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Building resilience of damaged flood mitigation structures along river Indus in Sindh province

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- (i) The fiscal year (FY) of the Government of the Islamic Republic of Pakistan and its agencies ends on 30 June. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2011 ends on 30 June 2011.
- (ii) In this report, "\$" refers to United States dollars.

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**IRRIGATION DEPARTMENT
GOVERNMENT OF SINDH**

**BUILDING RESILIENCE OF DAMAGED FLOOD MITIGATION STRUCTURES ALONG
RIVER INDUS IN SINDH**



INITIAL ENVIRONMENTAL EXAMINATION REPORT

October 2023



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Building Resilience of Damaged Flood Mitigation Structures along River Indus in Sindh

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ACRONYMS

ADB	Asian Development Bank
AoI	Area of Influence
BHUs	Basic Health Units
BOQs	Bill of Quantities
CCI	Council of Common Interest
CDA	Canal and Drainage Act
CRVA	Climate Risk and Vulnerability Assessment
EA	Executing Agency
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
FRM	Flood risk management
EGST	Elevated Ground Storage Tanks
GoP	Government of Pakistan
GRC	Grievance Redress Committee
GRM	Grievance Redressal Mechanism
GCM	Global circulation models
HSE	Health, Safety and Environment
IBAT	Integrated Biodiversity Assessment Tool
IEE	Initial Environmental Examination
IFC	International Financing Corporation
NDRMF	National Disaster Risk Management Fund
NCS	National Conservation Strategy
NEQS	National Environmental Quality Standards
NOC	No Objection Certificate
PEPA	Pakistan Environmental Protection Act
PAPs	Project Affected Peoples
PAHs	Poly-nuclear aromatic hydrocarbons
PPE	Personal Protective Equipment
PMU	Project Management Unit
PD	Project Director
RoW	Right of Way
REA	Rapid Environmental Assessment
SEPA	Sindh Environment Protection Agency
SID	Sindh Irrigation Department
SSEMP	Site-specific Environmental Management Plan
SPS	Safeguard Policies Statement
SEQS	Sindh Environmental Quality Standards
SC	Supervision Consultants

EXECUTIVE SUMMARY

A. INTRODUCTION

1. This report presents the findings of an Initial Environmental Examination (IEE) study for the proposed project i.e. rehabilitation of damaged flood mitigation structures along the river Indus in Sindh province. The project is being funded by the Asian Development Bank (ADB) through the National Disaster Risk Management Fund (NDRMF), with the Sindh Irrigation Department (SID) acting as the implementing agency (IA).

2. The project is located in four districts: Sukkur, Naushero Feroze, Sujawal and Matiari of Sindh province. In these areas, the positions of river banks (bunds) are very vulnerable and continuous floods have further deteriorated the respective river banks, particularly in the mentioned sites. Additionally, the adjacent areas are under severe threat of flooding during heavy rains. In order to address these issues, the SID has already taken remedial measures to build resilience in damaged flood mitigation structures along the river Indus in Sindh and to carry out flood mitigation works in the respective areas. However, these existing structures suffered severe damage to river bank sites during the unprecedented floods in 2011, 2015 and 2022, with most of the mitigation works being at riverbank sites. Under the proposed activity, SID intends to sustainably restore and rehabilitate flood mitigation structures with the main components as follows:

- Rehabilitation / Reconstruction of stone aprons, pitching, studs, and bund infrastructure to enhance flood resilience.
- Restore, elevate, and strengthen bund spurs, incorporating stone pitching and aprons to mitigate flood hazards and safeguard vital infrastructure.

B. Project Categorization

3. According to ADB Safeguard Policy Statement (SPS) 2009, the proposed projects are expected to have only short term, site specific and largely reversible impacts which will be primarily during the construction phase of the project and thus the project has been classified as Category 'B'.

4. In regard to the national environmental legislation, the proposed project falls under the category of "Water management, dams, irrigation & flood protection" of Schedule I and thus this IEE report has been prepared to obtain the No Objection Certificate (NoC) from Sindh Environment Protection Agency (SEPA).

C. Policy Legal and Administrative Framework

5. This report has been prepared in accordance with the Pakistan Environmental Protection Act 1997, Sindh Environmental Protection Act, 2014 and the ADB SPS, which requires that environmental considerations be incorporated into ADB's funded project to ensure that the project will have minimal environmental impacts and be environmentally sustainable.

D. DESCRIPTION OF PROJECT

6. This project will be implemented for rehabilitation / reconstruction of six flood protection bunds that have been severely damaged during the recent high intensity rainfall in July and August, 2022. Details of the flood protection bunds are presented in the Table 1 below.

Table 1: Bunds and nomenclature of Proposed Interventions

Sr. No.	Structure Description/Sub Type	District	Nomenclature of Proposed Intervention
1	Rehabilitation / Reconstruction of Stone Apron and Stone Pitching along S.M Bund from Mile 70/7 to 72/0 in Moro Bund Sub Division.	Naushahro Feroze	Stone pitching, stone apron.
2	Rehabilitation / Reconstruction of Stud / Apron along S.M Bund at Mile 12/0 to 12/7 and Bakhri Loop Bund Mile 0/0 to 0/1 in Kandiaro Bund Sub Division.	Naushahro Feroze	Stone pitching, stone apron.
3	Recouping of Stone Spurs Mile 142/3 and Stone Studs Mile 136/1 Along S.M Bund in Hala Irrigation Division Hala.	Matiari	Stone spurs, stone studs
4	Rehabilitation, Raising and Strengthening of Spurs along Surjani Complex Bund Sujawal of Pinyari Circle Hyderabad Kotri Barrage Region Hyderabad.	Sujawal	Raising and strengthening of spurs
5	Rehabilitation/Restoration of Stone Apron at Mile 1/1+360 to 1/2 and Stone Pitching at Mile 0/0 to 2/4 along Baiji Bund	SID	Stone pitching, stone apron.
6	Restoration/Raising & Strengthening along R.N Loop Bund Mile 0/0 to 3/0 & Garking Loop Bund Mile 0/0 to 2/6, Providing Stone Pitching along R.N Bund Mile 5/0 to 6/0 and Providing Stone Apron, Baiji Bund Mile 7/5 to 7/6	Sukkur	Raising and strengthening of spurs, Stone pitching, stone apron

E. PROJECT ALTERNATIVES

7. Traditional rehabilitation and enhancement option (alternative 1) was compared with the innovative flood resilience design (alternative 2). It was found that the alternative 1 i.e. relying on conventional engineering methods, offers a shorter implementation timeline and lower initial costs, but it falls short in terms of flood resilience and environmental considerations. It may lead to higher long-term maintenance expenses and leave communities vulnerable to future floods. On the contrary, alternative 2, characterized by its innovative flood resilience design, requires specialized expertise and a longer construction period. However, it excels in prioritizing flood resilience, environmental mitigation and long-term sustainability.

8. With potential reductions in environmental impact, enhanced flood protection and long-term cost savings, the alternative 2 emerges as the recommended choice. Its proactive approach aligns seamlessly with the project's objectives, ensuring the comprehensive rehabilitation of flood mitigation structures and significantly bolstering their capacity to withstand flood hazards while safeguarding both communities and the environment.

F. BASELINE CONDITIONS

- **Topography:** The topography of the four districts of the project area located in Sindh province varies significantly. Matiari, located in the northern part is characterized by flat arid plains and is traversed by the Indus river. Naushahro Feroze, situated in the southeast, features a diverse landscape with plains, low hills, and riverine areas influenced by the Indus river and its distributaries. Sujawal, in the coastal south, has low-lying areas along the Arabian Sea, including wetlands and marshes, with susceptibility to tidal influence and flooding. Sukkur, in the northern part, is predominantly a flat alluvial plain.

- **Geology and Soil:** The geology of the four districts in Sindh is primarily shaped by their location within the broader Indus basin. Matiari and Naushahro Feroze districts are situated in the lower Indus basin and are characterized by alluvial and fluvial deposits. On the other hand, Sujawal district, located along the coast of the Arabian Sea, features a distinct geological setting. This district's geology includes coastal and deltaic formations influenced by the sea.

The soil composition in the four districts of Sindh varies, but is primarily alluvial and fertile due to their proximity to the Indus river.

- **Hydrology of the Project Area:** The hydrology of Matiari, Naushahro Feroze, and Sukkur districts in Sindh, Pakistan, is intricately tied to their proximity to the Indus River. The Indus River, a vital water source, plays a central role in sustaining agriculture in these districts. Canal systems divert water from the Indus and its tributaries, ensuring consistent irrigation and fertile soil conditions, supporting a diverse range of crops, and contributing significantly to the local economies. Sujawal's hydrology is unique due to its coastal location along the Arabian Sea. Tidal movements from the sea influence the district's waterways, and it experiences seasonal variations in water levels. Wetlands, creeks, and marshes are common features in Sujawal district.
- **Ground Water:** Groundwater in Sukkur, Naushahro Feroze, Sujawal and Matiari districts of Sindh is integral to agriculture and domestic water supply, with its recharge primarily dependent on the Indus river and canals. Tube wells and shallow wells are commonly used for groundwater extraction in these agricultural regions. However, groundwater quality can vary and issues related to salinity and waterlogging may arise if not managed properly. In coastal areas like Sujawal, there is a risk of saltwater intrusion into freshwater aquifers. Sustainable groundwater management is essential to prevent over-extraction and protect water quality, necessitating a balance between surface water and groundwater use, overseen by local authorities and water management agencies.
- **Average Temperature:** Project area has hot summer and cold winters. The summer starts from May and lasts till September. July is the hottest month. The mean maximum and minimum temperature are 45 °C in the month of June and 29 °C in July respectively. The winter seasons lasts from November to February. January is the coldest month. The mean maximum and mean minimum temperatures are 24 °C and 8 °C in January.

- **Wind:** Maximum wind speeds can be observed in the months of March to June which is >19 km/h. Wind speed >12 km/h dominates throughout the year. The wind rose that dominant wind direction is towards South (S).
- **Ambient Air Quality:** Monitoring results revealed concerning findings regarding air quality in the vicinity of the barrage. Specifically, it was found that the levels of fine particulate matter (PM_{2.5} and PM₁₀) exceeded the standards set by the World Health Organization (WHO). Additionally, the levels of carbon monoxide (CO) also surpassed both WHO and National Environmental Quality Standards (NEQS) standards. The major contributors to air pollution in this area were identified as vehicular traffic and industrial activities.
- **Ambient Noise:** The noise levels near Sukkur barrage were notably high, posing potential concerns for the local environment and residents. These elevated noise levels were primarily attributed to heavy vehicular traffic in the area. Noise monitoring results indicated that the noise pollution exceeded the national standards, reflecting the need for mitigation measures to address these high noise levels.
- **Water Quality:** The water quality of the Indus River, particularly during the high-flow season, was assessed at Sukkur barrage. Findings revealed that the river's water was highly turbid, with nephelometric turbidity unit (NTU) readings ranging from 970 to 1220. Moreover, the total suspended solids content in the water varied from 1275 to 1860 mg/L. The electrical conductivity of the water was found to be between 515 to 577 μ S/cm, while chloride levels ranged from 11 to 18 mg/L.
- **Flora:** The sub-project area exhibits a variety of tree species, including Kikar (*Acacia nilotica*), Jand (*Prosopis cineraria*), Jungli Bair (*Ziziphus nummularia*), Ghaz or Khagal (*Tamarix indica*), and Eucalyptus (*Eucalyptus* spp). Dominant shrubs and bushes comprise species such as Capparis spinose, *Saccharum griffithii*, *Saccharum munja*, Alhaji, *Glinus lotoides*, *Paspalum vaginatum*, *Kohautia retrorsa*, *Salvadora oleoides*, *Typha dominghensis*, *Phyla nodiflora*, and *Capparis decidua*. Herbs like *Atambae* (*Valerianella szovitsiana*), Cheir (*Ferula costata*), Kamha (*Ferula ovina*), Sagdaru (*Heliotropium dasycarpum*), and grasses like Adin (*Phacelurus speciosus*), Gasht (*Stipa trichoides*), Hawae (*Cymbopogon jawarancusa*, *C. commutatus*), Kaj (*Chrysopogon aucheri*), Kholambae (*Avena sterilis*), Lashabae (*Poa bulbosa*), and Sarandu (*Biossiera squarrosa*) contribute to the ground cover in the area. No flora species with ecological significance were identified during the baseline survey of the sub-projected areas.
- **Fauna:**
 - Mammals:** Indian Wild Boar (*Sus scrofa*), Common Palm Civet (*Paradoxurus hermaphroditus*), Smooth-coated Otter (*Lutrogale perspicillata*), Indian Grey Mongoose (*Herpestes edwardsii*), Indian Hedgehog (*Paraechinus micropus*), Indian Pangolin (*Manis crassicaudata*), Asiatic Jackal (*Canis aureus*), and Indian Desert Fox (*Vulpes vulpes pusilla*).
 - Reptiles and Amphibians:** Sind Krait (*Bungarus sindanus*), Sind Awl-Headed Snake (*Aspidura sindanensis*), Cobra (*Naja naja sindica*), Pit Viper (*Gloydius himalayanus sindanus*), Monitor (*Varanus sindanicus*), Sand Gecko (*Tropicolotes tripolitanus sindicus*), and Painted Frog (*Kaloula pulchra*).
 - Birds:** Black-winged Stilt (*Himantopus himantopus*), White-cheeked Bulbul (*Pycnonotus leucotis*), Common Babbler (*Turdoides caudata*), Pheasant Crow (*Corvus splendens*), Jungle Babbler (*Turdoides striata*), Mallard Duck (*Anas platyrhynchos*), Northern Pintail (*Anas acuta*), Lesser Flamingo (*Phoenicopterus minor*).

- **Population and Households size:**

In the project area, the population varies across different Talukas/Tehsils. Hala has a population of 262,639 with an average household size of 5.77, while Kandiaro's population is 322,376 with an average household size of 6.11. Moro has a population of 368,579 and an average household size of 5.49, while Rohri's population stands at 370,582 with an average household size of 5.60. Jati has a population of 201,868 and an average household size of 6.02, and Pano Aqil records a population of 436,372 with an average household size of 5.57.
- **Caste and Tribes:** Major castes and tribes in the sub-projects include Khaskhely, Malah, Solangi, Khoso, Jatoi, Memon, Machhi, Rind, Sangrasi, Chohan, Shahuk, Bheel, Marri, Domki, and Kohli.
- **Mother Tongue:** Sindhi is the primary language in the sub-project area, while most people, particularly males, can also speak Urdu and Saraiki.
- **Source of Drinking water:** The Indus river is the major source of freshwater, but for drinking purposes, the local villages obtain their drinking water from multiple sources such as hand pumps, river creeks, canals, and ponds, among others. However, hand pumps serve as the primary source of drinking water in the project area.
- **Health:** Health is a concern in the project area, with diseases like hepatitis and typhoid prevalent. Maternal health facilities are lacking, leading to childbirth-related fatalities. Many women in the community are malnourished. There are Basic Health Units (BHUs) in the following villages: Hala, Bhanote village, Jumo Shahuk village, Sekhat village of Matiari district; Kandiaro village, Dera Mohabat Khan, Khan Muhammad Chandio village of Nousheroferoze district; Shah Bandar, Mirpur Batharo village and Sekhat village of Sujawal district. Seriously ill patients are often transported to Matiari, Nousheroferoze, Sujawal, or the Hyderabad civil/district hospitals for treatment.
- **Educational Facilities:** Within a 1-kilometer radius on both sides of the sub-project area, there are 10 primary schools for boys, 4 primary schools for girls, 1 middle school for boys, 1 middle school for girls, 1 high school for boys, and 1 high school for girls.
- **Housing:** In the project area, rural residents mainly live in isolated settlements. These houses are typically constructed without formal plans and are made of mud or huts. Many of them include boundary walls for cattle and storage. The roofs are a combination of wooden beams, date-palm mats, and a top layer of clay plaster. Importantly, the inhabitants own these houses. Additionally, in Hala, there are some Pacca houses.
- **Transport:** In the project area, roads, including village tracks and blacktop (Pucca) roads, exist, but many are in poor condition and require maintenance by the local government. Furthermore, a major national highway (N-5) runs through the project area, connecting Karachi, Hyderabad, Sukkur, and other provinces. For transportation, vans and pickups are the primary choices, followed by buses, cars, and motorcycles. Trucks, trailers, and tractor trolleys are used for transporting agricultural goods, while trucks are essential for moving animals to Hyderabad and Karachi. Additionally, trucks and trolleys serve for transporting firewood and furniture wood.

- **Telecommunication:** No landline telephone facility is available in the project area. However, mobile phone communication is highly prevalent in it, with frequent mobile phone usage observed during project field visits. Landline facilities, on the other hand, are accessible outside the project area.
- **Energy Source:** Electricity is widely available in most villages, primarily used for household lighting and powering tube wells for drinking water and irrigation purposes. In addition to electricity, residents in the area also gather firewood from the surrounding areas or purchase it from nearby towns.
- **Livestock:** A sizeable proportion of the rural population is engaged in livestock rearing activities. In urban areas, dairy farms are maintained for commercial purposes.
- **Irrigation:** In the last quarter of the 20th century, the major sources of irrigation were the Rohri canal irrigation system in the project area, which was costly to maintain. Nowadays, irrigation canals have become the primary source of irrigation. Several schemes have been initiated in Sindh, including the rehabilitation and remodeling of branch canals, lining of minors and distributaries, flood irrigation, and perennial irrigation schemes.
- **Archaeological Sites:** The project area features several significant cultural and religious sites, including Hala Monuments (Mir's Tombs) in Matiari district (26 km), the Shrine of Shah Abdul Latif Bhittai in Matiari district (10 km), Dargha Haleji Shareef in Sukkur district (14 km), and Dargha Baiji Shareef in Sukkur district (approximately 14 km).

G. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

H. Impact Assessment Methodology

9. The risk assessment matrix is provided as Table 2 below.

Table 2: Impact Assessment Matrix

Activity / Impact	Likelihood	Consequence	Impact (Consequence x likelihood)	Residual Impact
Design Phase				
Flooding	Likely	Major	High	Low
Seismic damage	Likely	Moderate	Medium	Low
Land Acquisition	Unlikely	Minor	Low	Low
Construction Phase				
Air Quality	Likely	Moderate	Medium	Low
Noise Pollution	Likely	Moderate	Medium	Low
Vibration impacts	Likely	Minor	Medium	Low
Borrowing and Quarrying of Materials	Likely	Moderate	Medium	Low
Solid waste generation incl. Spoil material	Likely	Moderate	Medium	Low
Resource Conservation	Likely	Minor	Medium	Low
Soil Contamination	Likely	Moderate	Medium	Low
Soil erosion/ silt run-off	Likely	Moderate	Medium	Low
Community Health and Safety	Likely	Minor	Medium	Low

Occupational Health and Safety	Likely	Moderate	Medium	Low
Traffic management	Likely	Minor	Medium	Low
Communicable diseases	Likely	Minor	Medium	Low
Flora	Likely	Minor	Medium	Low
Fauna	Likely	Moderate	Medium	Low
Use of local water resources	Likely	Moderate	Medium	Low
Contamination of water resources	Likely	Moderate	Medium	Low
Social and Cultural Conflicts	Likely	Minor	Medium	Low
Religious and Cultural Heritage	Unlikely	Minor	Low	Low
Operation Phase				
Damage to infrastructure	Likely	Major	High	Medium
Biodiversity impacts	Unlikely	Minor	Low	Low

I. ENVIRONMENTAL MANAGEMENT PLAN

10. The EMP sets out mitigation actions, monitoring actions, responsibilities and schedules for impact mitigation and monitoring. Environmental monitoring will be undertaken during both the construction and operation phases to ensure the effectiveness of the proposed mitigation measures.

11. The EMP provides its implementation mechanism during construction and operation phases:

- **Implementation during Construction phase:** The SID, having core implementation responsibility, will overall monitor the environment related activities of Supervision Consultant and construction Contractor and report to SEPA regarding implementation status of EMP. Construction Contractor will be in direct coordination with Supervision Consultant through its HSE department and the Contractor will be required to be on-board prior to mobilization.
- **Implementation during O&M:** The key players involved during operation of the proposed project are EA (SID) and district environmental officers of Sukkur, Naushero Feroze, Sujawal, and Matiari, who will randomly check the project operation in context of EMP and report to district environmental officers annually.

12. The EMP has been prepared taking into account the environmental consequences of the proposed action and the required mitigation measures have been proposed at different stages of the activities along with performance indicators to mitigate any potential impacts along with a comprehensive environmental monitoring plan as part of the EMP. A suitable training program is also proposed to train the Contractor(s) staff, who will be involved in the construction phase and the SID staff at the project operational phase. All required permits shall be obtained from the concerned departments before starting the related activity and any grievances will be addressed promptly, as suggested in the EMP.

J. EMP Budget

13. The Environmental Management Costs (including EMP implementation, environmental monitoring and capacity building) for the construction and operation phases of the project are estimated to be 15.35 million PKR.

K. Public Consultation and Information Disclosure

14. In order to ascertain the perceptions of different stakeholders about the project (during construction/operation), consultation meetings were held with them in August 2023. Consultation meetings were carried out during the site visits with local communities of Jatio Village, Sarvari Colony Village old Halla, Mulla Sawari Goth, Bakhi Kathri, Village Daim Khan Palijo, Village Jahan Khan Jatoi, Solangi Village etc. The comments and feedback received from the different stakeholders were incorporated into the IEE study and it was ensured that their comments and/or concerns were considered during the different stages of the proposed project activity.

L. Grievance Redressal Mechanism

15. The Grievance Redressal Mechanism (GRM) has been developed under ADB SPS, 2009 to deal with complaints at any stage of the proposed project. The GRM will help to receive and resolve the concerns/complaints of any project affected persons regarding the project's social and environment performance. The measures have been identified to mitigate any potential environmental and social impacts due to implementation of proposed project and the mechanism for information disclosures has been provided in the GRM.

M. CONCLUSION

16. The report provides conclusions based on the impacts assessed and the mitigation measures suggested. It is recommended that the EMP and IEE will be made a part of all bidding/tender documents. Also, the Contractor will be bound to completely implement relevant mitigation measures set out in the EMP and the cost related to these mitigation measures will be borne by the Contractor, who shall prepare all required documentation such as the site specific EMP (SSEMP).

17. No land acquisition and involuntary settlement is involved. No indigenous persons reside or will be affected by the proposed interventions in the areas of influence.

18. Environmental impacts during the construction phase are largely temporary in nature and can be minimized with effective management. Construction of worker camps will not necessarily be required and/or may be very limited in size in view of the scale and scope of works while all efforts shall be made to engage locals for employment for the proposed project activities. It is concluded that the proposed project should proceed, with appropriate mitigation measures and monitoring programs identified in the IEE study.

1. INTRODUCTION

1.1 PROJECT BACKGROUND

19. Sindh experienced severe impacts from the 2022 floods, affecting around 10 million people across 30 districts. The area's most severely affected remained submerged for months due to the absence of natural drainage pathways, resulting in extensive damage to public infrastructure, agricultural land, and homes. Consequently, significant medium to long-term rehabilitation and reconstruction efforts are imperative. In order to address this issue, the National Disaster Risk Management Fund (NDRMF) and the Sindh Irrigation Department (SID) have reached an agreement to conduct the rehabilitation and strengthening of water mitigation structures.

20. This project is of utmost importance due to the vulnerable state of the river Indus protective bunds within Sindh's jurisdiction. Recent floods caused severe damage to critical structures like spurs, studs, stone aprons, and stone pitching, posing threats to both public and private infrastructure. The shifting river course and narrow passages have increased the risk of adverse events during future floods. Additionally, the six bunds included in this project face significant vulnerability due to extensive erosion and damage during previous flood events. Urgent rehabilitation and restoration work is essential to protect these vital areas and mitigate the risks associated with changing river dynamics, ensuring infrastructure safety and public well-being. The project focuses on the rehabilitation and reconstruction of six schemes that suffered substantial damages in districts Sukkur, Naushero Feroze, Sujawal and Matiari, requiring urgent attention to prevent potential harm to lives and property.

The project's paramount significance lies in the crucial rehabilitation of partially compromised spurs and studs within the designated areas, serving as key defence for the integrity of the bunds. Its primary objective is to prevent potential disasters during future flood events, thereby safeguarding the structural and operational integrity of both public and private assets. This initiative is deeply rooted in the preservation of national assets and public properties, encompassing agricultural lands, industrial facilities and critical government infrastructure. By taking this comprehensive approach, the project aims to strengthen the region's socio-economic resilience and overall well-being, offering multifaceted protection against future flood-related vulnerabilities.

This document presents the findings of the Initial Environmental Assessment (IEE) study for the proposed sub-project activities.

1.2 NATURE SIZE AND LOCATION OF THE PROJECT

21. The project involves the rehabilitation/reconstruction of the six damaged bunds in Sindh province. This project of SID will rehabilitate and enhance flood mitigation structures and restore the spur system to improve flood resilience and safeguard vital infrastructure. Location map of the six project sites have been provided as Figure 1-1 below.

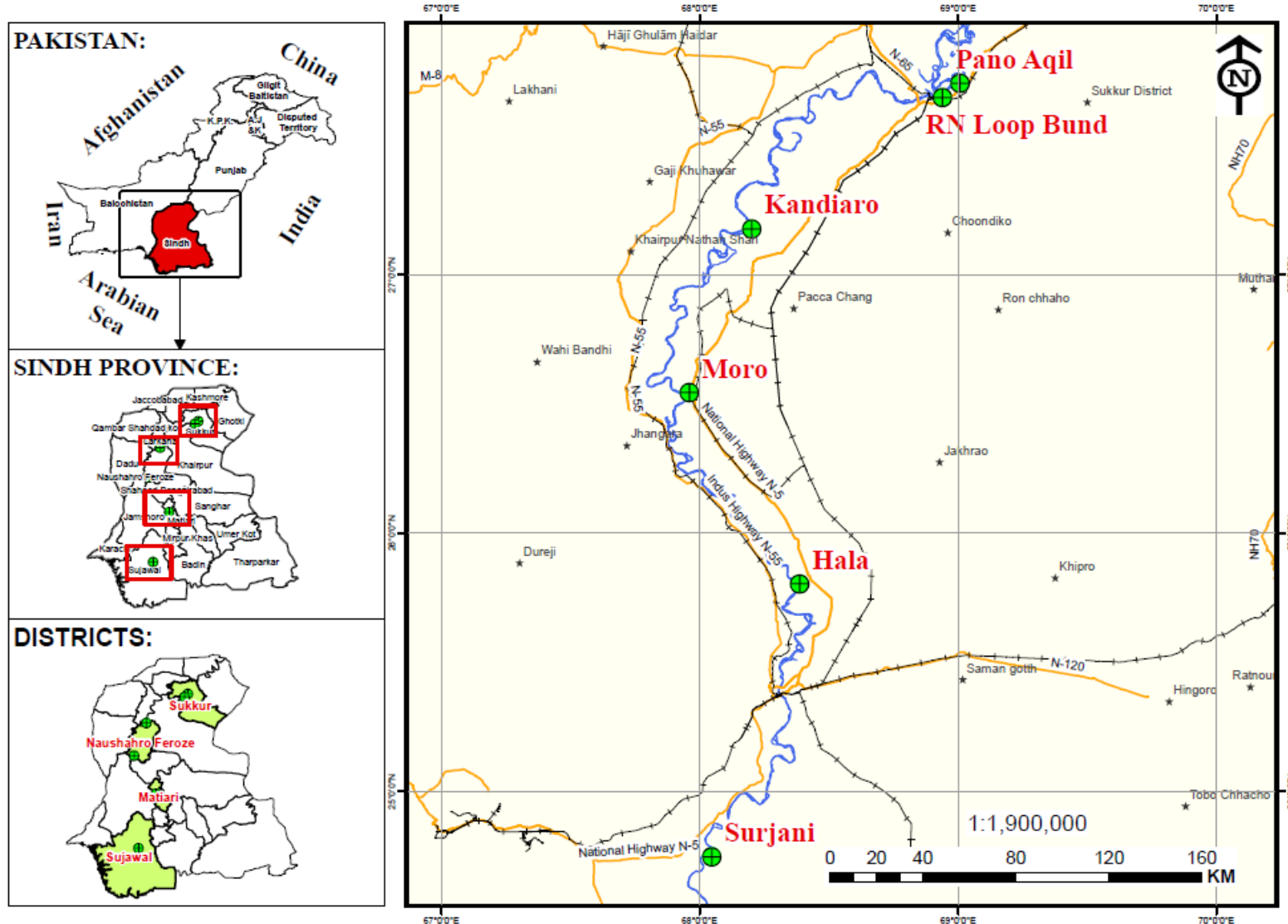


Figure 1-1 : Project Location

1.3 ENVIRONMENTAL ASSESSMENT

22. After the 18th amendment to the constitution of Pakistan, environment became a provincial subject, and the environmental law governing the proposed project activity is the “Sindh Environmental Protection Act, 2014”.

23. The Sindh EIA / IEE regulations of 2014 provide categories of projects for which IEE or EIA needs to be conducted. The proposed project falls under the category of “Water management, dams, irrigation & flood protection” and hence the environmental study has been conducted and an IEE report has been prepared.

24. For ADB’s SPS, all loans and investments are subject to categorization to determine environmental assessment requirements. Categorization has been undertaken using Rapid Environmental Assessment (REA) and the completed environmental categorization form is attached as Annexure-I and the proposed project has been categorized as ‘B’ for Environment.

25. The IEE report complies with both the SEPA requirements as well as the ADB Safeguard Policies SPS – 2009 for environmental management of projects.

1.4 OBJECTIVES OF IEE REPORT

26. The objectives of this IEE report are as follows:

- (i) Meet the statutory requirements set forth by the Pakistan Environmental Protection Act (PEPA) 1997 and the Sindh Environmental Protection Act, 2014.
- (ii) Comply with ADB policies and safeguards for environmental and social management of Projects.
- (iii) Facilitate proponents and financiers of the project in ensuring environmental and social acceptability of the project.
- (iv) Establish a baseline of existing environmental status at the project site prior to project initiation by collecting secondary and primary data/information on physical, biological and social environment of the project area.
- (v) Help the SID to incorporate necessary measures for legally compliant and socially acceptable environmental performance of their project.
- (vi) Identify significant environmental impacts (both positive and negative) during all stages of the project implementation and propose mitigation measures for negative impacts.

1.5 SCOPE OF IEE STUDY

27. The scope of this IEE study is collection and analysis of data related to physical, biological and socio-economic environment of the project area and to prepare the baseline environmental profile. It also aims at the identification, prediction and evaluation of the possible environmental impacts of the proposed project on its immediate surroundings on both short and long-term basis. Based on the nature and scale of those impacts, appropriate mitigation measures are proposed in this IEE report.

1.6 PURPOSE OF IEE REPORT

28. The purpose of this IEE report is to assess significant adverse environmental and social impacts and to suggest mitigation and remedial measures to make the project environmentally

friendly and sustainable during the construction and operational stages and to initiate the process of NOC from the SEPA as well as clearance from ADB prior to mobilization of the Contractor.

1.7 STUDY TEAM

29. A multidisciplinary team was formulated to conduct the study. The team comprised the following experts:

Mr. Aftab Qasim	:	Environment Specialist
Mr. Jahangir Narai	:	Jr. Environmentalist
Mr. Sheeraz Akhund	:	Environmentalist /Sociologist
Mr. Zeeshan Ahmed	:	GIS Expert

1.8 METHODOLOGY

30. The following methodology was adopted for carrying out the IEE study of the proposed project:

a) Orientation

31. Meetings and discussions were held among the members of the IEE consulting team. This activity was aimed at achieving a common ground of understanding of various issues of the study.

b) Planning for Data Collection

32. Subsequent to the concept clarification and understanding obtained in the preceding step, a detailed data acquisition plan was developed for the internal use of the IEE consulting team. The plan identified specific data requirements and their sources; determined time schedules and responsibilities for their collection; and indicated the logistics and facilitation needs for the execution of the data acquisition plan.

c) Data Collection

33. In this step, primary and secondary data were gathered through field observations, concerned departments and published materials to establish baseline of physical, biological and socio-economic environmental conditions.

- Site reconnaissance
- Analysis of maps and plans
- Literature review
- Meetings with concerned department
- Public consultation

d) Physical Environment

34. Information was gathered on the existing physical environment, particularly as related to geology, topography, soils, hydrology and drainage, water quality, air quality, climate, seismology and noise through available secondary and primary data on water, air and noise.

e) Biological Environment

35. The status of the flora and fauna of the study area were determined by a review of literature of the area and an assessment of both terrestrial and aquatic environments.

Flora

36. The vegetative communities were identified and classified into community types. Identification was carried out of dominant tree species, assessment of stage of growth (mature or sapling) and assessment of canopy cover.

Fauna

37. Information on fauna was gathered from existing literature on reported species as well as observations in the field.

f) Socio-Cultural Environment

38. The consultants utilized a combination of literature, field investigations, census reports, meetings through public consultation and interviews to describe the existing social environment and assessment of the potential impact of the construction of the proposed sub-projects. Data was gathered on the following aspects of the social environment:

- Land use and municipal status
- Demographics
- Livelihoods
- Community facilities
- Solid waste management
- Proposed developments
- Archaeological and cultural heritage
- Identification and evaluation of environmental impacts

39. The impacts of the proposed project on the physical, biological and socio-economic environments prevalent in the project area are identified at the design, construction and operational phases.

g) Mitigation Measures and Implementation Arrangements

40. The adequate mitigation measures and implementation framework were proposed so that the SID can incorporate them beforehand in the design phase.

1.9 STRUCTURE OF THE REPORT

Section 1 “**Introduction**” briefly presents the project background, objectives, methodology and need of the IEE study.

Section 2 “**Policy, Legal and Administrative Framework**” comprises policy guidelines, statutory obligations and roles of institutions concerning the IEE study of the proposed project.

Section 3 “**The Project**” furnishes information about the studied alternatives, location of the proposed project, cost and size of the project, its major components and alternatives considered for the proposed project to select at the preferred alternative for detailed environmental assessment.

Section 4 “**Environmental and Social Baseline**” describes physical, biological and socioeconomic conditions prevalent in the project area.

Section 5 “**Analysis of Alternatives**” describes the proposed alternatives of the project and identified the environmentally, socially and economically viable project design.

Section 6 “**Public Consultation**” identifies the main stakeholders and their concerns raised through scoping sessions and deals with the measures to mitigate the social impacts.

Section 7 “**Environmental Impacts Assessment and Mitigation Measures**” identifies and evaluates impacts of the project activities during the construction and operation stages and recommends with the measures proposed to mitigate potential environmental impacts of the proposed sub-project activities.

Section 8 “**Environmental Management Plan**” outlines institutional arrangements for the implementation of the proposed mitigation measures, training needs of the staff for implementation of the mitigation measures, monitoring requirements, monitoring cost etc.

Section 9 “**Conclusion and Recommendation**” describes the conclusion of this IEE report and recommendations for the proposed sub-project activities.

2. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

2.1 GENERAL

41. This chapter provides the current legal framework which is applicable on the proposed project in context of environment and sustainable development. The institutional arrangement that exists in Pakistan and may influence the environmental management of the proposed project is also discussed in this chapter. This IEE report also conforms with the guidelines as provided in ADB's Safeguard Policy Statement (SPS), 2009.

2.2 BACKGROUND

42. The enactment of PEPA 1997 took up the key issues of PEPO and in addition provided for a considerable strengthening of institutions at the national and provincial level for the formulation, execution and enforcement of environmental policies and conferred broad-based enforcement powers to the EPA. NEQS for municipal and liquid industrial effluent, industrial gaseous emissions and motor vehicle exhaust and noise, were issued by Pakistan EPA in 1994.

43. Sindh EPA review of IEE and EIA Regulations, 2014 and Pakistan Environmental Assessment Procedures were published, to provide necessary guidelines for preparation, submission and review of IEE and EIA studies.

2.3 NATIONAL ENVIRONMENTAL POLICY

44. The National Environment Policy aims to protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development. The Policy provides broad guidelines for addressing environmental concerns and ensuring effective management of their environmental resources. The provincial, AJK, Northern Areas and local governments, however, may devise their own strategies, plans and programs in pursuit of this Policy.

45. Enforcement of the policy is being carried out through National Environmental Quality Standard (NEQS) and Self-Monitoring & Reporting Tools (SMART) in order to optimize energy and environmental resource consumption within the industries; encourage reduction, recycling and reuse of municipal and industrial solid and liquid wastes; introduce discharge licensing system for industry; devise and implement master plans for treatment of municipal and industrial wastewater in urban and rural areas. The policy has not been revised since 2005.

2.4 National Water Policy 2018

46. This first-ever water policy was unanimously approved in April 2018 by the Council of Common Interest (CCI). The policy aims to efficiently manage and conserve existing water resources, develop potential water resources optimally, minimize time and cost overruns in completing water sector projects, ensure equitable water distribution in various areas and canal commands, address declining groundwater levels in low-recharge areas, increase groundwater exploitation in high-recharge areas, implement effective drainage interventions for maximum crop production, enhance flood control and protective measures, ensure acceptable and safe water quality, reduce salt build-up and other environmental hazards in

irrigated areas, and undertake institutional reforms to make managing organizations more dynamic and responsive.

47. The policy covers all water-related issues, including water usage, priority allocation, integrated planning for development and water resource utilization, environmental preservation of the basin, the impact of climate change, transboundary water sharing, irrigated and rain-fed agriculture, drinking water and sanitation, hydropower and industry, groundwater management, water rights, sustainable water infrastructure, water-related hazards, quality management, awareness, conservation efforts, and the legal and capacity-building aspects of infrastructure.

48. This policy is relevant, as the proposed project is located along the bank of the Indus river, through which water is being utilized for local level irrigation, livestock etc. purposes.

2.5 ENVIRONMENTAL LEGISLATIONS

49. The key environmental regulations and legislations which are applicable to the proposed project is discussed below.

2.5.1 National Regulations

50. The environmental policy framework governing the project is the National Conservation Strategy (NCS) of Pakistan. The Pakistan NCS is a broad-based policy statement aimed at achieving environmentally sustainable social and economic development in Pakistan. The three overriding objectives of the NCS are:

- Conservation of natural resources
- Sustainable development
- Improved efficiency in the use and management of resources

51. Three operating principles are identified to achieve these objectives as follows:

- Greater public participation in development and environmental management
- A merging of environmental and economic decision making
- Lasting improvements in the quality of life

The NCS specifies the basic guidelines for an integrated effort aimed at protecting the environment and the natural resources of the country. This broad framework provides a comprehensive point of reference for all agencies, departments, private sector companies, financial institutions, and donor agencies for undertaking systematic efforts to bring about an effective change for sustainable development.

2.5.2 Pakistan Environmental Protection Act, 1997

52. The PEPA 1997 is the apex environmental law of the country. Under section 12 of the Act, it is mandatory for the proponents of the projects to execute the IEE and/or EIA (where warranted) and obtain the approval from relevant provincial EPA.

53. The following rules and regulations have been issued under the Pakistan Environmental Protection Act, 1997.

Rules:

- National Environmental Quality Standards (Self-monitoring and Reporting by Industries) Rules, 2001.
- Provincial Sustainable Development Fund (Procedure) Rules, 2001.
- Pakistan Sustainable Development Fund (Utilization) Rules, 2001.
- Pollution Charge for Industry (Calculation and Collection) Rules, 2001.
- Environmental Tribunal Procedures and Qualifications Rules, 2000.
- Environmental Samples Rules, 2001.
- Hazardous Substance Rules, 2000

Regulations:

- Review of IEE / EIA Regulations, 2020.
- National Environmental Quality Standards (Certification of Environmental Laboratories)

2.5.3 Sindh Environmental Protection Act, 2014

54. Sindh Environmental Protection Agency as a part of Sindh Act No. VIII of 2014 prepared Sindh Environmental Protection Act (SEPA), 2014 which was passed by the provincial assembly of Sindh on 24th February, 2014 and asserted by the Governor of Sindh on 19th March, 2014 and notified on 20th March, 2014. It is a fairly comprehensive legislation and provides legislative framework for protection, conservation, rehabilitation and improvement of the environment. It contains concrete action plans and programs for the prevention of pollution and promotes sustainable development.

55. Salient features of the Act are:

- **Section 11:** No person shall discharge, emit, or allow the discharge or emission of any effluent waste, pollutant, noise, or adverse environmental effects in an amount, concentration, or level exceeding that specified in Sindh Environmental Quality Standards.
- **Sections 12 & 13:** No person shall import hazardous waste into Sindh province or handle hazardous substances without the necessary licenses or permits.
- **Section 14:** No person shall undertake any action that adversely affects the environment or leads to pollution, impairment, or damage to biodiversity, ecosystems, aesthetics or the environment.
- **Section 15:** This section deals with the regulation of motor vehicles, prohibiting the emission of air or noise pollutants exceeding allowable standards.
- **Section 17:** No proponent of a project shall commence construction or operation without filing an initial environmental examination or environmental impact assessment with the Agency and obtaining approval. SEPA shall review the IEE & EIA and grant approval with specified terms and conditions. The agency shall communicate its approval or otherwise within four (4) months from the date the EIA is filed; failing this, the EIA shall be deemed approved.
- **Section 21:** When the agency is satisfied that a discharge or emission has occurred in violation of any provision of this act or rules, it may, after providing an opportunity to the responsible person, issue an order directing remedial measures within a specified period.

The agency is empowered to immediately stop, prevent, or minimize emissions or disposal to remedy adverse environmental effects.

- **Section 22:** Any person failing to comply with sections 11, 17, 18, and 21 may be fined up to five million rupees, with additional fines of up to one hundred thousand rupees for each day of continuing contravention. In the case of a previous conviction under this Act, the Environmental Protection Tribunal (EPT) may also impose imprisonment for up to three years or order confiscation or closure of facilities.
- **Section 23:** When a violation of this Act is committed by an employee of a corporate body, that employee shall be considered guilty of environmental pollution.
- **Section 25:** This section allows for the establishment of Environmental Protection Tribunals.

56. This Act has a direct bearing on the proposed project as it is located in Matiari, Naushahro Feroze, Sujawal and Sukkur districts of Sindh province and so it falls under the jurisdiction of the SEPA that will be the responsible authority for approval of the IEE..

2.5.4 Sindh EPA Environmental Assessment Regulations, 2021

57. Sindh IEE–EIA Regulations (2021) prepared by SEPA under the powers conferred upon it by PEPA-97, provides the necessary details on the preparation, submission, and review of the IEE and the EIA. The categorization of projects for IEE and EIA is one of the main components of Sindh IEE–EIA Regulations (2021). Projects have been classified based on the expected degree of adverse environmental impact. Project types included in Schedule III of the regulations include those that are likely to have a potentially significant impact on the environment and thus an EIA is required for such projects, whereas those included in Schedule II are listed as having potentially less adverse effects and therefore require an IEE.

58. The procedure for the review and approval of IEE/EIA by the EPA, as contained in Article 11-15, includes the following key features:

- According to Article 11, upon accepting the EIA for review, the agency will issue a public notice. This notice will be published in widely circulated English, Urdu, or Sindhi national newspapers, as well as in a local newspaper with general circulation in the area affected by the project. The notice will include details about the project type, its precise location, the name and address of the proponent, and the date, time, and location of the public hearing. The public hearing date must be scheduled no earlier than ten days from the date of notice publication.
- Article 12 of these regulations provides guidance on the review process, as follows:
 1. SEPA shall make every effort to conclude its review process of the EA, EMP or environmental checklist within fifteen days, of the IEE within thirty days, and of the EIA within sixty days after receiving of complete case.
 2. In reviewing an EIA, the Agency shall consult such Committee of Experts be constituted for the purpose by the Director General, and may also solicit views of concerned Advisory Committee, if any, constituted by the Agency.
 3. The Director General may, where considers it necessary, constitute a committee to inspect the site of the project and submit its report on such matters as may be specified.
 4. In reviewing the IEE, the Director General may constitute a committee of the officers from within the Agency, on case to case basis, in view of the jurisdiction and location

of the project for the purpose to extend final recommendation about the approval or rejection of the IEE.

5. The review of the IEE or EIA by the Agency shall be based on quantitative and qualitative assessment of the documents and data furnished by the proponent, comments from the public and Government Agencies received under regulation 12, and views of the committees mentioned in sub-regulations (2) and (3) above.
 6. EMP, EA, EC shall be reviewed as per guidelines issued by SEPA.
- Article 13 concerns decisions within these regulations and includes the following points:
 1. The documentary evidence in the form of videos (soft copies) of public hearing shall be submitted by the proponent within three days after conclusion of public hearing to the Agency.
 2. On completion of the review process, the decision of the Agency shall be communicated to the proponent in the form prescribed in Schedule-VI or in case of an IEE or EMP or environmental checklist or environmental audit in the form prescribed in Schedule-VII in case of an EIA.
 - Article 14 pertains to the conditions of approval. It states that every approval of an EC, IEE, EIA, EMP, or EA shall, in addition to any conditions imposed by the Agency, be subject to the condition that the project must be designed, constructed, and operated, and mitigatory and other measures must be adopted strictly in accordance with the EC, IEE, EIA, EMP, or EA, unless the Agency specifies variations in the approval.
 - Article 15 outlines the validity of approval. It states that once approval is granted, it remains valid for three years from the date of issue. If construction work does not commence or complete within this three-year period, the proponent must submit an application to the Agency for an extension, which can be granted for an additional three years.

2.5.5 Sindh Environmental Quality Standards

59. On June 28, 2016, the Sindh environmental industrial wastewater, effluent, domestic sewerage, industrial air emissions and ambient air quality, noise for vehicles, air emissions for vehicles and drinking water quality standards, 2015 have been notified by SEPA. The SID shall follow the SEQs in letter and spirit during project execution.

2.5.6 Land Acquisition Act 1894

60. The primary law for acquisition of land for public purposes in Pakistan is the "Land Acquisition Act, 1894" (hereinafter referred as the Act). The land acquired under the Act vests in the province and it is only thereafter that the province may transfer it to someone else.

61. This law is not relevant to this project as it involves restoration/rehabilitation of water conservation structures within existing RoW owned by SID and land acquisition is not involved in this project.

2.5.7 Forest Act 1927

62. The Forest Act, 1927 was largely based on previous Indian Forest Acts implemented under the British. The first and most famous was the Indian Forest Act of 1878. Both the 1878 act and the 1927 one sought to consolidate and reserve the areas having forest cover, or significant wildlife, to regulate movement and transit of forest produce, and duty leviable on timber and other forest produce. It also defines the procedure to be followed for declaring an area to be a Reserved Forest, a Protected Forest or a Village Forest.

63. This Act is not relevant as the project does not lie in any of the notified forest land of Sindh.

2.5.8 The Antiquities Act, 1975

64. This act basically defines how to repeal and re-enact the law relating to the preservation and protection of antiquities. The federal government may, by notification in the official Gazette, declare any antiquity to be a protected antiquity for the purposes of this Act. No person shall put any neon signs or other kinds of advertisement, including bill posting, commercial signs, poles or pylons, electricity or telephone cables and television aerials, on or near any protected immovable antiquity. No person shall, for any commercial purpose, make a cinematograph film of any protected antiquity or any part thereof except under, and in accordance with, a license granted by the Director. A contravention of any provision of this Act or the rules shall, where no punishment has been specification provided, be punishable with rigorous imprisonment for a term which may extend to six months, or with fine which may extend to five thousand rupees or both.

2.5.9 Pakistan Penal Code, 1860

65. The Pakistan Penal Code, usually called PPC, is a penal code for all offences charged in Pakistan. It was originally prepared on the behalf of the Government of British India. After the partition of India in 1947, Pakistan inherited the same code and subsequently after several amendments by different governments, it is now a mixture of Islamic and English Law. Presently, the Pakistan Penal Code is still in effect and can be amended by the Senate of Pakistan.

2.5.10 The Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020

66. This Act provides for the preservation, protection, and conservation of wildlife by the formation and management of protected areas and prohibition of hunting of wildlife species declared protected under the ordinance. The Act also specifies four broad classifications of the protected areas: National parks, Wildlife sanctuaries, Game reserves and Private game reserve. Activities such as hunting and breaking of land for mining are prohibited in the protected areas, as are removing vegetation or polluting water flowing through the park. Wildlife sanctuaries are areas that have been set aside as undisturbed breeding grounds and cultivation and grazing is prohibited in the demarcated areas. Nobody is allowed to reside in a wildlife sanctuary and entrance for the general public is by special dispensation. Game reserves are designated as areas where hunting or shooting is not allowed except under special permits.

67. The project is not neighbouring any wildlife sanctuary or game reserve.

2.5.11 The Sindh Cultural Heritage (Preservation) Act, 1994

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

2.5.12 The Sindh Occupational Safety and Health Act, 2017

69. The Sindh Occupational Safety and Health Bill, 2017 has been approved by the Provincial Assembly of Sindh (Ref. Sindh Bill No. 27 of 2017) and enacted as the Sindh Occupational Safety and Health Act, 2017. The Act makes provision for Occupational Safety and Health conditions at all workplaces for the protection of persons at work places against risk of injury arising out of the activities at work places and the promotion of safe, healthy and decent working environment adapted to the physical, physiological and psychological needs of all persons at work. The Sindh Occupational Safety and Health Rules, 2019 have also been framed under the Act.

2.5.13 The Canal and Drainage Act, 1873

70. This is an Act to regulate irrigation, navigation and drainage. The provincial government is entitled to use and control for public purposes the water of all rivers and streams flowing in natural channels and of all lakes, sub-soil water and other natural collections of still water.

2.6 INSTITUTIONAL SETUP FOR ENVIRONMENTAL MANAGEMENT

71. The structural setup of agencies/departments in the environmental sector is such that the provincial ministry of Environment governs and regulates environment-related work at the government level. The SEPA works directly under the control of the ministry.

2.6.1 Provincial Environmental Protection Council (Provincial EPC) and the Sindh Environmental Protection Agency (SEPA)

72. After devolution of the subject environment to provincial level under 18th amendment, these two organizations are primarily responsible for administering the provisions of the Sindh Environmental Protection Act, 2014. The EPC oversees the functioning of the SEPA. Its members include the representatives of the government, industry, nongovernmental organizations and the private sector. The EPA is required to ensure compliance with the National Environmental Quality Standard (NEQS), establish monitoring and evaluation systems, and both identify the need to, as well as initiate legislation, whenever necessary. It is thus the primary implementing agency in the hierarchy. Another function of the provincial EPA are the review and approval of environmental assessment reports.

2.7 ASIAN DEVELOPMENT BANK SAFEGUARD POLICIES

2.7.1 ADB Requirements for Preparation of Environmental Assessments of Projects

73. The ADB SPS, 2009 affirms that “environmental and social sustainability is a cornerstone of economic growth and poverty reduction in Asia and the Pacific” (p 14). Furthermore, the document underlines the ADB’s Strategy, 2030, promoting the “sustainability of project outcomes by protecting the environment and people from project’s potential adverse impacts”.

74. This IEE study is fully committed to the requirements determined in the “ADB Safeguard Policy Statement”. The environmental works carried out by RHC on behalf of project proponents have been essentially guided by these rules as enunciated in the “Outline of an Initial Environmental Examination Report”.

75. In the light of significance attached by ADB to various environmental impacts, the proposed project works are classified as Category B and require an IEE study to be prepared.

76. However, an environmental assessment using ADB’s Rapid Environmental Assessment (REA) checklist for urban development and water supply, was filled by PPTA consultants and results of the assessment show that the projects are unlikely to cause significant adverse impacts. This initial environmental examination (IEE) has been prepared in accordance with ADB SPS’s requirements for environment category B projects and provides mitigation and monitoring measures to ensure no significant impacts as a result of the subprojects.

2.7.2 ADB Safeguard Policy 2009

77. Safeguard policies are generally understood to be operational policies that seek to avoid, minimize, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process. ADB’s SPS, 2009 consists of three safeguard policies i.e. environment, involuntary resettlement and indigenous peoples. These are accompanied by Operations Manual sections on environmental considerations in ADB operations; involuntary resettlement; and indigenous peoples. All three safeguard policies involve a structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle. The safeguard policies require that:

- Impacts are identified and assessed early in the project cycle;
- Plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and
- Affected Persons (AP) are informed and consulted during project preparation and implementation.

The Project will need to comply with all the safeguard policies in the sub-project activities, irrespective of whether or not they are being funded in whole or in part by the ADB, the GoP or any other donor. A brief synopsis of these policies and their relevance for the proposed project is given in the **Table 2-1**.

Table 2-1 ADB Safeguard Policy 2009 Relevant to Project

S. No.	Safeguard Policies	Key Requirements	Remarks
1.	Environment	Projects and subprojects need IEE to address important issues not covered by any applicable regional or sectoral EA.	Applicable to proposed project.
2.	Involuntary Resettlement	Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs. Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.	No involuntary resettlement is envisaged for the proposed project.
3.	Indigenous Peoples	Measures to avoid potentially adverse effects on the Indigenous Peoples' communities; and when avoidance is not feasible, minimize, mitigate, or compensate for such effects. Bank-financed projects are also designed to ensure that the Indigenous Peoples receive social and economic benefits that are culturally appropriate and gender and intergenerationally inclusive.	There are no groups of people in the project area that could be categorized as indigenous people, therefore, this policy does not apply to the proposed project.

2.7.3 ADB's Accountability Mechanism Policy 2012

78. The objectives of the Accountability Mechanism are providing an independent and effective forum for people adversely affected by ADB-assisted projects to voice their concerns and seek solutions to their problems, and to request compliance review of the alleged noncompliance by ADB with its operational policies and procedures that may have caused, or is likely to cause, them direct and material harm. The Accountability Mechanism is a "last resort" mechanism.

79. In case PAPs' grievances/complaints are unaddressed by multi-tiered Grievance Redressal Committee (GRC), ADB provides an independent forum to all the affected personnel to register their complaints directly. However, ADB may refer back the case to multi-tiered GRC for consideration if any complainant approaches ADB without utilizing the project based GRM first.

2.7.4 ADB's Access to Information Policy 2018 (AIP)

80. The objective of the AIP is to promote stakeholder trust in ADB and to increase the development impact of ADB activities. The policy reflects ADB's commitment to transparency, accountability, and participation by stakeholders in ADB-supported development activities in

Asia and the Pacific. It also recognizes the right of people to seek, receive, and impart information about ADB's operations.

81. The policy applies to documents and information that ADB produces, requires to be produced by its borrowers or clients, or are produced and provided to ADB by other parties in the course of ADB operations. The policy will be implemented in accordance with detailed arrangements approved by ADB Management and made publicly available in accordance with ADB's normal procedures.

2.8 Relevant International Treaties

2.8.1 Convention on Biological Diversity

82. The Convention was opened for signature on 5th of June 1992 at the United Nations Conference on Environment and Development (the Rio "Earth Summit"). It remained open for signature until 4th of June 1993, by which time it had received 168 signatures. The Convention entered into force on 29th of December 1993, which was 90 days after the 30th ratification. The first session of the Conference of the Parties was scheduled on 28th of November – 9th of December 1994 in the Bahamas.

83. The Convention on Biological Diversity was inspired by the world community's growing commitment to sustainable development. It represents a dramatic step forward in the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources. Pakistan became its member in 1994. The inspector general of Forests office in the ministry of Climate Change acts as its focal point.

2.8.2 Convention on the Conservation of Migratory Species of Wild Animals

84. Also known as CMS, it is an environmental treaty under the aegis of the United Nations Environment Program. CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range. This was established at Bonn in 1979 and Pakistan has become its member in 1987. National Council for the Conservation of Wildlife in the Ministry of Climate Change is the focal desk for CMS.

2.9 COMPARISON OF INTERNATIONAL AND LOCAL ENVIRONMENTAL LEGISLATIONS

85. The ADB's SPS 2009 requires application of pollution prevention and control technologies and consistency with international good practice, as reflected in internationally recognized standards. The SPS states that when host country regulations differ from these standards, the EA will achieve whichever is more stringent.

86. In order to select the most stringent standards applicable, a comparison of local (SEQS) and international i.e. International Financing Corporation (IFC)/ World Health Organization (WHO) regulations have been made, as shown in Table 2-2 below. For air quality, comparison was only possible for pollutants having same averaging periods in SEQS, IFC and WHO. WHO for ambient air quality are more stringent in comparison to SEQS standards, in the case of most pollutants so WHO standards will be used.

87. Similar to the standards for air quality, the comparison of noise standards provided in Table 2-3 clearly shows that SEQs for noise are more stringent in comparison to the WHO/IFC standards so these will be used to compare with baseline noise values. The only exception is the daytime noise level standard for industrial areas where the WHO/IFC standard is more stringent (70 dB (A)) in comparison to NEQS (75 dB (A)) and so for this particular parameter, the WHO/IFC standard will be used.

88. Similar to the standards for air and noise quality, the comparison of drinking water quality standards provided in Table 2-4 clearly shows that SEQs for biological and physical parameters of drinking water quality are same as for WHO standards except for total hardness as CaCO₃. SEQs for chemical, toxic inorganic and organic parameters are mostly similar/comparable to zinc, residual chlorine, Phenolic compounds (as Phenols) mg/l, Polynuclear aromatic hydrocarbons (as PAHs) g/l. WHO for Lead and Zn are more stringent comparatively. No WHO standards will be used to compare with baseline values.

Table 2-2: Applicable Most Stringent Air Quality Standards*

Pollutants	WHO/IFC		NEQS/SEQS	
	Avg. Time	Standard	Avg. Time	Standard
SO ₂	24 hr	40 mg/m ³	Annual Mean	80 mg/m ³
CO	24 hr	4 mg/m ³	8 hrs 1 hr	5 mg/m ³ 10 mg/m ³
NO ₂	1 yr 24 hr	10 mg/m ³ 25 mg/m ³	-	-
O ₃	8 hrs	100 mg/m ³	1 hr	130 mg/m ³
TSP	-	-	Annual Mean 24 hrs	360 mg/m ³ 500 mg/m ³
PM ₁₀	1 yr 24 hr	15 mg/m ³ 45 mg/m ³	-	-
PM _{2.5}	1 yr 24 hr	5 mg/m ³ 15 mg/m ³	1 hr	15 mg/m ³

* In instances where the airshed is significantly degraded and the pollutant levels are already exceeding the ambient pollutant concentrations provided in the table above, it shall be ensured that the project activities cause as small an increase in pollution levels as feasible and amounts to a fraction of the applicable short term and annual average air quality guidelines or standards as established in the project specific environmental assessment.

Table 2-3: Applicable Most Stringent Noise Standards

	Limit in dB(A) Leq			
	SEQS		WHO	
	Day Time 06:00 – 22:00	Night Time 22:00-06:00	Day Time 07:00 – 22:00	Night Time 22:00-07:00
Residential area (A)	55	45	55	45
Commercial area (B)	65	55	70	70
Industrial area (C)	75	65	70	70
Silence zone (D)	50	45	55	45

89. There are no national standards for surface water quality. Instead, drinking water quality and effluent discharge (to inland waters) are listed below. The latter standard assumes a dilution factor of 10 to 1 at discharge and this dilution is taken as an indicator of acceptable surface water quality. The WHO standards will be used for comparison with baseline water quality values.

Table 2-4 Comparison of International and Local Drinking Water Quality Standards

Sr. No.	Parameter	Units	SEQS	WHO Standards
1	Temperature (During Sample Collection)	°C	NS	NS
2	Color	Pt-Co	≤15TCU	<15TCU
3	pH	pH unit	6.5-8.5	6.5-8.5
4	Turbidity	NTU	<5	<5
5	Total, Hardness	mg/L	<500.00	NS
6	Total Dissolved Solid (TDS)	mg/L	<1000.00	<1000.00
7	Total Suspended Solid (TSS)	mg/L	NS	NS
8	Ammonia	mg/L	NS	NS
9	Fluoride F ⁻	mg/L	<1.50	1.50
10	Sulfate (SO ₄ ⁻²)	mg/L	NS	NS
11	Chloride (Cl ⁻)	mg/L	<250.00	250
12	Nitrate (NO ₃ ⁻)	mg/L	<50.00	50.00
13	Odor	-	Non Objectionable / Acceptable	Non Objectionable / Acceptable
14	Taste	-	Non Objectionable / Acceptable	Non Objectionable / Acceptable
15	Sodium	mg/L	NS	NS

16	Iodine	ppm	NS	NS
17	Arsenic (As)	mg/L	< 0.05	0.01
18	Iron (Fe ³⁺)	mg/L	NS	NS
19	Zinc (Zn ²⁺)	mg/L	5.0	3.0
20	Conductivity	µS/cm	NS	NS
21	Bicarbonate	mg/L	NS	NS
22	Nitrite	mg/L	<3	3
23	Magnesium	mg/L	NS	NS
24	Calcium as Ca	mg/L	NS	NS
25	Phosphate	mg/L	NS	NS
26	Potassium	mg/L	NS	NS
27	Boron	mg/L	<0.3	0.3
28	SAR Iodine (I)	mg/L	NS	NS
29	Aluminum	mg/L	< 0.2	0.2
30	Antimony	mg/L	<0.005	0.02
31	Cadmium	mg/L	0.01	0.003
32	Mercury	mg/L	<0.001	0.001
33	Nickel	mg/L	<0.02	0.02
34	Selenium	mg/L	0.01	0.01
35	Barium	mg/L	0.7	0.7
36	Total Chromium	mg/L	<0.05	0.05
37	Copper	mg/L	2	2
38	Lead	mg/L	<0.05	0.01
39	Cyanide (CN)	mg/L	<0.05	0.07
40	Manganese	mg/L	<0.5	0.5
41	Total Coliforms	cfu/100ml	0/100 ml	0/100 ml
42	Fecal Coli forms (E.Coli)	cfu/ml	0/100 ml	0/100 ml

NS = Not Specified

*The standards highlighted in green for each respective pollutant are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed project. Other are same in both case.

Table 2-5: Comparison of National and International Surface Water Standards

Sr. No.	Parameter	Units	SEQS	WHO Class V (Agriculture)	FAO Standards
1	Temperature	°C	--	--	--
2	pH	pH unit	6-9	<5.3	6.0-8.5
3	COD	mg/L	150	>30	--
4	(BOD ₅)	mg/L	80	--	--
5	Solids, Total dissolved (TDS)	mg/L	3500	--	0-2000
6	Solids, Total suspended (TSS)	mg/L	200	--	--
7	Chloride	mg/L	1000	--	0-1065
8	Fluoride (F ⁻)	mg/L	10	--	--
9	Oil & grease	mg/L	10	--	--
10	Phenols, Total (Phenolic Compounds)	mg/L	0.10	--	--
11	Cyanide(CN ⁻)	mg/L	01.00	--	--
12	Anionic Detergents as MBAS	mg/L	20.00	--	--
13	Sulfate (SO ₄ ⁻²)	mg/L	600	--	0-960
14	Sulfide (S)	mg/L	01.00	--	--
15	Ammonia NH ₃	mg/L	40.00	--	--
16	Cadmium (Cd)	mg/L	0.10	>0.0039 mg/L	--

17	Chromium (Cr) as Hexavalent				--
18	Copper (Cu)	mg/L	1.00	>0.018 mg/L	--
19	Lead	mg/L	0.50	>0.082 mg/L	--
20	Nickel	mg/L	1.00	>1.4 mg/L	--
21	Zinc	mg/L	5.00	>0.12 mg/L	--
22	Iron	mg/L	8.00	--	--
23	Manganese	mg/L	1.50	--	--
24	Selenium	mg/L	0.50	--	--
25	Silver	mg/L	1.00	--	--
26	Arsenic	mg/L	1.00	>0.36 mg/L	--
27	Barium	mg/L	1.50	--	--
28	Magnesium	mg/L	--	--	0-61
29	Nitrate	mg/L	--	--	0-10
30	Sodium	mg/L	--	--	0-920
31	Boron	mg/L	6.00	--	0-2
32	Mercury	mg/L	0.01	>0.0024 mg/L	--
33	Chlorine	mg/L	01.00	--	--
34	Total Toxic Metals	mg/L	02.00	--	--
35	Turbidity	NTU	NS	--	--
36	Oxygen, Dissolved	mg/L	NS	--	--
37	Pesticides	µg/L	NS	--	--
38	Nutrients as Potassium	mg/L	--	--	0-2
39	Nutrients as Nitrogen	mg/L	--	--	--
40	Nutrients as Phosphorous	mg/L	--	--	--
41	Total Coliform	MPN/100ml	--	--	--
42	Fecal Coliform	MPN/100ml	--	--	--

NS = Not Specified

*The standards highlighted in green for each respective pollutant are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed project. Other are same in both case.

3. PROJECT DESCRIPTION

3.1 BACKGROUND

90. As a result of the 2022 floods, rehabilitation and enhancement efforts are imperative to rehabilitate the damaged infrastructure and mitigate the risks arising from the ever-changing river dynamics. In response to these challenges, the proposed project not only seeks to restore the damaged structures but also to fortify them against future similar events.

3.2 COMPONENTS OF THE PROJECT AND SCOPE OF WORK

91. Main components of the sub-project include:

- **Rehabilitation and Enhancement:** Rehabilitation / reconstruction of stone aprons, pitching, studs, and bund infrastructure to enhance flood resilience.
- **Spur System Restoration:** Restore, elevate, and strengthen bund spurs, incorporating stone pitching and aprons to mitigate flood hazards and safeguard vital infrastructure.

92. The salient features of the project and details of the scope of work are presented below.

3.2.1 NAUSHAHRO FEROZE DISTRICT

(i) Rehabilitation / reconstruction of stone apron and stone pitching along S.M bund from mile 70/7 to 72/0 in Moro bund sub-division.

93. The S.M. bund, located in Sahaeed Benazirabad district, Taluka Qazi Ahmed, near Shahpur Juhania along National Highway N-5, faced severe erosion between miles 70/7 to 72/0 during the 2015 flood. This area is particularly vulnerable as it lacks a second defense line and is exposed to direct wind action. In addition, wave wash incidents occurred during floods in 1986, 1988, 1995, and 2015, making the situation even more precarious. The encroachment of the river Indus, drifting up to 3000 ft. towards the bund, poses a significant threat to the area. The bund, comprised of earth, is located just 3 miles away from Shahpur Juhania city, which houses Al-Noor sugar mills and MDF mills, making it imperative to undertake protective measures. This is crucial for safeguarding public property, government hospitals, the main National Highway N5, schools, animal hospitals, and other critical infrastructure, serving the best interests of national importance. Additionally, these bunds shield the highly fertile and densely populated regions of Shaheed Benazirabad and Naushahero Feroze districts, including industries, railway lines, highways, irrigation networks, schools, public houses, public health infrastructure, and other nationally significant infrastructure.

94. To address this, the construction of a stone apron and stone pitching along this stretch of the SM bund is vital to protect against inundation, safeguarding public property, infrastructure and national interests.

Figure 3-1: Typical Design of Stone Apron

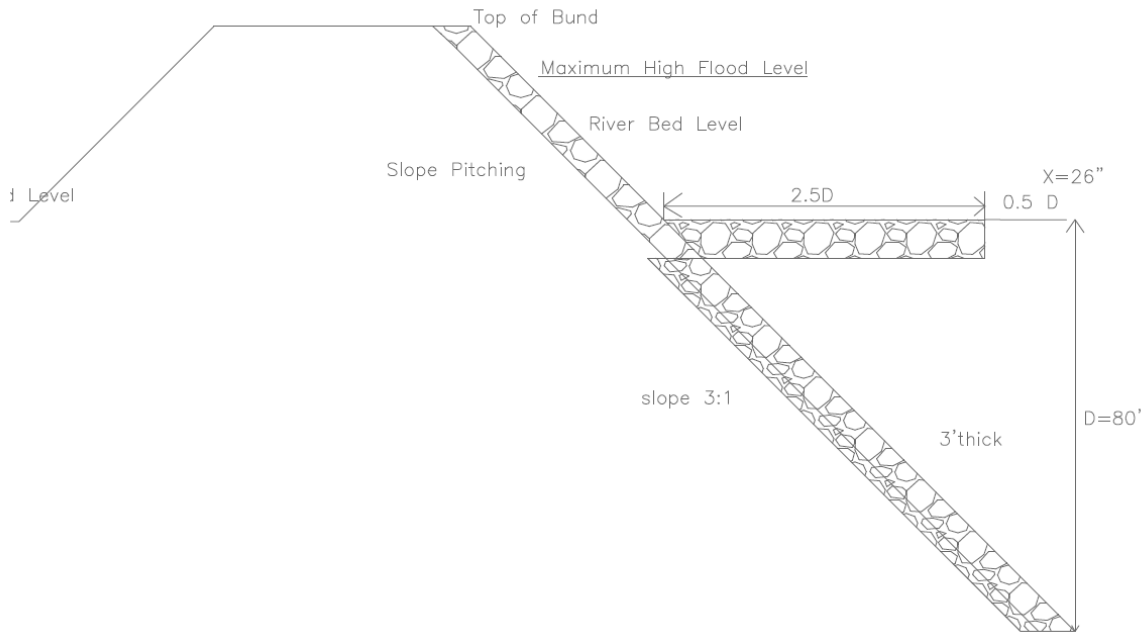


Figure 3-2: Location Map of Moro Bund

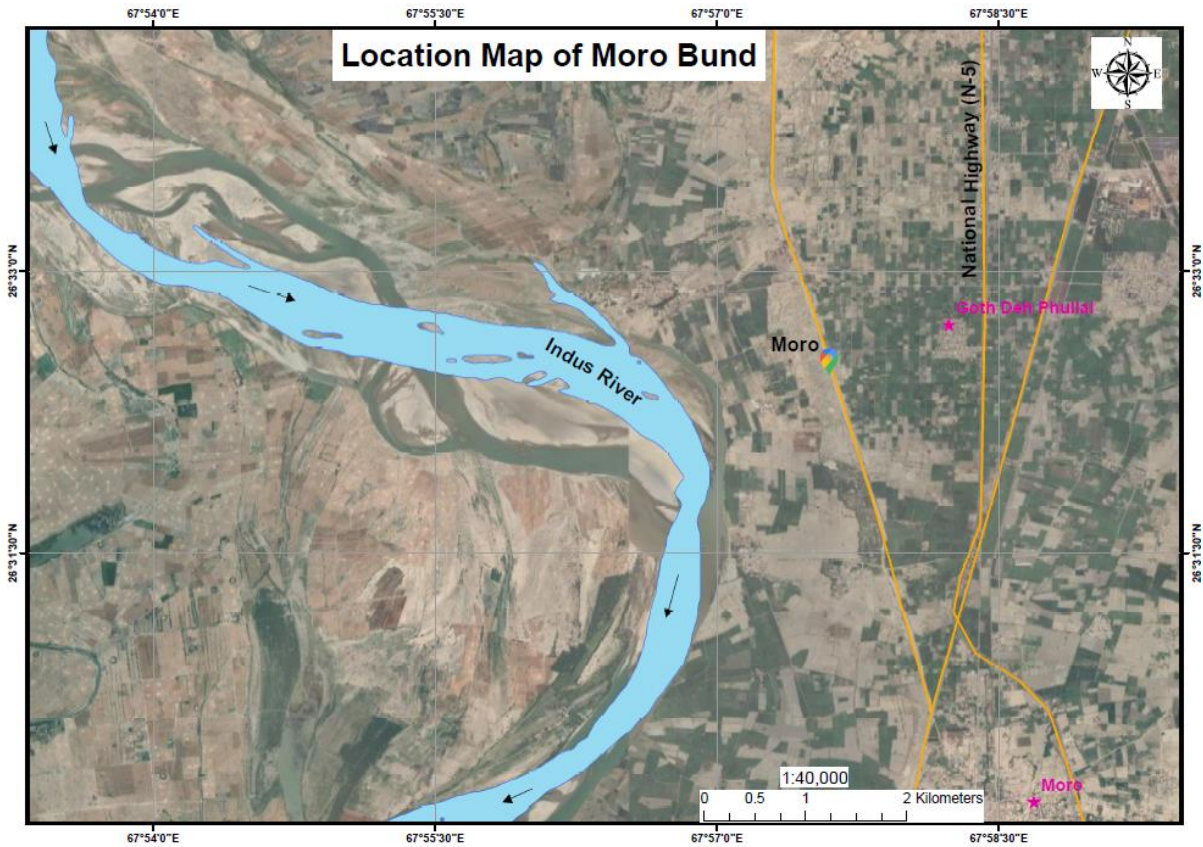
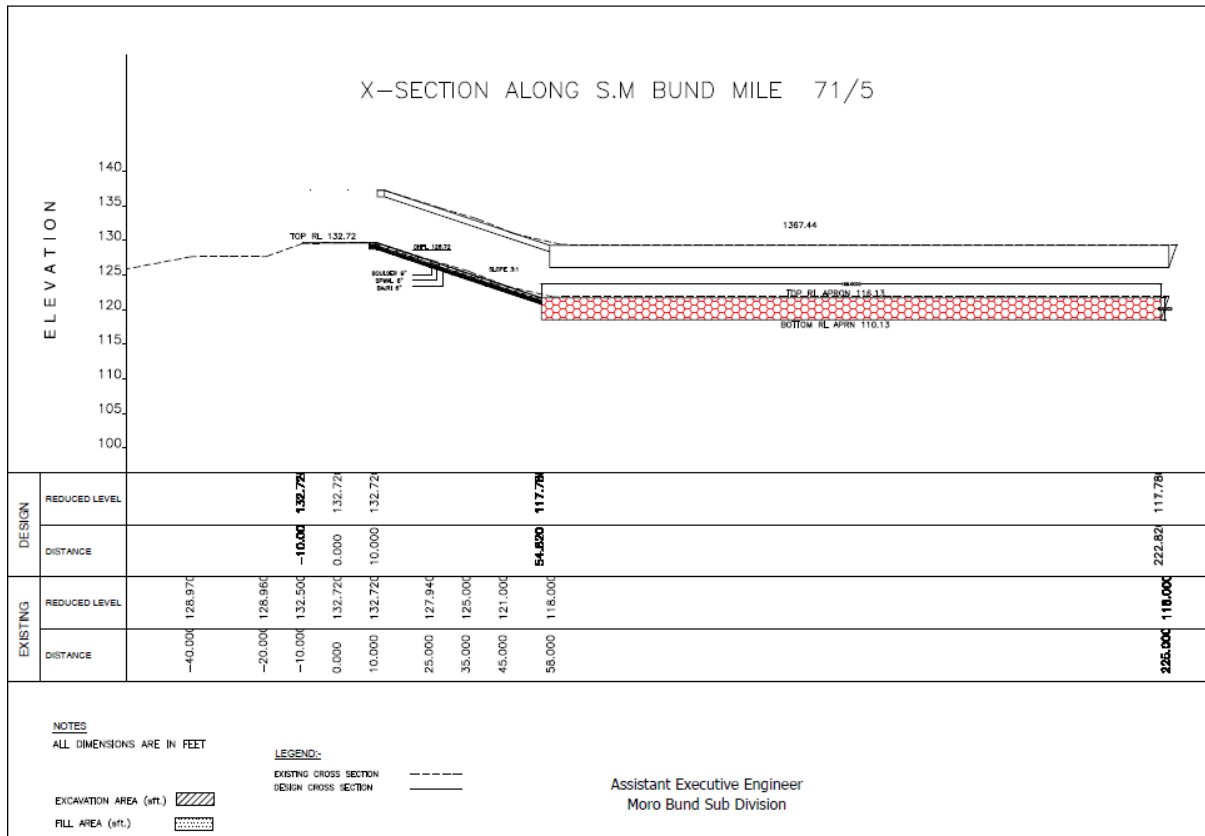


Figure 3-3: Typical X-Section Along Bund



(ii) Rehabilitation / reconstruction of stud / apron along S.M bund at mile 12/0 To 12/7 and Bakhri Loop bund mile 0/0 To 0/1 in Kandiaro bund sub division.

95. The S.M. bund on the left bank of the river Indus in the Rohri canal circle, stretching from Mile 0/0 to 60/10 in Naushahro Feroze district, has faced significant challenges. Intensive erosion and wave action during super flood-2010 and high flood-2015 led to substantial damage, particularly at Mile 12/3 to 12/7 (known as Bakhri Point), raising concerns of a potential disaster. Timely flood-fighting efforts and stone dumping saved the bund, but it remained vulnerable.

96. In the recent High Flood of 2022, further erosion occurred, extending the impact by an additional 400 ft. upstream, reaching Mile 12/11. While flood-fighting measures and stone dumping helped save the S.M. bund again, significant damage was inflicted on its infrastructure. Given this ongoing vulnerability and the shift in the river course closer to the bund's toe, it is imperative to undertake rehabilitation and recoument works to prevent future disasters and protect public and private infrastructure. Hence, the project "Rehabilitation/reconstruction of stud/apron along SM bund at mile 12/10 to 12/17 and Bakhri Loop bund mile 0/0 to 0/11" has been proposed.

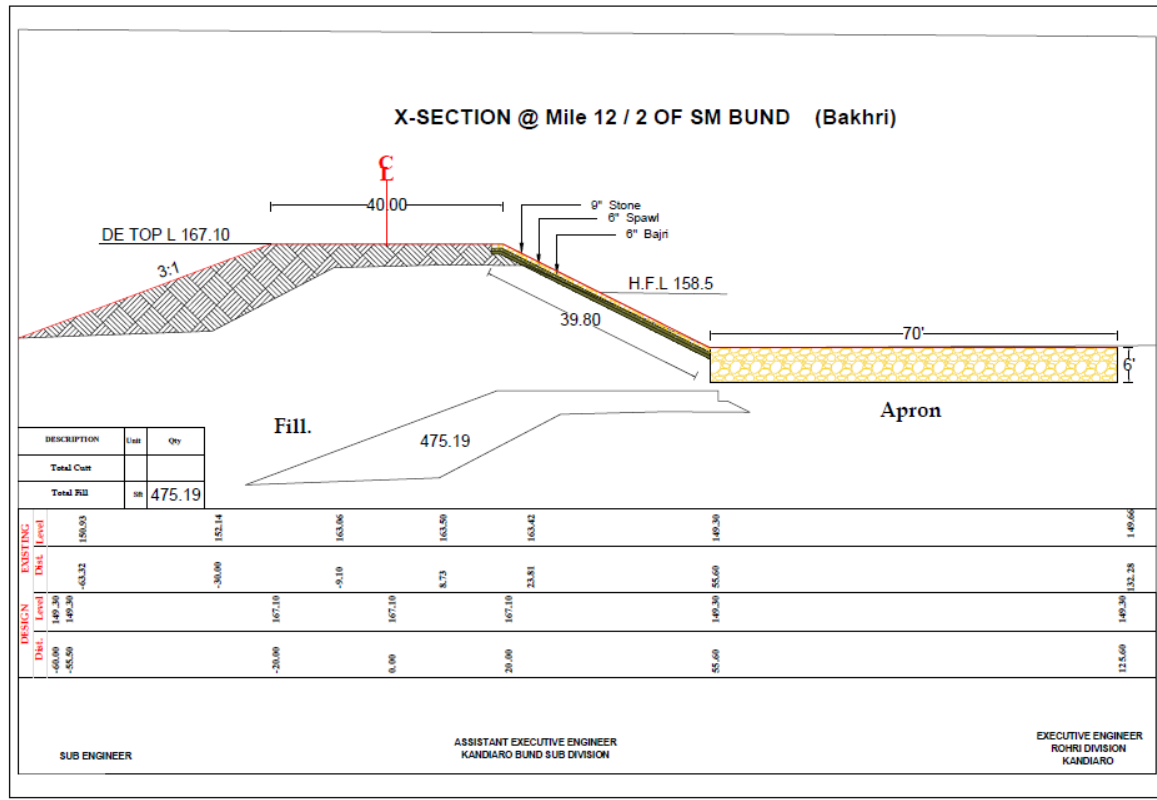


Figure 3-4: Typical showing Apron and other components

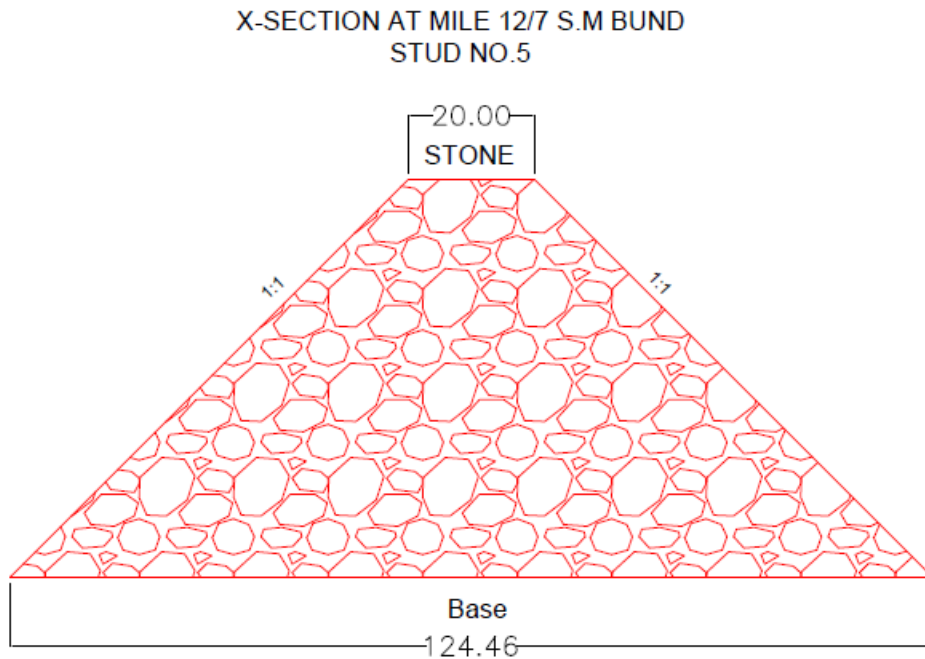


Figure 3-5: Typical X-Section of Stud

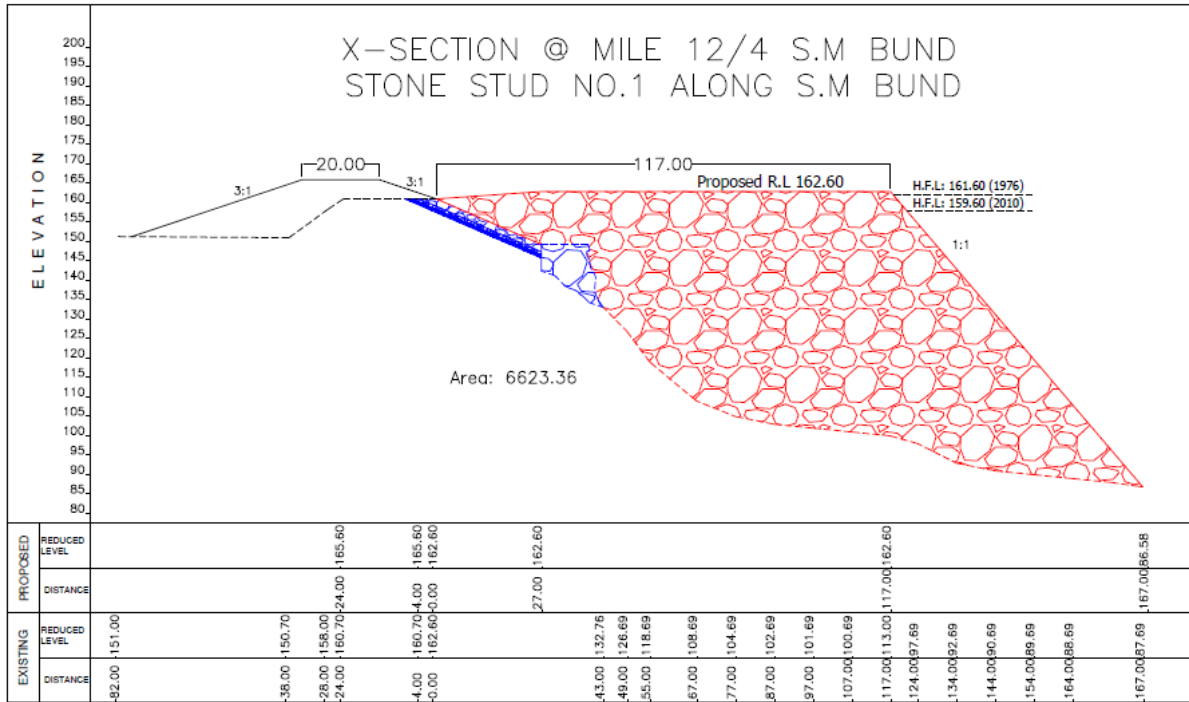


Figure 3-6: Typical X-Section of Stone Stud

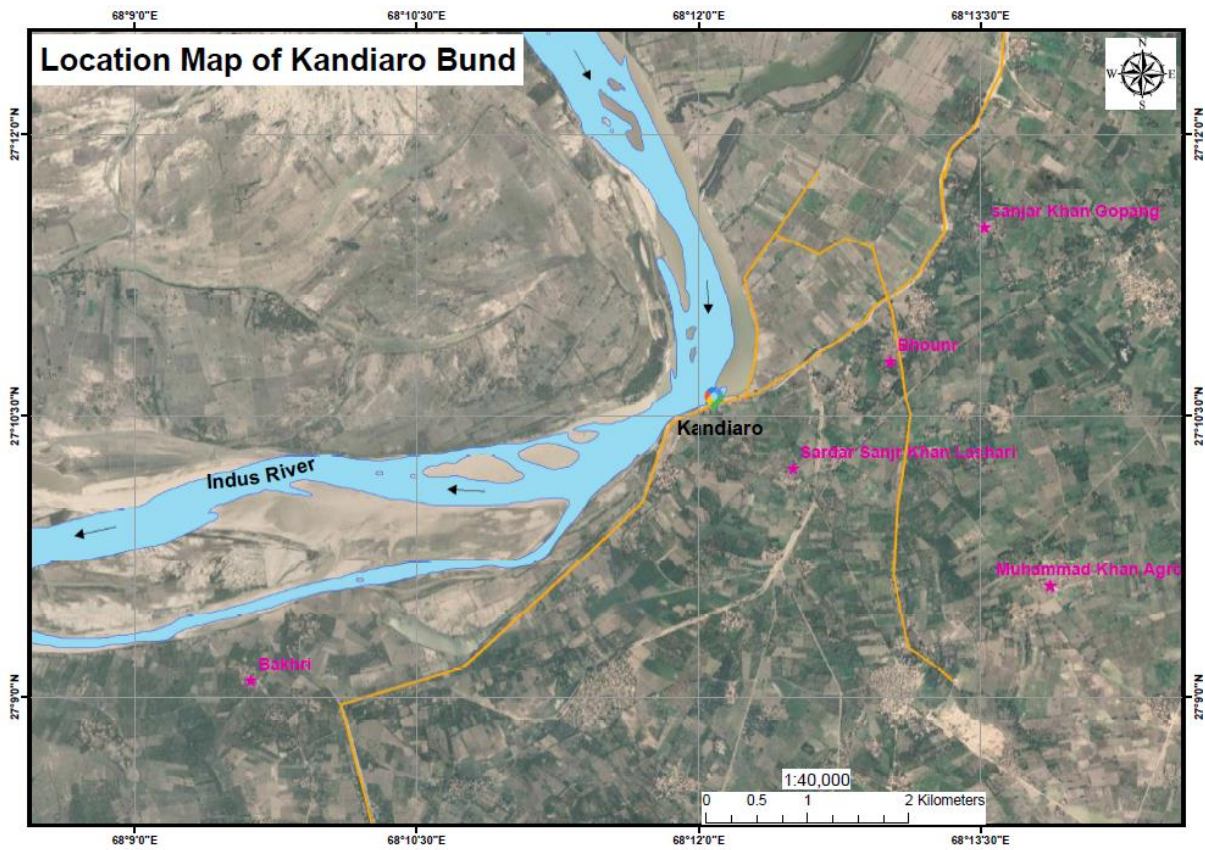


Figure 3-7: Location map of Kandiaro Bund

3.2.2 MATIARI DISTRICT

(i) Recouping of stone spurs mile 142/3 and stone studs mile 136/1 along S.M bund in Hala irrigation division Hala.

97. During the 2010 floods, a discharge of 1,124,700 cusecs passed downstream of Sukkur barrage. This high discharge led to persistent erosion along the left side of the S.M. bund at Mile 136/1 and 142/3, causing damage to irrigation infrastructure, cultivable and cultivated lands, as well as Bhanoth and Hala towns. The studs of Bhanoth and Hala spurs were directly impacted by the river water, resulting in partial spurs erosion.

98. Additionally, the river meanders at Hala Bund and Bhanoth, directly impacting spur No. 02 & spur No. 03 at mile 142/3 and 142/5. To ensure the safety of the area's inhabitants and prevent potential mishaps, the recouping of Spurs & Studs is imperative. Recognizing the vulnerability of this point, irrigation officials decided to strengthen Hala spur, as the river's changing course here posed a greater threat to the buildings. The proposed project aims to protect the bund from direct river hits, ensuring the safety of all lands and infrastructure in the adjacent areas of the bund.

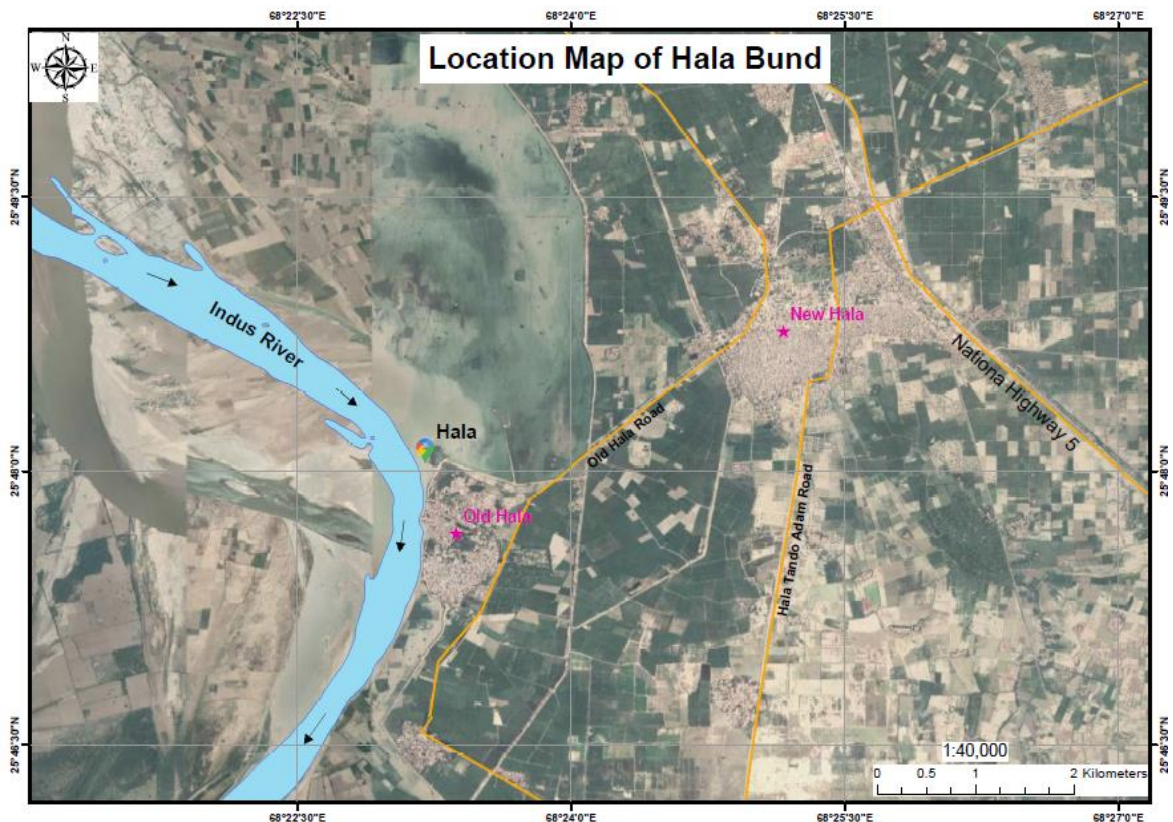


Figure 3-8: Location map of Hala Bund

3.2.3 SUJAWAL DISTRICT

(i) Rehabilitation, raising and strengthening of spurs along surjani complex bund Sujawal of Pinyari circle Hyderabad Kotri barrage region Hyderabad.

99. For the past approximately thirty-four years, the mighty river Indus has been relentlessly eroding the left bank of the M.S. bund in the stretch from mile 24/0 to 29/0. To counteract this, the 1st Surjani loop bund was constructed in 1965, covering a length of 4 miles and 2 furlongs. Subsequently, in 1983-84, the 2nd Surjani bund, with a length of 1 mile and 5 furlongs, was built between Mile 3/1+330' of the 1st Surjani bund and mile 29/1 of the M.S. bund. However, the river Indus continued to exert pressure with its erosion tendencies, which eventually led to a significant breach during the 1988 flood. Despite vigilant day-and-night monitoring, this breach occurred at mile 0/7 of the 1st Surjani bund, resulting in havoc in the taluka Sujawal.

100. After this catastrophic incident, immediate measures were taken to control the flow of the river. The following works were completed in 1989:

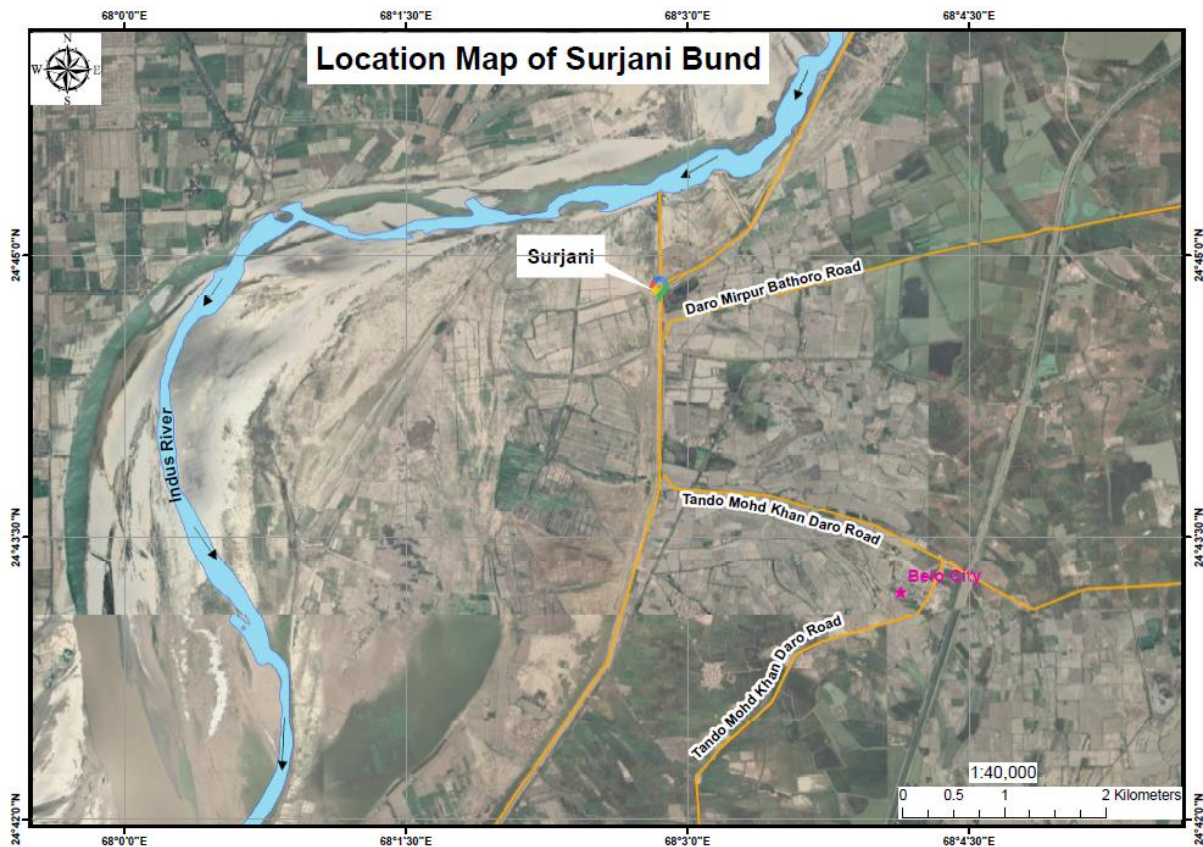
- Construction of T-Head Spur at Mile 2/5 of the 1st Surjani Bund.
- Construction of Stone Pitching from Mile 2/0 to 2/5 of the 1st Surjani Bund.
- Construction of Short Spur, No: 01 at Mile 3/1+200' of the 1st Surjani Bund.
- Construction of Short Spur, No: 02 at Mile 0/2+400' of the 2nd Surjani Bund.
- Construction of T-Head Spur at Mile 1/0 of the 2nd Surjani Bund.
- Construction of Mole-Head Spur at Mile 28/5 of the M.S. Bund.
- Construction of Stone Pitching with a stone apron from Mile 2/5 to 3/1+200 of the Surjani Bund and Mile 0/0 to 1/5 of the 2nd Surjani Bund.

101. Despite extensive protection works, the river Indus has continued to erode the left bank of the M.S. bund from mile 24/0 to 29/0 for over three decades. To counter this, the 1st Surjani loop bund was built in 1965, covering a length of 4 miles and 2 furlongs. In 1983-84, the 2nd Surjani bund, with a length of 1 mile and 5 furlongs, was constructed between mile 3/1+330' of the 1st Surjani bund and mile 29/1 of the M.S. bund. However, during the 1988 flood, a significant breach occurred at Mile 0/7 of the 1st Surjani bund, resulting in havoc in the taluka Sujawal.

102. Following this catastrophic incident, immediate measures were taken in 1989, including the construction of T-head spur at mile 2/5 of the 1st Surjani bund, stone pitching, and short spurs. Despite these efforts, the river continued to shift, and during the flood of 1992, with a discharge of 4,20,000 cusecs, more erosion occurred. This prompted the construction of 5 additional spurs in 1992. After the Flood of 2010, not all spurs were raised to the required level, leaving them vulnerable.

103. Subsequent floods in 2015, 2020, and 2022 caused severe damage to these spurs and the Surjani bunds. This project has been proposed for raising and strengthening these spurs to protect against further erosion.

Figure 3-9: Location map of Surjani Bund



3.2.4 SUKKUR DISTRICT

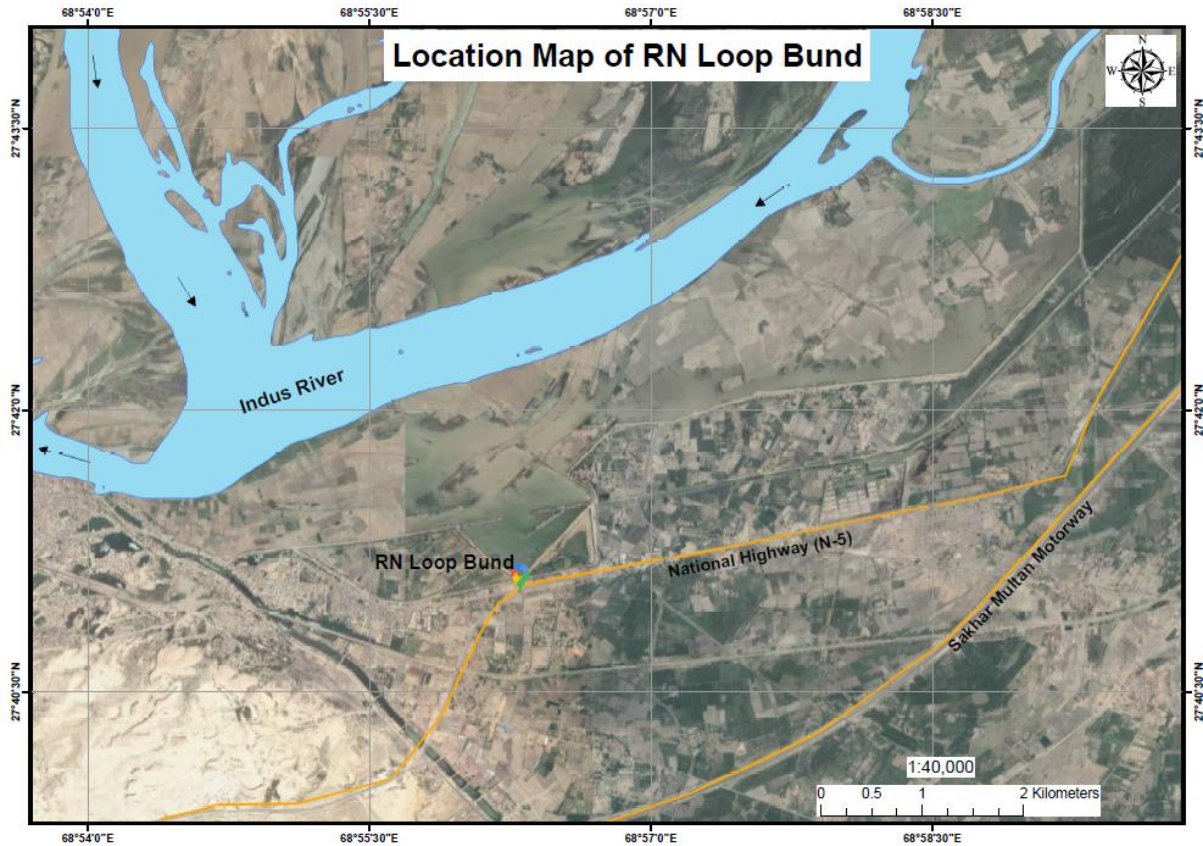
- (i) Restoration / raising and strengthening along R.N loop bund mile 0/0 to 3/0 and garikhano loop bund mile 0/0 to 2/6 providing stone pitching along R.N loop bund mile 5/0 to 6/0 and providing stone apron along bail bund mile 5/7 to 7/6 of Ghotki Division Ghotki.

104. Historical data for R.N Loop bund, Garkino Loop bund, R.N bund, and Baiji bund indicate that during the super flood of 2010, these bunds withstood heavy pressure, and remained safe. During the flood season of 2022, the bunds also remained secure, and no untoward situations arose. Sindh irrigation department has proposed several projects in this regards. These include:

- Restoration, raising, and strengthening along R.N Loop bund mile 0/0 to 3/0 and Garkino Loop bund mile 0/0 to 2/6 to enhance the safety of critical infrastructure elements, including the railway line, Ghotki Feeder, National Highway, Panoaaqil Cantonment, Panoaakil Bund, and densely populated villages like Sangi and Hingro.
- Stone Pitching along R.N bund Mile 5/0 to 6/0, addressing the vulnerability to wave wash action from the river Indus in this specific stretch.

- Providing a stone apron from Mile 7/5 to 7/6, safeguarding the existing stone pitching and earthen bund against the threat posed by the creek (old river course) passing near the toe of Baiji bund. These measures are vital to protect national assets, including PanoAkil Cantonment, National Highway, Pakistan Railway Line, government installations, and public property.

Figure 3-10: Location Map of RN Loop Bund



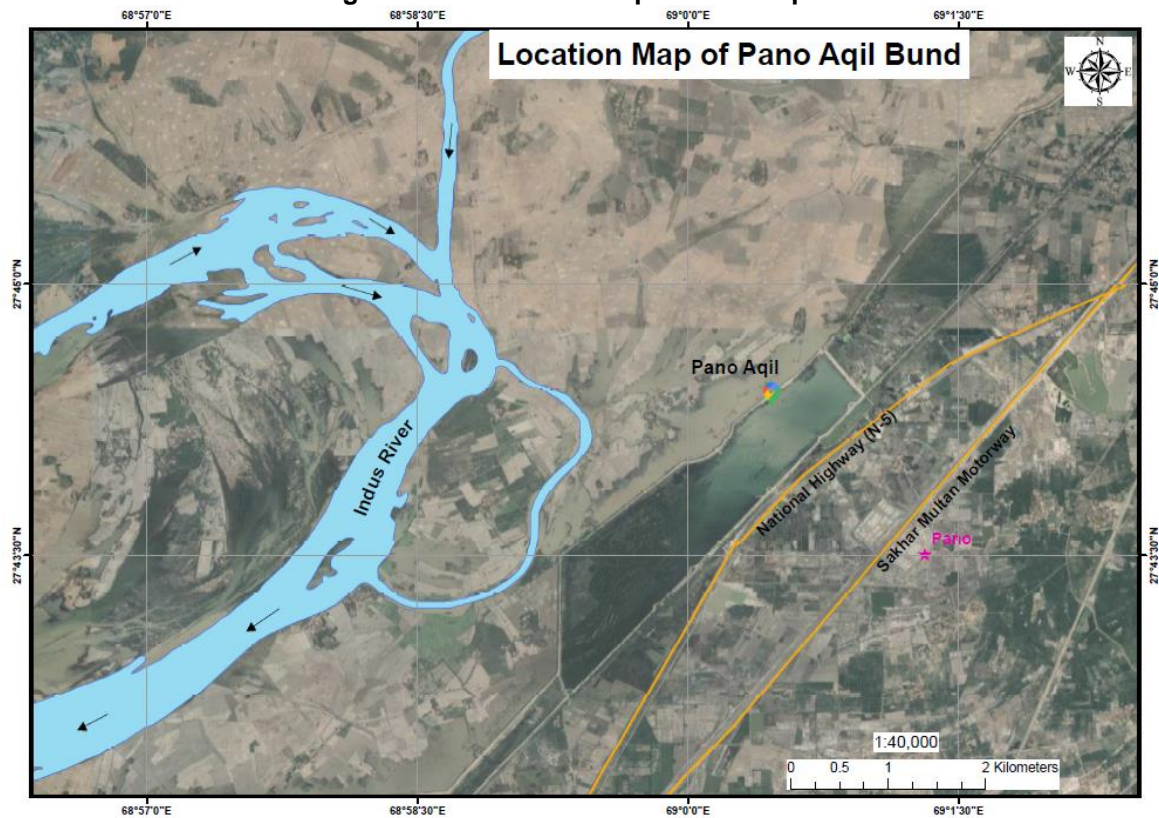
(ii) Rehabilitation / restoration stone apron at mile 1/1 + 360 to 1/2 and stone pitching mile 0/0 to 2/4 along bail bund Ghotki division Ghotki.

105. Historical data for Baiji bund during the super flood of 2010 shows that it withstood heavy pressure, and remained safe. During the flood season of 2022, the bund also remained secure, and no untoward situations arose.

106. Baiji bund from mile 0/0 to 10/3 serves as the frontline flood protective bund. It safeguards PanoAkil bund, PanoAkil cantonment area, Pakistan railway, National highway, as well as motorway, where numerous cotton, oil, and sugar mills are situated. Unfortunately, during the flood season of 2020, the river creek (old river course) became active and initiated erosion towards the toe of the bund. It started whirling at Mile 1/1+360 to 1/2, resulting in the formation of a deep, narrow ditch with a length of 300' and a breadth of 500', reaching depths of 30' to 38'. There are concerns that the front-line bund could be washed away, potentially leading to a disastrous situation.

107. Considering the site's situation, it is imperative to save the bund by dumping Stone boulders at mile 1/1+360 to 1/2. The inner toe of the bund is exposed to wave wash action from floodwater; hence, Stone Pitching along the inner slope of the bund from Mile 0/0 to 2/4 is necessary for the bund's safety. Sindh irrigation department proposed to provide a stone apron from mile 1/1+360 to 1/2 along Baiji bund and to implement stone pitching at mile 0/0 to 2/4 along Baiji bund.

Figure 3-11: Location map of Pano Aqil Bund



Project Cost

108. The estimated total cost for construction of proposed project is 3011.46 million PKR. This cost is tentative and will be finalized with the detailed technical design of the proposed project.

3.3 Project Administrative Jurisdiction

109. The proposed project falls under the jurisdiction of chief engineer FERP, chief engineer Sukkur barrage and chief engineer Kotri barrage Government of Sindh.

3.4 Project Implementation Schedule

110. It is estimated that with efficient management the work will be completed within 06 months after the commencement subject to availability of funds.

3.5 Construction Activities and Civil Works

111. Proposed project involves following construction activities and civil works that are:

- **Excavation:** Earthwork excavation in irrigation channels and drains to designed section, grades, and profiles. Excavated material to be disposed of and dressed within a 50 ft. (15m) lead, using shingle or gravel.
- **Stone filling:** Stone filling dry hand packed as filling behind retaining walls or pitching and aprons.
- **Supply stone boulder:** Supply stone boulder.
- Supplying within 5 chains (a) stone boulder 9" and above.
- Dumping shingle spawn's and boulders i/c carriage of material within 3 chains.
- **Borrow pit excavation:** Borrow pit excavation undressed lead up to 100 feet (a) Ordinary Soil.
- **Carriage:** Carriage of 100 cft / %tons of all material like stone aggregates, spawl, coal, lime, surkhi etc. B.G rad fastening points & crossing bridges girders pipes sheets Rails. M.S bars etc or 1000 Nos of bricks 10x5x3 or 1000 Nos or tiles 12x6x2 or 150 cft of timber or 100 mounds of fuel wood by trucks or any other means maned by the contractor.
- **Formation dressing and preparing sub-grades on slopes:** Formation dressing and preparing sub-grades on slopes.
- **Stone pitching:** Stone pitching i/c sub base with hammer dressed stone laid on surface in i/c carriage of material chain.

112. No demolition works are to be conducted as part of the proposed works. The stones will be obtained from commercial limestone quarries at Khanote and Jamshoro Petaro located in hilly areas in Jamshoro districts. No material will be sourced from river / stream bed.

3.6 Construction Camps

- Camp sites will be selected based on following considerations:
- Number of workforces deployed
- Type and quantity of machinery mobilized
- Availability of adequate area for establishing camp sites including parking areas for machinery, stores and workshops,
- Access to communication and local markets
- Appropriate distance from sensitive areas including settlements and religious and/or cultural facilities.

113. Final locations will be selected by the contractor with the assistance of Supervision Consultant. Care will be taken to safeguard the existing environment of the area and location shall be selected away from settlements. The contractors may acquire land on lease from private landowners.

3.7 Workforce Requirement

Workforce during Construction Phase

114. Total combined manpower requirement for all the proposed sub-projects will be approximately 250 workers per day.

Workforce during Operation Phase

115. Total manpower required during operation phase for proposed project will be approximately 60 workers, comprising of both skilled and unskilled staff.

3.8 Solid Waste Generation

116. Due to construction activities, waste will be generated at construction sites and contractors camp site. The construction waste will include wastewater, oil spillage from machinery, domestic waste and waste construction materials (construction waste will be reused or recycled through vendors).

117. Considering the labourers residing in the construction camp and the locally available labour, an average solid waste generation rate of 0.5 kg/capita/day has been adopted for the estimation of solid waste generation¹. Based on this assumption, a total of about 130 kg of solid waste will be generated from construction camps on daily basis. Solid waste generated during construction and camp sites shall be safely disposed in designated waste disposal sites after consultation with the concerned authorities of relevant district.

3.9 Water requirement

Construction Phase

118. The water consumption is estimated to be 10,400 litres/day² for 260 construction workers during construction phase of the proposed project.

Operation Phase

119. The water consumption is estimated to be 2400 litres/day for 60 workers during operation phase of the sub-projects.

3.10 Waste Water Generation

120. The wastewater generation is estimated to be 8,320 litres/day. Constructed wetland will be best option for wastewater treatment. Considering location of the project area in the outskirts of settlements, best disposal option will be a constructed wetland for wastewater treatment. Its operation will result in treated water within the WHO standards being discharged into the environment and thus is expected to reduce the load on the aquatic and terrestrial habitats present in proximity to the receiving water bodies in the project areas.

Power Requirement

Construction Phase

121. The main source of electricity/electric power during construction phase will be diesel generators for construction camps and construction machinery.

3.11 CONSTRUCTION EQUIPMENT

122. Table 3-1 shows a tentative list of construction equipment required by the contractor to enable him to undertake this work and meet the prescribed schedule.

¹ Source: The World Bank Report 2012. What a Waste: A global review of solid waste management, Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day

² Tentative Work Force Requirements Contractor Staff =

Water consumption per (1) worker = 40 liters/day

(260 workers) x (40) = 10,400 liters/day

Wastewater generation=(260 workers) x (80% of water consumption)=8,320 liters/day

Table 3-1: List of Construction Equipment Required by each Contractor

Sr. No.	Description	Estimated Quantity
1	Bulldozer D8 with ripper (Blade capacity = 12.9 m ³)	5
2	Motor Grader cat 14G or Equivalent	4
3	Front End Loader Bucket capacity = 6 m ³	5
4	Sheep foot roller for core compaction (10-ton capacity)	3
5	Dump Trucks (capacity = 14 m ³)	5
6	Mobile water tanker 500 gallons	3
7	Hydraulic Excavator with 14" wide bucket	5
13	Jeeps	5

4. ENVIRONMENTAL AND SOCIAL BASELINE

4.1 GENERAL

123. The purpose of this chapter is to establish the baseline conditions for the physical, biological and the socio-economic aspects of environment of the project area. The data were collected regarding the physical environment, biological environment and social aspects of the study area during stakeholder consultation and technical visits conducted by the environment team.

4.2 AREA OF INFLUENCE

124. This chapter describes the environmental, social and biological baseline conditions of the project 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 project area.

125. In this report, the Area of Influence (AOI) is referred where the potential impacts of the proposed project are anticipated. The Aoi includes all those areas in the region within 0.5 km from the project site and which may be affected directly or indirectly by the project activities. This chapter describes the environmental setting of the proposed interventions.

4.3 PHYSICAL ENVIRONMENT

4.3.1 Topography

126. Topographically, Sindh can be divided into 4 distinct parts: the dry and barren Kirthar Range in the West, a central alluvial plain bisected by the river Indus, a desert belt in the East and the Indus delta in the South. The topography of the four districts within the project area, located in the Sindh province, varies significantly. Matiari, situated in the northern part, is characterized by flat arid plains and is traversed by the Indus river. Naushahro Feroze, located in the southeast, features a diverse landscape with plains, low hills, and riverine areas influenced by the Indus river and its distributaries. Sujawal, in the coastal south, has low-lying areas along the Arabian sea, including wetlands and marshes, with susceptibility to tidal influence and flooding. Sukkur, in the northern part, is predominantly a flat alluvial plain, known for the Sukkur barrage controlling the Indus river's flow and its extensive canal network. These districts collectively showcase Sindh's diverse topographical features, from fertile plains to coastal regions, shaped by the Indus river and the Arabian sea.

4.3.2 Geology and Soil

127. The soil composition in the four districts of Sindh varies but is primarily alluvial and fertile due to their proximity to the Indus River. Matiari's soil is characterized by rich alluvial deposits, making it suitable for agriculture. Naushahro Feroze has fertile soils, owing to the Indus River and its distributaries, which support various crops. Sujawal, being in a coastal region, features soils influenced by tidal effects, including marshy and saline areas, which pose challenges to traditional agriculture. Sukkur boasts highly fertile alluvial soils, owing to its location along the Indus river, making it a vital agricultural region with extensive cultivation

facilitated by irrigation systems. These districts exhibit a range of soil types, from arable to saline, impacting the agricultural practices and livelihoods of their inhabitants.

128. The geology of the four districts in Sindh is primarily shaped by their location within the broader Indus basin. Matiari and Naushahro Feroze districts are situated in the lower Indus basin and are characterized by alluvial and fluvial deposits. The geology of these regions consists of recent sediments carried and deposited by the Indus river and its tributaries. These sedimentary deposits primarily comprise fertile clay and silt, making Matiari and Naushahro Feroze suitable for agriculture.

129. On the other hand, Sujawal district, located along the coast of the Arabian sea, features a distinct geological setting. This district's geology includes coastal and deltaic formations influenced by the sea. As a result, Sujawal's landscape encompasses sedimentary deposits, wetlands, marshes, and tidal creeks. Lastly, Sukkur district, situated along the Indus River, shares a geology similar to Matiari and Naushahro Feroze, characterized by alluvial and fluvial deposits. The fertile soils here are conducive to agriculture, with irrigation facilitated by the Sukkur barrage.

4.3.3 Hydrology of the Project area

130. The hydrology of Matiari, Naushahro Feroze, and Sukkur districts is intricately tied to their proximity to the Indus river. The Indus river, a vital water source, plays a central role in sustaining agriculture in these districts. Canal systems divert water from the Indus and its tributaries, ensuring consistent irrigation and fertile soil conditions, supporting a diverse range of crops, and contributing significantly to the local economies. Sukkur district is further distinguished by the presence of the Sukkur barrage, which regulates the Indus's flow, manages water resources, and enhances water availability for agricultural and industrial purposes, strengthening the hydrological system of the region. Rohri Canal system is also present in the project area.

131. Sujawal's hydrology is unique due to its coastal location along the Arabian sea. Tidal movements from the sea influence the district's waterways, and it experiences seasonal variations in water levels. Wetlands, creeks, and marshes are common features in Sujawal, and the district faces challenges related to managing tidal flooding and drainage.

4.3.4 Climate and Meteorology

132. The province of Sindh is situated in a subtropical region. It is hot in the summer and cold in winter. Temperatures frequently rise above 46°C between May and August, while the minimum average temperature of 20°C occurs during December and January. The coldest period spans from December to February, with mean monthly temperatures ranging from 20°C in the southern coastal zone to 15°C in the northern region of the province. Summer temperatures peak in May and June, with mean monthly highs from 25°C to 45°C. The annual rainfall averages around seven inches, falling mainly during July and August. The south-westerly monsoon wind begins to blow in mid-February and continues until the end of September, whereas the cool northerly wind blows during the winter months from October to

January. Sindh spans four distinct climatic regions: hot very arid, hot arid, semiarid, and coastal³.

133. In the proposed project districts, Sujawal falls in a semi-arid zone where warm summers and mild winters are experienced. Matiari falls in a hot arid zone where hot summers and mild winters are experienced. Naushahro Feroze falls in a hot very arid zone where hot summers and cool winters are experienced. Sukkur falls in a hot very arid zone where hot summers and mild winters are experienced.

a) Average Temperatures

134. The Figure 4-1 represents modelled data where mean monthly maximum and minimum temperatures for different months of the last 30 years. The "mean daily maximum" (solid red line) shows the maximum temperature of an average day for every month for Sukkar. Likewise, "mean daily minimum" (solid blue line) shows the average minimum temperature. Hot days and cold nights (dashed red and blue lines) show the average of the hottest day and coldest night of each month of the last 30 years⁴

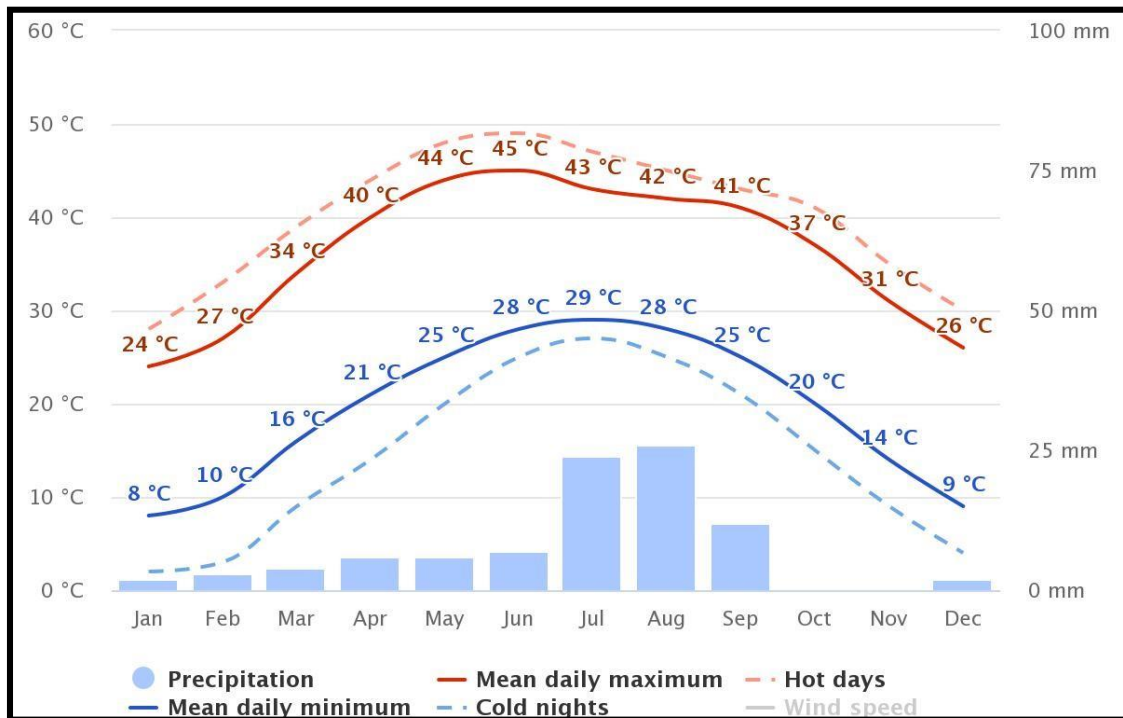


Figure 4-1: Average Temperatures

135. As it can be seen from Figure 4-1 the project area has extreme climate. It has hot summer and cold winters. The summer starts from May and lasts till September. July is the hottest month. The mean maximum and minimum temperature are 45 °C in the month June and 29 °C in July respectively. The winter seasons lasts from November to February. January is the coldest month. The mean maximum and mean minimum temperature are 24 °C and 8 °C in January. The maximum temperatures are presented in Figure 4-2.

³ World Bank-NDMRF(2022). Restoration of Riverine, Inland, Mangroves, Dry-land and Urban Forests Ecosystems of Sindh Province (RRIMDU) <https://sindhforests.gov.pk/uploads/files/ESMP.pdf>

⁴ https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/liaquatpur_pakistan_1172020

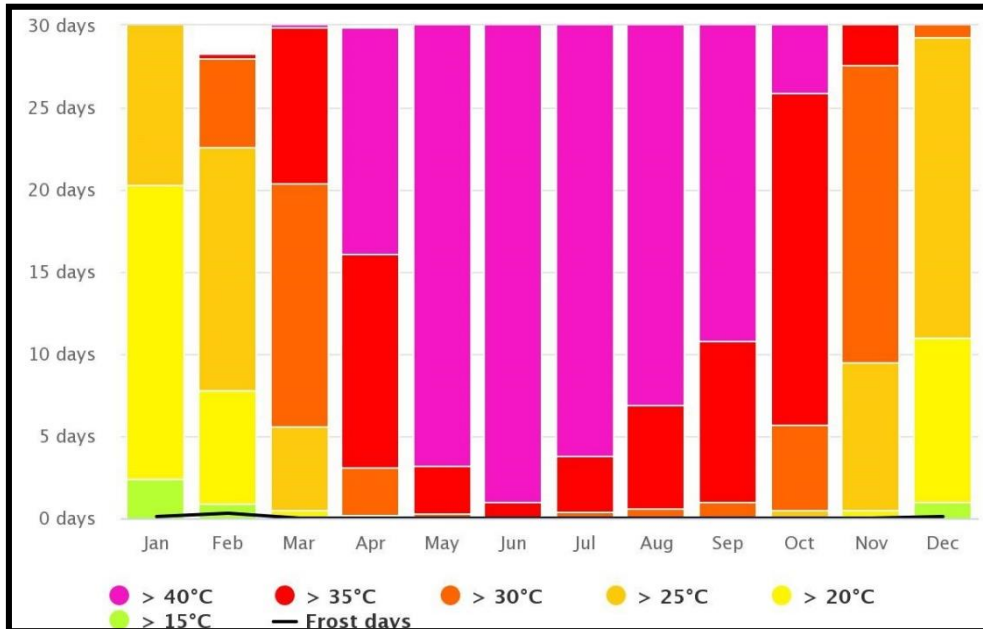


Figure 4-2: Maximum Temperatures

b) Wind:

136. Figure 4-3 shows the days per month, during which the wind reaches a certain speed. Maximum wind speeds can be observed in the months of March to June which is >19 km/h. Wind speed >12 km/h dominates throughout the year.

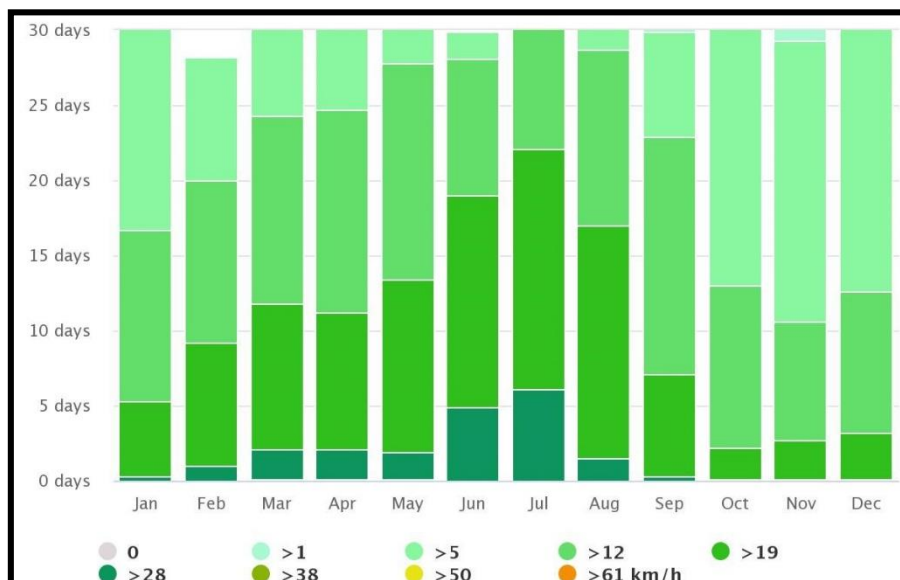


Figure 4-3: Wind Speed

137. The wind rose for Sukkar shows how many hours per year the wind blows from the indicated direction. Wind rose is shown in Figure 4-4. It can be seen from the wind rose that dominant wind direction is towards South (S).

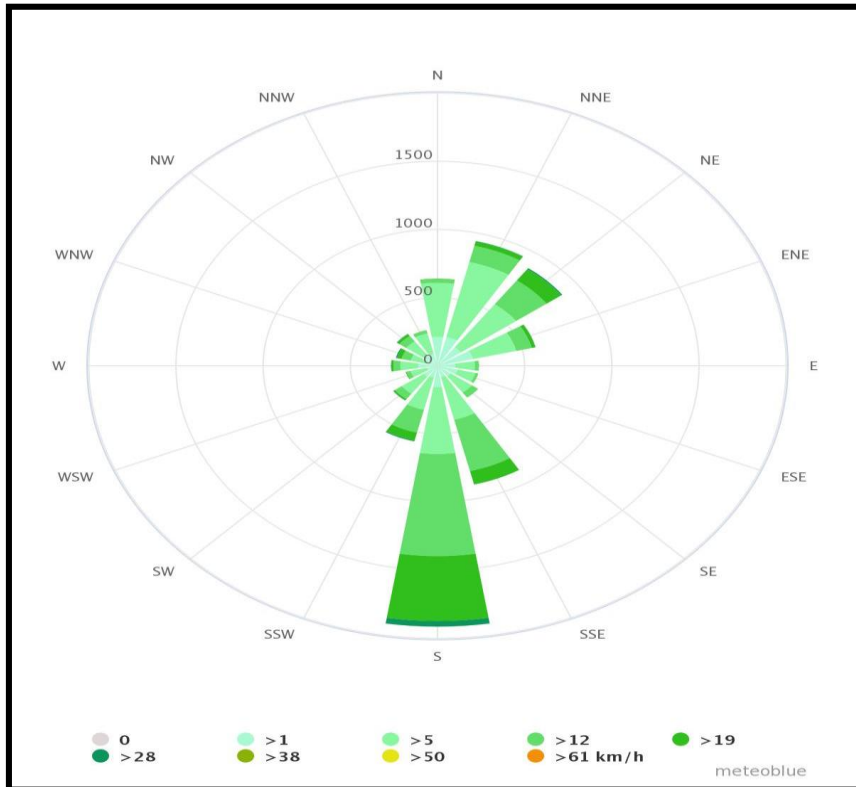


Figure 4-4: Wind Rose

4.3.5 Climate Change.

138. According to the Global Climate Risk Index (GCRI) of 2020, Pakistan was ranked as the 5th most affected nation by extreme weather events (1999-2018). Natural disasters, which already disrupt livelihoods and the economy, are expected to increase in frequency and intensity with climate change. Projected temperature increases are expected to be above global averages, negatively impacting agricultural production, water availability, and human health. This will be particularly true for large parts of Punjab, Sindh, and Baluchistan provinces, already considered intense heat zones.

139. Climate change will impact flood mitigation structures in various ways, depending on the specific mode and location characteristics. All flood mitigation structures are constructed according to design standards that take into account precise temperature and precipitation ranges, as well as return intervals for extreme events like floods and extreme heat. Flood mitigation structures may malfunction if weather conditions deviate from the design range, as was experienced during the 2022 flood in Sindh within this project area. Such deviations could occur more frequently as the climate continues to change. Heatwaves are expected to become more frequent and longer-lasting in the future, making flood mitigation structures especially vulnerable to extreme precipitation events.

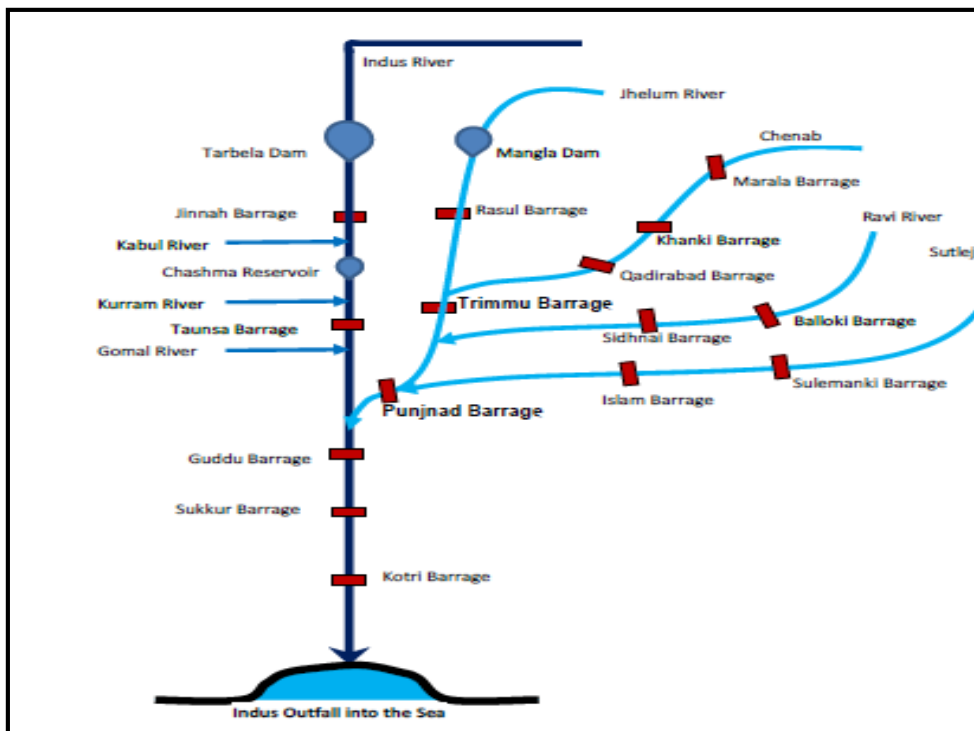


Figure 4-5: Indus river system and major hydraulic structures

Climate Risk and Vulnerability Assessment (CRVA)⁵

140. The CRVA of the Indus river at Trimmu and Panjnad barrages was conducted as part of the ADB-funded Trimmu and Panjnad Barrages Improvement Project (RRP PAK 47235). These barrages represent the last barrages of the Punjab province, marking the entry of the River Indus into Sindh, where the proposed project structures are located downstream to Sukkur barrage. This study outlines the Indus basin and Chenab river, as well as the prerequisites for rehabilitating and upgrading the existing Trimmu and Panjnad barrages to ensure a reliable water supply to approximately 1.7 million hectares. It evaluates the climate impacts, changes in temperature and precipitation in the catchment areas, and their potential effects on river flows at the project sites. Furthermore, it conducts a hydrological assessment using long-term flow data. The approach encompasses (i) verifying the original capacity of the existing barrages against climate change projections, (ii) assessing the need to upgrade the barrages for flood risk management (FRM), and (iii) determining the final discharging capacity that aligns with climate change, FRM, and upstream structures for more dependable and cost-effective designs.

141. The analysis of annual maximum river flows over the past 80 years reveals a decreasing trend at both project sites. However, climate projections, based on global circulation models (GCM) and downscaling using regional climate models (RCM), indicate an anticipated increase in temperature and precipitation within the catchment area. Precipitation may potentially increase within a range of 2% to 7%. Nevertheless, only a portion of the

⁵ Climate Risk and Vulnerability Analysis and Adaptation Strategy Report (2014). Trimmu and Panjnad Barrages Improvement Project (RRP PAK 47235)

<https://www.adb.org/sites/default/files/linked-documents/47235-001-sd.pdf>

increased precipitation may translate into augmented river flows. The rainfall projections vary from 2% (low) to 7% (high), with a medium projection scenario resulting in a maximum flow increase of 4.5%. It's important to note that these projections exhibit high variability and uncertainties.

142. The design flow of both barrages was estimated while considering FRM, optimizing the capacity of upstream structures, and ensuring the safety of the proposed upgraded barrages. The FRM scenario, in conjunction with upstream structures, necessitates increasing the design flow of Trimmu barrage by 35% and Panjnad barrage by 24%. This estimate results in higher flows than the climate change projections and has been incorporated into the design of these barrages. Key conclusions drawn from this assessment are as follows:

- Rainfall projections, as derived from downscaling three GCMs for the project, do not exhibit a significant increase in rainfall between 2011 and 2050 but indicate an increase from 2051 to 2098. However, existing country-level studies indicate a substantial rise in temperature and precipitation.
- Long-term flow data reveals a declining trend in annual maximum flows, which contradicts the results of climate change projections.
- Given uncertainties in climate data, models, and projection outcomes, adopting a conservative approach in designing the barrages is deemed necessary.
- The design approach, which optimizes flood risk management, accounts for potential damages, addresses performance, incorporates climate change considerations, and ensures structural safety, is considered appropriate.
- The proposed design of the barrages is robust and provides adequate safeguards against the impacts of climate change.

Climate Risks and Vulnerabilities in the Project Area

143. Based on the previous discussion, the project area along the Indus river in Sindh province is exposed to various climate risks and vulnerabilities. Despite indications of increased precipitation from 2051 to 2098 in downscaled climate projections, the conflicting trend of decreasing annual maximum river flows complicates matters. Addressing these challenges requires prioritizing a cautious approach in project design. Nevertheless, the robust design, which emphasizes flood risk management, damage prevention, performance, and structural safety, ensures resilience to evolving climate conditions and secures effectiveness in the face of climate change impacts.

4.3.6 Seismology

144. The project sites are in seismic zone 2A, signifying moderate seismic activity (magnitude 5.0 to 5.9). This could cause structural damage and instability, necessitating seismic design measures for safety.

145. The project area is located in Seismic Zone-II, where Zone-II represents seismic ground acceleration factor $>0.15g$. **Figure 4.6** shows the seismic zoning map of Pakistan, indicating that the project area falls under Seismic Zone-II, which is a moderate seismic zone.

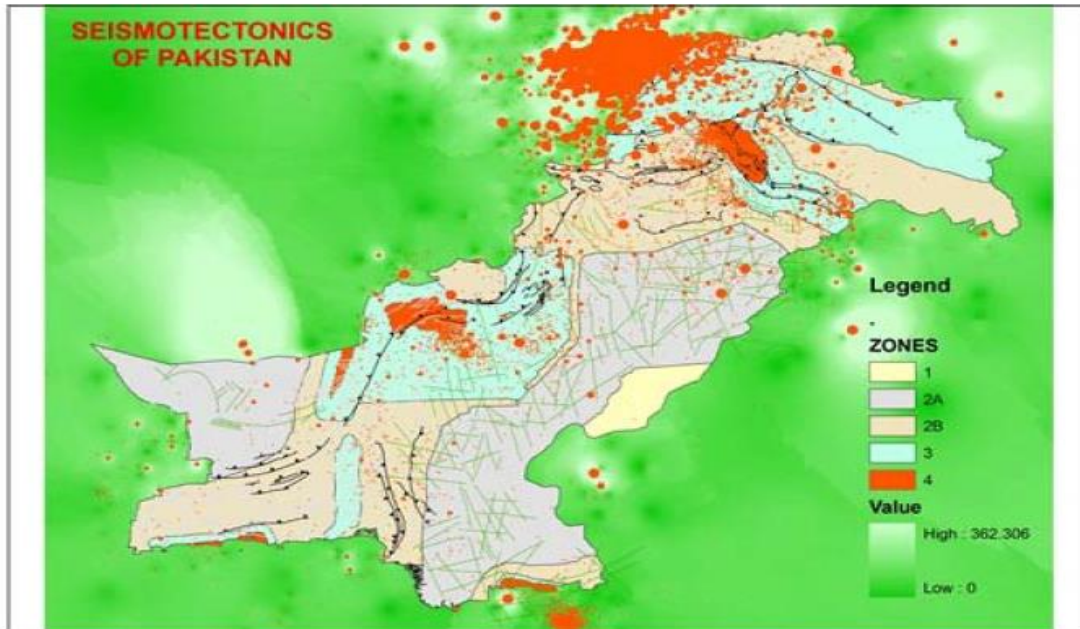


Figure 4-6: Seismic Zoning Map of Pakistan

4.3.7 Sensitive Receptors

146. Apart from the three project sites, all the settlements with sensitive receptors, such as schools and mosques, are located within the distance of 500 meters from the area of influence of the proposed sub-projects. Sensitive receptors and their respective sensitivities for the selected villages are listed in Table 4.1 for the three bunds, as in other subproject sites, sensitive receptors are not located within the area of influence.

147. For the proposed project, sensitive receptors include, but are not limited to, educational, health, religious, cultural, archaeological, and ecological resources. These are areas where the occupants are more susceptible to the adverse effects of exposure to toxic chemicals and other pollutants through air and noise emissions due to construction and project operation.

148. Major environmentally sensitive receptors, including residential areas, religious places such as mosques and madrassas, and educational institutions, were identified using the ArcGIS tool and further verified through field visits for the proposed project. **Figure 4-1** shows the locations of these environmentally sensitive receptors indicated on the map. These identified sensitive receptors, along with their distances from the site, are provided in Table 4-1 below:

Table 4-1: Sensitive Receptors

Sr.No	Name of Scheme	Name of Physical Sensitive receptor or village/settlement
1	Rehabilitation / Reconstruction of Stud / Apron along S.M Bund at Mile 12/0 to 12/7 and Bakhri Loop Bund Mile 0/0 to 0/1 in Kandiaro Bund sub-division.	Small settlement Naushahro Feroze (100 m)
2	Recouping of Stone Spurs Mile 142/3 and Stone Studs Mile 136/1 along S.M Bund in Hala Irrigation Division Hala.	Old Hala and school (Matiari district) at 400m
3	Rehabilitation/Restoration of Stone Apron at Mile 1/1+360 to 1/2 and Stone Pitching at Mile 0/0 to 2/4 along Baiji Bund	Ali Wahan village and Masjid at 490 m (district Sukkur)

4.4 ENVIRONMENTAL MONITORING OF THE PROJECT AREA

149. Sukkur barrage is located 9 km away from the Baill Bund site (ii) of district Sukkur of this proposed project. Baseline environmental monitoring was conducted at Sukkur barrage during the feasibility study for its rehabilitation and modernization⁶. The results have been reported below."

4.4.1 Ambient Air Quality

150. Air quality in the overall project area appears to be generally good since these project sites are located in remote areas with no significant sources of air pollution in the vicinity. The only major sources of air pollution are vehicular emissions from the limited traffic, dust arising from winds and other ground or soil disturbance during dry weather, and from the movement of vehicles on poorly surfaced or katcha access roads.

151. The baseline ambient air quality monitoring (NO_x, SO₂, CO, PM₁₀ and PM_{2.5}) at Sukkur Barrage was done during the feasibility study of the project and the results are shown in Table 4-2. Air quality near the barrage area was found to exceed WHO standards of ambient air quality for fine particulate matter (PM_{2.5}, PM₁₀) and WHO and SEQs standards for Carbon Monoxide (CO). Vehicular traffic and industries are the major sources air pollution.

⁶ Government of Sindh, Pakistan, Irrigation Department. (2017, December). Sindh Barrages Improvement Project - Sukkur Barrage Rehabilitation and Modernization - World Bank Funded - ENVIRONMENTAL AND SOCIAL ASSESSMENT. <https://documents1.worldbank.org/curated/ar/356891516200660593/pdf/SFG3992-EA-P162117-Box405323B-PUBLIC-Disclosed-1-17-2018.pdf>

Table 4-2: Ambient Air Quality

Parameters	Unit	Site-I (at Sukkur Barrage)			Site-II (at Bridge on NH on Downstream of the Barrage)			WHO	SEQS
		Min	Max	Average	Min	Max	Average		
Nitrogen oxides, NO _x	µg/m ³	BDL	BDL	BDL	BDL	BDL	BDL	24 hrs. (25 µg/m ³)	80
Sulphur di Oxide, SO ₂	µg/m	BDL	BDL	BDL	BDL	BDL	BDL	24 hrs. (40 µg/m ³)	120
Carbon monoxide, CO	µg/m	0	7	5	4	10	7	8 hrs. (4 mg/m ³)	5
PM _{2.5}	µg/m	48	106	78	146	311	242	24 hrs. (15 µg/m ³)	35
PM ₁₀	µg/m	68	311	180	174	423	317	24 hrs. (45 µg/m ³)	120

4.4.2 Ambient Noise

152. Noise levels near the barrage are generally high due to vehicular traffic and have also exceeded the national standards as well as WHO standards

153. . Noise monitoring results are shown in Table 4-3 below.

Table 4-3 Ambient Noise Quality⁷

Parameters	Unit	Site-I (at Sukkur Barrage)			Site-II (at Bridge on NH on Downstream of the Barrage)			WHO	SEQS
		Min	Max	Average	Min	Max	Average		
Noise (day)	dB	77	78	78	80	81	80	70	65
Noise (Night)	dB	66	78	72	75	79	77	70	55

4.4.3 Drinking Water Quality

Baseline data for drinking water quality has not been found from the seconhary soruces, however water samples will be collected from the nearby sources for testing through certified labs prior to construction works to establish baseline. Same water sources will be tested twice during and at completion of works for comparion and impact identification. Cost provions have been ensured in the EMP cost for such tests.

4.4.4 Surface Water Quality of Indus River

154. The water quality of the Indus in the high-flow season is highly turbid, ranging from 970 to 1220 NTU, with a total suspended solids content of 1275 to 1860 mg/L. The electrical conductivity ranges from 515 to 577 µS/cm. The chloride level ranges from 11 to 18 mg/L. Water from irrigation canals is also being used for drinking purposes in Kotri and Rohri towns and in the command area, where groundwater is saline. The existing threats to Indus water

⁷ IBID., p.4-11

quality include discharges of municipal and industrial wastewater. Water quality data monitoring for the Indus are given in Table 4-4 below.

Table 4-4: Water Quality of the Indus River at Sukkur Barrage⁸

Sr. No.	Parameters	Unit	SEQS	Detectable limit	Right Bank Upstream	Right Bank Downstream	Left Bank Upstream	Left Bank Downstream
1.	Conductivity Electrical (EC)	µS/cm	-	0	515	557	519	535
2.	Organic Carbon Total (TOC)	mg/L	-	0.3	2.36	2.04	1.84	1.93
3.	Turbidity	NTU	-	0.2	1260	1020	990	970
4.	COD	mg/L	150	5	62.5	80	71	64
5.	BOD	mg/L	80	2	18	24	22	19
6.	Solids, Total Suspended (TSS)	mg/L	-	5	1860	1450	1275	1537.5
7.	Phosphate, Total	mg/L	-	0.1	3.55	1.08	1.01	0.89
8.	Nitrogen, Total	mg/L	-	1	34.71	89.84	8.17	8.17
9.	Calcium (Ca)	mg/L	-	0	60.76	61.35	57.06	57.2
10.	Potassium (K)	mg/L	-	0.2	4.17	3.19	3.57	3.14
11.	Magnesium (Mg)	mg/L	0.05	0	0.9	7.37	7.64	7.8
12.	Sodium (Na)	mg/L	-	1	7.48	6.61	7.22	7.62
13.	Alkalinity Bicarbonate mg	mg/L	-	5	235.37	309.33	253.1	234.18
14.	Alkalinity Carbonate	mg/L	-	5	<05.00	<05.00	<05.00	<05.00
15.	Chloride	mg/L	1000	5	17.64	11.48	12.35	10.81
16.	Sulphate	mg/L	600	5	69.13	70.78	56.79	78.39

4.5 Biological Environment

4.5.1 Flora

155. During the environmental assessment visit of the sub-project area, various types of trees, shrubs, and herbs were recorded. Major tree species include Kikar (*Acacia nilotica*), Jand (*Prosopis cineraria*), Jungli Bair (*Ziziphus nummularia*), and Ghaz or Khagal (*Tamarix indica*), while Eucalyptus (*Eucalyptus* spp) is a major tree species in the sub-project areas.

156. The main shrubs and bushes include *Capparis spinosa*, *Saccharum griffithii*, *Saccharum munja*, *Alhaji*, *Glinus lotoides*, *Paspalum vaginatum*, *Kohautia retrorsa*, *Salvadora*

⁸ Government of Sindh, Pakistan, Irrigation Department. (2017, December). Sindh Barrages Improvement Project - Sukkur Barrage Rehabilitation and Modernization - World Bank Funded - ENVIRONMENTAL AND SOCIAL ASSESSMENT. <https://documents1.worldbank.org/curated/ar/356891516200660593/pdf/SFG3992-EA-P162117-Box405323B-PUBLIC-Disclosed-1-17-2018.pdf>

oleoides, *Typha dominghensis*, *Phyla nodiflora*, and *Capparis decidua*, among others. During the baseline survey, no flora species with ecological importance were found in the sub-project areas.

157. The ground cover of sub-projects is mainly constituted by herbs like *Atambae* (*Valerianella szovitsiana*), *Cheir* (*Ferula costata*), *Kamha* (*Ferula ovina*), *Sagdaru* (*Heliotropium dasycarpum*), *Ushi* (*Ferula oopoda*), etc., and grasses like *Adin* (*Phacelurus speciosus*), *Gasht* (*Stipa trichoides*), *Hawae* (*Cymbopogon jawarancusa*, *C. commutatus*), *Kaj* (*Chrysopogon aucheri*), *Kholambae* (*Avena sterilis*), *Lashabae* (*Poa bulbosa*), *Sarandu* (*Biossiera squarrosa*), etc.

Figure 4-7 : Flora in the vicinity of sub-projects





4.5.2 Fauna

158. The natural habitat of the area has the potential to support various wildlife species. Crop fields provide feeding and roosting grounds for rodents and birds, while waterlogged sites offer an alternative habitat for aquatic fauna, including fish breeding. The river lagoon (Kori) is a potential hotspot for waterfowls and other migratory bird species. Fallow land around the SM bund provides refuge to various bird species and mammals such as Jackals, Wild Boars, and rodents.

159. **Mammals** in the area include the Indian Wild Boar (*Sus scrofa*), Common Palm Civet (*Paradoxurus hermaphroditus*), Smooth-coated Otter (*Lutrogale perspicillata*), Indian Grey Mongoose (*Herpestes edwardsii*), Indian Hedgehog (*Paraechinus micropus*), Indian Pangolin (*Manis crassicaudata*), Asiatic Jackal (*Canis aureus*), Indian Desert Fox (*Vulpes vulpes pusilla*), and Wild Boar (*Sus scrofa*).

160. **Reptiles and amphibians** include the Sind Krait (*Bungarus sindanus*), Sind Awl-Headed Snake (*Aspidura sindanensis*), Cobra (*Naja naja sindica*), Pit Viper (*Gloydius himalayanus sindanus*), Monitor (*Varanus sindanicus*), Sand Gecko (*Tropicolotes tripolitanus sindicus*), and Painted Frog (*Kaloula pulchra*).

161. **Birds:** The riverine forest of the area provide an excellent feeding, roosting, and breeding ground for local resident and migratory avian species. During the baseline survey of the subproject area, through interviewing and personal observation, it was recorded that Black-winged Stilt (*Himantopus himantopus*), White-cheeked Bulbul (*Pycnonotus leucotis*), Common Babbler (*Turdoides caudata*), Pheasant Crow (*Corvus splendens*), Jungle Babbler (*Turdoides striata*), Common Myna (*Acridotheres tristis*), Bank Myna (*Acridotheres ginginianus*), House Sparrow (*Passer domesticus*), Common Crow (*Corvus brachyrhynchos*), Indian Roller (*Coracias benghalensis*), and Rose-ringed Parakeet (*Psittacula krameri*) are birds of the project area. Waterfowls included Mallard Duck (*Anas platyrhynchos*), Northern Pintail (*Anas acuta*), Common Teal (*Anas crecca*), Eurasian Wigeon (*Anas penelope*), Great Cormorant (*Phalacrocorax carbo*), Little Egret (*Egretta garzetta*), Grey Heron (*Ardea cinerea*),

Pallas's Gull (*Ichthyaetus ichthyaetus*), Black-headed Gull (*Chroicocephalus ridibundus*), Lesser Flamingo (*Phoenicopterus minor*), etc.

162. **Fish species** in the area include Mrigal (*Cirrhinus mrigala*), Naked Carp (*Gymnostomus ariza*), Calbasu (*Labeo calbasu*), Catla (*Labeo catla*), Rohu (*Labeo rohita*), Sindh Catfish (*Mystus cavasius*), Rita Catfish (*Rita rita*), Senghala Catfish (*Sperata seenghala*), Mullee (*Wallago attu*), Mozambique Tilapia (*Oreochromis mosambicus*).

Figure 4-8: Common Birds near Sub-Projects



Black winged stilt



Common Myna near SM Band



Bank Myna



White Cheek Bulbul

163. Aquatic ecology is non-existent, as there are seasonal hill torrents in the project area and no perennial stream or river. In addition, bunds of this project are in damaged condition since last year floods (2022).

4.5.3 Protected and Historical Area:

164. There is no wildlife protected areas in the project areas of both districts, nor are any of the historical buildings protected.

4.5.4 Integrated Biodiversity Assessment Tool (IBAT)⁹

165. The project area was also screened for ecological sensitivities using the Integrated Biodiversity Assessment Tool (IBAT) with its outputs provided as Annexure 3. The tool was run for one buffer zone (5 km). The findings of IBAT were correlated with the primary and secondary data collected as part of the detailed scoping activities conducted during preparation of this study. It was observed that IBAT correctly stated that no protected areas and/or key biodiversity areas are present within buffer zone of 5 km. Furthermore, IBAT predicted that within a 50 km area of interest, there are possibly 46 species that are listed in the IUCN Red List, consisting of 17 Aves, 10 Reptiles, 10 mammals and 9 fish species.

166. Based on actual observations during local surveys, or review of the relevant literature, Annexure 3 also presents the validated status of the threatened faunal species identified through IBAT. It is concluded from the validation table (Annex 3) that there are no threatened species at the sub-project sites.

167. The Forest and Wildlife departments were consulted, and the findings of IBAT were shared and discussed (Figure 6-2). Based on the discussions with these departments, it was concluded that there are no species of conservation importance, endemic species, endangered species, or critically endangered species present in the vicinity of the project area (Aol).

4.6 SOCIO-ECONOMIC BASELINE STRUCTURE¹⁰

4.6.1 Demographic Features

168. The following table presents population statistics for various talukas/tehsils of the project area, including population count, population density per square kilometer, average household size, and average annual growth rate in the project area. These statistics offer valuable insights into the demographic characteristics of each taluka/tehsil.

Table 4-5: Demographic Characteristics

Taluka /Tehsil Name	Population	Population Density per Square Kilometers	Average Household Size	Average Annual Growth Rate
Hala	262,639	538.19	5.77	2.57
Kandiaro	322,376	418.13	6.11	1.97
Moro	368,579	605.22	5.49	1.74
Rohri	370,582	459.21	5.60	2.68
Jati	201,868	57.86	6.02	2.6
Pano Aqil	436,372	418.78	5.57	2.59

⁹ IBAT Proximity Report. Generated under licence 1400-48641 from the Integrated Biodiversity Assessment Tool on 11 September 2023 (GMT). www.ibat-alliance.org

¹⁰ Sindh District 2021 Profiles, Research & Training Wing, Planning & Development Department Government of Sindh.

<https://pnd.sindh.gov.pk/storage/resourcePage/62u7SvClgi5XnYvm2a5n3vvTesu4DcqKnhbxeyJP.pdf>

4.6.2 Caste and Tribes:

169. The major castes and tribes in the sub-project areas include Khaskhely, Malah, Solangi, Khoso, Jatoi, Memon, Machhi, Rind, Sangrasi, Chohan, Shahuk, Bheel, Marri, Domki, and Kohli.

4.6.3 Mother Tongue:

170. Sindhi serves as the primary language in the sub-project area. Additionally, most of the people, particularly males, can also speak Urdu and Saraiki.

4.6.4 Drinking water and sanitation:

171. In the project area, women and children play a significant role in fetching water for drinking and domestic purposes. Fortunately, the underground water in this region is mostly sweet and suitable for consumption. Various sources of water are available, including hand pumps, tube-wells for irrigation, and access to canal water in several villages. However, in some areas, water is primarily sourced from hand pumps for drinking purposes. Unfortunately, there is a concerning issue regarding the disposal of wastewater and solid waste, as these are often disposed of in open areas.

4.6.5 Health:

172. The health situation in the project area is concerning, with many people suffering from diseases such as hepatitis, typhoid, diarrhea, and other hygiene-related illnesses. Tragically, some women lose their lives during childbirth due to the unavailability of maternal health facilities. Additionally, a significant number of women in the community are malnourished, often being the last to have meals within their families. In the Old Hala project area, there are five Basic Health Units (BHUs): two in Hala, one in Bhanote village, one in Jumo Shahuk village, and one in Sekhat village of Matiari District. In Moro, there are three BHUs: one in Kandiaro village, one in Dera Mohabat Khan, and one in Khan Muhammad Chandio village of Noushero feroze. In Jati, there are three BHUs: one in Shah Bandar, one in village Mirpur Batharo, and one in Sekhat village of Sujawal District. Seriously ill patients are usually transported to Matiari, Nousheroferoze, or Sujawal for treatment, or to the Hyderabad civil/district hospitals.

4.6.6 Educational Facilities:

173. Within a 1-kilometer radius on both sides of the sub-project area, there are 10 primary schools for boys, 4 primary schools for girls, 1 middle school for boys, 1 middle school for girls, 1 high school for boys, and 1 high school for girls.

4.6.7 Housing:

174. In the project area, the rural population predominantly resides in isolated settlements. These houses are constructed without formal layouts or plans and are typically made of mud or huts. Most of them feature boundary walls that enclose space for cattle and storage of goods and grains. The roofs of these dwellings are crafted from a combination of wooden beams, date-palm mats, and a top layer of clay plaster. Notably, the inhabitants own their houses.

4.6.8 Social Cohesion and Conflict

175. The social organization within the surveyed villages is primarily based on the Biradari (tribal) system, where each tribe is led by a tribal head, often also a landlord and political leader. Interaction among families of the same tribe is strong, particularly in matters like marriage, where marrying within the same tribe is preferred. Interactions between different tribes are less common, given the large number of villages in the area. Over time, separate villages have been established as land gets divided among successive generations of brothers within a family.

4.6.9 Conflict Resolution within Tribes and Villages

176. There are no major inter or intra-tribal disputes in the project area. Most conflicts, which are mainly related to voting rights, marriage settlements, and other local matters, are resolved by the village head or the tribal leader. Majority of the conflicts are resolved at the village level, and the decisions of village heads or tribal leaders are generally accepted within the community.

177. In case of serious matters, local influential politicians (who are often also tribal leaders) intervene to settle the dispute. Occasionally, when parties do not agree on the decision of village head or tribal leader, matters may go to the police and ultimately to the court of law. The police and the court of law are the last options and these are rarely exercised.

4.6.10 Transport

178. In terms of transportation, villages of the project area have village tracks or blacktop roads, although many are in poor condition, with local governments responsible for their maintenance. Additionally, a national motorway/highway(N-5) connecting Karachi, Hyderabad, Sukkur, and other provinces passes through the project area. For human transport, vans and pickups are the primary modes of transportation for the general public. Trucks, trailers, and tractor trolleys are used for transporting agricultural goods, while trucks are essential for moving animals to Hyderabad and Karachi. Trucks and trolleys are also employed for transporting firewood and furniture wood.

4.6.11 Energy Source

179. Electricity is available in project area villages and is primarily used for lighting houses and operating tube wells for drinking water and irrigation. In addition to electricity, people in the area collect firewood from the surroundings or purchase it from nearby towns. Firewood consumption averages 10 maunds (one maund equals 40 kg) in winter and 6 maunds in summer per household.

4.6.12 Archaeological and Cultural Heritage

180. There are total 04 archaeological sites situated near the subproject area. The current condition of both archaeological sites is intact. Details of the archaeological sites are given in the Table-4-6. The archaeological map of the subproject area is provided in Figure 4-9.

Figure 4-9: Archaeological Sites



Tomb of Hazrat Shah Abdul Latif Bhittai



Tomb of Mir's near Khudabad, Matiari



Dargha Haleji Shareef near Pano Aqil



Baiji Dargha near Baiji Bund

Table 4-6: Number of Archaeological Sites in the Project Area

S. No	Name/Description	Location	District	Estimated Distance (km) from the Sub-Project Area
1	Hala Monuments (Mir's Tombs)	Fateh Pur, Hala	Matiari	26 km from S.M Bund
2	Shrine of Shah Abdul Latif Bhittai	Bhitt Shah Hala	Matiari	10 Km from S.M Bund.
3	Dargha Haleji Shareef	Pano Aqil	Sukkur	14 km from Baiji Bund
4	Dargha Baiji Shareef	Pano Aqil	Sukkur	14km Near Baiji Bund

5. ANALYSIS OF ALTERNATIVES

5.1 GENERAL OUTLINE AND SCOPE .

181. The discussion and analysis of alternatives in this IEE study consider pragmatic strategies that will promote the elimination of negative environmental and social impacts. It is imperative to assess different alternatives to reach the most viable possible option. Different alternatives were considered at the design stage of the proposed project and at the time of preparing this IEE study.

5.2 Categorical Analysis of Alternatives

182. Categorical analysis of alternatives is an integral part of the IEE process to select the best preferable option among all the possible project options by comparing the potential positive and negative impacts for each alternative in terms of environmental, social and economic aspects as shown in Table 5-1. For the proposed project, different alternatives were analysed.

A. Alternative-I: Without Project

B. Alternative-II: With Project

183. Comparing the "No project" option with the execution of the project for the proposed project activity entails evaluating the potential benefits and drawbacks of each option.

5.2.1 Alternative-I: Zero Alternative/Without Project

184. Without restoration and rehabilitation, the flood mitigation structures will result in the following potential issues:

- ***Status Quo Maintenance:***

185. The "No Project Option" entails maintaining the existing flood mitigation structures along the river Indus without any significant modifications or upgrades. This means that the structures will remain in their current state, potentially without necessary repairs or improvements.

- ***Limited Environmental Impact Consideration:***

186. Since this option involves no changes to the existing infrastructure, there is limited consideration for environmental impacts or mitigation measures. It does not incorporate innovative designs or materials to reduce environmental consequences.

- ***Vulnerability to Future Flooding:***

187. By maintaining the status quo, this option leaves the region vulnerable to future flooding events. The existing structures may not be equipped to handle increasingly severe weather patterns and rising water levels, which could lead to extensive damage.

- ***Short-Term Environmental Impact:***

188. While this option avoids immediate construction and the associated environmental disruption, it does not address the long-term environmental impact of potential flood events, which could be more significant without enhanced flood defences.

- **Long-Term Costs and Consequences:**

189. Although the "No Project Option" avoids immediate community disruption, it may result in significant long-term costs. These costs could stem from flood damage, recovery efforts, and the inability to prevent or mitigate future flooding events effectively. In the absence of infrastructure improvements, the region may face recurring financial and social consequences.

5.2.2 Alternative-II: With Project (Innovative Flood Resilience Design) Option)

- **Forward-Thinking Flood Resilience:**

190. The "Project Option" represents a forward-thinking approach that involves innovative flood resilience design and comprehensive rehabilitation of the bund infrastructure along the River Indus. It aims to proactively address the challenges posed by potential flooding events.

- **Environmental Considerations and Mitigation:**

191. This alternative prioritizes environmental considerations and mitigation measures. It will incorporate advanced materials and designs that help reduce ecological impacts. For example, the use of eco-friendly construction materials or techniques that minimize disturbance to local ecosystems.

- **Enhanced Flood Protection:**

192. The primary objective of this project option is to enhance flood protection significantly. By elevating and strengthening bund spurs, incorporating stone pitching and aprons, it aims to reduce the risk of extensive damage during flooding events. This proactive approach will safeguard vital infrastructure and communities.

- **Temporary Community Disruption:**

193. While the construction associated with this option may cause temporary disruption to local communities, it is a necessary trade-off to ensure long-term community safety. The goal is to balance the short-term inconvenience with the long-term benefits of enhanced flood defenses.

- **Long-Term Cost Savings:**

194. Despite a higher initial investment, this option is expected to yield long-term cost savings. By reducing the need for frequent maintenance and repairs and by extending the lifespan of the infrastructure, it will result in overall lower costs in the future. Additionally, it helps mitigate the financial and social consequences of potential flood events by preventing or minimizing damage.

195. The "No Project" option is not viable, leaving vulnerabilities and potential long-term costs. Thus, the "Project (Alternative 2) Innovative Flood Resilience Design" is preferred for its proactive flood resilience, environmental focus, and cost-effectiveness in safeguarding communities and infrastructure.

196. Table 5.1 provides brief comparison of both alternatives with respect to environment and social view points.

Table 5-1: Comparison of Alternatives

Options	Technical Comparison	Environmental Comparison	Social Comparison	Cost Comparison
NO PROJECT OPTION VERSUS PROJECT OPTION				
No Project Option	<ul style="list-style-type: none"> Limited technical changes, maintaining existing structures. Minimal innovation in flood mitigation design. Potential risk of inadequate protection against severe flooding. 	<ul style="list-style-type: none"> Limited consideration for environmental impacts. Maintains the current ecological status but does not actively improve it. Potential for greater long-term environmental consequences due to increased flood damage. 	<ul style="list-style-type: none"> Minimizes immediate disruption to local communities. Does not prioritize community safety in the event of severe flooding. Potential for greater social disruption and economic consequences during flood events. 	<ul style="list-style-type: none"> Lower initial costs but potential for higher long-term expenses due to flood damage. Recurring financial and social costs associated with flood events.
Project Option	<ul style="list-style-type: none"> Utilizes advanced engineering techniques and innovative designs. Comprehensive rehabilitation of bund infrastructure. Enhanced flood resilience and protection against severe flooding. 	<ul style="list-style-type: none"> Prioritizes environmental considerations and mitigation measures. May incorporate eco-friendly materials and techniques to minimize ecological impact. Reduces the risk of significant environmental consequences by enhancing flood defenses. 	<ul style="list-style-type: none"> Balances short-term community disruption with long-term flood protection benefits. Enhances community safety by reducing the risk of extensive flood damage. Mitigates social disruption and economic consequences associated with potential flood events. 	<ul style="list-style-type: none"> Involves a higher upfront investment but offers long-term cost savings. Reduced need for frequent maintenance and repairs. Mitigates financial and social consequences of potential flood events.
TRADITIONAL REHABILITATION AND ENHANCEMENT VERSUS INNOVATIVE FLOOD RESILIENCE DESIGN				
Traditional Rehabilitation and Enhancement	This approach relies on well-established engineering practices that are commonly used in similar projects. It involves standard methods for rehabilitation and reconstruction,	This alternative relying on conventional practices, is likely to have an environmental impact typical of standard engineering	The shorter implementation time of this Alternative is advantageous in terms of minimizing disruption to local communities. It	This alternative involves lower initial costs because it follows standard engineering practices and has a shorter implementation

Options	Technical Comparison	Environmental Comparison	Social Comparison	Cost Comparison
	<p>resulting in a relatively shorter implementation timeline. The focus here is on efficiently restoring the structures without extensive design modifications.</p>	<p>approaches. It may not prioritize environmental considerations or incorporate extensive mitigation measures, potentially resulting in limited reductions in environmental consequences</p>	<p>reduces the period during which communities might be affected by construction activities. However, it's important to note that this alternative provides limited flood resilience, potentially leaving communities vulnerable to future flood events.</p>	<p>timeline. However, it may result in higher long-term maintenance expenses, as the structures might require more frequent repairs and updates due to their limited flood resilience.</p>
<p>Innovative Flood Resilience Design</p>	<p>This alternative requires a higher level of specialized engineering expertise. It proposes an innovative design that emphasizes flood resilience. This design may incorporate advanced materials and construction techniques to achieve a higher level of protection. However, these enhancements also lead to a longer implementation period, as the design and construction phases are more complex and time-consuming.</p>	<p>This alternative has the potential to reduce environmental impact through its innovative design and materials. It may incorporate environmentally friendly practices and mitigation measures, such as erosion control and habitat preservation. Additionally, the focus on long-term sustainability can result in less harm to the environment over time.</p>	<p>Although this Alternative may cause more significant disruption due to its longer implementation timeline, it offers a crucial benefit of enhanced flood protection. This is particularly important for community safety in flood-prone areas. The temporary inconvenience during construction may be outweighed by the long-term benefits of reduced flood risk.</p>	<p>While this Alternative requires a higher upfront investment due to its specialized design and longer construction period, it has the potential for long-term cost savings. The enhanced flood resilience and durability of the infrastructure can lead to reduced maintenance costs and increased longevity. Over time, this may result in a more cost-effective solution.</p>

5.3 Recommended Option .

197. Based on a comprehensive analysis of alternatives between the 'Traditional Rehabilitation and Enhancement' and 'Innovative Flood Resilience Design', the recommended option is the 'Innovative Flood Resilience Design' approach. This option demonstrates favourable technical, environmental, and social outcomes, while also proving to be cost-effective. It prioritizes innovative flood resilience, environmental considerations, community safety, and long-term cost-effectiveness, making it the more feasible choice for safeguarding communities and infrastructure.

6. PUBLIC CONSULTATION AND DISCLOSURE

6.1 GENERAL

259. This section describes the outcome of the public consultation sessions held with different stakeholders that may be affected (positive / negative) by the proposed project activities. Public consultation is a mandatory part of the IEE / EIA process for development projects. The adequacy of the public consultation and information disclosure is one of the basic criteria used to determine the project compliance with the national laws.

260. The consultation process was carried out in accordance with the requirements of Pakistan environmental procedures. The objectives of this process were to:

- Informing the public about what is proposed project.
- Identify and involve all stakeholders, especially local residents, in the consultative and participation process;
- Share information with stakeholders on the design and construction of the proposed project and anticipated impacts (positive / negative) on the physical, biological and socio-economic environment of the project area;
- Understand stakeholders' concerns regarding various aspects of the project, including the existing available facilities and problems, construction of the project and the likely impacts of construction and operation related activities;
- Understand the perceptions, assessment of social impacts and concerns of the communities in the vicinity of the proposed project;
- Provide an opportunity to the public in the public consultation session to provide valuable suggestions for the project design in a positive manner; and
- Reduce the chances of conflict through the early identification of controversial issues and consult them to find acceptable solutions.

6.2 Consultation and Participation Process

261. For ascertaining the perceptions of different stakeholders about the project (during construction/operation), consultation meetings were held with them. Site visits of dam sites were conducted on 8,10,23 and 24 august and 4-5 September 2023. Consultation meetings were carried out during the site visit with local communities of Jatio Village, Sarvari Colony Village Old Halla, Mulla Sawari Goth, Bakhi Kathri, Village Daim Khan Palijo, Village Jahan Khan Jatoh, Solangi Village etc. Consultation pictures have been provided as Figure 6-1. Consultation is a continuous process and would be carried throughout all stages of the project implementation.

6.3 METHODS OF PUBLIC CONSULTATION

262. Public consultation was carried out in order to establish stakeholder's opinion regarding project implementation. The following methods were used for public consultation with project stakeholders:

- Scoping Sessions
- Informal Meetings
- Individual Interview

6.4 IDENTIFICATION OF STAKEHOLDERS

263. Stakeholders are those who have a direct or indirect interest in project development, and who will be involved in the consultation process. During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. The stakeholders identified during field survey were the local residents, private land owners, shop keepers, farmers, job holders (Govt / pvt), drivers, daily wage labor and students. All the stakeholders had different type of stakes according to their professions which are listed down along with their comments and/or feedback. Informal group discussions were also held as an additional tool for the assessment of the perceptions of the stakeholders.

6.5 MAJOR STAKEHOLDERS AND THEIR APPREHENSIONS

264. The Table-6.1 contains the list of major stakeholders.

Table 6-1 Stakeholders Contacted in the Project Area

Sr. No.	Stakeholder Category	No.
1	Farmers	18
2	Shop keepers	9
3	Job (Govt / Pvt)	11
4	Daily wage labor	7
5	Students	5
6	Drivers	3
7	Unemployed	7

265. No major concerns were raised by the local residents during these consultation meetings. Participants showed their full support for project implementation. No private land acquisition is involved in the sub project. Figure 6-1 below shows the pictorial view of interviews and consultation meetings held with the stakeholders.

6.6 CONSULTATION MEETINGS AND FORMAL AND INFORMAL GROUP DISCUSSIONS

266. In order to get spontaneous responses, scoping sessions in the proposed project area were held to extract qualitative information about the perception and apprehensions about the project and the views of the locals were formally recorded in order to address and incorporate their comments and concerns into the project design.

267. Consultation meetings regarding project impacts, their magnitude and mitigation measures were held with the local residents, private land, shop keepers, farmers, job holders (Govt / pvt), drivers, daily wage labor and students to determine their concerns regarding proposed sub-project works.

268. Generally, it was found that people were already aware of the proposed project. After the meetings, most of the respondents including all local residents and other stakeholders showed their full support for the proposed sub-projects. This project will be beneficial in terms of water resource management and agricultural development, not only for the local residents but also good for the development of the area.

Table 6-2: Community Concerns and Consultant Responses

Sr. No	Concern	Response
1.	Does this project require any land acquisition for development, or any demolish of house, building?	Not required land acquisition but where need to demolish any building the department will concern before.
2.	Will trees cutting involved in the project.	The first priority is to avoid tree cutting. If cutting trees becomes a necessity, it will be compensated by planting new trees.
3.	There is a lot of unemployment in our area, will our locals be hired to work in this project?	The project will create the job opportunity and locals will be given preference for these job opportunities.
4.	Dust will be produced during the construction which will affect the people of area and may cause lungs diseases.	The contractor will be bound to sprinkled the water on dusty paths regularly on daily basis which will be monitored by the consultants.
5.	Due to the movement of loaded trucks during construction, congestion on the access road will increase.	Construction machinery and asphalt plant will be situated away from residential areas. To avoid restricting daily movement, construction vehicles will remain confined within designated areas.
6.	What would be the mechanism for noise control during the construction phase due to the operation of heavy machinery?	Noise emissions from vehicles and machinery will comply with national standards, and high noise generating equipment will be provided with mufflers. Noise generating activities will not be carried out during night time near the residential areas.
7.	Increase in traffic and safety hazards will create problems for the local population and surrounding communities.	A detailed health and safety plan will be developed to mitigate construction and operation risks on local residents and communities.
8.	Solid waste produced during construction should be disposed of timely.	Solid waste generated during construction will be disposed of safely at approved waste disposal sites.
9.	Damaged lands should be rehabilitated/ restored after the construction work is completed.	The contractor will rehabilitate/ restore the lands damaged by the construction activities.
10.	Local labour should be hired during construction by the contractor.	There will be contract clause in the contract of contractor for hiring local labour during the construction of the project.
11.	How long will it take to start the construction work of the bund?	The rehabilitation of the dam will begin as soon as possible possibly within 3 months
12.	How long will it take to complete the project?	The project is expected to take approximately 10 months to complete.

Figure 6-1: Pictorial view of interviews & public consultations



Mulla Sawari Goth Old Hala



Bakhi Kathri Kandiaro District



Village Daim Khan Palijo, District Sujawal
(Surjani Bund)



Village Jahan Khan Jatoi (Surjani Bund)



Solangi Village, Taluka Pano Akil District
Sukkur (RN Bund)



District Rohri, Sindh



Goth Deh Phullal



Sarvari Colony Village

6.7 Departmental Consultation

269. Stakeholder consultations were also conducted with relevant public sector departments i.e. Forest department, Wildlife department etc. during the field visits on 13-14 September and 18th October, 2023 on IBAT results. Consultations were conducted to obtain the views and concerns of stakeholders for the proposed sub-projects, and the IBAT results were shared for verification. Table 6.3 below presents the details of these consultations, including stakeholders' designations/departments and their views and concerns regarding the proposed sub-projects.

Table 6-3: Departmental Consultation Concerns and Responses

Concerned Departments/Persons	Stakeholder Views/Concerns	Response/Actions
Wildlife Department, Sindh Hussnain Raza Assistant wildlife and forest Sindh. Matiari 0321-5077110 Mr. Asad Rind Assistant wildlife and forest Sindh. Naushahro Feroze 0331-3073664 Syed Madad Shah Assistant wildlife and forest Sindh. Sujwal 0322-2111978	Solid waste or Construction waste should not be dumped into the river which will cause damage to the aquatic ecosystem.	Waste management plan will be prepared and implemented during the construction phase
	Hunting of animals should be prohibited during by the workers.	The contractor's workers will not be allowed to hunt any kind of animal in the project area and workers will also carry out awareness program regarding hunting of the animals.
	Construction activities will disturb the habitat of different animal and birds due to noise and dust pollution.	During construction activities the machinery used in the construction will be in good condition that cause the less noise pollution. The noise level will be monitored during the construction phase of the project. While the contractor will bound regular sprinkling of water to avoid the dust pollution.
Forest Department, Sindh Hussnain Raza Assistant wildlife and forest Sindh. Matiari 0321-5077110 Mr. Asad Rind Assistant wildlife and forest Sindh. Naushahro Feroze 0331-3073664 Syed Madad Shah Assistant wildlife and forest Sindh. Sujwal 0322-2111978	During the construction phase the workers could damage the flora of the project area by using them as fire fuel.	The workers will not be allowed to damage any kind of flora present in the area. Contractor will also carry out awareness program regarding the "no damage of Flora" in the project area.
	Is there any tree cutting involved in the project area?	No, there is no tree cutting involved in the project area.
	Is there any tree plantation program involved in the project if not there should be a tree plantation in the project	At the moment there is no such program of tree plantation. The suggestion is noted.
	The project should inform the Forest department Sindh if any of the tree cutting involved in the project and should get a NOC for tree cutting first.	The project will inform the Forest department Sindh, in case of any tree cutting.

270. The findings of IBAT were shared and discussed the forest and wildlife departments (Figure 6-2). Based on the discussions with these departments, it was concluded that there are no species of conservation importance, endemic species, endangered species, or critically endangered species present in the vicinity of the project area (Aol).

Figure 6-2: Departmental Consultations



Wildlife Officer Matiari district



Forest Officer Sujawal district

6.8 Women Consultations

According to the ADB SPS requirement, conducting 'meaningful consultations' is necessary to ensure inclusive project planning and implementation, which includes consulting all stakeholders, including women. However, due to the conservative nature of the communities near project sites of project areas concerning issues related to women, conducting consultations with women was not possible. It is important to mention here that in view of the highly conservative norms in the project areas, it was not possible to gain access to female respondents to obtain their responses. However, their views were indirectly obtained through their spouses and children to ensure the requirement of 'meaningful consultations' as per ADB SPS was fulfilled.

7. ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATION MEASURES

7.1 GENERAL

271. This chapter identifies the significant potential environmental and socio-economic impacts which may occur during the project life. The appropriate mitigation measures are also discussed in this and the subsequent chapters of this report. A brief qualitative description of each aspect and the affected environment in both project area is presented in the following sections.

7.2 METHODOLOGY FOR IMPACT SCREENING

272. Determining the significance of potential environmental impacts and their effects enables the identification of necessary mitigation and benefit enhancement measures as well as an estimation of the related financial costs associated with the impacts of a project. An impact can be either beneficial or adverse and is assessed by comparing the quality of the baseline conditions with the predicted quality once the project is under implementation or in place.

273. The procedure for determining the level of risk associated with each potential impact is described below.

274. The likelihood that the activity will have an effect on the environment, as well as the consequence of the effect occurring, are used to assess risk. It is frequently described as follows:

$$\text{Risk} = \text{Likelihood} \times \text{Consequence}$$

Table 7-1: Likelihood Scale

Likelihood	Definition	Scale
Certain	Will certainly occur during the activity at a frequency greater than every week if preventative measures are not applied	5
Likely	Will occur more than once or twice during the activity but less than weekly if preventive measures are not applied	3
Unlikely	May occur once or twice during the activity if preventive measures are not applied	2
Rare	Unlikely to occur during the project	1

Table 7-2: Consequence Scale

Consequence	Definition	Score
Catastrophic	The action will cause unprecedented damage or impacts on the environment or surrounding communities	5
Major	The action will cause major adverse damage on the environment or surrounding communities.	3
Moderate	No or minimal adverse environmental or social impacts	2
Minor	No or minimal adverse environmental or social impacts	1

Table 7-3: Risk Score Table

Likelihood	Consequence			
	Catastrophic	Major	Moderate	Minor
Certain	25	15	10	5
Likely	15	9	6	3
Unlikely	10	6	4	2
Rare	5	3	2	1

Risk: Significant: 15-25
 Medium: 6-10
 Low 1-5

275. Any 'Medium' to 'Significant' risk requires an environmental management measure to manage the potential environmental risk. Judgment will be required concerning the application of an environmental management measure to mitigate low risk situations.

276. The impact assessment matrix presenting the potential impacts and expected impacts during the different project development phases are presented in the Table 7-4 below.

Table 7-4: Impact Assessment Matrix

Activity / Impact	Likelihood	Consequence	Impact (Consequence x likelihood)	Residual Impact
Design Phase				
Flooding	Likely	Major	High	Low
Seismic damage	Likely	Moderate	Medium	Low
Land Acquisition	Unlikely	Minor	Low	Low
Construction Phase				
Air Quality	Likely	Moderate	Medium	Low
Noise Pollution	Likely	Moderate	Medium	Low
Vibration impacts	Likely	Minor	Low	Low
Borrowing and Quarrying of Materials	Likely	Moderate	Medium	Low
Solid waste generation incl. Spoil material	Likely	Moderate	Medium	Low
Resource Conservation	Likely	Minor	Medium	Low
Soil Contamination	Likely	Moderate	Medium	Low
Soil erosion/ silt run-off	Likely	Moderate	Medium	Low
Community Health and Safety	Likely	Minor	Medium	Low
Occupational Health and Safety	Likely	Moderate	Medium	Low
Traffic management	Likely	Minor	Medium	Low
Communicable diseases	Likely	Minor	Medium	Low
Flora	Likely	Minor	Medium	Low
Fauna	Likely	Moderate	Medium	Low
Use of local water resources	Likely	Moderate	Medium	Low
Contamination of water resources	Likely	Moderate	Medium	Low
Social and Cultural Conflicts	Likely	Minor	Medium	Low
Religious and Cultural Heritage	Unlikely	Minor	Low	Low
Operation Phase				
Damage to infrastructure	Likely	Major	High	Medium
Biodiversity impacts	Unlikely	Minor	Low	Low

7.3 Anticipated Impacts during Pre-Construction/ Design Phase

277. Following is the description of impacts envisaged and the recommended mitigation measures during pre-construction/design phase.

7.3.1 Land acquisition

Potential Impacts

278. The proposed works will be carried out on SID land and will utilize the department's owned Right of Way on all proposed sites. Therefore, there is no requirement for any type of land acquisition, including Voluntary Land Donation, for these sub-projects.

279. Currently, no community is occupying the existing structures for both permanent and temporary shelter and relief from floods, and no community asset has been identified for relocation. Therefore, no mitigation measures are needed.

Mitigation Measures

No measures required.

7.3.2 Seismic Hazard

Potential Impacts

280. According to the seismic zone map of Pakistan, the districts of Sukkur, Naushero Feroze, Sujawal, and Matiari are situated in Zone 2A, indicating moderate seismic activity (magnitude 5.0 to 5.9). In Zone 2A, the design of various structures should take into account the Peak Ground Acceleration (PGA). The occurrence of an intense earthquake in the vicinity of the project site could potentially lead to structural damage and instability, necessitating seismic design measures for safety. The resulting impact is expected to be of 'medium' significance.

Mitigation Measures

281. At the detailed design stage, the safety of the structures to be rehabilitated against the damages due to seismic activity need to be ensured. As such, structural designs of bund body, spillway and other structures need to follow the applicable criteria for the zone 2A recommended in the Building Code of Pakistan, 2021.

Residual Impacts

282. By adopting the aforementioned measures, the residual impact would be of low significance.

7.3.3 Flooding

Potential Impacts

283. The project area, comprised solely of bunds along the river Indus, faces a substantial risk of flooding, primarily driven by heavy rainfall events. The rapid floods originating from the river Indus pose a significant threat due to their high velocity and magnitude, as exemplified by the high magnitude flash flood of 2022. Future flooding events hold the potential to breach the bunds and make them vulnerable to damage, making this impact of high significance.

Mitigation Measures

- The estimation of river Indus discharge in the project area will be calculated against a 500-year return period. Hydrological studies should consider peak historical floods to incorporate into bund design, aiming to avoid or minimize future flooding impacts.
- A pre-construction visit is recommended to be conducted by a team comprising Route Engineer, Hydrologist and Hydraulic Engineer to validate the crossing locations and design.

Residual Impacts

284. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4 Construction Phase

7.4.1 Impact on Air Quality

o Fugitive Dust Emissions

Potential Impacts

285. Air quality will be affected by fugitive dust emissions from excavating activities of construction machinery, material stockpiles & material transportation, dust from the unpaved surfaces and movement of construction vehicles, which can be very harmful for the site worker, local population and natural vegetation. Emissions may be carried over longer distances depending upon the wind speed, direction, temperature of surrounding air and atmospheric stability. These emissions may also affect the bio-physical environment. List of air sensitive receivers is given in **Table 4-1**. This impact would be of medium significance.

Mitigation Measures

286. The measures are as follows:

- The material being transported or stored at the stockpiles will be kept covered with plastic to ensure protection of ambient air from fugitive emission during wind storm emissions.
- The contractor will monitor air quality on regular basis near the plant.
- Preventive measures against dust should be adopted for unloading operations. Regular water sprinkling of all excavation work the site should be carried out to suppress excessive dust emission(s);
- Grading operation will be suspended when the wind speed exceeds 20 km /hr.
- Enforce the maximum speed limit to 20km/h for vehicles using embankments and access road.
- Road damage caused by project activities will be promptly attended to with proper road repair and maintenance work.
- Proper Personal Protective Equipment (PPE) should be issued to the site worker and make sure the worker wears the PPE properly during working on site.

Residual Impacts

287. By adopting the aforementioned measures, the residual impact would be of low significance.

o Smoke from Burning of Waste Material or Burning Firewood

Potential Impacts

288. A number of big and small fires in the labor camp can produce smoke and smog, which can cut off visibility, reduce traffic ability and cause suffocation along with causing diseases of respiratory tract.

Mitigation Measures

289. The mitigation measures will be as follows:

- It is contractor's contractual obligation to use and provide clean and smoke free fuel in the labor camp.
- Cutting and burning trees or shrubs for fuel should be prohibited.
- Gas Cylinders should be used in the labor camp for cooking purposes.

o Vehicular and Generator Exhaust Emissions

Potential Impacts

290. Emissions of noxious gases from movement of heavy machinery and generators etc. would release emissions which would certainly add to the ambient air levels of the immediate vicinity. Also, the movements of heavy machinery and vehicles of old make and poor engine condition tend to release more than new well-tuned vehicles while the use of low-grade fuels and lubricants also increase pollutant emission levels.

Mitigation Measures

291. The mitigation measures will be as follows:

- All vehicles during construction activities will be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions;
- Emissions from power generators and construction machinery are important point sources at the construction sites. Proper maintenance and repair is needed to minimize the hazardous emissions.
- SEQS / WHO applicable standards to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works.
- Best quality fuel and lubes should be purchased where possible lead free oil and lubes should be used.

Residual Impacts

292. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.2 Impact of Noise Pollution

o Noise from Construction Activities

Potential Impacts

293. Noise is the most pervasive environmental nuisance. Noise is a by-product of human activity and area of exposure increases as a function of mobility and construction activities. The main sources for noise in the project area may be heavy machinery such as excavators, concrete mixing plant, stone crushers and other equipment. Noise generated by construction machinery is likely to affect sensitive receptors located within Aol (**Refer Table 4-1**). Health risks associated with exposure to continuous noise levels include high blood pressure, hypertension, annoyance and sleep disturbance, temporary threshold shift etc. This impact would be of medium significance.

Mitigation Measures

294. The mitigation measures will include the following:

- Vehicles and equipment used should be well fitted, as applicable, with silencers and properly maintained; that will reduce noise hazards according to permissible limits as fixed by Pak EPA (noise is 85 dB (A) while the WHO noise guidelines prescribed a limit of 55 dB (A).
- Construction workers will be provided suitable hearing protection like ear cap, or earmuffs and will be trained about their usage.
- Construction activities that are close to settlements will be stopped during night times if high noise values are observed.
- Consultations will be held to discuss appropriate solutions and techniques to control noise (e.g. mud or brick walls, bushes, etc.). Such hearings consultations should also be regularly conducted to solicit public feedback, to avoid public inconvenience and suggestions for improvement in working strategy / working environment and progress of project activities; and
- In accordance with the environmental monitoring plan, noise measurements will be carried out on regular basis at locations and schedule specified to maintain the level within the SEQs / WHO standards and to ensure the effectiveness of mitigation measures.

Residual Impacts

295. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.3 Vibration

Potential Impacts

296. Construction activities i.e. soil compaction, excavation, moving of heavy trucks have the potential to produce vibration levels that may be annoying or disturbing to humans and may cause damage to structures if appropriate precautions are not taken. (Refer **Table 4-1**). This impact would be of medium significance.

Mitigation Measures

297. Following mitigation measures should be implemented to combat the potential vibration impacts during the construction stage:

- Use of heavy machinery should be allowed in limited time only from 07.00 a.m. to 10.00 p.m. except for any emergency for which contractor should take prior approval; and
- Low vibration level machinery should be used and a system of regular maintenance and repairs to be employed.
- Where vibration could become a major consideration (within say 100m of schools, religious premises, hospitals or residences) a building condition survey should take place prior to construction.

- should be discussed with the local population as well as timing of the works to serve as a vehicle for further public consultation at the implementation stage and to assist in public relations.

Residual Impacts

298. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.4 Borrowing and Quarrying of Materials

299. The proposed sub-project will require approximately 3,477,018.40 cubic feet of earth material for the construction of ramps and approximately 136,603.40 cubic feet of stones for slope pitching. The stones will be sourced from commercial limestone quarries located in the hilly areas of Jamshoro district, specifically Khanote and Jamshoro Petaro. These quarries are established sources of stone and gravel for various projects in Sindh and do not pose any specific negative impacts.

300. However, improper borrowing of earth material may lead to issues such as the creation of deep permanent ponds with potentially stagnant water, which could have adverse health effects. If borrow pits are situated too close to embankments, they may pose structural challenges for these structures. Additionally, using cultivated areas as borrow areas may reduce the land's value. This impact would be of medium significance.

Mitigation Measures

- The barren or unfertile land will be preferred to use as borrowing area than the agricultural land avoiding areas that are permanently flooded. The borrow material will be obtained from riverine/floodplain areas owned by SID, which are currently uncultivable due to salinity and waterlogging. Since the area is flood-prone, there are few settlements in the vicinity.
- When earth is required to be lifted from private own land, then the owner(s) of the land would be duly compensated.
- Borrow areas will be selected at least 150 meters away from existing embankments to ensure the stability of these structures, as well as other settlements, civil works, and natural habitats.
- The contractor will not leave the borrow pits in such a condition that they are unusable and could be filled with rain water and cause the problems for the community e.g. breeding place for mosquitoes etc.
- The contractor will ensure that selected borrow areas are clearly demarcated, including the allowable depth of the excavation, before starting any soil removing.
- The edges of the pits should be given flat slopes and area should be leveled as far as possible at the completion of the excavation.

Residual Impacts

301. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.5 Solid Waste Generation Incl. Spoil material

Potential Impact

302. Considering the labourers residing in the construction camp and the locally available labour, solid waste generation will take place. The major components of the labour camp waste will be garbage, putrescible waste, rubbish and small portion of ashes and residues. Other type of wastes may include inorganic construction wastes including hazardous waste.

303. Spoils will be generated from the excavation activities. Disposal of spoil / surplus material may cause negative environmental impacts, if not properly mitigated during implementation of the proposed project. Potential impacts from spoils and its disposal are (i) land for disposal of spoil, (ii) conversion of those land areas into a permanent dumping area, (iii) potential erosion from the spoil areas and spoil material reaching the river Indus, and (iv) aesthetic impacts. Approximately 770 m³ of material will be excavated, most of which will be reused after approval of quality control engineer. Estimated 136.45 m³ spoil will be dumped safely and levelled to avoid any harm to aesthetic sense at approved disposal areas. This impact would be of medium significance.

Mitigation Measures

- All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper solid waste management system. The contractor will coordinate with local representatives and administration of the concerned solid waste management department for the disposal of solid waste;
- The contractor must develop a plan of action with the help of concerned solid waste management department for transporting the waste to the disposal site;
- Toxic waste will be handled, stored, transported and disposed separately;
- The waste will be properly sealed in containers with proper labels indicating the nature of the waste; and
- Solid waste will be segregated at source so that it can be re-used or recycled.
- Waste management plan will be developed to implement an efficient and responsive solid waste management system during construction phase. Recyclable wastes e.g. steel bars will be sold to waste vendors;
- Reusable material will be used as a filling material during ground levelling;
- Solid waste generated during construction will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan; and
- The site will be restored back to its original condition after construction completion.
- The spoil material from the excavation will be dumped at designated places. The dumping sites must be approved by environment specialist of the Construction Supervision Consultant (CSC).
- The contractor will also ensure that no spoil material is disposed into River Indus/nearby canal and into any other water body along the project site.
- As far as possible barren/waste lands available will be used for disposal of the excavated waste material.
- The spoil material shall be deposited in layers and properly rolled and sprinkled to avoid any negative environmental impacts.
- Contractor will prepare and approve a spoil management plan, prior any disposal of spoil.

Residual Impacts

304. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.6 Resource Conservation

Potential Impact

305. During the construction, overburden on local resources is possible if construction facilities such as workers camp and construction camp built near rural areas and can create problems for local communities. There can be a conflict for resources between workers and local community. This impact would be of medium significance.

Mitigation Measures

- Use potable water bowsers for construction works and mineral water bottles/ ground water for drinking purposes;
- Plan for the provision/purchase of adequate insulation to reduce heat loss through construction plants;
- Reduction of wastage of water through training of workers involved in water use;
- Reuse of construction waste materials may be adopted wherever possible;
- Aggregates will not be sourced from River Indus bed.
- Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment;
- Efficient and well -maintained equipment and machinery will be used;
- The equipment and machinery will be turned off when not in use;
- A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels.

Residual Impacts

306. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.7 Soil Contamination

Potential Impacts

307. Surface soil has the potential to be contaminated by construction material, vehicle movements and various construction activities. Spillage of fuel, lubricants, cement and chemicals has the potential to result in contamination. Possible sources of spillage are:

- During transfer of fuel from one container to another or during refueling;
- Unloading of construction material due to careless handling;
- Maintenance of equipment and vehicles;
- Due to leakages from equipment and containers;

- It is anticipated that a large quantity of excavated material will need to be disposed of. If this waste material is not properly disposed of, it will contaminate the soil and water resources, especially during the rainy season. Improperly managed excavated material, if left exposed or not stored correctly, can easily erode and get washed away by rainwater. During the rainy season, the increased water flow can carry the eroded soil into nearby water bodies, causing sediment runoff. This impact would be of medium significance.

Mitigation Measures

308. The following practices will be adopted to minimize the risk of soil contamination:

- The Contractor will be required to train its workforce in the storage and handling of materials like oils, diesel, petrol, other chemicals, concrete and cement, etc., that can potentially cause soil contamination. The Contractor will be required to prepare a training manual and module for all the construction related activities along with the schedule of training program and submit to the supervising consultants for approval.
- Refueling areas will have impervious concrete bases with appropriate drainage to prevent spills from contaminating the surrounding area.
- During on-site maintenance of construction vehicles and equipment, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil.
- Oils, fuels and hazardous materials will be stored in appropriately bounded areas. Fuel tanks will have to be placed within sealed bunds capable of containing 120% of the total volume of the tank in case of leakage.
- Regular inspections will be carried out to detect leakages from vehicles and construction machinery.
- Vehicles and/or equipment with leakage will not be used, until repaired.
- Solid waste generated during construction and at camp sites will be properly treated and safely disposed of only in demarcated waste disposal sites.
- The construction phase will consume lot of cement additives and oils and the empty containers will contain dangerous amount of chemicals inside, which can impact the humans as cancer producers. All such containers must not be sold to general public and must be destroyed and sent for recycle. This will be contractor's responsibility who must seek consultant's supervision. The people must be warned against use of empty chemical containers through local press and erecting banners in project area.

Residual Impacts

309. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.8 Soil Erosion

Potential Impacts

310. Major considerations are as follows:

- Soil erosion may occur in the workshop areas as a result of improper runoff drawn from the equipment washing-yards and improper management of construction activities. Potential sources of soil erosion (due to wind or rain) include clearing of area for construction, preparation of camp sites, workshop areas, equipment washing-yards access tracks for operations, off road vehicular traffic on unpaved roads during construction.
- The reduction in vegetative cover along sides of project infrastructure will reduce the binding capacity of the soil and susceptibility to erosion by the force of rainfall, resulting in increased soil erosion and removal of plant nutrients. The loss of vegetative cover can increase propensity for landslides.

311. This impact would be of medium significance.

Mitigation Measures

312. Good engineering practices will help controlling soil erosion both at construction sites and in peripheral areas, particularly in haul tracks. Soil erosion remedial measures will be based on geotechnical, geomorphic and hydrological conditions of the project area and these will vary from site to site. However, the following measures will be adopted as per site conditions:

- All the freshly cut surfaces will be restored/stabilized as soon as possible;
- Seeding or plantation of erodible surfaces will be done;
- Construction activities will be planned in such a way so as to avoid cutting of erodible surfaces and earth movement in rainy season;
- Along cross-drainage structures of the access road where embankments are more susceptible to erosion by water runoff stone pitching or a riprap will be provided across the embankment.
- Proper monitoring of the soil erosion prone areas will be carried out during operation phase and soil conservation measures (if needed) will be carried out like provision of physical structures e.g. retaining walls, etc.

Residual Impacts

313. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.9 Community Health and Safety

Potential Impacts

314. The communities residing in the project areas might be at risk from the proposed works since deep excavation works will take place along with movement of heavy machinery and vehicles transporting the raw materials and spoils etc. to and from the work sites. This could potentially result in injury and/or death to community members, particularly women and

children if care and precautions are not taken while moving in the project areas. This impact would be of medium significance.

Mitigation Measures

- The Contractor will prepare the site specific community health and safety plan in compliance with applicable national and international regulations and guidelines.
- The Contractor will clearly barricade work areas to prevent access by the public, while ensuring passage by providing safe pathways for pedestrians around construction zones;
- The Contractor will exclude parking, waiting vehicles and vendors from areas adjacent to the work by means of clearly marked barricades and posted signage;
- The Contractor will remove excavated earth, spoil, rubble, cut vegetation and refuse whether generated by the project or discarded by third parties from areas within the construction zone, where it has potential to interfere with the public or generate dust;
- The Contractor will provide temporary lighting to facilitate construction during night time;
- The Contractor will remove hazardous conditions on construction sites that cannot be controlled effectively with site access restrictions and will barricade any excavations and materials placed near the public place (if applicable);
- Hard Barricades will be provided at the excavation deeper than 1.5 meter as per “NZS 3845:1999 Road safety barrier systems”;
- The Contractor will promptly reinstate any services and reinstall any physical facilities that are cut, disconnected or damaged during construction, and maintain or provide temporary services that are interrupted by construction. The Supervisory Consultant will inspect and certify the adequacy of all reinstated services and facilities;
- Installation and maintenance of speed control and traffic calming devices at pedestrian crossing areas especially near the settlements;
- An Emergency Preparedness and Response Plan (EPRP) in coordination with the local emergency responders to provide timely first aid response in the event of accidents and hazardous materials response in the event of spills;
- Instruct foremen to strictly enforce the keeping out of non-working persons, particularly children, off work sites;
- Timely public notification on planned construction works;
- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links;
- Any environmental condition that is disagreeable to the public and causes an avoidable nuisance can be addressed with additional provisions over and above those described above, as determined necessary by the supervisory consultant.
- These requirements will be incorporated into the bidding specification and contract documents, and will be binding on the contractor, at risk of penalty for noncompliance, as charges to be recovered from contractor for unsafe act or condition.

Residual Impacts

315. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.10 Occupational Health and Safety

Potential Impacts

316. Occupational Health and Safety (OHS) related impacts will arise during construction stage activities including clearing of earth, levelling, compaction, foundations, finishing, testing & commissioning. In a nutshell, occupational health and safety issues associated with the construction of proposed sub-projects will primarily include physical hazards; chemical hazards; and noise.

317. Noise: Construction and maintenance personnel may be potentially exposed to high levels of noise from heavy equipment operation and from working in proximity to vehicular traffic. As most of these noise sources can be prevented by using personal hearing protection by exposed personnel and implementation of work rotation programs to reduce cumulative exposure. Lack of Emergency Response Plan (ERP) or an inefficient response plan may lead to an accident or critical injury. This impact would be of medium significance.

Mitigation Measures

318. Following mitigation measures shall be adopted by the contractor to control accidents due to deep excavations:

- Proper barricading shall be applied to all excavation deeper than 6feet.
- Warning taps shall be applied to trenches which are around 3 feet deep.
- Isolation of area must be done during excavation activities to control accidents.
- Damping down of area to control fugitive dust.
- Where necessary, apply green sheet to control fugitive dust, especially during high wind season.
- Material shall be stored at least 3 feet away from the edges of excavations.
- Designated entry and exit points at all deep excavations.
- If any confined space encounters (excavation deeper than 10 feet or any main hole etc.), procedure for confined space entry shall be followed.

319. For further details, framework for Occupational Health and Safety Management plan has been developed to handle any health and safety issue of workers and community. Mitigation measures to prevent and control physical hazards include:

Moving Equipment and Traffic Safety

320. Establishment of work zones to separate workers on foot from traffic and equipment by:

- Routing of traffic to alternative roads when possible;
- Regulation of traffic flow by warning lights, avoiding the use of flaggers if possible;
- Reduction of maximum vehicle speeds in work zones; and

- Training of workers in safety issues related to their activities, such as the hazards of working on foot around equipment and vehicles; and safe practices for work at night and in other low-visibility conditions, including use of high-visibility safety apparel and proper illumination for the work space (while controlling glare so as not to blind workers and passing motorists).
- Provide appropriate PPE in conjunction with training, use, and maintenance of the PPE.
- Furthermore, the noise reduction options that should be considered which include:
 - Selecting equipment with lower sound power levels;
 - Installing suitable mufflers on engine exhausts and compressor components;
 - Installing vibration isolation for mechanical equipment;
 - Providing noise protection PPEs (ear plugs/ear muffs) to the construction workers;
 - Re-locating noise sources to fewer sensitive areas to take advantage of distance and shielding;
 - Developing a mechanism to record and respond to complaints; and
 - Regular monitoring of noise levels at active sites or near noise producing equipment/machinery and compare it to the available occupational noise standards.

Monitoring of OHS Activities:

321. During the construction phase of proposed project, occupational health and safety monitoring programs of the contractor (s) should verify the effectiveness of prevention and control strategies. The selected indicators should be representative of the most significant occupational, health, and safety hazards at the construction site and camps, and the implementation of prevention and control strategies. The occupational health and safety monitoring program should include:

- Regular inspection and testing of all safety features and hazard control measures focusing on engineering and personal protective features, work procedures, places of work, installations, equipment, and tools used;
- Surveillance of the working environment: The contractors should document compliance using an appropriate combination of portable and stationary sampling and monitoring instruments. Monitoring and analyses should be conducted according to internationally recognized methods and standards. Monitoring methodology, locations, frequencies, and parameters should be established individually for each project following a review of the hazards;
- Continuous and efficient surveillance of worker's health during the entire construction phase by the nominated officials of contractors; and
- Training: Training activities for employees (construction contractor & supervision consultant staff) and visitors should be adequately monitored and documented (curriculum, duration, and participants). Emergency exercises, including fire drills, should be documented adequately. Service providers and contractors should be contractually required to submit to the employer adequate training documentation before start of their assignment.
- Contractor(s) shall prepare a comprehensive OHS Plan as part of Site Specific Environmental Management Plan (SSEMP).

Residual Impacts

322. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.11 Traffic Management

Potential Impacts

323. During construction activities, large number of light and heavy vehicles is expected to use the community roads. Similarly, heavy machinery will be stationed in and adjoining areas of the project site. This may create a burden on the capacity of the existing road network and the project-generated traffic may be a nuisance for surrounding communities.

Mitigation Measures

- Construction traffic hindrance should be avoided by providing proper diversion and signage.
- Traffic management plan will be prepared by the contractor after consultation with RE for its implementation.
- GRM will be put in place to address community grievances in this regard.

Residual Impacts

324. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.12 Communicable diseases

Potential Impacts

325. The laborers in the contractor camp, truck drivers and like personnel who interact with each other have the potential for the spread of HIV/AIDS if the incidence exists. Majority of the people living in the surrounding of the Project, and potential labor are not aware of the source, mode of communication or consequences of HIV/AIDS. Although their religious and cultural value system, to a large extent excludes the outbreak or rapid communication of HIV/AIDS, yet its occurrence in such a situation cannot be precluded. It is necessary that awareness and preventive campaigns are run from time to time in the labor camps and the field offices of the Project to prevent the communicable diseases like Cholera, Typhoid and Tuberculosis.

326. There is a chance of spreading of an epidemic of Coronavirus disease (COVID-19) due to close interaction of the labor force during construction not only among the workers but also in the area. This impact would be of medium significance.

Mitigation Measures

327. The Contractor shall:

- Arrange to run an active campaign, in the labour camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS;

- Latest / Updated SOPs by WHO, national and provincial Government related to the construction industry to control spreading of COVID-19, should be implemented by the contractor and should be strictly monitored;
- Strengthen the existing local health & medical services for the benefit of labour as well as the surrounding villages;
- Ensure cleanliness and hygienic conditions at the labour camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by the Health Department;
- Locating a labour camp at least away from the villages (local settlement), and
- Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents.

Residual Impacts

328. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.13 Flora

Potential Impacts

329. No tree cutting is expected as this is restoration /rehabilitation project and being executed within its already available ROW. The Contractor's workers may damage the vegetation and trees (for use as firewood to fulfil the camps requirements). The cutting of small trees and shrubs will cause degradation of local environment as under:

- It will enhance soil erosion. Without the branches and leaves, to break its fall, heavy storms can quickly wash away the soil from even a gentle slope. Cutting down of trees/shrubs also takes away the roots that would otherwise help in binding the soil.
- During the entire construction period dust, laden polluted air will form a dust film on leaves thus blocking sunshine and stomata consequently hindering photosynthesis processes causing detrimental effect on the plant health.

Mitigation Measures

330. Following measures will be adopted during construction and operation stages.

- Campsites and Elevated Ground Storage Tanks (EGST) will be established on waste/barren land rather than on forested or agriculturally productive land. However, if such type of land is not available, it will be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth or agricultural area.
- Construction vehicles, machinery and equipment will remain confined within their designated areas of movement.
- The Contractor's staff and labour will be strictly directed not to damage any vegetation such as small trees or bushes. They will use the paths and tracks for movement and will not be allowed to trespass through farmlands.
- Contractor will provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel will not be allowed.

- The compaction of trenches should also be done properly. Inadequate compaction of trenches will result in flow of soil during rainy season resulting in increased soil erosion.
- As far as possible digging in the cultivated land should be done when the land is barren to avoid damage to agricultural crops.
- Open fires should be banned in the area to avoid hazards of fire in the project area.
- Tree cutting due to project intervention is not expected. However, ten saplings will be replanted in case a tree is cut as per EPA rule.

Residual Impacts

331. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.14 Fauna

o Mammals and Reptiles

332. The impact on mammals and reptiles will include the following:

During the construction phase, there will be minor negative impacts on the mammals and reptiles of the area, due to construction activities involving excavation, movement of labour, carriage of goods and machinery to various sites.

The key terrestrial species in the project area are:

Mammals:

- Indian Wild Boar (*Sus scrofa*),
- Smooth-coated Otter (*Lutrogale perspicillata*),
- Indian Grey Mongoose (*Herpestes edwardsii*),
- Asiatic Jackal (*Canis aureus*), and
- Fox (*Vulpes vulpes pusilla*).

Reptiles:

- Monitor (*Varanus sindanicus*),
- Sand Gecko (*Tropicolotes tripolitanus sindicus*),
- Cobra (*Naja naja sindica*),
- Pit Viper (*Gloydus himalayanus sindanus*),

333. Mammals, such as jackal, fox, porcupine, etc. will avoid these areas for fear of being persecuted. Same will be the case with reptiles; some reptiles might be killed during the digging and dragging operations. Movements of the mammals and reptiles will be restricted during the construction phase.

334. Eatable and refuse goods of the Contractor's camps may attract wildlife that might be hunted by the workers. The accidental striking of all terrestrial fauna by project vehicles on access routes is a considerable risk during the project. This impact will be of medium significance.

o **Birds-Avian Fauna**

335. The presence of migratory and sedentary birds is considered likely throughout the area surrounding the project footprint. Avifauna prefers undisturbed marshy habitats, such as that surrounding the larger streams and away from agricultural land. However, they are also observed within cultivated lands and around settlements of the project area. The presence of avifauna will increase during the winter months, with the arrival of migratory birds. However, there are no landing zones used by migratory birds in the immediate project area.

336. The key avifauna species in the project area are:

- Grey Partridge (*Perdix perdix*),
- Black-winged Stilt (*Himantopus himantopus*),

337. During construction, avifauna may be disturbed due to sensory disturbance from construction; movement of vehicles and crew personnel; location and operation of camps; operation of large plant; and site restoration. This will be a temporary disturbance within the project area. Following construction, there will be availability of wetland areas in the project area.

338. Birds will try to find shelter and food somewhere else and will tend to move away from the project area due to the activities mentioned above for fear of being hunted/trapped.

Mitigation Measures

o **Mammals and Reptiles**

- Hunting, poaching and harassing of wild animals will be strictly prohibited and Contractor will warn their labor accordingly.
- Noise generating activities will be avoided during the night.
- The camps will be properly fenced and gated to check the entry of wild animals in search of eatable goods. Similarly, wastes of the camps will be properly disposed off to prevent the chances of eating by wild animals, which may become hazardous to them.
- Vehicles will be maintained in good condition and provided with mufflers to reduce noise.

Residual Impacts

339. After adopting the above-mentioned mitigation measures, the residual impact will be of low risk of striking fauna on access routes.

o **Birds-Avian Fauna**

- Special measures will be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding.
- The contractor should be committed to ensuring the conservation and protection of wildlife within the project area. To achieve this goal, a strict "No Hunting" policy shall be implemented and enforced among all workers and personnel involved in the project.
- Staff working on the project should be given clear orders, not to shoot, snare or trap any bird.

Residual Impacts

340. By adopting the aforementioned measures, the residual impact would be of low significance.

o Impact on Fisheries

Potential Impacts

The Indus River is home to a variety of fish species, including Mrigal, Catla, Rohu, and others (Refer Section 4.4.2). These fish are not only essential for local food security but also contribute to the livelihoods of many communities through fishing activities. When flood mitigation structures like bunds are damaged, it can disrupt the river's natural flow and habitat, negatively affecting fish populations. Rehabilitating and strengthening the bunds can help maintain a stable river environment, allowing fish populations to thrive. Although construction activities will be along the river bank but these can lead to increased sediment runoff into the river, which can affect aquatic life. Excessive sedimentation can clog fish gills, smother aquatic vegetation, and reduce water clarity, making it more challenging for fish to find prey and navigate. This impact would be of medium significance.

Mitigation Measures

341. Although fish species in the river Indus may have the ability to migrate or move away from areas experiencing excessive sedimentation and disturbance due to construction. This natural mobility can be advantageous for their survival during the construction phase. However, following mitigation measures should be implemented:

- Implement sediment control measures, such as silt fences, sediment basins, or erosion control blankets, to prevent excessive sediment runoff into the river. Proper erosion and sedimentation control can help maintain water clarity and reduce the risk of sediment suffocating fish.
- Monitoring water quality during construction to detect and mitigate any pollution.

Residual Impacts

342. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.15 Use of Local Water Resources

Potential Impacts

343. The water resources of the project area mainly comprised of surface water (River Indus), canals and groundwater. There will be ample need of water not only for construction purposes (of concrete side slopes) but also for meeting the consumptive and non-consumptive needs of the campsites, workshop, washing yard, etc. It is obvious that these needs will be met from the existing resources of the areas in close proximity to the bund. This impact would be of medium significance.

Mitigation Measures

344. Mitigation measures regarding use of local water supplies are as follows:

- Availability of water for camp site facilities and construction purposes will be ensured by the contractor prior to start of construction activities. As per local Government Act, the contractor will seek approval from the local government for exploitation of the water resources.
- Contractor will ensure that the water availability of the existing local users remains unimpeded by the project interventions. The contractor will make arrangements for the availability of drinking water and construction works on his own. For this purpose, contractor will install hand pumps/tube wells accordingly.
- The Contractor will be required to act as a go-between closely with local communities to ensure that any potential conflicts related to common resource utilization for project purposes are resolved quickly.
- The contractor will prepare guidelines for the workers for minimizing the wastage of water during construction activities and at campsites.

Residual Impacts

345. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.16 Contamination of Water Resources

Potential Impacts

346. During stone pitching and earthworks activities, particularly in areas where the rehabilitation work closely aligns with the Indus river flow, there may be a temporary impact on water quality. Water resources (River Indus and Rohri canal) may get polluted from hazardous construction materials, wastewater effluent, solid waste, silt from construction and soil erosion, etc. both during construction and operation phases. This normally occurs when waste material is disposed of improperly. Pollution of water resources and its consequences may occur through following ways:

- Implementation of the project may aggravate the pollution of surface water resources of the Project area through contamination by the wastewater effluent and solid waste material generated from the kitchens and toilets at construction campsites.
- Subsurface water may be contaminated from the spills of chemicals, oil, lubricants, detergents, etc. through runoff from the construction area, construction camp, workshops and equipment washing-yards.

347. This impact would be of medium significance.

Mitigation Measures

348. Measures to prevent contamination of surface and ground water will include the following.

- Camps will be located at least 500 m away from the nearest local settlement to prevent the contamination of River Indus and canals, etc.

- Wastewater effluent from contractors' workshops and equipment washing-yards will be passed through an oil skimmer and to gravel/sand beds to remove oil/grease contaminants before discharging it into natural streams. Similarly, the wastewater effluent from the campsite will be treated before disposal into a stream.
- Borrow pits and natural depressions lined with impervious liners will be used to dispose of scraped obnoxious material, and then covered with soil. Cost of this item will be made part of Contractor's Bill of Quantities (BOQs). This will check potential groundwater contamination. Such measures will also be provided at stream side disposal of waste material in addition to retaining walls or gabions. Available stone (boulders) from excavated rocks will be used for retaining walls as well as for gabions. It will reduce the quantity of dumping material. However, all types of hazardous waste will have to be collected on site separately and stored in appropriate containers to be finally removed from site and be brought to adequate handling, recycling or disposal facilities.

349. Specific measures for water quality protection to be taken on the construction site will be the following:

- Fuels, lubricants and other hazardous material will have to be properly stored in adequate containers in sites equipped with retaining structures, including oil skimmers for the treatment of contaminated runoff water.
- Repair and maintenance work on machines and vehicles will only be done in specific places designed and equipped for this purpose (oil skimmer). These must be at a safe distance from the river Indus/Canals. No washing of vehicles will be done in or near the river Indus/canals.
- Water contaminated with concrete will have to be collected in sedimentation ponds and, if required, will have to be neutralized before being discharged to the surface water bodies of the area. Contamination of the River Indus with concrete or cement must be avoided.
- Sewage water from the camp will have to be collected and treated in a suitable septic tank before being released into the streams.
- Generally, waste should be reduced, re-used, recycled and the disposal has to be controlled.

Residual Impacts

350. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.17 Social and Cultural Conflicts

Potential Impact

351. During the construction phase of the proposed project, conflicts may arise between labor force and local community. Use of local resources and products by the construction workers can generate stress on the local resources. Furthermore, difference in cultural values may also cause discomfort to local residents. This impact would be of medium significance.

Mitigation Measures

- Local labor especially from nearby communities should be given preference for the construction works;
- Careful planning and training of work force to minimize disturbance to the local people;
- Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals; and
- Adequate training especially for the transitive workforce of the station (involved both in the construction process and in the commissioning) to regard the customs of the area so that the locals do not feel insecure.

Residual Impacts

352. By adopting the aforementioned measures, the residual impact would be of low significance.

7.4.18 Religious and Cultural Heritage

Potential Impacts

353. No graveyard will be disrupted due to this project. No historical or archaeological site has been observed or reported along the project area. So no mitigation measured for graves, cultural and historical sites needed. This impact would be of low significance.

Mitigation Measures

354. Currently no graveyard is affected by this project. However, if any graves affected by the project, they will have to be shifted. The proponent will obtain Fatwa from local Mufti before shifting the graves. During such operation the proponent will inform local administration and seek their assistance for security. The request will also be extended to health department for deputation of medical and paramedical staff during the operation. As referred earlier, no relocation of historical site is involved, so no mitigation is required except that contractor will follow the prayer timing particularly at prayer of Juma and the workforce will observe the sanctity of religious properties.

355. There are no cultural sites located within the study area and no impacts on archaeological sites are envisaged. However, the Contractor will be required to instruct the construction crews and site supervisors in respect of archaeological site recognition, conservation procedures, and temporary site protection. In case of a chance finding during excavation, the contractor will protect the site and notify the Engineer who will inform department of archaeology & museums through irrigation department and hand over such sites to the department if instructed by Engineer / irrigation department. The 'Chance Find' procedure is provided as Annexure 9.

Residual Impacts

356. By adopting the aforementioned measures, the residual impact would be of low significance.

7.5 Operational Phase

7.5.1 Damage to infrastructure

Potential Impacts

357. Breach of bund and associated structures is likely to occur. However, it will threat system sustainability and following factors may also contribute to this process:

- Improper operation of water control facilities;
- Reservoir sedimentation
- Deterioration of free board due to cattle trespass and other factors;
- Inadequate supervision;
- Lack of timely and adequate repairs; and
- Lack of coverage of hydraulic gradient.
- Natural hazard i.e. flooding and earthquakes.

358. This impact would be of high significance.

Mitigation Measures

359. To mitigate the above-mentioned impacts, the following measures shall be adopted:

- SID to monitor the system regularly;
- Annual checks and maintenance of bunds and its associated strictures which are affected by siltation or scour.
- Repairs on urgent basis; and
- Emergency response plan for bund breach shall be followed, which is attached as Annexure-2 of this report.

Residual Impacts

360. By adopting the aforementioned measures, the residual impact would be of medium significance.

7.5.2 Biodiversity impacts

Potential Impacts

361. The proposed works include only limited rehabilitation works of the bund structures damaged by the floods. Since these bunds have already been operational in the past, thus, the respective ecological characteristics have already adjusted to the flow regimes from these bunds and thus there will be no changes and/or negative impacts on the ecology/biodiversity and environmental flows (e-flows)¹¹ in the respective water bodies downstream of these bunds. Furthermore, the rehabilitation of the bunds will restore the pre-flood ecological and e-flow dynamic that was present downstream of these bunds. This impact would be of low significance.

¹¹ Environmental flows describe the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well being that depend on these ecosystems.

Mitigation Measures

No mitigation measures required.

7.5.3 Resilience to Extreme Events:

362. Strengthened bunds will be better equipped to withstand extreme weather events such as heavy floods and intense rainfall. By preventing breaches and protecting adjacent areas, these structures will help maintain a stable environment even during adverse conditions. This resilience can ensure that fish populations have a better chance of surviving and recovering after extreme events. This impact will be positive.

7.6 Induced Impacts

363. The proposed works will not result in any induced impacts. The works to be conducted will be in remote locations that will be away from any settled areas and based on the limited nature of the scope and scale of works, no stress on any of the resources or infrastructure will be caused and thus no induced impacts will take place.

7.7 Cumulative Impacts

364. There are no cumulative impacts expected from the proposed project activities since there will be no other works going on in parallel while the works proposed in this IEE study are being conducted in the respective sub-project areas.

8. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

8.1 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

8.1.1 General

365. The EMP is a strategic approach towards the effective implementation of the mitigation measures and environmental protection of the project area and its surroundings. This EMP ensures that the undue or reasonably adverse impacts of a project are prevented and the positive benefits of the project are enhanced. According to this plan, all the activities related to various phases of the project are controlled and monitored.

366. This EMP encompasses all the phases of the project and may be used as a quick reference by the personnel(s) of client and contractors for effective implementation of the proposed mitigation measures and tracking the overall environmental performance of the project.

367. This EMP addresses all the significant impacts that are identified during the impacts identification process. It will be amended in consultation with the concerned regulatory authority; if any issue has been overlooked or if any need would arise as the project continues.

8.1.2 Structure of EMP

368. The contents of this chapter are given below:

- Regulatory requirements
 - Purpose & need of the EMP
 - Objectives of EMP
 - Scope of EMP
 - Institutional arrangement for implementation of EMP
- ☐ Institutional arrangements for implementation of EMP during Construction phase
- Role and responsibilities of the functionaries involved in EMP implementation
 - Reporting mechanism
 - Non-compliance of the EMP
- ☐ Institutional arrangements for implementation of EMP during Operation phase
- Role and responsibilities of the functionaries involved in EMP implementation
 - Reporting mechanism
 - Environmental mitigation plan
 - Environmental monitoring plan
 - Implementation of EMP
 - NOC and other approvals
 - Stakeholder coordination
 - Trainings
 - Communication and documentation

- Environmental management cost
- Change management

8.1.3 Regulatory Requirements

369. This EMP refers to the applicable national and international legal framework for the proposed project for the protection of the environment.

8.1.4 Purpose & Need of the EMP

370. Primarily, the purpose of this EMP is to serve as a quick reference for the consultants, contractor as well as SID to implement the proposed mitigation measures effectively and to monitor the overall environmental performance of the project.

371. Furthermore, to house the procedure, which the SID follows to implement and maintain this EMP. The need of the EMP is mentioned as follows:

- Ensure that attention is paid to the actual environmental effects arising from construction and operation of the proposed sub-projects;
- Ensure that anticipated impacts are maintained within the predicted levels;
- Ensure that unanticipated impacts are managed or mitigated before they become a problem; and
- Ensure that environmental management brings about real environmental benefits and achieves environmental sustainability.

8.1.5 Objectives of the EMP

372. The main objectives of the EMP during different phases of the project is to implement mitigation measures and to evaluate the effectiveness of mitigation measures as proposed in the IEE and recommend improvement if any need would arise.

8.1.6 Scope of the EMP

373. The scope of the EMP includes the following phases of the project:

- Design phase
- Construction phase; and
- Operation phase.

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

8.1.7 Institutional Arrangement for Implementation of EMP

375. The following is a broad guideline that has been proposed for institutional setup under this project as a reference for SID.

a) Institutional Arrangements for Implementation of EMP during Construction Phase

376. The SID is the project's executing agency (EA). The key players involved during construction stage of the proposed project are the Project Director –Environmental safeguards staff; SEPA, the Contractor and the Supervisory Consultants (SCs).

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

- Project Director –Environmental safeguards staff;
- SC's Environmental specialist/engineer; and
- Contractor's Environmental engineer/scientist.
- SEPA

378. The construction contractor will make a bond through contract documents to implement the EMP. The IEE study and EMP will be included as a clause of the contract documents. The organizational setup for implementation of EMP is given below:

Roles and Responsibilities

379. The roles, remits and responsibilities of organizations that will be involved in EMP implementation are outlined below.

a) SEPA

380. SEPA is the regulatory authority for issuance of NOC for the proposed sub-projects. As part of its mandate, protection of environment is its responsibility. Therefore, this agency will undertake an audit (as and when required) of project activities with respect to the protocols as defined in the EMP.

b) Project Director:

381. Project director through environmental safeguards staff will have responsibility for assuring implementation of EMP. This includes the following:

- Ensuring that required environmental training is provided to the concerned staff.
- Carrying out random site visits to the construction site to review the environmental performance of the construction contractors.
- Review monitoring reports for the progress of environmental related activities.
- Make sure that the construction contractor is implementing the additional measures suggested by the supervision consultant in environmental monitoring reports.
- To assist contractor for obtaining necessary approval from the concerned departments.
- Maintaining interference with the other lined departments / stakeholders.
- Reporting to SEPA on status of EMP Implementation.
- Reporting to ADB on status of EMP implementation.

c) Supervision Consultant: Resident Engineer

382. Resident Engineer's (RE) roles and responsibilities will be:

- To oversee the performance of construction Contractor to make sure that the Contractor is carrying out the work in accordance with the tender design and follow the specifications;
- Ensuring that the day-to-day construction activities are carried out in an environmentally and socially sound and sustainable manner;
- Strong coordination with the Contractor and EA.

d) Supervisory Consultant: Environmental Specialist-Field

383. Supervisory consultant (SC)'s Environmental Engineer / Scientist will perform following responsibilities.

- Directly reporting to R.E
 - Preparing training materials and implementing programs
 - Ensure the implementation of the mitigation measures suggested in the EMP.
 - To supervise and monitor environmental activities being performed at site
 - To organize periodic environmental training programs and workshops for the Consultants and Contractor staff.
 - Periodic reporting as mentioned in the EMP.
 - Suggest any additional mitigation measures if required.
- Ensure that no civil works are started without submitting and approval of Contractor SSEMP.

e) Construction Contractor: Environmental Engineers / Managers

384. Its contractor contractual obligation to appoint site Environmental Engineer / Manager with relevant educational background and experience. Contractor Environmental Engineer manager will carry out the following activities:

- Implementation of mitigation measures and SSEMP recommendations at construction sites.
- Plan, manage, monitor and coordinate the entire construction phase in term of HSE.
- Take account of health and safety risk to everyone effected by the work.
- Liaise with the client and consultant for the duration of the project to ensure that all the risks are effectively managed.
- Maintain and practice good housekeeping and keep everything at work in its proper place.
- Ensure suitable welfare facilities are provided from the start of project and maintained throughout the construction phase.
- Contractor will be bound through contract to take action against all the special and general provision of contract document.
- Ensure the provision of Personal Protective Equipment (PPE), conduct the environmental, health & safety training to the workers / Labour and coordinate

with Environmental Engineer of SC.

- The Contractor will prepare and submit the Site-Specific Environmental Management Plan (SSEMP) to the CSC and PMU for approval at least ten (10) days prior to commencement of the physical works.

8.1.8 Employees/ Workers Responsibility/ Obligations

385. Employees / workers have obligation to take reasonable care for the health and safety of themselves and of other persons who may be affected by their acts or omissions at work. The other responsibilities are:

- To cooperate with employer in assisting them to fulfill their statutory duties.
- Comply with safety instructions and procedures.
- Use all safety equipment properly and do not tamper it.
- Not to interfere with deliberately or misuse anything provided, in accordance with health and safety legislation, to further health and safety at work.

8.1.9 Reporting Mechanism

386. Progress reporting related to environmental activities will be responsibility of supervision consultant, environmental specialist. He will also be responsible for submitting monthly EMP compliance report for the project to the PD Office. A semi-annual report of environmental activities shall be submitted to NDRMF by SID.

387. PD will in turn add his remarks / comments / feedback and submit the report to NDRMF and SEPA in accordance with the frequency defined by them. In case the frequency is not defined and/or communicated, bi-annual monitoring reports based on the monthly monitoring report will be submitted to ADB for disclosure on ADB website.

8.1.10 Inclusion of EMP in Contract documents

388. In order to make the Contractors fully aware and responsible of the implications of the EMP and to ensure compliance, it is recommended that mitigation measures be treated separately in the tender documentation and that payment milestones should be linked to performance, measured by execution of the prescribed mitigation measures. Such a procedure would help ensure adequate management of project impacts is carried out during the construction and operation phases, where a consistent approach will be expected on behalf of the Contractor and its sub-contractors so that data and information collected from monitoring programs is comparable with baseline monitoring data.

389. The Contractor shall be made accountable through contract documents and/or other agreements for fulfilling the environmental safeguard obligations and delivering on the environmental safeguard components of the Project. Contractors shall be prepared to co-operate with the executing agency and supervising consultants and local population for the mitigation of adverse impacts. After the EMP's inclusion in the contract documents, the Contractor will be bound to implement the EMP and will engage appropriately trained environmental and social management staff to ensure the implementation and effectiveness of the mitigation measures.

390. The Contractor is required to bid for executing the EMP, including the recommended mitigation measures and monitoring programs, as part of its Bill of Quantities (BoQ).

8.1.11 Environmental Management and Monitoring Plan

391. Potential impacts and their mitigation measures are devised against the project activities to minimize their significance. Responsibilities for the collection and analysis of data as well as the reporting requirements have been outlined in Table 8-1. Implementation of environmental impact mitigation measures during construction is to avoid and reduce short- and long-term potential environmental impacts. Incorporation of environmental impact mitigation considerations into the tender and contract documents is a fundamental pre-requisite for effective implementation of the EMP.

Table 8-1: ENVIRONMENT MANAGEMENT AND MONITORING PLAN (EMP)

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
A. Design & Planning Phase					
1.	Seismic Hazard	Failure of design	<ul style="list-style-type: none"> At the detailed design stage, the safety of the proposed water conservation structures against the damages due to seismic activity need to be ensured. As such structural designs of bunds need to follow the applicable criteria for the zone 2A recommended in the Building Code of Pakistan 2021. 	Design Engineer	SID
2.	Flooding	Failure of design	<ul style="list-style-type: none"> The estimation of River Indus discharge in the project area should be calculated against a 500-year return period. Hydrological studies should consider peak historical floods to incorporate into bund design, aiming to avoid or minimize future flooding impacts. A pre-construction visit is recommended to be conducted by a team comprising Route Engineer, Hydrologist and Hydraulic Engineer to validate the crossing locations and design. 	Design Engineer	SID
B. Construction Phase					

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
1.	Impact on Air Quality	Air quality will be affected by fugitive dust emissions from excavating activities of construction machinery, material stockpiles & material transportation, dust from the unpaved surfaces and movement of construction vehicles, which can be very harmful for the site worker, local population and natural vegetation.	<p><u>Fugitive Dust Emissions</u></p> <ul style="list-style-type: none"> The material being transported or stored at the stockpiles will be kept covered with plastic to ensure protection of ambient air from fugitive emission during windstorm emissions. The contractor will monitor air quality on regular basis near the plant. Preventive measures against dust should be adopted for unloading operations. Regular water sprinkling of all excavation work the site should be carried out to suppress excessive dust emission(s); Grading operation will be suspended when the wind speed exceeds 20 km /hr. The plant should be located at least 500m away from any living area. Enforce the maximum speed limit to 20km/h for vehicles using embankments and access road. Road damage caused by project activities will be promptly attended to with proper road repair and maintenance work. Proper Personal Protective Equipment (PPE) should be issued to the site worker and make sure the worker wears the PPE properly during working on site. 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<ul style="list-style-type: none"> Smoke from Burning of Waste Material or Burning Firewood Clean and smoke free fuel will be used in the labor camp. Cutting and burning trees or shrubs for fuel should be prohibited. Gas Cylinders should be used in the labor camp for cooking purposes. <p><u>Vehicular and Generator Exhaust Emissions</u></p> <ul style="list-style-type: none"> All vehicles during construction activities will be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions; Proper maintenance and repair of power generators and construction machinery will be ensured to minimize hazardous emissions. Batching plant should be set up considering the wind direction so that the nearby communities are not affected by the emissions from batching plant. SEQS / WHO applicable standards to gaseous emissions generated by construction vehicles, equipment and machinery will be enforced during construction works. 		

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<ul style="list-style-type: none"> Best quality fuel and lubes will be purchased and where possible, lead free oil and lubes will be used. 		
2.	Impact of Noise Pollution	The main sources for noise in the project area may be heavy machinery such as excavators, concrete mixing plant, stone crushers and other equipment.	<ul style="list-style-type: none"> Vehicles and equipment used should be well fitted, as applicable, with silencers and properly maintained; that will reduce noise hazards according to permissible limits as fixed by Pak EPA (noise is 85 dB (A) while the WHO noise guidelines prescribed a limit of 55 dB (A). Construction workers will be provided suitable hearing protection like ear cap, or earmuffs and will be trained about their usage. Construction activities that are close to settlements will be stopped during night times if high noise values are observed. Consultations will be held to discuss appropriate solutions and techniques to control noise (e.g. mud or brick walls, bushes, etc.). Such hearings consultations should also be regularly conducted to solicit public feedback, to avoid public inconvenience and suggestions for improvement in working strategy / working environment and progress of project activities; and In accordance with the environmental monitoring plan, noise measurements will be carried out on regular basis at locations and schedule specified to 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			maintain the level within the SEQS / WHO standards and to ensure the effectiveness of mitigation measures.		
3.	Vibration impacts	Construction activities i.e. soil compaction, excavation, moving of heavy trucks have the potential to produce vibration levels that may be annoying or disturbing to humans and may cause damage to structures if appropriate precautions are not taken.	<ul style="list-style-type: none"> • Use of heavy machinery should be allowed in limited time only from 07.00 a.m. to 10.00 p.m. except for any emergency for which contractor should take prior approval; and • Low vibration level machinery should be used and a system of regular maintenance and repairs to be employed. • Where vibration could become a major consideration (within say 100m of schools, religious premises, hospitals or residences) a building condition survey should take place prior to construction. • should be discussed with the local population as well as timing of the works to serve as a vehicle for further public consultation at the implementation stage and to assist in public relations. 	CC	SC
4.	Borrowing and Quarrying of Materials	Improper earth borrowing can create stagnant ponds, risking health. Close pits to bunds cause structural problems; cultivating areas devalue land.	<ul style="list-style-type: none"> • The barren or unfertile land will be preferred to use as borrowing area than the agricultural land avoiding areas that are permanently flooded. The borrow material will be obtained from riverine/floodplain areas owned by SID (Sindh Irrigation Department), which are currently 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<p>uncultivable due to salinity and waterlogging. Since the area is flood-prone, there are few settlements in the vicinity.</p> <ul style="list-style-type: none"> • When earth is required to be lifted from private own land, then the owner(s) of the land would be duly compensated. • Borrow areas will be selected at least 150 meters away from existing embankments to ensure the stability of these structures, as well as other settlements, civil works, and natural habitats. • The contractor will not leave the borrow pits in such a condition that they are unusable and could be filled with rain water and cause the problems for the community e.g. breeding place for mosquitoes etc. • The contractor will ensure that selected borrow areas are clearly demarcated, including the allowable depth of the excavation, before starting any soil removing. • The edges of the pits should be given flat slopes and area should be leveled as far as possible at the completion of the excavation. 		
5.	Solid Waste Generation incl. Spoil Material	Waste and Spoils will be generated from the camps and from excavation activities. Disposal of spoil / surplus material may cause	<ul style="list-style-type: none"> • All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper solid waste management system. The contractor will 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
		negative environmental impacts, if not properly mitigated during implementation of the proposed project.	<p>coordinate with local representatives and administration of the concerned solid waste management department for the disposal of solid waste;</p> <ul style="list-style-type: none"> • The contractor must develop a plan of action with the help of concerned solid waste management department for transporting the waste to the disposal site; • Toxic waste will be handled, stored, transported and disposed separately; • The waste will be properly sealed in containers with proper labels indicating the nature of the waste; and • Solid waste will be segregated at source so that it can be re-used or recycled. • Waste management plan will be developed to implement an efficient and responsive solid waste management system during construction phase. Recyclable wastes e.g. steel bars will be sold to waste vendors; • Reusable material will be used as a filling material during ground levelling; • Solid waste generated during construction will be safely disposed in demarcated waste disposal sites 		

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<p>and the contractor will provide a proper waste management plan; and</p> <ul style="list-style-type: none"> The site will be restored back to its original condition after construction completion. The spoil material from the excavation will be dumped at designated places. The dumping sites must be approved by environment specialist of the Construction Supervision Consultant (CSC). The contractor will also ensure that no spoil material is disposed into River Indus/canal and into any other water body along the project site. As far as possible barren/waste lands available will be used for disposal of the excavated waste material. The spoil material shall be deposited in layers and properly rolled and sprinkled to avoid any negative environmental impacts. Contractor will prepare and approve a spoil management plan, prior any disposal of spoil. 		
6.	Resource Conservation	During the construction, overburden on local resources is possible if construction facilities such as workers camp and construction camp built near rural	<ul style="list-style-type: none"> Use potable water bowsers for construction works and mineral water bottles/ ground water for drinking purposes; 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
		areas and can create problems for local communities.	<ul style="list-style-type: none"> Plan for the provision/purchase of adequate insulation to reduce heat loss through construction plants; Reduction of wastage of water through training of workers involved in water use; Reuse of construction waste materials may be adopted wherever possible; Aggregates will not be sourced from river and stream beds. Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment; Efficient and well -maintained equipment and machinery will be used; The equipment and machinery will be turned off when not in use; A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels. 		
7.	Soil Contamination	Surface soil has the potential to be contaminated by construction material, vehicle movements and various construction activities.	<ul style="list-style-type: none"> The Contractor will be required to train its workforce in the storage and handling of materials like oils, diesel, petrol, other chemicals, concrete and cement, etc., that can potentially cause soil 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
		Spillage of fuel, lubricants, cement and chemicals has the potential to result in contamination.	<p>contamination. The Contractor will be required to prepare a training manual and module for all the construction related activities along with the schedule of training program and submit to the supervising consultants for approval.</p> <ul style="list-style-type: none"> • Refuelling areas will have impervious concrete bases with appropriate drainage to prevent spills from contaminating the surrounding area. • During on-site maintenance of construction vehicles and equipment, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil. • Oils, fuels and hazardous materials will be stored in appropriately bounded areas. Fuel tanks will have to be placed within sealed bunds capable of containing 120% of the total volume of the tank in case of leakage. • Regular inspections will be carried out to detect leakages from vehicles and construction machinery. • Vehicles and/or equipment with leakage will not be used, until repaired. • Solid waste generated during construction and at camp sites will be properly treated and safely disposed of only in demarcated waste disposal sites. • The construction phase will consume lot of cement additives and oils and the empty containers will 		

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			contain dangerous amount of chemicals inside, which can impact the humans as cancer producers. All such containers must not be sold to general public and must be destroyed and sent for recycle. This will be contractor's responsibility who must seek consultant's supervision. The people must be warned against use of empty chemical containers through local press and erecting banners in project area.		
8.	Soil erosion/ silt run-off	Phenomenon may pose serious environmental impacts like landslides, slumps, slips and other mass movements.	<ul style="list-style-type: none"> All the freshly cut surfaces will be restored/stabilized as soon as possible; Seeding or plantation of erodible surfaces will be done; Construction activities will be planned in such a way so as to avoid cutting of erodible surfaces and earth movement in rainy season; Along cross-drainage structures of the access road where embankments are more susceptible to erosion by water runoff stone pitching or a riprap will be provided across the embankment. Proper monitoring of the soil erosion prone areas will be carried out during operation phase and soil conservation measures (if needed) will be carried out like provision of physical structures e.g. retaining walls, etc. 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
9.	Community Health and Safety	The communities residing in the project areas might be at risk from the proposed works since deep excavation works will take place along with movement of heavy machinery and vehicles transporting the raw materials and spoils etc. to and from the work sites.	<ul style="list-style-type: none"> The Contractor will prepare the site specific community health and safety plan in compliance with applicable national and international regulations and guidelines. The Contractor will clearly barricade work areas to prevent access by the public, while ensuring passage by providing safe pathways for pedestrians around construction zones; The Contractor will exclude parking, waiting vehicles and vendors from areas adjacent to the work by means of clearly marked barricades and posted signage; The Contractor will remove excavated earth, spoil, rubble, cut vegetation and refuse whether generated by the project or discarded by third parties from areas within the construction zone, where it has potential to interfere with the public or generate dust; The Contractor will provide temporary lighting to facilitate construction during night time; The Contractor will remove hazardous conditions on construction sites that cannot be controlled effectively with site access restrictions and will barricade any excavations and materials placed near the public place (if applicable); Hard Barricades will be provided at the excavation deeper than 1.5 meter as per "NZS 3845:1999 Road safety barrier systems"; 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<ul style="list-style-type: none"> • The Contractor will promptly reinstate any services and reinstall any physical facilities that are cut, disconnected or damaged during construction, and maintain or provide temporary services that are interrupted by construction. The Supervisory Consultant will inspect and certify the adequacy of all reinstated services and facilities; • Installation and maintenance of speed control and traffic calming devices at pedestrian crossing areas especially near the settlements; • An Emergency Preparedness and Response Plan (EPRP) in coordination with the local emergency responders to provide timely first aid response in the event of accidents and hazardous materials response in the event of spills; • Instruct foremen to strictly enforce the keeping out of non-working persons, particularly children, off work sites; • Timely public notification on planned construction works; • Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links; • Any environmental condition that is disagreeable to the public and causes an avoidable nuisance can be addressed with additional provisions over and above those described above, as determined necessary by the supervisory consultant. 		

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<ul style="list-style-type: none"> These requirements will be incorporated into the bidding specification and contract documents, and will be binding on the contractor, at risk of penalty for noncompliance, as charges to be recovered from contractor for unsafe act or condition. 		
10.	Occupational Health and Safety	Occupational Health and Safety (OHS) related impacts will arise during construction stage activities including clearing of earth, levelling, compaction, foundations, finishing, testing & commissioning.	<ul style="list-style-type: none"> All suggested project-specific health and safety plans would include appropriate training and supervision of employees and enforcement of workplace safety policies. All processes and equipment will be designed and constructed for safe operation. A process of safety management program will be developed and implemented to identify hazards associated with each applicable chemical. All project related staff will be provided with the required personal PPE and shall be trained to make sure that they are aware of the usefulness and correct use. Working at heights and in confined spaces should be done after obtaining approvals from the safety supervisors and should regularly be monitored. Emergency preparedness and response plan and emergency escape routes shall be identified and all the workers will be made aware of them. Use of correct signage for better understanding of all the health safety instructions and precautions for 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			the workers. Signage will be in languages appropriate to the workforce employed.		
11.	Traffic Management	During construction activities, large number of light and heavy vehicles is expected to use the community roads. Similarly, heavy machinery will be stationed in and adjoining areas of the project site.	<ul style="list-style-type: none"> Construction traffic hindrance should be avoided by providing proper diversion and signage. Traffic management plan will be prepared by the contractor after consultation with RE for its implementation. GRM will be put in place to address community grievances in this regard. 	CC	SC
12.	Communicable diseases	The laborers in the Contractor Camp, truck drivers and like personnel who interact with each other have the potential for the spread of HIV/AIDS if the incidence exists.	<ul style="list-style-type: none"> Arrange to run an active campaign, in the labour camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS; Latest / Updated SOPs by WHO, national and provincial Government related to the construction industry to control spreading of COVID-19, should be implemented by the contractor and should be strictly monitored; Strengthen the existing local health & medical services for the benefit of labour as well as the surrounding villages; Ensure cleanliness and hygienic conditions at the labour camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by the Health Department; 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<ul style="list-style-type: none"> Locating a labour camp at least away from the villages (local settlement), and Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents. 		
13.	Flora	No tree cutting is expected as this is restoration /rehabilitation project and being executed within its already available ROW. The Contractor's workers may damage the vegetation and trees (for use as firewood to fulfil the camps requirements).	<ul style="list-style-type: none"> Campsites and Elevated Ground Storage Tanks (EGST) will be established on waste/barren land rather than on forested or agriculturally productive land. However, if such type of land is not available, it will be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth or agricultural area. Construction vehicles, machinery and equipment will remain confined within their designated areas of movement. The Contractor's staff and labour will be strictly directed not to damage any vegetation such as small trees or bushes. They will use the paths and tracks for movement and will not be allowed to trespass through farmlands. Contractor will provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel will not be allowed. The compaction of trenches should also be done properly. Inadequate compaction of trenches will 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<p>result in flow of soil during rainy season resulting in increased soil erosion</p> <ul style="list-style-type: none"> As far as possible digging in the cultivated land should be done when the land is barren to avoid damage to agricultural crops. Open fires should be banned in the area to avoid hazards of fire in the project area. Ten trees will be replanted for each tree cut as per EPA rule. 		
14.	Fauna	<p>The accidental striking of all terrestrial fauna by project vehicles or equipment/machinery</p> <p>Avifauna may be disturbed due to sensory disturbance from construction equipment; movement of vehicles and crew personnel; location and operation of camps</p>	<p><u>Mammals and Reptiles</u></p> <ul style="list-style-type: none"> Hunting, poaching and harassing of wild animals will be strictly prohibited and Contractor will warn their labor accordingly. Noise generating activities will be avoided during the night. The camps will be properly fenced and gated to check the entry of wild animals in search of eatable goods. Similarly, wastes of the camps will be properly disposed off to prevent the chances of eating by wild animals, which may become hazardous to them. Vehicles will be maintained in good condition and provided with mufflers to reduce noise. <p><u>Birds-Avian Fauna</u></p> <ul style="list-style-type: none"> Special measures will be adopted to minimize impacts on the wild birds, such as avoiding noise 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<p>generating activities during the critical periods of breeding.</p> <ul style="list-style-type: none"> The contractor should be committed to ensuring the conservation and protection of wildlife within the project area. To achieve this goal, a strict "No Hunting" policy shall be implemented and enforced among all workers and personnel involved in the project. Staff working on the project should be given clear orders, not to shoot, snare or trap any bird. <p>Fishries:</p> <ul style="list-style-type: none"> Implement sediment control measures, such as silt fences, sediment basins, or erosion control blankets, to prevent excessive sediment runoff into the river. Monitoring water quality during construction to detect and mitigate any pollution. 		
15.	Use of local water resources	Burden on local water resources and possible social conflicts.	<ul style="list-style-type: none"> Availability of water for camp site facilities and construction purposes will be ensured by the contractor prior to start of construction activities. As per Local Government Act, the contractor will seek approval from the Local Government for exploitation of the water resources. Contractor will ensure that the water availability of the existing local users remains unimpeded by the project interventions. The contractor will make arrangements for the availability of drinking water at 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<p>site. The contractor will arrange for the water required for construction works on his own. For this purpose, he will install hand pumps/tube wells accordingly.</p> <ul style="list-style-type: none"> The Contractor will be required to act as a go-between closely with local communities to ensure that any potential conflicts related to common resource utilization for project purposes are resolved quickly. The contractor will prepare guidelines for the workers for minimizing the wastage of water during construction activities and at campsites. 		
16.	Contamination of Water Resources	The water resources, may get polluted from may get polluted from hazardous construction materials, wastewater effluent, solid waste, silt from construction and soil erosion, etc.	<ul style="list-style-type: none"> Camps will be located at least 500 m away from the nearest local settlement to prevent the contamination of hill torrents, etc. Wastewater effluent from contractors' workshops and equipment washing-yards will be passed through an oil skimmer and to gravel/sand beds to remove oil/grease contaminants before discharging it into natural streams. Similarly, the wastewater effluent from the campsite will be treated before disposal into a stream. Borrow pits and natural depressions lined with impervious liners will be used to dispose of scraped obnoxious material, and then covered with soil. Cost will be added in Contractor's BOQs. 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<ul style="list-style-type: none"> Fuels, lubricants and other hazardous material will have to be properly stored in adequate containers in sites equipped with retaining structures, including oil skimmers for the treatment of contaminated runoff water. Repair and maintenance work on machines and vehicles will only be done in specific places designed and equipped for this purpose (oil skimmer). These must be at a safe distance from the River Indus/nearby canal. No washing of vehicles will be done in or near the River Indus. Water contaminated with concrete will have to be collected in sedimentation ponds and, if required, will have to be neutralized before being discharged to the canal/river. Contamination of the River Indus and canal with concrete or cement must be avoided. Sewage water from the camp will have to be collected and treated in a suitable septic tank before being released into the streams. Generally, waste should be reduced, re-used, recycled and the disposal has to be controlled. Contractor will have to get water quality testing of bund sites at the start of construction and biannual basis as per SEQS. 		

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
17.	Social and Cultural Conflicts	During the construction phase of the proposed project, conflicts may arise between labor force and local community.	<ul style="list-style-type: none"> Local labor especially from nearby communities should be given preference for the construction works; Careful planning and training of work force to minimize disturbance to the local people; Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals; and Adequate training especially for the transitive workforce of the station (involved both in the construction process and in the commissioning) to regard the customs of the area so that the locals do not feel insecure. 	CC	SC
18.	Religious and Cultural Heritage	No graveyard will be disrupted due to this project. No historical or archaeological site has been observed or reported along the project area.	<ul style="list-style-type: none"> If any graves affected by the project, they will have to be shifted. The proponent will obtain Fatwa from local Mufti before shifting the graves. During such operation the proponent will inform local administration and seek their assistance for security. The request will also be extended to Health Department for deputation of medical and paramedical staff during the operation. Contractor will follow the prayer timing particularly at prayer of Juma and the workforce will observe the sanctity of religious properties. Contractor will be required to instruct the construction crews and site supervisors in respect of archaeological site recognition, conservation procedures, and temporary site protection. 	CC	SC

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Monitoring
			<ul style="list-style-type: none"> In case of a chance finding during excavation, the contractor will protect the site and notify the Engineer who will inform Department of Archaeology & Museums through Irrigation Department and hand over such sites to the department if instructed by Engineer / Irrigation Department. 		

Table 8-2: Environmental Management Plan (Operation Phase)

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility
C. Operation Phase				
1.	Damage to Infrastructure	Fatal accidents System sustainability	<ul style="list-style-type: none"> SID (Irrigation Department) to monitor the system regularly; The important facilities that need attention and annual maintenance are bund, falls and control structures and bed levels which are affected by siltation or scour. The bund section has been designed to ensure safety by adhering to standard design principles. The construction and rehabilitation of flood protection bunds as part of the project will be regularly checked to undertake any prone damage; Repairs on urgent basis; and 	EA Staff

S. No.	Aspect	Project Impact	Mitigation Measures	Responsibility
			<ul style="list-style-type: none">Emergency response plan for Bund breach shall be followed, which is attached as Annexure-2 of this report.	

Key: CC=Construction Contractor, DC=Design Consultant, EA=Executing Agency, SC=Supervision Consultant, PD = Project Director

8.2 Monitoring Parameters

392. A monitoring plan for the pre-construction/design and construction phases of the project, indicating environmental parameters, mitigation measures of the negative environmental impacts, responsible authority and frequency is provided below as Error! Reference source not found. and Error! Reference source not found. below.
393. During the procurement/pre-construction period, the monitoring activities will focus on (i) checking the contractor's bidding documents particularly to ensure that all necessary environmental requirements have been included; and (ii) checking that the contract documents' references to environmental mitigation measures requirements have been incorporated as part of contractor's assignment and making sure that any advance works are carried out as per planned schedule.
394. During the construction period, the monitoring activities will focus on ensuring that any required environmental mitigation measures are implemented to address possible impacts.
395. In general, the construction impacts will be manageable, and no insurmountable impacts are predicted, provided that the EMP is implemented to its full extent as required in the Contract documents. However, experience suggests that some Contractors may not be familiar with this approach or may be reluctant to carry out some measures. For the proposed project, in order that the Contractor is fully aware of the implications of the EMP and to ensure compliance, environmental measures must be costed separately in the tender documentation and listed as BOQ items, and that payment milestones must be linked to environmental performance with regards to carrying out of the EMP.
396. The effective implementation of the EMP will be audited as part of the loan conditions by both NDRMF and ADB, and as part of regulatory/NOC compliance by SEPA. In this regard, the PMU/CSC will guide the design engineers and Contractors on the environmental aspects and necessary EMP documentation.

Table8-3. 'Pre-Construction' Environmental Monitoring Plan for Baseline Development

Parameter to be measured	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility	
						Implementation	Monitoring
Ambient Air Quality	To establish baseline air quality levels.	CO, NO ₂ & PM ₁₀ (particulate matter smaller than 10 microns) concentration at receptor level, PM _{2.5} .	1-hr and 24-hr concentration levels.	At one random receptor location at <u>each</u> of the sub-project sites.	Once	Contractor	CSC
Ambient Noise	To establish baseline noise levels.	Ambient noise level near receptors in project area.	A-weighted noise levels 24 hours, readings taken at 15 s intervals over 15 min. every hour, and then	At one random receptor location at <u>each</u> of the sub-project sites.	Once	Contractor	CSC
Water quality monitoring for drinking water and wastewater	To determine the effectiveness of mitigation measures	As per WHO/SEQS	Water samples for comparison against SEQS parameters	At one random receptor location at <u>each</u> of the sub-project sites	Once	Contractor	CSC

Table 8-4: Construction Phase Monitoring Requirements

Project Activity and Potential Impact	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Noise Disturbance due to noise from construction activity.	To determine the effectiveness of noise abatement measures on sound pressure levels.	Ambient noise level at different locations in project area.	A-weighted noise levels 24 hours, readings taken at 15 s intervals over 15 min. every hour at 15 m from receptors, and then averaged.	At one random sensitive receptor location at each sub-project area	Quarterly basis on a typical working day.	Contractor's Environmental officer, CSC
Air Quality Dust emissions from construction vehicles and equipment.	To determine the effectiveness of dust control program on dust at receptor level.	CO, NO ₂ & PM ₁₀ (particulate matter smaller than 10 microns) ,PM _{2.5} concentration at receptor level.	1-hr and 24-hr concentration levels.	At one random sensitive receptor location at each sub-project area	Quarterly basis on a typical working day.	Contractor's Environmental officer, CSC
		Visible dust	Visual observation of size of dust clouds, their dispersion and the direction of dispersion.	Construction site.	Once daily during peak construction period.	Contractor's Environmental officer, CSC

Water quality monitoring for drinking water and wastewater.	To determine the effectiveness of mitigation measures.	As per WHO/NEQS	Water samples for comparison against NEQS parameters.	Workers camp and active construction site.	Quarterly basis on a typical working day.	Contractor's Environmental officer, CSC
Safety precautions by Safety workers	To prevent accidents for workers and general public.	Number of near miss events and accidents taking place.	Visual inspections	Construction site	Once Daily	Contractor's Environmental officer, CSC
Soil Contamination	To prevent contamination of soil from oil and toxic chemical spills and leakages.	Incidents of oil and toxic chemical spills.	Visual inspections	At construction site and at vehicle and machinery refuelling & maintenance areas.	Once a month	Contractor's Environmental officer, CSC
Solid Waste & Effluent disposal Insufficient procedures for waste collection, storage, transportation and disposal.	To check the availability of waste management system and implementation.	Inspection of solid and liquid effluent generation, collection, segregation, storage, recycling and disposal will be undertaken at all work sites in project area.	Visual inspections	At work sites in project area.	Once daily	Contractor's Environmental officer, CSC



8.3 Environmental Training

8.3.1 Capacity Building and Training

397. Capacity building and training programs are necessary for the project staff in order to control the negative impacts resulting from the project construction and during its operation phase. They will also require trainings on monitoring and inspecting of such a project for environmental impacts and for implementation of mitigation measures.
398. The details of capacity building and training program are presented in the Error! Reference source not found..

Table 8-5: Capacity Development and Training Programme

Provided by	Organized by	Contents	Target Audience	Venue	Duration
<p>Pre-construction Phase PMC offering specialized services in environmental management and monitoring.</p>	CSC & PMU	Short seminars and courses on: Environmental Management Plan and Environmental Monitoring Plan Group exercise and participatory workshop to measure effectiveness of program.	Contractor staff	SID Office	One day long training seminar including group exercise/workshop.
<p>Construction Phase PMC offering specialized services in social management and monitoring.</p>	CSC & PMU	Short seminar on Environmental risks associated with construction phase. Development of Environmental Performance Indicators Occupational Health and Safety (OHS) issues. Group exercise and participatory workshop to measure effectiveness of program.	Contractor staff	SID Office	One day long training seminar including group exercise/workshop.

8.4 Environmental Management Costs

399. The **Error! Reference source not found.** below provides cost estimates for 'Pre-Construction phase' monitoring while **Error! Reference source not found.** provides cost estimates for 'Construction phase' monitoring of key environmental parameters.
400. The costs associated with implementation of the EMP and the necessary mitigation measures are provided as
401. below. The **Error! Reference source not found.** below provides the cost for capacity development and training programme for project contractors for the proposed sub-projects.

Table 8-6: Annual Cost Estimates for 'Pre-Construction Phase' Environmental Monitoring

Monitoring Component	Parameters	Quantity	Amount PKR	Details
Air Quality ¹²	CO, NO ₂ , SO ₂ , O ₃ , PM ₁₀ , PM _{2.5}	6 (Once at each of the six sub-project locations)	180,000	6 readings @ PKR 30,000 per sample
Noise Levels ¹³	dB(A)	6 (Once at each of the six sub-project locations)	180,000	6 readings @ PKR 30,000 per reading
Groundwater Quality	SEQS /NEQS	6 (Once at each of the six sub-project locations)	120,000	6 readings @ PKR 20,000 per sample
Surface water Quality	SEQS /NEQS	6 (Once at each of the six sub-project locations)	120,000	6 readings @ PKR 20,000 per sample
Contingencies			30,000	5% of monitoring cost
Total (PKR)			630,000	

Table 8-7: Annual Cost Estimates for 'Construction Phase' Environmental Monitoring

Monitoring Component	Parameters	Quantity	Amount PKR	Details
Groundwater Quality	SEQS / WHO	12 (Quarterly at 6 locations)	192,000	12 readings @ PKR 16,000 per sample

¹² For air quality monitoring: 'Passive samplers' such as test tubes can be used or 'Active samplers' with sorbent tubes can also be used

¹³ For noise monitoring: sampling equipment with duration greater than 1 hour can be used.

Surface water quality	SEQS / WHO	12 (Quarterly at 6 locations)	192,000	12 readings @ PKR 20,000 per sample
Air Quality	CO, NO ₂ , PM ₁₀ .PM _{2.5}	12 (Quarterly at 6 locations)	360,000	12 readings @ PKR 30,000 per sample
Noise Levels	dB(A)	12 (Quarterly at 6 locations)	360,000	12 readings @ PKR 30,000 per reading
Total				1,104,000
Contingencies			55,200	5% of monitoring cost
Total (PKR)			1,159,200	

*Subject to monitoring requirements of EPAs as per conditions of environmental approval for construction phase.

Table 8-8: Estimated Costs for EMP Implementation

Item	Sub-Item	Estimated Total Cost (PKR)
Contractor Environment Specialist	6 persons for 6 months (@ 100,000 per month)	3,600,000
Monitoring Activities	Provided separately in Tables 8.6 and 8.7.	-
Mitigation Measures	As prescribed under EMP and IEE.	4,500,000
(i) Water sprinkling	To suppress dust emissions	1,000,000
(ii) Solid waste collection & disposal (including hazardous waste)	From construction sites (based on initial estimates)	1,500,000
(iii) Cost of Hard Barricades	Provision of hard barricades in case the trench is 1.5 meter deep	1,000,000
(iv) SSEMP preparation and Implementation	Preparation and Implementation of SSEMP	1,000,000
Total		8,100,000
Contingencies	5% of EMP implementation cost	405,000
Total Estimated Cost (PKR)		8,505,000

Table 8-9: Cost of Capacity Development and Training Programme for Project Contractor(s)

Provided by	Organized by	Contents	No.of training events	Duration	Cost (PKR)
Pre-construction Phase Monitoring Consultants / Organizations offering specialized services in environmental management and monitoring.	CSC & PMU	Short seminars and courses on: Environmental Management Plan and Environmental Monitoring Plan.	Two seminars for Contractor management staff and project staff.	1 day	100,000
Construction Phase Monitoring Consultants / Organizations offering specialized services in environmental management and monitoring.	CSC & PMU	Short seminars on Environmental risks associated with construction phase. Development of Environmental Performance Indicators Occupational Health and Safety (OHS) issues.	Two seminars for Contractor management staff and project staff dealing in environment and social issues.	1 day	100,000
Total			200,000 (PKR 0.2 million)		

8.5 Performance Indicators

402. For evaluating the performance of the environmental management and monitoring plan, performance indicators are identified for the efficient and timely implementation of measures/actions proposed in EMP. The indicators are defined both for the implementation phase and for the operation phase. QA/QC Consultant will be responsible for compiling the information on these indicators and report to PMU.

403. To measure the overall environmental performance of the project, a list of performance indicators is given below:

- The number of inspections carried out by environmental team of CSC per month.
- The number of non-compliances observed by CSC.
- Availability of environmental, and OHS specialists in CSC .
- Availability of environmental, and OHS specialists with Contractors.
- Timely reporting of documents (as defined in EMMP and monitoring plan).
- Number of training imparted to stakeholders/other capacity building initiatives.
- Number of grievances received.
- Number of grievances resolved.
- Number of constructions related accidents.

9. GRIEVANCE REDRESSAL MECHANISM

9.1 General

404. This section deals with the Grievance Redressal Mechanism (GRM) to be developed for proposed sub-projects. The proposed project, at stage of construction may involve some disturbance to local community and thus this GRM is necessary for the successful resolution of potential disputes.

405. The ADB Policy (SPS 2009) requires establishment of a local grievance redress mechanism to receive and facilitate resolution of concerns and grievances regarding the project's social and environment performance. The measures have been identified to mitigate any potential environmental and social impacts to be caused due to implementation of the project works.

406. However, despite of best efforts, there is chance that the individuals / households affected by the project or other stakeholders are dissatisfied with measures adopted to address adverse social impacts of the project. To address, such situation an effective GRM will be established at the time of award of contracts to ensure timely and successful implementation of the project. It will also provide a public forum to the aggrieved to raise their objections and the GRM would address such issues adequately. It will receive, evaluate and facilitate the resolution of complaints and grievances about the social and environmental performance at the level of the project.

407. The GRM will aim to investigate charges of irregularities and complaints received from any displaced persons and provide a time-bound early, transparent and fair resolution to voice and resolve social and environmental concerns link to the project.

408. The PMU shall make the public aware of the GRM through public awareness campaigns. The name of contact person(s) and his/her phone number, PMU contact numbers will serve as a hotline for complaints and shall be publicized through the media and placed on notice boards outside their offices, construction camps of contractors, and at accessible and visible locations in the project area. The project information brochure will include information on the GRM and shall be widely disseminated throughout the project area. Grievances can be filed in writing, via web-based provision or by phone with any member of the PMU.

409. **First tier of GRM:** The PMU is the first tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The PMU staff for environment and social safeguards will be designated as the key officers for grievance redressal. Resolution of complaints will be completed within seven (7) working days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.). Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number will be assigned for each grievance, including the following elements:

410. Initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;

411. Grievance monitoring sheet, mentioning actions taken (investigation, corrective measures);

412. Closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed-off.

413. The updated register of grievances and complaints will be available to the public at the PMU office, construction sites and other key public offices in the project area. Should the grievance remain unresolved, it will be escalated to the second tier.

414. **Second Tier of GRM:** The PMU will activate the second tier of GRM by referring the unresolved issue (with written documentation) to the PMU, who will pass unresolved complaints upward to the Grievance Redress Committee (GRC). The GRC will be established by PMU before start of site works. The GRC will consist of the following persons: (i) Project Director; (ii) representative of district government; (iii) representative of the affected person(s); (iv) representative of the local deputy Commissioners office (land); and (v) representative of the SEPA (for environmental-related grievances). A hearing will be called with the GRC, if necessary, where the affected person can present his/her concerns/issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within fifteen (15) working days. The Contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC will not impede the complainant's access to the Government's judicial or administrative remedies.

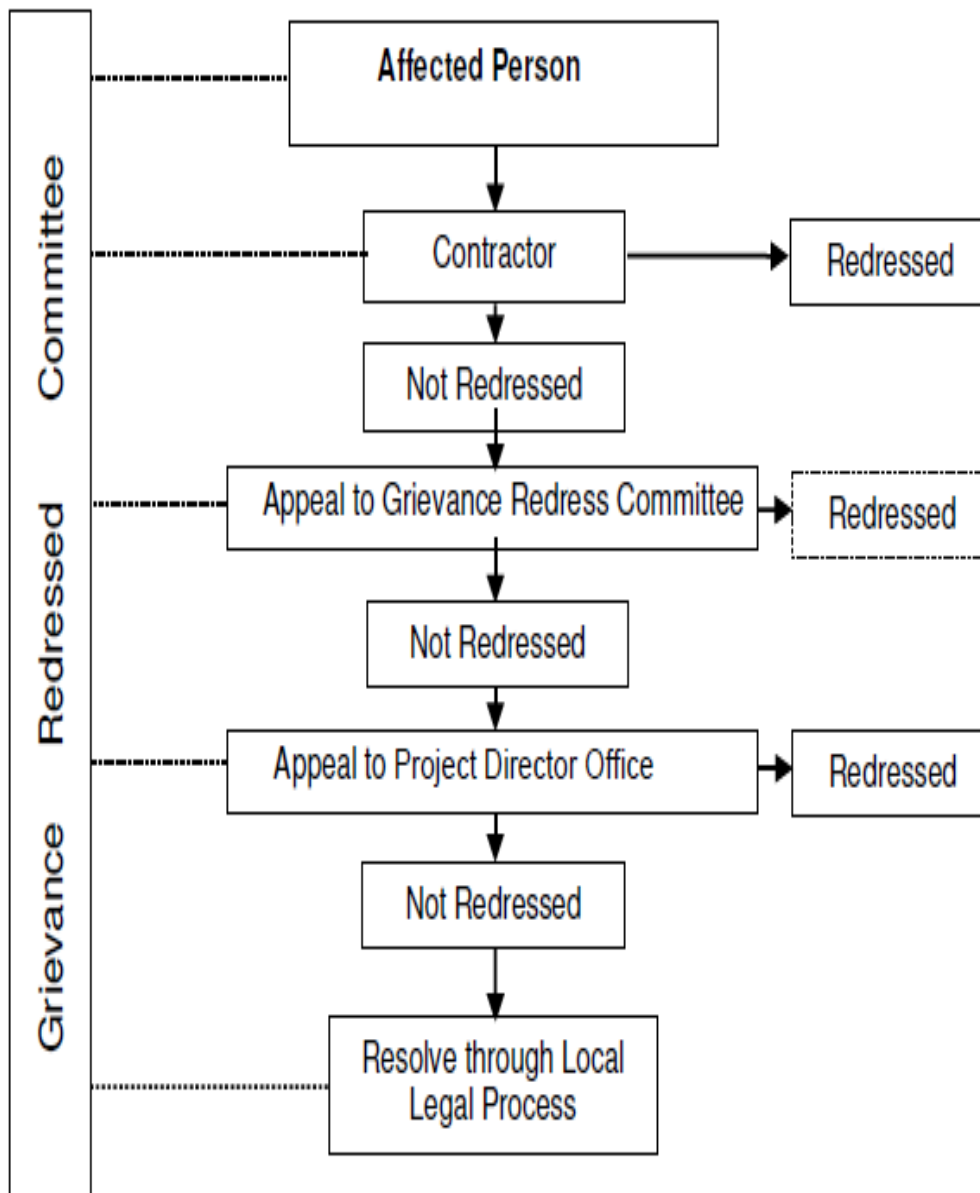
415. The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues and including dust, noise, utilities, power and water supply, waste disposal, traffic interference and public safety as well as social issues and land acquisition (temporary or permanent if any); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) reconfirm grievances of displaced persons (if any at any stage of project), categorize and prioritize them and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

416. The PMU officers will be responsible for processing and placing all papers before the GRC, maintaining a database of complaints, recording decisions, issuing minutes of the meetings and monitoring to see that formal orders are issued and the decisions carried out.

417. **Third tier of GRM:** In the event that a grievance cannot be resolved directly by the PMU (first tier) or GRC (second tier), the affected person can seek alternative redressal through the district or sub-district committees, as appropriate. The PMU or GRC will be kept informed by the district, municipal or national authority. The grievance redress mechanism Process Flow Diagram (PFD) is provided in the **Figure 9-1** below. The monitoring reports of the EMP implementation will include the following aspects pertaining to progress on grievances: (i) Number of cases registered with the GRC, level of jurisdiction (first, second and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as Name, ID with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e. open, closed,

pending). In order to provide greater clarity, the pictorial description of the GRM is provided in Error! Reference source not found. below.

418. Figure 9-1 Process Flow Diagram of Grievance Redressal Mechanism



9.2 Grievance Redress Committee (GRC)

420. A Grievance Redress Committee will be notified under the project for all proposed schemes in the Project Implementation Unit (PIU) and will be chaired by the Project Director.

- The GRC's members phone number, fax, address, email address will be disseminated to the people through displays at the respective irrigation offices, and at all the project sites of target district. In case of civil works construction contractor will also display this information prominently at their site offices.
- The GRC will log complaint and date of receipt onto the complaint database and inform the E&S staff at PIU level
- The GRC will instruct contractors and Grievance Focal Person (GFP) to refer any complaints that they have received directly to the GRC
- The GRC, with the contractors and GFPs, will investigate the complaint to determine its validity, and to assess whether the source of the problem is due to project activities, and identify appropriate corrective measures. If corrective measures are necessary, GRC, through the GFPs, will instruct the contractors to take necessary action
- The GRC will inform the Complainant of investigation results and the action taken
- The GRC will review the Contractors response on the identified mitigation measures, and the updated situation
- The GRC will undertake additional monitoring, as necessary, to verify as well as review that any valid reason for complaint does not recur

421. During the complaint investigation, the GRC should work together with the contractors and GFPs. If mitigation measures are identified in the investigation, the contractor will promptly carry out the mitigation. GFPs will ensure that the measures are carried out by the contractor and community representatives in plantation interventions.

422. The PIU will establish a Grievance Redress Committee (GRC) with the following composition:

- Project Director Head of PIU (Chairman)
- Environment and Social Specialist PIU (Member)
- Project Manager Contractor (Grievance Focal Person)
- Environment and Social Specialist Contractor (Member)
- Community Representatives at least two (Members)

10. CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusion

423. The proposed sub-projects are of high significance considering the urgent need for rehabilitating the damaged flood mitigation infrastructure in four districts of the project area. Primary and secondary data has been collected and used to assess the environmental impacts of the project. This IEE report highlights the potential environmental impacts associated with the project and recommends mitigation measures accordingly. Any environmental impacts associated with the project need to be properly mitigated, through the existing institutional arrangements described in this report.

424. The majority of the environmental impacts are associated with the construction phase of the proposed project and majority of these impacts are short term and reversible.

425. Major impacts during construction phase will be related to deep excavations, occupational and community health and safety issues along with ensuring debris and spoils are disposed in an effective and efficient manner during the sub-project works.

426. The implementation of mitigation measures during construction period will be the responsibility of the Contractor. Therefore, the required environmental mitigation measures will have to be clearly defined in the bidding and contract documents, and appropriately qualified environmental staff retained by the Construction Supervision Consultant (CSC) to supervise the implementation process. The EMP includes measures to minimize project impacts due to traffic, noise, air pollution, waste generation etc.

427. The EMP prepared for the proposed project under this IEE document is considered sufficient for issuance as part of the contracts to the successful bidder(s) and for subsequent use during the project works.

428. It should be mentioned that prior to the commencement of works, this EMP must be further updated by the Contractor into site specific EMPs (SSEMPs) for review and approval of ADB. In these SSEMPs, aspects such as a detailed traffic management plan, identification of locations for disposal of debris and spoil and any other details which shall become available later must be included for efficient implementation of all proposed mitigation measures and the subsequent monitoring of these measures.

429. NOC from concerned department for disposal of mucking material, spoil and municipal solid waste from worker camps will be taken which will be the responsibility of the Contractor.

430. The Indus river is home to a variety of fish species, including Mrigal, Catla, Rohu, and others. These fish are not only essential for local food security but also contribute to the livelihoods of many communities through fishing activities. When flood mitigation structures like bunds are damaged, it can disrupt the river's natural flow and habitat, negatively affecting fish populations. Rehabilitating and strengthening the bunds under this project can help maintain a stable river environment, allowing fish populations to thrive.

431. Strengthened bunds are better equipped to withstand extreme weather events such as heavy floods and intense rainfall. By preventing breaches and protecting adjacent areas, these

structures will help maintain a stable environment even during adverse conditions. This resilience can ensure that fish populations have a better chance of surviving and recovering after extreme events.

432. Based on the above, this report concludes that there are no potential adverse environmental impacts from the proposed sub-project activities. Impacts of less significance can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified and suggested in EMP, hence, no significant or unacceptable change in the baseline environmental conditions will occur.

433. Furthermore, SID will ensure that selected construction Contractor has contractual obligation with respect to EMP implementation and will ensure appropriate staffing and budgeting for effective implementation and monitoring of project EMP.

434. Based on the findings of the IEE, the project is unlikely to cause any significant, irreversible or unprecedented environmental impacts. The potential impacts are localized, temporary in nature and can be addressed through proven mitigation measures. Hence, the classification of the project as "Category B" as per ADB SPS, 2009 is confirmed and this IEE study has been conducted. No further study or assessment is required at this stage.

10.2 Recommendations

435. Based on the findings of this IEE report, following recommendations have been formalized for smooth functioning of proposed project:

- SID shall obtain statutory clearances prior to award of contract and ensure conditions/requirements are incorporated in the project design and documents;
- Upon mobilization of the contractors, PMU to provide a safeguards orientation as per IEE and project administration manual;
- Contractor to appoint environmental and social safeguards, responsible for environmental compliance, occupational health and safety and core labour standards.
- The templates for different management plans are attached as annexures. However, detailed plans shall be developed by the contractor before mobilization of construction teams.
- SSEMPs shall be developed and implemented by the contractor during the construction phase. PMU will supervise the implementation status through CSC.
- Prior approval for setting up of construction camps shall be obtained by the Contractor from PMU, SID.
- Employment opportunities shall be given to local community as per plans discussed in the IEE report.

ANNEXURES

Annexure 1: Rapid Environmental Assessment Checklist

The projects are screened through Rapid Environmental Assessment (REA) checklist to determine environmental categorization. The environmental and social rapid screening depicts that:

- (i) the subproject will not require any land acquisition;
- (ii) the subproject will not involve any involuntary resettlement
- (iii) the subproject does not fall in any protected area.

Screening Questions	Yes	No	Remarks
A. Project Site			
Is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Protected Area		✓	
▪ Wetland		✓	
▪ Mangrove		✓	
▪ Estuarine		✓	
▪ Buffer zone of protected area		✓	
▪ Special area for protecting biodiversity		✓	
B. Potential Environmental Impacts			
Will the proposed project cause.....			
▪ Loss of precious ecological values (e.g. result of encroachment into forest/swampland or historical/cultural buildings/area, disruption of hydrology of natural waterways, regional flooding and drainage hazards)?		✓	
▪ Conflicts in water supply rights and related social conflicts?		✓	
▪ Impediments to movements of people and animals?		✓	
▪ Potential ecological problems due to increased soil erosion and siltation, leading to decreased stream capacity?		✓	
▪ Insufficient drainage leading to salinity intrusion		✓	
▪ Over pumping of groundwater, leading to salinization and ground subsidence?		✓	Limited use of water for project activities which will not be significant
▪ Impairment of downstream water quality and therefore, impairment of downstream beneficial uses of water?		✓	
▪ Dislocation or involuntary resettlement of people?		✓	No dislocation or involuntary resettlement of people will occur
▪ Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups		✓	
▪ Potential social conflicts arising from land tenure and land use issues?		✓	No land acquisition will be required
▪ Soil erosion before compaction and lining of canals?			N/A

Screening Questions	Yes	No	Remarks
▪ Noise from construction equipment?	✓		It will be managed through mitigation measures and will be documented in EMP.
▪ Dust during construction?	✓		It has moderate impact for labor during construction, but it will be managed by water sprinkling. Dust generated will be managed through sound planning and good management practices with implementation of EMP.
▪ Waterlogging and soil salinization due to inadequate drainage and farm management?		✓	
▪ Leaching of soil nutrients and changes in soil characteristics due to excessive application of irrigation water?		✓	
▪ Reduction of downstream water supply during peak seasons?		✓	
▪ Soil pollution, polluted farm runoff and groundwater, and public health risks due to excessive application of fertilizers and pesticides?		✓	
▪ Soil erosion (furrow, surface)?		✓	
▪ Scouring of canals?		✓	
▪ Clogging of canals by sediments?		✓	
▪ Clogging of canals by weeds?		✓	
▪ Seawater intrusion into downstream freshwater systems?		✓	
▪ Introduction of increase in incidence of waterborne or water related diseases?		✓	
▪ Dangers to a safe and healthy working environment due to physical, chemical and biological hazards during project construction and operation?	✓		The subproject does not have usage of any hazardous chemicals during construction. However, health and safety measures for laborers will be taken to implement HSE Plan that will be developed and 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)?	✓		Local people will be employed as much as possible from close by villages/ towns and the same will be documented in EMP
▪ Social conflicts if workers from other regions or countries are hired?	✓		Priority will be given to locals for employment and

Screening Questions	Yes	No	Remarks
			the same will be documented in EMP.
<ul style="list-style-type: none"> 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? 	✓		Earth works will not lead to any risk for community during construction time. However, Health and Safety Plan and Emergency response procedures will be prepared and implemented. The same will be documented in EMP.
<ul style="list-style-type: none"> 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? 	✓		Safety measures for community will be taken to avoid any risk and consequence. It will be documented in EMP. However, it has major positive impact, because the construction of the bund will save community/infrastructure from flood threat if any.
Climate Change and Disaster Risk Questions			
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes? 	✓		Project area is prone to floods. Appropriate engineering measures to minimize negative impacts, such as designing flood mitigation structures on the basis of calculating 500 years return period of river Indus to maintain downstream flows.
<ul style="list-style-type: none"> Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., increased glacial melt affect delivery volumes of irrigated water; sea level rise increases salinity gradient such that source water cannot be used for some or all of the year)? 	✓		climate resilience considerations will be incorporated into the project design and Restoration and rehabilitation flood mitigation structures will be done.

Screening Questions	Yes	No	Remarks
<ul style="list-style-type: none">Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g., high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		✓	
<ul style="list-style-type: none">Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by diverting water in rivers that further increases salinity upstream, or encouraging settlement in earthquake zones)?		✓	

Annexure 2: Emergency Response Plan for Breach of Bund

1. BUND EMERGENCY PLAN

The purpose of this Bund Emergency Plan (BEP) is to reduce the risk of human life loss and injury and minimize property damage during an unusual or emergency event at proposed project.

This BEP has been prepared with the intent of coping and responding to the disaster in case of bund breaching.

2. BASIC BUND DESCRIPTION

This project will be implemented for restoration and rehabilitation of 6 bund sites that have received severe damages during Recent High Intensity Rainfall in July and August 2022. Details of bunds and damage Nomenclature are presented in below table.

Sr. No.	Structure Description/Sub Type	District	Nomenclature of proposed Interventions
1	Rehabilitation / Reconstruction of Stone Apron and Stone Pitching along S.M Bund from Mile 70/7 to 72/0 in Moro Bund Sub Division.	Naushahro Feroze	Stone pitching, stone apron.
2	Rehabilitation / Reconstruction of Stud / Apron along S.M Bund at Mile 12/0 to 12/7 and Bakhri Loop Bund Mile 0/0 to 0/1 in Kandiaro Bund Sub Division.	Naushahro Feroze	Stone pitching, stone apron.
3	Recouping of Stone Spurs Mile 142/3 and Stone Studs Mile 136/1 Along S.M Bund in Hala Irrigation Division Hala.	Matiari	Stone spurs, stone studs
4	Rehabilitation, Raising and Strengthening of Spurs along Surjani Complex Bund Sujawal of Pinyari Circle Hyderabad Kotri Barrage Region Hyderabad.	Sujawal	Raising and strengthening of spurs
5	Rehabilitation/Restoration of Stone Apron at Mile 1/1+360 to 1/2 and Stone Pitching at Mile 0/0 to 2/4 along Baiji Bund	Sukkur	Stone pitching, stone apron.
6	Restoration/Raising & Strengthening along R.N Loop Bund Mile 0/0 to 3/0 & Garking Loop Bund Mile 0/0 to 2/6, Providing Stone Pitching along R.N Bund Mile 5/0 to 6/0 and Providing Stone Apron, Baiji Bund Mile 7/5 to 7/6	Sukkur	Raising and strengthening of spurs, Stone pitching, stone apron

The Scope of work for this project includes following design of interventions related to all components of this sub-project.

- Rehabilitation and Enhancement: Rehabilitation / Reconstruction of stone aprons, pitching, studs, and bund infrastructure to enhance flood resilience.
- Spur System Restoration: Restore, elevate, and strengthen bund spurs, incorporating stone pitching and aprons to mitigate flood hazards and safeguard vital infrastructure.

2. Disaster Risk Management

Disasters can be divided into four major phases:

1. Non-Disaster Phase
2. Pre-Disaster Phase
3. During-Disaster Phase
4. Post-disaster phase

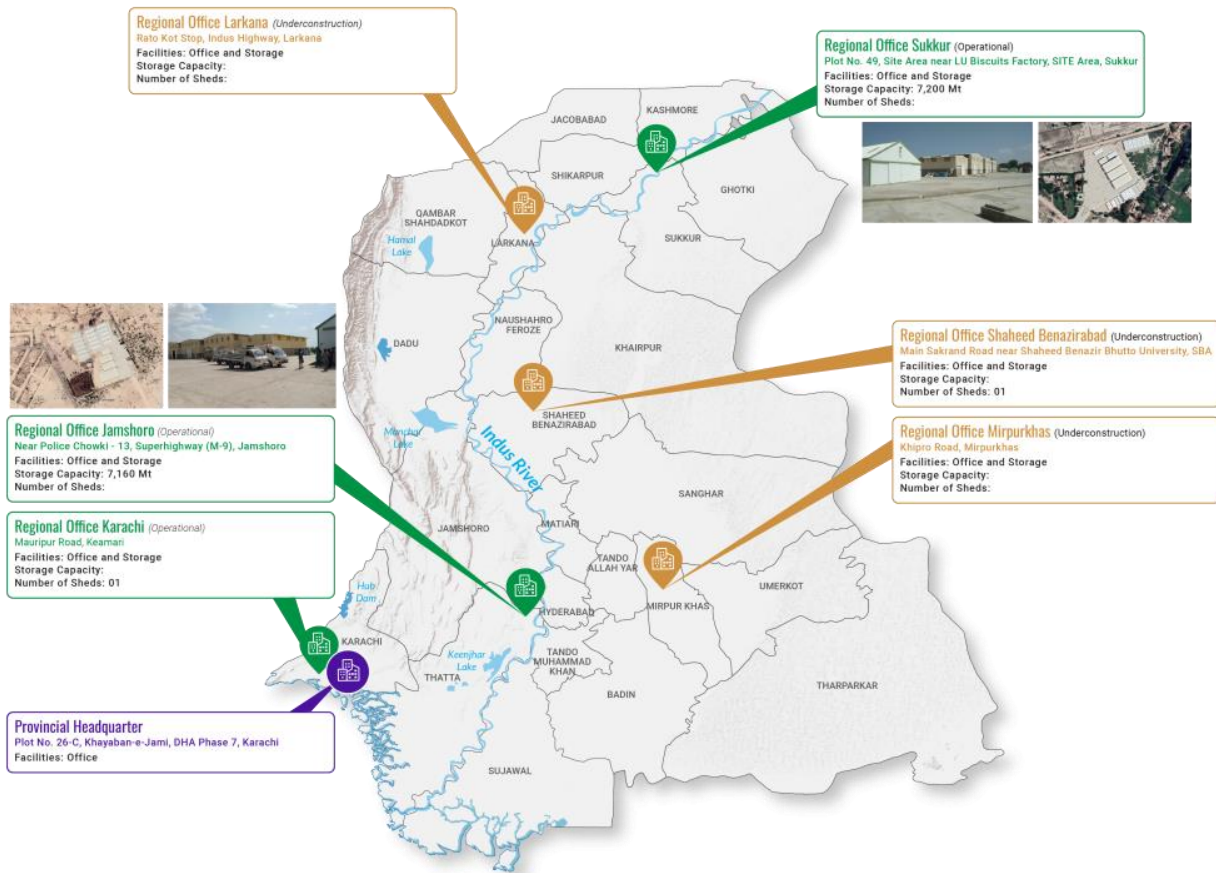
PRE-DISASTER PHASE

1. Use Guidance notes provide as **Annexure A** of this document, to quality of emergency.
2. In the event of any emergency / disaster, inform the relevant following departments:

Level	Agency	Contact Person Details (to be updated)
National Level	National Disaster Management Authority (NDMA)	Prime Minister's Office, 2nd Floor Sector G-5-1, Constitution Avenue, Islamabad Post Code 44000
Provincial Level	Provincial Disaster Management Authority (PDMA)	Emergency Help line: 1129 Director General: 021-99332003-5
Project Level	Regional Office Sukkur	Abdur Rehman Indhar Assistant Director Sukkur
	Administration such as Assistant Commissioner (AC)	ACs of Sukkur, Naushero, Feroze, Sujawal, and Matiari
Subproject Level	Bund Incharge	Sub Divisional Officer Irrigation

3. PDMA and its field office in regional offices and district administration to prepare evacuation plan for events such as bund failure, including evacuation area and route. They should have an idea of the population that will need to be evacuated.
4. PDMA and district administration should also initiate capacity building and train local community for such events.

Location & Address map of Regional offices of PMDA, Sindh



DISASTER PHASE

The following are the basic emergency planning and response roles and responsibilities for the key agencies involved when an emergency occurs:

1. Merged Areas Secretariat to undertake appropriate remedial actions as given in **Annexure B** of this document.
2. Issue immediate evacuation warnings to people in the vicinity of the bund likely to be affected,
3. Merged Areas Secretariat to provide updates of the situation to the press and local emergency authority to assist them in making timely and accurate decisions regarding warnings and evacuations.
4. Provincial Disaster Management Authority support and coordinate the overall emergency response activities within its geographical or functional jurisdiction.

POST DISASTER PHASE

1. Relevant District administration to undertake DEP exercises as appropriate.
2. Provincial Disaster Management Authority to provide leadership to assure the DEP is reviewed and updated annually and copies of the revised DEP are distributed to all who received copies of the original DEP including the records for the local emergency authorities.

3. Provincial Disaster Management Authority will decide when to terminate the emergency.

Appendix A: Guidance for Determining the Emergency

Event	Situation
Seepage	New seepage areas in or near the bund
	New seepage areas with cloudy discharge or increasing flow rate
	Seepage with discharge greater than 10 gallons per minute
Sinkholes	Observation of new sinkhole in reservoir area
	Rapidly enlarging sinkhole
Instruments	Instrumentation readings beyond predetermined values.
Earthquake	Measurable earthquake felt or reported on or within 50 kilometers of the bund earthquake resulting in uncontrolled release of water from the bund.
	Earthquake resulting in visible damage to the bund or associated structures.
	Earthquake resulting in uncontrolled release of water from the bund.
Security threat	Verified bomb threat that, if carried out, could result in damage to the bund or associated structures with no impacts to the functioning of the bund.
	Detonated bomb that has resulted in damage to the bund or associated structures.
Sabotage/ vandalism	Damage to bund with no impacts to bund function.
	Modification to the bund or appurtenances that could adversely impact the functioning of the bund.
	Damage to the bund or associated structures that has resulted in seepage flow.
	Damage to the bund or associated structures that has resulted in uncontrolled water release.

Earthquake

Although risk related with the seismic activities has been taken into account while designing the structure and type of bund, yet there is risk in the case of unexpected earthquake of high magnitude. In case of earth quake:

1. Immediately conduct a general overall visual inspection of the bund.
2. Perform a field survey to determine if there has been any settlement and movement of the bund and low-level outlet works.
3. Drain the reservoir, if required.

Extreme weather events that exceed the original designed conditions can cause significant flow through the spillway or overtopping of the embankment. However, accidental or intentional damage to the bund may also result in emergency conditions. The conditions have been grouped to identify the most likely emergency-level condition. The groupings are provided as guidance only. Not all emergency conditions may be listed and the bund in charge is urged to use conservative judgment in determining whether a specific condition should be defined as an emergency situation at the bund.

Urgent; bund breach appears imminent or is in progress Seepage and Sinkholes Potential bund failure situation; rapidly developing:

1. Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes.
2. New or increased areas of wet or muddy soils are present on the downstream and/or foundation of the bund, and there is an easily detectable and unusual increase in volume of downstream seepage.
3. Significant new or enlarging sinkhole(s) near the bund or settlement of the bund is observed.
4. Reservoir level is falling without apparent cause.
5. The following known bund defects are or will soon be inundated by a rise in the reservoir:
 - Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the bund; or
 - Transverse cracks extending through the bund, abutments, or foundation.

Urgent; bund failure appears imminent or is in progress:

1. Rapidly increasing cloudy seepage or soil deposits at seepage exit points to the extent that failure appears imminent or is in progress.
2. Rapid increase in volume of downstream seepage to the extent that failure appears imminent or is in progress.
3. Water flowing out of holes in the downstream slope, abutment, and/or foundation of the bund to the extent that failure appears imminent or is in progress.
4. Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the bund or foundation.
5. Rapidly enlarging sinkhole(s) are forming on the bund or abutments to the extent that failure appears imminent or is in progress.
6. Rapidly increasing flow through crack(s) eroding materials to the extent that failure appears imminent or is in progress.

Potential bund failure situation; rapidly developing:

1. Settlement of the crest, slopes, abutments and/or foundation of the bund that may eventually result in breaching of the bund.
2. Significant increase in length, width, or offset of cracks in the crest, slopes, abutments, and/or foundation of the bund that may eventually result in breaching of the bund.

Urgent; bund failure appears imminent or is in progress:

1. Sudden or rapidly proceeding slides, settlement, or cracking of the crest, slopes, abutments, and/or foundation, and breaching of the bund appears imminent or is in progress.

Annexure 3: Validation of IBAT Proximity Report

Sr. No	Scientific Name	Common Name	Red List Category	Validation Status (Local survey)	Validation Status (Literature Review)
1.	<i>Sypheotides indicus</i>	Lesser Florican	CR	Not found	Reported in Tharparkar district of Sindh ¹⁴
2.	<i>Vanellus gregarius</i>	Sociable Lapwing	CR	Not found	Reported in Qambar Shahdadkot, Larkana Districts of Sindh ¹
3.	<i>Gyps bengalensis</i>	White-rumped Vulture	CR	Not found	Reported in District Tharparkar ¹⁵ and Nagarparker ¹⁶ Sindh
4.	<i>Sarcogyps calvus</i>	Red-headed Vulture	CR	Not found	Nagarparkar and Islamkot, Sindh ¹⁷
5.	<i>Gyps indicus</i>	Indian Vulture	CR	Not found	
6.	<i>Geoclemys hamiltonii</i>	Spotted Pond Turtle	EN	Not found	Reported in Khario Dhand, District Khairpur Sindh ¹⁸
7.	<i>Hardella thurjii</i>	Crowned River Turtle	EN	Not found	Reported in Guddu Barrage, Sindh ¹⁹
8.	<i>Manis crassicaudata</i>	Indian Pangolin	EN	Not found	Reported in Khirthar Protected Area Complex Sindh ²⁰
9.	<i>Panthera tigris</i>	Tiger	EN	Not found	According to IUCN Red List, it is extinct in Pakistan geographically
10.	<i>Varanus flavescens</i>	Yellow Monitor	EN	Not found	Reported near Floodplain area of Indus in Thatta ²¹
11.	<i>Nilssonia gangetica</i>	Indian Softshell Turtle	EN	Not found	Reported in Karp Lake and Ghulamullah Canal of Thatta district and Sanghriaro Lake (Chotiari) and Khipro Lake of Sanghar districts of Sindh ²²

¹⁴ Iqbal, M. A., Ullah, U., Khan, M. Z., Ghalib, S. A., Zehra, A., Khan, A. R., & Beg, M. N. RECENT OBSERVATION ON THE STATUS AND DISTRIBUTION OF THREATENED AND NEAR THREATENED BIRDS OF SINDH, PAKISTAN.

¹⁵ Murn, C., Saeed, U., Khan, U., & Iqbal, S. (2015). Population and spatial breeding dynamics of a Critically Endangered Oriental White-backed Vulture *Gyps bengalensis* colony in Sindh Province, Pakistan. *Bird Conservation International*, 25(4), 415-425.

¹⁶ Iqbal, M. M. Distribution and Status of Oriental White-backed Vulture *Gyps bengalensis* in Nagar Parkar, Sindh, Pakistan.

¹⁷ Mirza, Z. B., Soomro, N. A., & Shariff, F. (2021). New Distribution Record and the Status of Long-Billed Vulture *Gyps indicus* in Sindh Province of Pakistan in 2019–2020.

¹⁸ Safi, A., Khan, M. Z., Kanwal, R., & Karl, H. V. (2021). Population Status, Threats and Conservation of the Spotted Pond Turtle; *Geoclemys Hamiltonii* (Gray, 1830)(*Geoemydidae*) of Pakistan. *Journal of Zoological Research*, 3(1).

¹⁹ Hingoro, K., Chang, M. S., & Gachal, G. S. (2023). Hematological and Biochemical Analysis of Blood of Fresh Water Turtles (Order: Testudines) from River Indus (Guddu), Sindh, Pakistan.

²⁰ Khan, M. Z., Ghalib, S. A., Khan, A. R., Zehra, A., Yasmeen, R., Hussain, B., ... & Hashmi, M. U. A. (2013). Current habitat, distribution and status of the mammals of Khirthar protected area complex, Sindh. *Canadian Journal of Pure and Applied Science*, 7(2), 2347-2356.

²¹ Hashmi, M. U. A., Khan, M. Z., Amtiyaz, N. U. H., & Nawaz-Ul-Huda, S. (2013). Current status, distribution and threats of *Varanus* species (*Varanus bengalensis* & *Varanus griseus*) in Karachi & Thatta of Sindh. *Int. J. Fauna Biol. Stud*, 1(1), 34-38.

²² Khan, M. Z., Safi, A., Fatima, F., Ghalib, S. A., Hashmi, M. U. A., Khan, I. S., ... & Hussain, B. (2015). An evaluation of distribution, status and abundance of freshwater Turtles in Selected areas of Sindh and Khyber Pakhtunkhwa Provinces of Pakistan. *Canadian journal of pure and applied sciences*, 9(1), 3201-3219.

Sr. No	Scientific Name	Common Name	Red List Category	Validation Status (Local survey)	Validation Status (Literature Review)
12.	<i>Nilssononia hurum</i>	Indian Peacock Softshell Turtle	EN	Not found	Reported in Haleji Lake and Hadero Lake of Sindh ²³
13.	<i>Platanista minor</i>	Indus River Dolphin	EN	Not found	Reported at Guddu and Sukkhar barrage ²⁴
14.	<i>Axis porcinus</i>	Hog Deer	EN	Not found	Reported in Nara Game Reserve, Sindh ¹
15.	<i>Oxyura leucocephala</i>	White-headed Duck	EN	Not found	Reported only at Gharo Creek, Karachi Coast ¹
16.	<i>Calidris tenuirostris</i>	Great Knot	EN	Not found	Occurrence were recorded along the Indus Delta (Badin, Ketu Bunder, Gharo Creek and Korangi Creek, Port Qasim Area), mudflats of Haleji wetland complex, Phusna Lake and Chotiari Reservoir Sanghar ²⁵
17.	<i>Rynchops albicollis</i>	Indian Skimmer	EN	Not found	Haleji Wetland Complex , Gharo Creek, Korangi Creek, Hadero Lake, Hammal Lake and Manchar Lake Sindh ¹
18.	<i>Sterna acuticauda</i>	Black-bellied Tern	EN	Not found	Reported in wetlands of Sanghar, Sindh
19.	<i>Haliaeetus leucoryphus</i>	Pallas's Fish-eagle	EN	Not found	Reported in chotiari wetlands complex, sangahr, sindh, pakistan ²⁶
20.	<i>Neophron percnopterus</i>	Egyptian Vulture	EN	Not found	Reported in Mithi area close to Mithi bypass, Surjan Game Reserve (KPAC), Nagarparkar, Nara Desert Wildlife Sanctuary Khairpur ¹
21.	<i>Aquila nipalensis</i>	Steppe Eagle	EN	Not found	Kirther Protected Area Complex (KPAC), Haleji Lake, Keenjhar Lake (Chul-side Area), Hilly area of Gharo ¹
22.	<i>Falco cherrug</i>	Saker Falcon	EN	Not found	Reported as uncommon visitor of Indus River Delta ²⁷

²³ Khan, M. Z., Safi, A., Fatima, F., Ghalib, S. A., Hashmi, M. U. A., Khan, I. S., ... & Hussain, B. (2015). An evaluation of distribution, status and abundance of freshwater Turtles in Selected areas of Sindh and Khyber Pakhtunkhwa Provinces of Pakistan. Canadian journal of pure and applied sciences, 9(1), 3201-3219.

²⁴ Mahessar, A. A., Abro, N. A., Qureshi, A. L., Hafeez, M., Hassan, H. U., Hussain, M., & Niaz, G. (2021). Population Assessment and Conservation Strategies of the Indus River Dolphin, *Platanista gangetica* Minor, in Indus River Sindh, Pakistan. Egyptian Journal of Aquatic Biology & Fisheries, 25(4).

²⁵ Iqbal, M. A., Ullah, U., Khan, M. Z., Ghalib, S. A., Zehra, A., Khan, A. R., & Beg, M. N. (2023). Recent Observation on the status and distribution of threatened and near threatened birds of Sindh, Pakistan.

²⁶ Rais, M., Khan, M. Z., Ghalib, S. A., Nawaz, R., Akbar, G., Islam, S. L., & Begum, A. (2013). Global conservation significance of Chotiari Wetlands Complex, Sangahr, Sindh, Pakistan. J. of Animal and Plant Sc, 23(6), 1609-1617.

²⁷ Mahmood, T., Hussain, R., Rais, M., Hussain, I., & Nadeem, M. S. (2012). Habitat Analysis and Population Estimates of Three Falcon Species, Red-headed Merlin (*Falco chicquera*), Common Kestrel (*Falco tinnunculus*) and Saker Falcon (*Falco cherrug*), Inhabiting District Chakwal, Pakistan. Pakistan Journal of Zoology, 44(3).

Sr. No	Scientific Name	Common Name	Red List Category	Validation Status (Local survey)	Validation Status (Literature Review)
23.	Leptoptilos dubius	Greater Adjutant	EN	Not found	Not reported in Sindh
24.	Acinonyx jubatus	Cheetah	VU	Not found	As IUCN Red list, it is extinct in Pakistan
25.	Crocodylus palustris	Mugger	VU	Not found	Reported Deh Akro 2 Wildlife Sanctuary Nawabshah ²⁸
26.	Panthera pardus	Leopard	VU	Not found	Not reported in Sindh
27.	Prionailurus Viverrinus	Fishing Cat	VU	Not found	Spotted in District Sanghar, Sindh ²⁹
28.	Ursus thibetanus	Asiatic Black Bear	VU	Not found	As per IUCN Red List, it is extinct in Sindh Province
29.	Pangshura tecta	Indian Roofed Turtle	VU	Not found	Observed in Khirthar Canal, Dadu Canal, and Nara Canal, K. F. Feeder and Mirwah Canal. ³⁰
30.	Wallago attu		VU	Not found	Found in Manchar Lake, District Jamshoro, Sindh, Pakistan ³¹
31.	Neophocaena phocaenoides	Indo-Pacific Finless Porpoise	VU	Not found	Found along coastline areas of Sindh ¹
32.	Saara hardwickii	Indian Spiny tailed Lizard	VU	Not found	Reported in Haleji Lake, District Thatta, Sindh ³²
33.	Aythya ferina	Common Pochard	VU	Not found	Aythya ferina is a migratory bird and visit major water bodies including Hamal lake situated in District Shahdad Kot in Sindh, Pakistan every winter during November to February ³³
34.	Halcyon pileata	Black-capped Kingfisher	VU	Not found	Not reported in Sindh Province

²⁸ Chang, M. S., Gachal, G. S., Qadri, A. H., & Shaikh, M. Y. (2012). Bio-ecological status, management and conservation of marsh crocodiles (Crocodylus palustris) in Deh Akro 2, Sindh–Pakistan. *Sindh University Research Journal-SURJ (Science Series)*, 44(2).

²⁹ Islam, S., Nawaz, R., & Moazzam, M. (2015). A survey of Smooth-coated Otter (Lutrogale perspicillata sindica) and Fishing Cat (Prionailurus viverrinus) in Chotiari Reservoir, Sanghar, Pakistan using camera traps. *Internasional Journal of Biology and Biotechnology*, 12(4), 579-584.

³⁰ Khan, M. Z., Safi, A., Fatima, F., Ghalib, S. A., Hashmi, M. U. A., Khan, I. S., ... & Hussain, B. (2015). An evaluation of distribution, status and abundance of freshwater Turtles in Selected areas of Sindh and Khyber Pakhtunkhwa Provinces of Pakistan. *Canadian journal of pure and applied sciences*, 9(1), 3201-3219.

³¹ Wadhar, G. M., Narejo, N. T., Mahar, G. M., & Dars, B. A. (2013). Age and growth study of fresh water shark, Wallago attu (Bloch and Schneider) from Manchar Lake, District Jamshoro, Sindh, Pakistan. *Sindh University Research Journal-SURJ (Science Series)*, 45(2).

³² Begum, A. B. E. D. A., Khan, M. Z., Khan, A. R., Zehra, A. F. S. H. E. E. N., Hussain, B. A. B. A. R., Siddiqui, S. A. I. M. A., & Tabbassum, F. O. Z. I. A. (2013). Current status of mammals and reptiles at Hub Dam area, Sindh/Balochistan, Pakistan. *Current World Environment*, 8(3), 407-414.

³³ Thebo, A. K., Naz, S., Dharejo, A. M., Siyal, S., & Birmani, N. A. (2019). A new record and new species of a digenic trematode from common pochard Aythya ferina (Anseriformes: Anatidae) in Sindh, Pakistan. *Journal of Entomology and Zoology Studies*, 7, 151-154.

Sr. No	Scientific Name	Common Name	Red List Category	Validation Status (Local survey)	Validation Status (Literature Review)
35.	Columba eversmanni	Yellow-eyed Pigeon	VU	Not found	Recorded in Khararo Creek, China Creek, Keenjhar Lake, Gharo Creek, Sindh ³⁴
36.	Sterna aurantia	River Tern	VU	Not found	Recorded in Karachi and surrounding areas ³⁵
37.	Clanga clanga	Greater Spotted Eagle	VU	Not found	Recorded in Kohistan area, Thatta, Haleji Lake, Hadero Lake, Manchar Lake, Dadu, Kirthar Protected Area Complex, Nara Desert Wildlife Sanctuary. ¹
38.	Aquila rapax	Tawny Eagle	VU	Not found	Surjan and Sumbak Game Reserves in KPAC ³⁶
39.	Aquila heliaca	Eastern Imperial Eagle	VU	Not found	Reported in Sangahr, Sindh ³⁷
40.	Chrysomma altirostre	Jerdon's Babbler	VU	Not found	Reported in Sanghar and Tharparkar ³⁸
41.	Chlamydotis macqueenii	Asian Houbara	VU	Not found	Reported in Kohistan area, Thatta, Jhimpir, Badin, Nara Desert Wildlife Sanctuary, Ghotki and Tharparkar ¹ .
42.	Ovis vignei	Urial	VU	Not found	Reported in Khirthar Protected Area Complex, Sindh ³⁹
43.	Lissemys punctata	Indian Flapshell Turtle	VU	Not found	Reported in Badin, Dadu, Khairpur, Sanghar districts of Sindh Province ⁴⁰
44.	Xenochrophis cerasogaster	Painted Keelback	VU	Not found	Found in Sindh Province ⁴¹
45.	Schizothorax plagiostomus	Snow Trout	VU	Not found	Found along coastline of Sindh province ⁴²

³⁴ Hassan, H. U., Ali, Q. M., Ahmad, N., Attaullah, M., Chatta, A. M., Farooq, U., & Ali, A. (2020). Study of vertebrate diversity and associated threats in selected habitats of Sindh and Baluchistan, Pakistan. *International Journal of Biology and Biotechnology*, 17(1), 163-175.

³⁵ Khan, M. Z., Tabbassum, F., Ghalib, S. A., Zehra, A., Hussain, B., Siddiqui, S., ... & Iqbal, M. A. (2014). Distribution population status and conservation of the birds in Karachi Sindh, Pakistan. *Canadian Journal of Pure and Applied Sciences*, 8(1), 2697-2713.

³⁶ Iqbal, M. A., M. Z. Khan, U. Ullah, Zehra, A. and S, Zubair (2023). Distribution and status of mammals, birds and reptiles of Surjan and Sumbak Game Reserves, Kirther Protected Area. *Int. Journal of Biology and Biotechnology*, 20 (1) 125-136.

³⁷ Rais, M., Khan, M. Z., Ghalib, S. A., Nawaz, R., Akbar, G., Islam, S. L., & Begum, A. (2013). Global conservation significance of Chotiari Wetlands Complex, Sangahr, Sindh, Pakistan. *J. of Animal and Plant Sc*, 23(6), 1609-1617.

³⁸ Khan, A. A., Hussain, T., Rafay, M., Shahzad, M. I., & Ruby, T. (2014). Novel microsatellite based population genetic analysis of Pakistan endemic, jerdon's babbler (*chrysomma altirostre*: aves) from indus plains. *International Journal of Biosciences (IJB)*, 5(1), 97-103.

³⁹ Khan, M. Z., Ghalib, S. A., Khan, A. R., Zehra, A., Yasmeen, R., Hussain, B., ... & Hashmi, M. U. A. (2013). Current habitat, distribution and status of the mammals of Khirthar protected area complex, Sindh. *Canadian Journal of Pure and Applied Science*, 7(2), 2347-2356.

⁴⁰ Khan, M. Z., Kanwal, R., Ghalib, S. A., Fatima, F., Zehra, A., Siddiqui, S., ... & Ullah, U. (2016). A review of distribution, threats, conservation and status of freshwater turtles in Sindh. *Canadian Journal of Pure and Applied Sciences*, 10(3), 3997-4009.

⁴¹ Khan, M. Z., Ghalib, S. A., Siddiqui, S., Siddiqui, T. F., Farooq, R. Y., Yasmeen, G., ... & Zehra, A. (2012). Current status and distribution of reptiles of Sindh. *Journal of Basic and Applied Sciences*, 8(1), 26-34.

⁴² Ibrahim, A., Chen, B., Ali, I., Ali, H., Qadir, A., & Yang, G. (2021). Diversity and Conservation of Cetaceans in Pakistan. *ARPHA Preprints*, 2, e75384.

Sr. No	Scientific Name	Common Name	Red List Category	Validation Status (Local survey)	Validation Status (Literature Review)
46.	Bagarius bagarius		VU	Not found	It is indigenous fish species of Punjab and Sindh ⁴³ ,

43 Rafique, M., & Khan, N. U. H. (2012). Distribution and status of significant freshwater fishes of Pakistan. Rec. Zool. Surv. Pakistan, 21, 90-95.



Integrated Biodiversity Assessment Tool

MULTI-SITE REPORT

SINDH NDRMF

Number of sites selected: 6

Buffer applied: 1.0 km

Date of analysis: 16 October 2023 (GMT)

Generated by: Shazia Shahid

Organisation: ADB

About this report

The Multi-site Report serves to improve the inclusion of biodiversity within annual sustainability reporting. The report enables users to assess the biodiversity-related features of multiple operational sites for corporate disclosure. In particular, this report is relevant for Global Reporting Initiative (GRI) standard GRI 304: Biodiversity. For each operational site chosen by the user, the following biodiversity-related features are provided: counts of protected areas and Key Biodiversity Areas (KBAs) within the selected radius of operational sites, counts of Critically Endangered, Endangered and Vulnerable IUCN Red List species that are potentially found within a 50 km radius. Scores associated with the Species Threat Abatement and Restoration Metric are also provided to allow users to determine the relative opportunities for positive biodiversity action at sites.

Report package contents

This report is part of a package generated by IBAT on 16 October 2023 (GMT) which includes the following files:

1. This PDF report.
2. PDF "README" containing recommended use of IBAT, limitations, and glossary.
3. Compressed CSV file "iucn_red_list" containing the total number of IUCN Red List species by level of extinction risk within 50 km buffer of each operational site.
4. Compressed CSV file "protected_areas" containing names and designations of protected areas found within the selected buffer of each operational site.
5. Compressed CSV file "sites_of_biodiversity_importance" containing names of Key Biodiversity Areas (and details such as biodiversity elements triggering identification of the KBA) found within the selected buffer of each operational site.
6. Compressed CSV file "overlaps" listing the operational sites and the numbers of protected areas and Key Biodiversity Areas that occur within the selected buffer of each operational site.
7. Compressed CSV file "species_threat_abatement_and_restoration_star" listing the total and mean STAR Threat Abatement and STAR Restoration scores for each operational site.



Overlap with protected areas and Key Biodiversity Areas (KBAs)

The following table shows the number of protected areas and KBAs overlapped by a 1.0 km buffer for each operational site where an overlap occurs.

Site	Area (km ²)	Protected Areas	KBAs
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% Summary of protected areas overlap



6

- 0 (0.00% of sites) are within 1.0 km of a protected area.
- 6 (100.00% of sites) are not within 1.0 km of a protected area.

% Summary of KBAs overlap



6

- 0 (0.00% of sites) are within 1.0 km of a Key Biodiversity Area.
- 6 (100.00% of sites) are not within 1.0 km of a Key Biodiversity Area.

IUCN Red List of Threatened Species

The following table shows counts of species categorized as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) under the IUCN Red List of Threatened Species and found within 50 km of each site. For counts of all IUCN Red List species within a 50 km radius of each site please refer to the "iucn_red_list" CSV file located in the download package.

Site	CR	EN	VU	TOTAL
Sindh 1	3	17	21	41
Sindh 2	3	17	21	41
Sindh 3	3	16	19	38
Sindh 5	5	15	21	41



Site	CR	EN	VU	TOTAL
sindh 4	5	16	21	42
sindh 6	5	15	21	41

STAR Threat Abatement and Restoration Scores

The following table shows Species Threat Abatement and Restoration scores (centiSTAR unit) for the selected sites.

For a more granular understanding of the STAR scores at each Area of Interest, please generate an IBAT STAR report. For information on how STAR is calculated and STAR interpretation please see IBAT's "STAR Briefing Note" and "Business User Guidance".

Site	Total Threat Abatement Score	Total Restoration Score	Mean Threat Abatement Score	Mean Restoration Score
Sindh 1	0.002	2.983	0.002	2.983
Sindh 2	0.002	2.983	0.002	2.983
Sindh 3	0.0	3.28	0.0	3.28
Sindh 5	51.746	22.92	51.746	22.92
sindh 4	20.481	33.124	20.481	33.124
sindh 6	51.746	22.92	51.746	22.92



List of selected operational sites assessed in this report

Sindh 1, Sindh 2, Sindh 3, Sindh 5, sindh 4, sindh 6

Recommended citation

IBAT Multi-site Report. Generated under licence 1400-50001 from the Integrated Biodiversity Assessment Tool on 16 October 2023 (GMT). www.ibat-alliance.org

Limitations

This report provides an indication of potential biodiversity related features; protected areas, Key Biodiversity Areas and species close to the specified location. While it provides an early indication of potential biodiversity concerns, the report does not provide details of potential direct, indirect, downstream or cumulative impacts. Furthermore, the report provides a set of conservation values sourced from global data sets and is not a substitute for additional investigation and due diligence, especially concerning national and/or local conservation priorities.

Annexure 4: Occupational Health and Safety Plan

General

Occupational Health and Safety covers all personnel working under the project and will be in line with the World Bank/IFC EHS guidelines on health and safety.

The Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the work places, and, specifying how consultation, training and information are to be provided to employees at various workplaces.

Some of the risks/hazards associated with workplaces are due to working close to or at sites associated with the various project construction activities. Other risks associated with the project construction phase include risk of increase of vector borne and other different diseases.

The following sections will be implemented during the construction phase to address and ensure workers' health and safety.

a. Screening and regular unannounced checking of workers

As per the procedure for hiring workers, all contractors and labor agencies are required to make all prospective workers undergo medical tests to screen for diseases and sicknesses, prior to selection and employment of any worker. The contractor is also responsible for ensuring that no worker who has a criminal record is employed at the project site. It will be ensured that all workers undergo medical tests to screen diseases at source and at sites in consultation with the designated Health Officer.

In addition to this, the Project Management will also undertake sudden, unannounced checks on workers to look for diseases such as HIV, STDs, and hepatitis and take necessary steps as mandated by the Contractual agreement between the Contractor and the Worker(s).

b. Minimizing hazards and risks at the workplace.

To ensure safety at all work sites, the following will be carried out:

- i. Installation of signboards and symbols in risky and hazardous areas, to inform workers to be careful.
- ii. Construction of barricades around construction sites and deep excavated pits, to cordon off and deter entry of unauthorized personnel and workers into these areas.
- iii. Providing a safe storage site/area for large equipment such as power tools and chains, to prevent misuse and loss.
- iv. Proper Housekeeping: Ensuring that materials are all stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse. Brick stacks will not be more than 7 feet in height and for concrete blocks they will not be more than 6 feet high.
- v. Removing all scrap timber, waste material and rubbish from the immediate work area as the work progresses.

- vi. Where scaffolds are required, ensuring that each scaffold or its components shall be capable of supporting its own weight and at least 4 times the maximum intended load applied or transmitted to it. The platform/scaffold plank shall be at least 15 inches wide and 1.5 inches thick. The rope should be capable of supporting at least 6 times the maximum intended load applied or transmitted to that rope. Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer and shall be constructed and loaded in accordance with that design. Where scaffolds are not provided, safety belts/safety nets shall be provided;
- vii. Ensure that all ramps or walkways are at least 6 feet wide, having slip resistance threads and not inclined at more than a slope of 1 vertical and 3 horizontals.
- viii. Stacking away all excavated earth at least 2 feet from the pit to avoid material such as loose rocks from falling back into the excavated area and injuring those working inside excavated sites.
- ix. Constructing support systems, such as bracing to adjoining structures that may be endangered by excavation works nearby.
- x. Only a trained electrician to construct, install and repair all electrical equipment to prevent risks of electrical shocks and electrocution.
- xi. Install fire extinguishers and/or other fire-fighting equipment at every work site to prepare for any accidental fire hazards.

c. Provision of Personal Protective Equipment

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. This will be included in the construction cost for each Contractor. Depending on the nature of work and the risks involved, contractors must provide without any cost to the workers, the following protective equipment:

- i. High visibility clothing for all personnel during road works must be mandatory.
- ii. Helmet shall be provided to all workers, or visitors visiting the site, for protection of the head against impact or penetration of falling or flying objects.
- iii. Safety belt shall be provided to workers working at heights (more than 20 ft) such as roofing, painting, and plastering.
- iv. Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet.
- v. Ear protecting devices shall be provided to all workers and will be used during the occurrence of extensive noise.
- vi. Eye and face protection equipment shall be provided to all welders to protect against sparks.
- vii. Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapor.
- viii. Safety nets shall be provided when work places are more than 25 feet (7.5 m) above the ground or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors or safety belts is impractical.

The specific PPE requirements for each type of work are summarized below.

Table 6.1 PPE Requirement List

Type of Work	PPE
Elevated work	Safety helmet, safety belt (height greater than 20 ft), footwear for elevated work.
Handling work safety	Helmet, leather safety shoes, work gloves.
Welding and cutting work	Eye protectors, shield and helmet, protective gloves.
Grinding work	Dust respirator, earplugs, eye protectors.
Work involving handling of chemical substances	Dust respirator, gas mask, chemical-proof gloves. Chemical proof clothing, air-lined mask, eye protectors.
Wood working	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Blasting	Hard hat, eye and hearing protection.
Concrete and masonry work	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Excavation, heavy equipment, motor graders, and bulldozer operation	Hard hat, safety boots, gloves, hearing protection.
Quarries	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.

d. Procedures to Deal with Emergencies such as Accidents, Sudden Illness and Death of Workers

First aid kits will be made available at all times throughout the entire construction period by the respective contractors. This is very important, because most work sites will be at some distance from the nearest hospital. In addition to the first aid kits, the following measures should be in place:

- i. Provision of dispensaries by the individual EPC contractor.
- ii. A vehicle shall be on standby from the Project Office so that emergency transportation can be arranged to take severely injured/sick workers to the nearest hospital for immediate medical attention.
- iii. A designated Health Officer/worker for the Project will be identified as a focal person to attend to all health and safety related issues. This employee's contact number will be posted at all work sites for speedy delivery of emergency services. The focal person shall be well versed with the medical system and facilities available at the hospital.
- iv. Communication arrangements, such a provision of radios or mobile communication for all work sites, for efficient handling of emergencies, will be made.

e. Record Maintenance and Remedial action

The Project Management will maintain a record of all accidents and injuries that occur at the work site. This work will be delegated by the contractor to the site supervisor and regularly reviewed every quarter by project management. Reports prepared by the contractor shall include information on the place, date and time of the incident, name of persons involved, cause of incident, witnesses present and their statements. Based on such reports, the management can jointly identify any unsafe conditions, acts or procedures and recommend for the contractor to undertake certain mitigative actions to change any unsafe or harmful conditions.

f. Compensation for Injuries and Death

Any casualty or injury resulting from occupational activities should be compensated as per the local labor laws. Where compensation is sought by the injured party, proper procedures for documentation of the case will be followed, including a detailed report on the accident, written reports from witnesses, report of the examining doctor and his/her recommendation for treatment. Each individual contractor will be responsible for ensuring compensation for the respective workers.

g. Awareness Programs

The Project management will undertake awareness programs through posters, talks, and meetings with the contractors to undertake the following activities:

- i. Dissemination sessions will clarify the rights and responsibilities of the workers regarding interactions with local people (including communicable disease risks, such as HIV/AIDS), work site health and safety, waste management (waste separation, recycling, and composting), and the illegality of poaching.
- ii. Make workers aware of procedures to be followed in case of emergencies such as informing the focal health person who in turn will arrange the necessary emergency transportation or treatment.

h. Nomination of a Health and Safety Focal Person

Within each site (especially if different sites are being implemented by different contractors), a Health and Safety Focal Person will be appointed. The Terms of Reference for the focal person will mainly be as follows:

- i. Function as the focal person/representative for all health and safety matters at the workplace;
- ii. Responsible for maintaining records of all accidents and all health and safety issues at each site, the number of accidents and its cause, actions taken and remedial measures undertaken in case of safety issues;
- iii. Be the link between the contractor and all workers and submit grievances of the workers to the contractor and instructions/directives on proper health care and safety from the contractors back to the workers;
- iv. Ensure that all workers are adequately informed on the requirement to use Personal Protective Equipment and its correct use;
- v. Also responsible for the first aid kit and making sure that the basic immediate medicines are readily available.

Annexure 5: Emergency Response Plan

PURPOSE

The purpose of this Emergency Response Procedure is to provide measures and guidance for the establishment and implementation of emergency preparedness plans for the project. The aim of the Emergency Response Procedure is to:

- (i) Ensure all personnel and visitors to the office/job sites are given the maximum protection from unforeseen events.
- (ii) Ensure all personnel are aware of the importance of this procedure to protection of life and property.

EMERGENCY PREPARATION AND RESPONSE MEASURE SCOPE

The emergency management program is applied to all Project elements and intended for use throughout the Project life cycle. The following are some emergencies that may require coordinated response.

- (i) Construction Accident
- (ii) Road & Traffic Accident
- (iii) Hazardous material spills
- (iv) Structure collapse or failure
- (v) Trauma or serious illness
- (vi) Sabotage
- (vii) Fire
- (viii) Environmental Pollution
- (ix) Loss of person
- (x) Community Accident

RESPONSIBILITIES

The detailed roles and responsibilities of certain key members of the Emergency Response team available to assist in emergency are provided in **Table 5.1** below.

Table 5.1 Emergency Response Team

Action Group	Responsibility
Emergency Coordinator	<p>Overall control of personnel and resources.</p> <p>The Emergency Coordinator will support and advise the Site Safety Supervision as necessary.</p> <p>Serves as public relations spokes persons, or delegates to some staff member the responsibility for working with news media regarding any disaster or emergency. Also assure proper coordination of news release with appropriate corporate staff or other designated people.</p>
Site Safety Supervision (Emergency Commander)	<p>Overall responsibility for activating emergency plan and for terminating emergency actions.</p> <p>Be alternative of emergency response chairpersons.</p> <p>Disseminates warnings and information as required to ensure all people in the immediate area have been warned and evacuated either by alarms or by word of mouth.</p> <p>Supervise the actions of the Emergency Response Team to ensure all persons are safe from the danger.</p> <p>Notify outside authorities if assistance is required.</p> <p>Carries the responsibility for coordinating actions including other organizations in accordance with the needs of the situation.</p> <p>Ensure maximum co-operation and assistance is provided to any outside groups called to respond to an emergency.</p> <p>Establish and appoint all emergency organization structure and team.</p> <p>Assures adequate delegation of responsibilities for all key positions of assistants on the Project to assist with any foreseeable emergency.</p> <p>Ensure resources available to purchase needed emergency response equipment and supplies.</p> <p>Assures that all persons on the Emergency Response Team aware and fully understand their individual responsibilities for implementing and supporting the emergency plan.</p> <p>Establish the emergency drill schedule of all identified emergency scenarios, track the status and evaluate the emergency.</p> <p>The Emergency Commander shall ensure that senior management personnel have been reported of the emergency as soon as practical after the event.</p>
Security Team	<p>Ensure that the exit route is regularly tested and maintained in good working order.</p> <p>Maintain station at the security gate or most suitable location to secure the area during any emergency such that only authorized personnel and equipment may enter, prevent access to the site of unauthorized personnel.</p> <p>Assist with strong/activation of services during an emergency.</p> <p>Ensure vehicles and obstructions are moved to give incoming emergency vehicles access to the scene, if ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct any incoming emergency service to the site of emergency.</p>

Action Group	Responsibility
Rescue & Medical Team	<p>Protect the injured from further danger and weather.</p> <p>Provide treatment to the victim(s) to the best of their ability by first aid and then transfer to hospital.</p> <p>Remain familiar with the rescue activities and rescue apparatus.</p> <p>Assist outside medical services personnel when they arrive</p>
General Administration Team	<p>Response to support any requested general facilities for assisting Emergency Response Team in their work.</p>
Government Relation Team	<p>Coordinate with local government on a matter of concerned in the emergency response plan to liaise with local officers in their affair for support Emergency Response Team.</p> <p>Coordinate emergency plan with the government authorities, local community.</p>
Environment Team	<p>In case of emergency related to the environmental pollution such as the chemical spill, oil spill into the ambient, the environment team will support the technical advice to control and mitigate the pollution until return to the normal situation.</p>
Department Heads	<p>Call up of personnel into the safe location for protective life and property.</p> <p>Take immediate and appropriate action while Emergency Response Team is being mobilized.</p> <p>Keep in touch with the Emergency Commander</p> <p>Control and supervise operators and contractors on the implementation of this procedure, with consultation with Safety Team as necessary.</p> <p>Provide and maintain emergency equipment of their responsible areas.</p>
Other Staff and Employees	<p>All other staff and employees will remain at their workstations or assembly point unless directed otherwise from Emergency Response Team.</p> <p>Each supervisor will ensure that all members of his work group are accounted for and keep in touch with each of their Department Head.</p>

PROCEDURE

Emergency situation and injuries to person can occur at any time or place either on Project site or elsewhere. The most two common types of emergencies on site are fire and serious accident.

Figure 5.1. Emergency Procedure for Fire

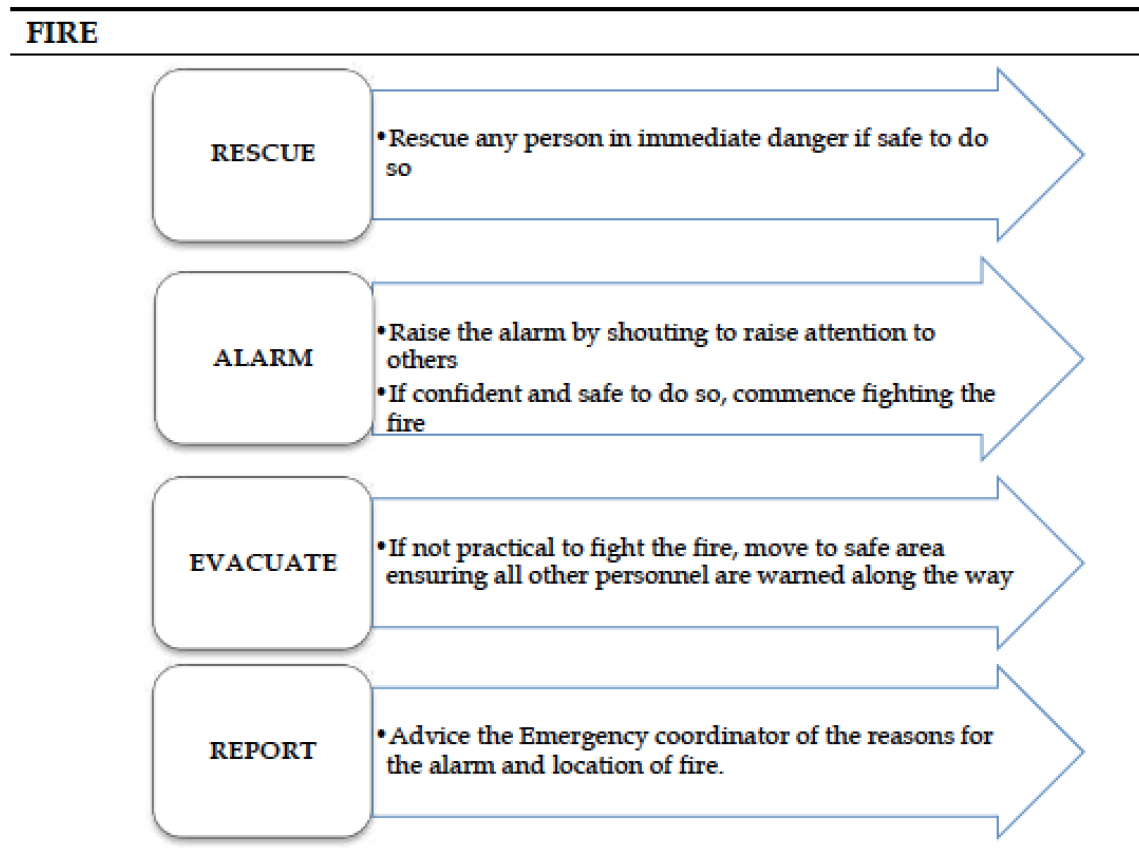
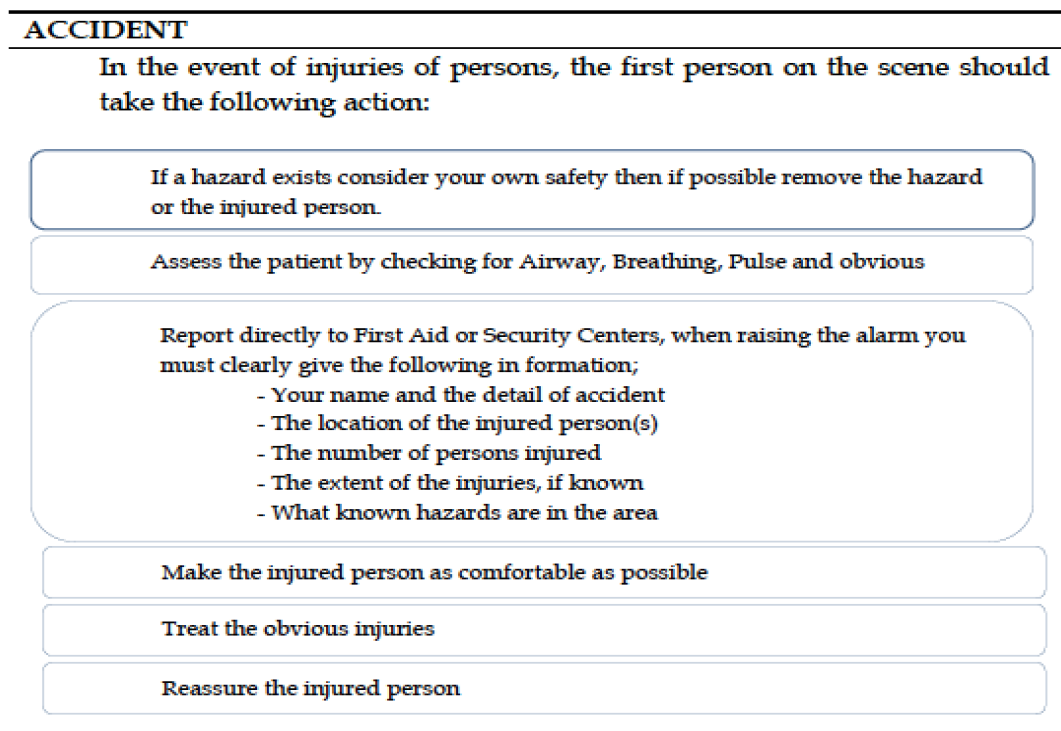


Figure 5.2 Emergency Procedure for Serious



COMMUNICATION WITH AUTHORITIES / PRESS AT SITE

In the event of an accident or incident, only senior staff is permitted to give factual information to the authorities for resource of liability exposure. The press must be avoiding politely, at all costs, with the terse comment that “the matter is under investigation and relevant information when available will be provided by our Head Office” Do not ever give your opinion or story.

First Aid Persons

- Upon advice of medical emergency, make immediate assessment to response required and if necessary, advise security to summon ambulance or medical assistance, the qualified first aid attendant should also,
- Provide treatment to the victim(s) to the best of his/her ability.
- Ensure the safety of victims by ceasing any work activity in the area.
- Protect the injured from further danger and weather.
- Assist medical services personnel when they arrive.

General Administration Team

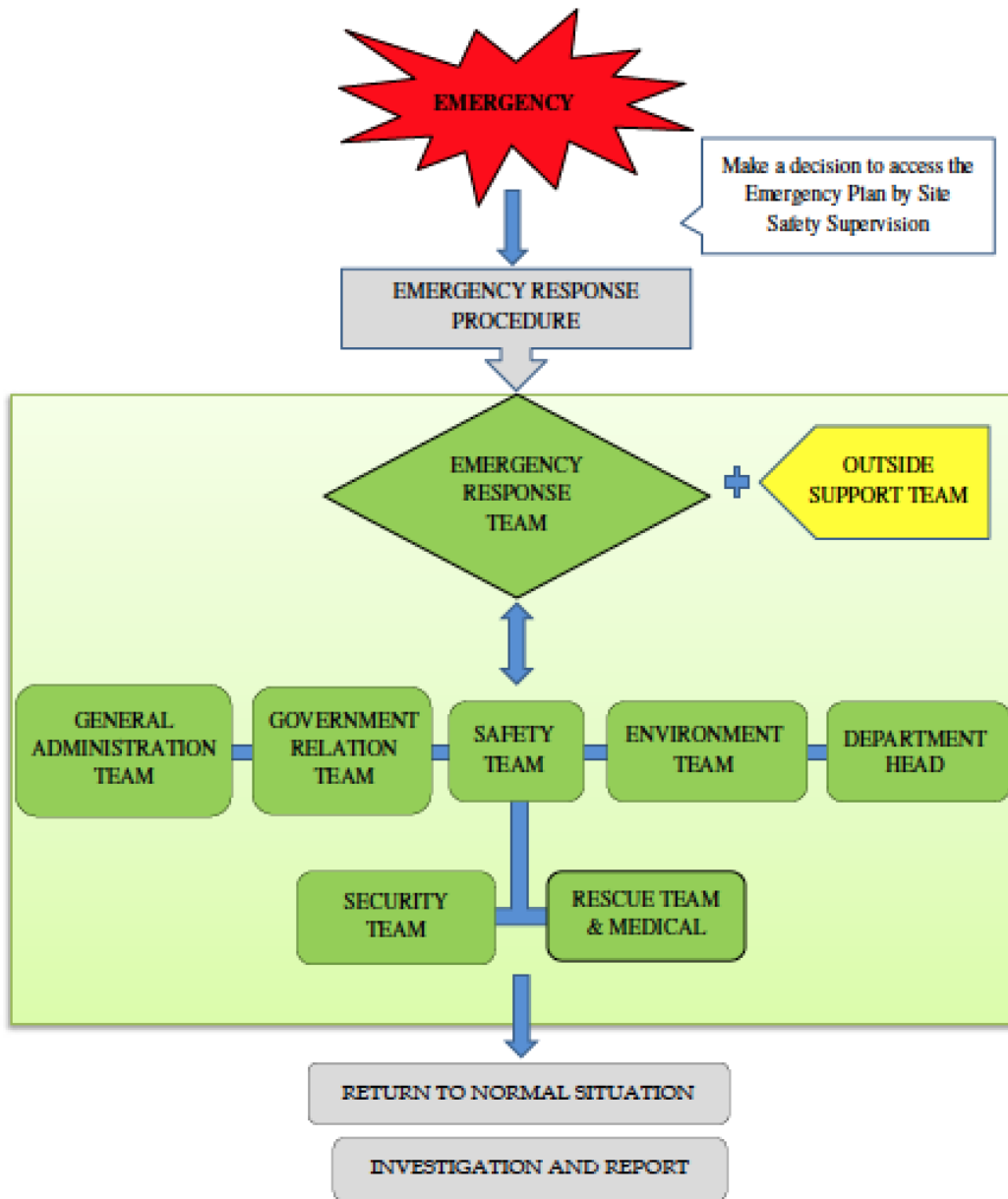
- Upon advice of medical emergency, maintain contact with first aid personnel and summon ambulance if required.

Security Team

- If ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct vehicle closest to the scene.
- Prevent access to the site of unauthorized personnel (press, etc.).

Emergency Coordinator

- The Emergency Coordinator shall assist emergency personnel at the scene as required through allocation of company resources.
- The Emergency Coordinator shall ensure next-of-kin are properly notified as soon as possible and give whatever company support and assistance is necessary to assist them bundle the situation.
- The Emergency Coordinator shall ensure that senior management personnel are advised of the emergency as soon as practical after the event.



Note: Name of contact person and call number from Owner/Contractor to be determined.

Figure 5.3 INCIDENT AND ACCIDENT REPORT

Section A: Identification Data										
Report No:	Date of Reported:				Reporter:	Sign:				
Job Title:					Company Name:					
Section B: Violence Rate										
Accident Violence: <input type="checkbox"/> 01-Death <input type="checkbox"/> 02-Serious Injury <input type="checkbox"/> 03-Lost Time Injury <input type="checkbox"/> 04-First Aid <input type="checkbox"/> 05- Not Injury <input type="checkbox"/> 06-Near Miss										
Property Damage Cost: <input type="checkbox"/> 1-2,000 USD <input type="checkbox"/> 2,001-10,000 USD <input type="checkbox"/> 10,001-50,000 <input type="checkbox"/> > 50,001										
Section C: Environmental Impact										
Affected area		<input type="checkbox"/> Construction area			<input type="checkbox"/> Public area					
Receptor		<input type="checkbox"/> None			<input type="checkbox"/> Workers		<input type="checkbox"/> Community			
Type of pollution		<input type="checkbox"/> Physical			<input type="checkbox"/> Chemical		<input type="checkbox"/> Biological			
Toxicity		<input type="checkbox"/> Non-toxic			<input type="checkbox"/> Low - toxic		<input type="checkbox"/> High - toxic			
Return to Normal		<input type="checkbox"/> 1 day			<input type="checkbox"/> 1 day to 1 week		<input type="checkbox"/> ≥ 1 week			
Cumulative impact		<input type="checkbox"/> Non-cumulative			<input type="checkbox"/> Cumulative					
Section D: Injured/Illness Employee										
1.Name:		Sex:	Date of Birth:			Age:	Regular Job Title:		Experience:	
		<input type="checkbox"/> Male <input type="checkbox"/> Female	Month	Day	Year				In this job title	In this Project
								Years	Weeks	Years
Site:	Company:		Reference:			Phone No:		Social Security Number:		
Part of Body Injured or Affected:					Nature of Injury or Illness:					
<input type="checkbox"/> Head	<input type="checkbox"/> Hands	<input type="checkbox"/> Face	<input type="checkbox"/> Nose	<input type="checkbox"/> Laceration	<input type="checkbox"/> Amputation	<input type="checkbox"/> Puncture	<input type="checkbox"/> Fracture			
<input type="checkbox"/> Eyes	<input type="checkbox"/> Legs	<input type="checkbox"/> Teeth	<input type="checkbox"/> Neck	<input type="checkbox"/> Strain & Sprain	<input type="checkbox"/> Burns	<input type="checkbox"/> Contusion	<input type="checkbox"/> Dry Heat Friction			
<input type="checkbox"/> Trunk	<input type="checkbox"/> Toes	<input type="checkbox"/> Elbow	<input type="checkbox"/> Shoulder	<input type="checkbox"/> Hernia	<input type="checkbox"/> Foreign Body	<input type="checkbox"/> Chemical	<input type="checkbox"/> Contamination			
<input type="checkbox"/> Back	<input type="checkbox"/> Ankle	<input type="checkbox"/> Wrist	<input type="checkbox"/> Foot	<input type="checkbox"/> Skin (Occupationnel)	<input type="checkbox"/> Rash	<input type="checkbox"/> Irritation				
<input type="checkbox"/> Arms	<input type="checkbox"/> Thump	<input type="checkbox"/> Fingers	<input type="checkbox"/> Internal							
Remark:					Remark:					
2.Name:		Sex:	Date of Birth:			Age:	Regular Job Title:		Experience:	
		<input type="checkbox"/> Male <input type="checkbox"/> Female	Month	Day	Year				In this job title	In this Project
								Years	Weeks	Years
Site:	Company:		Reference:			Phone No:		Social Security Number:		
Part of Body Injured or Affected:					Nature of Injury or Illness:					
<input type="checkbox"/> Head	<input type="checkbox"/> Hands	<input type="checkbox"/> Face	<input type="checkbox"/> Nose	<input type="checkbox"/> Laceration	<input type="checkbox"/> Amputation	<input type="checkbox"/> Puncture	<input type="checkbox"/> Fracture			
<input type="checkbox"/> Eyes	<input type="checkbox"/> Legs	<input type="checkbox"/> Teeth	<input type="checkbox"/> Neck	<input type="checkbox"/> Strain & Sprain	<input type="checkbox"/> Burns	<input type="checkbox"/> Contusion	<input type="checkbox"/> Dry Heat Friction			
<input type="checkbox"/> Trunk	<input type="checkbox"/> Toes	<input type="checkbox"/> Elbow	<input type="checkbox"/> Shoulder	<input type="checkbox"/> Hernia	<input type="checkbox"/> Foreign Body	<input type="checkbox"/> Contamination	<input type="checkbox"/> Chemical			
<input type="checkbox"/> Back	<input type="checkbox"/> Ankle	<input type="checkbox"/> Wrist	<input type="checkbox"/> Foot	<input type="checkbox"/> Skin (Occupationnel)	<input type="checkbox"/> Rash	<input type="checkbox"/> Irritation				
<input type="checkbox"/> Arms	<input type="checkbox"/> Thump	<input type="checkbox"/> Fingers	<input type="checkbox"/> Internal							
Remark:					Remark:					
Section E: Accidents/incident Details										
Date Accident/Incident Occurred:				Time Accident/Incident Occurred:				Exact Location of the Accident / Incident:		

Details of the actual Job Being done at the time:

Details of Accident / Incident / What actually happened?

Section F: Accident Cause (Basic cause mark X / Contributing cause, if any mark O)

UNSAFE CONDITIONS		UNSAFE ACTS	
1	<input type="checkbox"/> Inadequately Guarded	1	<input type="checkbox"/> Operating Without Authority / Training
2	<input type="checkbox"/> Unguarded	2	<input type="checkbox"/> Operating at Unsafe Speed
3	<input type="checkbox"/> Defective Tools, Equipment, or Substance	3	<input type="checkbox"/> Marking SHE Device Inoperative
4	<input type="checkbox"/> Unsafe Design or Construction	4	<input type="checkbox"/> Using Unsafe Equipment or Equipment Unsafely
5	<input type="checkbox"/> Hazardous Arrangement	5	<input type="checkbox"/> Unsafe Loading, Placing, Mixing
6	<input type="checkbox"/> Unsafe Illumination	6	<input type="checkbox"/> Taking Unsafe Position
7	<input type="checkbox"/> Unsafe Ventilation	7	<input type="checkbox"/> Working on Moving or Dangerous Equipment
8	<input type="checkbox"/> Unsafe Clothing	8	<input type="checkbox"/> Distraction, Teasing, Horse Play
9	<input type="checkbox"/> Insufficient Instruction	9	<input type="checkbox"/> Failure to use Personal Protective Devices
10	<input type="checkbox"/> Lack of system of work	10	<input type="checkbox"/> Lack of effective instruction or supervision
Why was the unsafe act committed? _____		Why did the unsafe condition exist? _____	

Section G: Guide to Corrective Action (Base on the cause checked above, I am taking the following corrective action)

UNSAFE ACT	UNSAFE CONDITION	If Supervisor can't handle, then recommend to
<input type="checkbox"/> Stop the Behaviour	<input type="checkbox"/> Remove	<input type="checkbox"/> Site Engineer, or
<input type="checkbox"/> Study the job	<input type="checkbox"/> Guard	<input type="checkbox"/> Site Manager, or
<input type="checkbox"/> Instruct (tell-show-try-check)	<input type="checkbox"/> Warn	<input type="checkbox"/> Project Manager, or
<input type="checkbox"/> Follow Up	<input type="checkbox"/> Supervisory Training	<input type="checkbox"/> Safety Committee
<input type="checkbox"/> Enforce		

Detail below any immediate remedial actions that have been taken:

Detail below any corrective and preventative actions that could be taken to prevent future re-occurrence:	Responsible	Completion Date

Section H: Witness Statement			
Witness Name		Interviewer Name	
Section I: Reviewed & Recommend by			
Recommendation:			
Reviewed By:	Position:	Signature:	Date:
Remarks : If Accident or Incident happened with lost time injury and affected to the publicity must further report to Safety Department; : First Aid Cases will not applicable to this form; : The accident report shall submit to Safety Department within 3 days : Attached the photograph or sketch the location of accident / incident;			

Annexure 6: Archaeological 'Chance Find' procedure

Background

The purpose of this document is to address the possibility of archaeological deposits becoming exposed during ground altering activities within the project area and to provide protocols to follow in the case of a chance archaeological find to ensure that archaeological sites are documented and protected as required.

Archaeological sites are an important resource that is protected for their historical, cultural, scientific and educational value to the general public and local communities. Impacts to archaeological sites must be avoided or managed by development proponents. The objectives of this 'Archaeological Chance Find Procedure' are to promote preservation of archaeological data while minimizing disruption of construction scheduling/ It is recommended that due to the moderate to high archaeological potential of some areas within the project area, all on site personnel and contractors be informed of the Archaeological Chance Find Procedure and have access to a copy while on site.

Potential Impacts to Archaeological Sites

Developments that involve excavation, movement, or disturbance of soils have the potential to impact archaeological materials, if present. Activities such as road construction, land clearing, and excavation are all examples of activities that may adversely affect archaeological deposits.

Archaeological 'Chance Find' Procedure

If you believe that you may have encountered any archaeological materials, stop work in the area and follow the procedure below:

The following 'chance-find' principles will be implemented by the contractor throughout the construction works to account for any undiscovered items identified during construction works:

- (i) Workers will be trained in the location of heritage zones within the construction area and in the identification of potential items of heritage significance.
- (ii) Should any potential items be located, the site supervisor will be immediately contacted and work will be temporarily stopped in that area.
- (iii) If the site supervisor determines that the item is of potential significance, an officer from the department of Archaeology (DoA) will be invited to inspect the site and work will be stopped until DoA has responded to this invitation.
- (iv) Work will not re-commence in this location until agreement has been reached between DoA and proponent as to any required mitigation measures, which may include excavation and recovery of the item.
- (v) A precautionary approach will be adopted in the application of these procedures.

Detailed Procedural Steps

If the Director, department of Archaeology receives any information or otherwise has the knowledge of the discovery or existence of an antiquity of which there is no owner, he shall, after satisfying himself as to the correctness of the information or knowledge, take such steps with the approval of the Government, as he may consider necessary for the custody, preservation and protection of the antiquity.

Whoever discovers, or finds accidentally, any movable antiquity shall inform forth with the Directorate within seven days of its being discovered or found.

If, within seven days of his being informed, the Director decides to take over the antiquity for purposes of custody, preservation and protection, the person discovering or finding it shall hand it over to the Director or a person authorized by him in writing.

Where the Director decides to take over an antiquity, he may pay to the person by whom it is handed over to him such cash reward as may be decided in consultation with the Advisory Committee.

The Director or any officer authorized by him with police assistance may, after giving reasonable notice, enter into, inspect and examine any premises, place or area which or the sub-soil of which he may have reason to believe to be, or to contain an antiquity and may cause any site, building, object or any antiquity or the remains of any antiquity in such premises, place or area to be photographed, copied or reproduced by any process suitable for the purpose.

The owner or occupier of the premises, place or area shall afford all reasonable opportunity and assistance to the Director.

No photograph, copy of reproduction taken or made shall be sold or offered for sale except by or with the consent of the owner of the object of which the photograph, copy or the reproduction has been taken or made.

Where substantial damage is caused to any property as a result of the inspection, the Director shall pay to the owner thereof reasonable compensation for the damage in consultation with the Advisory Committee.

If the Director after conducting an inquiry, has reasonable grounds to believe that any land contains any antiquity, he may approach the Government to direct the Revenue Department to acquire such land or any part thereof and the Revenue Department shall thereupon acquire such land or part as for a public purpose.

Annexure 7: Dust Management Plan

General

The purpose of this plan is to describe the measures that the project shall take to ensure that the risk of emissions from dust generated by site operations during construction are minimized and that best practice measures are implemented.

Dust emissions from construction can cause ill health effects to Contractor staff along with nuisance and annoyance to members of the local community. Dust will be controlled through:

- Elimination
- Reduction/Minimization
- Control

This dust management plan shall be implemented based on the measures already provided in the Environmental Management Plan (EMP) relating to controlling dust emissions.

Methodology

The following methodology will be undertaken for each project section:

Step 1 – Identify the dust generating activities

Construction activities that are likely to produce dust will be identified. The activities that will be taken into account are:

- Haulage Routes, Vehicles and Asphalt/Concrete Batching Plant
- Roads, surfaces and public highways
- Static and mobile combustion plant emissions
- Tarmac laying, bitumen surfacing and coating
- Materials Handling, Storage, Spillage and Disposal
- Storage of material
- Stockpiles
- Spillages
- Storage of Waste
- Site Preparation and Restoration after Completion
- Earthworks, excavation and digging
- Storage of spoil and topsoil
- Demolition
- Construction and Fabrication Processes

Step 2 – Identify Sensitive Receptors

Sensitive receptors have already been identified. The nature and location of the sensitive receptors will be taken into account when implementing control measures.

Step 3 – Implement Best Practice Measures to Control

Based on the nature of the activity producing the dust, the likelihood of dust being produced and the possible consequence of dust based on the sensitive receptors, the most effective control measure will be identified and implemented.

Step 4 – Monitor effectiveness of control

Construction Supervision Staff (CSC) will have the responsibility to ensure that dust control measures are being implemented and are effective.

Step 5 – Record and report result of monitoring

All inspections, audits and results of monitoring will be recorded and kept as part of the site filing system.

Method Statements and Risk Assessments

- The Contractor's Risk Assessments and Method Statements will be required to be approved by the CSC prior to commencing work and will be required to contain environmental aspects of the task, including dust control measures where required.
- Where dust has been identified within the risk assessment as a significant issue, the method statement will be required to cover the following:
 - Methods and materials that will be used to ensure that dust generation is minimized.
 - The use of pre-fabricated materials where possible.
 - Optimum site layout:
 - Dust generating activities to be conducted away from sensitive receptors
 - Supply of water for damping down.
 - Good housekeeping and management
 - All employees will be briefed on the Risk Assessment and Method Statement before starting work.

Training

All Contractor staff will be required to attend training seminars as already mentioned in the EMP document. A site-specific induction will also be required before being allowed to work on site. These will include site-specific sensitive receptors and details regarding dust control measures to be taken.

Toolbox talks on air pollution and minimizing dust emissions will be provided on a regular basis to Contractor staff.

Identification of Dust Generating Sources and Control Methods Haulage Routes, Vehicles and Asphalt/Concrete Batching Plant

Dust Source	Dust Control Methods
Major haul roads and traffic routes	Haul roads will be dampened down via a mobile bowser, as required.
Public Roads	Road sweeper will be used to clean public roads as required.
Site traffic management	Site traffic will be restricted to constructed access roads as far as possible. Site speed limit will be set at 10 mph as this will minimize the production of dust.
Road Cleaning	A mechanical road sweeper will be readily available and used.
Handling, Storage, Stockpiling and Spillage of Dusty materials	
Material handling operations	The number of times a material will have to be handled will be kept to a minimum to prevent double handling and ensure dusty materials are not handled unnecessarily.
Transport of fine dusty materials and aggregates.	Closed tankers will be used or sheeted vehicles.
Vehicle loading/unloading materials on to vehicles and conveyors.	Dusty materials will be dampened down Drop heights will be kept to a minimum and enclosed where possible.
Storage of Materials	
Bulk cement, bentonite etc.	Bentonite will be delivered in tankers and stored in dedicated enclosed areas. Bulk cement will be transported through tractor trollies or trailers.
Fine dry materials	These will be protected from the weather and by storing in appropriate containers and indoors, where necessary.
Storage location	Material will be stored in dedicated lay-down areas.
Storage of Stockpiles	
Stockpile location	Stockpiles will be placed so as to minimize double handling and facilitate the site restoration.
Building stockpiles	Stockpiles, tips and mounds will not be stored at an angle greater than an angle of repose of the material.
Small and temporary stockpiles	Where possible, stocks will be placed under sheeting. Dusty material will be damped down. Wind barriers (protective fences) of a similar height to the stockpiles will be erected, if required.
Large and long term stockpiles	Long-term stockpiles will be vegetated and stabilized as soon as possible. Stock plies will be dampened down until stabilized, where necessary. Wind barriers (protective fences) of a similar height to the stockpile will be erected, if required.
Waste Material from Construction	
Disposal method	A dedicated lay-down area will be available for waste. Waste will not be allowed to build up and will be disposed off at the designated locations as per EMP.
Site Preparation and Restoration	

Dust Source	Dust Control Methods
Earthworks, excavation and digging	These activity areas will be kept damp where required and if possible, will be avoided during dry and windy periods.
Completed earthworks	Surfaces will be stabilized by re-vegetation as soon as possible, where applicable.
Construction and Fabrication Process	
Crushing of material for reuse, transportation and disposal	Authorization will be obtained from PMU and ADB before using any mobile plant on site for activities such as crushing and screening. Any crushing or screening activities will be located away from sensitive receptors.
Cutting, grinding, drilling, sawing, trimming, planing, sanding	These activities will be avoided wherever possible. Equipment and techniques that minimize dust will be implemented. Water will be used to minimize dust.
Cutting roadways, pavements, blocks	Water sprinkling to be used.
Angle grinders and disk cutters	Best practice measures will be used such as dust extraction

Monitoring Arrangements

Monitoring will be conducted at sensitive receptor locations in the project area as provided in the EMP. Furthermore, at locations where PM levels are exceeding applicable guidelines, additional stringent measures will be implemented at the respective location(s) in the project area to ensure dust levels are controlled as far as possible.

Annexure 8: Site Specific EMP (SSEMP) Guide & Template for Guidance to Contractor

Guide for Development of SSEMP

- Step 1: Define Boundaries
- Step 2: Identify Sensitive Receptors
- Step 3: Specify construction activities
- Step 4: Conduct Risk Assessment
- Step 5: Assign Environment Management measures
- Step 6: Prepare Site Plans
- Step 7: Prepare Environment Work Plans (if required)
- Step 8: Monitoring

Step 1: The project area needs to be clearly defined.

Step 2: The mapping of sensitive receptors has already been conducted and needs to be presented clearly in a map.

Step 3: The tentative construction activities to be conducted are as follows:

- Site Surveying and Vegetation (Trees and plants) Clearance
- Establishment of Work Camp, Batching and Asphalt plant and access roads
- Dismantling of Asphalt and existing structures including Utilities
- Preparation of ground for Asphaltting
- Asphaltting
- Landscaping

Step 4: The Risk Assessment matrix template is provided in the table below.

Risk is assessed as the likelihood that the activity will have an effect on the environment as well as the consequence of the effect occurring. It is often described like this:

Risk = Likelihood × Consequence

Likelihood Scale

Likelihood	Definition	Scale
Certain	Will certainly occur during the activity at a frequency greater than every week if preventative measures are not applied	5
Likely	Will occur more than once or twice during the activity but less than weekly if preventative measures are not applied	3
Unlikely	May occur once or twice during the activity if preventative measures are not applied	2
Rare	Unlikely to occur during the project	1

Consequence Scale

Consequence	Definition	Score
Catastrophic	The action will cause unprecedented damage or impacts on the environment or surrounding community e.g. extreme loss of soil and water resources and quality from stormwater runoff extreme pollution of soil and water resources including major contamination from hazardous materials widespread effects on ecosystems with deaths of fauna/flora widespread community impacts resulting in illness, injury or inconvenience loss or destruction of archaeological or historical	5

	sites Occurrence will almost certainly result in the work being halted and a significant fine.	
Major	The action will cause major adverse damage on the environment or surrounding communities' e.g. major loss of soil and water resources and quality from stormwater runoff major pollution of soil and water resources including contamination from hazardous materials significant effects on ecosystems with isolated deaths of non-vulnerable flora and fauna significant annoyance or nuisance to communities major damage to or movement required to archaeological or historical sites Occurrence may result in work being halted and a fine	3
Moderate	No or minimal adverse environmental or social impacts e.g. no measurable or noticeable changes in stormwater quality. Water quality remains within tolerable limits little noticeable effect on ecosystems no or isolated community complaints no or unlikely damage to archaeological or historical sites no likelihood of being fined	2
Minor	No or minimal adverse environmental or social impacts e.g. no measurable or noticeable changes in stormwater quality. Water quality remains within tolerable limits little noticeable effect on ecosystems no or isolated community complaints no or unlikely damage to archaeological or historical sites no likelihood of being fined	1

Risk Score Table

Likelihood	Consequence			
	Catastrophic	Major	Moderate	Minor
Certain	25	15	10	5
Likely	15	9	6	3
Unlikely	10	6	4	2
Rare	5	3	2	1

Risk: Significant: 15-25

Medium: 6-10

Low 1-5

Any Medium to Significant risk requires an environmental management measure to manage the potential environmental risk. Judgement will be required concerning the application of an environmental management measure to mitigate low risk situations.

The higher the risk the more intensive the required mitigation measure will need to be; e.g. where site sedimentation is deemed to be low risk, then silt fences may be needed but as the

risk increases, then sediment traps may be required. The selection of the appropriate mitigation measure will require judgement based on the level of risk and the specific site parameters.

Step 5: The Environmental Management measures are to be extracted from the IEE study for the project and should be added in the last column of the table below.

No.	Construction Activity	Hazards to Consider	Likelihood that the site or sensitive receptors will be affected?	Consequence of the site or sensitive receptors being affected?	Risk Score (consequence x likelihood)	Environmental Management Measures
i	Site Surveying & vegetation clearance	Damage to vegetation beyond project footprint				These can be taken from the EMP provided in the IEE report (If Risk Score is 6 or more)
		Erosion of exposed areas and sediment				
		Loss of topsoil				
		Dust generation				
		Noise				
ii	Establishment of Work Camp, Batching plant etc.	Soil deposited onto roads from tires				
		StocPunjabile erosion				
		Noise & Vibration				
		Traffic congestion				
		Fuel spills				
iii	Dismantling of Asphalt and existing structures including Utilities	Noise and vibration				
		Dust generation				
		Community safety				

		Worker safety				
		Traffic Congestion				
iv	Preparation of Sub-Base	Noise and vibration				
		Dust generation				
		Traffic Congestion				
v	Landscaping	Dust generation				
		Sediment runoff				
		Failure of vegetation to take root				

Step 6: The Site plans are a critical part of the SSEMP and will need to be prepared, otherwise the ADB will consider the document as incomplete.

The site plan will need to provide the following:

- Indication of North and scale
- Existing and planned supporting infrastructure (e.g. access roads, water supplies and electricity supplies)
- Location of planned work
- Contours
- Drainage systems
- Locations of sensitive receptors

Step 7 (if required)⁴⁴: The completed SSEMP provides details of all the environmental management requirements for all stages of the construction process. For individual work teams who are responsible for only a small part of the overall construction works it can be confusing as to what is required for their particular work component. For example, the work team responsible for stripping soil for the construction areas are not going to be interested in the requirements for pouring concrete for footings and foundations. However, it is essential that the soil stripping team knows exactly what to clear and what to leave and where to put stockpiles of soil for later use.

In situations where different work activities are required at different times or at different locations, environmental work plans can be prepared. These are similar to the work method statements that are often produced for major construction projects.

Step 8: A detailed monitoring plan will be provided along with frequency and responsibilities to ensure all key environmental parameters are monitored to ensure compliance with both national and ADB requirements.

Template for SSEMP

- Introduction
- Project Overview
- Scope of SSEMP
- Objectives of SSEMP
- Map of Sensitive Receptors
- Construction Activities
- Risk Assessment
- Risk Assessment Matrix & Mitigation Measures
- Site Plan(s)
- Environmental Monitoring Plan
- Instrumental Monitoring of Environmental Parameters by Contractor as per EMP
- In-house monitoring
- Third Party environmental monitoring
- Visual monitoring of Environmental Parameters by Contractor as per EMP
- Responsibilities
- Organizational Responsibilities and Communication
- Responsibility of EA
- Responsibility of Construction Supervision Consultant (CSC)
- Responsibility of Contractor
- Responsibility of EPA

⁴⁴ ADB, Safeguards Unit for Central & West Asia Department, *Environmental Management for Construction Handbook*.

Annexure 9: Accident and Incident Investigation Procedure

INCIDENT / NEAR MISS REPORT	QUALITY RECORDS / FORMS
Doc. Level:	Doc. Version:1
Doc. No	

HS.T.02	INCIDENT / NEAR MISS REPORT
Title of Project:	
Location:	Date:

Objective(s)
To implement immediate and effective process in order to provide immediate treatment against any fatality, Injuries, Casualty.

SECTION A: TO BE COMPLETED BY PERSON INVOLVED (OR BY SUPERVISOR OR HEALTH AND SAFETY REPRESENTATIVE IF WORKER IS INCAPACITATED) AND BY THEIR SUPERVISOR													
<p>Details of the person involved in the incident/near miss</p> <p>Employee #: Site Address Work phone:</p> <p>Name: Father Name:</p> <p>Position: Date of birth: <input type="checkbox"/> Male <input type="checkbox"/> Female</p> <p>Please select one: <input type="checkbox"/> Member <input type="checkbox"/> Client Member <input type="checkbox"/> Sub Contractor <input type="checkbox"/> Visitor/Other</p>													
<p>Details of the: <input type="checkbox"/> Incident <input type="checkbox"/> Near miss <input type="checkbox"/> Medical</p> <p>Date: Time: A.M /P.M</p> <p>City: Location:</p> <p>Was the incident/near miss reported to your supervisor, immediately: <input type="checkbox"/> Yes <input type="checkbox"/> No</p>													
<p>Part of the body injured</p> <table style="width: 100%; border: none;"> <tr> <td style="vertical-align: top;"> <p>Head</p> <input type="checkbox"/> neck <input type="checkbox"/> hip <input type="checkbox"/> nose <input type="checkbox"/> mouth <input type="checkbox"/> teeth <input type="checkbox"/> face <input type="checkbox"/> skull </td> <td style="vertical-align: top;"> <p>Trunk</p> <input type="checkbox"/> heart <input type="checkbox"/> lungs <input type="checkbox"/> chest <input type="checkbox"/> stomach <input type="checkbox"/> groin <input type="checkbox"/> back <input type="checkbox"/> multiple </td> <td style="vertical-align: top;"> <p>Internal</p> <input type="checkbox"/> left <input type="checkbox"/> right <input type="checkbox"/> systemic </td> <td style="vertical-align: top;"> <p>Arm</p> <input type="checkbox"/> left <input type="checkbox"/> right <input type="checkbox"/> shoulder <input type="checkbox"/> upper arm <input type="checkbox"/> elbow <input type="checkbox"/> forearm <input type="checkbox"/> wrist </td> <td style="vertical-align: top;"> <p>Hand</p> <input type="checkbox"/> left <input type="checkbox"/> right <input type="checkbox"/> thumb <input type="checkbox"/> fingers <input type="checkbox"/> palm </td> <td style="vertical-align: top;"> <p>Leg</p> <input type="checkbox"/> left <input type="checkbox"/> right <input type="checkbox"/> knee <input type="checkbox"/> lower leg <input type="checkbox"/> ankle <input type="checkbox"/> thigh <input type="checkbox"/> upper leg </td> <td style="vertical-align: top;"> <p>Foot eye</p> <input type="checkbox"/> ear <input type="checkbox"/> great toe <input type="checkbox"/> other toes <input type="checkbox"/> psychosocial </td> </tr> </table> <p>Nature of injury</p> <table style="width: 100%; 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Annexure 10: Traffic Management Plan

Need for Plan

The construction of the sub-projects will take place over 7 months and in this period, vehicular movement carrying large amount of material and machinery is expected. This will interrupt the local traffic and is therefore important to manage the traffic to avoid the nuisance to local residents in terms of noise, dust, congestion and inconvenience.

The plan

The objective of the Traffic Management Plan (TMP) is to define the requirements that should be implemented to mitigate any potential negative risks to the environment, workers or the community resulting from construction traffic.

- The TMP will advise and inform site Contractors and external suppliers of equipment and materials of access and entry points along with other key information such as tipping areas and wash-out areas. It is intended to compliment and work alongside relevant ESMMP. The TMP will be classed as “live” and therefore be subjected to updates as required.
- Contractor, at the time of the execution of the project will prepare a comprehensive TMP in coordination with local traffic police department, PMU, emergency services and local administrative department. The PMU and CSC will review and approve contractors TMP. The contractor’s TMP shall include following mitigation measures during its preparation:
- Undertake a road conditions assessment prior to and following the peak construction period, to assess any damage to road infrastructure that can be attributed to Project construction.
- Repair damage as appropriate or enter into a voluntary agreement with the relevant roads authority to reimburse the cost of any repairs required to the public road network as a result of the Project.
- Spoil dumpsites located close to Project site to minimise journey distance and limit movements to site access roads.
- Concrete mixing plant located at Project site limiting traffic movements associated with concrete delivery to site access roads
- Construction of worker accommodation on site to reduce light vehicle movements relating to travel to/ from the site
- Provision of bus/minibus services for personnel living in nearby settlements
- Movements of construction workers will be planned to avoid the busiest roads and times of day when traffic is at its greatest.
- Schedule deliveries and road movements to avoid peak periods
- Road maintenance fund to leave a useful asset for communities after the construction phase.
- Driver training for HGV drivers and refresher course every six months for Project drivers
- Speed restrictions for project traffic travelling through communities (to be agreed with Traffic Management Authority)
- Run a safety campaign to improve the people’s knowledge of the traffic hazard on their roads, public information and other activities to address the issues.
- Run a pedestrian awareness programme

- Temporary signage
- The traffic management plan is provided below.
- Other Recommendations

It is important to manage public access routes during construction because it can cause delay to local traffic and create a safety hazard both on and offsite. People working and living near the project site would be annoyed by the emissions, noise and visual intrusion of queuing vehicles. Some important factors involved in access routes and site traffic are as follows:

- Public Access Routes
- The use of public road for site access may be restricted in terms of:
- Vehicle size, width and type of load
- Time limits
- Parking
- Pedestrian conflicts
- Contractor should have consultation with the local police or local authority to address these issues and to effectively manage them before the beginning of the construction.

Site Workers Traffic

Site personnel should not be permitted to park vehicles near the site boundary; this will lead to disruption in material deliveries. Designated parking area with appropriate parking space will be needed for this purpose; any plain area near construction site can be used for this purpose.

Site Rules

- Access to and from the site must be only via the specified entrance.
- On leaving the site, vehicles must be directed to follow the directions given.
- Drivers must adhere to the site speed limits.
- All material deliveries to site must keep allocated time limits.
- No material or rubbish should be left in the loading-unloading area.
- Develop a map for alternate routes showing material delivery services.
- Assign designated personnel on site to receive deliveries and to direct the vehicles.
- Monitor vehicle movement to reduce the likelihood of queuing or causing congestion in and around the area.
- Project vehicles should have a unanimous badge or logo on windscreen displaying that they belong to the project.

Contractor's Obligation

The traffic management plan of the Contractor should be safe enough and widening of access roads and construction of the detours must be completed before start of project construction activities so that heavy vehicular transportation for construction activities do not hinder the normal course of traffic lanes. While widening the access roads, the safe movement of the vehicles, people, animals and wildlife must be ensured. It will be sole responsibility of

Contractor. The roads widening should be designed on the basis of the traffic survey, summarized and estimated site traffic. Contractor must ensure that road closures are carried out by a competent person. The Contractor obligation must include the display of traffic signs according to the need to divert the traffic volume and to guide the road users in advance. The traffic sign, traffic light should be placed from any diverting route or road marking.

The Contractor should consider the environmental and social impacts of the traffic during construction. It will be sole responsibility of the Contractor to implement a plan which produces minimum nuisance to the local people and to the environment. Safety of the people should be given due importance. It will be under Contractor obligation to notify the traffic management plan and its later changes to CSC, PMU, emergency services and Traffic Police, and also publish weekly programme in local newspapers.

Annexure 11: Solid Waste Management Framework

INTRODUCTION

Construction contractors may use this framework as guiding document for preparation of site specific solid waste management plan. The purpose of this Framework Solid Waste Management Plan is to ensure that wastes arising from the proposed construction works are managed, reused, recovered or disposed of by a method that ensures the provisions of the SEPA rules and ADB SPS, 2009. It also ensures that the optimum levels of waste reduction, re-use and recycling are achieved.

Waste management priorities for project are based following waste management hierarchy.

- Prevent material wastage
- Minimise the quantity of waste
- Reuse of site materials
- Recycling of waste
- Energy recovery
- Disposal
-

WASTE MANAGEMENT at Sindh Project sites

National Level

Waste management of the project will be carried as per national rules including:

- Solid Waste Management Policy, 2000
- Requirements of Sindh Environmental Protection Act
- Draft Guidelines on Solid Waste Management, 2005.
- Section 11 of PEPA, 1997 prohibits discharge of waste in amount that violates the NEQS.
- Draft Hazardous Substances rule of 1999
- Section 132 of Cantonment Act, 1942
- Provision Contains in the Local Government Ordinance, 2001

Regional Level

- Asian Development Bank (ADB) SPS, 2009
- IFC guidelines for Solid Waste Management
- Best practices of waste management on construction sites

Details of the wastes to be produced

During construction/civil works, potential sources of waste will include spoils generated during excavation, concrete and construction waste, domestic wastes (solid & wastewater), fuel or oil leakages or spills, onsite effluents from vehicle wash & cleaning, and cement spills. It is the responsibility of all personnel on site including Contractors, Sub-Contractors and their Employees to ensure compliance with this Waste Management Plan.

Main Waste Categories

Contractors are required to develop inventory of main waste categories that will be generated during construction phase of the project. Anticipated main waste categories include construction debris, concrete waste, scrap wood, bricks, concrete, asphalt, plumbing fixtures, piping, insulation (asbestos and non-asbestos), metal scraps, oil, electrical wiring and components, chemicals, paints, solvents.

Anticipated Hazardous Waste

Fuels stored on site that will be used during the construction phase are classed as hazardous. There will be fuel stored on site for machinery and construction vehicles. All fuel tanks and draw off points will be bunded. If the fuel is correctly contained and bunded, it is not expected that there will be any fuel wastage at the site. Other sources of hazardous waste include used paints, used oil/lubricants, electrical waste and chemicals. Project contractors are required to develop SOPs for handling, storage and disposal of hazardous waste arising from the project.

ESTIMATED WASTE GENERATION

Construction Waste Generation

Project contractors are required to develop and maintain waste inventory clearly showing the type, amount and location of waste generated from different activities at the site. Waste record keeping is key to successful implementation of waste management plan.

Proposed Waste Management Options

Waste will be segregated on site. Contractor will ensure that sufficient number of waste drums are placed at site with appropriate color coding. All recyclable waste will be handed over to recycling contractor. The appointed waste contractor will collect and transfer the recyclable wastes as receptacles are filled. The non-recyclable waste will be transferred by an authorized waste collector to an appropriate facility. Project contractors will identify both recycling and non-recycling contractor working in the project area. Contractors through bidding documents will be bound to hire such waste contractors for efficient waste management at project sites.

A successful Waste Management Plan is largely dependent on how readily it can be changed in to normal site operations by the person responsible. It is recognized that the plan should not be obstructive to site operations and the construction program by placing the responsibility of construction waste management with the Manager, all reuse, recycling, wastage and necessary disposal can be monitored as close to the source as possible. An Environmental Representative from each Works Sub-Contractor will also be nominated responsible for all waste management in their own operations. In this way, it is possible to identify where the greatest material wastage occurs, with a view to implementing better management.

The site Construction Manager will be designated as the Responsible Person and have overall responsibility for the implementation of the on-site Waste Management Plan. The Responsible Person will be assigned the authority to instruct all site personnel to comply with the specific provisions of the plan. At the operational level, a nominated Environmental Representative from each sub-contractor company on the site shall be assigned the direct responsibility to ensure that the discrete operations stated in this framework for solid waste management are performed on an on-going basis.

Tracking and documentation procedures for off-site waste

The site construction Manager will maintain a copy of all waste collection permits. If waste (soil & stone) is being accepted on-site, a waste docket must be issued to the collector. If the waste is being transported to another site, a copy of the waste permit for that site must be provided to the manager. Record of waste collection docket, a receipt from the final destination of the material will be kept as part of the on-site waste management records. All information will be entered in a waste management system to be maintained on-site.

Disposal of Waste

Contractors are required to develop SOP for disposal of recyclable, non-recyclable and hazardous waste generated at site. Food waste will be disposed at food waste pit which will be fenced. Recycling waste will be handed over to recycling waste contractor. Hazardous waste will be disposed through incineration facility available in close proximity of the project

area. Workers on the site will be encouraged to recycle as much municipal waste as possible i.e. cardboard, plastic, metals and glass. Prior to removal, the municipal waste will be examined to determine if recyclable materials have been placed in other containers. If this is the case, effort will be made to determine the cause of the waste not being segregated correctly.

ESTIMATED COST OF WASTE MANAGEMENT

Contractors are required to estimate and budget cost for waste management through BOQ items. Such waste management cost should include cost of waste drums, cost of waste handling crew, cost of waste transportation, cost of EPA approved waste contractor services and associated incineration costs if any. By reusing materials on site, there will be reduction in transport and disposal costs for a waste contractor taking the material away.

TRAINING PROVISIONS FOR WASTE MANAGER AND SITE CREW

A waste manager will be appointed or designated by construction contractors to ensure commitment, operational efficiency and accountability during the project execution.

Site Manager Training and Responsibility

The waste manager will be given responsibility and authority to select a waste team if required i.e. members of the site crew that will aid him in the organization, operation and recording the waste management system implemented on-site. The waste manager will have overall responsibility to oversee record and provide feedback to the CSC on everyday waste management at the site. Authority will be given to the waste manager to delegate responsibility to sub-contractors where necessary and to co-ordinate with suppliers, service providers and sub-contractors to prioritize waste prevention and salvage. The waste manager will be trained in how to set up and maintain a record keeping system, how to perform an audit and how to establish targets for waste management on-site. He will also be trained in the best method for segregation and storage of recyclable materials, have information on the materials that can be reused on-site and know how to implement this Framework for Solid Waste Management.

Site Crew Waste Management Training

Training of the site crew is the responsibility of the waste manager and as such, a waste training program should be organized. A basic awareness course will be held for all crew to outline the construction waste management plan and to detail the segregation of waste at source. This may be incorporated with other training needs (e.g. general site induction, safety training etc.). This basic course will describe the materials to be segregated, the storage methods and the location of the waste storage areas. A subsection on hazardous wastes will be incorporated and the particular dangers of each hazardous waste will be explained.

RECORD KEEPING

Records will be kept for each waste material which leaves the site, either for reuse on another site, recovery, recycling or disposal. A system will be put in place to record the construction waste arising on-site. The waste manager or delegate will record the following:

- Waste taken off-site for reuse
- Waste taken off-site for recovery
- Waste taken off-site for recycling
- Waste taken off-site for disposal
- Waste (soil & stone) accepted on-site for recovery

For each movement of waste off-site, a signed waste collection docket will be obtained by the waste manager (or delegate) from the contractor. This will be carried out for each material

type. This system will also be linked with the delivery records. A signed waste acceptance docket will be issued for each movement of waste on-site.

OUTLINE WASTE AUDIT PROCEDURE

Contractors are required to develop SOP for waste auditing at the construction sites. Such SOP should reflect frequency and types of waste audits, audit criteria and way forward to close non-compliances.

Responsibility for Waste Audit

The appointed waste manager will be responsible for conducting a waste audit at the site during project execution.

Review of Records and Identification of Corrective Actions

A review of all the records for the waste generated and transported off-site, as well as waste accepted, should be undertaken. If waste movements are not accounted for, the reasons for this should be established in order to see if and why the record keeping system has not been maintained. Each material type will be examined in order to see where the largest percentage waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how the targets can be achieved. Waste management costs will also be reviewed. Upon completion of the construction phase a final report will be prepared summarizing the outcomes of waste management processes adopted and the total recycling/reuse/recovery figures for the development.

CONSULTATION WITH RELEVANT BODIES

Local Authority

Project contractors are required to maintain close coordination with focal government departments/agencies to ensure that all available waste reduction, re-use and recycling opportunities are identified and utilized.

Annexure 12: WHO advice on Use of Masks for the COVID-19 Virus

Advice on the use of masks in the context of COVID-19: interim guidance

masks away from those in health care who need them most, especially when masks are in short supply.

Persons with symptoms should:

- wear a medical mask, self-isolate, and seek medical advice as soon as they start to feel unwell. Symptoms can include fever, fatigue, cough, sore throat, and difficulty breathing. It is important to note that early symptoms for some people infected with COVID-19 may be very mild;
- follow instructions on how to put on, take off, and dispose of medical masks;
- follow all additional preventive measures, in particular, hand hygiene and maintaining physical distance from other persons.

All persons should:

- avoid groups of people and enclosed, crowded spaces;
- maintain physical distance of at least 1 m from other persons, in particular from those with respiratory symptoms (e.g., coughing, sneezing);
- perform hand hygiene frequently, using an alcohol-based hand rub if hands are not visibly dirty or soap and water when hands are visibly dirty;
- cover their nose and mouth with a bent elbow or paper tissue when coughing or sneezing, dispose of the tissue immediately after use, and perform hand hygiene;
- refrain from touching their mouth, nose, and eyes.

In some countries masks are worn in accordance with local customs or in accordance with advice by national authorities in the context of COVID-19. In these situations, best practices should be followed about how to wear, remove, and dispose of them, and for hand hygiene after removal.

Advice to decision makers on the use of masks for healthy people in community settings

As described above, the wide use of masks by healthy people in the community setting is not supported by current evidence and carries uncertainties and critical risks. WHO offers the following advice to decision makers so they apply a risk-based approach.

Decisions makers should consider the following:

1. **Purpose** of mask use: the rationale and reason for mask use should be clear— whether it is to be used for source control (used by infected persons) or prevention of COVID-19 (used by healthy persons)
2. Risk of **exposure** to the COVID-19 virus in the local context:
 - The population: current epidemiology about how widely the virus is circulating (e.g., clusters of cases versus community transmission), as well as local surveillance and testing capacity (e.g., contact tracing and follow up, ability to carry out testing).
 - The individual: working in close contact with public (e.g., community health worker, cashier)
3. **Vulnerability** of the person/population to develop severe disease or be at higher risk of death, e.g. people with comorbidities, such as cardiovascular disease or diabetes mellitus, and older people

4. **Setting** in which the population lives in terms of population density, the ability to carry out physical distancing (e.g. on a crowded bus), and risk of rapid spread (e.g. closed settings, slums, camps/camp-like settings).
5. **Feasibility**: availability and costs of the mask, and tolerability by individuals
6. **Type** of mask: medical mask versus nonmedical mask (see below)

In addition to these factors, potential advantages of the use of mask by healthy people in the community setting include reducing potential exposure risk from infected person during the “pre-symptomatic” period and stigmatization of individuals wearing mask for source control.

However, the following potential risks should be carefully taken into account in any decision-making process:

- self-contamination that can occur by touching and reusing contaminated mask
- depending on type of mask used, potential breathing difficulties
- false sense of security, leading to potentially less adherence to other preventive measures such as physical distancing and hand hygiene
- diversion of mask supplies and consequent shortage of mask for health care workers
- diversion of resources from effective public health measures, such as hand hygiene

Whatever approach is taken, it is important to develop a strong communication strategy to explain to the population the circumstances, criteria, and reasons for decisions. The population should receive clear instructions on what masks to wear, when and how (see mask management section), and on the importance of continuing to strictly follow all other IPC measures (e.g., hand hygiene, physical distancing, and others).

Type of Mask

WHO stresses that it is critical that medical masks and respirators be prioritized for health care workers.

The use of masks made of other materials (e.g., cotton fabric), also known as nonmedical masks, in the community setting has not been well evaluated. There is no current evidence to make a recommendation for or against their use in this setting.

WHO is collaborating with research and development partners to better understand the effectiveness and efficiency of nonmedical masks. WHO is also strongly encouraging countries that issue recommendations for the use of masks in healthy people in the community to conduct research on this critical topic. WHO will update its guidance when new evidence becomes available.

In the interim, decision makers may be moving ahead with advising the use of nonmedical masks. Where this is the case, the following features related to nonmedical masks should be taken into consideration:

- Numbers of layers of fabric/tissue
- Breathability of material used
- Water repellence/hydrophobic qualities
- Shape of mask
- Fit of mask

Home care

For COVID-19 patients with mild illness, hospitalization may not be required. All patients cared for outside hospital (i.e. at home or non-traditional settings) should be instructed to follow local/regional public health protocols for home isolation and return to designated COVID-19 hospital if they develop any worsening of illness.⁷

Home care may also be considered when inpatient care is unavailable or unsafe (e.g. capacity is limited, and resources are unable to meet the demand for health care services). Specific IPC guidance for home care should be followed.³

Persons with suspected COVID-19 or mild symptoms should:

- Self-isolate if isolation in a medical facility is not indicated or not possible
- Perform hand hygiene frequently, using an alcohol-based hand rub if hands are not visibly dirty or soap and water when hands are visibly dirty;
- Keep a distance of at least 1 m from other people;
- Wear a medical mask as much as possible; the mask should be changed at least once daily. Persons who cannot tolerate a medical mask should rigorously apply respiratory hygiene (i.e. cover mouth and nose with a disposable paper tissue when coughing or sneezing and dispose of it immediately after use or use a bent elbow procedure and then perform hand hygiene.)
- Avoid contaminating surfaces with saliva, phlegm, or respiratory secretions.
- Improve airflow and ventilation in their living space by opening windows and doors as much as possible.

Caregivers or those sharing living space with persons suspected of COVID-19 or with mild symptoms should:

- Perform hand hygiene frequently, using an alcohol-based hand rub if hands are not visibly dirty or soap and water when hands are visibly dirty;
- Keep a distance of at least 1 meter from the affected person when possible;
- Wear a medical mask when in the same room as the affected person;
- Dispose of any material contaminated with respiratory secretions (disposable tissues) immediately after use and then perform hand hygiene.
- Improve airflow and ventilation in the living space by opening windows as much as possible.

Health care settings

WHO provides guidance for the use of PPE, including masks, by health care workers in the guidance document: Rational use of PPE in the context of COVID-19.²⁴ Here we provide advice for people visiting a health care setting:

Symptomatic people visiting a health care setting should:

- Wear a medical mask while waiting in triage or other areas and during transportation within the facility;
- Not wear a medical mask when isolated in a single room, but cover their mouth and nose when coughing or sneezing with disposable paper tissues. Tissues must be disposed of appropriately, and hand hygiene should be performed immediately afterwards.

Health care workers should:

- Wear a medical mask when entering a room where patients with suspected or confirmed COVID-19 are admitted.
- Use a particulate respirator at least as protective as a US National Institute for Occupational Safety and Health-certified N95, European Union standard FFP2, or equivalent, when performing or working in settings where aerosol-generating procedures, such as tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, manual ventilation before intubation, and bronchoscopy are performed.
- Full infection prevention and control guidance for health care workers is provided [here](#).

One study that evaluated the use of cloth masks in a health care facility found that health care workers using cotton cloth masks were at increased risk of infection compared with those who wore medical masks.²⁵ Therefore, cotton cloth masks are not considered appropriate for health care workers. As for other PPE items, if production of cloth masks for use in health care settings is proposed locally in situations of shortage or stock out, a local authority should assess the proposed PPE according to specific minimum standards and technical specifications.

Mask management

For any type of mask, appropriate use and disposal are essential to ensure that they are effective and to avoid any increase in transmission.

The following information on the correct use of masks is derived from practices in health care settings:

- Place the mask carefully, ensuring it covers the mouth and nose, and tie it securely to minimize any gaps between the face and the mask.
- Avoid touching the mask while wearing it.
- Remove the mask using the appropriate technique: do not touch the front of the mask but untie it from behind.
- After removal or whenever a used mask is inadvertently touched, clean hands using an alcohol-based hand rub or soap and water if hands are visibly dirty.
- Replace masks as soon as they become damp with a new clean, dry mask.
- Do not re-use single-use masks.
- Discard single-use masks after each use and dispose of them immediately upon removal.

WHO continues to monitor the situation closely for any changes that may affect this interim guidance. Should any factors change, WHO will issue a further update. Otherwise, this interim guidance document will expire 2 years after the date of publication.

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