development aims to maintain the natural meander of the river but fixing the river width will reduce meander and cause straightening of river as compared to its natural course. Straightening causes the streams to flow more rapidly, which can, in some instances, vastly increase soil erosion. All of this results in faster water flow and higher water levels during floods. The increased erosion results in higher water turbidity, which is a big problem for all aquatic organisms because it reduces the penetration of sunlight into the water. The movements of heavy vehicles on the Katcha tracks, excavation activities, cut and fill processes at the project site, oil and petroleum, bitumen/coal tar and other liquid and chemical spills may also deteriorate the quality of the surface water. This impact is significant in nature.

### Mitigation

- Barrage and Channelization works shall be properly designed to accommodate design flows. Provision to control flood damages and provision of safety of embankments will be considered during the design of these arrangements
- Control of wastewater and sediment releases to river.
- Contractor will be required to implement the water quality management protocols.



- Ensure the minimum ecological flow at downstream area.
- A monitoring program will be initiated for the impact of the construction activities on the aquatic habitat and key species.
- Inspections by the fisheries officers should be facilitated in camps to facilitate the proper implementation of relevant laws.
- All vehicles, machinery, equipment and generators used during construction activities will be kept in good working condition and be properly tuned to minimize the adverse impact on waterfowl habitat by reducing noise, exhaust and land disturbance.
- Communities are given awareness and are involved in the proper protection of the Biota inside and around the project area.
- Proper monitoring to check the compliance of PEQS will be carried out.

### **C) Cutting Down Riparian Vegetation**

The removal of this vegetation leads to increased water temperature and changes in river ecosystems. The absence of riparian belt of vegetation leads to unhindered passage of nutrients into the river. Where this vegetation belt is intact, up to 90% of the nutrients are captured and absorbed before reaching the river. The roots of plants, especially of trees have an important structural role on the reinforcement of river banks because they retain the soil particles and prevent the water from carrying them away.

#### **Mitigation**

Plantation of grasses, sedges and other herbs on the outside embankment slopes and their adjacent areas has a potential to mitigate lost riparian grassland habitats. Planting on such bank slopes would increase the value of habitat by providing vertical structural diversity and will provide a compensation for the lost land-water interface for the movement of reptile and amphibian species. Establishment of extensive and continuous vegetation cover along the embankments of the river banks is highly recommended. It is further recommended that at least 50 m wide continuous green belt comprising of shrubs and trees be established on both sides of the river. A mixture of plant species with various life forms and heights should be used to encourage development of a multi-level canopy which would increase the habitat diversity and resource provision to the biological diversity.

### **D) Wildlife Disturbance**

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. The forest areas close to the river bank exhibit trait of wilderness. Due to construction in this area, human disturbance to

ecosystems, to the wild animals and birds especially. The severity of this disturbance totally depends upon duration of activity in the site, its intensity and frequency. Many mammals and birds can be more disturbed by presence of workers, loud noises and operational construction plants.

### **Mitigation**

- Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor force accordingly and clear orders should be given in this regard.
- Proponent must take NOC from the relevant department prior to construction phase.
- After consultation with the Wildlife Department, site specific Wildlife Safety Plans should be developed.
- Punjab Wildlife Act, 1974 will be followed for compliance.
- Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them.
- Moreover, Proper planning should be done for food storage, setting up of kitchens, production of sewage and wastewater may result in multiplication of rodents like rats, mice and shrew etc. and vectors like mosquitoes, bugs and flies which will have a negative impact.

### **E) Concrete Boundary of River**

River banks are used as corridor for bridging land and terrestrial life. These banks should be as natural as possible of earthen material, grass concrete or pebbles rather than concrete. The concrete boundary will act as a barrier for many amphibians and reptiles that use the sandy banks of the river.

### **Mitigation**

The establishment of grasscrete in the foreshore areas like viewpoints, parking lots and walking tracts can be made with grasscrete using native grasses. "Foreshore is the part of a shore between the water and cultivated or developed land."

Buffer belts along the main roads and railway tracts shall be created using native tree species. This will not only help in the conservation of native species of wild flora and fauna but will also reduce air and noise pollution created by vehicles. A good compensation for the lost habitats can be creation of new habitats at other sites.

## **F) Island creation**

There is also an island proposed in the project area that will be artificially created in phase I. Creating new island will be a fruitful idea if it will provide shoreline and terrestrial habitat to birds and other species. Creation of islands will mean diverting river water to an artificially constructed channel that can lead to reduced water flows in the main channel.

### **Mitigation**

Island in the project area should be planted with the shoreline vegetation which will be removed from the river banks. This will help in compensating the lost vegetation of the riverbank and restoring a new site with native trees.

## **6.3.3 Socio-Economic Environment**

### **A) Impacts on Local Population**

The population residing in and the surroundings of the Project Area will be affected during the construction phase as follows:

- During the construction phase, the general mobility of the local residents and their livestock in and around the Project Area is likely to be hindered.
- Insecurity problems may arise for the local population due to the Contractor's workers during the construction phase.
- Community may face the noise and dust problems during the construction activities.
- Theft problems to the community by the Contractor's workers and vice versa.
- The Kala Khatai Road, Multan Road and Jaranwala Road are very busy locations; commuters may face problems of traffic jams during the construction phase of the project.

### **Mitigations**

- Contractor should select specific timings for heavy machinery operation so as to cause least disturbance to the population considering their peak movement hours.
- Effective construction controls may be made by the Contractor to avoid inconvenience to the population due to noise, smoke and fugitive dust.
- Haul-trucks carrying concrete, aggregate and sand fill materials will be kept covered with tarpaulin to help contain the construction materials being transported to the specific site.

- The Contractor should warn the workers not to involve in any theft activities and if anyone would involve in such type of activities, he will have to pay heavy penalty and would be handed over to police. Similarly, at the time of hiring labor/workers, Contractor has to ensure that the workers should be of good repute/character.
- In order to improve the project ownership among local residents, the contractors should engage local semi-skilled and un-skilled labor on project during construction phase.
- Proper arrangements in the form of alternative routes should be made to ensure that the mobility of locals should not be disturbed.
- A proper traffic management plan has been prepared by the contractor in consultation with Traffic Police Department to reduce the problems of traffic jams during construction.

## **B) Visual Impacts and Aesthetics**

Possible visual impacts during construction phase activities are likely to arise from fugitive dust, on-site storage of construction material, storage of construction debris, physical presence and operation of labor camp which may affect visual and aesthetic aspects of the proposed project area especially Shahdara area and Barrage-I site. This impact is temporary and low adverse in nature.

### **Mitigation**

- a) The construction site should be fenced and all the construction activities should be restricted within the demarcated site;
- b) Condition of the site approach road should be kept free of dust and mud as much as possible through implementation of dust suppression measures; and
- c) All temporary structures, surplus materials and wastes should be completely removed on completion of works.

## **C) Disturbance to Public Properties**

Due to the proposed Project activities, houses, mosques, shrines existing in and around the Project Area may get affected indirectly due to noise and dust.

### **Mitigation**

As there is no direct impact, therefore no mitigation is required. The indirect impact of dust and noise can be reduced by sprinkling water and reducing the noisy activities during the prayer timings.

**D) Accessibility Issue**

Closure of existing unpaved / deteriorated road and other pathways during the construction phase of the project will cause inconvenience to the nearby residents and affecting their daily life activities.

**Mitigation**

Mitigation measures will include public awareness through media, proper traffic diversion plans, appropriate sign boards and timely completion of the project.

**E) Loss of Livelihood**

One of the main assets and sources of income for local people is agricultural land. About 1410.83 acres of agricultural land will be lost due to the implementation of Proposed Ravi Training and Channelization Project. The impact is significant as most people will lose their livelihood by loss of the agriculture land.

**Mitigation**

It is imperative that the land acquisition and resettlement program will be completed prior to the commencement of the construction of the project. It will be necessary to ensure that suitable replacement provision is made for these losses. Every subproject under this strategic developmental plan will prepare Livelihood Restoration Plan (LRP) in order to restore their livelihood.

**F) Impacts on Public Health and Safety Hazards**

The construction activities and vehicular movement at construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents, etc. The proposed project will also have potential of air (dust pollution), noise and vibrational impacts on nearby community. The labor works with different transmittable diseases may cause spread out of those diseases in the local residents. The construction areas located near the residential, settlements, may cause accident for the people moving near to those areas. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Tensions may also arise between different groups within the labor force, and pre-existing conflicts in the local community may be exacerbated. Ethnic and regional conflicts may also be aggravated if workers from one group are moving into the territory of the other.

### **Mitigation**

- Contractor will ensure the provision of medicines, first aid kits, emergency vehicles, etc. at the work place.
- The laborers with different transmittable diseases will be restricted within the construction site.
- Ensure that the site is restricted for the entry of irrelevant people particularly children.
- Training of workers in the construction safety procedures, environmental awareness, and equipping all construction workers with safety boots, helmets, gloves, ear plugs, and protective masks, and monitoring their proper and sustained usage.
- Provision of proper safety and diversion signage, particularly at urban areas and at sensitive/accident-prone spots.
- Setting up speed limits in close consultation with the local stakeholders.
- The mitigation measures provided in the for air and noise shall be adopted to reduce the air pollution, noise pollution and vibrational impacts on nearby community.
- Effective implementation GRM and reduce this impact.

### **G) Occupational Health and Safety**

Occupational Health and Safety (OH&S) related impacts will arise during construction phase activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. Eye injury can be caused by stone or metal particles. Hazard of being hit by falling objects, major hand-arm and whole body vibration hazards, skin and respiratory tract irritation from exposure to cement dust, overexertion and awkward postures etc. will be another impact. Welding hazards include electric shock, fumes and gases, fire and explosions, falls from height, eye and head injuries etc. Security as well as the safety of the Contractor and Consultant staff will be major issue. Operating mechanical and electrical equipment will trigger the H&S issues e.g., struck by moving vehicles or other equipment, slips or trips, struck by flying objects, such as dirt or splashed fluids, caught in pinch points, shear points, crush points, falling from machine etc. Considering these consequences, this impact temporary and medium probability.

### **Mitigation**

- Providing basic medical training to specified work staff and basic medical service and supplies to workers;



- Complying with the safety precautions for the construction workers as per International Labor Organization (ILO) Convention No. 62, as far as applicable to the Project Contract;
- Training of workers in construction safety procedures, environmental awareness, equipping all construction workers with safety boots, helmets, gloves and protective masks, goggles, shields and monitoring their proper and sustained usage;
- Contractor will ensure the provision of medicines, first aid kits, ambulance etc. at the camp site;
- Work areas will be cordoned off where necessary;
- Contractors will instruct their staff to use Personnel Protective Equipment (PPE) (e.g., wire containment, displaying warning signs along the work site, communicating advance warnings to mats) to enhance the safety; and
- Safety lookouts will be built to prevent people and vehicles from passing at the time of hot or cold work; and
- An emergency management plan must be devised by the contractor in close coordination with the provincial emergency services.

#### **H) Workforce from other Region**

This can be particularly acute in smaller communities hosting a largely male workforce and/or a workforce from other regions which may result in conflicts between locals and non-locals concerning employment opportunities, wages and natural resources. Mobile workers can also contribute significantly to gender-based social impacts and risks. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources

The influx of workers and service providers into communities may increase the rate of crimes and/or a perception of insecurity by the local community. Such illicit behaviour or crimes can include theft, physical assaults, substance abuse, prostitution and human trafficking. Local law enforcement may not be sufficiently equipped to deal with the temporary increase in local population.

The influx of people may bring communicable diseases to the project area, including Sexually Transmitted Diseases (STDs), COVID- 19 or the incoming workers may be exposed to diseases to which they have low resistance. This can result in an additional burden on local health resources. Workers with health concerns relating to substance abuse, mental issues or STDs may not wish to visit the project's medical facility and instead go anonymously to local medical providers, thereby placing further stress on local resources. Local

health and rescue facilities may also be overwhelmed and/or ill- equipped to address the industrial accidents that can occur in a large construction site.

Large populations of workers generate increased amounts of waste, for which no sufficient local waste management capacities may exist, which would likely lead to improper disposal practices. The camp use can result in increase in noise and light pollution especially at night. The construction of new access roads can also lead vegetation removal and landscape transformation.

### **Mitigation**

- The Contractor will prepare the plan related to construction camp and labor management. This will be reviewed and approved by RUDA.
- The Contractor will select the specific timings for the construction activities particularly near the settlements, so as to cause least disturbance to the local population, particularly women.
- Local population will be given preference in construction related jobs. Most unskilled workers will be hired from local communities, while for skilled manpower also, first choice will be given to local area residents.
- Contractor will take due care of the local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions.
- The contractor will also ensure that solid waste and wastewater is disposed of in an approved method only.
- The contract will explore alternative water sources and ensure that water usage by the project does not affect or compete with water requirements of the local community.
- SOPs related to COVID-19, should be implemented by the contractor and should be strictly monitored.

### **I) Archaeological / Monument / Cultural Site**

During field survey it was observed that two cultural/historical/archaeological properties are present in the proximity of Phase-I of River Channelization Project. One is Kamran Baradari, which is a monument declared as “Special Premises” by Punjab Government under Punjab Special Premises (Preservation) Ordinance, 1985. It is also an archaeological site / monument protected by the Federal Government located in Punjab Province under Guidelines for Protected Areas, 1997. This site is about 1.5km downstream to the project area. Second is Jahangir's Tomb, which is also protected by the Federal Antiquities Act 1975. The site was also inscribed on the tentative list

Section - 6: Anticipated Environmental Impacts and Mitigation Measures

Source: The World Bank Report 2012 – What a Waste: Average is 0.45 kg/capita/day.

for UNESCO World Heritage Site status in 1993. It is also 0.5km away from the construction areas, hence, no impact is expected.

Due to this river channelization project, it is apprehended that the rise in water level and other construction activities, may pose some threat of damage to this historical monument. Such historic structures are vulnerable to damaging effects from vibration, generated from heavy construction vehicles and equipment.

### **Mitigation**

- The high water level near Baradari should be managed by construction protection wall around the Baradari.
- Detailed hydrological and geotechnical investigations should be carried out to assess the level of impact and to design the mitigations accordingly.
- In addition, best construction techniques and closely monitored activities should be carried out to save Kamran Baradari and Jahanir's Tomb from vibration impacts.

## **6.4 IMPACTS AND MITIGATIONS MEASURES DURING THE PROJECT**

### **OPERATION**

#### **6.4.1 Sedimentation and Erosion**

A water body is proposed to be formed by constructing gated structures along Ravi River in the proposed project area. This channel is planned to provide a sizeable water body that would enhance the aesthetics of the proposed project area as well as recreational facilities to the people living in the neighbourhood.

The construction of this barrage across the Ravi, may encounter sediment deposition due to relatively very low flow-velocities that are generated because of high increase in flow areas due to artificially increased water level, as compared to those in the original condition of the river. The drop in flow-velocity decreases the sediment transport capacity of the stream which may causes deposition of the sediment in the River.

The lack of sediment flowing downstream combined with the natural erosive force of the flow of the river creates erosion in the form of deepening of the river channel in project area and widening and deepening outside the project boundaries. These sediments play an important role in nourishing both natural ecosystems and agricultural land downstream. The impact is moderate negative.

### Mitigation

- Regular Flushing of river is required to flush out the deposited sediments. Natural flushing can happen during the flooding season but steps must be taken in a case if natural flushing is not being happening. The flushing will have positive impact on life of the project water body and downstream ecosystem.
- Afforestation is needed at downstream banks of the river beyond the boundaries of project areas in order to prevent shore from erosion.
- Sedimentation Management Plan is needed as part of River Basin Management Plan to be developed before the operational phase of project.

#### 6.4.2 Aquatic Weeds Formation in River Basin

The condition of proposed river will be ideal for the aquatic weeds formation because the aquatic weeds are ideal to form with decrease in flow of river and trapped sediments in a favorable climatic condition (25-42 °C) like Lahore. Due to aquatic weeds formation, there will be negative impacts on Entire River and its related ecosystem. The impacts are given as follow-:

- An aquatic weed reduces the effectiveness of river water body for fish production.
- Aquatic weeds can assimilate large quantities of nutrients from the river water reducing their availability for planktonic algae.
- They may also cause reduction in oxygen levels and present gaseous exchange with river water resulting in adverse fish production.
- The excessive weed growth may provide protective cover in river water for small fish growth it may also interfere with fish harvesting.
- Dense growth of aquatic weeds may provide ideal habitat for the development of mosquitoes causing malaria, encephalitis and filariasis.
- These weeds greatly reduce the aesthetic value of river water body from a recreational point of view.
- They cause tremendous loss of water from water bodies like lakes and dams through evapo-transpiration.

#### Mitigation:

Although many methods exist for the control of aquatic weeds but best possible measures that can employ under the circumstances are given as under-:

- a) The aquatic weeds can be controlled biologically by the introduction of various herbivorous species. Introduce grass carp with common carp, turtles, Ducks and Geese are well known for aquatic weed feeders. The grass carp and turtles are very much effective in controlling aquatic weed because they feed directly on these weeds. The common carp feed on bottom dwelling plants and sediments and important to root out of these plants.
- b) The above measure will be very much effective in controlling aquatic weeds although still if problem exist then mechanical aquatic harvester should be employed for cutting and removing all the weeds present in the river water body.

### **6.4.3 Impact on Downstream Barrage**

Due to increase in volume of water and flow velocity especially during monsoon, there may be impact on downstream areas.

#### **Mitigation**

- The increased volume of water will be managed by constructing barrages.
- The barrages will be designed to deal with extra water flow if encountered at any stage.

### **6.4.4 Impact on Micro Climate**

- The sizeable water body is likely to have only a very minor effect on the local micro-climate as compared to the no project situation. There is likely to increase in humidity in nearby areas due to increase in volume of water and the presence of the water body could moderate low winter temperatures and reduce the summer maximums.

#### **Mitigation**

Plantation plan.

## **6.5 POTENTIAL ENVIRONMENTAL AND SOCIAL ENHANCEMENT MEASURES**

### **6.5.1 Ecological Uplifting of River Ravi**

The River Ravi is known as River of Death because all the ecological functions have disturbed due to industrial and sewage pollution. The birds and fishes which once thrive in the river have all gone and the river takes the form of sewerage. The current project will help in entire ecological uplifting of the river. The abundance of fresh water will have overall positive impact on ecosystem and its functions. The proposed artificial islands provided in the river will be habitat for many birds and native species. The food chain will be

naturally created with some artificially species inductions and the fauna which once seen around the River Ravi will emanate. The Ecological uplifting will have direct benefit of providing food resources and indirect benefit in increasing aesthetic beauty of the river.

### **6.5.2 Recreational Activities and Tourism**

The development of proposed Ravi River Front Urban Development Project opens the doors for tourism and recreational activities like boating, sport fishing, hoteling, visiting and wildlife viewing. The project has state of the art parks and floating island which will be worthwhile for watching, visiting and picnics, spaces and new places to visit, admire and enjoy. Hotels and restaurants build at bank of the river will attract national and international tourists that have overall positive impact on economy of the region. It will provide the general public with an open space for leisure and recreation and will do the revitalization of the neighbourhood. In addition, the Riverfront development will create and promote a more positive image of the Lahore city.

### **6.5.3 Job Opportunities**

During the design, construction and operational phases of the project there will be a demand for workers, both skilled and unskilled. This will include opportunities for all relevant local peoples directly on the construction site and also indirectly in related service works such as supply of construction materials etc. During the detailed design phase of the proposed strategic plan, the clearer picture of extent of job opportunities would be estimated. Among these opportunities, the preference shall be given to locals, especially those who lose their assets and livelihood. During the operation phase, the project will have commercial centres, business centres, hotels, recreational facilities, offices and educational and health institutions. All of these interventions will create more job opportunities which will ultimately uplift the earning as well as life standards of the residents of area.

### **6.5.4 Economic Uplifting of the Region**

The project will create new opportunities with great benefit to create one of the powerful economic zones of the country. The new city created at the banks of the river will be economic hub of the region at national and international levels. The new city developed will also know as Economic City. It will open new horizons for business community as well as for professionals and labor class. This riverfront development will bring benefit for all city residents through generation of wealth, job and improved built environment and physical infrastructure.



The riverfront development will give economic benefits to local people and business establishments, that it will attract public and private establishments and will boost investment activity and economic regeneration. In addition, it will increase the city's value in economic competitiveness, will attract more investment, will lead to more spending and will offer substantial premiums to developers, landowners and local government. Moreover, it will increase real estate tax revenues and cause Economic spin-off's by rising the value of properties and acting as a catalyst for redevelopment and renewal of nearby places.

#### **6.5.5 Flood Protection**

Flood events are a part of nature. They have existed and will continue to exist. Floods have devastating impacts on human's losing thousands of lives, property, livestock and agriculture whenever it hits. Considering devastative impacts of flood in Pakistan, it should be prevented. River Training and Channelization is designed to cater the maximum flood that occurs in the history of River Ravi. The maximum flood observed in River Ravi was in 1988 which was around 576,000 cusecs. This was unusual event but the River Ravi has now been channelized that will cater the 1000 year return period flood of 5,86,000 cusecs. So this is one of the important benefits that will avoid the flow of flood water into the developed areas.

## SECTION - 7: ENVIRONMENTAL MANAGEMENT PLAN (EMP)

This Chapter provides an overall approach for managing and monitoring the environmental issues and describes the institutional framework and reporting mechanism to implement the Environmental Management Plan (EMP) for the River Ravi Training and Channelization. This chapter also includes a Resettlement Policy Framework (RPF) to deal with social/resettlement issues. The EMP has been prepared with the following objectives:

- Provide the details of the project impacts along with the proposed mitigation measures, and a corresponding implementation schedule.
- Define the roles and responsibilities of the project proponent, contractor, and supervisory consultants in order to effectively communicate environmental issues among them.
- Frame a monitoring mechanism, reporting frequency, auditing mechanism and identifying monitoring parameters to ensure that all the mitigation measures are completely and effectively implemented.
- Define the requirements necessary for documenting compliance with EMP and communicating it to all the concerned regulatory agencies.
- Providing a cost estimate for all proposed EMP actions.

### 7.1 SCOPE OF THE EMP

The scope of the EMP includes the following phases of the proposed Project:

- Pre-construction Phase;
- Construction Phase; and
- Operation and Maintenance Phase.

All the activities performed during these phases will be controlled and monitored according to this EMP.

### 7.2 REGULATORY REQUIREMENTS AND APPLICABLE STANDARDS

The main law and legislation concerned with the environment is Pakistan Environmental Protection Act (PEPA) 1997 now been amended as Punjab Environmental Protection Act, 1997 (amended 2012 and 2017) for Punjab after 18th amendment. This Act is a fairly comprehensive legislation and provides for protection, conservation, rehabilitation and improvement of the environment.

The salient features of the law are:

- No proponent of a project shall commence construction or operation unless he has filed with the Government Agency designated by Federal EPA or Provincial EPAs an EIA, and has obtained NOC.

- Establishment and Formation of the Pakistan Environmental Protection Council (PEPC).
- Powers and Functions of the Federal and Provincial Environmental Protection Agencies.
- Prohibition of certain discharges or emissions.
- PEQS, 2016 for wastewater, air emissions and noise.
- Empowers Federal and Provincial Government to issue notices and to enforce them for the protection of the environment.

The proposed project related environmental laws/guidelines are as follows:

- Pakistan Environmental Protection Agency Regulations, 2000 for Review of IEE and EIA
- Pakistan Environmental Impact Assessment Procedures
- Guidelines for Public Consultation
- PEQS, 2016
- Sectoral Guidelines for Environmental Reports, October 1997.

Refer Chapter 3 for details regarding regulatory requirement and applicable standards.

### **7.3 INSTITUTIONAL ARRANGEMENTS FOR IMPLEMENTATION OF EMP DURING CONSTRUCTION PHASE**

The key players involved during construction phase of the proposed Project are the RUDA as employer/proponent, EPA-Punjab, the Supervisory Consultant (SC) and the Contractor. The roles and responsibilities of these organizations are outlined below.

The following staff will be involved in the implementation of EMP:

- RUDA/ Proponent / Deputy Director Environment;
- Environmental Specialist of SC's; and
- Contractor's Environmental Manager.

The proponent (RUDA) will make Contractor bond through contract documents to implement the EIA including EMP and other terms and conditions of the Environmental Permit. The whole EMP will be included as a clause of the contract documents. Construction camps will be established after necessary approvals and submission of Site-Specific EMPs to be developed in the light of the relevant agencies requirements, before commencement of new works.

## 7.4 ENVIRONMENTAL MANAGEMENT TEAM ALONG WITH THEIR ROLES & RESPONSIBILITIES FOR IMPLEMENTATION OF EMP

### 7.4.1 Construction Phase

This sub section describes the roles & responsibilities required for the implementation of EMP. Following are the agencies involved in the implementation process:

- RUDA/ Proponent / Deputy Director Environment;
- Environmental Specialist of SC's; and
- Contractor's Environmental Specialist.

The executing agency of the project will be RUDA. Project Director (PD) from RUDA will be the overall in-charge of the project. PD-RUDA will delegate the supervisory responsibilities of the project to Deputy Director (DD)-Environment, RUDA. EPA Punjab will act as the regulatory body. The specific roles of key functionaries in implementation of EMP are described below:

#### A) RUDA/ Proponent / Deputy Director Environment

##### **Project Director**

The Project Director will be responsible for the successful implementation of the project. He / She will be assisted by the Supervision Consultants. The Project Director will have one Deputy Director Environment.

##### **Deputy Director (DD)-Environment**

The Deputy Director (Environment) will be handling the RUDA obligations with respect to the EMP. DD-Environment will be responsible for ensuring that the provisions of the EMP are implemented. In addition, the DD-Environment will also coordinate with the EPA Punjab to ensure compliance of provisions of environmental approval of the project. The DD Environment will be assisted by two (02) Assistant Directors (ADs) for environment and social aspects. Each of the ADs will be assisted by two field inspectors.

##### **Supervision Consultant (SC)**

Supervision Consultant appointed by RUDA will be headed by a "Project Manager". Environmental Engineer / specialist of Supervising Consultant (SC) will oversee the performance of contractor to make sure that the contractor is carrying out work in accordance with Site Specific Environmental Management Plan (SSEMP) as mentioned in the contract documents and EIA. The Environmental Engineer / Specialist will also provide assistance to the Contractor's Staff to implement EMP. SSEMP will be prepared by the contractor under the supervision of Environmental Specialist of SC. The SSEMP would be approved by the supervision consultant. EE of SC will provide guidance to the contractor's EE for implementing each of the activity as

given in EMP. EE of SC will be responsible for record keeping providing instruction through the Resident Engineers (REs) for corrective actions and will ensure the compliance of various statutory and legislative requirements. EE of the SC will maintain close coordination with the contractor and DD of RUDA for successful implementation with environmental safeguard measures. However, overall responsibilities of EE of SC are as follows:

- Directly reporting to Resident Engineer.
- Discussing various environmental issues and environmental mitigation, enhancement and monitoring actions with all concerned directly or indirectly.
- Review contractor's SSEMP as part of their work program.
- Inspect, supervise and monitor all the construction and allied activities related to the EMP for the project.
- Ensure that all the environmental and social parameters/provisions fulfil the requirements according to applicable standards.
- Ensure that day-to-day construction activities are carried out in an environmentally sound and sustainable manner.
- Ensure that all the mitigation measures proposed are being followed by the contractor.
- Prepare environmental compliance reports against the provisions of the environmental approval of the project.
- Develop "good practices" construction guidelines to assist the contractors and RUDA staff in implementing the EMP.
- Assist Resident Engineer to ensure the environmental sound engineering practices;
- Assisting contractor and DD RUDA in all matters related to public contacts including public consultation pertaining to environmental and community health & safety issues;
- Carryout out environmental monitoring;
- Organizing training to Environmental Manager of contractor and field staff;
- Preparing and submitting monthly and quarterly environmental progress / compliance reports to DD RUDA.

### **Construction Contractor**

EMP will be made part of the construction contract agreement and the contractor will ensure that all project activities are in compliance with the EMP.

- Environmental Specialist of contractor will prepare Site Specific EMP, monitoring plan traffic control / diversion plan, and asphalt and batching plant area plans and will submit all the plans to the Environmental Specialist of SC.
- Environmental Specialist of contractor will be responsible for the implementation of EMP and to take effective measures against corrective actions plan;
- Environmental Specialist of contractor will prepare compliance reports as per schedule and will submit it to the SC;
- Provision of proper Personal Protective Equipment (PPEs) to the workers and train them on proper use;
- Environmental Specialist of Contractor will conduct the environmental and health & safety trainings to the workers / labor.
- Reporting to the Environmental Specialist of SC on status of EMP implementation for onward submission to DD- Environment RUDA and EPA Punjab.

#### 7.4.2 Operation and Maintenance (O&M) Phase

The proposed Project will be administrated by RUDA during the O&M phase. The Project Director and DD Environment along with ADs will be responsible for the following:

- Coordinating with the operational staff to monitor environmental compliance during operation;
- Advising on, and monitoring tree plantations along the proposed project;
- Reporting on the progress of environmental compliance to the EPA Punjab;
- Assessing the long-term environmental impacts of operation;
- Sustaining a working partnership among the RUDA, EPA-Punjab, Agriculture, Irrigation, Forest and Wildlife departments of Lahore and Sheikhpura; and
- Reporting to Project Director RUDA about progress of the work.

#### 7.5 MITIGATION MANAGEMENT MATRIX (MMM)

This matrix identifies the environmental impacts of River Ravi Training and Channelization Project during the construction and operation stages and establishes the linkages between the environmental and social impacts, mitigation strategy and the agencies responsible for execution. The MMM presented in **Table 7.1** identifies the following:



- The 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.

**Table 7.1: Environmental Management Plan for River Ravi Training and Channelization Project**

Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring Parameter/Monitoring Method
			Execution	Supervision	
PRE-CONSTRUCTION / DESIGN PHASE					
Contractor's Mobilization					
1.	If the contractor is made responsible to comply with EMP, there will be several construction related impacts.	<p>In order to make the Contractors fully aware of the implications of the EMP and responsible for ensuring compliance, technical specifications in the tender documents will include compliance with mitigation measures proposed in the EIA. The Contractor must be made accountable through contract documents for the obligations regarding the environmental and social components of the project. Contractor need to prepare site-specific construction environmental and social action plans (CESAP) to manage and mitigate potential adverse environmental and social impacts. CESAP will be reviewed and approved by CSC and RUDA. CESAP should include the following but not limited to:</p> <ul style="list-style-type: none"><li>• Material Transportation Plan</li><li>• Construction Camp Management</li></ul>	Contractor	SC, RUDA	<ul style="list-style-type: none"><li>• The Environment Specialist of the contractor should prepare such plans and share with supervision consultant and the project proponent i.e. RUDA.</li></ul>

		Plan ,Tree plantation plan, Borrow Area Management plan, Disaster Management plan, pandemic management plan,traffic management plan, Risk management plan • Emergency Response Plan • Solid Waste Management Plan			
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Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring Parameter/Monitoring Method
			Execution	Supervision	
Social Impacts during Pre-Construction (Land Acquisition and Resettlement)					
2	<ul style="list-style-type: none"><li>Agriculture land acquisition of about 1410.83 Acres.</li><li>Resettlement of 634 households with population 4,271.</li></ul>	<ul style="list-style-type: none"><li>The payment of full, fair and prompt compensation to the affected people should be made in accordance with LAA, 1894 and the proposed RPF.</li><li>For the purpose of resettlement, only those villages will be relocated which are falling in the riverbed, while all other settlements and houses will be retained. Various options (like apartments, model villages, land for land) have been explored to resettle these settlements which are given in RPF.</li></ul>	RUDA	RUDA	<ul style="list-style-type: none"><li>Services of local administration and revenue department shall be sorted to resolve this issue.</li></ul>
Forest Clearance/Tree Cutting					

	<ul style="list-style-type: none"> <li>Two forests will partially be affected covering an area of about 138.76 acres.</li> <li>Impact of Wildlife Habitat and disturbance to Ecosystem.</li> </ul>	<ul style="list-style-type: none"> <li>The forest area may be avoided either by converting them into island or by diverting/realigning the river channelization.</li> <li>The mature trees falling in the land to be used for various developmental purposes under this project will be shifted to dedicated green areas/gardens with the help of tree transplanting machines instead of cutting.</li> </ul>	Contractor	SC/RUDA	Regular monitoring by CS and RUDA to make sure the minimum impact on forest and trees.
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Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring Parameter/Monitoring Method
			Execution	Supervision	
Impact due to Diversion of River					
3	Failure of the Cofferdam during construction includes a partial or total Failure of the Cofferdam resulting delay in the Project schedule, loss or damage to equipment, temporary or permanent damage to structures, serious injury, or even loss of life and/or the release of sediment and/or debris downstream.	Standard acceptable engineering design considers and accounts for the associated loadings or stresses which will be imposed on the Cofferdam. Mitigation measures include, but are not limited to, designing the Cofferdam to relevant codes and scheduling of activities to accommodate weather interruptions, and regular inspections by the Project Engineer of the Cofferdam.	Contractor	CS, RUDA	Daily inspections of the Cofferdam will identify potential weakness or soft spots in the Cofferdam
CONSTRUCTION PHASE					
Physical Environment					
4	<ul style="list-style-type: none"><li>Soil erosion may take place in the camp areas as a result of improper runoff drawn from the equipment washing.</li><li>Soil contamination may take place due to the generated solid waste at camp site in addition to oil spillage and use of chemicals at site.</li></ul>	<ul style="list-style-type: none"><li>Good engineering practices should be adopted by Contractors, which will help to control soil erosion both at the construction sites, particularly at camp areas and overhead structures.</li><li>Soil contamination can be curtailed by reducing the oil spill in the camp as well as at project construction areas, proper solid waste management and placing chemical containers in caissons.</li></ul>	Contractor	SC/RUDA	<ul style="list-style-type: none"><li>Equipment washing method and frequency to be regulated/controlled.</li><li>Vegetation to control erosion.</li><li>Placement of solid waste storage containers at camp sites.</li><li>Collection and disposal into LWMC containers.</li></ul>

Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring Parameter/Monitoring Method
			Execution	Supervision	
	<ul style="list-style-type: none"> <li>Scarified/scraped materials, which are not disposed of properly, may contaminate soil resources.</li> </ul>	<ul style="list-style-type: none"> <li>The Contractor is required to impart proper training to his workforce in the storage and handling of obnoxious materials, like furnace oil, diesel, petrol and chemicals, etc., that can potentially cause soil contamination.</li> </ul>			<ul style="list-style-type: none"> <li>Maintenance of construction vehicles</li> </ul>
5	<ul style="list-style-type: none"> <li>Due to construction activities i.e., drilling, excavation and dumping of soil, chemicals, oil, lubricants, detergents, etc. surface water quality can be slightly deteriorated.</li> <li>Sewage is generated from the construction camps. This may contaminate surface and groundwater, if not disposed of properly</li> <li>Due to the construction activities of the proposed Project the existing hydrology of the Project Area may get disrupted, which mainly includes disturbance in existing drainage of the site.</li> </ul>	<ul style="list-style-type: none"> <li>The contractor should instruct its staff not to throw any of the waste and the other scarified/scraped materials directly into the river or any surface water body in order to avoid contamination. The batching plant should place at least 1 KM away from river</li> <li>Construction camps should be developed in area having natural drainage and its sewage will be disposed off using septic tank</li> <li>Construction should be done only on the required land and with minimum disturbance so that the natural drainage will be prevented.</li> <li>Avoid accidental spills of oils and lubricants through good practice and develop emergency response plans and procedures</li> </ul>	Contractor	SC/RUDA	<ul style="list-style-type: none"> <li>Contractor should clearly instruct his workers no to throw anything directly in to the river.</li> <li>Provision of Septic tank/soakage pit in Camps</li> <li>Emergency Response Procedures in case of Accidents</li> </ul>



Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring Parameter/Monitoring Method
			Execution	Supervision	
6	<ul style="list-style-type: none"> <li>Generation of particulate- matter (PM<sub>10</sub>), smoke, dust, CO and NO<sub>x</sub> in the ambient air from the 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. which may deteriorate the air quality and resulting in impacts on human health, fauna and flora</li> </ul>	<ul style="list-style-type: none"> <li>Tuning of vehicles should be made mandatory to reduce the emissions of NO<sub>x</sub>, CO, Hydrocarbons (HC) and PM.</li> <li>Emissions from the batching plants should be controlled with appropriate control equipment (such as fabric filters or cyclone separators).</li> <li>Equipment and vehicles powered with diesel should be well maintained to minimize particulate emissions.</li> <li>Haul-trucks carrying, earth, sand, aggregate and other materials should be kept covered during transportation of materials and during storage on site, with tarpaulin to contain the construction materials being transported within the body of each carrier between the sites.</li> <li>The fugitive dust emission will be a problem for the nearby settlements, flora and fauna which will be mitigated by sprinkling of water. Also main access roads and exposed terrain should be sprayed by water trucks to minimize the dust.</li> </ul>	Contractor	SC/RUDA	<ul style="list-style-type: none"> <li>Regular tuning of construction equipment and vehicles.</li> <li>Covering of construction material with tarpaulin.</li> <li>Vehicles Emissions Reports.</li> <li>Checking of Water Spraying.</li> </ul>
7	<ul style="list-style-type: none"> <li>Noise and Vibration can be generated and have negative impact on surroundings from the machinery utilized for the construction work</li> </ul>	<ul style="list-style-type: none"> <li>Proper tuning of vehicles should be done in order to control noise levels that exceeds PEQS.</li> <li>Movements of the trucks and other construction machinery causing high noise levels must be restricted at night time. Truck drivers should be instructed not to play loud music at night and stop use of horn.</li> <li>Proper noise barrier boundary walls will be built on asphalt/ concrete plants which come close to any locality.</li> </ul>	Contractor	SC/RUDA	<ul style="list-style-type: none"> <li>Noise Emission Reports of Vehicles</li> <li>Maintenance Records of Vehicles <ul style="list-style-type: none"> <li>Proper Noise Barrier wall in case of asphalt plant that exist close to the settlements</li> </ul> </li> </ul>

Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring Parameter/Monitoring Method
			Execution	Supervision	
8	<ul style="list-style-type: none"> <li>During the development large quantity of construction waste will produce, the disposal of which, if not managed properly could have negative impacts on the site and surrounding areas.</li> <li>Inadequate provision of portable restrooms like worker's camps, temporary restaurants and garbage dumpsters at the construction site could lead to unsanitary and unhygienic conditions. Resulting impacts could vary from unsightly littering of the site, fly and vermin infestations to increased nutrient levels in the drains.</li> </ul>	<ul style="list-style-type: none"> <li>A site waste management plan should be prepared</li> <li>Appropriate waste storage area on the site should allocated</li> <li>Timely collection, waste segregation and removal of construction debris to an approved dump site.</li> <li>Compost should be made from organic waste</li> <li>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.</li> </ul>	Contractor	SC/RUDA	<ul style="list-style-type: none"> <li>Waste management Plan</li> <li>Provision of restrooms and temporary wash rooms by contractor at site</li> </ul>

Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring Parameter/Monitoring Method
			Execution	Supervision	
Ecological Environment					
9	<ul style="list-style-type: none"><li>During the construction activities some of the vegetation from land and from shore needs to be removed. The removal of vegetation may have negative impact on micro climate of the area. The removal of vegetation from bank may increase nutrient level and temperature in river</li></ul>	<ul style="list-style-type: none"><li>Buffer belt of native species should be planted along the roads and railway tracks in order to extend the wild life habitat and compensation for loss of trees in the area.</li><li>Embankment slope should be given along with river and planted with grasses herbs and Serb in order to compensation for removal of vegetation from bank of river</li><li>Conservation steps should be taken for the already neglected forests and Shahdara forest. This will have positive impact on overall micro climate of area.</li><li>The big trees removed from land will be transplanted in Eco zone of phase III or any other area suggested by forest department.</li></ul>	Contractor / Forest Department / PHA	SC/RUDA	<ul style="list-style-type: none"><li>Heath and Growth of Transplanted Trees</li><li>Tree Plantation Plan</li><li>Conservation Plan</li></ul>
10	<ul style="list-style-type: none"><li>Few of the habitats will be lost permanently e.g., river shoreline. The river shore is significant for fauna species</li></ul>	<ul style="list-style-type: none"><li>Embankment slope should be given along with the concrete wall and then planted with grasses and herbs</li></ul>	Contractor	SC/RUDA	<ul style="list-style-type: none"><li>Monitoring of construction activities.</li></ul>

Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring Parameter/Monitoring Method
			Execution	Supervision	
	<p>(reptiles and amphibians) like fresh water turtles that uses shore as nesting places.</p> <ul style="list-style-type: none"> <li>▪ Migratory birds that uses the route of Indus flyway may be disturbed due to construction activities in winter season.</li> <li>▪ Load noises during construction activities near forest may disturb the wild life especially birds species.</li> </ul>	<p>in order to provide the habitat for fauna species</p> <ul style="list-style-type: none"> <li>▪ Construction activities along river should be restricted in migratory period</li> <li>▪ Avoid loud noise during construction activities.</li> </ul>			
12	<ul style="list-style-type: none"> <li>▪ Impact of underwater noise levels from pile driving on Fish fauna vocalization and behavior.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Use of vibratory hammers instead of impact hammers.</li> <li>▪ Monitoring of underwater noise levels and use of bubble curtains around piles to reduce noise levels if required.</li> <li>▪ 'Soft start' (gradually ramping up sound levels) approach during drilling to chase away fish fauna.</li> </ul>	Contractor	SC/RUDA	<ul style="list-style-type: none"> <li>▪ Regular check especially at the time of barrage construction.</li> </ul>
<b>Social Environment</b>					
13	<ul style="list-style-type: none"> <li>▪ During the construction phase, the general mobility of the population using the roads in and around the Project Area will be hindered.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Effective construction controls may be made by the Contractor to avoid inconvenience to the population due to noise, smoke and fugitive dust.</li> </ul>	Contractor	SC/RUDA	<ul style="list-style-type: none"> <li>▪ Timing of vehicle movement to be noted.</li> <li>▪ Checking of Traffic Management Plan</li> </ul>

Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring parameter/Monitoring Method
			Execution	Supervision	
	<ul style="list-style-type: none"> <li>People will face the noise and dust problems during the construction phase</li> <li>The Kala Khatai Road, Multan Road and Jaranwala Road are very busy locations; commuters may face problems of traffic jams on these major roads during the construction phase of the project.</li> <li>Insecurity problems may arise for the local population due to the Contractor's workers during the construction phase</li> </ul>	<ul style="list-style-type: none"> <li>Temporarily, the Contractor should select specific timings for heavy machinery operation so as to cause least disturbance to the population considering their peak movement hours.</li> <li>Proper traffic management plan should be prepared in consultation with Traffic Police Department to reduce the problems of traffic jams during construction.</li> <li>The Contractor should warn the workers not to involve in any theft activities and if anyone would involve in such type of activities, he will have to pay heavy penalty and would be handed</li> </ul>			
14	Potential of about 200 employment opportunities for local communities in un-skilled and semi-skilled category.	Preference to the local communities in the construction works should be given. Their capacity building should also be done before engagement.	Contractor	SC/RUDA	SC and RUDA should regularly check to make sure the hiring of local people.
15	Due to the proposed Project activities, houses, mosques and shrines existing in and around the Project Area may get	This indirect impact of dust and noise can be reduced by sprinkling water and reducing the noisy activities during the prayer timings.	Contractor	SC/RUDA	<ul style="list-style-type: none"> <li>Water Sprinkling should be checked</li> <li>Regular Environmental Monitoring of Noise should be done</li> </ul>

Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring Parameter/Monitoring Method
			Execution	Supervision	
	affected indirectly due to noise and dust.				
16	The proposed project will cause traffic jams and congestions on various roads like Grand Trunk Road, Sagian Wala Bypass Road, Khaju Ranwali Road, Bund Road Shahdara and Kala Khatai-Narang Mandi Road.	<ul style="list-style-type: none"> <li>• Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime to reduce traffic load and inconvenience to the local population.</li> <li>• Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid unnecessary congestions along the major roads.</li> <li>• The speed of the vehicles will be controlled to reduce the probability of severe accidents, soil erosion, debris flows due to vibrations and dust emission.</li> </ul>	Contractor / Traffic Police, Lahore	SC/RUDA	<ul style="list-style-type: none"> <li>▪ Regular Monitoring by SC and RUDA especially the timings of heavy vehicle movement.</li> </ul>
17	Labor influx may create social and gender issues due to the unawareness of local customs and norms and can hinder the mobility of local women.	The contractor will be required to provide mandatory and repeated training to workers on sexual exploitation and abuse and HIV/AIDS prevention.	Contractor	SC / RUDA	Regular Monitoring and check by RUDA and SC.
18	Due to this river channelization project, it is apprehended that the rise in water level and other construction activities, may	<ul style="list-style-type: none"> <li>• Detailed hydrological and geotechnical investigations should be carried out to assess the level of</li> </ul>	Contractor	SC / RUDA / Archaeological	Regular Monitoring especially when construction works near



Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring Parameter/Monitoring Method
			Execution	Supervision	
	pose some threat of damage to Kamran Baradari, a historical monument located about 1.5km downstream from the proposed barrage and Jahangir's Tomb located on right bank at distance of about 0.5km. Such historic structures are vulnerable to damaging effects from vibration, generated from heavy construction vehicles and equipment.	<p>impact (if any) and to design the mitigations accordingly.</p> <ul style="list-style-type: none"> <li>In addition, best construction techniques closely monitored activities should be carried out to avoid any impact on both these historical sites.</li> </ul>		Department of Punjab	Kamran Baradari are under process.
<b>Operation Stage</b>					
19	<ul style="list-style-type: none"> <li>There may be problem of sedimentation in proposed river structure due to decrease in flow and erosion downstream beyond the boundaries of project area.</li> </ul>	<ul style="list-style-type: none"> <li>Regular Flushing of river is required to flush out the deposited sediments.</li> <li>Afforestation is needed at downstream banks of the river beyond the boundaries of project areas in order to prevent shore from erosion.</li> <li>Sedimentation Management Plan is needed as part of River Basin Management Plan to be developed before the operational phase of project.</li> </ul>	Forest Department / Irrigation Department	RUDA/EPA	<ul style="list-style-type: none"> <li>Sedimentation monitoring in River Basin</li> <li>Erosion Monitoring Downstream</li> </ul>
20	Aquatic Weeds may be formed in the River which may have many negative impacts on	<ul style="list-style-type: none"> <li>Aquatic weeds can be controlled biologically by the introduction of various herbivorous species like Grass Carp,</li> </ul>	Irrigation Department	RUDA	<ul style="list-style-type: none"> <li>Aquatic Weeds Monitoring</li> </ul>

Sr. No.	Anticipated Impacts	Mitigation Measure	Institutional Responsibilities		Action/Monitoring Parameter/Monitoring Method
			Execution	Supervision	
	ecological and physical environment of Entire River.	Common Carp, Turtles, Ducks and Geese etc. ▪ Still if problem exist then mechanical aquatic harvester should be employed for cutting and removing all the weeds present in the river water body.	/Fisheries Department		
21	▪ Due to increase in volume of water and flow velocity especially during monsoon, the downstream area will be monitored.	▪ The water flow will be managed by barrages. ▪ The engineering techniques will be used for the maintenance of water flow.	Irrigation Department /Design Consultant	RUDA	▪ Monitoring of flow at downstream
22	Risk of barrage failure due to earthquakes and floods	Preparation of emergency preparedness plan.	RUDA / Design Consultant	RUDA	▪ RUDA should develop a comprehensive emergency preparedness plan clearly stating the actions and responsibilities of the personnel.

**RUDA:** River Ravi Urban Development Authority, **SC:** Supervisory Consultants, **EPA:** Environmental Protection Agency – Punjab, **LWMC:** Lahore Waste Management Company, **WASA:** Water and Sanitation Agency Lahore

## 7.6 PROPOSED MONITORING PROGRAM TO ASSESS PERFORMANCE OR OUTPUT OF EMP

### 7.6.1 Objectives

The objectives of the environmental monitoring during the construction and operation stages are as follows:

- To check compliance with the requirements of the EMP by monitoring activities of the project contractors. This will be called Activity Monitoring.
- To monitor actual impacts of the project activities on physical, ecological and socioeconomic receptors of the Project Area so that any impacts not anticipated in the EMP or impacts which exceed the levels anticipated in the EMP can be identified and appropriate mitigation measures can be adopted in time. This objective will be achieved through effects monitoring.
- To achieve these objectives, the following monitoring program will be implemented.

### 7.6.2 Monitoring Strategy

#### Activity Monitoring

Activity monitoring will be carried out to ensure compliance with the requirements of the EMP. The EMMM will be used as a management and monitoring tool. All the monitoring related activities will be the responsibility of Contractor during the construction phase and RUDA during the operation phase.

The Contractors will report compliance with the EMMM to SC and RUDA for verification. Any non-compliance observed by SC will be recorded on noncompliance recording forms. The compliance report then also submitted in EPA - Punjab for effective monitoring and implementation of EMP.

#### Effects Monitoring

Effects monitoring will be the responsibility of RUDA. Monitoring requirements have been outline in the EMP. However, a detailed monitoring program is attached as Table 8.3. The monitoring program describes in detail the resources and methodology that will be adopted for the purpose of Effects Monitoring.

### 7.6.3 Monitoring Parameters and Frequency

Monitoring protocols for compliance and effect monitoring are specified in **Table 7.2** and **Table 7.3** respectively. The monitoring should be conducted for the entire period of construction and operation of the project. It is suggested

that PEQS, 2016 should be used as a main reference and WHO / FAO standards should be used where PEQS, 2016 are silent or not applicable.

**Table 7.2: Environmental Monitoring Plan**

Sr. No.	Parameter/ Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
1	Surface Water / Wastewater (as per PEQS, 2016)	<ul style="list-style-type: none"> <li>At existing Sewage near to the construction sites.</li> <li>Worker's camp</li> <li>Disposal areas of earthfill or solid waste</li> <li>Fuel (Petrol. Oil and Grease) products storages</li> <li>Vehicle and machine repairing and servicing yards.</li> <li>Estimated sampling points are two (02) for surface water and two (02) for wastewater.</li> </ul>	<ul style="list-style-type: none"> <li>Discrete grab sampling and Analysis from EPA certified laboratory.</li> </ul>	<ul style="list-style-type: none"> <li>Once before the start of construction.</li> <li>Quarterly basis during the construction stage.</li> <li>Bi-annually for at least one year during O&amp;M.</li> </ul>
2	Dust Emissions (as per PEQS, 2016)	<ul style="list-style-type: none"> <li>At all Construction Sites</li> <li>At sites where there is route of most heavy transportation.</li> <li>Estimates sampling points are two(02).</li> </ul>	<ul style="list-style-type: none"> <li>Sampling and Analysis from EPA certified Laboratory.</li> <li>Visual Monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>Ambient Air (PM<sub>10</sub> and PM<sub>2.5</sub>).</li> <li>Once before the start of construction.</li> <li>Quarterly basis during the construction stage.</li> <li>Bi-annually for at least one year during O&amp;M.</li> <li>Visual Daily Monitoring</li> </ul>
3	Noise Levels (as per PEQS, 2016)	<ul style="list-style-type: none"> <li>Camp sites,</li> <li>Construction Sites</li> <li>At Routes of</li> </ul>	<ul style="list-style-type: none"> <li>From Noise meter by Contractor or</li> </ul>	<ul style="list-style-type: none"> <li>Once before the start of construction.</li> </ul>

Sr. No.	Parameter/ Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
		<ul style="list-style-type: none"> <li>Heavy Transport.</li> <li>Estimates sampling points are two (02).</li> </ul>	from EPA certified Laboratory	<ul style="list-style-type: none"> <li>Quarterly basis during the construction stage.</li> <li>Bi-annually for at least one year during O&amp;M.</li> </ul>
4	Stack Emission/ Vehicular Emission Monitoring (as per PEQS, 2016)	<ul style="list-style-type: none"> <li>Silencers of heavy machinery, trucks and other vehicles.</li> <li>Stack monitoring of Asphalt Plants.</li> <li>Estimates sampling points are two (02).</li> </ul>	Monitoring of EPA Certified Laboratory	<ul style="list-style-type: none"> <li>Once before the start of construction.</li> <li>Quarterly basis during the construction stage.</li> <li>Bi-annually for at least one year during O&amp;M.</li> </ul>
5	Drinking / Ground Water Quality (as per PEQS, 2016)	<ul style="list-style-type: none"> <li>Workers Camps Sites</li> <li>Construction Sites</li> <li>Estimates sampling points are two (02).</li> </ul>	Monitoring by EPA Certified Laboratory	<ul style="list-style-type: none"> <li>Once before the start of construction.</li> <li>Quarterly basis during the construction stage.</li> <li>Bi-annually for at least one year during O&amp;M.</li> </ul>
<b>Ecological Environment</b>				
6	Cutting of trees	<ul style="list-style-type: none"> <li>In all Project Area i.e. during the infrastructure development</li> </ul>	<ul style="list-style-type: none"> <li>Periodic visits at site by Supervisory Consultant to ensure that only those trees should be cut, which are demarcated for cutting and ensure that trees to be relocated are properly</li> </ul>	<ul style="list-style-type: none"> <li>Weekly during routine monitoring and reported on monthly basis during the construction period, and once in a year monitoring and reporting during the</li> </ul>

Sr. No.	Parameter/ Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
			handled.	operation period for one year.
7	Health of transplanted trees	Entire Study Area and Areas of Transplantation.	<ul style="list-style-type: none"> <li>Frequent visits to the sites by Supervisory Consultant to record these five characteristics: new leaves and buds, leaf size, twig growth, trunk deformity, crown dieback.</li> </ul>	Weekly monitoring and reporting during the construction period, and once in a month monitoring and reporting during the operation period for one year.
<b>Socio-Cultural Environment</b>				
8	Inconvenience to the community	All around the Project Area	<ul style="list-style-type: none"> <li>Supervisory Consultant has Consultations with community to get feedback about inconvenience due to the construction activities to perform their daily routine chores.</li> </ul>	<ul style="list-style-type: none"> <li>Monthly monitoring and reporting during the construction period.</li> <li>Once in a month monitoring and reporting during the operation period for one year.</li> </ul>

**Table 7.3: Environmental Monitoring Plan- Recommended Effect Monitoring Protocol**



Sr. No.	Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
1	Surface Water / wastewater Quality (as per PEQS, 2016)	Sampling from the River and Sewerage points located at a greater distance	3 <sup>rd</sup> party EPA certified laboratory testing.	Sampling and laboratory testing should be done on quarterly basis
Sr. No.	Parameter/Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
		from the construction sites to ensure that they show the influence on a wider range of receiving body.		during the construction stage and annually during the operation stage.  (Construction and Operational Stage)
2	Drinking Water / Ground Water Quality (as per PEQS, 2016)	Sampling of ground water located at greater distance form construction sites.	-do-	-do-
3	Ambient Air Quality and Noise Level (as per PEQS, 2016)	Ambient Air Quality and Noise level parameters in accordance with PEQS, 2016 and points located near the construction sites	-do-	Monthly ambient air quality monitoring during the construction stage. Once a year during the operation stage.

## **7.7 PROPOSED EMP REPORTING AND REVIEWING PROCEDURES**

### **7.7.1 Reporting Mechanism**

Environmental Specialist of contractor will prepare and submit the environmental compliance reports to the SC. Environmental Specialist of SC after reviewing the reports will submit the Due Diligence reports to DD Environment for onward submission to PD RUDA and EPA, Punjab. At the completion of the project, Environmental Specialist of SC will prepare the project completion report based on the periodical progress reports for submission to DD Environment for onward submission to PD RUDA and EPA, Punjab.

### **7.7.2 Non-Compliance of the EMP**

The implementation of the EMP involves inputs from various functionaries as discussed earlier. The contractor will be primarily responsible for ensuring implementation of the mitigation measures proposed in the EMP, which will be part of the contract documents. The provision of the environmental mitigation cost will be made in the total cost of project. However, if the contractor fails to comply with the implementation of EMP and submission of the monthly compliance reports, deductions will be made from the payments to the contractor's claimed under the heads of environmental components.

### **7.7.3 Change Management Plan (CMP)**

The present EIA has been carried out on the basis of the Project information available at this stage. It is however possible that the changes are made in some components of the Project during the design and construction phases. In order to address the environmental and social implications of these changes, a simple framework has been devised, which is described in this section.

### **7.7.4 Additions to the EMP**

The EMP has been developed based on the best possible information available at the time of the study. However, it is possible that during the execution of proposed project, additional mitigation measures based on the findings of environmental monitoring during the construction and operation may have to be included in the EMP. In such cases following actions will be taken for changes during the construction stage:

- A meeting will be held between RUDA, Contractor and the SC representatives. During the meeting, the proposed addition to the EMP 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 EMP 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 RUDA, Contractor and SC head offices.
- All relevant project personnel will be given information about the addition/change.

## **7.8 COMMUNICATION AND DOCUMENTATION**

### **7.8.1 Monthly Environmental Report**

A Monthly Environmental Compliance Report will be prepared by Contractor and summarizing the project activities and results of the activity and effects monitoring. The Environmental Compliance Report as a minimum will include the following:

- Summary of Project Activities
- Schedule of Activity Monitoring and Effects Monitoring team
- Summary of Activity and Effects Monitoring
- Statistical record of non-compliances observed during the month
- Record of mitigation measures taken or pending
- Record of social complaints
- Record of change managements
- Record of water consumption
- Record of fuel consumption
- Report should also include Risk Assessments and Mitigations
- Records of Accidents

The Environmental Compliance Monitoring will be prepared by the Contractor and communicated to the SC and RUDA within three (3) days of the month's end. A hard copy of the report will be retained at the SC site office. One copy will be submitted to EPA, Punjab.

A contractor also required to do environmental monitoring of construction sites as described in activity monitoring and regular report to SC.

### **7.8.2 Social Complaints Register**

The Contractor will maintain a register of complaints received from the local communities and measures taken to mitigate these concerns. SC will report the status of complaints to RUDA, for information and further action.

### **7.8.3 Change Management Record**

All changes to the EMP or the project will be handled through the Change Management Plan. The Contractor will maintain the change record register.

### **7.8.4 Non-Compliance Record Register**

The Contractor will maintain a non-compliance record register to record all the non-compliances observed during the construction activities. A copy of the register will be appended with each Environmental Compliance Report.

### **7.8.5 Photographic Record**

The Contractor 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 areas, parking areas, access tracks, camp sites, and activity monitoring of different categories during and after the construction.

## **7.9 TRAFFIC MANAGEMENT PLAN (TMP)**

Before construction phase 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

## **7.10 MATERIAL TRANSPORTATION PLAN (MTP)**

Material Transportation Plan specifies the routes for material transportation for construction camp and batching plants. These routes have been established in such a way that there is minimum hindrance or disturbance to the local communities and flow of traffic.

### **7.10.1 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.

### **7.10.2 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 initialled. 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 clean-up 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.

## **7.11 TRAINING PROGRAM TO IMPLEMENT THE EMP AND MONITORING PLAN**

An environmental and social training and Technical Assistance (TA) program is to be carried out before the implementation of the project. Contractor's environmental awareness and appropriate knowledge of environmental protection is critical to the successful implementation of the EMP.

The training will be directed towards all personnel for general environmental awareness as depicted in **Table 8.5**.

### **7.11.1 Objectives**

The key objective of the training program is to ensure the implementation of EMP and Monitoring Plan throughout the Project.

### **7.11.2 Roles and Responsibilities**

SC will be responsible for conducting environmental training to all the Project personnel on potential environmental issues of the Project through Contractor, who will be responsible to arrange training and ensure the presence of targeted staff. SC 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 at the time of their recruitment and before the start of any activity in the Project Area. This will be followed by training arranged by the SC to all the targeted staff.

### **7.11.3 Training Log**

A training log will be maintained by the SC. The training log will include;

- Topic
- Date, time and location
- Trainer
- Participants

### **7.11.4 Training Material**

SC will develop and prepare training material regarding the environmental awareness, EIA and EMP. Training for the operation period will be planned by RUDA in future. Separate training material will be prepared for each targeted staff and training program provided in **Table 7.4** will be followed along with need based programs:



**Table 7.4: Training Program**

Trainees	Trainers	Contents	Timing
Selected Management Staff of RUDA, and CC	SC	<ul style="list-style-type: none"> <li>Environmental Sensitivity of the Project Area</li> <li>Vegetation and community issues and related mitigation</li> <li>EMP communication, documentation and monitoring requirements.</li> <li>Short lectures relating to Occupational Safety and Health.</li> <li>Communicable diseases especially COVID-19.</li> <li>Natural resource conservation</li> </ul>	Prior to the start of any Project activity

Trainees	Trainers	Contents	Timing
All Site Personnel (including locally hired staff)	SC and CC	<ul style="list-style-type: none"> <li>Environmental Sensitivity of the Project Area</li> <li>Vegetation and community issues</li> <li>Communication of environmental problems to appropriate officers</li> <li>Waste disposal.</li> <li>Short lectures relating to Occupational Safety and Health.</li> <li>Communicable diseases especially COVID-19.</li> <li>Natural resource conservation.</li> </ul>	Prior to the start of Project activities
Construction Supervisors and Survey Crew	SC and CC	<ul style="list-style-type: none"> <li>Environmental Sensitivity of the Project Area</li> <li>Vegetation and community issues and related mitigation</li> <li>EMP communication, documentation and monitoring requirements</li> <li>Good construction practices</li> <li>Community relations.</li> <li>Short lectures relating to Occupational Safety and Health.</li> <li>Communicable diseases especially COVID-19.</li> <li>Natural resource conservation.</li> </ul>	Before the start of construction activities, monthly during construction period

Drivers	SC	<ul style="list-style-type: none"> <li>▪ Road safety</li> <li>▪ Road restrictions</li> <li>▪ Vehicle restrictions</li> <li>▪ Waste disposal ▪ Defensive driving.</li> <li>▪ Short lectures relating to Occupational Safety and Health.</li> <li>▪ Communicable diseases especially COVID-19.</li> <li>▪ Natural resource conservation</li> </ul>	Before and during start of construction
Mechanics and Vehicle Repair Personnel	SC and CC	<ul style="list-style-type: none"> <li>▪ Environmental control of vehicles and equipment</li> <li>▪ Waste disposal</li> <li>▪ Short lectures relating to Occupational Safety and Health.</li> <li>▪ Communicable diseases especially COVID-19.</li> <li>▪ Natural resource conservation</li> </ul>	Prior to the start of construction and during construction stage
Restoration and Cleaning-	SC and CC	<ul style="list-style-type: none"> <li>▪ Restoration requirements. ▪ Short lectures relating to</li> </ul>	Prior to the start of restoration activity
<b>Trainees</b>	<b>Trainers</b>	<b>Contents</b>	<b>Timing</b>
up Team		<ul style="list-style-type: none"> <li>Occupational Safety and Health.</li> <li>▪ Communicable diseases especially COVID-19.</li> </ul>	

## 7.12 PROJECT SITE MANAGEMENT PLANS

The Contractor will prepare the site-specific management plans for the better management and implementation of EMP during construction phase of the proposed Project. These plans should be reviewed by the SC and approved by the RUDA.

## 7.13 TRAFFIC MANAGEMENT PLAN (TMP)

Prior to start of construction, the contractor will be developed the detailed TMP for transportation of construction machinery and materials in coordination with Traffic Police Department. The traffic management plan is needed for smooth flow of traffic at all major roads during the construction activities of the Project.

## 7.14 SITE RESTORATION PLAN

The main areas to be considered for the site restoration include the construction area along the existing roads, camp site tracks etc. These areas will be restored to the original condition before construction with the

maximum possible effort. The restoration work comprises the removal of temporary construction works and removal of any fence installed, levelling of areas (wherever required), etc. The following procedures will be adopted for the restoration of the site:

- All temporary construction built for the Project will be removed.
- All the toxic and hazardous chemicals/materials will be completely removed the site and properly disposed of. Efforts will be made to completely remove the spills during the construction stage.
- All fencing and gates will be removed and pits will be backfilled.
- Necessary landscaping will be done as required to restore the site as per plantation plan.
- Whole of the site will be covered with the original soil and revegetation will be done, wherever required.
- Finally, after the completion of the restoration process, RUDA and SC will inspect the site and RUDA will give restoration clearance to the Contractor.

## **7.15 OCCUPATIONAL HEALTH AND SAFETY**

All the staff (skilled and semi-skilled) should be provided with safe and healthy working environment taking into account risks inherent to the particular sector and specific classes of hazards in Project Area. Contractor will be responsible for all HSE related issues and to comply with national laws and international standards for occupational health and safety during the construction stage. The Contractor will be responsible for the preparation of detailed HSE Management Plan.

## **7.16 DISASTER MANAGEMENT PLAN**

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.

The main natural and manmade disasters that can occur in project area are listed as under:

- Flood.
- Earth Quake.
- Fire at any Place.
- Terrorist Activity.
- Outbreak of Diseases.

The Provincial Disaster Management Authorities (PDMAs) of Government of the Punjab are mandated for planning, implementing and coordinating all activities in case of the onset of a disaster. Therefore, there is a specific requirement for developing a plan that effectively responds to any Monsoon induced emergency. PDMA specialize in mitigation, preparedness and an organized response to a disaster. The most important role of PDMA lie in providing a platform to come together and strategize management and response to disasters and calamities.

#### **7.17 TREE PLANTATION PLAN**

The proposed project involves the cutting of 2,000 (approximately) including forest areas. Therefore, there will be a need to restore and augment the populations after the project completion to enhance the biodiversity in the area and to provide more habitats for other species. Therefore, ten (10) trees against each fallen tree of similar floral function on both sides of the proposed Alignment that will help in rehabilitating the floral and faunal activities of the project area, approximately, 20,000 trees will be planted in the project area. Such forest restoration should be done with native species, e.g., *Dalbergia sissoo*, *Tamarix aphylla*, *Acacia nilotica*, *Populus euphratica*, *Prosopis cineraria* and *Tamarix dioca* etc. This will enhance the site value and in part will provide compensation for the lost habitat for the species. The estimated cost for tree plantation is estimated as PKR 10 million.

#### **7.18 DISPOSAL AREA MANAGEMENT AND RESTORATION PLAN**

The management and restoration plan of disposal areas will be prepared by the Contractor. The Plan will describe the procedures for spoil management, transportation and disposal at the selected site(s). The Plan will also describe the procedures for systematically disposing the spoil at the disposal site. This Plan would aim at minimizing the environmental and social impacts during disposal activities and restoring as much as possible the original natural situation of these sites by various measures.

### 7.19 WASTE MANAGEMENT PLAN

Waste management plan will be prepared and implemented by the Contractor based on the applicable national, international standards and mitigation measures in the EMP.

### 7.20 DRINKING WATER SUPPLY AND SANITATION PLAN

Separate water supply and sanitation provisions will be needed for the temporary facilities, labor camps and workshops, in order not to cause shortages and/or contamination. A plan will be prepared by the Contractor for resource conservation.

### 7.21 NOC AND OTHER APPROVALS

During the construction stage, the proposed Project involves the clearing of vegetation and trees which belongs to the forest or agriculture department, the Contractor will be responsible for acquiring a 'No Objection Certificate'(NOC) from the provincial forest and wildlife departments. Similarly, if any Archaeological monument or site is crossed by or near to the Proposed Project concerned provincial department needs to be contacted for NOC. The Contractor is also required to contact with concerned department before the start of the construction work.

The contractor is also required to obtain NOC from other concerned departments (which may affect during the construction stage) prior to start of construction to avoid any delay.

### 7.22 COST TO IMPLEMENT THE EMP

The cost for EMP will be a part of the contract document with the Contractor and total project cost. The total estimated cost for the environmental and social management and monitoring during pre-construction, construction and operation phases (annual cost and will be updated for next upcoming years accordingly) comes to about PKRs. 20.42 Million. This cost is for one year and shall be updated for remaining period of construction phase as the total project completion time is estimated 10 years for this Phase-I.

Details are given in **Table 7.5**.

**Table 7.5: Environmental Management/Monitoring Costs**

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
A	PRE- CONSTRUCTION PHASE						
a-1	Environmental Monitoring Cost						
1	Surface Water	Discrete grab sampling and Analysis form EPA certified laboratory.	Once	20,000	2	40,000	
2	Wastewater	Discrete grab sampling and Analysis form EPA certified laboratory. As per PEQS	Once	20,000	2	40,000	
3	Drinking Water / Groundwater	Form EPA certified laboratory. As per PEQS	Once	20,000	2	40,000	
4	Noise Levels	dBA Leq. as per PEQS 2016	Once	2,000	2	4,000	
5	Ambient Air Monitoring	As per PEQS	Once	30,000	2	60,000	
6	Tree Plantation Cost	Including maintenance cost	Plantation of 20,000 trees			10,000,000	This cost is tentative and will be updated prior to implement the project in consultation with forest department.
Sub-Total( a)						10,184,000	
B	CONSTRUCTION PHASE						
b-1	Environmental Monitoring Cost						

1	Surface Water	Discrete grab sampling and Analysis form EPA certified laboratory.	Once	20,000	2x4	160,000	• For one-year construction
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Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
2	Wastewater	Discrete grab sampling and Analysis form EPA certified laboratory. As per PEQS	Once	20,000	2x4	160,000	period on Quarterly basis. • Updated each year based on latest rates throughout the construction period
3	Drinking Water / Groundwater	Form EPA certified laboratory. As per PEQS	Once	20,000	2x4	160,000	
4	Noise Levels	dBA Leq. as per PEQS 2016	Once	2,000	2x4	16,000	
5	Ambient Air Monitoring	As per PEQS	Once	30,000	2x4	240,000	
6	Environmental Specialist	Deals with all Environment related aspects.	Monthly	200,000		2,400,000	Tentative cost for one year
7	Social Specialist	Deals with all Social related aspects.	Monthly	200,000		2,400,000	
8	Training Cost	Provide trainings related environment, health & safety and social aspects to ensure the effective implementation of EMP	Monthly	80,000		960,000	For one year
9	PPEs Cost	For 200 staff (skilled and semi-skilled)	--	1,500,000		1,500,000	Cost for PPEs cost for 200 staff (dust masks, safety shoes, gloves, first aid box, ear plugs, safety helmets, safety jackets).



10	Medical Tests	From approved lab	Yearly	200,000	200,000	For Kitchen staff at each camp site.
<b>Sub-Total (b)</b>					<b>8,196,000</b>	
<b>c</b>	<b>OPERATION &amp; MAINTENANCE PHASE (One Year Cost)</b>					

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity	Cost (PKRs)	Remarks
<b>c-1</b>	<b>Environmental Monitoring Cost</b>						
1	Surface Water	Discrete grab sampling and Analysis form EPA certified laboratory.	Once	20,000	2	40,000	
2	Wastewater	Discrete grab sampling and Analysis form EPA certified laboratory. As per PEQS	Once	20,000	2	40,000	
3	Drinking Water / Groundwater	Form EPA certified laboratory. As per PEQS	Once	20,000	2	40,000	
4	Noise Levels	dBA Leq. as per PEQS 2016	Once	2,000	2	4,000	
5	Ambient Air Monitoring	As per PEQS	Once	30,000	2	60,000	
	<b>Sub-Total (c)</b>					<b>184,000</b>	
	<b>Grand Total (a+b+c)</b>					<b>18,564,000</b>	
	<b>Contingency Charges (10%)</b>					<b>1,856,400</b>	
	<b>Total</b>					<b>20,420,400</b>	

## 7.23 SOCIAL/RESETTLEMENT POLICY FRAMEWORK

To deal with the social, resettlement and livelihood issues to be faced during implementation of Phase-I of River Ravi Training and Channelization Project, a framework has been proposed. This framework comprises three main components i.e. (a) resettlement options including livelihood restoration; (b) Eligibility/Entitlement criteria and; (c) Grievance Redress Mechanism (GRM). These are described as followings:

### 7.23.1 Resettlement Options

This section provides the fundamental principles for the identification and preparation of resettlement sites. A detailed assessment will be undertaken of proposed resettlement sites and the findings should be documented in the RAP. The fundamental principle in identifying resettlement sites, is that resettlement sites should, in overall terms, be an equivalent or better location for the communities moving to them. Besides, the selection of resettlement sites requires consultation with individual households. The affected households shall be entitled to compensation as cash payments, in-kind contributions and/or in the form of assistance or replacement. These terms and elaborated in following table.

**Table 7.6: Resettlement Options**

Type	Description
Cash Payments	Compensation will be calculated on market rates and paid in the national currency. Rates will be adjusted for inflation.
In-Kind Compensation	Compensation may include land, houses, other structures, building materials, seedlings, agricultural inputs, and financial credits for equipment.
Replacement Cost for Houses	Cash compensation based on market-based value for affected land and structure at full replacement cost-free of taxes, registration, and transfer costs.
Assistance	Assistance may include a transition allowance, transportation, and labor. Support with livelihood restoration.
Replacement	Replacement cost of the same or better public infrastructure and productive assets such as schools, mosques, health centers, etc.

Specific lessons in Pakistan from resettlement experience at different development projects indicate that the following are key resettlement options.

**A) Cash Compensation**

Cash compensation should be the first reasonable option for affected persons. They can get a sufficient amount of money and shift wherever they want. They can buy land or build a house with their own choice.

**B) Plot/Apartment**

The second option can be a plot or apartment within the project. Most people belong to villages and are not used to with apartment living style, so the apartment may not be a suitable option. A rural setting would appear to be most appropriate for the villages to be resettled. But plot for their house can be acceptable for them as they may get higher value in shorter time. It is important to allow ample time to plan and develop the new villages and the actual evacuation. During the resettlement exercise, if enough time is not allowed for land acquisition and compensation payment, resulting in tensions between resettled populations.

**C) Model Villages**

As most of the affected population belongs to the village, the model resettlement village can be considered an option at the planning stage. The village size should be such that it can support services (for example, a school) but not too large that the village environment and present lifestyle is significantly changed. Village size affects social networks. If a small village suddenly becomes part of a large village, social networks' nature can change dramatically. The same caste/clan people may be able to integrate to minimize tension due to cultural differences and resettled in the same resettlement site.

**D) Land and Cash**

A combined option may also be possible to propose land where government land available with cash compensation for affected assets. The resettlement villages should be located, so there is the least amount of difficulty with respect to land tenure. The community must be chosen where there is adequate spare land and where ownership of the land is clear and undisputed.

**E) Land for Land**

Due regard must be given to establish an economic base in the new environment similar to that previously practiced by the community (e.g., agriculture, livestock, or grazing). Farmers must be moved to the land where they can continue farming and livestock. The carrying capacity of the land and access to common natural resources must be considered in site selection.

## **F) Compensation for Housing and Structures**

The decision to provide the option of cash compensation and/ or alternative housing will be undertaken in close consultation with village members. Residents of the same village will be moved together and given alternate housing in the site; every effort will encourage all resettled households to accept compensation in kind. No person will be given cash instead of housing unless they refuse to accept anything other than cash compensation. Compensation will be facilitated by; (a) paying particular attention to the adequacy of legal arrangements, registration, site occupation; (b) publicizing the laws and regulations on valuation and compensation among people to be displaced, and (c) establishing criteria for determining the resettlement eligibility of affected households. Property loss falls under the following categories:

**Property Owners:** The property owner must be compensated for lost structures (business or residential); compensation is at full new replacement value and not depreciated. If alternate structures are provided, households with multiple structures will be given the option of being provided with multiple structures at the new site.

**Residential Tenants:** Any individuals will be paid six months' rent equivalent for disturbance and compensated for the assets that cannot be moved. During the RAP preparation, the provisional finding during preparation of the RPF (that there are no formal tenancy arrangements) will be verified.

## **G) Preferences for Resettlement**

However, these options and the proposals noted above should be verified through assessment and extensive consultation before the RAP sites are confirmed. During the detailed design and resettlement planning stage, the residents will be asked about their resettlement sites' preferences. Residents of each village should have a clear idea of where they wanted to move, and the majority of households should move to the same place. Identification of the eventual sites will need to be undertaken in close consultation with the village representatives and the local communities, and differences between the opinions expressed by representatives and villagers, and amongst households within villages, reconciled.

## **H) Housing, Infrastructure and Social Services**

This section describes key principles relating to the provision of housing, infrastructure (e.g., water supply, roads), and social services (e.g., schools, health services) to the resettled population and to ensure comparable services are provided. These measures will need to be further developed in the RAP.

The general principle will be to provide new housing that is an improvement on existing housing conditions. Housing will be designed to accommodate local resident's social and cultural needs.

The following are key issues that can be raised as part of the resettlement experience and may be considered in the resettlement plan. These will be considered and further investigated in the RAP.

**Self-building of houses:** A decision will be taken as to whether people can build their own houses (should they wish to). However, if schedules are tight, the use of contractors may be essential. During the resettlement, the self-help scheme resulted in significant delays, and the remainder of the work had to be done by contractors.

**Design:** Houses must be designed in a manner that is sympathetic to traditional architectural styles while at the same time addressing people's aspirations to improve/modernize their houses and have more hygienic surroundings. The following recommendations are based on the resettlement; these will need to be discussed with the local residents, as preferences will vary.

- All permanent structures should be replaced based on a room for a room (it is unacceptable, for example, to replace three low-quality rooms with two good quality rooms).
- All houses should be provided with a bath area and an enclosed compound.
- All houses should be provided with a kitchen.

**Allocation of Housing:** It is important to move people into dwellings where they are comfortable with their immediate neighbors. During the census survey, people should be asked which families they would like to live near. This information will provide the basis for further consultation during the design and housing allocation for resettled households at the sites. Due respect should also be given to people who state they do not wish to live next to certain households. Efforts should be made to keep caste and clans or extended family groups together as an identifiable unit.

**Consultation:** Consultation with the PAPs at all stages of the process is essential to successful resettlement, i.e., planning the design of the new communities, planning the designs of the houses and their location relative to each other, building the houses, and during subsequent monitoring and evaluation of resettlement.

**Plot Size:** The RAP process must verify whether existing plot sizes are sufficient to meet basic subsistence needs. In some cases, small plot size may indicate vulnerable households that will require additional targeted measures going beyond the general principle of ensuring that livelihoods are restored to pre-project levels.

## I) Provision of Infrastructure and Social Services

The principle will be to replace access to all infrastructure and social services and improve it wherever possible. These improved social services should also be extended to other communities, which provides an incentive for them to accept incoming households and facilitate the integration of the resettled population.

**Infrastructure:** Resettlement will be viewed as an opportunity to improve public infrastructure access, which is limited in the pre-resettlement villages. The resettlement process should provide the following to the resettled.

**Electricity:** As the villages are being resettled due to the development of a riverside urban development project, it is appropriate that the resettled residents in their new locations benefit from the supply of electric power in the area. This should be made available for household lighting and appliances, irrigation pumps, shops and workshops, and street lighting.

**Water:** Potable water should be made available through boreholes or by setting up piped infrastructure.

**Roads:** All major roads should be surfaced with lateritic gravel, with suitable ditches and culverts for run-off and drainage. Parking areas adjacent to communal facilities, such as markets, should be demarcated and gravelled.

**Social Services:** Currently, the services in the villages to be resettled are rudimentary or non-existent. Many of the smaller villages to be moved have no schools, health centres, or market facilities, and children in these settlements have to walk to a nearby village to go to school, and obtaining medical treatment or engaging in trade is more complicated.

**Health:** Appropriate healthcare facilities, namely immediate access to primary health care and easier access to secondary and tertiary healthcare facilities, should be provided at all the sites by building new primary facilities and upgrading transport links, or enhancing existing health care provision sites.

**Education:** Provision must be made for primary schools, and if necessary, a middle school. Specifications for classroom size and design should be based on present and projected school-age populations. They should consider both the capacity and requirement for schools at the sites and the characteristics (e.g., religious and ethnic composition).

**Markets:** Market stalls should be built in all the villages where trading is likely to be a significant economic activity. This will discourage the use of random materials and haphazard layouts.

Discussions should be held with the appropriate authorities at the district level to ensure that services are staffed and managed by local staff of the relevant government department (e.g., Department of Health, Education).

**Avoiding materials salvage for rebuilding:** All building materials from the old villages should be confiscated during the clearing operation. This is to prevent random materials from being salvaged and used for making additional rooms in the new villages, which was a problem during the resettlement.

## J) Replacement of Farming Land

Land for land' compensation will be applied to affected households. The following will be taken into account in the identification of replacement arable land:

- The quality of the land for equivalent agricultural production; and
- The area of land.

With the consultation of affected households, it will be decided at the detailed design stage that households express their preference for compensation in kind, i.e., Land for Land (if government land is available) or prefer cash compensation.

**For cash crops:** Harvest or market value will be paid for lost cash crops, based on the average annual market value over crops for the previous three years. It is challenging to forecast when a farmer might need to give up his land during the growing season. Thus, land compensation will cover all investments that a farmer will make. Assistance will be provided to ensure that replacement land will be ready by the sowing dates. The farmer will continue to receive cash compensation to pay for sowing, weeding, and harvesting.

**Other assets:** Tube wells, graves, fishponds, poultry houses, fences, and other tangible assets will be replaced in kind (or with functional equivalents), relocated, or be compensated at full replacement cost.

**For public infrastructure:** In-kind replacement within an agreed schedule or full compensation to the agency replacing the service will be provided.

**For cultural property and community-owned facilities:** In-kind replacement or compensation at new replacement cost will be provided to owners (primarily voluntary organizations) for land and structures (e.g., mosques, private or community-operated schools, etc.).

## K) Agricultural Assistance

Key measures are proposed but will require further development through consultation with farmers and the institutions responsible for developing and preparing, and implementing the RAP. Agricultural assistance measures will be complementary and integrated with agricultural extension services provided by the project.

As per social impact assessment, livelihood of 82.8% of population in the project area depends on agriculture. After losing their land, they may need the training to establish a new business. The affected persons should be



provided with training as per available business opportunities after completing the project. The project affected persons must be prioritized and assisted in establishing the business. Farmers will attend training to prepare a Business Plan detailing required inputs, anticipated returns, possible extension services, and timeline.

#### **L) Trading Business**

Small scale trading activities in the project area are dependent on market linkages and personal contacts through which the local traders buy and sell their goods. The traders affected by resettlement will need to establish new connections, change existing practices (i.e., goods stocked, pricing, etc.).

Resettled traders may also face increased competition from traders located in or near. Any risks to the recovery of their trading business after resettlement will be identified, and measures to address them will be developed in close consultation with affected traders and by assessing opportunities post resettlement to the sites. The measures may include the following:

**Ensuring access to markets:** It will be essential that market linkages are considered at sites, taking into account existing traders and trading infrastructure at the new site (e.g., roads to existing or potential new markets). It may also be necessary to facilitate negotiations with existing markets if the resettled traders join a market association to trade.

**Ongoing support:** Provision of continuing support to traders in the first six months after resettlement will help them re-establish their business. The assistance may include identifying new customers and suppliers, developing new pricing structures, assessing and advising on changes to adjust to different market preferences amongst their recent clientele, and dealing with competition.

**Construction of market stalls.** This will be an essential component of the plans for the development of the sites. During the consultation to prepare this RPF, traders highlighted the occupational hazards (dust, accidents, crime) from having makeshift stalls along the roadside. Provision of planned, appropriate structures will improve traders' working environment, reduce damage and deterioration of goods, and provide a more appealing, hygienic sales environment.

#### **M) Livelihoods Restoration Program**

The Livelihoods Restoration Program will provide a "safety net" for those households for who the disruption to economic and social networks and livelihoods may heighten the risk of vulnerability and increased poverty, with all its negative consequences. It will also seek opportunities to improve livelihoods compared to pre-project levels and will also cover impacts. The objectives of the Livelihoods Restoration Program, the full details, and the plan of the program will be developed at the detail design stage.

### 7.23.2 Eligibility, Entitlements, Assistance and Benefits

This section provides details about eligibility for compensation, entitlements, assistance and benefits.

#### A) Eligibility for Compensation

The affected persons will be eligible for compensation or rehabilitation assistance as discussed below:

- All land owning affected persons having impact on land or non-land assets, whether covered by legal title or customary land right for temporary acquisition;
- Tenants and share croppers, whether registered or not based on prevailing tenancy arrangements;
- Affected persons losing crops, plants / trees or other assets attached to the land, irrespective of their legal status;
- DPs losing income and livelihoods;
- Vulnerable affected persons to be identified through the social impact assessment survey/analysis; and
- In case of severance, one year crop additional compensation in addition to the standard crop compensation.

The compensation eligibility will be limited by a 'cut-off date' for all the the proposed sub-projects under this plan on the day of the completion of the "census" survey for the impact assessment in order to avoid an influx of outsiders. The affected persons who settled in the vicinity of the sub-project area after the cut-off date will not be eligible for compensation.

#### B) Entitlements for Compensation

The following entitlements are applicable for affected persons facing permanent impact on land, crops and trees and other assets.

- **Permanent Land Loss:** Cash compensation for land based on current market value to titleholders, plus 15% Compulsory Acquisition Surcharge (CAS), as provided in LAA. Cash compensation for loss of land of sharecropper/tenants as per LAA.
- **Vulnerable Affected Persons:** Vulnerable households, legal/legalizable owners, tenants or encroachers will be entitled to one vulnerable impact allowance equal to 03 months' wage rate fixed by Government of Pakistan in the financial year budget 2019-20 in addition to the compensation for his lost assets as agreed during public consultation. Other options can be considered, including noncash based livelihood support and employment, both temporary and permanent.

- **Severance:** DPs/households owners of land facing impact on more than 10% of their total landholding will be entitled to one severance impact allowance equal to the market value of the harvest of the lost land for one year (summer and winter), in addition to the standard crop compensation. Other options can be considered, including noncash based livelihood support and employment, both temporary and permanent.
- **Crops:** Crops will be compensated to owners, tenants and sharecroppers based on their agreed shares. The compensation will be the full market rate for one year of harvest including both *rabi* and *kharif* seasons.
- **Fruit and Non-Fruit Trees:** Fruit and other productive trees will be compensated based on rates sufficient to cover income replacement for the time needed to re-grow a tree to the productivity of the one lost. Trees used as sources of timber will be compensated for based on the market value of the wood production, having taken due consideration of the future potential value.
- **Houses/Structures:** Cash compensation at full replacement costs for affected structure and other fixed assets free of salvageable materials, depreciation and transaction costs. In case of partial impacts full cash assistance to restore remaining structure.
- **Relocation:** Provision of one time shifting charges to cover transport expenses and livelihood expenses for six months.
- **Community Structures and Public Utilities:** Community structures and public utilities, including mosques and other religious sites, graveyards, schools, health centres, hospitals, roads, water supply and sewerage lines, will be fully replaced or rehabilitated to ensure their level of provision is, at a minimum, to the pre-sub-project situation.
- **Vulnerable People:** The vulnerable groups as households below the poverty line, the elderly, those without legal title to assets, landless, women, children and the disabled. This includes distinct groups of people who may suffer disproportionately from resettlement effects.
- **Assistance for livelihood restoration against loss of business/wage income:** (a) One-time lump sum grant to owner of business; minimum one-month's income based on the nature of business and type of losses assessed on a case-to-case basis. (b) One-time financial assistance to hired laborers equivalent to 30-60 days' wages to be computed on the basis of minimum wage board rates for respective district for respective categories. (c) Family workers in small business enterprises are not eligible, as they have already been covered by income assistance for loss of business by shops/SBE owners. (d) One-

time lump sum grant to mobile roadside vendors/SBE; official minimum wage board rates for one month, plus shifting allowance. Priority to be given as tenant for any facilities built by respective municipal administration or RUDA, to streamline the market. (e) APs who are eligible for semi-skilled and unskilled labor, will be given preference in employment opportunities in the Project's implementation works.

It is to ensure that the compensation is reflective of appropriate rates corresponding to actual impacts; the updated rates shall be applied, if and when the delivery of compensation gets delayed. The compensation and rehabilitation entitlements are summarized in the Entitlement Matrix presented as below:

### C) Entitlement Matrix

The compensation and rehabilitation entitlements are summarized in the following **Table** which outlines the complete entitlement matrix for the Project based on the identified losses.

**Table 7.7: Entitlement Matrix**

Sr. No.	Type of Loss	Application	Definition of DPs	Compensation Entitlements
1	Permanent Land Loss	DPs facing permanent land acquisition	Legal legalizable landowners	<ul style="list-style-type: none"> <li>Cash compensation at replacement cost plus a 15% compulsory acquisition surcharge (CAS) free of taxes and transfer costs; or, through land for land compensation mechanisms with plots comparable in area, productivity and location to the plots lost or through the negotiation with the displaced persons.</li> <li>Leaseholders of public land will receive rehabilitation in cash equivalent to the market value of the gross yield of lost land for the remaining lease years (up to a maximum of three years).</li> <li>Encroachers will instead be rehabilitated for land use loss through a special self-relocation allowance equivalent to one year of agricultural income or</li> </ul>

Sr. No.	Type of Loss	Application	Definition of DPs	Compensation Entitlements
				through the provision of a free or leased replacement plot comparable in area, productivity and location to the plots lost.
2	Vulnerability Allowance	DPs below the minimum wage rate and female headed HHs and HHs with 3 disabled persons etc.	All affected vulnerable DPs	<ul style="list-style-type: none"> <li>Vulnerable households, legal/ legalizable owners, tenants or encroachers will be entitled to one vulnerable impact allowance equal to 03 months' wage rate fixed by Government of Pakistan in the financial year budget 2019-20 in addition to the compensation for his lost assets.</li> <li>Preferred employment, both temporary and permanent.</li> </ul>
3	Severance Impact	DPs/ households owners of land facing impact on equal to and more than 10% of their total landholding	All DPs facing impact on equal to or more than 10% of their total landholding	<ul style="list-style-type: none"> <li>One severance impact allowance equal to the market value of the harvest of the lost land for one year (summer and winter), in addition to the standard crop compensation.</li> <li>Preferred employment, both temporary and permanent.</li> </ul>
4	Crops	Affected crops	All DPs (owners, tenants and share croppers)	<ul style="list-style-type: none"> <li>Compensation at the full market rate for one year of harvest including both <i>rabi</i> and <i>kharif</i> (summer &amp; winter) seasons.</li> </ul>

5	Fruit and Fruit Trees	Non Trees affected	Owner of trees	<ul style="list-style-type: none"> <li>Fruit and other productive trees will be compensated based on rates sufficient to cover income replacement for the time needed to re-grow a tree to the productivity of the one lost.</li> <li>Trees used as sources of timber will be compensated for based on the market value of the wood production, having taken</li> </ul>
Sr. No.	Type of Loss	Application	Definition of DPs	Compensation Entitlements
				due consideration of the future potential value.
6	Houses/Structures	All affected structures	All DPs losing their household/miscellaneous structures fully/partially	<ul style="list-style-type: none"> <li>Cash compensation at full replacement costs for affected structure and other fixed assets free of salvageable materials, depreciation and transaction costs.</li> <li>In case of partial impacts full cash assistance to restore remaining structure.</li> </ul>
7	Relocation Assistance	Transport and transitional livelihood support	All household DPs	<ul style="list-style-type: none"> <li>Provision of one time shifting allowance i.e. Rs.15000/household to cover transport expenses and livelihood expenses for six months equal to minimum wage rate fixed by the government of Pakistan in the financial year budget 2019-20 as agreed during the consultation with the DPs.</li> </ul>

8	Community Structures and Public Utilities	Mosques and other religious sites, graveyards, schools, health centers, hospitals, roads, water supply and sewerage lines.	Affected community	<ul style="list-style-type: none"> <li>Fully replaced or rehabilitated to ensure their level of provision is, at a minimum, to the pre-subproject situation.</li> </ul>
9	Unidentified Losses	Unanticipated Impacts	All DPs	<ul style="list-style-type: none"> <li>Dealt with as appropriate during implementation according to prevailing provision under the LAA.</li> </ul>
10	payment	Legal provisions	As agreed by the authority	All payments will be made as per rules determined under RUDA and payment mode and final entitlement will be made after final verification at site as per rules and regulations of the authority.

### 7.23.3 Grievance Redress Mechanism (GRM)

This section provides policy and procedure, hereinafter to be referred as "The Grievance Redress Mechanism (GRM)", outlining a process for documenting, addressing, responding and employing methods to resolve project grievances (and complaints) that may be raised by affected persons or community members regarding major project specific activities such as, environmental and social performance, the engagement process, land acquisition and resettlement and/or unanticipated social impacts resulting from project activities that are performed and/or undertaken by Project Authority. It describes the scope and procedural steps and specifies roles and responsibilities of the parties involved.

For the purpose of this GRM an 'Affected Person (AP)' means a person that is adversely affected temporarily or permanently as a result of the project undertaken by the Project Authority or works carried out thereunder.

Moreover, the term 'Grievance/Complaint' is confined to any formal communication made by an AP that expresses dissatisfaction and/or adversity about an action or lack of action, about the standard of service, works or policy, deficiency of service, works or policy of the project management and its implementation mechanism.



## A) Principles

A GRM is proposed to address any complaints or grievances arising during the implementation period of the projects undertaken by Project Authority. Members of the public may perceive risks to themselves or their property or their legal rights or have concerns about the possible adverse environmental and social impact that a project may have. Any concerns or grievances should be addressed quickly and transparently, and without retribution to the AP or Complainant.

The primary principle is that any complaints or grievances are resolved as quickly as possible in a fair and transparent manner.

All minor complaints regarding land or property disputes that can be resolved should be resolved immediately on the site at the village level/UC level. In case the concerned parties are unable to resolve the said dispute on the site the AP may make a complaint to the Grievance Redressal Committee (GRC), the details of which are provided herein below. The focus of the GRM is to resolve issues in a customarily appropriate fashion and record details of the complaint, the Complainant and the resolution.

## B) Objectives

The objectives of the GRM are to:

- develop an organizational framework to address and resolve the grievances of individual(s) or community(s), fairly and equitably;
- provide enhanced level of satisfaction to the aggrieved;
- provide easy accessibility to the aggrieved/affected individual or community for immediate grievance redressal;
- ensure that the targeted communities and individuals are treated fairly at all times;
- identify systemic flaws in the operational functions of the project and suggest corrective measures; and
- ensure that the operation of the project is in line with its conception and transparently to achieve the goals for sustainability of the project.

## C) Structure of Grievance Redress Mechanism

The project shall have multi-tier GRM with designated staff responsibilities at each level. These levels comprise the following:

### i. Project Management Unit (PMU)/Project Implementation Unit (PIU) Level

The Project Authority shall constitute a Grievance Redressal Committee (GRC-P) at PMU/PIU level to resolve all grievances and complaints of the APs

and the Complainants. The GRC-P shall comprise of the members shown in following figure:

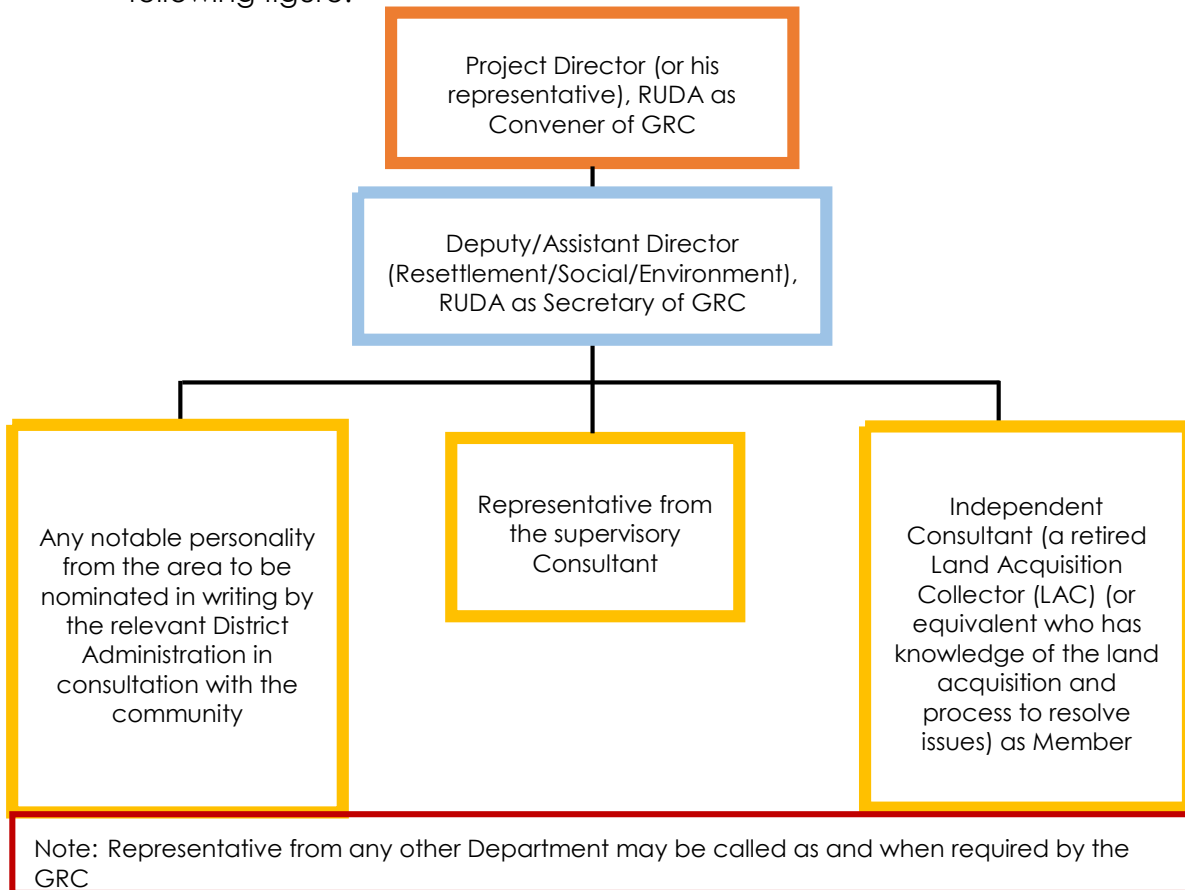


Figure 7.1:

### Project Management Unit (PMU)/Project Implementation Unit (PIU) Level GRC

PIU will install a complaint box in the office and dedicate a telephone number for registration of any complaints. PIU will also designate a staff not below the rank of an Office Assistant who shall record the complaints and immediately report it in PIU and concerned officials.

The GRC-P, through an authorized representative, will acknowledge the Complainant about his complaint, scrutinize the record, explore the remedies available and request the Complainant to produce any record in favor of his claim. After thorough review and scrutiny of the available record on complaint, visit the field and collect additional information, if required. Once the investigations are completed, the GRC shall provide with a decision within 21 days of receipt of the complaint. If aggrieved person is not satisfied, he/she will be allowed to elevate the complaint to next level of GRM for resolution of his/her grievances within 07 days after communication of decision by the GRC-P. **ii. RUDA Headquarter (HQ) Level**

RUDA shall constitute a Grievance Redressal Committee (GRC-HQ) at HQ level. The committee will have following composition:

### **Chief Engineer, RUDA**

Director Environment and Social Safeguards as member

Gender Focal Point or RUDA female Director as member

Representative of the Legal Department as member

This GRC-HQ, through authorized representative, will acknowledge the complainant about his complaint, scrutinize the record of the GRC-P, investigate the remedies available and request the complainant to produce any record in favor of his claim. After thorough review and scrutiny of the available record on complaint, visit the field and collect additional information, if required. Once the investigations are completed, the GRC-HQ shall give decision within 21 days of receipt of the complaint. If the complainant is still dissatisfied with the decision, he can go to the court of law, if he/she wishes so

Gender representation will be ensured by inducting a female member in both GRCs. The mechanism will ensure the access of APs to a GRM that openly and transparently deals with the grievances and makes decision in consultation with all concerned that are consistent with Foreign Donor's requirements and country safeguard system.

### **D) Grievance Redress Mechanism**

The intention of GRM is to resolve a complaint as quickly and at as low a level as possible to avoid a minor issue becoming a significant grievance. Irrespective of the stage of the process, a Complainant has the option to pursue the grievance through the court as is his or her legal right in accordance with law. The details of the process are given below:

### **E) Grievance Redress Procedure**

- a) The grievance or complaint shall be addressed to the Convener of GRC-P/HQ with copy to Chairman RUDA. This can be launched in writing, through telephone or verbally at office. If the complaint is verbal, the office will arrange to convert verbal complaint in written form.;
- b) A serial number will be assigned to it together with the date of receipt;
- c) A written acknowledgement to a Complainant shall be sent promptly and in any case within not more than 3 working days. The acknowledgement shall contain:
  - i. The name and designation of the authorized representative (if the designated representative is in another office then the relevant address will also be included) who will deal with the grievance.

- ii. Information that necessary action will be taken within the specified working days from the date of receipt of the grievance by the authorized representative concerned.
- d) If the office receiving the grievance/complaint is not the one designated to consider and dispose it, the receiving office shall forward it to the designated office, but after having complied with the requirements at (b to c) above;
- e) The GRC shall provide an opportunity of hearing to all the concerned parties and examine the relevant record before making the final decision;
- f) The GRC or its representative designated to consider the matter shall make every effort to ensure that grievances/ appeals are considered and disposed off preferably within the stipulated period; and
- g) The complete records of all activities shall be kept and filed into the grievance database maintained by the both GRCs. The GRCs shall also be responsible to compile records of the GRM and make quarterly reports to the Foreign Donor or any other concerned Authority.

#### **F) Follow up/Closeout**

The complaint shall be considered as disposed off and closed when:

- The designated GRC has decided/disposed off the grievance/complaint;
- Where the Complainant has indicated acceptance of the response of the GRC in writing;
- Where the complainant has not responded to the Grievance Redress staff within one month of being intimated the final decision of the grievance officer on his grievance/complaint;
- Where the Complainant fails to attend the proceedings of the GRC within the stipulated period of the disposal of the complaint; and
- Where the Complainant withdraws his/her complaint.

#### **G) Exclusions**

The following allegations/complaints shall not be construed or taken up for consideration and disposal as 'Grievances':

- Anonymous complaints or frivolous cases in respect of which inadequate supporting details are provided;
- Cases involving decisions/policy matters in which the Complainant has not been affected directly/indirectly;
- Cases where quasi-judicial procedures are prescribed for deciding matters or cases that are sub-judice;

- A grievance which has already been disposed off by GRC;
- Complaints of corruption should be lodged and dealt with separately.

**H) Information Dissemination and Community Outreach**

GRM will also develop an information dissemination system to inform the APs about their rights under the statute LAA, 1894, IFI's policy and approved environmental and social reports for the project. The APs will be informed about the GRM, its functioning, complaint process.

## SECTION - 8: PUBLIC & STAKEHOLDERS CONSULTATION

### 8.1 GENERAL

Public 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.

### 8.2 IDENTIFICATION OF STAKEHOLDERS

First setup for the stakeholder consultation is the identification of stakeholders. RUDA 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 persons according to the conditions, Environmental Protection Authority and District level concerned departments whereas the secondary stakeholders include the public and private agencies involved in the implementation of the project. The consultations with the primary and secondary were conducted in October, 2014 and in January, 2021.

### 8.3 CONSULTATION WITH PROPONENT'S ENVIRONMENT MANAGEMENT TEAM

Findings of the consultations with proponent's environment management team are summarized in **Table 8-1**.

**Table 8-1: Views of Proponent's Environment Management Team**

Sr. No.	Name of Respondent	Organization	Designation	Views/Concerns
1.	Mr. Haseeb Khan	Ravi Urban Development Authority	Company Secretary	This project will; 1. Develop River Ravi in to the perennial fresh water body to sustain ecosystem and good enough for high quality waterfront development.

Sr. No.	Name of Respondent	Organization	Designation	Views/Concerns
				<p>2. Treatment of Lahore cities waste water currently flowing in to the river.</p> <p>3. Develop sustainable city to cater high growing population of Lahore.</p>

#### 8.4 CONSULTATION WITH THE PREPONSIBLE AUTHORITY

Findings of the consultations with Responsible Authority/EPA' s team are summarized in **Table 8-2**.

**Table 8-2: Views of Responsible Authority**

Sr. No.	Respondent	Organization	Views/Concerns
1.	EPA Officials		<p>Consider all guidelines of Punjab EPA during preparation of Environmental Impact Assessment.</p> <p>Extensive public consultation should be conducted.</p> <p>Ecological baseline should be conducted. Primary and updated data should be used.</p> <p>Detailed environmental management and monitoring plan should be developed.</p> <p>Global best practices for green urban development should be adopted in detailed designing.</p>

#### 8.5 CONSULTATION WITH THE OTHER DEPARTMENTS & AGENCIES

Findings of the consultations with other departments & agencies are summarized in **Table 8-3**.

**Table 8-3: Views of other Department & Agencies**

Sr. No.	Name of Respondent	Organization	Designation	Views/Concerns
1.	Mr. Mohammad Junaid Butt	(Flood Bund Division), Department of Irrigation, Government of Punjab	XEN	<ul style="list-style-type: none"> <li>• Already knows about the project</li> <li>• Concerned about the “Water way” to be able to sustain a flood like 1988</li> <li>• Also, since Indus water treaty, India has control</li> </ul>



Sr. No.	Name of Respondent	Organization	Designation	Views/Concerns
				<p>over upstream and can use water as strategic weapon</p> <ul style="list-style-type: none"> <li>• Appreciate the fact that water parks are planned which are good for groundwater recharge and useful for surface water supply to the city</li> <li>• One of his concerns is of Shahdara Bridge being an old bridge and doesn't have enough waterway</li> </ul>
2.	Mr. Hassan Pervaiz	WASA	Director Planning	<ul style="list-style-type: none"> <li>• Knows about the project</li> <li>• Already onboard since LDA times</li> <li>• He is for the project and assures full support</li> <li>• He appreciated the inclusion of wastewater treatment plants into the master plan. Wastewater treatment is long due and necessary for the city.</li> </ul>
3.	Noman Zafar	Lahore Waste Management Company	Assistant Manager	As it is strategic development plan for year 2050 so the EIA report should include policy level mitigations regarding the solid waste management
4.	Shahid Saleem	National Transmission Dispatch Company	Deputy Director	The Project is good for future development of Lahore but should focus more on renewable energy projects

## 8.6 CONSULTATION WITH THE ENVIRONMENTAL PRACTITIONERS AND EXPERTS

Findings of the consultations with Environmental Practitioners & Experts are summarized in **Table 8-4**.

**Table 8-4: Views of Environmental Practitioners & Experts**

Sr. No.	Name of Respondent	Organization	Designation	Views/Concerns
1.	Mansoor Khan	Individual Strategic Environmental Expert	Individual Strategic Environmental Expert	The policy level issues must be considered in the EIA Report
2.	Sameen Khokhar	Associated Consulting Engineers	Sr. Environmental Expert	Ecological Linkage should be incorporated in the RRUDP. Strategic level mitigations should be given in report

## 8.7 CONSULTATION WITH THE AFFECTED AND WIDER COMMUNITY

Findings of the consultations with affected & wider community are summarized in **Table 8-5**.

**Table 8-5: Views & Concerns of the Affected & Wider Community**

Sr. No.	Respondent	Residence	Views/Concerns
1.	Village community Barath and Dogranwala		The project is beneficial as we could also have facility of school, hospitals and networks of roads. Our only concern is that if government acquires our land then they should give us compensation in form of land close to or inside the project area so that we should also be benefited from the project.
2.	Residents and owners of commercial shops and industry at Kala Khatai Road		Separate business place in form of retail shop should be given inside the project area or close to the project area so that his commercial activities will not be affected. Current development is the need of time and of the concern that if his industry needs to resettle then separate place and relocation price should be given.
3.	Village community Ainu Bhatti, Karol and Jabbo- Lahore		We are very close to the Lahore and here soil is very fertile for all the crops. The price of all vegetables reduces when our vegetables come in to markets of Lahore. We are not in favor of this project as we lost our fertile land with implementation of this project. We will not give our agro- land at any cost

**Table 8-6: Views & Concerns of the Affected & Wider Community (Survey Conducted in 2014)**

Sr. No.	Name of Village	Date	No. of Participant	Major concern
1.	Dagranwala	27-09-2014	23	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Require plots in the project</li> <li>• Requirement of Road, Hospital, School, Drainage System</li> </ul>
2.	Gharangwala	27-09-2014	14	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Requirement of Proper potable water</li> </ul>
3.	Muhammad Pur	27-09-2014	4	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> </ul>
4.	Fateh Rehan	27-09-2014	6	<ul style="list-style-type: none"> <li>• Need road and hospital</li> <li>• Villagers don't want to resettle</li> <li>• Need cash compensation</li> </ul>
5.	Mekhowali	27-09-2014	8	<ul style="list-style-type: none"> <li>• Need road and hospital</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> </ul>
6.	Iyya Khurd	27-09-2014	4	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> </ul>

Sr. No.	Name of Village	Date	No. of Participant	Major concern
7.	Lathypur	27-09-2014	1	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need hospital</li> </ul>
8.	Dhoop Sari	27-09-2014	1	<ul style="list-style-type: none"> <li>• Require Flood Water Drainage System</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> </ul>
9.	Goyal	27-09-2014	21	<ul style="list-style-type: none"> <li>• Require Drainage, Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> </ul>
10.	Basti Awan	27-09-2014		<ul style="list-style-type: none"> <li>• Require Drainage, Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> </ul>
11.	Mubarak Pur(Khurd)	27-09-2014	4	<ul style="list-style-type: none"> <li>• Require plots in the project</li> <li>• Require cash compensation</li> </ul>
12.	Mubarak Pur(Kalan)	27-09-2014	11	<ul style="list-style-type: none"> <li>• Require road and sewerage system on priority</li> <li>• Require plots in the project</li> </ul>

13.	Chohan Bangla	27-09-2014	3	<ul style="list-style-type: none"> <li>Require high school, conservation of house for chukidar rafi</li> <li>Need cash compensation</li> </ul>
14.	Babakwal	27-09-2014	4	<ul style="list-style-type: none"> <li>Need high school and lined river</li> </ul>

Sr. No.	Name of Village	Date	No. of Participant	Major concern
				<ul style="list-style-type: none"> <li>Need cash compensation</li> <li>Need plots in the project</li> <li>Need jobs in the Project</li> </ul>
15.	Chak-39	01-10-2014	7	<ul style="list-style-type: none"> <li>Require plots in the project</li> <li>Require cash compensation</li> <li>Need road, hospital in village</li> </ul>
16.	Chak-40	01-10-2014	6	<ul style="list-style-type: none"> <li>Need School for village</li> <li>Need cash compensation</li> <li>Need plots in the project</li> <li>Need jobs in the Project</li> </ul>
17.	Missan	27-09-2014	8	<ul style="list-style-type: none"> <li>Need compensation of land, assets and crops as per market value</li> <li>Jobs should be provided at priority</li> <li>Need cash compensation</li> </ul>
18.	Jhangian Chohan	27-09-2014	9	No comments on the project
19.	Fazal Pura	01-10-2014	3	<ul style="list-style-type: none"> <li>Need compensation of land, assets and crops as per market value</li> <li>Jobs should be provided at priority</li> <li>Need cash compensation</li> <li>Project will increase the prices of our land</li> </ul>

20.	Din Pura	01-10-2014	5	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Project will increase the prices of our land</li> <li>• Need school, road, hospital</li> </ul>
21.	Kot Mulchand	01-10-2014	1	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need Drainage system and School for village</li> </ul>

Sr. No.	Name of Village	Date	No. of Participant	Major concern
22.	Balkhay		10	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need Drainage system and School for village</li> </ul>
23.	Parth	27-09-2014	16	<ul style="list-style-type: none"> <li>• Need animal hospital, high school</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> </ul>

24.	Haji Kot	27-09-2014	2	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Project will increase the prices of our land</li> <li>• Need school, road, hospital</li> </ul>
25.	Nathu Kot	27-09-2014	1	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Need cash compensation</li> <li>• Project will increase the prices of our land</li> <li>• Need hospital, high school and Metaled road</li> </ul>
26.	Kot Jaspat	27-09-2014	3	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need road and Hospital</li> </ul>
27.	Kot Hidayat Ali	27-09-2014	6	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> </ul>

Sr. No.	Name of Village	Date	No. of Participant	Major concern
				<ul style="list-style-type: none"> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> <li>• Need Sui Gas, Hospital &amp; School</li> </ul>
28.	Dandian	27-09-2014	7	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Need cash compensation</li> <li>• Need Sui Gas, Hospital &amp; School</li> </ul>



29.	Awan Par	28-09-2014	4	<ul style="list-style-type: none"> <li>• Require road and sewerage system on priority</li> <li>• Need cash compensation</li> <li>• Need Hospital &amp; School</li> <li>•</li> </ul>
30.	Sanat Pura	28-09-2014	4	<ul style="list-style-type: none"> <li>• Require Flood Water Drainage System</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need Hospital, School and Water filtration facility</li> </ul>
31.	Marl Mari	28-09-2014	11	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Project will increase the prices of our land</li> <li>• Need road, hospital for village</li> </ul>
32.	Rat Garh	28-09-2014	4	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> </ul>

Sr. No.	Name of Village	Date	No. of Participant	Major concern
				<ul style="list-style-type: none"> <li>• Need Hospital, animal hospital, school and road for village</li> <li>• Need improvement in Sanitation system</li> </ul>

33.	Bheni Par	28-09-2014	2	<ul style="list-style-type: none"> <li>• Require Water Drainage &amp; Sewerage System</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need Hospital, School</li> </ul>
34.	Bukan Wali	28-09-2014	2	<ul style="list-style-type: none"> <li>• Require Water Drainage &amp; Sewerage System</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Need cash compensation</li> <li>•</li> </ul>
35.	Jhuggian Arazi	28-09-2014	4	<ul style="list-style-type: none"> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>•</li> </ul>
36.	Ainu Bhatti	28-09-2014	4	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need Drainage system and School for village</li> <li>• Need Electricity for village</li> </ul>
37.	Karol	28-09-2014	17	<ul style="list-style-type: none"> <li>• Require Flood Water Drainage System</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Need cash compensation</li> <li>•</li> </ul>
38.	Hardo Jabbo	28-09-2014	4	<ul style="list-style-type: none"> <li>• Require Water Drainage &amp; Sewerage System</li> </ul>

Sr. No.	Name of Village	Date	No. of Participant	Major concern
				<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need Hospital, School</li> </ul>
39.	Saggian Wasupura	28-09-2014	12	<ul style="list-style-type: none"> <li>• Require Sewerage System</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need Hospital, School and road</li> <li>• Need Plots in the Project Boundary</li> </ul>
40.	Jhuggian Joda	28-09-2014	4	<ul style="list-style-type: none"> <li>• Need high school and lined river</li> <li>• Need cash compensation</li> <li>• Need jobs in the Project</li> </ul>
41.	Jhuggian	28-09-2014	17	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Project will increase the prices of our land</li> <li>• Need High School for village</li> </ul>
42.	Marl Par	28-09-2014	1	water, Health
43.	Ganja Sindhu	01-10-2014	8	Sewarge, hospital
44.	Hando	01-10-2014	16	Tex More, water, Hospital, school

45.	Natt Kalan	28-09-2014	10	<ul style="list-style-type: none"> <li>Require Drainage, Road, High School</li> <li>Need compensation of land, assets and crops as per market value</li> </ul>
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Sr. No.	Name of Village	Date	No. of Participant	Major concern
				<ul style="list-style-type: none"> <li>Jobs should be provided at priority</li> <li>Require plots in the project</li> <li>Need cash compensation</li> </ul>
46.	Dera Fazal Din	01-10-2014	3	<ul style="list-style-type: none"> <li>Need Road, High School</li> <li>Need compensation of land, assets and crops as per market value</li> <li>Jobs should be provided at priority</li> <li>Require plots in the project</li> <li>Need cash compensation</li> <li>Need Hospital, Animal Hospital</li> </ul>
47.	Dera Urbaan	01-10-2014	5	<ul style="list-style-type: none"> <li>Require Drainage, Road, High School</li> <li>Need compensation of land, assets and crops as per market value</li> <li>Jobs should be provided at priority</li> <li>Require plots in the project</li> <li>Need cash compensation</li> </ul>
48.	Subhan Ka Thatta	29-09-2014	6	<ul style="list-style-type: none"> <li>Require Sewerage &amp; Sanitation, Road, High School</li> <li>Need compensation of land, assets and crops as per market value</li> <li>Need cash compensation</li> </ul>
49.	Dera Bari (Boory wala burj)	29-09-2014		<ul style="list-style-type: none"> <li>Need compensation of land, assets and crops as per market value</li> <li>Need Hospital, School, Road</li> </ul>

50.	Burj (Par Wala Burj)	29-09-2014	8	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need improvement in Sanitation system</li> </ul>
51.	Babar Da Dera	01-10-2014	5	<ul style="list-style-type: none"> <li>• Need cash compensation</li> <li>• Need Drainage system</li> </ul>

Sr. No.	Name of Village	Date	No. of Participant	Major concern
				<ul style="list-style-type: none"> <li>• Need Hospital</li> <li>•</li> </ul>
52.	Nawan Pind	29-09-2014	7	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need Hospital, animal hospital, school and road for village</li> </ul>
53.	Kalal Wala	29-09-2014	2	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Need School for Village</li> </ul>
54.	Chak Kalal	29-09-2014	6	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Need cash compensation</li> <li>• Need Hospital, High School</li> </ul>
55.	Qadarabad	29-09-2014	6	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Need cash compensation</li> <li>• Need Hospital, High School</li> <li>• Need Drainage System</li> </ul>

56.	Mir pur	29-09-2014	4	<ul style="list-style-type: none"> <li>Need compensation of land, assets and crops as per market value</li> <li>Need cash compensation</li> <li>Need Hospital, High School</li> </ul>
57.	Dosair pur	29-09-2014	1	<ul style="list-style-type: none"> <li>Need compensation of land, assets and crops as per market value</li> <li>Jobs should be provided at priority</li> <li>Need cash compensation</li> <li>Need improvement in Sanitation system</li> </ul>
58.	Sad Par	29-09-2014	1	<ul style="list-style-type: none"> <li>Need compensation of land, assets and crops as per market value</li> <li>Jobs should be provided at priority</li> </ul>

Sr. No.	Name of Village	Date	No. of Participant	Major concern
				<ul style="list-style-type: none"> <li>Need cash compensation</li> <li>Need improvement in Sanitation system</li> <li>Need School, Hospital</li> </ul>
59.	Taria	29-09-2014	3	<ul style="list-style-type: none"> <li>Need compensation of land, assets and crops as per market value</li> <li>Jobs should be provided at priority</li> <li>Need cash compensation</li> <li>Need improvement in Sanitation system</li> <li>Need School, Mosque</li> </ul>
60.	Goharpur Sani	29-09-2014	2	<ul style="list-style-type: none"> <li>Need compensation of land, assets and crops as per market value</li> <li>Need cash compensation</li> <li>Need School, Hospital, road</li> </ul>

61.	Mozang Nauabad	29-09-2014	3	They are happy, No demand
62.	Bhogan pura	29-09-2014	2	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Need School, Hospital</li> </ul>
63.	Murid wal	29-09-2014	1	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> <li>• Need Hospital,</li> </ul>
64.	Rajian Bhangwan	29-09-2014	2	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> </ul>

Sr. No.	Name of Village	Date	No. of Participant	Major concern
				<ul style="list-style-type: none"> <li>• Need cash compensation</li> <li>• Need Improvement in drainage system</li> </ul>
65.	Jungle thaki	29-09-2014	4	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> <li>• Need Hospital, School</li> </ul>



66.	rajian arain	29-09-2014	2	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Need cash compensation</li> <li>• Need Hospital, High School</li> <li>• Need Drainage System</li> </ul>
67.	Shah makeen	29-09-2014	8	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Need cash compensation</li> <li>• Need Hospital, High School</li> <li>• Need Flood water Drainage System</li> <li>• Need Electricity</li> </ul>
68.	Lurkey	29-09-2014	6	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Need cash compensation</li> <li>• Need Hospital, Need Drainage System</li> </ul>
69.	Maddar	30-09-2014	16	Happy, No commit about Project
70.	Matam	30-09-2014	18	<ul style="list-style-type: none"> <li>• Need Road, High School, Sui gas</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> </ul>

Sr. No.	Name of Village	Date	No. of Participant	Major concern
				<ul style="list-style-type: none"> <li>• Need Improvement in drainage system</li> </ul>
71.	Dhana	30-09-2014	17	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> <li>• Need Hospital, School</li> </ul>
72.	Bheni	30-09-2014	11	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> <li>• Need Hospital, School</li> </ul>
73.	Lawan Thatta	30-09-2014	10	<ul style="list-style-type: none"> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> <li>• Project will increase the prices of our land</li> <li>• Need Graveyard</li> </ul>
74.	Ayya pur	30-09-2014	10	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Need cash compensation</li> </ul>

75.	Sultan pur	30-09-2014	9	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> </ul>
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Sr. No.	Name of Village	Date	No. of Participant	Major concern
				<ul style="list-style-type: none"> <li>• Need cash compensation</li> <li>• Need Hospital, School</li> </ul>
76.	Ladwah	30-09-2014	16	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need Hospital</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> </ul>
77.	Tinde	30-09-2014	5	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> <li>• Need Hospital, School</li> </ul>
78.	Nurpur Arayan	30-09-2014	11	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> <li>• Need Improvement in drainage system</li> </ul>

79.	Wara Toleka	01-10-2014	3	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> <li>• Need Hospital, School</li> </ul>
80.	Jhuggian Naulan	30-09-2014	10	<ul style="list-style-type: none"> <li>• Need Hospital</li> <li>• Need compensation of land, assets and crops as per market value</li> </ul>
Sr. No.	Name of Village	Date	No. of Participant	Major concern
				<ul style="list-style-type: none"> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> </ul>
81.	Naliyan da dera	30-09-2014	8	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> <li>• Need Hospital, School</li> </ul>
82.	Khud pur	01-10-2014	16	<ul style="list-style-type: none"> <li>• Need School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> </ul>

83.	Miraka Quarters	01-10-2014	4	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> <li>• Need Hospital, School</li> </ul>
84.	Dera Churmali Khan	01-10-2014	12	<ul style="list-style-type: none"> <li>• Need Road, High School</li> <li>• Need compensation of land, assets and crops as per market value</li> <li>• Jobs should be provided at priority</li> <li>• Require plots in the project</li> <li>• Need cash compensation</li> <li>• Need Hospital, School</li> </ul>
<b>Total</b>			<b>249</b>	

Section-9

## CONCLUSIONS AND RECOMMENDATIONS

### 9.1 CONCLUSIONS

EIA Study was conducted for the proposed Phase-I of River Ravi Training and Channelization Project. The study included field surveys, investigations, verification and possible quantification of anticipated impacts together with their mitigation measures. The Environment Management Plan (EMP) and Resettlement Policy Framework (RPF) were also prepared for this EIA Report.

The project is the first of its kind that has been planned for conversion of dyeing river Ravi into perennial fresh water body. The revival of river Ravi has overall positive impact on entire ecosystem with increase in environmental benefits and recreational activities. During the implementation of this Phase-I of river training and channelization Project, some project level environment issues need to be focused on and actions have been required from different government departments in order to tackle these issues. The details of environmental issues with proposed Action Plan have been discussed in chapter Environment Management Plan.

Further, the following major recommendations need to be implemented during the implementation of this project:

1. There will be some part of existing reserve forests including Shahdara Forest which will be affected due to channelization and restructuring of river Ravi. Afforestation plans are proposed to mitigate the environmental impacts in the project area.
2. The project will increase ecological value of the area by revival of River Ravi, flood protection and will bring economic boom in the project area by inducing modern techniques and planned infrastructure. A new barrage and guide banks will provide water for irrigation and also improve water quality of the area.
3. The settlements to be relocated will need project assessments as per defined rules and the settlements coming under project area will be dealt as per agreed frames for the convenience of the public.
4. The agriculture land around 1410.83 acres would be affected during implementation of this Phase-I project. In order to offset the agriculture loss, modern agriculture input farming like; better seed, fertilizers and pesticides input is recommended. Also, the irrigation system requires drastic reforms to make sure un-interrupted irrigation water supply through canals. The barren areas should be converted into agriculture land by constructing new canals and water bodies. In addition, the affected persons for this loss shall be compensated as per provisions of LAA,1894 and the proposed RPF.
5. Kamran Baradari and the Jahangir's Tomb are the sites of great archaeological significance. Although, both of these are sufficiently away from the

construction site, however, vibration and dust pollution should be controlled using modern techniques.

## **9.2 RECOMMENDATIONS**

After the detailed environmental assessment study, it is concluded that the Phase-I of River Ravi Training and Channelization Project is feasible at proposed location only if recommendations/mitigations suggested in this EIA report are implemented in true spirit. New mitigation plans will be developed where required to address any situation arisen at site. Rules and regulations of the Authority and national laws will be the source to address the issues. The compensation measures proposed in Resettlement Policy Framework (RPF) and strategic level mitigations suggested for agriculture sector in this report are sufficient to successfully implement the proposed River Channelization Project.



## APPENDIX 1: GLOSSARY

Aesthetic	Concerned with beauty or appreciation of beauty.
Agency	A business or organization providing a particular service on behalf of another business, person, or group
Aquifer	An aquifer is an underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand or silt) from which groundwater can be extracted using water well
Climate	The weather conditions prevailing in an area in general or over a long period.
Conservation	Official supervision of rivers, forests, and other natural resources in order to preserve and protect them through prudent management
Consultant	A person who provides professional advice or services to companies for fee
Construction Waste	Waste generated from the buildings and construction industry and includes material like bricks, concrete, tiles, debris, ceramics and more.
Convention	An agreement between states covering particular matters, especially one less formal than a treaty
Cultural Heritage	Valued objects and qualities such as historic buildings and cultural traditions that have passed from previous generations.
Demographic	A single vital or social statistic of a human population, as the number of births or deaths
Drainage	Natural or artificial removal of surface and sub-surface water from an area.
Ecology	The branch of biology that deals with the relations of organisms to one another and to their physical surroundings
Endangered Species	A species of animal or plant that is seriously at risk of extinction

Environment	Relationship of natural world (human beings, animals and plants) with physical surroundings (air, land, water).
Excavation	Excavation is the act or process of digging, especially when something specific is being removed from the ground. Archaeologists use excavation to find artifacts and fossils

Framework	A framework is a real or conceptual structure intended to serve as a support or guide for the building of something that expands the structure into something useful
Game Reserve	A large area of land where wild animals live safely or are hunted in a controlled way for sports.
Hazardous Waste	Hazardous Waste is waste that poses substantial or potential threats to public health or environment.
Impact	The action of one object coming forcibly into contact with another.
Livelihood	A set of activities involving securing the basic necessities –food, water, shelter and clothing of life.
Municipal Waste	Municipal Solid Waste (MSW)—more commonly known as trash or garbage—consists of everyday items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. This comes from our homes, schools, hospitals, and businesses.
Nature	The phenomena of the physical world collectively, including plants, animals, the landscape, and other features and products of the earth, as opposed to humans or human creations
Ordinance	An ordinance is a law enacted by a municipal body, such as a city council or county commission (sometimes called county council or county board of supervisors). Ordinances govern matters not already covered by state or federal laws such as zoning, safety and building regulation.
Peak ground acceleration	Peak ground acceleration (PGA) is equal to the maximum ground acceleration that occurred during earthquake shaking at a location

Preservation	Preservation is the strict setting aside of natural resources to prevent the use or contact by humans or by human intervention. In terms of policy making this often means setting aside areas as nature reserves (otherwise known as wildlife reserves), parks, or other conservation areas.
Proponent	A person who advocates a theory, proposal, or course of action.
Policy	A policy is a deliberate system of principles to guide decision and achieve rational outcomes
Rehabilitation	To restore to a condition of good health, ability to work, or the like

Resettlement	The settlement of people in a different place.
Resource	A stock or supply of money, materials, staff, and other assets that can be drawn on by a person or organization in order to function effectively.
Sanitation	Conditions relating to public health, especially the provision of clean drinking water and adequate sewage disposal.
Seismic Hazard	A seismic hazard is the probability that an earthquake will occur in a given geographic area, within a given window of time, and with ground motion intensity exceeding a given threshold.
Stakeholder	A stakeholder is a party that has an interest in a company, and can either affect or be affected by the business. The primary stakeholders in a typical corporation are its investors, employees and customers.
Topography	Topography is the study of the shape and features of the surface of the Earth and other observable astronomical objects including planets, moons, and asteroids.
Vegetation	Plants considered collectively, especially those found in a particular area or habitat.
Wetland	A wetland is a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem.

Valued Environmental Components	Valued environmental components (VECs) are defined as fundamental elements of the physical, biological or socioeconomic environment, including the air, water, soil, terrain, vegetation, wildlife, fish, birds and land use that may be affected by a proposed project.
Valued Social Components (VSCs)	Sociocultural factors are customs, lifestyles and values that characterize a society or group. Cultural aspects include concepts of beauty, education, language, law and politics, religion, social organizations, technology and material culture, values and attitudes. Social factors include reference groups, family, role and status in society, time and available resources. An understanding of sociocultural factors is crucial in developing marketing strategies for businesses or organizations seeking action from particular groups

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## APPENDIX 2: LIST OF ABBREVIATIONS

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ARI	Average Recurrence Interval
BOD	Biological Oxygen Demand
CBD	Convention on Biological Diversity
CC	Construction Contractor
CCC	Command and Control Center
CMP	Change Management Plan
CO	Carbon Mono-oxide
COD	Chemical Oxygen Demand
DDMA	District Disaster Management Authority
DEOC	District Emergency Operation Centre
DMP	Disaster Management Plan
DPRP	Disaster Preparedness and Response Plan
DRC	Disaster Response Cell
DRP	Disaster Response Plan
DS	Disposal Station
ECSP	Engineering Consultancy Services Punjab (Pvt.) Limited
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPD	Environmental Protection Department
ESA	Environmental and Social Assessment
ERC	Emergency Relief Cell
GIS	Geographical Information System
GRC	Grievance Redressal Committee
GRM	Grievance Redressal Mechanism
Mg/l	Milligram Per Liter

Mg/ m <sup>3</sup>	Milligram Per Cubic Meter
Ug/ m <sup>3</sup>	Microgram Per Cubic Meter
GoPb	Government of the Punjab
HSE	Health Safety Environment
IEE	Initial Environmental Examination
ILO	International Labor Organization
IRSA	Indus River System Authority
IUCN	International Union for Conservation of Nature
LAA	Land Acquisition Act
LESCO	Lahore Electric Supply Company
LPCD	Liters Per Capita Day
LRT	Light Rail Transit
LWMC	Lahore Waste Management Company
	Meter
M	Million Acre Feet
MAF	Moving Bed Bio-Reactor
MBBR	
MBT	Main Boundary Thrust
MMM	Mitigation Management Matrix
MTP	Material Transportation Plan
NCS	National Conservation Strategy
NDMA	National Disaster Management Authority
NTDC	National Transmission and Dispatch Company
PDMA	Provincial Disaster Management Authority
PEQS	Punjab Environmental Quality Standards
PHA	Parks and Horticulture Authority
PPE	Personnel Protective Equipment
NGO	Non-Governmental Organization
NPO	No Project Option
NOC	No Objection Certificate
NOx	Oxides of Nitrogen
O&M	Operation and Maintenance

PAPs	Project Affected Persons
P&D	Planning & Development
PCSIR	Pakistan Council of Scientific and Industrial Research
PDMA	Provincial Disaster Management Authority
PEPA	Pakistan Environmental Protection Act
PEPC	Pakistan Environmental Protection Council
PEOC	Provincial Emergency Operation Centre
PEQS	Provincial Environmental Quality Standards
PGA	Peak Ground Acceleration
PM	Particulate Matter
PTCL	Pakistan Telecommunication Company Limited
RP	Resettlement Planning
RAP	Resettlement Action Plan
RRUDP	Ravi Riverfront Urban Development Project
RNR	Renewable Natural Resources
RUDA	River Ravi Urban Development Authority
SC	Supervisory Consultant
SNGPL	Sui Northern Gas Pipelines Limited
SRO	Statutory Regulatory Order
SOX	Oxides of Sulphur
sqm	Square Meter
TDMA	Tehsil Disaster Management Authority
TMP	Traffic Management Plan
TOR	Terms of Reference
WWF	World Wildlife Fund
WAPDA	Water and Power Development Authority
WASA	Water and Sanitation Agency
WHO	World Health Organization



## APPENDIX 3:

# LIST OF INDIVIDUALS AND ORGANIZATIONS CONSULTED ALONG WITH THEIR FEEDBACK

### DEPARTMENT LEVEL CONSULTATIONS

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 Commerce
- Community residing in villages at Project Area
- Small industrial Associations in Project Area

### List of Scoping Sessions/Group Discussions carried out with the Stakeholders

Sr. No.	Date	Venue	No. of Participants
1	02-09-14	Village Barth and Dagrauwala- Community-Shiehpura	10
2	3-09-214	Village community Ainu Bhatti, Karol and Jabbo-Lahore	30
3	09-09-14	Commercial Shops and industries at Kala Khatai Road	06
4	29-09-14	MD Office- LWMC- Shaheen Complex Lahore	02
5	1-10-14	Head Office WASA Gulberg II Lahore	03
6	15/09/2014	DG WWF and Coordinator Ravi River Commission (RRC)	03
7	2/03/2015	Ahmad Rafy Alam – Advocate and Sectary RRC	01

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## APPENDIX 4:

# SOURCES OF DATA AND A FULL LIST OF ALL REFERENCES MATERIAL USED

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2. Dualization of Sheikhpura-Gujranwala Road Under PPP Mode (43 KM)
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## APPENDIX 5: TERMS OF REFERENCES

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### TERMS OF REFERENCE (TORs) FOR APPOINTMENT OF CONSULTING FIRMS FOR ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR “RAVI RIVER TRAINING AND CHANNELIZATION PROJECT”

#### Scope of Services and Deliverables:

The Consultant will review and update the EIA report in accordance with the guidelines set by EPA Punjab and meeting the requirements of IEE/EIA regulations 2000. The Consultant will be responsible for follow up of NOC with EPA, presenting the EIA in EPA/Public Hearing and addressing all the queries raised by EPA.

The Consultant shall render not limited to the following services:

- Review of all the existing surveys and data available for the proposed project and conduct the additional Surveys and collection of additional data of the proposed project area;
- Collection of available data, drawings and all relevant information about proposed project;
- Review of applicable existing Environmental Legislations, Standards and Policies;
- Environmental Monitoring of ambient air, noise, soil, water quality;
- Establishment of baseline environmental conditions;
- Review of policies related to the environment and proposed the additional policies required
- Evaluation of potentially positive and negative impacts due to proposed project at policy level, construction & operational stages;
- Conduct public consultation and stakeholders meeting;
- Proposed mitigation measures to eliminate or reduce the negative impacts to an acceptable level;
- Preparation of Environmental Management Plan (EMP);
- Preparation of Environmental Impact Assessment (EIA) Report;

### Composition of Team:

The team shall comprise of:

Expert Name	Qualification
Team Leader – Sr. Environmental Specialist	M.Sc Environmental Sciences with 12 years' experience. Must have competed at 2 EIA studies of Master Planning Projects
Expert Name	Qualification
Ecologist	M.Sc Botany/Zoology with 10 years of Experience in Ecological Studies. Must have completed at least 2 Ecological Studies of Master Planning projects
Sociologist	M.Sc Sociology with 10 years' experience
Legal Expert	L.L.B with 10 years' experience
Hydrological and Climate Change Expert	M.Sc Climate Change or Hydrology with 10 years of experience in Health and Safety of large projects
Air Quality Expert	M.Sc Environment Science with 10 years' experience

- The team should have excellent communication and influencing skills to effectively engage and coordinate with a wide range of stakeholders. Demonstrated capacity in providing advisory services at senior levels, with counterparts predominantly at strategic/management level;

### Duration:

The duration of the assignment is 2 months up to the final EIA report submission to RUDA.

## APPENDIX 6: LIST OF EIA TEAM

**List of Environment Study Team**

Sr. No.	Name	Position Held	Qualifications
1	Mr. Aleem Butt	Environmental Expert / Team Leader- EIA	M.Phil. Environmental Sciences (GCU), M.Sc. Environmental Sciences (PU), NEBOSH, Lead Auditor
2	Dr. Faiza Sharif	Senior Ecologist	P.hd (Conservation Biology) GC University Lahore
3	Dr. Saleem	Hydrology/ Hydraulic Specialist	P.hd (Water Resources Engineering)
4	Amir Hamza	Social/Resettlement Expert	Master's degree in Social Development, Eötvös Loránd University, Hungary Master's degree in History and Analysis of Land - European Territories, University of Catania, Italy Master's degree in Sociology, PU
5	Nouman Ashraf	Environmental Air Quality Expert	M. Phil Environmental Sciences from GCU, Lahore
6	Dr. Sidra Waheed	Environmental Climate Change Expert	P.hd Environmental Sciences from Quaid-e-Azam University, Islamabad
7	Yasin Hatif	Legal Expert	L.L.M London

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## **APPENDIX 7: APPROVAL FROM OTHER CONCERNED DEPARTMENTS**

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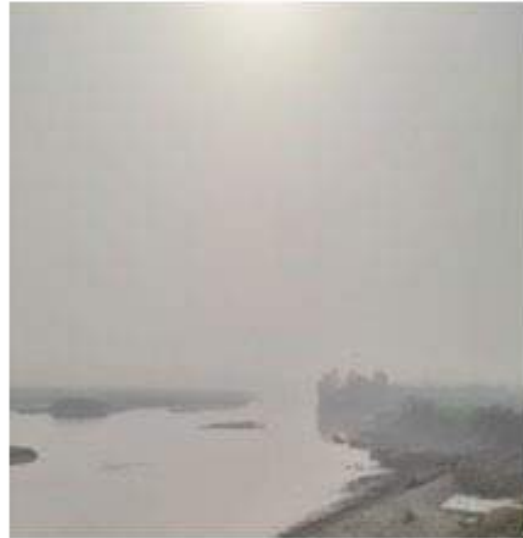
## APPENDIX 8: PHOTO LOG

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### Study and Project Area



River Ravi Siphon



Location Proposed for Barrage



Saggian Bridge



Bottleneck of project area (old Ravi bridge)

#### ENVIRONMENTAL MONITORING AND SAMPLING



Wastewater Sampling at Cantt Drain



Ambient Air monitoring at Missan



Noise Monitoring in Project Area



Vehicular Emission Monitoring in Project Area



### Social Survey



#### ECOLOGICAL SURVEY



Vegetation Analysis at Bhaini forest.



Vegetation and fauna analysis in a



Fishing in river Ravi.



Insect collection using sweep nets

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## **APPENDIX 9: ENVIRONMENTAL MONITORING REPORTS (CONDUCTED BY EPA CERTIFIED LAB)**

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## APPENDIX 10: ENVIRONMENTAL IMPACT MATRIX

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**Appendix 10 Project Impact Matrix**  
**Project Impact Matrix without Mitigation for Riverfront Ravi Urban Development Project**

ENVIRONMENTAL COMPONENTS	PHYSICAL						ECOLOGICAL			SOCIAL					
	Acquisition of Temp. Land	Soils (Erosion/Stability / Contamination)	Surface Water (quantity/quality)	Groundwater (quantity/quality)	Air Quality	Noise and Vibration	Crops/Vegetation/Trees	Terrestrial Fauna	Bird Species	Public Health	Public/Private Utilities	Employment/Income	Worker Safety	Public Safety	Living Standards of Surrounding Community
PROJECT ACTIVITIES/COMPONENTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Construction Phase</b>															
1. Excavation	0	LA	MA	LA	LA	MA	LA	LA	LA	LA	MA	MB	LA	LA	LA
2. Traffic on Main Roads	0	0	0	0	MA	MA	0	0	0	0	0	0	LA	LA	MA
3. clearing cutting	0	MA	LA	0	MA	0	MA	LA	LA	0	0	LB	LA	LA	LA
4. Construction Camp	LA	LA	MA	0	0	0	LA	0	LA	0	0	0	0	0	0
5. Storage of Excavated Material	0	0	LA	0	0	0	LA	0	LA	LA	0	LB	0	LA	LA
6. Compaction	0	0	0	0	0	LA	0	0	0	0	LA	LB	LA	0	0
7. Laying of Infrastructure Facilities	0	0	MA	0	LA	LA	LA	LA	LA	LA	LA	MB	LA	LA	LA
8. Use of Chemicals/ oils lubricants	0	LA	LA	0	0	0	LA	LA	0	LA	0	0	MA	LA	0
9. Solid Waste Generation/Disposal	LA	MA	MA	0	0	0	LA	LA	0	LA	0	0	0	LA	LA
10. Use of Heavy Machinery	0	LA	0	0	MA	MA	LA	LA	LA	LA	LA	MB	MA	LA	0
11. Vehicle/Equipment Maintenance	0	LA	0	0	0	0	0	0	0	0	0	LB	0	0	0
12. Demolition	0	LA	LA	0	LA	MA	LA	LA	LA	0	0	0	MA	MA	MA
13. Sewage Waste Generation	0	LA	LA	LA	0	0	LA	LA	0	LA	0	0	0	LA	LA
Weighted Overall	0	LA	MA	0	MA	MA	LA	LA	LA	LA	LA	LB	LA	LA	LA
<b>Operation Phase</b>	0	LA	HB	LA	LA	LA	LA	LA	HB	MB	MB	HB	0	LA	HB

HA = High Adverse, MA = Medium Adverse, LA = Low Adverse, HB = High Beneficial, MB = Medium Beneficial, LB = Low Beneficial, 0 = None/Insignificance



Project Impact Matrix with Mitigation for Riverfront Ravi Urban Development Project

ENVIRONMENTAL COMPONENTS	PHYSICAL						ECOLOGICAL			SOCIAL					
	Acquisition of Temp. Land	Soils (Erosion /Stability/ Contamination)	Surface Water (quantity/quality)	Groundwater (quantity/quality)	Air Quality	Noise and Vibration	Crops/Vegetation/Trees	Terrestrial Fauna	Bird Species	Public Health	Public/Private Utilities	Employment/Income	Worker Safety	Public Safety	Living Standards of Surrounding Community
PROJECT ACTIVITIES/COMPONENTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Project Location</b>	0	0	0	0	MB	0	LA	0	0	0	LA	0	0	0	0
<b>Construction Phase</b>															
1. Excavation	0	0	LA	LA	LA	LA	0	0	0	0	LA	MB	0	0	0
2. Traffic on Main Roads	0	0	0	0	LA	LA	0	LA	0	0	0	0	0	0	0
3. Clearing and Cutting	0	LA	0	0	LA	0	MA	LA	LA	0	0	HB	0	0	0
4. Construction Camp	0	0	0	0	0	0	LA	0	0	0	0	0	0	0	0
5. Storage of Excavated Material	0	0	LA	0	0	0	LA	0	0	LA	0	LB	0	0	LA
6. Compaction	0	0	0	0	0	LA	0	0	LA	0	LA	LB	LA	0	0
7. Laying of Infrastructure Facilities	0	0	LA	0	0	0	LA	LA	LA	0	LA	HB	0	0	LA
8. Use of Chemicals	0	0	LA	0	0	0	0	0	0	0	0	0	LA	LA	0
9. Solid Waste Generation/Disposal	0	LA	LA	0	0	0	0	LA	0	LA	0	0	0	LA	0
10. Use of Heavy Machinery	0	0	0	0	0	0	0	LA	LA	0	LA	MB	LA	0	0
11. Vehicle/Equipment Maintenance	0	0	0	0	0	0	0	0	0	0	0	LB	0	0	0
12. Demolition	0	0	0	0	LA	0	LA	0	0	0	0	0	LA	LA	LA
13. Sewage Waste Generation	0	LA	LA	0	0	0	0	0	0	0	0	0	0	0	0
Weighted Overall	0	0	LA	0	0	0	LA	0	0	0	0	MB	0	0	0
<b>Operation Phase</b>	0	0	HB	LA	LA	LA	LA	0	HB	HB	LB	HB	0	0	HB

HA = High Adverse, MA = Medium Adverse, LA = Low Adverse, HB = High Beneficial, MB = Medium Beneficial, LB = Low Beneficial, 0 = None/Insignificance