

Initial Environmental Examination

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Initial Environmental Examination of Remodeling of LMB of Qadirabad Barrage in Critical Reaches

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Asian Development Bank



INITIAL ENVIRONMENTAL EXAMINATION (IEE)

Flood Emergency Reconstruction and Resilience Project (FERRP)

REMODELLING OF LMB OF QADIRABAD BARRAGE IN CRITICAL REACHES

05 January 2017

**Prepared by:
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List of Abbreviations

AOI	Area of Influence
ADB	Asian Development Bank
EC	Electric Current
EIA	Environmental Impact Assessment
EMMP	Environmental Management and Monitoring Plan
EPA	Environmental Protection Agency
FI	Financial Intermediary
GOP	Government of Punjab
IEE	Initial Environmental Examination
IUCN	International Union for Conservation of Nature
LMB	Left Marginal Bund
MRS	Market Rate System
NCB	National Contract Bidding
NCS	National Conservation Strategy
NEP	National Environmental Policy (2005)
NEQS	National Environmental Quality Standards
NESPAK	National Engineering services Pakistan
NGO	Non-Governmental Organization
NOC	No Objection Certificate
PC	Planning Commission
PEPA	Pakistan Environmental Protection Agency
PEPC	Pakistan Environmental Protection Council
PID	Punjab Irrigation Department
PIDA	Punjab Irrigation & Drainage Authority
PIU	Project Implementation Unit
QB	Qadirabad Balloki
RD	Reduced Distance
REA	Rapid Environmental Assessment
RQ	Rasul Qadirabad
SEMU	Social & Environmental Management Unit
SMO	SCARP Monitoring Organization
SPS	Safeguard Policy Statement 2009
XEN	Executive Engineer

Executive Summary

A. Introduction

This report comprises the Initial Environmental Examination (IEE) study of the Remodeling of Left Marginal Bund (LMB) of the Qadirabad Barrage at the left bank on Chenab River. Generally, the Remodeling/ Rehabilitation works of the subproject comes under category “C” of the ADB guidelines, but due to the presence of the subproject in the vicinity of Punjab Wildlife Sanctuary and Forest Department protected areas Barubgarh and Khangarh, the REA Checklist defines this, in category “B” as per Safeguard Policy Statement.

B. Background

The Punjab irrigation network comprises 24 main Canals fed by 14 Barrages / Headwork's and 9 major inter-river Link Canals, irrigating more than 21 million acres of land. This irrigation network of Punjab Province makes it the most fertile area of Pakistan. More than 50% of the total national agricultural produce comes from this fertile land.

This subproject is one of the Flood Emergency and Reconstruction Resilience Project (FERRP) being implemented by the Project Implementation Unit (PIU), Punjab Irrigation Department, financed by the Asian Development Bank (ADB). The cost of subproject amounts to 81816,272/- PKR (81.8 millions).

In 2014, heavy monsoon rains in the catchment areas of the eastern rivers of Chenab, Ravi, Sutlej and Jhelum, resulted in flash floods and rain-hit areas in various districts of the province damaging community physical infrastructure as well as bringing destruction to private housing and agriculture. The causes of devastation can be classified into two categories in terms of their impact i.e. (a) Flood- affected and (b) Rain-affected. In Punjab, sixteen districts were affected by the floods in the eastern rivers (particularly Chenab River), emanating from across the eastern borders, and twelve additional districts also faced severe damages due to heavy rainfall in catchment areas causing flash floods and damages to the physical public and private infrastructure, agriculture land and communication facilities etc.

C. Project Location

Qadirabad Left Marginal Bund (LMB) is located at North East of Qadirabad Barrage, on River Chenab in tehsil Wazirabad, District Gujranwala of Punjab province in Pakistan. The Qadirabad Barrage itself is located at the boundary of Gujranwala and Mandi Bahuddin Districts of Punjab Province. Qadirabad Barrage is one of the most important major Hydraulic Engineering works constructed on River Chenab 18 miles downstream

of Khanki Headworks under Indus Basin Project. It was commissioned during the year 1967 to take water from River Jhelum released from Mangla Dam through Rasul Qadirabad (RQ) Link Canal and transfers the water to River Ravi through Qadirabad Balloki (QB) Link Canal as the water rights of River Ravi was allocated to India under Indus Water Treaty 1960. Both RQ and QB Link Canals are perennial canals and ultimately feed Lower Bari Doab Canal (LBDC) and Balloki Sulemanki (BS) Link Canal at Balloki Headworks for Perennial Canals of Sulemanki Headworks.

D. Environmental Issues

The subproject activities include rehabilitation/remodeling of LMB of Qadirabad Flood Bund from RD 0+000 to RD 30+000. This will cause some disturbance due to rehabilitation activities on the RoW of LMB at barrage site and the allied sites involving borrow material, camp areas, material and machinery yard, link roads and necessary facilities for the staff and labour to be engaged for the execution of the subproject.

E. Policy Legal and Administrative Framework

The Asian Development Bank's Safeguard Policy Statement (SPS) 2009 requires that environmental considerations be incorporated into ADB's funded project to ensure that the project will have minimal environmental impacts and be environmentally sound. Occupational health & safety of the local population should also be addressed as well as the project workers as stated in SPS 2009. Furthermore, this report also represents the requirements of National and Provincial Environmental Agencies (EPAs).

F. Project Categorization Note

According to ADB Safeguard Policy Statement 2009, projects are to be categorized into three environmental categories; A, B, or C. All the anticipated adverse environmental impacts of the project are mitigable, temporary, nature and localized. Also there is no environmentally sensitive or archeological site falling within project area of influence; However, generally the Remodeling/Rehabilitation works of the subproject comes under category "C" of the ADB guidelines, but due to the presence of Punjab Wildlife Sanctuary and Forest Department protected areas Barubgarh and Khangarh in the vicinity of the subproject, the REA Checklist defines the subproject in category "B".

G. Project Description

Qadirabad Barrage is one of the Major Engineering Components of Indus Basin project. It was constructed as a part of Rasul – Wazirabad – Balloki – Sulemanki Link Canal system. The Barrage length between the abutments is 3376 feet, there are 50 Spans, having length of 60 feet between each piers.

Qadirabad Barrage was constructed by the Water and Power Development Authority (WAPDA) and was commissioned during the year 1967. River Chenab is bounded by Marginal Bunds. To cope with the flood situation, river training works were also provided. Qadirabad Balloki Link Canal off takes from the left side and is central part of the Rasul Balloki Link Canal System.

Qadirabad has two marginal bunds i.e. Left Marginal Bund on the left side of the river having a length of 64,938 feet and Right Marginal Bund on the right side of the river having a length of 106,300 feet. The breach in Right Marginal Bund, flood water returns back to the river course and in case of breach in the Left Marginal Bund, water spreads in the area causing more damages and never returns to the river.

In order to minimize the chances of undetected cracks, burrows, rat holes and cavities, construction of an additional dowel bund 8.0 ft wide & 8.0 ft free board over HFL of 2014 on river side along the critical reach of Left Marginal Bund from RD 0+000 to RD 30+000 is proposed to minimize the risk of breach in Left Marginal Bund. The dowel bund will provide additional protection to the main embankment of LMB in critical reaches in terms of reduction of seepage, slope stability & piping action etc. A 6" thick shingle layer at the top of Bund with 15.0 ft width has also been provided..

The subproject Area of Influence (Aol) is the area likely to be affected by the subproject, including all its ancillary aspects such as access roads, borrow & waste disposal sites and labor camp as well as unplanned development induced by the subproject.

H. Environmental and Social Baseline

I. Physical Environment

Qadirabad barrages is located in District Gujranwala, which is entirely situated on the alluvial soils, Kanker is found all over the district. Entire district is a flat plain area. The types of soil commonly found in entire district Gujranwala are silt loam, loam, sandy loam, sandy clay loam and Riverine. On an average, within the direct influence of the river and in the immediate vicinity of the subproject area, 75%of the land is under agriculture. About 80% of total population depends upon agriculture. Main source of surface water in the surroundings area is river Chenab itself and canal system. The ground water aquifer is recharged by surface water.

The possibility of the bund (embankment) erosion will be rather limited. Local water pressures or whirlpool caused due to burrows of rodents, loosening of soil by root action of trees, dissolution of some localized deposits, faults developed in the embankment due to heavy rain showers or direct washing away of the embankment due to sheet erosion during heavy rains, can collectively or severally weaken the bunds through erosion.

June is the hottest month of the year while January is the coldest. The relative humidity during rainy season is as high as 60-70%. During dry months it falls below 50%. Average annual rain fall is about 375 mm (14.8 inches). The average daily wind speed in July has been recorded 4 km/h. Ambient air is generally good in the subproject area.

The area has no history of any serious damages due to earth quakes. A super flood with discharge, a peak of 656,666 Cusecs passed through the Barrage for 18 hours.

No sites of archeological, historical, cultural, or religious significance are known to exist in the areas where execution will take place or where different subproject facilities will be established / located. In case there is a chance find, it can be handled as per Law and Procedures

J. Biological Environment

There are two protected areas near the vicinity of subproject, i-e, Wildlife Sanctuary and Forest protected area Barubgarh and Khangarh.

The flora of the subproject area can be divided into two zones, Riverine Flora and Inland Flora. Agricultural crops like wheat, maize, sugarcane and tobacco in Rabi season and rice and pulses in Kharif season are cultivated. The main fruits grown are Jaman, falsa, malta, kino, fruiter, sweet lemon, plum, mulberry, guava and pomegranate. The principal vegetables grown in the district are onions, potatoes, ginger, egg plant, arum, lady finger, spinach, mint, tomato, turnip, carrot, cauli flower, bitter gourd, garlic, pea, reddish and cucumber etc.

The immediate and surrounding area of the subproject has been under human inference for a long time and, therefore, a large number of wild life species are already extinct or have shifted to other sites where they could find protection.

A series of barrages i.e., Marala, Khanki and Qadirabad have over the years, seriously hampered the survival and propagation of a large number of river fish species. Gulfam, Sawal, Mali, Panganr, Silver, Grass, Parry, Chirra, Dayee, Baam, Dola, Nolakhiand Khurni.

K. Socio-Economic and Cultural Aspects

According to the results of survey, total households of the surveyed villages were 1745 with population of 14080. The average family size was 8.0 and was living in different family system depending upon their culture and economic needs. It was observed that in Behrubgarh village, majority of the families (80 per cent) are living in nuclear family system, in Noorpur village, 50/50 and in Rasool Nagar, majority of the families (90 per

cent) live in joint family system.

It was observed that on right side of LMB from RD 0+000 to RD 27+000, fish ponds and fish farms were present, covering about 95 percent of subproject area. The lands of villages Barubgarh and Noorpur were not available for agriculture. The farmers availed the opportunity to utilize their affected lands and converted into fish farms. The survey data indicates that average monthly income of the households was more than Rs.16,000.

Most of the villages do not have adequate educational infrastructures and allied facilities especially for the female. Only Rasool Nagar had government high schools for boys and girls out of three studied villages

The subproject area lies in Rachna Doab, which is famous for buffaloes known as one of highest milk producing animals. There are no endangered, extinct or rare species reported / pertains to AOI.

L. Public Consultation

The public consultation process with various stakeholders has been carried out so as to create awareness, information dissemination and to involve them in the designing, planning and execution of subproject. The viewpoints of the stakeholders have been taken into account and their concerns and suggestions for possible improvements have been included where appropriate.

During the field survey, significant efforts were made to identify the possible categories of stakeholders. Stakeholder at site were notified villagers, local residents, government officials, shop owners, public representative, NGO's and general public. All those stakeholders had different types of stakes according to their professions.

M. Environmental Impact Assessment and Mitigation Measures

The Initial Environmental Examination (IEE) study has disclosed that the subproject is not likely to have any severe negative impacts on the environment and people of the area. All the potential impacts which have been identified during the present assessment are associated with the construction stage of the subproject, and minor to moderate in severity; and can easily be avoided (through good design and construction planning) or mitigated (through proper implementation of the EMP.

No acquisition of permanent land will be involved. All the other impacts like soil erosion, soil contamination, water contamination, air pollution, high noise level, etc. are of temporary nature and can be controlled and mitigated.

Environmentally sensitive areas such as the two protected forest areas and wildlife sanctuary that exist along the subproject corridor will not be affected by the activities.

No indigenous people and women headed households have been identified in the subproject. The other social issues like safety of general public and workers, security problems, risk of communicable diseases, vector borne diseases etc. are of temporary nature.

On the other hand, the subproject will create job opportunities particularly for the local population during construction stage and extremely beneficial for safety of the public, land and other infrastructures.

N. Environmental Management Plan

Environmental Management Plan (EMP) is produced as a complementary part of Detailed Design and as a free- standing document. It ensures incorporation of the relevant environmental factors into the overall subproject design and will identify linkages to other safeguard policies relating to the project.

Based on the preliminary assessment, key mitigation measures recommended under this Environmental Management Plan (EMP). Overall responsibility for Environmental Management and Monitoring will rest with the Project Implementation Unit (PIU) which is headed by a Project Director.

O. Conclusion and Recommendations

Based on the preliminary plans, environmental and social field surveys, and impacts assessment of the proposed project, it may be concluded that there are insignificant, short term and reversible impacts of the Project. In the light of the above discussions, it may be concluded that the proposed preliminary Project is environment friendly and will cause the least effects on the area's existing in sense of Safety for peoples, agricultural land and infrastructure.

Although comprehensive mitigation measures have been proposed in the report to minimize the negative impacts and to enhance the positive impacts of the subproject, however, major recommended mitigation measures are summarized as under:

1. Temporary labour camp should be developed on state land and facilitated with proper drainage facilities.
2. Soil erosion and contamination, water contamination, air pollution and high noise levels should be controlled with the use of good engineering practices.

3. Contractor should develop plan such as traffic management, Solid waste management and material management etc. before starting the construction activities.
4. Contractor should warn the workers not to hunt the birds, fish resources, etc. as there are plenty of fish farms around the subproject area as well as a wildlife sanctuary also lies within the subproject vicinity.
5. Contractor should take due care of the local community and its sensitivity towards local customs and traditions.
6. EMP proposed in the report should be implemented in the true letter and spirit.

1. INTRODUCTION

1.1 GENERAL

1. The Punjab irrigation network comprises of 24 canals fed by 14 Barrages /Headworks and 9 major inter-river Link canals, irrigating more than 21 million acres of land. This irrigation network of Punjab Province makes it the most fertile area of Pakistan. More than 50% of the total national agricultural produce comes from this fertile land.
2. This subproject is one of the Flood Emergency and Reconstruction and Resilience Project (FERRP) being implemented by the Project Implementation Unit (PIU), Punjab Irrigation Department, financed by the Asian Development Bank (ADB). The floods and heavy rains in the Punjab Province affected millions of people and damaged or destroyed a large number of infrastructures during last few decades. Due to this natural disaster, land & farmers are affected adversely with the passage of time. Non-farm sources of livelihoods and services were also affected by floods which include many small enterprises; manufacturing, processing units and loss of daily wages employment etc.
3. In 2014, heavy monsoon rains in the catchment areas of the eastern rivers of Chenab, Ravi, Sutlej and Jhelum, resulted in flash floods and rain-hit areas in various districts of the province damaging community physical infrastructure as well as bringing destruction to private housing and agriculture. The causes of devastation can be classified into two categories in terms of their impact i.e. (a) Flood- affected and (b) Rain-affected. In Punjab, sixteen districts were affected by the floods in the eastern rivers (particularly Chenab River), emanating from across the eastern borders, and twelve additional districts also faced severe damages due to heavy rainfall in catchment areas causing flash floods and damages to the physical public and private infrastructure, agriculture land and communication facilities etc.
4. The Government of Punjab is keenly interested for the safeguards of the people and their properties through Flood Emergency Reconstruction and Resilience Project (FERRP), financed by the Asian Development Bank. The FERRP will provide support for the restoration of resilient flood protection infrastructures and strengthening of government capacity to manage disasters and climate variability. The objective of the Project is to reduce the human sufferings and socio-economic effects of floods in Punjab, to improve social, economic, and ecological benefits of floods, and to foster safer human settlements near flood plains. The cost of subproject amounts to PKR 81816,272 (PKR 81.8 millions) and will be funded by ADB.

1.2 BACKGROUND OF THE SUBPROJECT

5. Qadirabad Barrage is one of the most important major Hydraulic Engineering works constructed on River Chenab, 18 miles downstream of Khanki Headworks under Indus Basin Project. It was commissioned during the year 1967 to take water from River Jhelum released from Mangla Dam through Rasul Qadirabad (RQ) Link Canal and transfers the water to River Ravi through Qadirabad Balloki (QB) Link Canal as the water rights of River Ravi was allocated to India under Indus Water Treaty 1960. Both RQ and QB Link Canals are perennial canals and ultimately feed Lower Bari Doab Canal (LBDC) and Balloki Sulemanki (BS) Link Canal at Balloki Headworks for Perennial Canals of Sulemanki Headworks.
6. Qadirabad has two marginal bunds i.e Left Marginal Bund on the right side of the river having a length of 106,300 feet. In case of a breach in Right Marginal Bund, flood water returns back to the river course, due to topographical features and in case of breach in the Left Marginal Bund, water spreads in the adjacent area causing more damages and never returns to the river. Therefore the protection of Left Marginal Bund needs more emphasis. Exceptionally High Flood 2014 with peak flow of 903,504 Cusecs was passed which posed continuous threat in the critical reach of Left Marginal Bund up to i.e. RD 30+000.

1.3 PURPOSE OF THE SUBPROJECT

7. The Government of Punjab is focusing on emergent restoration and flood mitigation through its early efforts. Need was recognized for achieving an integrated and sustainable recovery during the post-floods rehabilitation and reconstruction phase which led to Government's close interaction with Asian Development Bank (ADB). The dialogue at various levels has finally resulted in materializing commitment from ADB for its financial and technical assistance to Government of Punjab for resilience or risk reduction in all rehabilitation and reconstruction works.
8. In order to minimize the chances of undetected cracks, burrows, rat holes and cavities, construction of an additional dowel bund 8.0 ft wide & 8.0 ft free board over HFL of 2014 on river side along the critical reach of Left Marginal Bund from RD 0+000 to RD 30+000 is proposed to minimize the risk of breach in Left Marginal Bund.
9. The hydraulic gradient line of 1:6 emanating u/s HFL of 2014 indicates its seepage path below toe of the embankment on the country- side. Even, it travels below the fish ponds bed levels as depicted on the cross sections of the subproject. The dowel bund will provide additional protection to the main embankment of LMB in critical reaches in terms of reduction of seepage, slope stability and piping action

etc. A 6" thick shingle layer at the top of Bund with 15.0 ft width has also been provided..

1.4 PURPOSE OF THIS INITIAL ENVIRONMENTAL EXAMINATION (IEE)

10. This report comprises the Initial Environmental Examination (IEE) study of Left Marginal Bund (LMB) of the Qadirabad Barrage at the left bank on Chenab River. Due to the presence of Punjab Wildlife Sanctuary and Forest Department protected areas Barubgarh and Khangarh in the vicinity of subproject, the subproject has been classified as environmental category B according to ADB's Safeguards Policy Statement (SPS), 2009.
11. The IEE study takes into account the natural environment (air, water, land, flora & fauna), human health and safety. This study evaluates the subproject's potential environmental risks and impacts in its area of influence and outlines planning, designing and implementation by preventing, minimizing or mitigating for adverse environmental impacts and enhancing positive impacts throughout subproject implementation.
12. The Social Assessment (SA) has been conducted to evaluate the subproject's potential positive and adverse effects on the affected people and to examine subproject alternatives where adverse effects may be significant. The width, depth and type of analysis in the social assessment are proportional to the nature of the subproject and scale of its potential effects, positive or adverse, on the affected people.
13. The baseline data was developed and analyzed to identify potential environmental impacts of the subproject. A Rapid Environmental Assessment Checklist methodology was adopted to identify the high risk activities and suggest their mitigation measures. Where possible, eliminating the risk by altering the scope or method of execution of work was preferred rather than minimizing the risk with control measures.

1.5 SUBPROJECT LOCATION

14. Left Marginal Bund (LMB) of Qadirabad Barrage is located at on river Chenab in tehsil Wazirabad of District Gujranwala. The Qadirabad Barrage is located at the boundary of Gujranwala and Mandi Bahawdin Districts of the Punjab Province. The exact location is shown in Figure: 1.1.

1.6 PROJECT CATEGORIZATION

15. According to ADB Safeguard Policy Statement (SPS) 2009, projects are to be categorized into three environmental categories; A, B, or C. All the anticipated adverse environmental impacts of the project are mitigable, temporary, and

localized. Also there is no environmentally sensitive or archeological site falling within project area of influence. However, due to the presence of Punjab Wildlife Sanctuary and Forest Department protected areas Barubgarh and Khangarh in the vicinity of the subproject, the REA Checklist defines this in category “B” as per SPS 2009 categorization guidance.



Figure 1.1: Project Location

1.7 OBJECTIVES OF THE REPORT

16. The main objectives of the report are as follows:
- i. The application of environmental administrative and legal framework on the subproject.
 - ii. Develop Environmental baseline data for the subproject Area of Influence (AOI), derive land use and environmental maps.
 - iii. Assessment of potential environmental Impacts and management of measures to cater for adverse impacts.
 - iv. Preparation of framework of Environmental Management Plan (EMP) and envisaged EMP implementation cost for this subproject.

1.8 METHODOLOGY FOR PERFORMING THE STUDY

17. The environmental and social data was collected and analyzed for the overall environmental study area. Data was collected during site visits and through stakeholder consultation. The concerned departments and institutions like Wildlife, Forestry & Fishery, Water Management Office, Irrigation, SCARP Monitoring Organization (SMO), Social & Environmental Management Unit (SEMU) and Land Revenue etc were consulted. The baseline data was developed to identify potential environmental impacts of the subproject. A risk based methodology was adopted to identify the high risk activities and suggest the mitigation measures. Where possible, eliminating the risk by altering the scope or method of execution of work was preferred rather than minimizing the risk with control measures. Public consultations were also under taken including a gender study to take the public viewpoints about the subproject.
18. Mr Shabir Ahmad Khan Environment Specialist, Mr Ali Suleman Environment Inspector from Barqab Consultanting Services and Project Implementation Unit (PIU), Irrigation Department, Government of Punjab conducted the study.

1.9 ENVIRONMENTAL ISSUES

19. The subproject activities include rehabilitation / remodeling of LMB of Qadirabad Flood Bund from RD 0+000 to RD 30+000. The rehabilitation / remodeling activity will cause some disturbance on the subproject Right of Way (RoW) site and the allied sites involving borrow material, camp area, material/ machinery yard, link roads and necessary facilities for the staff and labour to be engaged for the construction of the subproject.
20. The materials and labours shall have to be carried from the Depot / camp to the work sites. As such, there is no irreversible adverse environmental impact of the subproject but construction impacts such as air pollution, noise and use of community resources can be well mitigated through the proper implementation of

the mitigation measures, which have been identified in this report. Moreover, no private land or property will be involved for the subproject activity.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 GENERAL

21. This section provides an overview of the policy framework and national legislation that applies to the proposed sub-project. The project is expected to comply with all national legislation relating to environment in Pakistan and ADB Safeguard Policy Statement (SPS) 2009.

2.2 NATIONAL POLICY AND LEGAL FRAMEWORK

22. The Pakistan's National Conservation Strategy (NCS), that was approved by the federal cabinet in March 1992, is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992). The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas, that are relevant in the context of the proposed sub-project, are pollution prevention and abatement and increasing energy efficiency while conserving biodiversity.
23. Prior to the adoption of the 18th Constitutional Amendment, the Pakistan Environmental Protection Act (PEPA) 1997 was the governing law for environmental conservation in the country. Under PEPA 1997, the Pakistan Environmental Protection Council (PEPC) and Pak Environmental Protection Agency (EPA) were primarily responsible for administering PEPA 1997. After the adoption of the 18th Constitutional Amendment in 2011, the subject of environment was devolved and the provinces have been empowered for environmental protection and conservation. Subsequently, the Punjab government amended PEPA 1997 as Punjab Environmental Protection (Amendment) Act 2012, and Punjab EPA (PEPA) is responsible for ensuring the implementation of provisions of the Act in Punjab's territorial jurisdiction. PEPA is also required to ensure compliance with the NEQS and establish monitoring and evaluation systems.

2.3 REGULATIONS FOR ENVIRONMENTAL ASSESSMENT, PAKISTAN EPA

24. Under Section 12 (and subsequent amendment) of the PEPA (1997), a project falling under any category specified in Schedule I of the IEE/EIA Regulations (SRO 339 (IO/2000), requires the proponent of the project to file an IEE with the concerned provincial EPA. Projects falling under any category specified in Schedule II require the proponent to file an EIA with the provincial agency, which is responsible for its review and accordance of approval or request any additional information deemed necessary.

2.4 REGULATORY CLEARANCES, PUNJAB EPA

25. In accordance with provincial regulatory requirements, an IEE/EIA satisfying the requirements of the Punjab Environmental Protection Act (2012) is to be submitted to Punjab Environmental Protection Agency (PEPA) for review and approval, and subsequent issuance of NOC before the commencement of construction. As the subproject is not included in the Schedule I and II of the Regulations, therefore, issuance of NOC from the provincial agency is not required.

2.5 GUIDELINES FOR ENVIRONMENTAL ASSESSMENT, PAKISTAN EPA

26. The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. The guidelines that are relevant to the proposed sub-project are listed below:

- Guidelines for the Preparation and Review of Environmental Reports, Pakistan, EPA1997;
- Guidelines for Public Consultations; Pakistan EPA May 1997;

2.6 NATIONAL ENVIRONMENTAL QUALITY STANDARDS (NEQS) 2000

27. The National Environmental Quality Standards (NEQS) were first promulgated in 1993 and have been amended in 1995 and 2000. They have been revised and the latest NEQS were issued in 2010. The following standards that are specified in the NEQS are relevant to the proposed Subproject (See detailed Tables in Annexure). Air and Noise NEQS are also compared in the following Table 2.1, while the drinking water quality Standards have already been compared at Annex 4 (Table 5). **The more stringent standards will be applied under this project. For example, for PM₁₀, IFC/WHO standard will be achieved while for SO₂- NEQS will be used.**

Table 2.1: Comparison of Air & Noise NEQS with IFC/WHO EQS

Parameter	NEQS		EQS of IFC/WHO	
Air	SO ₂ 24 Hours	120	125	
	NO ₂ 1 year	40	40	
	PM ₁₀ 24 hour	250	150	
Noise	Day time	Neight	Day time	Neight
Residential, Institutional, Educational	55	45	55	45
Industerial, Commercial	70	65	70	70

28. NEQS for Ambient Air – November, 2010 state the Maximum allowable concentration of pollutants (9 parameters) in gaseous emissions from vehicle exhaust.
29. NEQS for Drinking Water Quality – 2010 describe the drinking water properties by outlining the defined physical and chemical parameters.
30. NEQS for Noise – November 2010 states the maximum allowable limit of noise arising from vehicles in decibels (dB) separately for day and night times.
31. NEQS for Waste Effluents –2000 states the Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea.
32. These standards apply to the gaseous emissions and liquid effluents discharged by, campsites and construction machinery. The standards for vehicles will apply only during the construction phase of the subproject. Standards for ambient air quality have also been prescribed.

2.7 ADB'S SAFEGUARD POLICY STATEMENT (SPS), 2009

33. The Asian Development Bank's Safeguard Policy Statement (SPS) 2009 requires that environmental considerations be incorporated into ADB's funded project to ensure that the project will have minimal environmental impacts and be environmentally sound. Occupational health & safety of the local population should also be addressed as well as the project workers as stated in SPS.
34. All loans and investments are subject to categorization to determine environmental assessment requirements. Categorization is to be undertaken using Rapid Environmental Assessment (REA) checklists, consisting of questions relating to (i) the sensitivity and vulnerability of environmental resources in subproject area, and (ii) the potential for the subproject to cause significant adverse environmental impacts. Projects are classified into one of the following environmental categories:

Category A: A project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA) is required.

Category B: A project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) is required.

Category C: A project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

Category FI: A project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary (FI).

35. As a result of the completion of the REA checklist, the subproject has been placed in Category “B” due to presence of wildlife and forest protected areas in the vicinity of subproject, thus a detailed and comprehensive IEE study has been prepared including the EMP.

2.8 OTHER ENVIRONMENT RELATED LEGISLATIONS

36. The **Table 2.1** provides a summary of all legislations, guidelines, conventions and corporate requirements.

Table 2.1: Environmental Guidelines and Legislations

Legislation/Guideline	Description
Punjab Environmental Protection Act, 2012	Post adoption of the 18th Constitutional Amendment in 2011, the subject of environment was devolved and the provinces have been empowered for environmental protection and conservation. Subsequently, the Punjab government amended PEPA 1997 as Punjab Environmental Protection Act 2012, and Punjab EPA (PEPA) is responsible for ensuring the implementation of provisions of the Act in Punjab's territorial jurisdiction. PEPA is also required to ensure compliance with the NEQS and establish monitoring and evaluation systems.
Pakistan Environmental Protection act (PEPA) 1997	Basic legislative tool empowering the Government of Pakistan to frame and enforce regulations for the protection of environment. The PEPA 1997 is broadly applicable to air, water, soil, marine and noise pollution, and handling of hazardous wastes. Penalties have been prescribed for those contravening provisions of the Act. Under section 12 of the PEPA 1997, no project involving construction activities or any change in the physical environment can be undertaken unless an IEE or EIA is conducted and a report submitted to the federal or provincial EPA.
Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, (2000)	The Regulation classifies projects on the basis of expected degree of adverse environmental impacts and lists them in two separate schedules. Schedule I lists projects that may not have significant environmental impacts and therefore require an IEE. Schedule II lists projects of potentially significant environmental impacts requiring preparation of an EIA. The Regulations also require that all projects located in environmentally sensitive areas require preparation of an EIA. It also lists projects not requiring either an EIA or an IEE.
National Environmental Quality Standards (1993 and 2000)	The NEQS specify standards for industrial and municipal effluents, gaseous emissions, ambient air requirements and emission levels for Sulfur dioxide and Nitrogen oxide, vehicular emissions and noise levels. The PEPA specifies the imposition of a pollution charge in case of non-compliance with the NEQS. The standards were last revised in 2000.
National Environmental Policy (2005) (NEP)	NEP is the primary policy of Government of Pakistan addressing environmental issues. The broad Goal of NEP is, “to protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development”. The NEP identifies a set of sectoral and cross-sectoral guidelines to achieve its goal of sustainable development. It also suggests various policy instruments to overcome the environmental problems

Legislation/Guideline	Description
	throughout the country.
The Forest Act (1927)	The Act empowers the provincial forest departments to declare any forest area as reserved or protected. It empowers the provincial forest departments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce, quarrying and felling, lopping and topping of trees, branches in reserved and protected forests
Punjab Wildlife Protection Ordinance, 1972	It empowers the government to declare certain areas reserved for the protection of wildlife and control activities within in these areas. It also provides protection to endangered species of wildlife. As no activities are planned in these areas, no provision of this law is applicable to the proposed project.
The Antiquities Act (1975)	It ensures the protection of Pakistan's cultural resources. The Act defines "antiquities" as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the GOP to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, GOP, any archaeological discovery made during the course of the project.
Pakistan Penal Code (1860)	It authorizes fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs so as to make them less fit for ordinary use.
Canal Drainage Act 1973	This Act binds the public water users to restore the environment of the water bodies, users be it the communities, individuals, industries or a government concern. Pubic Local Government Ordinance 1979 This empowers Zilla council to control environmental pollution by preparing and implementing appropriate schemes to protect air, water and land.
The West Pakistan Fisheries Act 1961	The Fisheries Act requires protection of public waters as habitat of fish and other aquatic life. This is helping the Fisheries Department to provide effective protection to the fish and other aquatic life in the game Sanctuary upstream the barrage and the public waters downstream the barrage. Fish is a food to a good number of migratory birds.
The Forest Act 1927	This provides full protection to the Reserved Forests, Protected Forests as well as the wildlife sanctuaries, such as a Qadirabad Barrage pond area.
The Public Health (Emergency Provision) Act 1954 read with West Pakistan Epidemic Control Act 1958	These two laws cover the presentation and spread of human diseases, safeguarding the public health and providing and maintaining adequate medical services and other services essential to the health of the communities in the project area.

Legislation/Guideline	Description
Explosives Act 1884	Under the Explosives Act 1884, the Project Contractors are bound by regulation on properly and securely handling, transporting and using explosive during quarrying, blasting and other purposes.
NATIONAL ENVIRONMENTAL AND CONSERVATION STRATEGIES	
National Conservation Strategy	Before the approval of NEP, the National Conservation Strategy (NCS) was considered as the Government's primary policy document on national environmental issues. At the moment, this strategy just exists as a national conservation program. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage and recommends immediate attention to these core areas.
Biodiversity Action Plan	The plan recognizes IEE/EIA as an effective tool for identifying and assessing the effects of a proposed operation on biodiversity.
Environment and Conservation	There is a well-established framework for environmental management in Pakistan. The Ministry of Environment deals with environment and biological resources. Within the ministry, the NCS unit established in 1992 is responsible for overseeing the implementation of the strategy. Two organizations, the Pakistan Environmental Protection Council (PEPC) and the Pak EPA are primarily responsible for administering the provisions of the PEPA, 1997. The PEPC oversees the functioning of the Pak EPA. Its members include representatives of the government, industry, non-governmental organizations and the private sector. The Pak EPA is required to ensure compliance with the NEQS, establish monitoring and evaluation systems, and both identify the need to and institution of legislations whenever necessary. It is thus the primary implementing agency in the hierarchy. The Provincial Environmental Protection Agencies are formed by the respective provinces.
INTERNATIONAL CONVENTIONS	
The Convention on Conservation of Migratory Species of Wild Animals (1981.21)	The Convention requires countries to take action to avoid endangering migratory species. The term "migratory species" refers to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or cooperate with other countries in matters of research on migratory species. There are no endangered species of plant life or animal life in the vicinity of the Project.
Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)	The convention requires Pakistan to impose strict regulation (including penalization, confiscation of the specimen) regarding trade of all species threatened with extinction or that may become so, in order not to endanger their survival further.
International Union for Conservation of Nature and Natural Resources Red List (2000)	Lists wildlife species experiencing various levels of threats internationally. Some of the species indicated in the IUCN red list are also present in the wetlands of Pakistan.
Convention on wetlands	Taunsa and Qadirabad are RAMSAR sites for waterfowls and Pakistan is signatory to the RAMSAR convention. This Convention

Legislation/Guideline	Description
of international importance, especially as Waterfowl Habitat (RAMSAR 1971)	enjoins upon signatory factions to provide and protect the habitats of migratory waterfowl.
Convention on Conservation of Migratory species of Wild Animals (Bonn 1979), as a follow up to RAMSAR 1971	This convention came up as a follow up to RAMSAR 1971 and took care of the specifics
INTERNATIONAL ENVIRONMENTAL GUIDELINES	
ADB's Safeguard Policy Statement (SPS), 2009	ADB's Safeguard Policy Statement (SPS), 2009 provides guidelines for environmental assessments of development projects. These guidelines help prospective projects identify impacts they will have on various environmental receptors. The guidelines call for carrying out EIAs or IEEs of projects based on severity of their impacts.

3. SUBPROJECT DESCRIPTION

3.1 QADIRABAD BARRAGE

37. Qadirabad Barrage is one of the major engineering components of Indus Basin project. It was constructed as a part of Rasul – Wazirabad – Balloki – Sulemanki Link Canal system. The Barrage length between the abutments is 3376 feet and consist of 50 Nos Spans, each of 60 feet length, between the piers. The Barrage has designed capacity of 9.00 Lac cusecs. The Head Regulator of Q.B.Link has a capacity of passing 25000 cusecs located on the left side of Barrage, where under sluices pocket and divide wall has been provided to facilitate the regulation. The last two bays adjacent to the canal Head Regulator has been provided with silt excluder tunnels. A fish ladder has added in the divided wall.
38. Qadirabad Barrage was constructed by the Water and Power Development Authority (WAPDA) and was commissioned during the year 1967. River Chenab is bounded by Marginal Bund. To cope with the situation of flood, river training works have been provided. Qadirabad Balloki Link Canal off takes from the left side and is central part of the Rasul Balloki Link Canal System. It transfers Mangla releases to Ravi river for its utilization in the areas which is previously irrigated by Ravi River and Sutliej River. The Q.B Link falls into Ravi River at about 16 Km upstream of Balloki Headworks. It supplies irrigation water to approximately 6 million acres cultivatable land. Subproject location and a plan showing flood water route are shown in Figure 3.1 & Figure 3.2, respectively.

3.2 NEED FOR THE SUBPROJECT

39. The experience of exceptionally high flood in September 2014 lessoned that the existing free board is less to provide safeguard against high flood. It may be revisited in purview of flood heights of recent flood in September 2014 to make the bund strong enough to provide foolproof and risk free safety to local adabies/settlements, infrastructures, livestock, properties and human lives in particular.

3.3 OBJECTIVES OF THE SUBPROJECT

40. Qadirabad has two marginal bunds i.e Left Marginal Bund on the left side of the river having a length of 64+938 feet and Right Marginal Bund on the right side of the river having a length of 106+300 ft.
41. The breach in Right Marginal Bund, flood water returns back to the river course and in case of breach in the Left Marginal Bund, water spreads in the area causing more damages and never returns to the river. Therefore the protection of Left Marginal Bund needs more emphasis. Exceptionally High Flood 2014 with peak

flow of 903,504 Cusecs was passed which posed continuous threat in the critical reach of Left Marginal Bund up to i.e. RD 30+000.

42. In order to minimize the chances of undetected cracks, burrows, rat holes and cavities, construction of an additional dowel bund 8.0 ft wide & 8.0 ft free board over HFL of 2014 on river side along the critical reach of Left Marginal Bund from RD 0+000 to RD 30+000 is proposed to minimize the risk of breach in Left Marginal Bund. The hydraulic gradient line of 1:6 emanating u/s HFL of 2014 indicates its seepage path below toe of the embankment on the country- side. Even, it travels below the fish ponds bed levels as depicted on the X-sections of the subproject. The dowel bund will provide additional protection to the main embankment of LMB in critical reaches in terms of reduction of seepage, slope stability & piping action etc.
43. Installation of 6 No tube wells has been proposed to minimize the risk of breach in Left Marginal Bund. The bank level of Flood Bund has been proposed to be raised by 2.0 feet in order to have required free board of 6 feet above anticipated water level for a flood of 11,00,000 cusecs passing through the barrage and laying of shingle layer at the top of Bund with 15.0 ft width and 0.5 ft depth
44. Construction of a new wetting channel along the critical reach of Left Marginal Bund from RD 0+000 to RD 30+000 is also proposed. At the start of flood season, water will be filled in wetting channel with the help of tube wells to test the left marginal Bund for any cracks, burrows, rat holes and cavities in the bund which may prove devastating otherwise when the actual flood comes.
45. The Economic Analysis of the proposed project reveals as below:
46. Project Cost. (Rs. Million) = 233.668
47. Cost Benefit Raio = 1:1.77
48. Net Present Worth at 15% D.F = 319.91
49. Net Present Worth at 20% D.F = 192.89
50. Internal Rate of Return = 77.12%

50.1 NO PROJECT ALTERNATIVE

51. Not taking up the Project will, sooner or later, result in a catastrophic collapse of the existing bund and the destruction that will follow shall most probably be out of proportion and without warning. It will mean destruction of bund. Unprecedented floods shall be followed by loss of settelmemts, agricultural crops and other infra structures in addition to canal closure and destruction of agriculture by cutting off the crucial Irrigation water to most fertile agricultural lands of Punjab. The pond will be affected and along with that the flora and fauna that has been harboring the

habitat. A large number of villages along the left bank of the river will be badly affected resulting in a high death toll of humans and cattle. The women and children would be the worst affected. A significant part of the nearby population shall be turned homeless. Services including electricity, telephone, education and communication shall be disrupted.

52. For this proposal, the weaknesses and threats outweigh the strengths and opportunities. Therefore, No Project option, possessing the potentials of worst scenario is not recommended.
53. The Fig 3.1 shows the existing subproject i.e Left Marginal Bund (LMB) with RoW. The Figure also shows the Protected areas of Wildlife and Forest. While Figure 3.2 indicates the Plan showing flood water route through breaching section of Qadirabad Barrage

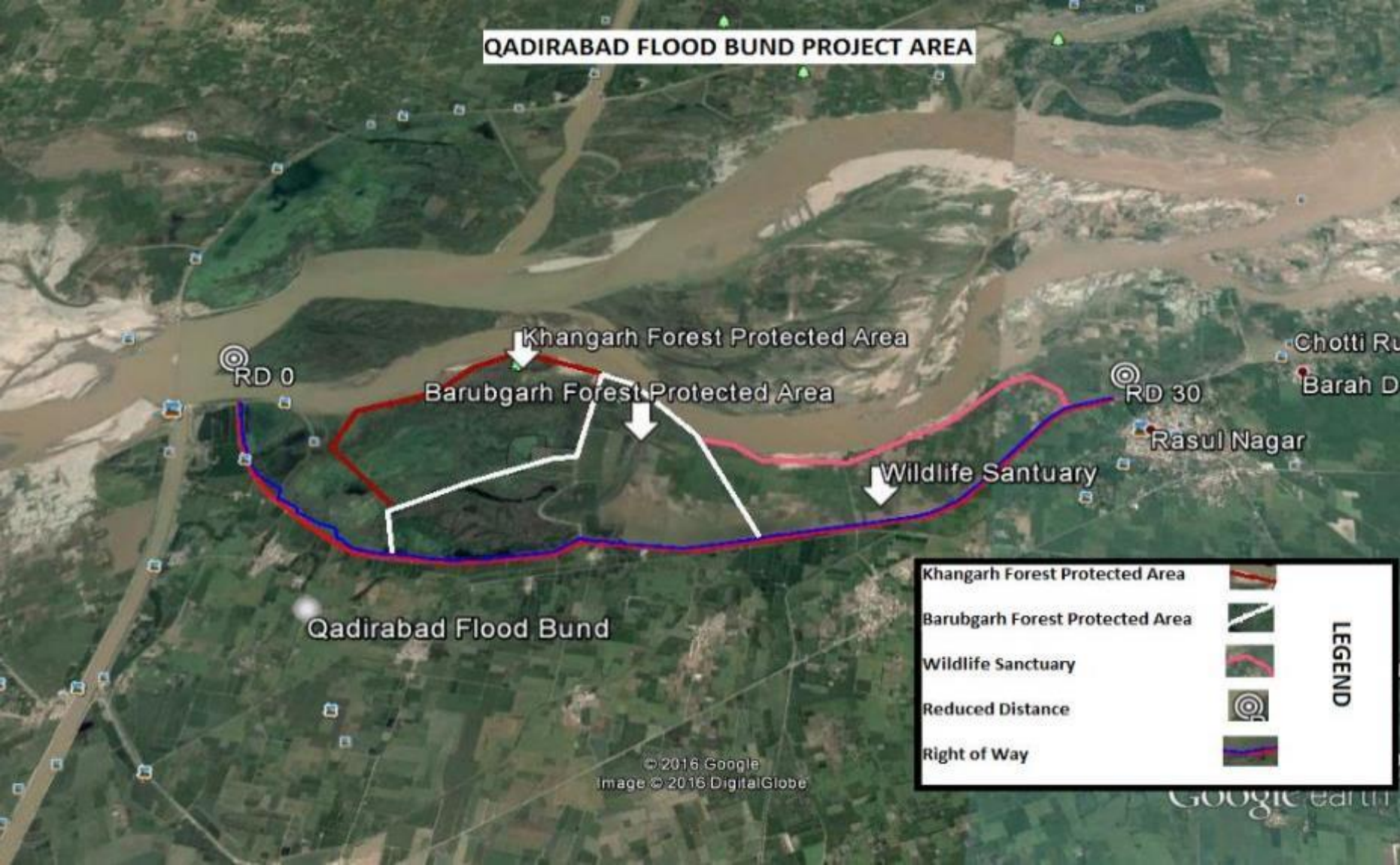


Figure 3.1: Project Location

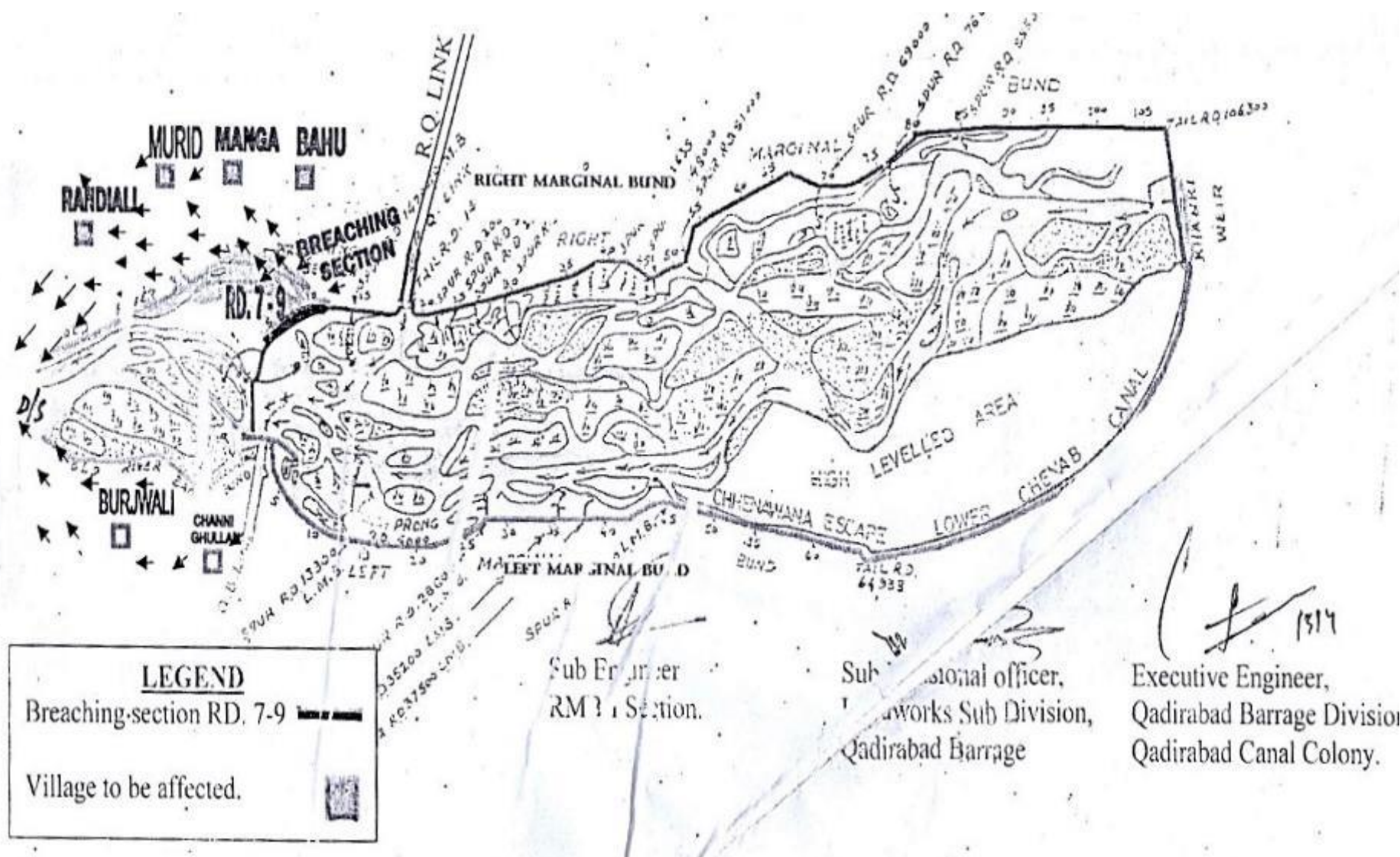


Figure 3.2: Plan showing Flood Water Route through Breaching Section of Qadirabad Barrage

3.4 ENVIRONMENTAL ASSESSMENT

54. The subproject Area of influence (AOI) is the area likely to be effected by the project RoW, nearby areas and all its ancillary aspects such as access roads, borrow areas, waste disposal sites and labor camp as well as unplanned development induced by the project.

3.5 CONSULTANT'S RESIDENCE

55. Residences for consultants will be required. They will be accommodated in the existing staff colony of Barrage.

3.5.1 Offices

56. There are old offices in the irrigation colony at Barrage which will be used for office purposes.

3.5.2 Contractors Facilities

57. Sufficient barren land is available for contractor and labour camps in the vicinity of the subproject area owned by Irrigation Department which will be used for the establishment of contractor's facilities. The contractor facilities would include messing, material storage area and labor camp. Contractor's camp would be fenced.

3.5.3 Borrow Area

58. The selected borrow site is in between RD 20+000 and RD 30+000 of Qadirabad Baloki Link canal, about 7 Km from the subproject area. The borrow areas will be inspected and will require approval by the Consultant before being used.

3.5.4 Works and Materials

3.5.4.1 Estimated Quantities of Works

59. Subproject estimates are according to the approved Market Rate System (MRS) notified by Finance Department for the MRS Biannual (1st February 2016 to 31st July 2016) District; Gujranwala. Subproject civil work includes excavation, loading/unloading of earth, providing / laying shingle on the bund and transportation of materials like stone aggregate. The arrangements will be made through National Contract Bidding (NCB). The subproject envisages "Remodeling Left Marginal Bund of Qadirabad Barrage in Critical Reaches" as explained above in subproject objectives. Following is the estimate of physical activities and the implementation schedule.

Table 3.1: Estimate of physical activities

Sr. No	Items	Year – I		Total	
1	Earth Work.	203.391	Million cft	203.391	Million cft
2	Shingle Layer	9.209	Million cft	9.209	Million cft
	Total:-	212.60	Million cft	212.60	Million cft

Table3.2: Availability of Raw Materials

Sr. No.	Raw Material Availability	Source
1	Borrow Material / Earth	Available locally at 7 Km distance QB Link in between RD 20 and RD 30
2	General and stone / shingle	Available at Quarry area Sikhanwali 139 Km from subproject area
3	Sand	Available locally
4	Clean water for specific uses	Available locally
5	Other water for compaction etc.	Available locally
6	Riprap and other purpose stone	Available 140Km away in Sargodha District

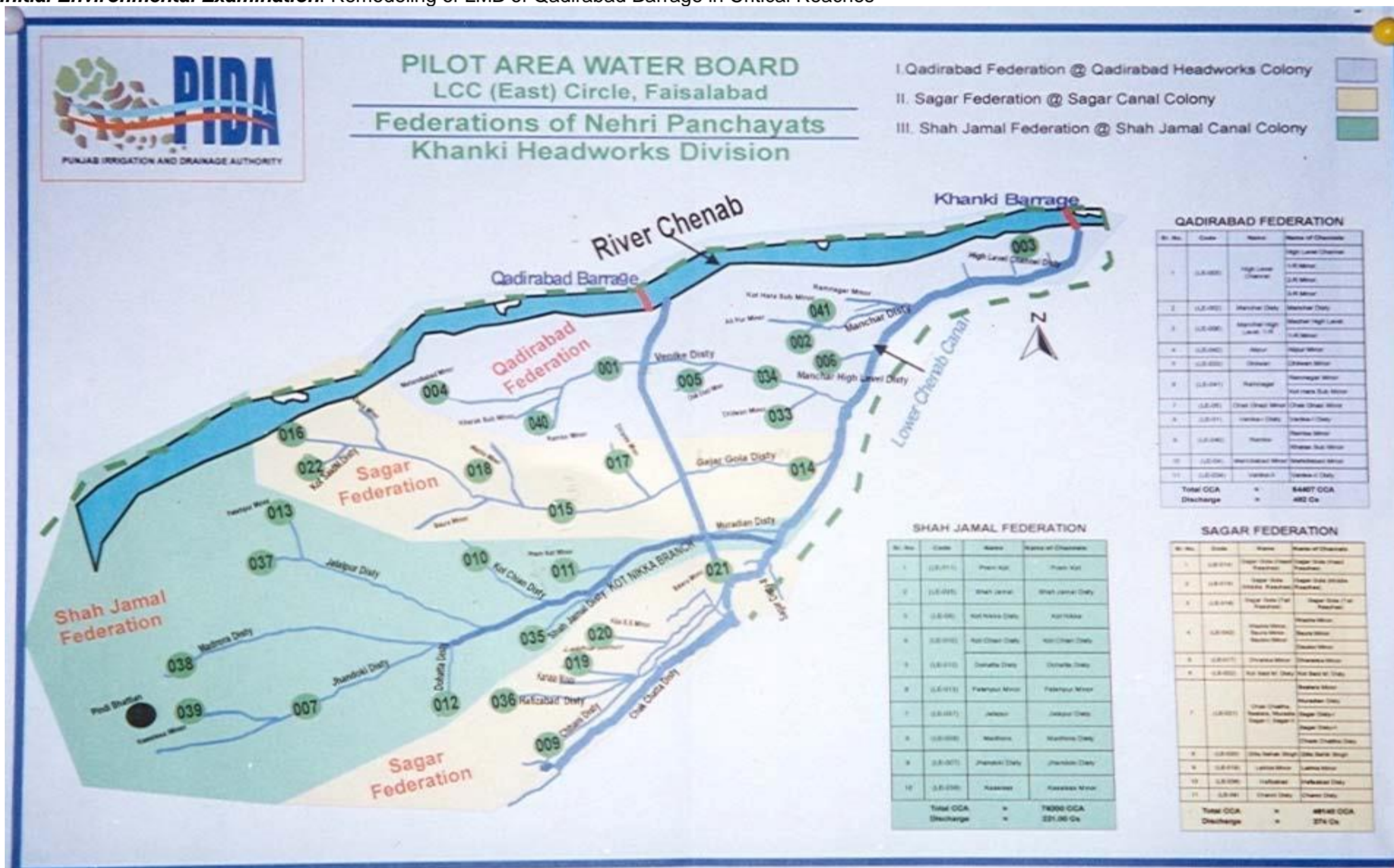
4. ENVIRONMENTAL AND SOCIAL BASELINE

4.1 GENERAL

60. The purpose of this chapter is to establish the baseline conditions for the physical, biological and the social aspects of the environment of subproject area. The data were collected regarding the physical environment, biological environment and social aspects of the study area during stakeholder consultation carried out by the environment team of PIU.

4.2 AREA OF INFLUENCE

61. This chapter describes the environmental, social and biological baseline conditions of the subproject area. The baseline conditions have been established on the basis of the data collected from the field, and through unstructured interaction with the local communities as well as the officials from various departments. In addition, the published data (secondary data) was also used to provide background information about the subproject area.
62. The extended area of influence of the subproject is part of Rachna Doab, three million acres of best agricultural land located in six districts of central Punjab with a population of above five million people. The area of influence of the subproject is Right of Way (RoW), surrounding areas, labour camps and stack yard etc. The subproject has great influence with the safety of the Rachna Doab irrigated command areas. Fig 4.1 shows the water distribution systems to communities in Rachna Doab.



63. The subproject Area of influence (Aoi) is referred to as all those areas which may be affected directly or indirectly by the subproject activities. This includes the following:-

- ***The Left Marginal Bund (LMB), RD 0 to RD 30 of Qadirabad Barrage at river Chenab and its surroundings.***
- ***The labor camp, site offices, equipment and vehicle yards;***
- ***Haul tracks to transport construction material;***
- ***Borrow areas, from where the fill material will be obtained;***
- ***Waste disposal sites; and***
- ***Unplanned development induced by the subproject***

4.3 PHYSICAL ENVIRONMENT

4.3.1 Alluvial Deposits

64. Qadirabad barrage site is located in District Gujranwala, which is entirely situated on the alluvium plain. Kanker is found all over the district. Sediment deposits are visible in the low velocity area of the river where initial plant colonizers can be seen at the early serial stages of succession of vegetation. Along the banks of the river, gradual accumulation of sediments has resulted in "Bela" formation, which supports tree growth and hence named as "Zakeeras".

4.3.2 Physiography

65. Entire Gujranwala district is a flat plain. The plain of Rachna Doab, inclusive of the immediate and extended area of influence of the subproject, is a region of generally uniform slope, with at its south west wards.

4.3.3 Soil Type

66. The types of soil commonly found in entire district Gujranwala are silt loam, loam, sandy loam, sandy clay loam and Riverine. The immediate subproject area soil is riverine alluvial silt tending to fall in sandy loam and silt loam group.

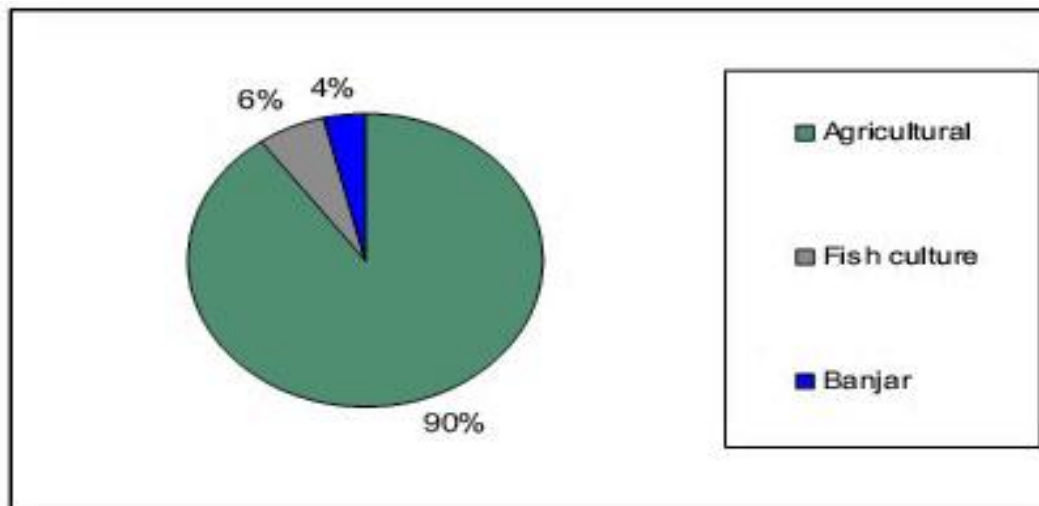


Figure4.2: Land use pattern in subproject Area

4.3.4 Land Use

67. On an average, within the direct influence of the river and in the immediate vicinity of the subproject area, 75 % of the land is under agriculture. About 10% is under Fish culture or wetlands, 6 percent forest and the remaining 9% is Pakkar / Banjar.
68. About 80% of total population depends upon agriculture. Most of the agriculture land is under cultivation. Rice is the main Kharif Crop (90%). The other being Maize, Bajra, Sugar cane and Oil seeds. Wheat is the main Rabi crop, the other being barley, pulses, gram, oil seed and green fodders. The cropping intensity is over 100% and multi cropping is quite common. Satellite Imagery map of land use is given in Figure 4.3.

4.3.5 The River and Hydrologic Regime at Qadirabad Head works

•Peak Discharge

69. The peak annual discharge of the river Chenab at Qadirabad Headworks is an indicator of the hydrological behavior of the river. Table 4.1 shows the discharge data at Headworks from the year 1973-2014.

Table 4.3: Peak Discharge at Qadirabad Barrage from 1973-2014

Sr. No.	Date	Discharge Cs.	Critical Gauge at R.D. 15+000 L.M.B.	Flood Stage.
1	10.08.1973.	8,54,341	712.32	Exceptionally High / Super Flood.
2	17.07.1975.	6,98,228	710.00	Exceptionally High
3	02.08.1976.	6,28,228	709.60	Exceptionally high
4	26.09.1988	8,92,299	711.40	Exceptionally High / Super flood
5	11.09.1992	9,48,530	713.40	Exceptionally High / Super Flood
6	29.07.1995	6,44,794	706.30	Exceptionally High
7	24.08.1996.	8,53,231	711.70	Exceptionally High /Super Flood
8	28.08.1997	8,73,442	711.90	Exceptionally High /Super Flood
9	08.07.2005	3,69,847	697.00	High Flood
10	04.09.2006	4,43,206	699.10	Very High Flood
11	15.08.2013	403403	698.05	Very High Flood
12	07-09-2014	9,03,504	712.30	Exceptionally High /Super Flood

Source; Irrigation Dept. Qaderabad Barrage

4.3.6 Water Resource in the Vicinity of subproject Area

a. Surface Water

70. Main source of surface water in the immediate subproject area is river Chenab itself. However, the surface water consists of several Nullahs (torrents) and the Lower Chenab Canal (LCC) system. The most important Nullahs are Palkhu, Bhimber, Aik, Dekand Bhair, which mark general drainage lines in the water shed. The surface water supply plays an important role in irrigation and drainage of the extended subproject area. Major source of Irrigation water is River Chenab through Qadirabad Balloki Link Canal, Rasul Balloki Link Canal which presently off takes from Qadirabad Headworks.

b. Ground Water

71. The ground water aquifer is recharged by surface water. The sub-soil ground water table is about 32-65 feet and the water is sweet and of drinkable quality. There are above 30,000 tube wells in the extended subproject area which meet about 20% of the requirement of water for drinking and irrigation purposes. By and large, the tube wells are owned privately by people of the

area. The reservoir of ground water becomes significant during Rabi season when the canal water is not available and rain fall is scanty. Around 23000 (77%) tube wells are being run on diesel while the remaining about 7000 (23%) are running with the help of electricity. Lesser dependence upon electricity is due to its un dependable supply in the rural areas.

c. Surface Salinity

72. SCARP Monitoring Organization (SMO) under takes the study to identify the saline area in Barrage command area. Portable digital conductivity meter was used to measure the EC of 0-15cm soil. Four categories namely, non-saline (S1(EC up to 4dS/m)), slightly saline (S2(EC between 4 to 8 dS/m)), moderately saline (S3 (EC between 8-15dS/m)) and strongly saline (S4 (EC above 15dS/m)) were recognized and mapped. The percentage of saline area found within the Barrage command area is summarized in Table 4.2.

Table 4.4: Percentage Surface Salinity Statistics

Class	Percentage
Non Saline(S1)	88
Slightly Saline(S2)	1
Moderately Saline(S3)	1
Strongly Saline(S4)	Negligible
Miscellaneous Land Type	9

d. Erosion of Protection Embankments

73. The possibility of the bund (embankment) erosion will be rather limited. Local water pressures or whirlpools caused due to burrows of rodents, loosening of soil by root action of trees, dissolution of some localized deposits, faults developed in the embankment due to heavy rains how ersor direct washing away of the embankment due to sheet erosion during heavy rains, can collective lyor severally weaken the bunds through erosion. These possibilities shall have to be warded off through an effective maintenance and frequent monitoring of the safety of the protection bunds.

4.3.7 Climate

74. The subproject is located in Gujranwala District, which has a hot climate during summer and moderately cold in winter. The summer season starts in April and continues till September. The winter season begins in November and lasts till March.

a. Temperature

75. June is the hottest month of the year while January is the coldest. During June, the mean maximum and minimum temperature ranges between 40°C and 27°C respectively. During January the mean maximum temperature is 19°C and means minimum is 5°C.

b. Relative Humidity

76. The relative humidity during rainy season is as high as 60-70%. During dry months, it falls below 50%. The evaporation effect from river surface, however, takes it a little higher, in the belt close to the river. The average daily relative humidity for July is around 69%.

c. Precipitation

77. Average annual rain fall is about 375 mm (14.8 inches) with most of it descending in the months of July, August and September. Winter rain fall is rare and scanty.

d. Wind Velocity

78. The average daily wind speed in July has been around 4 km/h, that's the equivalent to about 3 mph, or 2 knots. In recent years, the maximum sustained wind speed has reached 61km/h, that's the equivalent to 38 mph, or 33 knots. Prevalent wind velocity is 10-25 km/h. During summers, it can rise to 30-50km/h creating dust storms and making the air hazy and dusty. Wind direction keeps changing according to seasons. During summer, mostly it is northerly while during winter it is usually south easterly.

4.3.8 Ambient Quality of Environment

a. Ambient Air Quality

79. Kick-off dust suspension of fine particles from the ground will be the major source of atmospheric pollutant. Carbon monoxide and oxides of sulphur and nitrogen will be derived from powered vehicles and from burning domestic fuels, etc.

b. Noise Level

80. Currently there are no noise issues in the area. However, movement of equipment and machinery will cause noise on temporary basis.

4.3.9 Natural History Event / seismic hazards

81. The area has no history of any serious damages due to earthquake. There is no record regarding any serious earthquake impact on the Qadirabad Barrage, flood bunds, any part of the river or L.C.C.system.

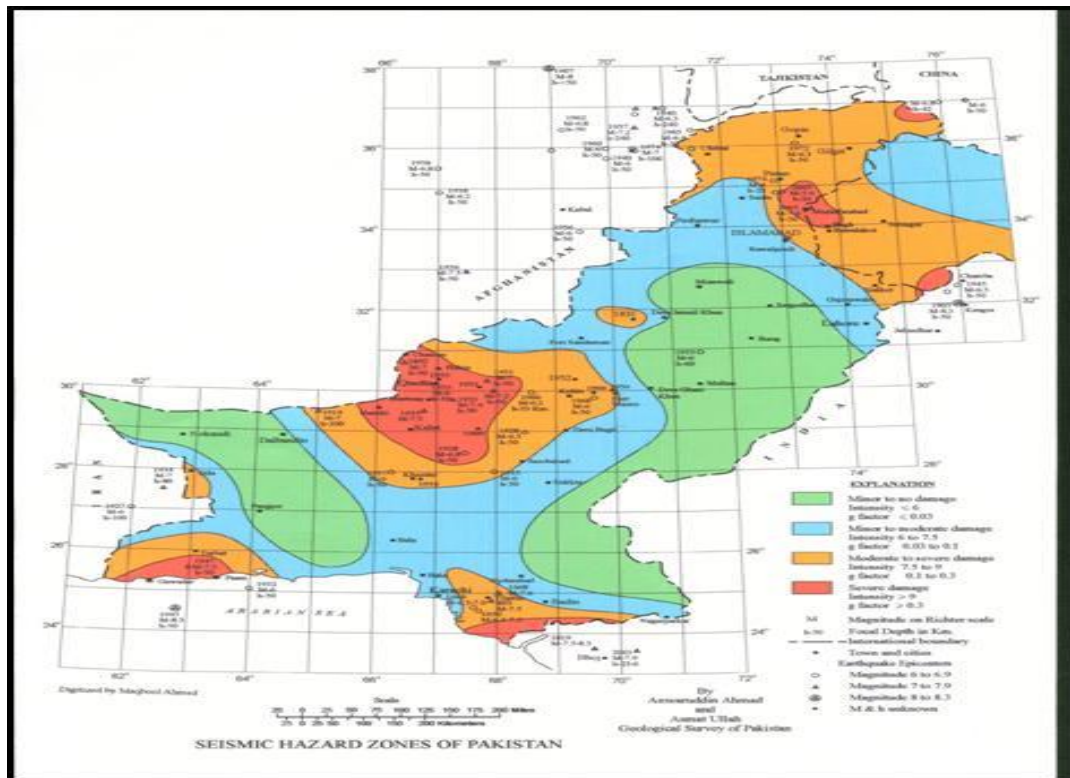


Figure 4.5: Seismic Hazard Zones of Pakistan

82. National Seismic Monitoring Centre of Pakistan issued the seismic zone map for Pakistan, as shown in Figure 4.3. Qadirabad flood bund area falls in low hazard area.

4.3.10 Floods

83. A super flood with discharge of 903,504 Cusecs has passed safely from the barrage. This peak flood was passed safely without operation of breaching section. The flood pressure towards right Guide Bund (RGB) is damaging the apron, pitching and the bund between RD 3+000 to 4+000. The present upstream river morphology and bela formation between the bunds, it is anticipated that the river threats will continue towards right guide bund.
84. Downstream of the Qadirabad Barrage, two new creeks have developed a few miles down the choking bund, inundating vast area. The creeks have been blocked by constructing embankment but water still flows around these bunds at higher discharges. In order to check flow magnitude on the left, a proposal for restoration of choking bund has been submitted.
85. Ten Nos. breaches occurred at Pindi Bhattian Flood Protection Bund due to structural inadequacy. The flood bund has a top width of 12 feet against a

design top width of 25 feet which necessitate remodeling of Pindi Bhattian Flood Protection Bund in accordance with the Federal Flood Commission guidelines. A subproject has been prepared for its remodeling.

4.3.11 Archaeological Sites/Chance Finds

86. No sites of archeological, historical, cultural, or religious significance are known to exist in the areas where construction will take place or where different project facilities will be established / located. In case there is a chance find, it can be handled as per Law and Procedures.

4.4 BIOLOGICAL ENVIRONMENT

4.4.1 Forests and Flora

87. The flora of the subproject area can be divided into two parts:

- i. Riverine Flora
- ii. Inland Flora

i. Flora of Riverine Tract

88. On fresh silt alluvium, mostly located in the pond area of the Headworks, depending upon the maturity of soil and its drainage status, a variety of river vegetation can be seen. In clearly visible succession of vegetation, first colonizers are grasses, sedges, Typha, Saccharum, Erianthus munja, Sacharum spontanem, Tamarix and Shisham. From small vegetation to trees, the stages appear as the alluvium level rises and becomes capable of anchoring an erect tree. In its present status, the flora of the Chenab river in the tract can be listed as follows:

- Lai / Pilchi (*Tamarix dioca*)
- Khabbal (*Cynodondactylon*)
- Kanwal, Kamian (*Nelumbium speciosum*)
- Munj (*Saccharummunja*)
- Kunder (*Typhaelephantina*)
- Kai (*Saccharum spontaneum*)

ii. Flora of Inland Tract

89. The inland areas are either the alluvial deposits along the right and left banks of the river. The main inland species of the flora of the immediate and extended subproject area are listed below:

- Kikar, Babool (*Acacia nilotica*)
- Shisham, Tahli (*Dalbergia sissoo*)
- Pipal (*Ficus religiosa*)

- Bohar (*Ficus bengalensis*)
- Mulberry (*Morus alba*)
- Lasoor (*Cordia obliqua*)
- Siris (*Albizia lebbela*)
- Amaltas (*Cassia fistula*)
- Beri (*Zizyphus jujuba*)
- Bakain, Dharek (*Melia azadirachta*)
- Sufaida (*Eucalyptus camaldulensis*)
- Simal (*Bombax ceiba*)

Other Plant

- Harmal (*Peganum harmala*)
- Pohli (*Argemone maxicana*)
- Khardar (*Alhajicamelorum*)
- Khabbal (*Cynodon dactylon*)
- Datura (*Datura alba*)
- Phog (*Calligonum polygoides*)
- Malla (*Zizyphus numularia*)
- Laily (*Convolvulus arvensis*)
- Shahtara (*Fumaria parviflora*)
- Saunchal (*Malva parviflora*)
- Dhodhak (*Euphorbia* sp.)
- Itsit (*Boerhaavia diffusa*)
- AK (*Calotropis procera*)
- Aksin (*Ipomea crassicaulis*)
- Dib Koonder (*Typha elephantina*)
- Deela (*Cyperus rotundus*)
- Bhang (*Cannabis sativa*)
- Bathu (*Chenopodium album*)
- Datura (*Datura innoxia*)
- Jantar (*Sesbania sesban*)

90. Agricultural crops like wheat, maize, sugarcane and tobacco in Rabi season and rice and pulses in Kharif season are grown.
91. The existing flora including the year round agricultural crops in the subproject area is because of adequate irrigation. If irrigation were not there, the original tropical Thorn Forest Flora would have continued to grow and which were as follows:
- Jand (*Prosopis picigera*)
 - Karir (*Capparis aphylla*)

- Var (*Salvadoraoleoides*)

- Peeloo (*Salvadorapersica*)

and the associated shrubs, herbs and grasses

92. The irrigation has changed the ecological conditions so much that the dry land flora has been wiped out.
93. The riverian as well as the inland flora plays a significant role in the local economy by way of Timber and Fuelwood production, protection from wind and water erosion, habitat of birds and animals environmental balance, cultural identification and rehabilitation of soils affected by water logging and salinity.

iii. Forest Protected Areas

94. There are two forest protected areas in the vicinity of the subproject area (Left Marginal Bund of Barrage). These protected are Natiionally recognized and not included in the IUCN Categorarized list. The detail is given below:

- **Barubgarh protected area**

95. The Behrubgarh protected area lies at the both side of the spur at RD 12+000 towards riverine side. The total area is 643 acres and the major forest species are Willow, Sheshum, Eucalyptus and Kikar. The grasses are Typha, Dhub grass and Sacharan Munja as shown in Figure 3.2.

- **Khangarh protected area**

96. The Khangarh protected area starts at the end of Spur at RD 12+000 up to 2.5 km along the river towards river flow. The total area of this protected forest is 518 acres. Only Eucalyptus forest specie has been grown. The protected area is shown in Figure 3.2.

4.4.2 Fauna

97. The immediate and surrounding area of the subproject has been under human inference for a long time and, therefore, a large number of wildlife species are already extinct or have shifted to other sites where they could find protection. The species left behind are those which have either adjusted with the present state of habitat or have adapted such like habits that they keep migrating between alternate habitats to strike their best balance with physical, biological or human factors of environment.
98. Following list shows an approximate state of fauna in immediate and extended subproject area:

Table 4.6: Mammals

Species	Scientific Name	Status
Jungle cat	Felischaus	Common

Porcupine	Hystriaseindica	Common
Hedge Hog	Hemiechinusspp	Common
Jackal	Canisaureus	Common
Wild Boar	Susscrofa	Common
Hare	Lepusnigricollis	Common
Squirrel	Funbuluspenanti	Common
Mole Rat	Bandicotabengalensis	Common
House Rat	Musmusculus	Common
Black Rat	RatusRatus	Common
Chamgadar /Bat	Pipistraliusterwis	Common
Gheese, House Shrew	Suncusmarirus	Common

Source: Wildlife Deptt Punjab

Table 4.7: Birds

(a) Resident Birds of Prey

Species	Zoological Name	Status
BrahminyKite	HaliasterIndus	Common
BlackKite	Milvusgrans	Common
White breasted KingFisher	Heleyonsinyrnensis	Common

(b) Seed Eating Birds

Species	Zoological Name	Status
Dove(ring necked)	Streptopeliadacaocto	Common
Dove	Streptopeliatranquebarica	Common
Dove	Streptopeliasenegalensis	Common
Finches	Estrildaamandava	Common
Larks	Mirafaerythroptera	Common
Weaverbirds	Ploceusphilippinus	Common

Species	Zoological Name	Status
Indian Sand Martins	Ripariapaludicola	Common
Indian rivertern	Sternaauranlia	Common
Black Partridge	Francolinusfrancolinus	Common
Common Babbler	Turdoidescandatus	Common
Woody – Wood Pecker	Chakkira	Common
Stark/Bagla	Bagla	Common

(c) Common Terrestrial Birds

Species	Zoological Name	Status
Grey partridge	Pyeronotusxyntropygos	Common
JunglePigeon	Teronwalia	Common

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SunBird	Necterinespp	Common
House sparrow	Passerspp	Common
Russian sparrow	Hirundorustica	Common
Crow	Corciasabyssinicus	Common
Owl	BuboAfricans	Common
Parakeets/Tota	Psittaciformes	Common
Shrikes	Passeriformes	Common
Tree-pies	Passeriformes	Common
Fly Catchers	Passeriformes	Common
Rollers	Passeriformes	Common
NeelKanth	Graciusgarrulous	Common
Common Babler	Turdiodescardatus	Common
House Sparrow	PasserSp.	Common
Mynas	Passeriformes	Common
Bee-eaters	Passeriformes	Common
Minivits	Passeriformes	Common
Munias	Passeriformes	Common
Koel	Koel	Common
Parrot	Psittaculakrameri	Common
Quail(Batera)	Pycnonotuscafer	Common
Black Rock Pigeon	Columbialivia	Common

(d) Migratory Birds

Species	ZoologicalName	Status
Cattleegret	Bubalbusibis	Common
CommonCoot	Fulicaatra	Common
CommonPochard	Athyaferinal	Common
CommonSandPiper	Actitishypalencus	Common
CommonTeal	Anazcrecia	Common
Greyheron	Ardeacinerea	Common
Pondheron	Ardeolagrayti	Common
Rivertern	Sternaaurantia	Common
LesserWhistlingteal	Denrocygnabicolor	Common
Littleegret	Egrettaarzetta	Common
Littlegrebe	Tackybaptusruficollis	Common
Purpleheron	Ardeapurpurea	Common
RedShank	Tringatetus	Common
CommonStarling	Sturnusvulgaris	Common

Source: Wildlife Deptt Punjab

Table 4.8: Reptiles

Species	Scientific Name	Status
Chequered Keel back Snake	Natrixpiscator	Common
Dark-bellied marsh Snake	Xenochrophiscerasogaster	Common
Indian Monitor Lizard	Veranusbengalensis	Common
Common Field Lizard	Uromastrixhardwickir	Common
Common House Lizard	Gekogeko	-

Table 4.8(a): Turtles–Hard Shells

Brown River Turtle	Kachugasmithin	Common
Saw Back Turtle	Kachugatecta	Common
Brahminy River Turtle	Hardellathurgi	Common

Table 4.8(b): Turtles–True Soft Shells

Common Tortoise	---	Common
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Table 4.8(c): Amphibians

Frogs	Rara Tigrina	Common
Toods		Common

Source: Wild life department Punjab and IEE Khanki Barrage.

- Fish**

99. A series of barrages i.e. Marala, Khanki and Qadirabad have over the years, seriously hampered the survival and propagation of a large number of river fish species, the number of which had been recorded as high as forty seven in 1960. All subsurface swimmer fishes, being unable to use fish ladder, suffer the most. Their upstream migration becomes impossible and their habitat gets broken. Chances for natural selection and survival of the fittest are denied to the species and over the time, it gets extinct. That is how most of the fishes now flourish only below Qadirabad Barrage and some above Marala Barrage. Khanki Barrage, as a fish habitat, is blocked on upstream as well as downstream side. That is why the fisheries as an economic activity has exhibited a consistent decline in the subproject area. The Fishermen communities are traditionally called “Machies” (singular Machi), have become merely “boatmen” or have taken alternate professions and have shifted elsewhere. However, the biological presence of the following fish species has been reported by the Fisheries Department Punjab.

Local Name	Zoological Name	Status
Dumbra	Labeo rohita	Present
Morakha/Mori	Cirrhinus mrigala	Present
Rohu/Tapra	Labeo rohita	Present
Seenghala	Mystus (Osteobagrus) seenghala	Present
Singhari	Mystus (Osteobagrus) aor	Present
Takla	Xenentodon cancila	Present
Tangra	Mystus (Mystus) vittatus	Present
Thaila	Catla catla	Present
Tilapia	Oreochromis niloticus	Present
Tirkanda	Rita rita	Present

Table4.9: Fish reported in river Chenab upstream and downstream of Qadirabad Barrage

(Source: Fisheries Department, Punjab)

100. Apart from the above mentioned fish species, the following fish are also present in the subproject area as shown in pictures below.

Gulfam, Sawal, Mali, Panganr, Silver, Grass, Parry, Chirra, Dayee, Baam, Dola, Nolakhi and Khurni.



4.4.3 Endangered Species

101. There are no endangered, extinct or rare species reported / pertains to AOI.

4.4.4 Livestock

102. The subproject area lies in Rachna Doab, which is famous for buffaloes known as one of highest milk producing animals. The people of the Doab have been cattle breeders traditionally and have been carrying their cast name as "Gujars". In fact, the main city of the area took its name after Gujars "and is called" Gujranwala. The livestock includes cattle, buffaloes, sheep, goats, camels, horses, asses and mules nearly 25% of the farmer's income is from livestock. At least 10% of the population is landless, cattle raisers and their living comes from cattle milk marketing. An average family possesses 5-6 cattle and 7-10 sheep and goats.

4.4.5 Agriculture

103. About 80% of the population of subproject area depends upon agriculture. Most of the area is well cultivated. Rice is the main kharif crop. Gujranwala district is known for its high quality Basmati with very pleasant flavor, which is very popular in the world especially in the Middle East. The other Kharif crops are Maize, Bajra, Sugarcane and oil seeds. Similarly wheat, barley, pulses, grams, linseed and green fodders are a main Rabi crops. Rice is grown on about 30% of cultivated area during Kharif and wheat is cultivated on 80% of area during Rabi season. The cropping intensity is 100% and even more than 100% on some areas. The area and production under different Rabi and Kharif crops is given as follows:-

Table 4.10: Area, Production and Cropping Intensities of Main Agriculture Crops in Rachna Doab

Sr. No.	Crops	Area (Hectares) Intensity	Cropping
1	Wheat	117,000	100%
2	Rice	40,000	100% and more
3	Sugarcane	4,000	100%

Source: Agriculture Extension services of Punjab Agriculture Department

4.4.6 Horticulture

104. The main fruits grown in District Gujranwala are Jaman, falsa, malta, kino, fruiter, sweet lemon, plum, mulberry, guava and pomegranate. The principal vegetables grown in the district are onions, potatoes, ginger, eggplant, arum, ladyfinger,

spinach, mint, tomato, turnip, carrot, cauliflower, bittergourd, garlic, pea, reddish and cucumber etc.

105. The soil as well as climate is quite suitable for growing citrus fruits like malta, kino, lemon etc, and guava. Horticulture is being practiced on about 8,000 acres which produces about 3000 tons of fruits and vegetables.

4.4.7 Protected Area (Wildlife Sanctuary)

106. There is protected area of wildlife (Wildlife Sanctuary) at a short distance of the subproject area at RD 12+000 to RD 28+600 having 7040 acres of land. This wildlife sanctuary is only Nationally recognized . Figure 3. 2 shows the protected area location. The permanent bird's species in the protected area are Water rans, Water Cock and Yellow water looking Carping. The migratory and occasional species are Fronted Goss, Coot, Rudish Common Sheldup, Grey Leg Goos, Bar Headed Goos, Fentail, Pelicans, Egrets Herous, Lesser Flamigo, Phasitait gancana and Painted Suipe. Generally the migratory birds are found in the period from September to March in winter season.

4.5 SOCIO-ECONOMIC AND CULTURAL ASPECTS

107. This section provides an overview of the socio economic conditions and cultural norms in the subproject area. Socio economic conditions of the area depend upon the population, employment level, trade and business, customs, religion, social activities, occasions and their social cohesion.

4.5.1 Methodology

108. The subproject survey was carried out to cover socio-economic condition of the area and assessment of resettlement impacts along the Left Marginal Bund (LMB) of Qadirabad Barrage from RD 0+000 to 30+000.
109. In order to collect the representative data and keeping in view the scope of work, survey technique was adopted, whereas a structured questionnaire was used for interview and data collection. As far as sample size was concerned, out of total 04 villages situated on right side of the bund up to RD 30+000, three villages were selected through simple random sampling technique from head, middle and tail of the proposed reach of the LMB. The names of sample surveyed villages are mentioned below in Table 4.11.

Table 4.11: Surveyed Villages

Sr. No.	Village Name	Location
1	Barubgarh (Head)	RD 03+000

2	Noor Pur (Middle)	RD 20+000
3	Rasool Nagar (Tail)	RD 30+00

4.5.2 Data Collection

110. In order to have comprehensive and detailed information, the data was collected by exploring both primary and secondary sources.

4.5.3 Secondary Source

111. The available published information and documents related to the subproject area, including PC-1 document, District census report of relevant District and other relevant documents were obtained and reviewed to identify different parameters and yardsticks, so as to make the study more meaningful and fruitful.

4.5.4 Primary Source

112. The primary quantitative and qualitative data was collected through interview schedule. The tool was designed to include information related to demographic characteristics, existing socio-economic pattern, impact assessment, people's perceptions about the subproject and remedial measures in case of adverse impact of the subproject. The data collection tool was also modified as per requirement of the subproject area and cultural traditions.

4.5.5 Socio-Economic Aspects of the subproject Area

113. Socio-economic aspects of the subproject area were studied on the basis of direct group discussions. At present, a brief description related to prominent social aspects is provided in the following sections:

4.5.5.1 Distribution of the Respondents Regarding Location

114. Respondent, belonged to three selected villages out of the 04 villages from head, middle and tail of the proposed reach of the LMB, were interviewed. The names and location of the selected villages is provided in Table 4.11. All respondents were living, along with the LMB of Qadirabad Barrage away from the RoW, in different villages.

4.5.5.2 Family Composition

115. According to the results of survey, total households of the surveyed villages were 1745 with population of 14080. The average family size was 8.0 and were living in different family system depending upon their culture and economic needs. It was observed that in Barubgarh village, majority of the families (80 percent) were living in nuclear family system, in Noorpur village, 50/50 and in Rasool Nagar, majority of the families (90 percent) lived in joint family system.

In addition to this, a large proportion of the population was migrant, who came in this area after partition of the sub-continent. A majority of the inhabitants were Punjabi speaking.

4.5.5.3 Occupation and Source of Income

116. During the field survey, it was observed that from RD 0+000 to RD 27+000, about 95 percent of subproject area along the right side of LMB was covered with fish ponds and fish farms .
117. The information regarding major source of income of the inhabitants was collected. According to the survey, fish farms and fishing were main sources of income of the local population. Due to river and QB Link Canal, the subproject area is suffering badly from water logging and seepage. The lands of villages Barubgarh and Noor Pur were not available for agriculture. The farmers availed the opportunity to utilize their affected lands and converted into fish farms. The respondents were earning reasonable monthly income for their livelihoods. However, the farmers of village Rasool Nagar were involved in agriculture as their lands were not affected from water logging and seepage.
118. The survey data indicates that average monthly income of the households was more than Rs.16,000. The majority of the inhabitants were living in Pacca houses, because with out pacca house construction material, the residential and other structures can not exist for a long time due to water logging and seepage.

4.5.5.4 Literacy Level

119. Data was collected from the respondents regarding educational facilities available in the area. Most of the villages do not have adequate educational infrastructures and allied facilities especially for the females. Only Rasool Nagar had government high schools for boys and girls out of three studied villages. In spite of that, few of the private schools were established by the local educated notables, which were serving to the local community. Moreover, with compared to one decade back, the trend of education was prevailing in the community which marks comparatively better literacy rate in boys and girls.

4.5.5.5 Caste System and Religion

120. In the rural areas of Pakistan, caste plays an important role to unite the people. Strength of groups depends on a number of the households in a caste. The survey data indicates that Rajpoot, Arain and Syed were in majority in the subproject area. The 99 percent of the population of these villages was Muslim.

4.5.5.6 Cropping Pattern

121. The survey investigation indicates that crops sown in the Rasool Nagar during the Rabi season were wheat and fodder while the Kharif crops were rice and seasonal fodder, while in other two studied villages, rice and fodder were reported. Market facilities were available at Rasool Nagar for sale and purchase. Generally, farmers sell their products to middlemen at local level.

5. ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATION MEASURES

122. This chapter categorizes the potential impacts of the Remodeling of Qadirabad Flood Bund (LMB Qadirabad) on the physical, biological and social environment of the subproject area and recommended mitigation measures for the negative impacts.

5.1 IMPACT ASSESSMENT - OVERVIEW

123. The Initial Environmental Examination (IEE) study has disclosed that the subproject is not likely to have any severe negative impacts on the environment and people of the area. All the potential impacts which have been identified during the present assessment are associated with the construction stage, and are minor to moderate in severity; they can easily be avoided (through good design and construction planning) or mitigated (through proper implementation of the EMP).
124. On the other hand, the subproject will be beneficial particularly for the local population on creation of job opportunities and extremely beneficial for safety of the public, land and other infrastructure. Significant social indicators of the subproject benefits are mentioned below:
- ***The socio - economic prosperity of the public.***
 - ***The safety of the public, Lands, crops and infrastructure.***
 - ***After implementation of the subproject, the beneficiaries of QBL Canal will be more secure, and it shall bring about a remarkable progress and prosperity to the inhabitants of subproject area.***
 - ***Living standard of beneficiaries of the subproject will improve.***
 - ***Environmental condition will also be improved.***

5.2 PRECONSTRUCTION/DESIGN STAGE

5.2.1 Bid documents prepared

125. No bid documents will be prepared without incorporated Legal obligation of EMP, which shall be included in the safeguard clauses of the translated version. Technical Specifications in the contracts and commitment to comply with Lender Requirements.

5.2.2 Protected Areas precautions

126. A plan for preventive and safeguards measures for Forest protected area and Wildlife Sanctuary must be prepared before the project start, in order to avoid environmental risks during rehabilitation works.

5.2.3 Potential damages to the existing infrastructure and facilities.

127. Especially underground installations (water supply and sewerage pipeline etc.), which cause obstacles in the provision of services to consumers. Precisely situate the position of infrastructure and underground installations at the local works in cooperation with the relevant institutions at all levels of authority.

. Close liaison with local relevant authorities

5.3 CONSTRUCTION PHASE

5.3.1 Land Resources

5.3.1.1 Site for disposal for waste construction material

128. There will be no cutting of earth involved at the RoW. All the work would require filling. There would, therefore, be no waste material for disposal or burial. If any such material, does need disposal, enough land for that is available on either bank of the bund. Most suitable spot is the depression on other side of protection Bund, where water is stagnating and is becoming a breeding place for disease vectors like malarial mosquitoes. Dumping waste material in these ponds will achieve two purposes; to dispose the waste material as well as to fill the pond and make the sites more health friendly. This is a moderately significant but mitigable factor.

Mitigation

129. The contractor through contract document, will dispose off the construction waste material in the water filled depression on outer sides of the protection bund.

5.3.1.2 Location of Labour Camps, Material Depots, Equipment yards and approach roads

130. Because of availability of ample area belonging to Irrigation Department, location of labour camps, material yards, equipment yards and approach roads will not cause any serious problem. So this is a matter of slight significance and is easily mitigable and manageable.

Mitigation

131. The contractor will, in consultation with RE, resolve the exact location of all these facilities within the land of Irrigation Department and labour camps etc will at least 500 m away from residential areas.

5.3.1.3 Contamination from Diesel and other oil spills from Construction machinery

132. At places, it may be inevitable and may exceed to the maximum permissible limit. In case it is allowed to be as per rule rather than an exception, the dumpings of oil

will permanently create contamination along with allied physical, biological and social losses. This is mitigable through effective application of the maximum spill regulations.

133. "Guidelines for Oil Spill Waste Minimization and Management issued by International Petroleum Industry Environmental Conservation Associate are as follows:-
134. **Soil contaminated by minor spills/ leakages** (defined as leaks from vehicles, machinery, equipment or storage containers such that the area and depth of contaminated soil is less than 10 sq ft and 3 inches respectively) is to be scraped and burnt in a burn pit.
135. **Moderate spills defined** as spills of volume less than or equal to 200 liters is to be contained and controlled using shovels, sands and native soil. These equipment's and materials are to be made available at camp sites during the operation. The contaminated soil is to be excavated and stored in a burn area lined with an impermeable base. Depending on the volume, the contaminated soil is either disposed-off through specialized treatment such as bioremediation or through approved contractor.
136. **Major spills** (defined as spills of volume much greater than 200 liters) require initiation of Emergency Response Procedures and Oil Spill Contingency Plan. These spills are to be handled and controlled according to the Plan and require special treatment such as bioremediation and through approved contractors.

Mitigation

137. Contractor's contractual obligation to impose strict rules on his workers and labour and ensures that no spill are caused. If the spills take place, it must be followed by treatment prescribed above as per the degree of spill. The contractor should prepare a spill contingency plan and familiarize his staff with it. The storage of fuel, oil and lubricants should be on impervious surfaces.

5.3.1.4 Damage to, roads, cross drainages by machinery

138. This will cause additional wear and tear of roads and cross drainage. Such situation can arise through carelessness of the heavy machinery drivers / operators. A considerable damage to paths, roads and drainages may occur if the drivers/operators are not made aware, trained and bound to be careful. It is a concern of moderate significance but is mitigable through care and regulation.

Mitigation

139. Contractor's contractual obligations to impose strict control over operators and drivers of all types of vehicles. Awareness and training must be given to them and speed limits should be enforced. Should the damage take place, the contractor must be bound to carry out repair immediately.

5.3.1.5 Earthen Embankments or Concrete work, Edge Scouring

140. Must be dealt at design stage. Wherever such a situation is anticipated, aprons should be provided to secure edges and specifications must be kept of high standards. Moderately significant but is a mitigable aspect.

Mitigation

5.3.1.6 Discharge from unstable slope or leakage on construction

141. Such an impact can destroy the structure leading to unprecedented damage. Though significant, it can be set aside through a careful planning of the work. If such a situation does appear, it becomes highly significant but a mitigable impact.

Mitigation

142. Contractor's contractual obligation not to let such leakage develop. Should such leakage develop, the contractor must remain fully prepared to immediately control the discharge. Material to emergency control the discharge i.e stones, jute bages and other earthen material must be store with emergency labour force at all time.

5.3.1.7 Impact of taking borrow material from earth borrow site

143. A large quantity of earth fill material will be obtained. Excavation and cutting activities in the borrow sites could cause adverse environmental impacts including sliding, soil erosion and drainage on the surrounding areas. The estimate of the quantity of earth material to be borrowed is given in the project discription.

Mitigation

- No private land will be acquired for the borrow areas.
- The Contractor will ensure that selected borrow areas on irrigation land are clearly demarcated and approved by the engineer including the allowed depth of the excavation before starting excavation.
- The borrow areas will be leveled. The Contractor will not leave the borrow pits in such a condition that they are unsuitably filled with rainwater and cause problems for the community.

- If the borrow area is near to the settlements, then it should be fenced completely.
- The borrow earth on spoil bank of the old L.C.C will be used. If agriculture land needs to be used as borrowing area, then the Contractor will adopt the following methods during the digging process.
 - Fix the location of excavation.
 - Remove thirty centimeters of the top soil and keep It on reserved site for re-spreading in the field.
 - Excavate upto one meter depth.
 - Maintain the slope as far as possible.
 - Place the top soil back during the restoration process.
 - Pay compensation for any damages/ crop losses.

5.3.1.8 Impact of stone quarrying

144. Stones shall be procured from quarry in Sargodha district. This will not cause any impact on the immediate subproject area except that the vehicles carrying the stone shall exert additional traffic load on the roads leading to the subproject. Crushed stone will fall on roads. Unloading of material may become hazards on site.

Mitigation

145. Contractor's contractual obligations will include using the road network carefully and repairing any damages immediately. During transportation, vehicle will be covered to avoid spillage of material on the roads. Unloading will be done on designated sites.

5.3.2 Hydrology and Water Resources

5.3.2.1 Source of construction water

146. Ordinarily the river water is suitable for the construction work. If obtained from elsewhere, it must be compensated.

Mitigation

147. Contractor's contractual obligation will be to pay for water obtained from sources other than the river.

5.3.2.2 Source of surface water

148. Contractor's labour will use river water, like other people living or working near the river banks, for washing, bathing and at time for sewage. The contractor may however, arrange to pump water from the river and supply running tap water to his workers. Disposal of sewerage may cause impact.

Mitigation

149. Contractor's contractual obligation to supply running tap water, pit latrines/flush latrines near the camp. It should be ensured that solid and liquid waste of about 2000 persons does not fall in to the river. All sewerages to be treated through septic tanks and/or soakage pits as required.

5.3.2.3 Source of drinking water

150. Communities along banks of Chenab river are sufficiently advanced to install tube wells and hand pumps for obtaining good quality drinking water. Similar arrangements can be made by the contractor for his labour camps. The water will be tested to ensure it is of drinkable quality. Drawing water for drinking from aquifer shall neither cause any significant change in the underwater reservoir, nor the river which recharges it. This impact can be considered as slight. If the surface water is not drinkable, the sub soil water should be tapped.

Mitigation

151. The contractor should tap the underground reservoir and install hand pumps or tube well with over head tank to supply drinking water to the labour and workers. The quality of drinking water should be monitored periodically. The distance of drinking water source i.e Hand pumps etc must be atleast 50 m away from the toilets or septic tanks.

5.3.3 Air Quality and Noise Pollution

5.3.3.1 Dust and smoke and other pollutants from construction machinery

152. This impact is inevitable, moderately significant but mitigable.

Mitigation

153. Contractor's contractual obligation to keep the dust and smoke low by using machinery which is well maintained and is almost noiseless and all Katcha roads and paths are sprinkled with water many times a day depending on weather conditions.

5.3.3.2 Dust or other pollutions from stored material

154. This is also inevitable, moderately significant and mitigable.

Mitigation

155. Contractor's contractual obligation to keep the dust and smoke by carefully storing and distributing the construction material so as to cause minimum dust which again will be within the acceptable limits. The stockpiles should be covered or kept moist in dry weather, and to be located in such a distance, so that the communities are not affected by upwind of the stockpiles.

5.3.3.3 Smoke from burning of waste material or burning fire wood

156. A large number of big and small fires in the labour camp can produce smoke and smog which can reduce visibility, hinderence in traffic mobility and may cause diseases of the respiratory tract.

Mitigation

157. Contractor's contractual obligation to use clean and smoke free fuel in the labour camp. Cutting and burning trees / shrubs for fuel shall be prohibited. Instead Gas Cylinders should be used in the labour camp for cooking purposes.

5.3.3.4 Noise from use of old or outdated machinery

158. Old and poorly maintained machinery generates higher decibels of noise and cause noise pollution for workers in the close vicinity of heavy machinery.

Mitigation

159. Contractor's contractual obligation to use new, well maintained and low noise machinery preferably during day time. The drivers, operators and workers working on or near the heavy machinery must be provided ear plugs.

5.3.3.5 Soil Compaction due to labour camps, and machinery yards

160. The human and mechanical activity normally compacts the soil and turns it non productive which leads to social impacts.

Mitigation

161. Contractor's contractual obligation to mitigate the impact of compaction and leave the site almost in the same state in which it is occupied. Pictures of the area should be taken before handing it over to contractor which will help the RE to ensure an acceptable state of soil while getting the area back from the contractor.

5.4 BIOLOGICAL RESOURCES

5.4.1 Damage to biological resources Flora, Fauna (Biota)

162. Since the level of pond will not rise or fall significantly and reservoir shore line will not change, so no major change is expected in the habitat of the natural flora or fauna. There will be no tree to cut for the subproject construction. Small readjustment of place maybe made by some birds and rodents.

Mitigation

163. About one percent of the total cost of subproject PCI has been allocated for new plantation, as per instruction of the Punjab Government. In this context different species will be planted according to the Tree Plantation plan.
164. Contractor's obligation not to cause any additional damage to Flora and Fauna of the area by respecting the limits of construction site and not to enter other territories.
165. No unauthorized tree or bush cutting should be allowed. Should it be necessary, it should not be done without permission of the RE.

5.4.1.1 Impact on migratory birds

166. Chenab River at the point of the subproject does not fall on the recognized route of globally recognized migratory waterfowl or ducks. However a number of migratory birds do pass this way and stay for wintering in the barrage area. Since the water: land ratio is not going to change, there shall be no or slight influence of subproject on the temporary habitat of the migratory water birds.

Mitigation

167. Contractor's contractual responsibility to facilitates a regular inspection by the Wildlife Department to ensure that the process of construction does not cause any hindrance to the migratory birds.
168. The construction activities will be carried out in off period of the migratory birds i.e from April to September. Generally bird migration period is from October to March (winter season).

5.4.2 Environmental Mitigation Measures for Protected Area

169. Wildlife Sanctuary and Forest protected areas i.e Barubgarh Protected Forest and Khangarh Protected forests are in the close vicinity of the subproject area, as shown in Figure 3.2 in chapter 3. These are the environmentally sensitive areas that have special environmental attributes worthy of retention or special care.

These areas are critical to the maintenance of productive and diverse plant and wildlife populations.

170. Considering the sensitivity of these protected areas in close vicinity of the subproject, a specific mitigation measures for the adverse impacts during construction are given below:

5.4.2.1 Mitigation Measure during Construction Phase

- Avoid or minimize trail construction in environmentally sensitive areas. Design any trails to avoid fragmentation of the environmentally sensitive area. Where trails are required, design the trail system to minimize impacts on the environmentally sensitive area, for example by using boardwalks over wet areas, or by placing natural barriers that restrict people to the main trail.
- Restrict access to environmentally sensitive areas and buffer areas by people and their pets, for example through the use of coarse woody debris, plantings, signs and fencing; Use signage and other educational tools to inform people about the ecological importance of environmentally sensitive areas.
- Identify environmentally sensitive areas and buffers in the field by clearly marking these areas with high visibility protection fencing.
- Post a site map of environmentally sensitive areas at the entrance to the worksite where workers are sure to see it.
- Use informational signage and other means to explain the importance of protection measures and the need to avoid any activity in environmentally sensitive areas, including clearing, disturbing, or storing construction materials in this area.
- Schedule construction activities to avoid sensitive periods such as bird nesting. Check timeframes with an appropriately qualified professional.
- Maintain snags and woody debris in buffer areas and environmentally sensitive areas to provide habitat for a diversity of wildlife.
- Prevent movement of silt laden waters into environmentally sensitive areas by using sediment control techniques.
- Maintain effective fuelling facilities well away from environmentally sensitive areas to prevent contamination
- The rehabilitation works should be restricted in day time in the vicinity of sensitive areas.

5.4.2.2 Mitigation Measure during Operational Phase

- Limit access to environmentally sensitive areas; Erect permanent fencing around environmentally sensitive areas to limit access.
- Use environmentally-friendly landscaping; Use native plants in landscaping. This avoids the use of alien species that might spread into neighboring environmentally sensitive areas, and leaves less open ground that might be colonised by alien plants.

Also, many native plants are adapted to local climates (such as hot, dry summers) and once established, will need less maintenance and watering.

- Encourage local residents to become knowledgeable stewards of environmentally sensitive areas,
171. During construction stage, the contractor and operation stage, the Irrigation Department should follow these remedial measures for the protection of protected areas.

5.5 SOCIOECONOMIC, CULTURAL AND ARCHAEOLOGICAL ISSUES

5.5.1 Impacts during Construction stage

172. The socio economic cultural and archaeological impacts can be:
- Disturbance to existing services: education, health, electricity, water supply or signboards.
 - Aggravation of any disputes on land ownership.
 - Any need for land acquisition.
 - Access to other construction materials.
 - Adverse effects on known archaeological sites.
 - Dealing with chance finds.
 - Problems to Health and Safety of labour and employees on construction work and provision of safety equipment to workers on site.
 - Employment of locals on the subproject.
 - Possibility of spread of HIV/AIDS amongst the subproject labour and adjoining population.
 - Rise in prices of essential commodities.
 - Gender Issues.
 - Recreational facilities for public.
 - Any spots of religious significance e.g. Mosques, Tombs and Shrines etc.

Mitigation

173. For matters pertaining to social obligation and benefits of the communities, if needed, a Social Framework Agreement shall be signed by the RE with communities to ensure their participation and full satisfaction in matters pertaining to them.
174. All matters where contractor is involved, these should be made as his contractual obligations.

5.5.2 Impacts during Operational and Management Phase

175. At operational phase, the consultant shall develop a comprehensive operational and Management Manual and an effective monitoring plan. Mistakes at operational level or handling of operations by un-trained staff can prove very risky and costly. Important points to be attended at operational stage are as follows:

- Comprehensive O&M Rules as per ISO standards.
- Strict application of prescribed M&E plan.
- Continuous evaluation of design efficiencies.
- Understanding and training of Operational and Maintenance Manual.
- Annual Environmental Audit.
- Regular maintenance of engineering works (mechanical as well as civil).
- Staff Welfare.
- Continued Public consultation and feedback if any of the social issues.
- Continued attention towards gender issues and women consultation.
- LCC system to run up to its design capacity and not beyond.
- Refresher Training Courses for operational staff.

6. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

176. This EMMP document is produced as a complementary part of Detailed Design, as a free- standing document. It ensures incorporation of the relevant environmental factors into the overall subproject design and will identify linkages to other safeguard policies relating to the project.
177. Based on the preliminary assessment, key mitigation measures recommended under this Environmental Management Plan(EMP)are listed as follows:
- a. Identify and locate on project plans any sensitive natural resources in the subproject area including but not limited to patches of natural habitat, bird colonies, and wet lands, unique plant communities etc. (consult with local nature protection authorities).
 - b. Identify local access routes through and around cultivated land and pasture.
 - c. Minimize requirements for temporary or permanent alteration of lands outside the embankment right of way.
 - d. Provide zones for preliminary accumulation of wastes that will cause no damage to the vegetation cover and other components of the environment.
 - e. Transport and disposal of construction concrete rubble, debris and spoils in approved paths and landfills/ dumpsites.
 - f. Delineate access roads/ work areas carefully and prevent their expansion.
 - g. Rehabilitate access roads and work areas after work completion (scratch soil with special engine, put fertile topsoil in place, etc.).
 - h. Use closed/covered trucks for transportation of construction materials.
 - i. Clean the surrounding area from dust by water sprinkling, removal of excess materials and cleaning of sites upon completion of activities.
 - j. Restoration to original conditions of landscape after completion of construction and rehabilitation works.
 - k. Arrange necessary preservation measures (establish protection zones, by-pass these areas during transportation and other).
 - l. Cease the works at once, historical and cultural monuments are encountered during earthworks and provide relevant information to the State Agency for Historical and Cultural Monuments Protection.
 - m. Conduct mid-term and end-of-project inspections to the sites during construction and rehabilitation works.
178. The parameters, mitigation, monitoring and responsibility have been discussed in detail in the EMMP.

6.1 INSTITUTIONAL ARRANGEMENTS

6.1.1 Management Responsibilities

179. Overall responsibility for Environmental Management and Monitoring will rest with the Project Implementation Unit (PIU) which is headed by a Project Director. Environmental and Social Unit (ESU) will also provide support to PIU for managing environment and social aspects of the subproject and implementation of the EMP. The PIU/ ESU will be supported by environmental team of Supervision Consultant during implementation and monitoring of the EMP. Environment and Social consultants will review periodical reports prepared by the Construction Supervision Consultant (CSC) as well as inspection notes based upon their visit to subproject site. This information shall make a basis for ESU for further reporting or visiting site. The specific responsibilities of the institutions involved in the EMP implementation are described below:

6.1.1.1 Project Implementation Unit (PIU)

180. Project Implementation Unit (PIU) will be responsible for implementation of EMP throughout the project duration. PIU would also support community participation and consultations from the sub-project identification to completion stage. The ESU supported by Environmental and Social Consultant will assist in implementation of EMP.

6.1.1.2 The Consultant

181. The Construction Supervision Consultant (CSC) will ensure the implementation and regular monitoring of the EMP in true letter and spirit during execution of the civil works and shall submit periodic reports to PIU regarding the EMP implementation status. The Consultant Environmental Specialist and Social Specialist will be responsible for EMP implementation and reporting any non-compliances to the Engineer of the Project and the PIU.

6.1.1.3 The Contractor

182. The contractor will be responsible for on-site implementation of the EMP of the sub-project environmental protection liabilities. He will be responsible for compliance of EMP provisions under contractual obligations. The contractor will train his crew/ staff in implementation of the EMP through capacity building interventions.
183. The EMP will be an integral part of the contract document. The bid should include a detailed environmental mitigation budget as part of the engineering costs of the respective works. Contractor will engage social and environmental managers to realize the above requirements.

6.2 ENVIRONMENTAL MANAGEMENT & MITIGATION PLAN

184. The mitigation plan, being a key component of EMP includes measures to mitigate potential negative impacts and enhance its positive impacts during construction phase of the sub-project. The contractor is responsible for implementation of EMP with the co-operation of executing and implementing agencies, ESU/ PIU staff, socio-environmental consultants and local community of the subproject.
185. Table 7.1 states the environmental management plan for the impacts along with mitigation plan, as well as the institutional responsibility.

Table 7.1: Environmental Management (Mitigation) Plan

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
<i>Planning/ Designing</i>		
Assure compliance with relevant construction field legislation.	<ul style="list-style-type: none"> • Acquire construction permit. • Provide Water management guidelines if subprojects are executed near surface watercourse. 	<i>PIU/ Consultant</i>
Potential damages to the existing infrastructure and facilities, especially underground installations (water supply and sewerage pipeline etc.) which cause obstacles in the provision of services to consumers.	<ul style="list-style-type: none"> • Precisely situate the position of infrastructure and underground installations at the local works in cooperation with the relevant institutions at all levels of authority. • Close liaison with local relevant authorities 	<i>Consultant / PIU in cooperation with concerned Department.</i>
Increased possibility of employment and income in the local community.	<ul style="list-style-type: none"> • Prioritize qualified local population in employment. 	<i>Contractor/ consultant</i>

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Waste Management and Protected area Protection/Management Plans	<ul style="list-style-type: none"> • Proper Waste Management at Construction sites and Labour Camps. • Protective measures for Forest Protected area and Wildlife Sanctuary near the project area (detail is given in the Impacts and Mitigation section of Protected areas.) 	Contractor with the cooperation of consultant.
Rehabilitation/ Reconstruction		
Conflict due to use of privately owned agriculture land for camp construction	<ul style="list-style-type: none"> • Establishment of camp on government levelled land away from population at least 500m away. • . Approval of camp site from the Engineer will be obtained. 	Supervised by CSC

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Social conflicts due to influx of external workforce	<ul style="list-style-type: none"> • Establishment of camp on government levelled land away from population at least 500m away. • . Contractor need to obtain approval from the Engineer. • Hiring of work force from local communities; Awareness raising of residents for safety protection. • Awareness raising of labor to ensure respect for local customs and norms. • Child labour will be prohibited at sub-project sites. • Maintain record of all resources usage like water, fuel, manpower, machinery, equipment, etc. 	Contractor & Supervised by CSC
Conflicts arising due to mixing of local and migratory job seekers.	<ul style="list-style-type: none"> • Preference to provide jobs to local job seekers. • Motivation to the workers for a peaceful work environment. 	Contractor/CSC

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Conflict with local water demand.	<ul style="list-style-type: none"> • The contractor to make his own arrangements for water required for construction ensuring that water availability and supply to nearby communities remain unaffected like new water well, sufficient yield available in existing water wells, etc.). • Prior approval to be obtained from Project Engineer to be obtained for water usage • Maintain record of water consumption 	Contractor/ CSC
Supply of material	<ul style="list-style-type: none"> • Use the existing quarries, asphalt and concrete bases for the supply of material. • Use licensed suppliers for other materials. • Prior approval to be obtained from project engineer 	Contractor & Supervised by CSC

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Transport of material	<ul style="list-style-type: none">• Using trucks with awning and special vehicles depending on the type of materials.• During the transportation of soil, the trucks must be covered with Tarpaulin.• Use earth material with the approval of the Engineer• Procure shingle/ stone from quarry site approved by the Engineer.• Regular inspection, tuning, and maintenance of transport vehicles.• Material transport in closed containers or covered with canvas (Tarpal) sheets.• Avoid night time activity.• Maintain liaison with communities; Repair of damaged roads/ other infrastructure.• Transportation of material during off peak hours.	Contractor & Supervised by CSC

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
<p>Emission of dust from the landfill of earth material, due to vehicles movement on roads and construction works execution.</p>	<ul style="list-style-type: none"> • Compact deposited earth material. • Sprinkle dust sources with water in order to reduce impacts on the surrounding population and vegetation. • Control the speed of vehicles in order to reduce dust rising. • Prepare and implement a plan for the construction site organization that includes good construction management practices. • The stock piles should be covered or kept moist in dry weather and to be located in such a distance, so that the communities are not affected by upwind of the stockpiles. 	<p>Contractor & Supervised by CSC</p>

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Emission of gases and particles from vehicles, mechanization and generators.	<ul style="list-style-type: none"> Regular equipment maintenance. The contractor is obliged to submit evidence of vehicle roadworthiness in line with the regulations on the hazardous gases emission. Prepare and implement the construction site organization plan that incorporates good construction practice measures. 	Contractor & Supervised by CSC
Noise in the operation of heavy mechanization and generators.	<ul style="list-style-type: none"> Observe law-defined working hours at the construction site. Make the generator casings sound proof if they are located near residential units. Ensure mufflers for heavy machinery. Prepare and implement the construction site organization plan that incorporates good construction practice measures. Regular inspection of equipment and machineries 	Contractor & Supervised by CSC

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Increased water turbidity as a consequence of the works.	<ul style="list-style-type: none">• Construction works should be executed in a way that surface and natural contents outside the project are not damaged and that works are performed so that watercourses are not unnecessarily made turbid and watercourses discontinued.• Works should be executed in dry weather.• Prepare and implement a construction site organization	Contractor & Supervised by CSC

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
<ul style="list-style-type: none"> • <i>Smoke and dust generation. Dispersal of un-covered/unsecured construction material during transportation.</i> • <i>Chance of accidents; Damage to access roads/ other infrastructure due to transportation of construction material</i> 	<ul style="list-style-type: none"> • Use earth material with the approval of the Engineer. • Procure shingle/ stone from quarry site approved by the Engineer. • Regular inspection, tuning, and maintenance of transport vehicles. • Material transport in closed containers or covered with canvas (Tarpal) sheets. • Avoid night time activity. • Maintain liaison with communities. • Repair of damaged roads/ other infrastructure. 	<p><i>Contractor & Supervised by CSC</i></p>

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Soil, groundwater and surface water pollution, with oils and lubricants due to equipment poor maintenance and repairs and refuelling at the construction site.	<ul style="list-style-type: none"> • Avoid servicing and re-fuelling at the site. • Use protective foils during possible vehicle re-fuelling and maintenance at the construction site. • Provide absorbing material in case of fuel spills. • Used oil/ oily materials and agents should be managed in line with the Waste management plan. • Procedure in place for actions in case of incidental oil and lubrication spills. • Prepare and implement the Construction Site Organization Plan that incorporates good construction practice measures, measures from water management documents and measures from the Water management plant. 	Contractor & Supervised by CSC
Soil erosion and contamination	<ul style="list-style-type: none"> • Restrict vehicle speeds to 30km/h.; • Restriction on repair of vehicles and equipment in the field. 	Contractor & Supervised by CSC

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Damage to crops and cultivated area	<ul style="list-style-type: none">• Crops and cultivated area is away from site so, the subproject will likely not to cause any damage to agriculture crops.• In case of any crop damage, compensation will be paid to the affected person.	<i>Contractor & Supervised by CSC</i>

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Loss of natural vegetation and associated fauna	<ul style="list-style-type: none"> • No cutting or removal of trees. • As per Punjab Government policy, sufficient amount has been allocated for tree plantation for better environment. For this purpose a tree plantation plan will be prepared including the type of species, location for plantation and other necessary information. This plan will also compensate any unlikely tree cutting involved during project implementation. Selection of borrow area with least vegetation cover. Soft start for allowing time to reptiles to move away from the project site • Restriction and prohibition on hunting, shooting, trapping, and poaching of wild species • Construction during non-migratory season • Continuous monitoring by wildlife experts • No night time activity • Photographs of pre and post project 	<p>Contractor & Supervised by CSC</p>

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Reduced possibility through the area where the works are executed.	<ul style="list-style-type: none"> Plan the relocation of equipment at time when daily traffic is not jammed; provide alternative passage for pedestrians and vehicles in cooperation with local authorities or provide a safe passage through the construction site. Avoid roads through inhabited areas especially near schools and hospitals. Prepare and implement the Construction Site Organization Plan that incorporates good construction practice measures. 	Contractor & Supervised by CSC
Potential pollution of soil and water due to the discharge of waste sanitary waters from the construction site	<ul style="list-style-type: none"> Installation of field toilets for workers 	Contractor & Supervised by CSC

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Population at increased risks of traffic accidents and construction works.	<ul style="list-style-type: none"> Assure adequate warning signs, lighting, protective fencing etc. Observe traffic rules. Clean construction waste form the construction site both in the construction phase and after works completion, when closing the construction site. Assure medical supplies and aid through institutional and administrative arrangements with municipal hospitals at the construction site. 	Contractor & Supervised by CSC
Risk of injuries at work	<ul style="list-style-type: none"> Demand from all workers to abide by the Protection at work measures. Provide protective equipment; install warning signs at the construction site. Prepare and implement the Construction site Organization Plan and Protection at work measures plan. 	Contractor & Supervised by CSC

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Accident risks	<ul style="list-style-type: none">• Preparation and implementation of HSE Plan.• Provision of PPEs.• Provision of first aid kits and emergency vehicle.• Emergency response teams.• Preparation of emergency response plans	Contractor & Supervised by CSC

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Protected Areas Safety requirements (Wildlife and forest Protected areas)	<ul style="list-style-type: none"> • Restrict access to environmentally sensitive areas and buffer areas by people and their pets, for example through the use of coarse woody debris, plantings, signs and fencing. ; Use signage and other educational tools to inform people about the ecological importance of environmentally sensitive areas. • Identify environmentally sensitive areas and buffers in the field by clearly marking these areas with high visibility protection fencing • Post a site map of environmentally sensitive areas at the entrance to the worksite where workers are sure to see it. • Use informational signage and other means to explain the importance of protection measures and the need to avoid any activity in environmentally sensitive areas, including clearing, disturbing, or storing construction materials in this area. • Schedule construction activities to avoid sensitive periods such as bird nesting. Check timeframes with an appropriately qualified professional. • Maintain snags and woody debris in buffer areas and environmentally sensitive areas to provide habitat for a diversity of wildlife. • Prevent movement of silt laden waters into environmentally sensitive areas by using sediment control techniques. • Maintain effective fuelling facilities well away from environmentally sensitive areas to prevent contamination. 	Contractor & Supervised by CSC

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Health risks due to unsafe and unhygienic living environment. Disposal of wastes	<ul style="list-style-type: none"> Preparation and implementation of HSE Plan. Safety measures taken by the contractor such as installation of firefighting equipment, safe storage of hazardous material, fencing, provision of first aid facilities etc.; Contingency measures in case of accidents; Obligatory insurance of contractor's staff and laborers against accidents; Provision of adequate sanitation, washing, lighting, cooking and dormitory facilities. HSE trainings to construction and camp staff. 	<i>Contractor & Supervised by CSC</i>
EHS Training	<ul style="list-style-type: none"> Arrange training, guidelines and brushers in urdu to staff and labours about the Environment, Health and Safety. 	<i>Contractor and CSC</i>
<ul style="list-style-type: none"> <i>Construction site closure</i> 		

Problem / Activity Impact	Mitigation Measures	Institutional Responsibility ¹
Construction material leftovers of after the closure of temporary construction sites	<ul style="list-style-type: none"> All shivers and material that remain after the closure of temporary construction sites are to be removed from the location and re-used/re-cycled where possible. All remains are to be disposed of in a manner that will not be harmful to environment. 	<p>Contractor Supervised by CSC & PIU</p>
<ul style="list-style-type: none"> Change in land use pattern Soil erosion. Visual sores in landscape. Dust pollution. Public health risks due to mosquito-breeding places. Land disputes. Loss of potential crop land. Loss of vegetation. Loss of fauna due to excavation of Borrow Area. 	<ul style="list-style-type: none"> Restoration and Environmental enhancement plan to be prepared. Use of borrow areas with Engineer's approval at specified depth. Limited movement of machinery. Documentation of area. Ensuring areas under crops are not used as borrow areas. Levelling and dressing of borrow areas; Water sprinkling. Rescue of any encountered species. 	<p>Contractor Supervised by CSC & PIU</p>

1 Institutional Responsibility: CSC Environment Specialist of Construction Supervision Consultant, PIU Social & Environment Management Unit of Project Implementation Unit and Contractor Environmental, Health and Safety Officer (EHS Officer)

6.3 MONITORING ACTIVITIES

186. For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities.
187. In addition to the critical locations selected during design stage, the environmental monitoring will also be done at the construction camp site and any other plant site as determined relevant during rehabilitation works stage.

6.3.1 Monitoring Plan

188. Monitoring Plan is also associated with mitigation plan during the different stages of the sub-project. It ensures that mitigation measures are being effectively implemented. The monitoring of the subproject is very imperative for implementation of the EMP. The Supervision Consultant through environmental Inspector will carry out the monitoring at the field level on a continuous basis. The PIU staff will carry out periodic monitoring during their site visits.
189. Monitoring will be carried out to ensure that the mitigation plans are regularly and effectively implemented. It will be performed at three levels. At the PIU level, the ESU will do EMP monitoring to ensure that the mitigation plans are being effectively implemented. At Consultant level, the environmental team of Supervision Consultant will regularly monitor the EMP implementation by the contractor. At contractor's level, the Environmental monitoring checklist will be filled on daily basis by their Environmental Manager and countersigned by the representative of Supervision Consultant.
190. Table 7.2 states the monitoring parameters, location and the body responsible for monitoring those parameters.

Monitoring Parameter	Monitoring Location	Monitoring manner / monitoring equipment	Frequency	Why is monitoring necessary	Responsibility	
					Planning	Implement.
Supply of material						
Possession of environmental Permits for Plants of quarries and concrete bases from which material is supplied	Legal entities that own the plants	Insight into the documentation	During material supply	Assure that the plants conform to the requirements of environment protection and human safety	Contractor	CSC/PIU
Transport of material						
If trucks are covered during material transport	At the construction site and transport roads	Visual supervision	During material transport	See that no dust is emitted into the air and material spilled into environment	Contractor	CSC/PIU

Rehabilitation/ Reconstruction Repair						
Conflict due to use of privately owned agriculture land for camp construction	Camp Site	Supervision	Weekly	To avoid conflict	Contractor	CSC
Social conflicts due to influx of external workforce	Construction/ Camp Site	Supervision	Fortnightly	For peaceful work environment.	Contractor	CSC
Water Demand at Camp Site	Camp & Construction Site	Visual supervision	Fortnightly	To ensure that water supply to locals and the nearby communities remain unaffected.	Contractor	CSC

Transport of Material	Construction Site and access roads	Regular inspection and supervision	Daily	Safe logistics of material.	Contractor	PIU/CSC
Degradation and soil pollution	At the construction site and directly around the construction site	Visual supervision	Weekly	To establish if liquid oil derivative leaked, soil erosion and landside occurred due to construction works	Supervising body	CSC
Occurrence of noise and air pollution	At the works execution location	Standard air quality and noise level through instrumental at site.	Upon received citizens' complaints	In order to establish the level of air pollution and noise and make comparison with legal limits values. In case of aberration additional mitigation measures.	Contractor	CSC
Destruction of crops, woods, meadows etc.	At the works execution location and in the vicinity	Visually	Upon received citizens' complaints	In order to establish that works are only executed at project-envisaged locations	Supervising body	CSC
Injuries at work, accidents etc.	Work Site	Site and material inspections,	Daily	To reduce work related injuries and promote good OHS practices.	Contractor	CSC

Water Quality	Camp Site/ Construction Site/ Adjoining Areas	Water Quality Tests	At the beginning on water uses source and quarterly testing.	To control the water quality of the area.	Contractor	PIU/CSC
Waste management during the works execution	At the construction site according to the Waste Management Plan.	Visually	Permanently	Are containers/bins for communal waste installed, is hazardous waste treated in adequate manners, in order to prevent uncontrolled waste disposal	Contractor	CSC
Number of registered accidents of Existence of hygienic conditions for workers, Protective equipment application	At the construction site	Visually and insight into the register	Permanently during the works execution	In order to establish that protection at work measures implemented.	Contractor	CSC

Quality of executed works Quality of material that is installed	At the construction site	Visual monitoring and through register	Permanently during the works execution and construction site removal	Poor monitoring and works execution quality assessment can cause damages to environment, bad quality structures and usage of poor quality material, can result in damages to structures and expose inhabitants to risks and possible accidents	Contractor	CSC
<p style="text-align: center;">Construction site closure</p>						
Waste remnants and soil degradation/contamination	At the project location	Visually	After the works completion	In order to establish whether all waste was removed from the construction site.	Contractor	CSC

<ul style="list-style-type: none"> • Restoration and Environmental enhancement plan implemented for barrow/quarry area, etc. • Change in land use pattern • Soil erosion. • Visual sores in landscape. • Loss of potential crop land. Loss of vegetation. • Loss of fauna due to excavation of Borrow Area 	At the project location	Visually	After the works completion	For entire satisfaction of EMP.	contractor	CSC/ PIU
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6.4 SUB PROJECT ENHANCEMENT PLANS

6.4.1 Tree Plantation Plan

191. Tree cutting/uprooting is not anticipated during the course of the sub-project. However in case the requirement of tree cutting intervened during construction phase of the sub-project, the impact shall be mitigated by re-plantation in the vicinity of the subproject area. It is proposed to plant five (05) new trees for each tree uprooted on site. If no trees will be affected, the contractor will still plant trees to offset the small vegetation to be lost. Local indigenous floral specie shall be plant in the project area by the contractor.
192. Moreover, according to the regulation of Govt. of Punjab for tree plantation in the new/rehabilitation irrigation projects, an amount of Rs 0.818 million (1 % of total construction budget) has been allocated for tree plantation at the project area.

6.4.2 Restoration Plan

193. Construction of bypass channel will generate sufficient soil material to fulfil the requirement of the fill for strengthening of embankments. If during construction, further material is required or contractor need to borrow material from any other site, then the contractor can acquire private land in accordance with the lease agreement with the land owner. Photographic record will be kept before and after the land use as borrowing area. The contractor will not leave borrowing pit in such a condition that they are unusable and could be filled with rain water and provide breeding place for mosquitoes or cause any health and safety issues. Agricultural land should be restored such that it can be re-used for the agricultural purpose. The topsoil of agricultural land, if used as borrow area, should be removed up to 6 inches and kept separate on site for its re-spread back on the levelled borrow area. After removal of top soil, excavation may be done up to maximum 3 feet. Then the site area should be levelled for placing the topsoil back

6.5 REPORTS

194. The Environmental Specialist of the Supervision Consultant shall produce periodical reports as well as inspection notes based upon the visits to the subproject site. This information shall make a basis for PIU for their further reporting or visiting the site. All reports shall be location and activity specific. The reports shall especially identify areas of contractor's noncompliance with the EMP and provide guiding remarks on actions to be taken. The significance of the non-compliance shall also be noted. Copies of these reports shall be sent to the Resident Engineer (RE) who shall forward them to the team leader, Head PIU, Irrigation Department and the contractor for their

action(s). The RE will include in routine reports a summary status of activities relating to the EMP. Supplemental reports on issues should also be prepared as and when required.

195. The consultant's environmental team will produce daily, monthly reports, as well as a final report of the project based on the information collected. The list of distribution reports is given in **Table 7.3**.

Table 7.3: Distribution of Reports

Report	Prepared by	Reviewed by	Distribution
Daily	Contractor's HSE officers	Reviewed contractor By environmental officer and Consultant's Environmental Specialists	Resident Engineer
Monthly	Environmental team of the Construction Supervision Consultants	Reviewed by ESU of PIU	Resident Engineer, PIU, ADB
Effects Monitoring	Environmental team of the Construction Supervision Consultants	Reviewed by & ESU of PIU	Resident Engineer, PIU, ADB
Change Management	Environmental team of the Construction Supervision Consultants	Reviewed by ESU of PIU	Resident Engineer, PIU, ADB
Final	Environmental team of the Construction Supervision Consultants	Reviewed by ESU of PIU	Resident Engineer, PIU, ADB

6.6 TRAINING SCHEDULE

196. Environmental training will form part of the Environment Management Plan. The training will be conducted for all personnel involved in the project works. The key objective of training program is to ensure that the requirements of the

EMP are clearly understood and followed throughout the subproject. The trainings to the staff will help in communicating environmental related restrictions specified in the EMP. The contractors will be primarily responsible for providing environmental training to all project personnel on potential environmental issues of the subproject. Responsibility of trainings related to public safety lies with PIU. In addition to the training specified in the training log, special/ additional trainings will be provided during the subproject activity.

6.7 IMPLEMENTATION ESTIMATED BUDGET

197. Contractor will be responsible for the implementation for environmental mitigation plan. Most of the mitigation measures are covered in the engineering costs of the respective works. However, cost for some of the mitigation and monitoring activities are estimated below in **Table 7.4**.

Table 7.4: Implementation Estimated Budget

Sr.#	Description	Cost (PKR)
1	Environmental Monitoring of air, water and noise (through environmental Kit and noise meter, while water testing in the lab)	150,000
2	Implementation of OHS requirements (preparation of Plan, PPEs, first aid boxes, others)	150,000
3	Environmental awareness and EMP training for staff	250,000
Total		5,50,000

7. PUBLIC CONSULTATION

7.1 GENERAL

198. The purpose in holding consultations is to share relevant information with stakeholders on the project interventions including potential environmental and social, (positive and negative) impacts. The consultation process consists of dialogue with the stakeholders and they are generally able to understand the implications of the project activities. This chapter describes the project stakeholders and their attitude towards the project construction and the process adopted in consulting the affected households and communities on relocation and resettlement, impacts assessment, socio-economic and physical losses due to project interventions
199. The public consultation process with various stakeholders has been approached so as to involve public and other stakeholders from the earliest stages. Public consultation has taken place during the planning and design stage and viewpoints of the stakeholders have been taken into account and their concerns and suggestions for possible improvements have been included where appropriate. Much of the public consultation process to date has revolved around concerns for the mitigation of construction impacts and the possible side effects from the proximity of the proposed subprojects.

7.2 OBJECTIVES

200. The main objectives of public participation and consultation are to achieve the following:
- *Ensure public and community participation in the subproject environmental policy objectives and decision making.*
 - *Ensure public confidence in the administration of the environment by demonstrating the role of government to enforce the environmental stewardship of government agencies and organs, corporate citizens and elite organizations;*
 - *Grant the citizenry access to environmental information and data, thereby promoting the quality of environmental management and compliance monitoring.*
 - *Provide key project information and create awareness among various stakeholders about project intervention;*
 - *Have interaction for primary and secondary data collection with project affectees and other stakeholders;*

- *Begin establishing communication and an evolving mechanism for the resolution of social and environmental problems at local and project level;*
 - *Involve project stakeholders in an inclusive manner; and*
 - *Receive feedback from primary stakeholders on mitigation and enhancement measures for environmental and social impacts.*
201. Community engagement provides a valuable link between the stakeholders of the project and serve by;
- *Enabling the community to be better informed*
 - *Reducing the level of misconception/ misinterpretation or deception*
 - *Ensuring commitment and greater ownership of the final decision by the community*
 - *Strengthening relationships between project cycle and the community*
 - *Encouraging the community to put forward ideas*
 - *Assembling better understanding of local needs*
 - *Helping to identify issues which may not otherwise have been considered*

7.3 IDENTIFICATION OF STAKEHOLDERS

202. Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and / or the ability to influence its outcome, either positively or negatively. Stakeholders for the subproject include locally affected communities and their formal and informal representatives, national or local government authorities, civil society organisations and groups with special interests, the academic community, or businesses. **(Figure 5.1).**
203. During the field survey different stakeholders identified were the villagers, local residents, government officials, shop owners, public representative, NGOs and general public. All those stakeholders had different types of stakes according to their professions.
204. Two types of the stakeholders were identified: the primary stakeholders, who would be directly affected by the subproject; and the secondary stakeholders, who would be indirectly affected by the subproject .

205. These stakeholders were contacted by the consultants and took into consideration their views and reservations/concerns about the subproject. Consultants also interacted with the community based organizations that can support the community during the execution of the subproject.



Figure 5.1: Identification of Stakeholders

7.4 METHODOLOGY

206. To carry out stakeholder consultations, the consultants adopted a strategic and flexible approach, where influential/ elected representatives were earlier briefed and taken into confidence for holding community level meetings and followed by candid meetings with residents and small group meetings with men and women separately.
207. A series of comprehensive consultations were carried out with the subproject stakeholders at various locations during the preparation of environmental and social impact assessment. The consultation and scoping sessions were designed specifically to provide subproject information to the public. These sessions were informal so as to encourage friendly social environment in which participants were comfortable in raising questions, expressing their opinion and concerns about the subproject besides seeking clarification regarding their concerns. The focus group discussions were instrumental in the process, whereas one-to-one meetings were also held with the institutional stakeholders..

208. The subproject survey was carried out to cover socio-economic condition of the area and assessment of resettlement impacts along the Left Marginal Bund (LMB) of Qadirabad Barrage from RD 0+000 to 30+000.
209. Three villages were selected from head, middle and tail of the proposed reach of the LMB. The detail of surveyed villages is given in **Table 5.2**.

Table 5.2: Surveyed Villages

Sr. No.	Village Name	Location
1	Barubgarh (Head)	RD 03+000
2	Noor Pur (Middle)	RD 20+000
3	Rasool Nagar (Tail)	RD 30+00

7.5 COMMUNITY CONSULTATIONS

210. During field survey, the following consultations were conducted.

7.5.1 Candid Meetings

211. Candid meetings were held with individuals of the area or small groups of inquisitive folks. The questions asked by respondents reflected that the awareness level regarding the proposed subproject was quite adequate.

7.5.2 Focus Group Discussions

212. Focus Group Discussions (FGDs) were conducted with the local people in the subproject area at head, middle and tail reaches of the LMB, photographs are provided in Figure 5.3, while the list of participants is attached at Annex- 3. The discussions focused on impacts of the floods on the local communities and impacts of the proposed subproject.
213. The people of the subproject area were pleased to know about the repair and strengthening of flood protection bunds. They considered it favourable. They were of the view that with the strengthening of the flood protection bund, their houses, structures, businesses and other infrastructures will become safer and they can flourish their livelihood and small business with faith and trust. According to the participants of the consultations, following positive impacts were anticipated by the implementation of the proposed subproject:
- ***Fear of flood damages will be reduced due to control of flood flows within river boundaries;***
 - ***Minimize the damages of existing infrastructure in the river area;***

- ***Protect to cultivable & irrigated lands and increase the productivity;***
- ***Proposed mitigation measures will provide an additional sustainable life and enhancement in socio-economic conditions of the farmers with uplift of general public economies; and***
- ***Save and protect the lives of their livestock which is important source of livelihood.***
- ***In addition to this, execution of the proposed subproject will generate employment opportunities in the area and will contribute in poverty reduction.***



Figure 5.3: Community Consultations at Different Locations

7.5.3 Gender Consultation

214. Like many other persistent developmental issues in Pakistan, gender issues are also less explored along with its marginal position in the planning process, policy formulation and implementation of various development activities ranging from national, provincial to local level. In the rural society, female plays important role in managing the household from domestic chores to work in the fields and taking care of the livestock as well. Rural-women are major contributors in four sub-sectors of the rural economy; crop production, livestock rearing, cottage industry and household & family maintenance activities, such as fetching water, fuel collection and fodder for livestock, food preparation & preservation and caring for children. Most of their work and labor does not carry weight, unrecognized and unappreciated
215. Keeping in view the important role of the female in the household as well as in the society, gender consultations were also conducted to record the views of the female regarding proposed intervention. During interviews of the male respondents/groups, data was also collected to ascertain female social status and gender issues. Findings of the gender consultations are presented in the following:
216. The survey indicates that the women of the selected villages were participating in various activities including household activities, child caring and importantly in income generation activities like management of livestock and work in fields in the season of sowing and harvesting of crops.
217. A major portion of the female community was involved in fish business indirectly to help the male members of the family.
218. During the consultation, the data was collected regarding the employment status of females in government and private sector. The data indicates that no female were reported in the government and private sector to help their male members in managing the household expenses except one female, who was serving as teacher in Government high school. She belonged to Noor Pur village. Government should launch a program through NGOs to motivate the female of the project area to adopt jobs to alleviate poverty.
219. Data regarding education of the female revealed that there were no limitation for female in going to schools and colleges except the colleges are situated at a distance from their villages. In spite of that, the trend of schooling for female prevailed and parents treat equally to the boys and girls in getting education.
220. It was observed that the participants were not satisfied with the available health facilities. There was no proper and equipped health centre for the

female. Female were forced to rely on the traditional practitioners and midwives.

221. It was also derived from the consultations that no NGO existed in the area to provide social services to the community members especially to the female.
222. The collected data revealed that the most pressing needs of women were the availability of proper health, education facilities (College nearby) in the area. Establishment of technical training institution, construction of roads and construction of flood protection bund was also expressed by the participants.

7.5.4 Consultation with Other Stakeholders

223. The potential stakeholders were inhabitants, field staff of Punjab Irrigation Department (PID) and other relevant departments working in the subproject area. During the consultation, maximum information about the subproject was shared.
224. A useful consultation was held with XEN Qadirabad Barrage, District Wildlife Officer and Sub Divisional Forest Officer as they provided enough information about the LMB and flood history, forest protected area and wildlife Sanctuary, while the Sub-Engineer accompanied in the field and guided the team.
225. A list of government officials consulted is enlisted in Table 5.3, while photographs are shown in Figure 5.4.

Table 5.4 List of Government Official Contacted

Sr. No	Name	Designation	Department/Contact No.
1	Rana Tahir	Executive Engineer	Irrigation Dept/ 03045479047
2	Abdur Raheem Watto	Sub Div Officer	Irrigation Dept/ 03014610600
3	Rana Shahid Tabassum	Sub Div. Forest Officer	Forest Office Gujranwala/ 03006468654
4	Dr. Muhammad Ibrar Khan	Asst. Horticulture Officer	Horticulture Department Gujranwala/ 03006407823
5	Sardar Muhammad Akbar	Exec. District Officer	Agriculture Department Gujranwala/ 03008770084
6	Abdul Razzaq	Dist. Forest Officer	Forest Office Gujranwala/

			03216601247
7	Bilal Chattha	Block Officer	Forest Office Gujranwala/ 03004181158
8	Sohail Ashraf	Dy. Director	Agriculture Department Gujranwala/ 0559200135
9	Ihsan Ahmad Raja	District Wildlife Officer	Irrigation Department Qadirabad/ 03015239026



Figure 5.3: Photographs of meetings with Concerned Government Officials

8. GRIEVANCE REDRESS MECHANISM

8.1 GENERAL

226. The stakeholder or affected people's concerns, complaints and grievances about the project environmental performance will be received recorded and replied in a systematic way using an understandable and transparent process that is gender responsive, culturally appropriate and readily accessible to all segments of the affected people at no cost and without retribution.

8.2 INSTITUTIONAL ARRANGEMENT

8.2.1 Management Responsibilities

227. Overall responsibility for environmental management will rest on Project Implementation Unit (PIU) of the Irrigation Department, Government of the Punjab.
- i. The Executing Agency: PIU of Punjab Irrigation Department (PID)
 - ii. Supervising and Monitoring: Social & Environmental Management Unit (ESU) of PIU.
 - iii. General Assistance to all: Head PIU/The Project Director, Irrigation above agencies in their Department will facilitate communications, respective tasks logistics and data collection as and when required.
 - iv. Logistic Support: Head PIU/The Project Director, Irrigation Department shall provide the logistic support and shall be the focal point for the construction activity.

(i) Project Implementation Unit (PIU)

228. The overall responsibility for the implementation of Environmental management/Monitoring Plan rests with the Project Implementation Unit (PIU) along with the assistance of Social & Environmental Management Unit (SEMU) of PIU. The ESU consists of Director Environment & Sociology, Deputy Director Environment and Deputy Director Sociology.
229. PIU will assume overall responsibility for ensuring that while executing the contract and undertaking the construction all environmental norms, regulations and requirements promulgated by Pakistan Environmental Protection Council (PEPC), Pakistan Environmental Protection Act (PEPA), Environmental Protection Agency (EPA) Punjab and Environmental Safeguard Policies of Asian Development Bank, with respect to the work site and adjacent areas are fully respected and implemented.
230. Overall responsibility for implementation of EMP is to ensure that Contractor and Construction Supervision Consultants appoint a dedicated environmental officer and allied staff.

231. PMU will also ensure that all environmental personnel are authorized to implement the socio- environmental policies and requirements of the EMP. PMU also coordinate with relevant government departments and stakeholders on concerned environmental and social issues, inspect and monitor residual impacts of the rehabilitation work, observe documentation of the impacts during the construction phase and inspect the significance of impact in case of unanticipated change in the project. Construction Supervision Consultants will assist and advise PIU in implementation of EMP, inspect and monitor residual impacts of the rehabilitation work and observe documentation of the impacts during the construction phase. and the significance of impact in case of unanticipated change in the project. Construction Supervision Consultants will assist and advise PMU in implementation of EMP.

(ii) Environment and Social Unit (ESU) of PIU

- a. The ESU within PIU will monitor Project performance.
- b. The ESU will function in coordination with the Construction Supervision Consultants and will receive reports from them on behalf of PIU.
- c. ESU will prepare and submit biannual Environmental Monitoring Reports to ADB.

(iii) Head PIU/The Project Director

232. The Project Director shall provide or arrange the logistics including communication, transport and accommodation to all visiting persons/teams experts from any of the above monitoring units and shall coordinate with the contractor(s) to facilitate the visits/inspections.

(iv) Contractor

233. The Contractor will be responsible for implementation of the project EMP. The Contractor will ensure that EMP for the project is implemented fully and must be integrated into the Project implementation and made integral part of the contract document. For any default damages so caused will be remediated by the contractor at his own cost and expenses. In case the contractor fails to rectify the damage the employer will remediate at the risk and cost of the contractor. The amount will be determined by the Construction Supervision Consultants, which will be adjusted from amount due to the Contractor. The Contractor will develop a Health, Safety & Environment (HSE) Plan and get it approved from Construction Supervision Consultants, before the commencement of the Physical works on site.

(v) Construction Supervision Consultants

234. The Construction Supervision Consultants will be responsible to ensure quality of work and fulfillment of contractual obligations. Environmental Specialist of the construction supervision consultants will ensure that all the environmental and social provisions comply with the applicable standards. He/She will confirm that day-to-day construction activities are carried out in environment friendly manner; and periodic environmental training programs organized for the consultant's and contractor's staff. It would be responsibility of the Construction Supervision Consultant to submit monthly environmental report to PIU

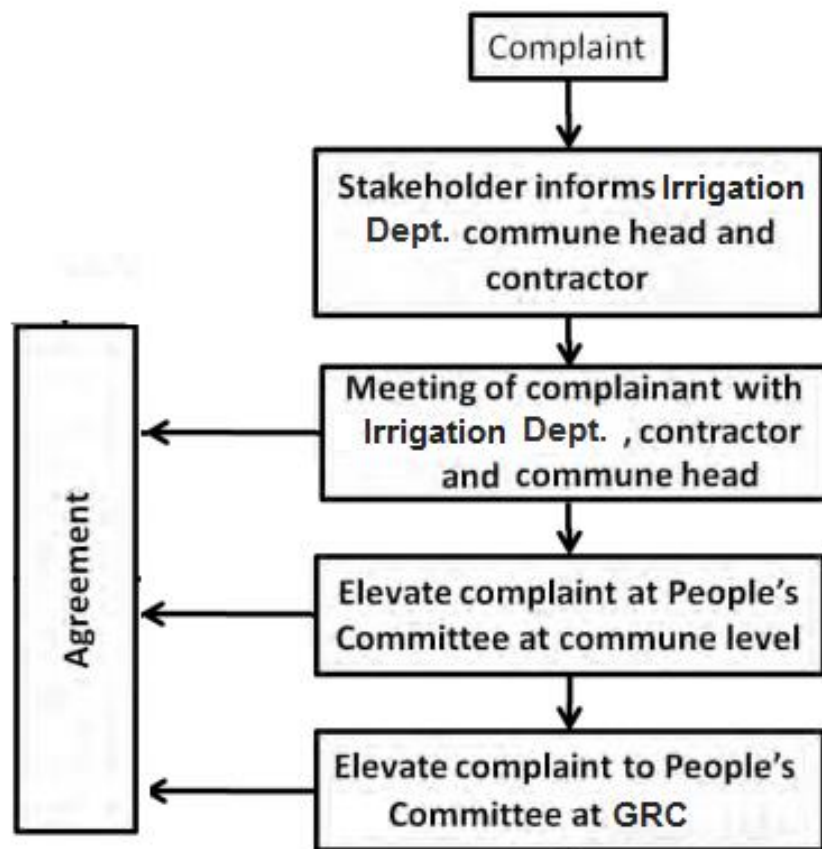


Figure 8.1 Flow Sheet Diagram of GRM

9. CONCLUSION & RECOMMENDATIONS

9.1 CONCLUSION

235. Based on the preliminary plans, environmental and social field surveys, and impacts assessment of the proposed project, it may be concluded that there are insignificant, short term and reversible impacts of the subproject. The major impacts of the subproject are summarized as under:
236. No acquisition of permanent land will be involved.
237. All the other impacts like soil erosion, soil contamination, water contamination, air pollution, high noise level, etc. are of temporary nature and can be controlled and mitigated.
238. It is expected that no trees will be cut during the subproject activities. However 1 % of the project cost will be spent on the new plantation according to Govt of Punjab Policy.
239. Environmentally sensitive areas such as two protected forest areas and wildlife sanctuary that exist along the subproject corridor, will not be affected by the subproject.
240. No indigenous people and women headed households have been identified in the subproject.
241. The other social issues like safety of general public and workers, security problems, risk of communicable diseases, vector borne diseases etc. are of temporary nature. Most of the above impacts are of temporary nature and manageable through good engineering practices and none of these are irreversible.
242. A comprehensive EMP has been developed to identify the impacts, mitigation measures, agencies responsible for implementation and monitoring of the proposed measures. EMP also describes the environmental and social monitoring responsibilities of related authorities.
243. In the light of the above discussions, it may be concluded that the proposed preliminary subproject is environment friendly and will cause the least effects on the area's existing social and environmental settings which will be mitigated through EMP.

9.2 RECOMMENDATIONS

244. Although comprehensive mitigation measures have been proposed in the report to minimize the negative impacts and to enhance the positive impacts of the Project, however, major recommended mitigation measures are summarized as under:

- 245. Temporary labour camps should be developed inside boundary and should be facilitated with proper drainage facilities.
- 246. Soil erosion and contamination, water contamination, air pollution and high noise levels should be controlled with the use of good engineering practices.
- 247. Contractor should develop plan such as traffic management, Solid waste management and material management etc. before starting the construction activities.
- 248. Contractor should warn the workers not to hunt the birds, fish resources, etc. as there are plenty of fish farms around the project area as well as a wildlife sanctuary also lies within the project vicinity.
- 249. Contractor should take due care of the local communities and its sensitivity towards local customs and traditions.
- 250. EMP proposed in the report should be implemented in its true letter and spirit.

10. ANNEX

ANNEX 1

PHOTOLOG



Meeting with SDO Irrigation Qadirabad



Meeting with SDFO



Meeting with SDFO



Meeting with EDO Agriculture



Focus Group Discussions with Locals



Focus Group Discussions with Locals



Focus Group Discussions with Locals



Focus Group Discussions with Locals



Qadirabad Barrage Site



Riverine Side of Bund



Qadirabad Flood Bund



Near Wildlife Sanctuary



Riverine Side of Bund



Protected Area

ANNEX 2

RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

IRRIGATION/FLOOD CONTROL

Instructions:

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the —without mitigation case. The purpose is to identify potential impacts. Use the —remarks section to discuss any anticipated mitigation measures.

Country/Project Title: Pakistan / Flood Emergency Reconstruction and Resilience Project

Sector Division: Remodelling of LMB of Qadirabad Barrage in Critical Reaches

SCREENING QUESTIONS	Yes	No	REMARKS
A. PROJECT SITING			
IS THE PROJECT AREA ADJACENT TO OR WITHIN ANY OF THE FOLLOWING			
▪ PROTECTED AREA		X	
▪ WETLAND		X	
▪ MANGROVE		X	
▪ ESTUARINE		X	
▪ BUFFER ZONE OF PROTECTED AREA	X		The project area (Rehabilitation of existing Bund) is near Wildlife protected area, (Head Qadirabad Wildlife Sanctuary), but adjoining sufficient land is available to increase the existing (25 feet) width of bund up to 37 feet which is available in the existing RoW. The rehabilitation activity will be carried out during the non-migratory season's i.e. from April to September . Additional mitigation measures have been suggested in EMP.
▪ SPECIAL AREA FOR PROTECTING BIODIVERSITY		X	
B. POTENTIAL ENVIRONMENTAL IMPACTS			
WILL THE PROJECT CAUSE...			

<input type="checkbox"/> Loss of precious ecological values (e.g. result of encroachment into forests/swamplands or historical/cultural buildings/areas, disruption of hydrology of natural waterways, regional flooding, and drainage hazards)?		X	The subproject activities does not encroach into other land. Activities will be carried out at existing RoW and bund/ embankment. Raw material will be obtained from sites approved by the Engineer.
SCREENING QUESTIONS	Yes	No	REMARKS
<ul style="list-style-type: none"> Conflicts in water supply rights and related social conflicts? 		X	Not applicable
<ul style="list-style-type: none"> Impediments to movements of people and animals? 		X	Small stretch of bund is black topped while the remaining is katcha track. People use bund as thoroughfare / passage but other roads in the area which is also used by the local community. Rehabilitation activities will be carried out by taking good management practices.
<ul style="list-style-type: none"> Potential ecological problems due to increased soil erosion and siltation, leading to decreased stream capacity? 		X	
<ul style="list-style-type: none"> Insufficient drainage leading to salinity intrusion? 		X	
<ul style="list-style-type: none"> Over pumping of groundwater, leading to salinization and ground subsidence? 		X	Limited use of water for sub-project activities which will not be significant
<ul style="list-style-type: none"> Impairment of downstream water quality and therefore, impairment of downstream beneficial uses of water? 		X	Not Applicable
<ul style="list-style-type: none"> Dislocation or involuntary resettlement of people? 		X	No significant dislocation or involuntary resettlement of people will occur.
<ul style="list-style-type: none"> Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups? 		X	
<ul style="list-style-type: none"> Potential social conflicts arising from land tenure and land use issues? 		X	No land acquisition will be required
<ul style="list-style-type: none"> Soil erosion before compaction and lining of canals? 		X	
<ul style="list-style-type: none"> Noise from construction equipment? 	X		Minor Impact during construction activities. It will be managed through mitigation measures. It will be documented in EMP.
<ul style="list-style-type: none"> Dust during construction? 	X		Minot Impact during construction activities but will be minimize with implementation of EMP. It will be managed for labors by water sprinkling and wet earth. Dust generated will be managed through sound planning and good management practices as given in EMP.
<ul style="list-style-type: none"> Waterlogging and soil salinization due to inadequate drainage and farm management? 		X	
<ul style="list-style-type: none"> Leaching of soil nutrients and changes in soil characteristics due to excessive application of irrigation water? 		X	

▪ Reduction of downstream water supply during peak seasons?		X	
▪ Soil pollution, polluted farm runoff and groundwater, and public health risks due to excessive application of fertilizers and pesticides?		X	
▪ Soil erosion (furrow, surface)?		X	
▪ Introduction of increase in incidence of waterborne or water related diseases?		X	
▪ Dangers to a safe and healthy working environment due to physical, chemical and biological hazards during project construction and operation?		X	Minor issues during construction phase. Health and safety measures for laborers and local population will be taken to avoid any consequences. HSE Plans shall be developed by the contractor. which will be documented in EMP.
▪ Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	Local people will be employed as much as possible from close by villages/ towns and the same will be documented in EMP
▪ Local people conflicts if workers from other regions or countries are hired?	X		Members from local community will be employed as much as possible equitably and the same will be documented in EMP
▪ Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	X		Health and safety measures for community will be taken to avoid any consequences by development of HSE Plan and its implementation. It will be documented in EMP.
▪ Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., irrigation dams) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?	X		Safety measures for community will be taken to avoid any risk and consequence through sound design, construction and operation. It will be documented in EMP. The strengthening activity will result in positive impact for the local adjacent community and their assets.

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
▪	X		The existing LMB (subproject) is being strengthened to control high floods in the area
▪		X	
▪		X	
▪		X	

ANNEX 3**List of Community Consultation Participants**

Location: Village Barub Garh , Tehsil Wazirabad, District Gujranwala					
Sr. No.	Name	Father's Name	Occupation	Contact Nos.	CNIC No.
1	Malik Farooq	-	XEN	0300-0760887 054-7550198	
2	Muzammal Hussain	M.Akbar	Laborer	0344-7907285	34104-8961434-9
3	M.Shafi	Faqir Muhammad	Farmer	NA	
4	Ghulam Abbas	M.Shafi	Laborer	0308-7168172	34014-8702570-3
5	M.Usman	M.Akbar	Tailor	0305-8056249	
6	Yasir Imran	Akbar Ali	----	---	34104-7132270-3
7	Mudassar Rehman	Akbar Ali	-----	-----	34104-5050889-3
8	Akbar Ali	Abdul Ghafoor	-----	-----	34104-1954081-3
9	M Muqueem	Khusi Muhammad	-----	-----	34104-6676530-3
10	Majeed-ur-Rehman	M.Ibrar	Mechanics	0346-6692316	
11	Ahmad Imam	M.Akbar	Laborer	0343-9024329	
12	Rao Zakriya Farooq	-	Deputy Director PIU	042-35294375 0333-4938676	36402-2446104-1
13	Shahid Habib	-	Deputy Director SEMU	0321-4600718	35202-2781181-3
14	Ali Raza	Lateef Ahmad	Farmer	0341-6534985	
Location: Village Noor Pur , Tehsil Wazirabad, District Gujranwala					
1	Zafar Iqbal	M.Yar	Farmer/fishing	0300-6521261	34104-2198542-9
2	Munir Ahmad	Sakhi Muhammad	Farmer/fishing	0341-3735069	34104-3080458-1
					34104-3656485-5

3	Riaz Ahmad	Dost Muhammad	Farmer/fishing	0340-5616245	
4	M.Shahid	Nazar Muhammad	Farmer/fishing	0342-6488722	
5	Zulfeqar Ali	Dost Muhammad	Farmer/fishing	0344-0490643	34104-2299170-7
6	Iftekhar Ahmad	Allah Yar	Farmer/fishing	0341-0463985	
7	Fakhar Hussain	M.Rafique	Farmer/fishing	0302-6696720	34104-7518421-5
8	M.Yaqoob	M.Inayat	Farmer/fishing	0348-4636023	34104-1649238-7
9	Munir Ahmad	M.Din	Farmer/fishing	NA	
10	M.Mansha	Sakhi Muhammad	Farmer/fishing	0305-4890918	
11	Rao Zakriya Farooq	-	Deputy Director Social Safeguard (PIU)	042-35294375 0333-4938676	36402-2446104-1
12	Shahid Habib	-	Deputy Director SEMU	0321-4600718	35202-2781181-3
Location: Village Meraj ke Chatha , Tehsil Wazirabad, District Gujranwala					
1	Fiaz Ahmad	Ghulam Ahmad	Farmer	0300-6313988	34104-5153919-9
2	Zafar ul Hassan	Muhammad Anwar	Farmer	0305-4903560	34104-2207165-1
3	Qamar ul Zaman	Shahbaz	Farmer	0300-6175890	34104-3459909-7
4	Muhammad Arshad Numberdar	Khan Muhammad	Farmer	0343-4953554	34104-2100926-9
5	Muhammad Asjad	Nazar Muhammad	Farmer	-	
6	Ali Sultan Gondal	Ghulam Muhammad	Farmer	-	34104-5174682-5
7	Muhammad Azam	Ghulam Rasool	Farmer	-	34104-2345367-5
8	Sanaulah	Noor Muhammad	Farmer	-	34104-2354209-5
9	Muhammad Ashraf	Ibrahim	Farmer	-	34104-1025539-3
10		Muhammad Feroz	Farmer	0303-8895020	

	Muhammad Sabir				
11	Muhammad Zaman	Khushi Muhammad	Farmer	-	34104-2306162-3
12	Safeer ul Hassan	Khalid Javed	Advocate	-	34104-2350896-7
13	Muhammad Ilyas		Design Engineer FERRP	-	
14	Rana Abdur Rehman		Chief Sociologist NESPAK	-	
15	Wasim Abbas		Sr. Sociologist NESPAK	-	
Location: Village Rasool Nagar , Tehsil Wazirabad, District Gujranwala					
1	Malik Farooq	-	XEN	0300-0760887 054-7550198	
2	Rao Zakriya Farooq	-	Deputy Director PIU	042-35294375 0333-4938676	36402-2446104-1
3	Shahid Habib	-	Deputy Director SEMU	0321-4600718	35202-2781181-3
4	Amjad Hussain	M.Shafi	Mason	0306-6488396	
5	Shafaqat Ali	M.Sadiq	Job	0304-9757231	
6	Ehan ullah	Ghulam Qadir	Irrigation Job	NA	34104-23106707-0
7	Tufail Hussain	Farzand Ali	Laborer	NA	
8	Aqib Ali	Jamil Ahmad	Laborer	0345-2311227	34104-5635265-1
9	Shafa,at Ali	Allah Rakha	Laborer	0303-6825997	34104-2552380-1
10	Akbar Ali	Karam Elahi	Irrigation Job	0308-6654889	34104-2318620-9
11	Amir Hussain	Khursheed Ahmad	Mason	0342-6516095	
12	Tariq Masih	Hadayat Masih	Mason	0347-6111992	34104-5479083-1
13	Ansar Ali	Walayat Hussain	Laborer	0342-6797919	

ANNEX 4

NATIONAL ENVIRONMENTAL QUALITY STANDARDS (NEQS),

Table 1: Effluent Discharge Standards (NEQS 2000) Applicable to the Works

Sr. No.	Determinant	NEQS
1	Temperature	40 °C =≤3 deg.
2	pH	6 – 9
3	BOD5	80 mg/l
4	Chemical Oxygen Demand (COD)	150 mg/l
5	Total Suspended Solid (TSS)	200 mg/l
6	Total Dissolved Solids	3500 mg/l
7	Grease and Oil	10 mg/l
8	Phenolic compounds (as phenol)	0.1 mg/l
9	Ammonia	40 mg/l
10	Chlorine	1.0 mg/l
11	Chloride	1000.0 mg/l
12	Sulphate	600 mg/l
13	Manganese	1.5 mg/l
14	Fluoride	10 mg/l
15	Cyanide (as CN ⁻) total	1.0 mg/l
16	An-ionic detergents (as MB As)	20 mg/l
17	Sulphide (S-2)	1.0 mg/l
18	Pesticides	0.15 mg/l
19	Cadmium	0.1 mg/l
20	Chromium trivalent and hexavalent	1.0 mg/l
21	Copper	1.0 mg/l
22	Lead	0.5 mg/l
23	Mercury	0.01 mg/l
24	Selenium	0.5 mg/l
25	Nickel	1.0 mg/l
26	Silver	1.0 mg/l
27	Total Toxic metals	2.0 mg/l
28	Zinc	5.0 mg/l
29	Arsenic	1.0 mg/l
30	Barium	1.5 mg/l
31	Iron	8.0 mg/l
32	Boron	6.0 mg/l

Table 2: National Environmental Quality Standards (NEQS) for Gaseous Emission (mg/Nm³, Unless Otherwise Defined)

Sr. No.	Parameter	Source of Emission	Existing Standards	Revised Standards
1	2	3	4	5
1.	Smoke	Smoke Opacity not to exceed	40% or 2 Ringlemann Scale	40% or 2 Ringlemann Scale or equivalent smoke number
2.	Particulate Matter (I)	(a) Boilers and Furnaces (i) Oil fired (ii) Coal fired (iii) Cement Kilns (b) Grinding, crushing, clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas.	300 500 200 500	300 500 200 500
3.	Hydrogen Chloride	Any	400	400
4.	Chlorine	Any	150	150
5.	Hydrogen Fluoride	Any	150	150
6.	Hydrogen Sulphide	Any	10	10
7.	Sulphur Oxide ⁽²⁾ ⁽³⁾	Sulfuric acid/ Sulphonic acid plants Other plants except power plants operating on oil and coal	400	1700
8.	Carbon Monoxide	Any	800	800
9.	Lead	Any	50	50
10.	Mercury	Any	10	10
11.	Cadmium	Any	20	20
12.	Arsenic	Any	20	20
13.	Copper	Any	50	50
14.	Antimony	Any	20	20
15.	Zinc	Any	200	200
16.	Oxides Nitrogen (3) of	Nitric acid manufacturing unit. Other plants except power plants operating on oil or coal: Gas fired Oil fired Coal fired	400 - -	400 600 1200

Explanations:-

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1 percent sulphur content in fuel. Higher content of Sulphur will case standards to be pro-rated.
3. In respect of emissions of sulphur dioxide Nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to National Environmental Quality Standards (NEQS) specified above, comply with the following standards.

Table 3: National Environmental Quality Standards (NEQS, 2009) for Vehicular Emission

Sr. No.	Parameter	Standard (Maximum permissible Limit)	Measuring Method	Applicability
1	Smoke	40% or 2 on the Ringlemann Scale during engine acceleration mode.	To be compared with Ringlemann Chart at a distance of 6 meters or more	Immediate effect
2	Carbon Monoxide (CO)	6%	Under idling condition: Non-dispersive infrared detection through gas analyzer.	
3	Noise	85 dB(A)	Sound Meter at 7.5 meters from the source	

Table 4: National Environmental Quality Standards (NEQS, 2010) for Noise

Sr. No.	Category of Area / Zone	Effective from 1 st July, 2010		Effective from 1 st July, 2013	
		Limit in dB (A) Leq*			
		Daytime	Night-time	Daytime	Night-time
1	Residential Area (A)	65	50	55	45
2	Commercial Area (B)	70	60	65	55
3	Industrial Area (C)	80	75	75	65
4	Silence Zone (D)	55	45	50	45

Note:

1. Daytime hours: 6:00 a.m. to 10:00 p.m.
2. Night-time hours: 10:00 p.m. to 6:00 a.m.
3. Silence Zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters round hospitals, educational institutions and courts.
4. Mixed categories of areas may be decided as one of the four above mentioned categories by the competent authority.

*dB (A) Leq: Time weighted average of the level of sound in scale "A" which is relatable to human hearing.

Table 5: National Environmental Quality Standards (NEQS, 2010) for Drinking Water

Sr. No.	Properties/Parameters	Standard Values for Pakistan	WHO Standards	Remarks
BACTERIAL				
1	All water is intended for drinking (E.Coli or Thermotolerant Coliform bacteria)	Must not be detectable in any 100ml sample	Must not be detectable in any 100ml sample	Most Asian Countries also follow WHO Standards
2	Treated water entering the distribution system (E.Coli or Thermotolerant Coliform and total Coliform bacteria)	Must not be detectable in any 100ml sample	Must not be detectable in any 100ml sample	Most Asian Countries also follow WHO Standards

Sr. No.	Properties/Parameters	Standard Values for Pakistan	WHO Standards	Remarks
3	Treated water entering the distribution system (E.Coli or Thermotolerant Coliform and total Coliform bacteria)	Must not be detectable in any 100ml sample. In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Must not be detectable in any 100ml sample. In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Most Asian Countries also follow WHO Standards
PHYSICAL				
4	Colour	≤15 TCU	≤15 TCU	
5	Taste	Non Objectionable/ Acceptable	Non Objectionable/ Acceptable	
6	Odour	Non Objectionable/ Acceptable	Non Objectionable/ Acceptable	
7	Turbidity	<5 NTU	<5 NTU	
8	Total hardness as CaCO ₃	<500mg/l	---	
9	TDS	<1000	<1000	
10	pH	6.5-8.5	6.5-8.5	
RADIOACTIVE				
11	Alpha Emitters bq/L or pCi	0.1	0.1	
12	Beta Emitters	01	01	
CHEMICAL				
Essential Inorganics		mg/litre	mg/litre	
13	Aluminum (Al) mg/l	≤0.2	0.02	
14	Antimony (Sb)	≤0.005	0.02	
15	Arsenic (As)	≤0.05	0.01	Standard for Pakistan similar to most Asian developing Countries
16	Barium (Ba)	0.7	0.7	
17	Boron (B)	0.3	0.3	
18	Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing Countries
19	Chloride (Cl)	<250	250	
20	Chromium (Cr)	≤0.05	0.05	
21	Copper (Cu)	2	2	
Toxic Inorganics		mg/litre	mg/litre	
22	Cyanide (CN)	≤0.05	0.07	Standard for Pakistan similar to most Asian developing Countries

Sr. No.	Properties/Parameters	Standard Values for Pakistan	WHO Standards	Remarks
23	Fluoride (F)	≤1.5	1.5	
24	Lead (Pb)	≤0.05	0.01	Standard for Pakistan similar to most Asian developing Countries
25	Manganese (Mn)	≤0.5	0.5	
26	Mercury (Hg)	≤0.001	0.001	
27	Nickel (Ni)	≤0.02	0.02	
28	Nitrate (NO ₃)	≤50	50	
29	Nitrite (NO ₂)	≤3	3	
30	Selenium (Se)	0.01	0.01	
31	Residual Chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	---	
32	Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing Countries
Organics				
33	Pesticides mg/L	---	PSQCA No. 4629-2004, Page No.4, Table No. 3, Serial No. 20-58 may be consulted	Annex-II
34	Phenolic Compounds (as Phenols) mg/L	---	≤0.002	
35	Poly nuclear aromatic hydrocarbons (as PAH) g/L		0.01 (By GC/MS method)	
***PSQCA: Pakistan Standards Quality Control Authority				

Table 6: National Environmental Quality Standards (NEQS, 2010) for Ambient Air

Pollutants	Time-weighted average	Concentration in Ambient Air		Method of Measurement
		Effective from 1st July 2010	Effective from 1st January 2013	
Sulphur Dioxide (SO ₂)	Annual Average*	80µg/m ³	80µg/m ³	Ultraviolet Fluorescence Method
	24 hours**	120µg/m ³	120µg/m ³	
Oxides of Nitrogen as (NO)	Annual Average*	40µg/m ³	40µg/m ³	Gas Phase Chemiluminescence
	24 hours**	40µg/m ³	40µg/m ³	
Oxides of Nitrogen as (NO ₂)	Annual Average*	40µg/m ³	40µg/m ³	Gas Phase Chemiluminescence
	24 hours**	80µg/m ³	80µg/m ³	
Ozone (O ₃)	1 hour	180µg/m ³	130µg/m ³	Non disperse UV absorption method
Suspended Particulate Matter (SPM)	Annual Average*	400µg/m ³	360µg/m ³	High Volume Sampling, (Average flow rate not less than 1.1m ³ /minute)
	24 hours**	550µg/m ³	500µg/m ³	

Pollutants	Time-weighted average	Concentration in Ambient Air		Method of Measurement
		Effective from 1st July 2010	Effective from 1st January 2013	
Respire able Particulate Matter (PM ₁₀)	Annual Average*	200µg/m ³	120µg/m ³	β-Ray Absorption Method
	24 hours**	250µg/m ³	150µg/m ³	
Respire able Particulate Matter (PM ₂₅)	Annual Average*	25µg/m ³	15µg/m ³	β-Ray Absorption Method
	24 hours**	40µg/m ³	35µg/m ³	
	1 hour	25µg/m ³	15µg/m ³	
Lead (Pb)	Annual Average*	1.5µg/m ³	1µg/m ³	AAS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	2µg/m ³	1.5µg/m ³	
Carbon Monoxide (CO)	8 hours**	5µg/m ³	5µg/m ³	Non-Dispersive Infrared (NDIR) method
	1 hour	10µg/m ³	10µg/m ³	
*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform intervals.				
**24 hourly/8 hourly values should be met 98% in a year. 2% of the time, it may exceed but not on two consecutive days.				