FEDERAL FLOOD COMMISSION (FFC)
SINDH IRRIGATION DEPARTMENT (SID)

March 2026

IEE Report

THE PREPARATORY SURVEY FOR THE PROJECT FOR FLOOD PROTECTION AND DIKE IMPROVEMENT ON INDUS RIVER IN SINDH PROVINCE

(INITIAL ENVIRONMENTAL EXAMINATION - IEE)

Funding Agency

Japan International Cooperation Agency (JICA)

Supported by: CTI Engineering International Co. Ltd.

&

Indus Environmental Engineering Consultants (IEEC)

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The Preparatory Survey for The Project for Flood Protection and Dike Improvement on Indus River in Sindh Province

(Initial Environmental Examination - IEE)

Prepared for:	Prepared by:
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Project Proponent/	Federal Flood Commission (FFC) Sindh Irrigation Department (SID)
Funding Agency	Japan International Cooperation Agency (JICA)
Consultants	CTI Engineering International Co. Ltd
Contractor for Environmental & Social Considerations	Indus Environmental Engineering Consultants (IEEC)

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ACRONYMS AND ABBREVIATIONS

Acronym	Full Form
AOI	Area of Influence
APHA	American Public Health Association
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
CTI	CTI Engineering International Co. Ltd
dB(A)	A-weighted decibels
EIA	Environmental Impact Assessment
E&S	Environmental & Social
FFC	Federal Flood Commission
FGDs	Focused Group Discussions
IEE	Initial Environmental Examination
IEEC	Indus Environmental Engineering Consultants
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
m/s	meters per second
mg/l	milligrams per liter
NGO	Non-Governmental Organization
NFPP-IV	National Flood Protection Plan-IV
NTU	Nephelometric Turbidity Unit
O3	Ozone
PCM	Public Consultation Meeting
PGA	Peak Ground Acceleration
PM2.5	Particulate Matter less than 2.5 microns
PM10	Particulate Matter less than 10 microns
PKR	Pakistani Rupee
RH	Relative Humidity
SEQS	Sindh Environmental Quality Standards
SID	Sindh Irrigation Department
SPM	Suspended Particulate Matter
TL	Team Leader
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WHO	World Health Organization

EXECUTIVE SUMMARY

1. The lower Indus River basin in Sindh, particularly around Larkana and Sukkur, faces increasing risks of embankment (bund) failures due to rising river discharges, climate change, and deteriorating flood protection infrastructure. Catastrophic events, such as the 2010 and 2022 floods, have caused massive economic losses, infrastructure destruction, and displacement of communities. In response, the Government of Pakistan has prioritized the rehabilitation and strengthening of river bunds through initiatives like the National Flood Protection Plan-IV (NFPP-IV) and the Resilient Recovery, Rehabilitation, and Reconstruction Framework (4RF). These efforts focus on upgrading critical sites such as Old Abad Bund near Larkana, which are particularly vulnerable and essential for protecting densely populated and agriculturally vital areas.

2. The proposed project involves structural upgrades, raising and widening bunds, installing seepage control measures, and using modern construction technologies to mitigate flood risks and enhance long-term resilience. The project also emphasizes compliance with environmental regulations, requiring an Initial Environmental Examination (IEE) as mandated by the Sindh Environmental Protection Act, 2014. The IEE aims to ensure that environmental and social impacts are identified and mitigated, supporting sustainable flood management and serving as a model for similar interventions across Pakistan.

3. The legal and regulatory framework for the proposed flood protection bunds project in Sindh is comprehensive, encompassing national and provincial legislation, international guidelines, and donor requirements. The Sindh Environmental Protection Act, 2014 mandates that no project can begin construction or operation without first conducting and obtaining approval for an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA). The project falls under Schedule II, Category G(3) of the Sindh EPA regulations 2021, specifically requiring an IEE for flood protection bunds, and must also comply with JICA's Category B guidelines, which address moderate, site-specific environmental and social impacts that are manageable with effective mitigation measures.

4. A wide array of cross-sectoral laws and policies are applicable, covering climate change, resettlement, water and sanitation, labor rights, disaster management, and cultural heritage. In addition, the project must adhere to international conventions ratified by Pakistan, as well as stringent local and international standards for air quality, noise, and drinking water. IFC Performance Standards and World Bank EHS Guidelines further ensure robust environmental and social risk management throughout the project lifecycle. Ultimately, the framework requires integrating environmental assessment into project planning, maintaining transparency, and prioritizing the most stringent standards to safeguard both people and the environment.

5. The project focuses on strengthening and upgrading embankments along the lower Indus River in Sindh, particularly near Sukkur and Larkana, to address the increasing risk of bund failures due to rising river discharges and climate change impacts. Key interventions include renovating the Old Abad Bund, identified as highly vulnerable by raising their heights, widening cross-sections, and implementing advanced erosion and seepage control measures. These enhancements are designed to protect densely populated urban areas, minimize economic losses, and ensure the resilience of local communities against future floods. The project employs rigorous flood modeling, follows modern design standards, and emphasizes

timely intervention to maximize effectiveness and safety.

6. The exploration of alternatives including the "No Project" option, various design approaches, and construction methodologies provides valuable insights into optimizing the proposed bund improvement project. Each alternative carries its own implications for safety, economic impact, and community resilience, which must be carefully assessed during the planning process. By considering these alternatives, stakeholders can make informed decisions that enhance flood protection and safeguard the livelihoods of communities along the lower Indus River. This comprehensive evaluation will ultimately contribute to a more resilient and sustainable approach to flood risk management in the region.

7. A comprehensive overview of the baseline environmental and social conditions for the Flood Protection and Dike Improvement Project along the Indus River in Sindh, focusing on Larkana District. The assessment, based on field surveys, community consultations, and scientific monitoring, details the region's flat alluvial landscape, fertile but flood-prone soils, and a hydrology dominated by the Indus River and its canal network. The climate is arid and hot, with extreme seasonal variations in temperature, rainfall, humidity, and wind. Sindh's climate is arid and hot, divided by UNESCO into three zones: Coastal (south of Thatta), Southern (Thatta to Nawabshah/Shaheed Benazirabad), and Northern (Nawabshah to Jacobabad). In Larkana, summers are extremely hot and humid, with temperatures ranging from 8°C to 45°C, peaking in June with average highs of 44°C, while winters are brief and cool, with January lows averaging 8°C. The wet season is short, lasting about 1.5 months (July–August), with July seeing the most wet days (2.7 days with at least 1 mm of rain), and August having the highest average rainfall (17 mm); the rest of the year is predominantly dry. Humidity peaks from June to September, especially in July, which has the most muggy days. Wind speeds are highest from late May to early September, reaching a maximum in July (16.4 km/h), with prevailing winds from the south in summer and from the north in winter. Solar energy is most abundant from mid-April to early July, with May being the brightest month (7.7 kWh/m²), while the darkest period is from November to early February, with December averaging 3.9 kWh/m².

8. Baseline environmental monitoring for the proposed project area was conducted by SEPA-approved experts, focusing on drinking water, surface water, air quality, noise, and vibration at the Old Abad Bund site, with sampling locations chosen near sensitive receptors based on site surveys. Meteorological data over February 14–15, 2025, showed moderate wind speeds, stable temperatures (22–29°C), and rising humidity. Air quality analysis revealed that all monitored parameters, including SO_2, NOx, CO, O3, PM2.5, PM10, SPM, and lead, were below the SEQS standards. Noise monitoring indicated fluctuating but moderate sound levels, peaking at 55.9 dB(A). Vibration levels varied across locations but were systematically measured. Groundwater at the site was free from microbial contamination. Surface water samples from the River Indus and Dadu Canal showed that all analyzed parameters were below the SEQS standards.

9. The biological assessment identified diverse habitats, wetlands, agricultural lands, sandy desert areas, and ruderal zones along bunds supporting a rich array of flora and fauna. Forty-eight plant species, 82 bird species, and 21 mammal species were recorded, with most classified as "Least Concern" by the IUCN. In the context of the sub-project area, no endemic or endangered species of flora or fauna have been identified. Furthermore, there are no protected areas/ Critical habitats in proximity to the proposed sub-project site. Socioeconomic data depict Larkana as a district with a large rural population, high rates of home ownership,

and significant agricultural and livestock activity, but also facing challenges in sanitation, female literacy, and gender equity. Community consultations, particularly with women, underscored both the benefits of improved flood protection and the need for better access to health, education, and employment opportunities. This baseline sets a critical foundation for predicting, managing, and mitigating the project's potential impacts on both the environment and local communities.

10. A comprehensive stakeholder consultation and information disclosure process undertaken for the Indus River flood protection project in Sindh. The project team engaged a wide range of stakeholders including local communities, government departments, NGOs, and project-affected persons (PAPs) through preliminary surveys, public consultation meetings, and focused group discussions. These consultations aimed to inform stakeholders about the project's scope, potential impacts, and mitigation measures while gathering their feedback, concerns, and suggestions to improve project design and implementation. Key issues raised included the need for fair compensation, local employment opportunities, protection of livelihoods and the environment, and transparent resettlement processes. The project responded by emphasizing transparency, adherence to compensation guidelines, and ongoing monitoring, ensuring that stakeholder input meaningfully shaped planning and decision-making.

11. Both primary stakeholders (local residents directly affected) and secondary stakeholders (government agencies, NGOs, and broader community representatives) were identified and consulted using tailored engagement methods. The process prioritized inclusivity ensuring the participation of women, marginalized groups, and local leaders and addressed socio-economic, environmental, and cultural concerns. The feedback gathered has been incorporated into the Initial Environmental Examination (IEE) and Resettlement Action Plan (RAP), reinforcing the project's commitment to transparency, community development, and minimizing adverse impacts throughout its implementation.

12. The report assesses the environmental and social impacts of the Indus River flood protection project and outlines robust mitigation strategies. The analysis encompasses both the immediate project area, where bunds, camps, and access roads will be constructed, and a broader 500-meter buffer zone, considering both direct and indirect effects on land, water, air, noise, biological resources, and local communities. Key anticipated impacts include temporary loss of fertile topsoil, soil erosion, water resource contamination, air and noise pollution, and disturbance to local flora and fauna. Mitigation measures are detailed, such as careful site selection, topsoil preservation, erosion control, water treatment, dust suppression, noise management. The project also addresses social impacts, including resettlement, compensation, gender issues, and public safety, with strategies for fair compensation, engagement of local labor, and protection of vulnerable groups.

13. During the operational phase, the strengthened bunds are projected to deliver significant benefits, including protecting up to 1.18 million people, reducing flooded areas by over 5,000 square kilometers, and saving hundreds of billions of PKR in flood damages. Enhanced flood defenses will also safeguard critical infrastructure such as hospitals, roads, and railways, while ongoing monitoring and community engagement will ensure long-term sustainability. The chapter emphasizes that with the proposed mitigation measures, the most adverse impacts can be minimized to low significance, ensuring that the project delivers substantial safety, economic, and environmental benefits to the region.

14. A comprehensive Environmental Management and Monitoring Plan (ESMP) designed

to address and control the environmental and social risks identified for the proposed project. The ESMP mandates that all contractors adhere to international standards (ISO 9001, 14001, and 45001) and develop detailed site-specific management plans covering waste, water, soil, air, noise, biodiversity, and community health and safety. Environmental and Social Codes of Practice (ECPs) guide the best practices in areas such as waste management, erosion control, labor influx, and cultural heritage protection. Contractors must submit a Construction Environmental and Social Management Plan (C-ESMP) and Occupational & Community Health and Safety Management Plan (OCHSMP) prior to mobilization, with compliance tied to payment milestones and subject to penalties for non-compliance.

15. Institutional arrangements involve a dedicated Project Management Office (PMO), Environmental and Social Unit (ESU), Project Implementation Consultants (PIC), and contractor environmental staff, all responsible for implementing, supervising, and monitoring the ESMP. The plan includes rigorous monitoring protocols for air and water quality, noise, waste, and community impacts, with regular reporting requirements. A robust three-tier Grievance Redress Mechanism ensures timely resolution of complaints from affected persons and stakeholders, while ongoing capacity building and training for all project personnel reinforce compliance and best practices. During both construction and operation phases, the ESMP emphasizes proactive mitigation, stakeholder engagement, and adaptive management to ensure the project's environmental and social sustainability.

16. This section outlines the estimated environmental and resettlement costs for the Indus River flood protection project, incorporating expenses for environmental monitoring, land acquisition, resettlement, and comprehensive environmental and social management. Key components include third-party laboratory monitoring of air, water, and noise during construction, costing Rs. 1,208,000; and provisional resettlement costs based on land acquisition and infrastructure replacement. Additional allocations cover health, safety, and environmental (HSE) activities, camp and waste management, stakeholder engagement, and capacity building. The total estimated environmental and social cost, including a 10% contingency, amounts to Rs. 6,108,300, ensuring that all mitigation, management, and community welfare measures are adequately funded throughout the project lifecycle.

CHAPTER - 1: INTRODUCTION

1.1 Background

17. The lower Indus River basin in Sindh, especially the downstream regions like Larkana and Sukkur, is increasingly vulnerable to bund (embankment) failures due to rising river discharges, the impacts of climate change, and the ongoing deterioration of flood protection infrastructure. Such failures have repeatedly resulted in devastating floods, causing significant economic losses, widespread infrastructure destruction, and the displacement of local communities. Notably, the catastrophic breaches of the Tori and MS Bunds during the 2010 floods underscored the fragility of the region's flood defenses and the urgent need for intervention.

18. Several factors heighten the risk. Many bunds have suffered from years of inadequate maintenance and erosion, resulting in a loss of height and structural integrity, which makes them particularly susceptible to overtopping and breaches during periods of high water flow. Additionally, climate change and upstream water management practices have increased the frequency and severity of flood events, further straining already compromised embankments. The socio-economic stakes are high, as the lower Indus basin is both densely populated and agriculturally vital; any failure of the bunds threatens homes, livelihoods, and essential infrastructure, thereby amplifying the social and economic consequences of disasters.

19. In response to these challenges, the Government of Pakistan, through the Federal Flood Commission (FFC) and the Sindh Irrigation Department, has prioritized the rehabilitation and strengthening of river bunds as a key component of its broader flood protection and disaster recovery strategies.

1.2 Project Outline

20. Pakistan, as an Islamic Republic, faces significant vulnerability to natural disasters such as floods, landslides, and earthquakes. Among these, floods are particularly frequent, especially in the Indus River and its tributaries during the monsoon season. These recurring floods have historically inflicted severe socioeconomic damage, as seen in the catastrophic events of 2010 and 2022. The 2022 floods alone submerged nearly one-third of the country, displaced millions, and caused over $40 billion in damages.

21. In response to the increasing intensity and frequency of such disasters, the Pakistani government has prioritized enhancing flood resilience through initiatives like the National Flood Protection Plan-IV (NFPP-IV), which spans from FY 2015/16 to FY 2024/25. Spearheaded by the Federal Flood Commission (FFC), this plan focuses on renovating and reinforcing river infrastructure to mitigate flood risks.

22. Following the devastating 2022 floods, the government conducted a Post-Disaster Needs Assessment (PDNA) and introduced the Resilient Recovery, Rehabilitation, and Reconstruction Framework (4RF) in January 2023. These efforts emphasize the critical importance of strengthening and securing bunds (embankments) in the lower Indus River basin in Sindh. Upgrading these bunds aims to reduce the risk of structural failures during floods, thereby minimizing economic losses and fostering a more resilient society capable of withstanding future disasters. The Indus River basin's flood management strategy lacks a unified, basin-wide river plan, but localized design standards and historical flood data inform

current infrastructure resilience efforts. At Sukkur Barrage, a critical flood control structure in Sindh, the design discharge is set at 1.15 million cubic feet per second (32,564 m³/s), with a design water level of 204.5 feet (62.3 m) based on historical maxima. Post-2010 flood reforms established a 1.8-meter freeboard for embankments to withstand discharges comparable to the 2010 event, which reached 1.13 million cusecs (32,026 m³/s)1.

1.3 Probability and Risk Analysis

23. The 2010 flood at Sukkur Barrage had an estimated 32-year return period, highlighting vulnerabilities in downstream regions. By contrast, the Panjnad Barrage at the Chenab River's terminus faced a far higher risk, with its 2010 flood discharge representing a mere 2.5-year return event (refer to Figure 1.1). Upstream, the Tarbela Dam on the Indus River demonstrated stronger resilience, with its 2010 inflow aligning with a 100-year return period. These disparities underscore the uneven flood risk distribution across the basin.

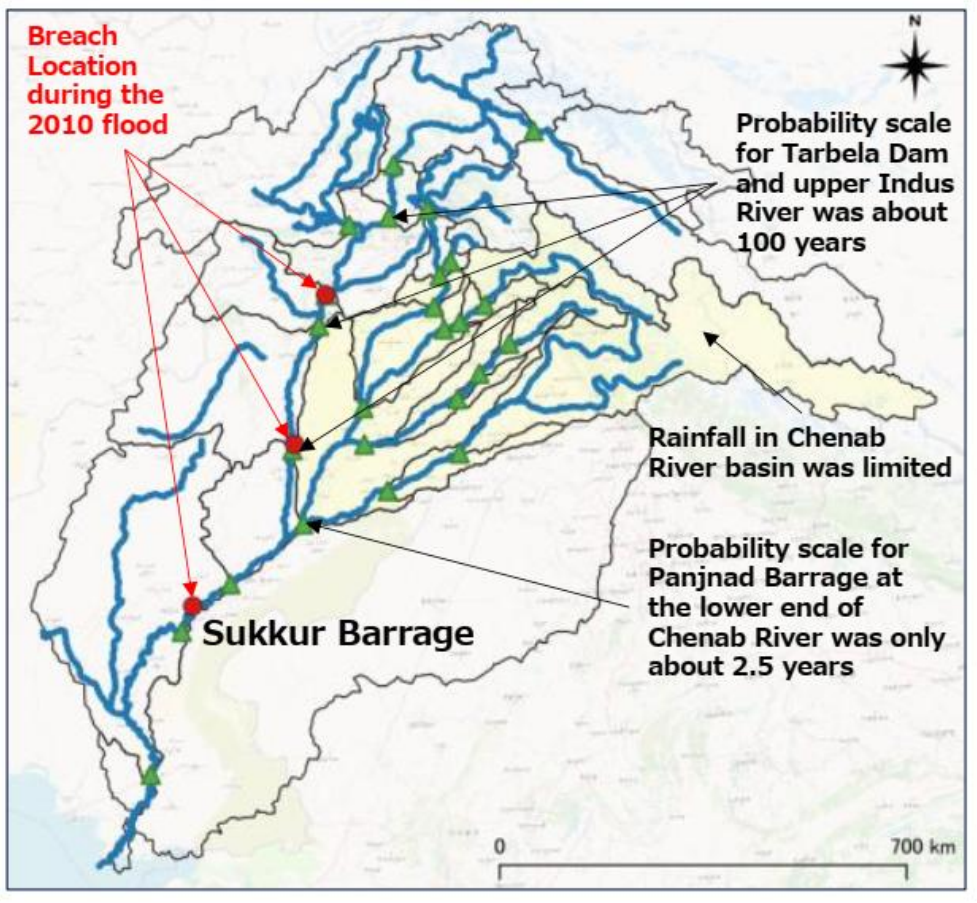


Figure 1.1: Probability and Risk Analysis

1.3.1 Integrated Mitigation Approach

24. Recent initiatives, such as Japan's $18.5 million grant for embankment construction and hydrological monitoring networks in Haripur district, emphasize a hybrid strategy:

25. *Structural upgrades*: Reinforcement of bunds with seepage control and erosion protection.

26. *Data-driven forecasting:* Installation of 45 water/rain gauges to improve flood prediction

[1] *https://irrigation.sindh.gov.pk/files/books/2010%20Flood%20Damage%20Assessment%20Report.pdf*

and real-time response.

27. These measures align with Pakistan's National Flood Protection Plan-IV, which advocates for integrating structural defenses with watershed management and floodplain zoning to reduce socio-economic vulnerabilities[2].

1.4 Proposed Project

28. The candidate site identified for improvement under this project is the **Old Abad Bund**. The site is located within 10 kilometers of the urban area of Larkana, making them particularly critical due to the high risk of urban flooding in the event of a levee breach. Site inspections revealed significant seepage and water leakage at both locations, with no countermeasures having been implemented to date. The site has suffered extensive damage from erosion, making its condition more severe than other sites.

29. The planned improvements for these bunds include a range of countermeasures. For seepage control, the project proposes raising the height and expanding the cross-section of the bund, installing a steel sheet pile cut-off wall, adding concrete facing for revetment, protecting the landside slope with sandfilled mattresses, and using single-grain crushed stone for drainage. Erosion control measures will also involve raising and widening the bund, concrete revetment works, sandfilled mattresses for landside slope protection, and, potentially, additional foot protection with riprap and randomly stacked concrete blocks as spurs-though these latter measures are still under study.

30. Furthermore, the design, construction, maintenance methods and techniques introduced through this project are intended to serve as a model for similar initiatives elsewhere in Pakistan. By standardizing and disseminating proper practices for bund reinforcement and maintenance, the project will contribute to improved flood safety in other vulnerable regions. Importantly, the adoption of relatively new construction technologies in Pakistan-such as concrete revetments, concrete blocks for foot protection, and sandfill mattresses-will encourage the broader use of innovative and more durable solutions in future river management projects. This technological advancement supports the long-term resilience of flood defenses and promotes the modernization of river engineering practices in the country

1.5 Justification for the Proposed Project

31. The evaluation results demonstrate the significant benefits of strengthening the Old Abad Bund in mitigating flood impacts in the lower Indus River basin. For the 2010 flood scenario, if the Old Abad Bund is improved, the total length restored would be 910 meters. This intervention would result in a reduction of 710,333 people affected by flooding, a decrease in flooded area by 3,270 square kilometers, and a reduction in flood damage costs by 302,516 million PKR. Additionally, it would protect 34 hospitals, 1,567 kilometers of roads, and 110 kilometers of railway from flood damage.

32. The qualitative evaluation of the project highlights several important benefits for the communities and river management practices in the lower Indus basin. First and foremost, the project will protect the living environment and enhance the quality of life for residents by reducing the risk of devastating floods and the associated disruptions to daily life. The installation of a maintenance road along the top of the bund will facilitate easier and more frequent river patrols, improving the ongoing monitoring and maintenance of the flood

[2] *https://ndrmf.pk/wp-content/uploads/2023/02/National-Flood-Protection-Plan-IV-NFPP-IV-1-min.pdf*

protection infrastructure.

1.6 Objectives of the Proposed Project

33. The project's primary objective is to mitigate the risk of bund failure in the lower Indus River basin in Sindh by upgrading and strengthening the embankments. Additionally, the project aims to mitigate the risk of economic losses during disasters and contribute to building a resilient society capable of withstanding such events. Residents' living conditions and quality of life will be improved and safeguarded. The project's design, construction, and maintenance techniques will serve as a model for other regions in Pakistan, ensuring effective bund reinforcement and maintenance and enhancing flood safety nationwide.

34. Introducing modern construction methods such as concrete revetments, concrete block foot protection, and sandfill mattresses will encourage the use of innovative technologies in future river management projects.

1.7 Need for Environmental Study

35. The apex Pakistani law governing environmental matters is the Pakistan Environmental Protection Act 1997 (PEPA-97). Under Section 12 of the Act, the proponents of the projects must execute the IEE and/or EIA (where warranted) and get approval from a federal agency (i.e., Pak-EPA). This function has been delegated under Section 26 to the provincial Environmental Protection Agencies (EPAs).

36. Following the 18th Amendment to the Constitution of Pakistan, the environment became a provincial subject. The environmental law governing the proposed project, titled "The Preparatory Survey for the Project for Flood Protection and Dike Improvement on the Indus River in Sindh Province," is now the Sindh Environmental Protection Act, 2014. In terms of its contents, the provincial act is the same as the national act. Under Section 17 of the Act, the proponents of the project must execute the Initial Environmental Examination (IEE) and/or Environmental Impact Assessment (EIA), where warranted, and obtain approval from the relevant Environmental Protection Agency (EPA), which in this case is the Sindh EPA, for this project.

37. The Sindh Environmental Protection Agency (Environmental Assessment) Regulations 2021 provide screening categories of projects for which an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) must be conducted. The proposed project falls under Schedule II, Category 'G' (3) - 'Flood Protection Bunds.' This category requires an IEE to be conducted. **Annexure I** describes the screening criteria for determining the Environmental Category of the proposed project.

1.8 The objective of the IEE Study

38. The overall objective of the IEE study is to investigate the interaction of project components with one another and the environment and to assess anticipated environmental impacts, proposing necessary mitigation measures against adverse effects. To achieve this objective, an assessment of the existing environmental status of the project site is a prerequisite and, therefore, included in this study by collecting and reviewing the baseline data of various environmental attributes.

39. This IEE is being prepared to ensure adequate environmental and social management during the development and implementation of the proposed project. It will provide

mechanisms for ensuring that potential environmental and social impacts of the current program are identified, assessed and mitigated as appropriate through an environmental and social screening process. The IEE will also comply with the donor guidelines, specifically those of JICA.

40. More Specific Objectives of IEE Study. These include:

- Meet the statutory requirements outlined in the Sindh Environmental Protection Act 2014.
- Comply with donor agencies' guidelines and policies on safeguards for environmental and social management of the project.
- Facilitate proponents and financiers of the project in ensuring the environmental and social acceptability of the project.
- Establish a baseline of the existing environmental status at the project site before project initiation by collecting both secondary and primary data/information on the physical, biological, and socio-economic environments of the project area.
- Help the project proponents incorporate necessary measures to ensure the legally compliant and socially acceptable environmental performance of their project.
- Identify significant environmental impacts (both positive and negative) during all stages of the project implementation and propose mitigation measures for negative impacts.

1.9 Location and Accessibility of the Project

41. Old Abad Bund is about 9.7 kilometers southeast of Larkana city. It is situated closer to the Khairpur District boundary and is accessible via Airport Road and its approach road, as indicated on the map. The bund is accessible by a magenta approach road that links it to the surrounding road network, including the Airport Road and other main roads.

1.10 Approach Adopted for IEE Study

42. The Consultants carried out the IEE study of the project area in a systematic manner. This included the collection of secondary data, maps, and related literature, as well as conducting field surveys for primary data collection, engaging in public consultations, and conducting desk studies. These are summarized below:

43. This methodology provides a structured framework for conducting a comprehensive field survey to collect baseline environmental and social data for the Flood Protection and Dike Improvement project on the Indus River in Sindh Province. The approach ensures accuracy, consistency, and adherence to environmental and social safeguard requirements.

1.10.1 Secondary Data Collection

44. Secondary data on meteorology, land use, land ownership, ecological aspects, flora and fauna, geology, and demographic information were collected from secondary sources. In addition to survey maps from the Survey of Pakistan, satellite images of the area have also been acquired.

1.10.2 Reconnaissance Survey of Project Area

45. A reconnaissance visit was made from 16 to 17 February 2025. Experts in various disciplines, including environmental and social fields, visited the project site. During this visit, the experts got acquainted with the project area and considered PCM locations. They collected information from locals about contact persons and notables in the area to facilitate the consultants' work on environmental and social surveys. During the visit, contacts were made with local notables, the local administration, and elected public representatives to arrange for scoping sessions with the people of the concerned villages. The visit was also aimed at familiarizing oneself with the physical and socioeconomic environment of the project area and its surrounding areas, as well as identifying critical areas of environmental and social concern.

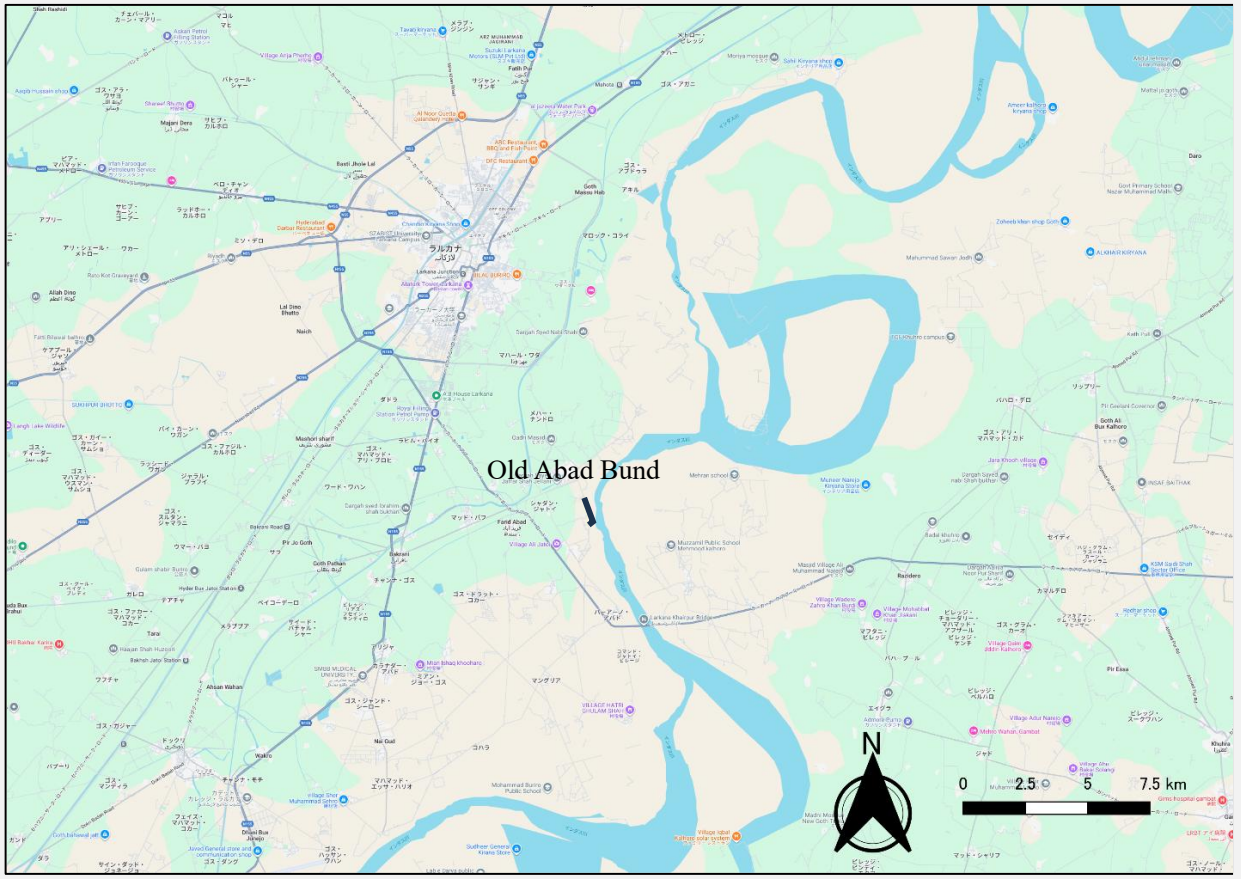


Figure 1.2: Location Route Plan for Proposed Bunds

1.10.3 Environmental Field Survey

46. In compliance with TOR, the consultants have carried out an environmental survey/ field investigation of various parameters, particularly with reference to the aspects described below:

47. The JICA Environmental Checklist (refer to Annexure I) serves as a vital tool for contractors and consultants to evaluate the environmental and social impacts of development projects. Specifically, Checklist 12, which focuses on river and sand erosion control, emphasizes the importance of mitigating environmental impacts while promoting sustainable practices. The field survey for Baseline data collection was conducted at the proposed project area from April 28 to May 1, 2025.

48. Investigation/survey of the Ecology/ Biodiversity of the project area, including the flora and fauna of the project-affected areas, such as the work yard, etc. A team of five members, including a plant taxonomist, a herpetologist, a biodiversity specialist, a photographer, and a local guide, conducted the study from April 26 to 30, 2025. To study the vegetation of the project area, direct field observations were conducted, and residents were interviewed.

49. Asset survey for shade and fruit trees (28 April to 1 May 2025) likely to be impacted by the proposed project's development. This also includes a census of farmland and other natural resources that will be degraded, either temporarily or permanently.

50. To evaluate pollution levels and environmental hazards, air quality monitoring has been performed using portable devices to measure pollutant concentrations in real-time. Water quality testing involves collecting surface and groundwater samples for laboratory analysis to identify potential contaminants. Noise and vibration measurements have been conducted to determine environmental noise levels in project-affected areas. Baseline Environmental Monitoring for Ambient Air, Water resources (including Drinking water, surface water, and wastewater), and noise levels in the project areas was conducted from 14 to 15 February 2025.

1.10.4 Socioeconomic / Resettlement Plan Survey

51. The socio-environmental team implemented a two-pronged approach to gather baseline data, essential for providing planners with a comprehensive understanding of the project area. This methodology enables planners to make informed and deliberate decisions regarding development initiatives.

a) Direct Interventions for Primary Data Collection

52. The first component of this approach involves collecting primary data through direct interventions within the project area. This includes a variety of methods such as conducting questionnaires and focused group discussions (FGDs). The team visited the project area, took transect walks at various facilities, and conducted field surveys to gather first-hand information. Additionally, data was collected using various checklists and scoping sessions, facilitating in-depth discussions with community members and stakeholders.

53. Socio-Economic field surveys have been conducted at the proposed project sites. The following aspects have been covered in these field surveys:

54. Census data was collected for all the affected persons. It includes the measurement of any existing infrastructure, the magnitude of potential agricultural loss, the number of shade

and fruit trees present on the prospective land, land use, and other activities related to the land.

55. Socioeconomic data of all affected households for which the owned land falls within the proposed project area have been collected.

56. Socio-economic data of non-affected persons residing in the project area have also been estimated and collected through sampling at a 90% confidence level and a 5% margin of error, using pre-developed questionnaires.

57. Gender survey. It was conducted by female field staff and covered the entire project area.

b) Indirect Interventions for Secondary Data Collection

58. The second component focuses on collecting information through indirect interventions, which involves acquiring secondary data related to the project area. This was achieved by reviewing previous studies and various reports published by national and international organizations. The team also gathered relevant information from online resources, including websites and other digital platforms.

59. Furthermore, they studied available maps and reviewed data from government departments and non-governmental organizations operating in District Larkana. This comprehensive approach ensures that planners have access to a wide range of information, enhancing their understanding of the socio-environmental context of the project area.

60. Secondary data regarding the project area was acquired through indirect interventions, which encompassed:

- Review of previous studies
- Various reports published by individual or national and international organizations
- Internet, Websites
- Study of available maps
- Review of information available with the Govt. Departments and non-governmental. Organizations working in the project area of the District.

1.10.5 Public Consultation Meeting

61. The first public consultation meeting was conducted at Old Abad Bund on 10th April 2025. Public Consultations. Besides consultation with knowledgeable individuals during the reconnaissance visit to the project area, consultations with local communities were carried out through scoping sessions during the field surveys. The purpose of the scoping sessions was to disseminate information on the scope of the Project, assess stakeholders' views on the Project, and gather first-hand information on the concerns of the affected population regarding environmental and social effects, as well as potential mitigation and resettlement options.

62. The second public consultation meeting was conducted at Old Abad Bund on 25th June 2025. Public Consultations. The primary purpose of the 2nd Public Consultation Meeting (2nd PCM) is to ensure that all relevant stakeholders are fully informed about the IEE & RAP findings, especially the potential environmental and social impacts associated with the proposed project and the suggested mitigation measures. By clearly communicating project details, the meeting enables stakeholders to understand how they may be affected.

Additionally, this 2nd PCM serves as a platform for gathering feedback from affected communities and key stakeholders, allowing them to share their concerns, expectations, and suggestions. This input is valuable for shaping project planning and execution, ensuring that diverse perspectives are considered. Ultimately, the PCM fosters transparency and compliance by maintaining open dialogue, which in turn builds trust and ensures the project meets all regulatory requirements. This process upholds accountability and transparency throughout all stages of the project.

1.10.6 Delineation of the Area of Project Influence

63. From an environmental viewpoint, the project area is defined as the area of project influence. Some areas are directly impacted, while others may be influenced indirectly. The EIA study area will be up to 500 meters[3] from the project area in all directions, as shown in Figure 1.3. The Project's area has been marked on maps as a Project Area of Influence (AOI).

64. For the Project, the areas of most concern are as follows:

- Areas falling near the structures, Areas to be used for establishing a work yard.
- Areas are likely to be used for the dumping of spoil material.
- Areas to be used for developing haul tracks.

65. The Project will not directly impact the majority of the residential area; however, it is likely to have indirect effects of mixed types. Primarily, the induction of heavy machinery and vehicles when transporting construction materials from quarries will cause traffic congestion and hazards. On the other hand, the induction of an outside workforce will be beneficial in boosting the local business.

[3] There is no explicit provision in the SEPA Act 2014 that defines a fixed 500-meter range as the standard environmental impact area for a project. The relevant regulations and guidelines leave the determination of the impact area to the discretion of the authorities and the specifics of each project rather than prescribing a fixed distance. The 500-meter parameter (environmental impact for this project) reflects a pragmatic approach to impact mitigation in project design, guided by environmental monitoring data and engineering best practices rather than a nationwide regulatory threshold.

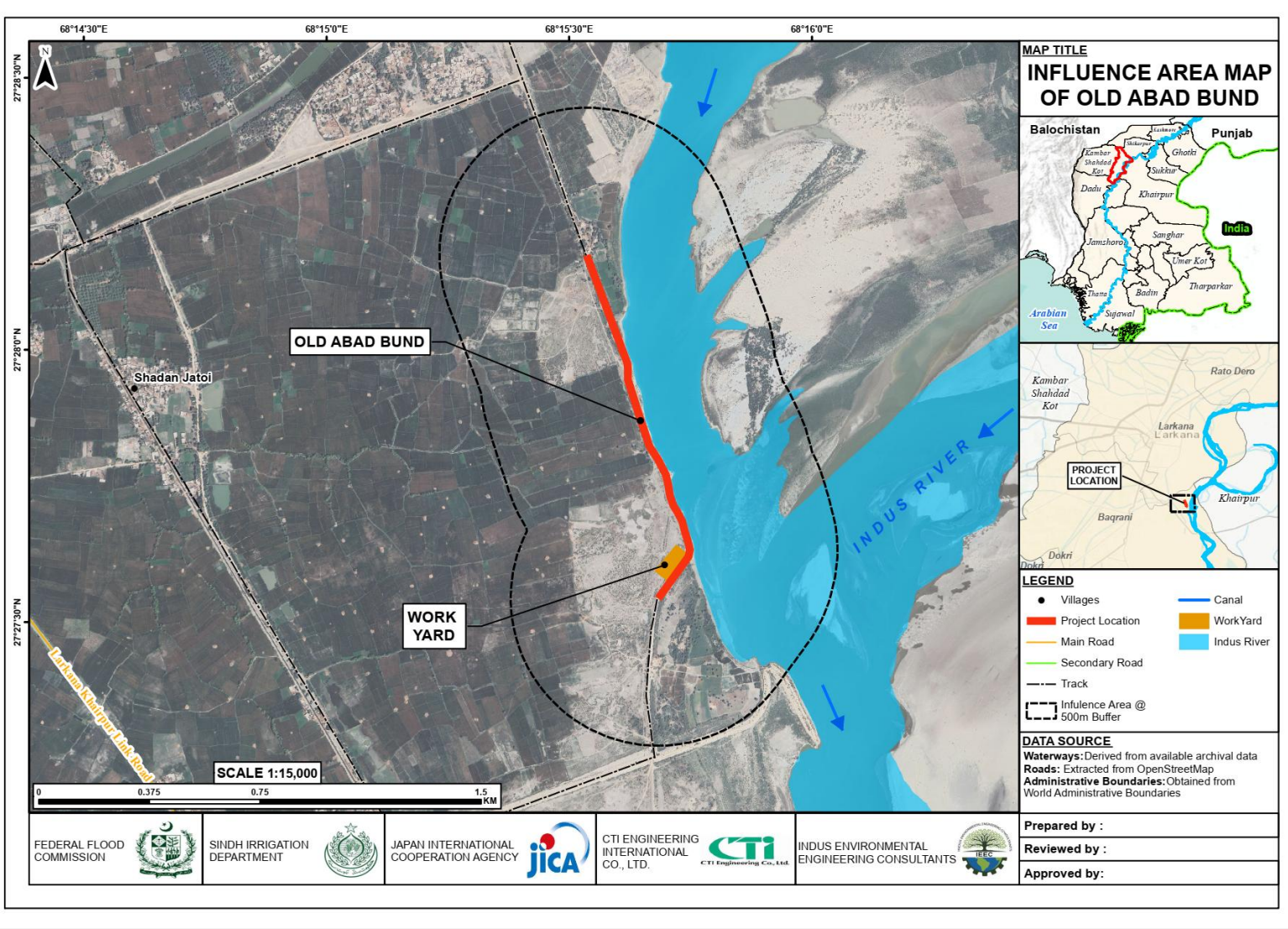


Figure 1.3: Old Abad Bund AOI @ 500 Meter Buffer

1.11 Structure of the Report

This IEE Report comprises ten chapters and a summary. The chapters are as follows:

Chapter 1, Introduction, provides an overview of the Project, the consultants' scope of services for IEE studies, and the approach adopted by the consultants to achieve compliance with the Terms of Reference (TOR).

Chapter 2, Legal and Regulatory Framework, describes national laws applicable during the implementation of the Project. National and international guidelines must be complied with during the preparation of the IEE report, as well as followed during the implementation of the Project. It also describes the need for inter- and intra-agency coordination.

Chapter 3, Description of the Project, provides a detailed account of the Project, with a particular emphasis on those components that are important in relation to environmental and social aspects.

Chapter 4, Project Alternatives Considered, provides a brief account of the country's need for electric energy, discusses various alternative sources that are currently exploited or are to be exploited to curb the climate crisis in the country, and examines the role of the present project in this context. The chapter also deals with various alternatives considered for project layout in consideration of technical, economic and environmental aspects.

Chapter 5, Environmental and Social Baseline Conditions. This chapter discusses various environmental and social entities, including biodiversity, Fauna and Flora, Water, and the human environment, prior to the project.

Chapter 6, Information Disclosure, Consultation, and Participation, addresses the outcomes of consultation and scoping sessions conducted with local communities, knowledgeable individuals, public representatives, and others. It addresses the concerns of various tiers of the population and provides an outline of how these have been addressed within the project framework.

Chapter 7, Project Impacts and Mitigation Actions, provides an analysis of the environmental and social impacts of the project and discusses measures to mitigate adverse impacts and enhance the environment of the project-affected areas.

Chapter 8, Environmental & Social Management and Monitoring Plan and Institutional Requirements, outlines plans and associated costs for implementing environmental management and monitoring. It proposes an organizational setup required for the implementation of mitigation actions and, in light of this, identifies strengthening needs in institutional arrangements presently existing within and allied departments.

Chapter 9, Estimated Environmental Cost. This chapter estimates an environmental cost, which comprises environmental mitigation costs during the construction and operation of the proposed project.

CHAPTER - 2: LEGAL AND REGULATORY FRAMEWORK

2.1 General

66. This Chapter provides an overview of the legal frameworks and environmental assessment process in Pakistan, as well as a list of key environmental legislation and guidelines applicable to the proposed project. It also provides an overview of the Sindh Environmental Protection Act (SEPA) and JICA GL, including applicable Environmental, Health and Safety Guidelines, among others.

2.2 National/ Provincial Legislation

2.1.1 Sindh Environmental Protection Act, 2014

67. The Sindh Environmental Protection Act, 2014 is a comprehensive legislation and provides the legislative framework for the protection, conservation, rehabilitation and improvement of the environment. The 'environment' has been defined in the Act as (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the interrelationships between any of the factors specified in sub-clauses 'a' to 'f'. The notable points of the law are:

- No proponent of a project shall commence construction or operation unless he has filed.
- an IEE/ EIA/EC with the Provincial Agency designated by the Provincial EPAs an IEE/EIA/EC, and has obtained an approval;
- Establishment and formation of the Environmental Protection Council;
- Prohibition of certain discharges or emissions;
- Sindh Environmental Quality Standards (SEQS) for wastewater, air emissions and noise; and
- The provincial government can issue notices and enforce them to protect the environment.

2.3 Project Category

2.1.2 Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021

68. According to Sindh – EPA: The Sindh Environmental Protection Agency (Environmental Assessment) Regulations 2021 provide screening categories of projects for which an Environmental Checklist (EC), an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) must be conducted. The proposed project falls under Schedule II, Category 'G' (3) - 'Flood Protection Bunds.' This category requires an IEE to be conducted. The completed IEE must be submitted to SEPA for No Objection Certificate (NOC) approval before project commencement.

2.1.3 JICA's Guidelines (JICA GL) for Environmental and Social Considerations

69. According to JICA's Guidelines for Environmental and Social Considerations, projects

are classified into four categories[4]: A, B, C, and FI, based on their potential environmental and social impacts.

70. For flood protection bunds, the likely JICA project category is: Category B: Projects in this category have potential adverse environmental and social impacts that are less significant than those of Category A. Under the JICA Environmental and Social Considerations Guidelines, this project is classified as Category B. Therefore, an Initial Environmental Examination (IEE)-level study is required in accordance with the JICA Guidelines.

71. These impacts are generally **site-specific**, few are **irreversible**, and **effective mitigation** measures can be readily designed. Typical examples include small- to medium-scale flood control or drainage projects, where impacts are limited and manageable.

72. *For your flood protection bunds project, which falls under Schedule II, Category G(3) of SEPA regulations, it would typically be classified as Category B under JICA guidelines, requiring an Initial Environmental Examination (IEE) or equivalent study, but not a full Environmental Impact Assessment (EIA).*

2.4 Other Applicable Cross-Sectorial Laws in Sindh

73. The scope of cross-sectoral law, as implied by the legal definition of the environment given in SEPA 2014, results in numerous laws enacted since the nineteenth century being classified as environmental laws. These include laws pertaining to forests, water resources, wildlife, land, agriculture, health and town planning. Laws relevant to the environment, along with their brief scope and applicability, are listed in Tables 2.1 & 2.2.

Table 2-1: Key Applicable Cross-Sectoral Legislation in Sindh

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
1.	National Climate Change Policy 2012 (updated 2021) (NCCP) Sindh Climate Change Policy, 2022	It also proposes promoting futuristic building designs with special emphasis on solar panels for energy self-sufficiency, especially in public sector buildings and developing all types of renewable energy generation technologies. The policy thus provides a comprehensive framework for developing Action Plans for national efforts on adaptation and mitigation.	Renewable energy generation technologies are relevant to the proposed project's context. It promulgates the enactment of a regulatory framework for efficient water resource management. This policy will be accelerated due to the emissions from the construction machinery.
2.	Sindh Resettlement and Rehabilitation (R&R) Policy 2023	The Sindh Resettlement and Rehabilitation (R&R) Policy 2023, introduced by the Government of Sindh in Pakistan, aims to address the negative impacts on individuals from past and ongoing development projects. Although approved by the provincial cabinet and officially notified by the Government of Sindh, its on-the-ground implementation has yet to commence. Encompassing various forms of displacement, including those arising from development projects, natural disasters, and government-driven anti-encroachment initiatives, the policy emphasizes avoiding or reducing displacement and resettlement by	The specifics of R&R remain unclear, but it is anticipated that R&R may be necessary during the implementation of the proposed projects. Therefore, this policy is expected to be applicable. However, a definitive determination will be made following thorough RAP.

[4] Category A is reserved for projects with significant, wide-ranging, or irreversible impacts, such as large-scale dams or major river basin developments. Category C is for projects with minimal or no adverse impacts. Category FI applies to financial intermediary projects.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		exploring alternative options and technical solutions wherever possible.	
3.	National Drinking Water Policy, 2009 Sindh Drinking Water Policy 2017	The National Drinking Water Policy provides a framework for addressing the key issues and challenges facing Pakistan in providing safe drinking water to the people. Drinking water is a constitutional responsibility of provincial governments, and the specific provision function has been devolved to specially created agencies in cities and towns, as well as Tehsil Municipal Administrations, under the Local Government Ordinance 2001.	This policy applies to the proposed subprojects regarding regular water quality monitoring during the construction phase.
4.	Sindh Sanitation Policy 2017	The sanitation policy primarily emphasizes enhancing the accessibility of sanitation services, ensuring the safe disposal of liquid and solid waste, and advocating for improved health and hygiene practices across the province. This encompasses the effective management of solid and liquid waste from municipal, hospital, and industrial sources.	This policy is applicable as the proposed project involves the establishment of facilities to provide safely managed sanitation services during the construction phase.
5.	National Environmental Policy, 2005	In March 2005, the Government of Pakistan (GoP) launched its National Environmental Policy, which provides a framework for addressing environmental issues. Section 5 of the policy commits to integrating the environment into development planning as a means of achieving the objectives of the National Environmental Policy. It also provides broad guidelines to the federal government, provincial governments, federally administered territories, and local governments to address their environmental concerns and ensure effective management of their environmental resources.	Clause (b) of Subsection 5.1: Integration of Environment into Development Projects states that Environmental Impact Assessment-related provisions in the Environmental Protection Act, 1997, will be diligently enforced for all development projects.
6.	National Forest Policy, 2001	This policy aims to promote the sustainable development of Renewable Natural Resources (RNR) in Pakistan by conserving and rehabilitating these vital resources and enhancing the sustainable livelihoods of rural communities, particularly women, children, and other vulnerable groups.	The proposed project does not pass through or affect the Reserve Forest or other notified areas. However, other relevant components, such as wildlife conservation and tree planting, will also be applicable.
7.	Sindh Labor Policy 2018 (SLP 2018)	The focus of SLP 2018 is on eliminating child labor, addressing the issue of bonded labor, tackling wage discrimination and unequal work opportunities, promoting freedom of association and collective bargaining, enhancing the labor inspection system, and improving occupational safety and health. In addition, SLP 2018 addresses women's labor issues, including opportunities and equal remuneration, in line with ILO conventions and the protection of vulnerable groups, such as mine workers, women, children, and persons with disabilities.	The provision of this policy will apply to all the labor employed.

Table 2-2: Main Social and Environmental Legislation Relevant to the Project

Sr. No.	Act	Brief Coverage	Relevance to Project
1.	Sindh Environmental Protection Act, 2014	The Act is comprehensive legislation that provides the legislative framework for protecting, conserving, rehabilitating, and improving the environment. The notable points of the law are: No project proponent shall commence construction or operation unless they have filed an IEE with the Provincial Agency designated by the Provincial EPAs, and have obtained approval.	The provision of the act applies to the proposed project for conducting an IEE/EIA/EC, as per Section 17, and for obtaining environmental approval from the SEPA. Section 18 of the Act applies to compliance with the Sindh Environmental Quality Standards (SEQS). Similarly, sections 11, 12, 13, and 14 of the Act prohibit the discharge or emission of hazardous waste, as well as the failure to comply with standards and the import of hazardous waste.
2.	Sindh Environmental Protection Agency, (Review of EC, IEE and EIA) Regulations, 2021	These regulations set out: • Key policy and procedural requirements for filing an EIA/IEE/EC; • The purpose of environmental assessment. • The requirement that environmental assessment be integrated with feasibility studies; • The responsibilities of proponents; • Provides schedules of proposals that the project requires either an EC or IEE or EIA; • The environmental screening process of the projects under schedule I, II and III; and • The procedure for obtaining environmental approval involves filing the case with the relevant SEPA to obtain a No Objection Certificate (NOC).	These regulations mandate environmental screening of the project, necessitating the completion of an EIA/IEE/EC for the project.
3.	Sindh Environmental Quality Standards (SEQS), 2016	SEQS was promulgated recently in 2016. Specified standards under SEQS are for: • Drinking Water; • Ambient Air; • Noise; • Industrial Gaseous Emissions; • Municipal and Liquid Industrial Effluents; • Motor vehicle exhaust and noise; and • Treatment of Liquid and Bio-Medical Waste.	All projects to be implemented in Sindh must conform to SEQS, 2016, throughout all phases, including construction and operation.
4.	Self-Monitoring and Reporting by Industry (SMRI) Rules, 2014	The SMRI Rules promote responsible environmental practices and transparency within industries, supporting environmental protection and regulatory enforcement by requiring regular self-assessments and reports on environmental performance.	These rules will apply to contractors and subcontractors regarding environmental monitoring and the submission of reports to SEPA.

Sr. No.	Act	Brief Coverage	Relevance to Project
5.	Pakistan Climate Change Act, 2017	This Act aims to meet obligations under international conventions relating to climate change and to provide for the adoption of comprehensive adaptation and mitigation policies, plans, programs, projects and other measures required to address the effects of climate change and for matters connected herewith and ancillary thereto.	This Act will accelerate due to emissions from construction machinery, the application of pesticides, and other factors.
6.	The Sindh Transparency and Right to Information Act, 2016	This Act aims to promote transparency and facilitate access to information, ensuring all citizens have improved access to public information. It seeks to enhance government accountability to citizens and uphold the fundamental right to information in all matters of public significance. Additionally, the Act aims to foster transparency across all government affairs. Transparency and access to information are fundamental tenets of democracy, empowering citizens to hold their government and its institutions accountable and contributing to the enhancement of governance systems.	This act applies as it is a public sector initiative and is required to maintain transparency for the public.
7.	The Sindh Local Government Act 2013 and Sindh Local Government (Amendment) Act, 2021	The Sindh Local Government Act 2013, Chapter VI, outlines the responsibilities of municipal corporations/committees, including land use planning, enforcement of building regulations, management of environmental and health risks, combating food adulteration, provision and upkeep of water supply systems and public drinking water sources, and engaging communities in local infrastructure enhancement such as transportation, landscaping, and removal of encroachments. The 2021 amendment aimed to clarify the roles of municipal corporations and committees while also establishing a structured relationship between elected councils and provincial departments operating within administrative boundaries.	The application of this act to the proposed project stems from its location and the utilization of public sources during the construction and operational phases. Additionally, the implementation of the project will be overseen by the Local Government Department (LGD) of the Government of Sindh, in conjunction with the Public Health Engineering Department and the Sindh Irrigation Department.
8.	Land Acquisition Act, 1894 and Land Acquisition (Sindh Amendment) Act, 2009	The primary law for the acquisition of land for public purposes in Pakistan is the "Land Acquisition Act (LAA), 1894" (hereinafter referred to as the Act). The land acquired under the Act vests in the Province and only thereafter may the Province transfer it to someone else. The Sindh Amendment 2009 of LAA 1894 specifically related to Section 16, Section 23, Section 24 and Section 28-A.	Public and private Land will be acquired; hence, RAP has been developed for the project under this Act.
9.	Sindh Public Property Act, 2010	The act has been passed to avoid illegal encroachments and provide measures for removing encroachment from public property and retrieving possession. The city government will provide continuous oversight and	This act is applicable because there is an encroachment on the proposed public or government land, as indicated by the field survey.

Sr. No.	Act	Brief Coverage	Relevance to Project
		reinforcement to ensure that the properties remain free from illegal encroachments.	
10.	Sindh Factories (Amendment) Act, 2021	The Act deals with regulations related to Project Area workers and workplace EHS requirements. The Factories Act also provides regulations with provisions for the general health and safety of the workforce in their work area. Conditions are specified for a clean workplace, toilets, waste handling, provision of drinking water quality, worker health and hygiene, among others. Under the Act, no factory occupier shall commence the manufacturing process unless they have obtained a factory registration certificate from the Directorate of Labor. The Act prohibits children under the age of 14 from working in a factory. The new Law restricts the employment of contractual labor in the manufacturing process. The 2021 amendment is specifically related to providing safe transportation facilities for women workers, as well as regulating working hours and periods for seasonal and year-round factories.	This act applies to the Project workers and those belonging to the community, including men, adults, women, and adolescents working in and near the construction industry (during the construction phase).
11.	The Sindh Occupational Safety and Health Act (2017)	The Act governs regulations concerning the health and safety of workers, as well as workplace environmental health and safety (EHS) requirements, in the project area. It includes provisions outlined in the Factories Act, ensuring the overall well-being of the workforce within their work environment. These provisions encompass maintaining workplace cleanliness, providing adequate toilet facilities, handling waste properly, supplying high-quality drinking water, and promoting worker health and hygiene. Additionally, the Act mandates that no factory operation can commence without obtaining a factory registration certificate from the Directorate of Labor. It strictly prohibits the employment of children under the age of 14 in any factory setting. Furthermore, the recent 2021 amendment imposes restrictions on the use of contractual labor in manufacturing processes. It introduces specific provisions for the safe transportation of female workers and regulations governing working hours for seasonal and year-round factories.	This law applies to projects that respect and protect the rights and interests of workers. It pertains to construction and project workers and will be adhered to throughout the construction and operational phases.
12.	The Protection against Harassment of Women at the Workplace Act, 2010	The Protection Against Harassment of Women at the Workplace Act (2010) addresses sexual harassment in the workplace.	This Act will apply to the Project if women are employed to construct the proposed Project.

Sr. No.	Act	Brief Coverage	Relevance to Project
	Amendment Bill 2022		
13.	Sindh Prohibition of Child Employment Act, 2017	Article 11(3) of the Pakistani Constitution prohibits employing children below 14 years in hazardous jobs, and the Prohibition of Child Employment Act (PCEA) 2017 in Sindh enforces this, allowing adolescents (14-17 years) to work under specific rules but not in hazardous occupations listed in the Act's schedule.	The relevance of this act to the Project is that it prohibits child employment during the construction of the proposed Project.
14.	Sindh Bonded Labor (Abolition) Act 2015	The Act incorporates gender sensitivity, integrating an anti-discrimination clause mandated by the International Labour Organization (ILO). This clause stipulates that no discrimination shall occur based on factors such as sex, religion, political affiliation, sect, color, caste, creed, or ethnic background when addressing matters related to the enforcement of this Act. Additionally, within all proposed laws, the jurisdictional authority has been shifted from the Judicial Magistrate to the Presiding Officer of Labor Courts, who holds the position of a Session Judge.	This act is relevant as the proposed project may employ a diverse workforce comprising individuals with various religions, political affiliations, sects, colors, castes, creeds, and ethnic backgrounds.
15.	The Sindh Minimum Wages Act, 2021 (Amendment 2023)	To provide the regulation of minimum rates of wages and various allowances for different categories of workers employed in certain industrial and commercial undertakings and establishments.	This Act will apply to the Project to ensure that minimum wages and allowances are provided to the Project labor (both skilled and unskilled) for the construction of the proposed Project.
16.	National Disaster Management Act, 2010	The National Disaster Management Act, 2010, was passed by the Parliament of Pakistan in 2010. The Act applies to the whole of Pakistan. The Act was passed on the backdrop of the 2010 floods in Pakistan and strengthened the disaster management system.	This act applies to the proposed Project due to its location. The proposed Project will require special consideration of flood disasters and risk management strategies per the Act.
17.	The Sindh Solid Waste Management Board Act, 2014	The Sindh Solid Waste Management Board Act, 2014 for the collection and disposal of all solid waste, to arrange for effective delivery of sanitation services, to provide a pollution-free environment and to deal with other relevant matters.	The proposed project may generate various types of solid and liquid waste; therefore, this act shall apply to the proposed project to address relevant matters.
18.	The Sindh Forest (Amendment) Act, 2012	Regulates forest resources. Empower the government to declare any forest area reserved or protected.	It is irrelevant, as no reserve or protected forest falls within the project area or the AOI.
19.	The Sindh Wildlife Protection Ordinance 1972 (Amendment 2001, 2010) Act, 2007, 2020	The law specifies three broad classifications of the protected areas:- a) National Parks - Hunting and breaking of land for mining are prohibited in national parks, as are removing vegetation or polluting water flowing through the park. b) Wildlife Sanctuaries - Wildlife Sanctuaries are areas left as undisturbed breeding grounds for	All interventions are anticipated to occur within rural regions of the province. There are no foreseen direct impacts on biodiversity and natural resources, as construction activities will be conducted in areas that have already been transformed or cultivated. All statutory requirements have been adhered to, and due diligence has

Sr. No.	Act	Brief Coverage	Relevance to Project
		wildlife. Cultivation, grazing, and habitation are prohibited in the demarcated areas. Special permission is required to enter the public. However, in exceptional circumstances, these restrictions are relaxed for scientific purposes or the betterment of the respective Area at the discretion of the authority. Game Reserves - Game reserves are designated as areas where hunting or shooting is not allowed except under special permits.	been conducted to identify any interventions within protected areas.
20.	The Antiquities Act 1975 & Sindh Cultural Heritage (Preservation) Act - 1994	Preserving and protecting antiquities (any object over 75 years old). Empower the government to declare any antiquity as protected. c) The Act 1994 provides rules and regulations to preserve and protect ancient places and objects of agricultural, historical, archaeological, artistic, ethnological, anthropological and national interest in the province of Sindh.	The law will apply to the proposed subprojects primarily because of two key provisions: Construction activities within a radius of 61 meters (200 feet) or less of protected antiquities are prohibited by law. The provisions of this act would also be relevant in the event of accidental archaeological discoveries during excavation work for the construction of proposed subprojects.

2.5 Gap analysis JICA GL and Local Laws & Regulationss

74. The JICA Guidelines for Environmental and Social Considerations require comprehensive assessment and mitigation of environmental and social impacts at the earliest project planning stage, emphasizing alternatives, stakeholder consultation, and public disclosure of information, with a strong focus on compliance with local laws, protection of sensitive areas, monitoring, and grievance mechanisms. In Pakistan, relevant laws mandate environmental approvals (IEE/EIA) and public hearings but are less explicit on issues like climate change, biodiversity, involuntary resettlement, and indigenous peoples; therefore, for this project, JICA's more rigorous standards especially regarding information disclosure, monitoring, climate change, biodiversity, resettlement, indigenous peoples, and grievance redress will be followed where local regulations are silent or less stringent, ensuring alignment with both international best practices and Pakistan's legal framework.

Table 2-3: Gap analysis JICA GL and Local Laws & Regulations

Item	JICA Guidelines for Environmental and Social Considerations	Pakistan Related Laws and Regulations	Policies in this project
Basic Matter	Environmental and social impacts caused by projects must be assessed and examined at the earliest possible planning stage. Alternatives or mitigation measures must be examined, in order to avoid such impacts as much as possible, and to minimize, reduce or mitigate them when such avoidance is impossible.	The project proponent shall not commence construction and operation without submitting an IEE or EIA and obtaining environmental approval.	No major differences. In addition to following Pakistan's system, the Project will also follow the JICA GL.

Item	JICA Guidelines for Environmental and Social Considerations	Pakistan Related Laws and Regulations	Policies in this project
	The result of the examinations must be reflected into the project plan.		
Impact Assessment Items	The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water use, climate change, biodiversity, and ecosystem services, including transboundary or global scale impacts. These also include social considerations such as: Migration of population including involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor peoples and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. In addition to the direct and immediate impacts of projects, derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects are also to be examined and assessed to a reasonable extent. It is also desirable to consider the impacts through a project life cycle.	Environmental considerations are not specifically defined. No mention of impacts to be investigated or considered.	Follow JICA guidelines.
Information Disclosure	The EIA report must be publicly available in the country where the project is implemented, including to local residents and other stakeholders, and must be accessible to local residents and other stakeholders at all times, and copies must be available for acquisition. The environmental assessment report (which may have a different name depending on the system) must be written in the official or widely used language of the country in which the project is implemented. It must be	In the case of the EIA, the Sindh EPA must publish a public notice in a widely circulated English, Urdu and Sindhi newspaper, as well as in a local newspaper that is generally published in the area affected by the project, that includes details of the type of project, the exact location, the name and address of the business operator, and the date, time and location of the public hearing to solicit opinions from the main stakeholders.	No major differences. In addition to following Pakistan's system, the Project will also follow the JICA GL.

Item	JICA Guidelines for Environmental and Social Considerations	Pakistan Related Laws and Regulations	Policies in this project
	written in a language and style that can be understood by local people.		
Compliance with Laws, Standards, and Plans	Projects must comply with the laws, ordinances, and standards related to environmental and social considerations established by host country governments, including local governments. Projects must also conform to the environmental and social consideration policies and plans of the host country governments. In principle, Projects must be undertaken outside of areas that are specifically designated for conservation of nature or cultural heritages by the host country governments, unless the main purpose of the Projects is to promote or restore the protection of such areas. Also, projects shall not cause significant adverse impacts on such designated conservation areas.	It follows the Sindh Environmental Protection Act and the Environmental Protection Agency Regulations. The Sindh EPA can designate environmentally sensitive areas. Project operators located in environmentally sensitive areas must submit an EIA to the Sindh EPA.	In Pakistan, there is no obligation to avoid protected areas when implementing projects, but in this project, we will avoid protected areas in principle.
Social Consensus	Projects must be adequately coordinated so that they are accepted in a socially appropriate manner for the countries and areas where the projects are planned. For Projects with potentially significant environmental and social impacts, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans are examined. The outcome of such consultations must be incorporated into the project plans.	In the case of EIA, all opinions received from local residents or government agencies shall be duly considered before issuing a decision.	No major difference. Consultation will be carried out from an early stage, and the opinions will be reflected in the project as much as possible.
Monitoring	During the implementation of the project, the existence of any situations that were difficult to predict, the implementation status and effectiveness of any mitigation measures planned in advance, etc., must be ascertained, and appropriate measures must be taken based on the results. If it is considered that sufficient monitoring is essential for appropriate environmental and social considerations, such as projects where mitigation measures should be implemented while ascertaining their effectiveness, a monitoring plan must	The Sindh EPA shall conduct or arrange for environmental monitoring of all projects for which an IEE or EIA has been approved, in order to determine whether the actual environmental impact exceeds the predicted level and whether the conditions of approval have been complied with. For this purpose, the Sindh EPA may require the project proponent to submit information as specified by the Sindh EPA, including quantitative and qualitative	The JICA GL requires that monitoring results be made public, but the Pakistani system does not clearly state this. In this item, the JICA GL will be applied.

Item	JICA Guidelines for Environmental and Social Considerations	Pakistan Related Laws and Regulations	Policies in this project
	be included in the project plan and the feasibility of that plan must be ensured. Efforts must be made to disclose the results of monitoring to local stakeholders involved in the project. In the event that a third party or other party makes specific comments regarding the lack of sufficient environmental and social considerations, etc., the project stakeholders involved must endeavor to establish a forum for discussing and examining countermeasures with sufficient information disclosure, and to agree on procedures for resolving the issues.	analysis of the environmental impact of the project. Report on a daily, weekly, monthly and annual basis on wastewater, waste, air pollutants, noise and other substances or activities that may be considered problematic, which are emitted from the project. Sindh EPA, after reviewing the data collected and the information provided, may issue instructions to the person in charge as deemed necessary to ensure compliance with the conditions of approval.	
Examination of Measures	Multiple alternatives must be examined in order to avoid or minimize adverse impacts by the project and to choose better project options in terms of environmental and social considerations. In the examination of measures, priority is to be given to avoidance of environmental impacts. When this is not possible, minimization, reduction, and then mitigation of the impacts must be considered, in accordance with the mitigation hierarchy. Compensation measures must be examined only when significant impacts are still remain even with the aforementioned measures. Appropriate plans and systems for measures, such as monitoring plans and environmental management plans, must be prepared. The costs of implementing such plans and systems, and the financial methods to fund such costs, must be determined. For projects with particularly significant impacts, detailed environmental management plans must be prepared.	'Environmental Impact Assessment' means an environmental study that includes data collection, prediction of qualitative and quantitative impacts, comparison of alternative plans, evaluation of preventive, mitigating and compensatory measures, development of environmental management plans, training plans and monitoring plans, development of recommendations and other prescribed elements. All approvals of EC, IEE, EIA, EMP or Environmental Audit (EA) shall be subject to the condition that the project shall be designed, constructed or operated in strict accordance with the EC, IEE, EIA, EMP or EA and that mitigation measures and other measures shall be adopted. Sindh EPA may issue guidelines regarding the scope of preparation of EMP or EA. If guidelines are issued, they must be prepared in accordance with them to the extent feasible.	No major differences. In addition to following Pakistan's system, the Project will also follow the JICA GL.
Climate Change	For projects that are expected to generate more than a certain amount of greenhouse gas emissions, the total amount of greenhouse gas emissions	Climate change is not mentioned.	Follow JICA GL.

Item	JICA Guidelines for Environmental and Social Considerations	Pakistan Related Laws and Regulations	Policies in this project
	will be estimated and disclosed before the project implementation.		
Biodiversity	Projects must not involve significant conversion or significant degradation of critical habitats or critical forests. Illegal logging of forests must be avoided. Project proponents need to obtain logging permits from regulatory agencies, and are encouraged to obtain forest certifications for forestry projects, in order to ensure the prevention of illegal logging.	No specific mention is made of avoiding illegal logging of forests, etc.	Follow JICA GL.
Involuntary Resettlement and Loss of Livelihood	For projects that result in large-scale involuntary resettlement, a Resettlement Action Plans (RAP) must be prepared and made available to the public prior to the resettlement and provision of compensation and support. For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.	There is no mention of involuntary resettlement or loss of livelihood.	If a cadastral survey is carried out and private land is confirmed within the target area, a resettlement plan will be prepared in accordance with the JICA GL.
Indigenous Peoples	Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. If avoidance is not possible even after such examination, effective measures for indigenous peoples must be taken to minimize the impacts and to compensate for the losses. When projects may have adverse impacts on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of the relevant international declarations and treaties, including the United Nations Declaration on the Rights of Indigenous Peoples. Efforts must be made to obtain the Free, Prior, and Informed Consent (FPIC) of the affected indigenous peoples. Measures for the affected indigenous peoples must be prepared as an Indigenous Peoples Plan (IPP), which may constitute as a part of other documents for environmental and social considerations, and must be	No specific mention of indigenous peoples.	Follow JICA GL.

Item	JICA Guidelines for Environmental and Social Considerations	Pakistan Related Laws and Regulations	Policies in this project
	made public in compliance with the relevant laws and ordinances of the host country. In preparing the IPP, efforts must be made to obtain the FPIC of the affected indigenous peoples based on sufficient information made available to them in advance. When consultations are held, explanations are given in languages and forms that are understandable to the indigenous peoples concerned. It is desirable that the IPP includes the elements laid out in the ESS 7 of the World Bank's environmental and social policies.		
Grievance Redress Mechanism	A mechanism for handling concerns and grievances from people and communities affected by the project's environmental and social impacts must be in place. 2. The grievance redress mechanism needs to be easily accessible for the project affected people and communities. Project proponents disseminate the information about the grievance redress mechanism through consultations with local stakeholders. The project affected people and communities must not be disadvantaged by filing a grievance. Project proponents should make efforts to respond promptly to the grievances they receive, taking into account the concerns and needs of the project affected people and communities.	The Sindh EPA will investigate and review environmental issues on its own initiative or based on complaints from individuals or organizations.	There is no mention of the development of a complaints handling mechanism. This will be in accordance with the JICA GL.

2.2 International Labor Organization (ILO) Conventions – Ratified by Pakistan

75. Pakistan has ratified 8 fundamental and 26 technical ILO conventions, the following of which are relevant to the proposed subprojects and are summarized in Table 2.4 below.

Table 2-4: Relevant ILO Conventions

Sr. No.	*ILO Conventions*	*Objectives*	*Relevance to the Project*
i.	C029 - Forced Labor Convention, 1930 (No. 29)	This convention states that each member undertakes to suppress the use of forced or compulsory labor in all its forms within the shortest possible period. The convention also states that the term forced or compulsory labor shall mean all work or service which is exacted from any person under the menace of any penalty and for	The proposed project must adhere to this convention to prohibit all forms of forced or compulsory labor. Accessible means to raise workplace concerns and complaints will also be ensured for all workers through an effective

Sr. No.	ILO Conventions	Objectives	Relevance to the Project
		which the person has not offered himself voluntarily.	grievance and redressal mechanism (GRM).
ii.	C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)	For the purposes of this Convention, discrimination includes any distinction, exclusion, or preference made based on race, color, sex, religion, political opinion, national origin, or social origin which has the effect of nullifying or impairing equality of opportunity or treatment in employment or occupation.	The proposed project will ensure fair treatment, non-discrimination, and equal opportunity for workers while also supporting freedom of association and collective bargaining. The proposed project must aim to close the gender gap rather than widen it through its intervention.
iii.	C138 - Minimum Age Convention, 1973 (No. 138)	Article 1 of the convention states that each Member which ratifies this Convention shall specify, in a declaration appended to its ratification, a minimum age for admission to employment or work within its territory and on means of transport registered in its territory, subject to Articles 4 to 8 of this Convention, no one under that age shall be admitted to employment or work in any occupation.	The proposed project should avoid, in particular, child labor that is mentally, physically, socially or morally harmful.
iv.	C001 - Hours of Work (Industry) Convention, 1919 (No. 1)	The term industrial undertaking under this convention includes (c) construction, reconstruction, maintenance, repair, alteration, or demolition of any building, railway, tramway, harbor, dock, pier, canal, inland waterway, road, tunnel, bridge, viaduct, sewer, drain, well, telegraphic or telephonic installation, electrical undertaking, gas work, waterworks or other work of construction, as well as the preparation for or laying the foundations of any such work or structure; Article 2 of the Convention states that the working hours of persons employed in any public or private industrial undertaking or in any branch thereof, other than an undertaking in which only members of the same family are employed, shall not exceed eight in the day and forty-eight in the week. The limit of hours of work prescribed in Article 2 may be exceeded in case of an accident, actual or threatened, or in case of urgent work to be done to machinery or plant, or in case of "force majeure", but only so far as may be necessary to avoid serious interference with the ordinary working of the undertaking.	The proposed project may involve wage labor; if it does, the working conditions should comply with this Convention.
v.	C011 - Right of Association (Agriculture) Convention, 1921 (No. 11)	Each Member of the International Labor Organization, which ratifies this Convention, undertakes to secure to all those engaged in agriculture the same rights of association and combination as to industrial workers and to repeal any statutory or other provisions restricting such rights in the case of those engaged in agriculture.	The proposed project may create wage labor; if it does, the rights of association and combination should be respected in accordance with this Convention. Accessible means to raise workplace concerns and complaints will also be ensured for all workers through an effective grievance and redressal mechanism (GRM).

2.3 IFC's Environmental and Social Performance Standards

76. International financial institutions, such as the International Finance Corporation (IFC), mandate that IEE/EIA be conducted in accordance with both national legislation and internationally recognized environmental and social safeguard standards. Accordingly, any project financed by these institutions must comply with their respective environmental, social, and disclosure policies. The following international standards and guidelines are particularly relevant for the current IEE:

- IFC Performance Standards on Environmental and Social Sustainability (2012)
- IFC/World Bank Environmental, Health, and Safety (EHS) Guidelines

77. These standards serve (refer to Table 2.5) as essential benchmarks for ensuring that environmental and social risks are effectively identified, assessed, and managed throughout the project lifecycle.

Table 2-5: IFC's Environmental and Social Performance Standards

Sr. No.	Performance Standard Title	Summary of Requirements	Project Relevance
1	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	Requires conducting an IEE/ EIA aligned with project risks, establishing Environmental and Social Management Plans (ESMPs), formulating action plans for compliance with legal and IFC standards, ensuring community engagement through grievance mechanisms, and monitoring effectiveness of environmental and social management.	Applicable to all projects with environmental and social risks. Therefore, it is relevant to the proposed project.
2	PS 2: Labor and Working Conditions	Requires establishing an HR policy in line with IFC standards, documenting employment terms, prohibiting child/forced labor, ensuring non-discrimination, and providing a safe work environment. Includes requirements for supply chain labor practices, grievance mechanisms, and monitoring of third-party compliance.	Applicable to direct, contracted, and supply chain workers associated with the project. Relevant to the proposed project.
3	PS 3: Resource Efficiency and Pollution Prevention	Calls for pollution prevention and control measures, minimizing emissions, and enhancing resource efficiency (including energy, water, and raw materials). Implementation of cost-effective and technically feasible methods is emphasized. Refers to applicable World Bank Group EHS Guidelines.	Applicable due to the project's potential for increased pollution. Pollution prevention and control measures will be required throughout the project lifecycle.
4	PS 4: Community Health, Safety and Security	Focuses on identifying and mitigating risks to community health and safety across the project lifecycle. Requires infrastructure design to follow best practices and measures to address natural hazard risks and disease exposure.	Applicable due to potential health and safety impacts on nearby communities during construction and operation.
5	PS 5: Land Acquisition and Involuntary Resettlement	Seeks to avoid or minimize displacement due to land acquisition and to mitigate adverse impacts when unavoidable.	Applicable as RAP will be prepared separately.

Sr. No.	Performance Standard Title	Summary of Requirements	Project Relevance
6	PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	It aims to conserve biodiversity, maintain ecosystem services, and ensure sustainable use of living natural resources.	Applicable. The proposed project falls in a low ecologically sensitive zone for proposed development.
7	PS 7: Indigenous Peoples	Addresses the avoidance and mitigation of impacts on Indigenous Peoples, ensuring their rights and interests are protected.	Not applicable. The project does not affect Indigenous Peoples.
8	PS 8: Cultural Heritage	Focuses on protecting cultural heritage from the adverse impacts of project activities.	Not applicable, as there are no cultural heritage sites present in the project area.

2.3.1 IFC EHS Guidelines

78. The General EHS[5] Guidelines contain information on cross-cutting environmental, health, and safety issues that are potentially applicable to all industry sectors. It should be used together with the relevant industry sector guideline(s).

79. The Environmental, Health, and Safety (EHS) General Guidelines will apply to this Project. (Table 2.6).

Table 2-6: General EHS Guidelines

1. Environmental	2. Occupational Health and Safety	3. Community Health and Safety	4. Construction and Decommissioning
1.1 Air Emissions and Ambient Air Quality	2.1 General Facility Design and Operation	3.1 Water Quality and Availability	4.1 Environment
1.2 Energy Conservation	2.2 Communication and Training	3.2 Structural Safety of Project Infrastructure	4.2 Occupational Health and Safety
1.3 Wastewater and Ambient Water Quality	2.3 Physical Hazards	3.3 Life and Fire Safety (L&FS)	4.3 Community Health and Safety
1.4 Water Conservation	2.4 Chemical Hazards	3.4 Traffic Safety	
1.5 Hazardous Materials Management	2.5 Biological Hazards	3.5 Transport of Hazardous Materials	
1.6 Waste Management	2.6 Radiological Hazards	3.6 Disease Prevention	
1.7 Noise	2.7 Personal Protective Equipment (PPE)	3.7 Emergency Preparedness and Response	
1.8 Contaminated Land	2.8 Special Hazard Environments		
	2.9 Monitoring		

[5] *(www.ifc.org/ehsguidelines)*

2.6 International Protocol/ Conventions

80. As Pakistan is a member of a number of international organizations such as United Nations Organization (UNO), Organization of the Islamic Conference (OIC), the South Asian Association for Regional Cooperation (SAARC), Economic Cooperation Organization (ECO), etc., so it has to follow the international protocols and obligations related to the environment. The major protocols, ratification dates by Pakistan and obligations related to the proposed project are given in Table 2.7:

Table 2-7: International Agreements/Conventions Relevant to the Project

Sr. No	Agreement/Convention	Ratification	Description/Relevance
1	Convention on Biological Diversity, 1994 Web Link: https://www.cbd.int/	Pakistan signed this treaty in 1992 and cabinet ratified it in 1994.	The Convention on Biological Diversity (CBD) has three main goals: Conservation of biological diversity (or biodiversity), sustainable use of its components, and fair and equitable sharing of benefits arising from genetic resources. *The law is partially relevant, as the proposed intervention involves natural resource management, and there are no natural habitats or game reserves within the project AOI.*
2	The Rio Declaration, 1992 Web Link: http://www.unep.org/documents. Multilingual /default.asp? documented =78 & articled = 1163	Pakistan signed the treaty on 13 Jun 1992 and ratified it on 1 June 1994	The Rio Declaration comprises 27 principles, which address important issues such as sustainable development, integrating environmental protection into the development process; common but differentiated responsibilities to conserve, protect, and restore the Earth's ecosystems; and public participation and access to information at the national level, to reduce and eliminate unsustainable patterns of production and consumption. *The law is relevant because the proposed project focuses on protecting the natural environment.*
3	Kyoto Protocol, 1992 Web Link: http://unfccc.int/kyoto_protocol/items/ 2830.php	Pakistan has ratified Kyoto Protocol in 2005	The Kyoto Protocol is a protocol designed to reduce greenhouse gases that contribute to climate change. It was agreed upon on 11 December 1997 at the 3rd Conference of the Parties to the treaty, which was held in Kyoto, and entered into force on 16 February 2005. As of November 2007, 175 countries have ratified the protocol. One hundred thirty-seven (137) developing countries have ratified the protocol, including Brazil, China, India, and Pakistan; however, they have no obligation beyond monitoring and reporting emissions. *The project has been proposed to fulfill the protocol by making no changes to the climate, rather than mitigating the effects of climate change.*

Sr. No	Agreement/Convention	Ratification	Description/Relevance
4	UN Convention to Combat Desertification (UNCCD), 1994 Web Link: http://www.unccd.int/en/Pages/ default.aspx	Pakistan signed the Convention on 15th October 1994 and ratified it on 24 February 1997	The UNCCD is a Convention to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements. *With the implementation of the proposed project, the major portion of the flood-affected land would come under cultivation*.
5	Convention on the International Trade of Endangered Species (CITES), 1975 Web Link: https://www.cites.org/	Pakistan signed the Convention in 1973 and ratified it in April 1976	The convention entered into force on 1 July 1975. The principal obligations of contracting parties to the CITES are to safeguard the trade in rare or endangered species and it established a permit system to control imports and exports of wild fauna and flora. According to this convention, species threatened with extinction whose movement between countries is prohibited except for conservation purposes, such as captive breeding, and species whose commercial trade is permitted but export permits are needed. *Irrelevant for the proposed project as no construction camp has been proposed near the natural habitat.*

2.4 A Comparison of Applicable Local and International Guidelines

81. To select the most stringent standards applicable, a combination of local (SEQS) and international (IFC, USEPA) regulations has been chosen.

2.4.1 Ambient Air Quality Comparison

82. A comparison of applicable local and international guidelines for ambient air quality has been provided in Table 2.8 below. Regarding CO, NO_2, and suspended particulate pollutants, the SEQS standards for ambient air quality are more stringent than those of the USEPA and WHO/IFC standards. However, for SO_2, $PM_{10,}$ and $PM_{2.5,}$ the WHO/IFC standards are more stringent.

Table 2-8: Comparison of International and Local Air Quality Standards

Sr. No.	Pollutants	USEPA		WHO/IFC		SEQS	
		Avg. Time	Standard	Avg. Time	Standard	Avg. Time	Standard
1	SO_2	3 hrs 1 hr	0.5 ppm 75 ppb	24 hr 10 min	20 ug/ m^3 500 ug/ m^3	Annual Mean 24 hrs	80 ug/ m^3 120 ug/ m^3
2	CO	8 hrs	9 ppm (11 mg/m^3)	-	-	8 hrs	5 mg/ m^3
		1 hr	35 ppm (43 mg/m^3)	-	-	1 hr	10 mg/ m^3
3	NO_2	Annual Mean	100 ug/m^3 (53 ppb)	1 year	40 ug/ m^3	Annual Mean	40 ug/m^3

Sr. No.	Pollutants	USEPA		WHO/IFC		SEQS	
		Avg. Time	Standard	Avg. Time	Standard	Avg. Time	Standard
		1 hr	100 ppb	1 hr	200 ug/m^3	24 hrs	80 ug/m^3
4	O_3	8 hrs	0.07ppm (148 ug/$m^{3)}$	8 hrs. daily maximum	100 ug/m^3	1 hr	130 ug/m^3
5	Suspended Particulate	-	-	-	-	Annual Mean	360 µg/ m^3
		-	-	-	-	24 hrs	500 ug/ m^3
6	PM_{10}	24 hrs	150 ug/ m^3	1 yr	20 ug/m^3	Annual Mean	120 µg/ m^3
		-	-	24 hr	50 ug/m3	24 hrs	150 µg/m3
7	PM2.5	Annual Mean	15 ug/m^3	1 yr	10 ug/m3	Annual Average	40 ug/m3
		24 hrs	35 ug/m^3	24 hr	25 ug/m3	24 hrs.	75 ug/m3
		-	-	-	-	1 hr	15 ug/m3

2.4.2 Noise Values Comparison

83. A comparison of noise standards (see Table 2.9) clearly shows that SEQS standards are more stringent than the WHO/ IFC standards for residential and commercial areas. The only exception is the daytime noise level standard for industrial areas, where the WHO/ IFC standard is more stringent, i.e., 70 dB(A), compared to the SEQS, i.e., 75 dB(A). For this particular parameter, the WHO/IFC standard will be used.

Table 2-9: Comparison of International and Local Noise Standards

Sr. No	Category of Area/ Zone	Limit in dB(A) Leq			
		SEQS		WHO/IFC	
		Day Time	Night Time	Day Time	Night Time
		06:00 - 22:00	22:00 - 06:00	07:00 - 22:00	22:00 - 07:00
1	Residential Area (A)	55	45	55	45
2	Commercial Area (B)	65	55	70	70
3	Industrial Area (C)	75	65	70	70
4	Silence Zone (D)	50	45	55	45

2.4.3 Drinking Water Values Comparison

84. The comparison of drinking water quality standards is given in Table 2.10, which clearly shows the comparison between SEQS and WHO standards.

Table 2-10: Comparison of Local and International Drinking Water Standards

Sr. No.	Parameters	Units	SEQS	WHO standards
1	Temperature (During Sample Collection)	^{O}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

Sr. No.	Parameters	Units	SEQS	WHO standards
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	1.5
10	Sulfate (SO4-2)	mg/L	NS	NS
11	Chloride(Cl-)	mg/L	<250.00	250
12	Nitrate (NO3)-	mg/L	≤50.00	50
13	Odor	-	Non-Objectionable / Acceptable	
14	Taste	-	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	3
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

Sr. No.	Parameters	Units	SEQS	WHO standards
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

85. The SEQS (2016) for ambient air quality, noise, water, and wastewater are more stringent compared to USEPA and WHO/IFC standards, except for a few parameters of ambient air quality, noise, and water that have been considered for these proposed subprojects. Based on the above comparison, only stringent national and international standards values shall apply to the proposed project.

86. Regarding regulations regarding other environmental parameters, such as acceptable effluent disposal parameters, the local regulations, i.e., SEQS 2016, are more stringent and would be preferred over other international regulations. In Pakistan, there are no standards for surface water (used for irrigation); therefore, Food and Agriculture Organization (FAO) standards will be followed.

CHAPTER - 3: PROJECT DESCRIPTION

3.1 General

87. The project aims to address the increasing risk of bund (embankment) failures along the lower Indus River, particularly in the downstream areas such as Sukkur and Larkana in Sindh. Anticipated rises in river discharge heighten the threat of these failures, especially in low-lying regions. If such failures occur, they could cause extensive damage to valuable assets and critical infrastructure.

88. To mitigate these risks, the project seeks to strengthen and upgrade the river bunds, thereby reducing the likelihood of failure. The overall goal is to minimize economic losses during flood events and help build a resilient community capable of withstanding future disasters.

89. Key components of the project include the renovation and enhancement of river bunds through improved erosion protection and seepage control. The project also involves consulting services for detailed design, bidding assistance, and procurement management, as well as the actual procurement and construction of the necessary infrastructure. The initiative covers the southern Indus River region in Sindh, with the Federal Flood Commission and the Sindh Irrigation Department serving as the main executing agencies.

3.1.1 Future Flood Projections

Climate change and erratic rainfall patterns in the Chenab River basin exacerbate flood risks. While Sukkur's current design accounts for historical extremes, statistical models predict that 1-in-100-year events could yield discharges up to 47,000 m³/s at Sukkur and 44,500 m³/s at Guddu Barrage, far exceeding existing infrastructure capacities[6]. Without upstream storage enhancements or basin-wide coordination, prolonged peak flows, like the 11-day 2010 event, could overwhelm embankments, particularly in low-lying areas like Larkana.

3.2 Overall River Plan

90. Currently, there is no specific river management plan in place. Nevertheless, key parameters such as design discharge, design water level, and flood reference discharge at Sukkur Barrage have been established. The embankments have been constructed to maintain a freeboard of 1.8 meters (6 feet) above the water level recorded during the 2010 flood, which serves as the most recent benchmark for flood events.

91. The likelihood of a flood event similar to the one experienced in 2010 at the Sukkur Barrage is estimated to be once every 32 years. However, floods exceeding the magnitude of the 2010 event could occur within a 10-year period, even without a breach upstream or significant rainfall in the tributaries, such as the Chenab River basin.

3.2.1 Selection of Candidate Sites for Improvement

92. A vulnerability assessment conducted under the "Dike Management Project" identified Old Abad Bund as the most at-risk locations, as shown in Figure 3.1: Bund Evaluation Matrix, according to the Dike Management Project. Among these, Old Abad Bund has been chosen

[6] *https://water.muet.edu.pk/wp-content/uploads/2019/03/Climate-Change-Impacts-on-Vulnerable-Guddu-and-Sukkur-Barrages-in-Indus-River-Sindh-Dr.-Abdul-Latif-Qureshi-.pdf*

as the top priority for rehabilitation in this project for several reasons:

- The bund has suffered severe erosion damage, making immediate intervention critical.
- The water depth at this location exceeds 5 meters even during normal conditions, necessitating robust and costly countermeasures.
- The Sindh Irrigation Department has also acknowledged the urgent need for rehabilitation at this site.

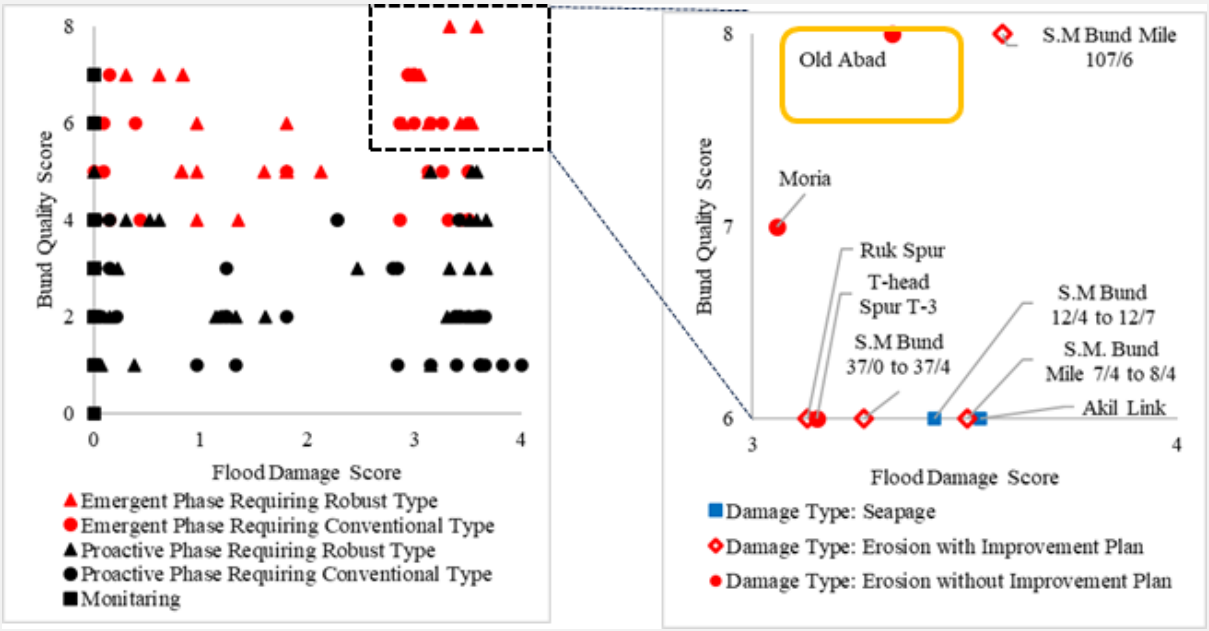


Figure 3.1: Bund Evaluation Matrix According to Dike Management Project

3.3 Quantitative Evaluation of Project Effectiveness

93. The effectiveness of the proposed project is quantitatively evaluated using five key indicators: the number of affected people, the flooded area, the duration of inundation, the flood damage cost, and the number of affected critical infrastructure elements. These indicators provide a comprehensive assessment of the potential impact of floods and the benefits of the proposed improvements.

3.4 Study Conditions and Methodology

94. The evaluation targets the 2010 flood, which recorded the highest flow rate among recent flood events. The focus is on assessing the damage caused by breaches at the specific location: Old Abad Bund. The site has been identified as the candidate for improvement based on their vulnerability and historical impact during major floods.

3.4.1 Flood Inundation Analysis Approach

95. The study employs a detailed flood inundation analysis, utilizing both one-dimensional (1D) and two-dimensional (2D) unsteady flow simulations. The 1D unsteady flow simulation is used for the river channel to provide water level and discharge data, while the 2D simulation models the floodplain to estimate inundated area, depth, and duration. The HEC-RAS Model

is used for these calculations, ensuring accurate representation of flood dynamics on both the river and land sides.

3.4.2 Estimation of Flood Damage

96. Flood damage is estimated based on the "Pakistan Floods 2022 Post-Disaster Needs Assessment." The analysis considers direct and indirect losses, with agriculture and houses accounting for a significant portion of the total damage 43% and 21%, respectively. The methodology involves calculating damage in each mesh cell using simulation results, population data, land use, and the presence of critical infrastructure. The total damage is then derived by summing the losses for houses, agriculture, and other sectors.

3.4.3 Evaluation Outcomes

97. By using these indicators and methodologies, the project evaluation provides a clear picture of the potential reduction in flood impacts resulting from the proposed improvements. This approach allows decision-makers to prioritize interventions that will most effectively reduce the number of affected people, minimize economic losses, and protect critical infrastructure in future flood events.

3.5 Design Specifications

98. The design for the Old Abad Bund includes several key specifications to enhance its flood protection capacity (refer to Figure 3.2). The bund will have a top width of 7.62 meters (25 feet) and a design water level, or highest flood level (HFL), set at 53.34 meters (175 feet). To ensure safety during extreme flood events, a freeboard of 2.14 meters (7 feet) has been incorporated, resulting in a total design bund height of 55.48 meters (182 feet). An additional embankment of 0.40 meters-representing 6.25% of the average embankment height of 6.4 meters-will be provided, bringing the finished top elevation to 55.88 meters (183.3 feet). The proposed high water channel level is set at 49.07 meters (161 feet).

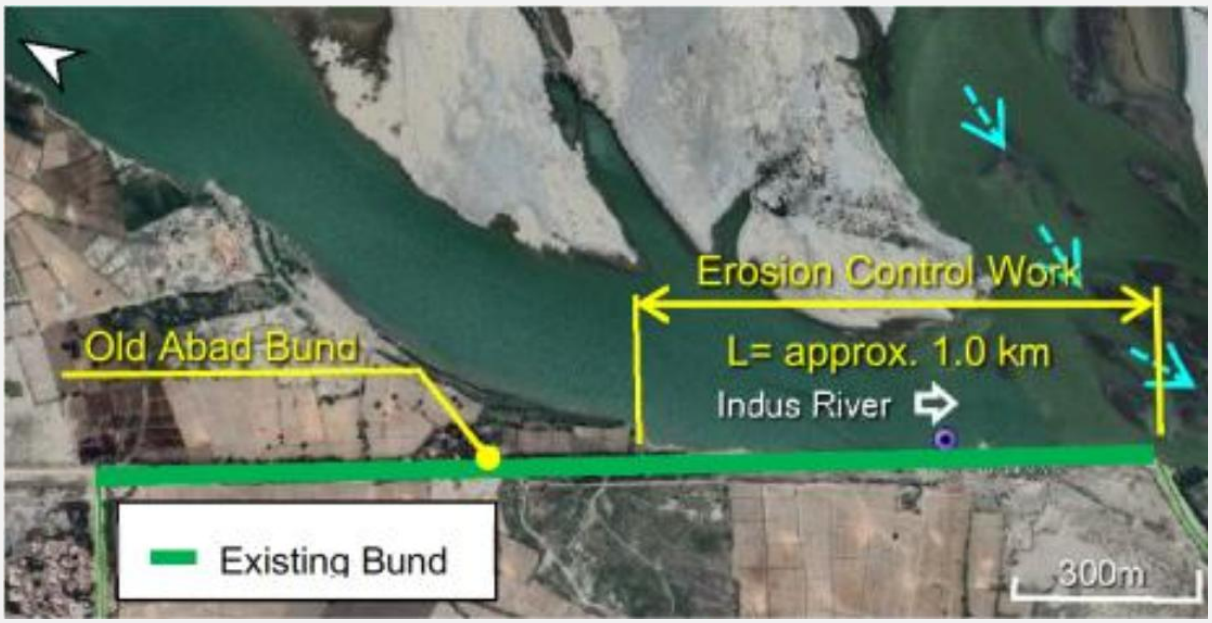


Figure 3.2 Overview of Old Abad Bund

99. The bund's slopes are designed for stability, with a riverside slope of 3:1 and a landside slope of 3.4:1, the latter taking into account cover from the assumed infiltration line. The facility

plan also includes provisions for smooth transitions at both the upstream and downstream ends, ensuring seamless integration with existing bunds. For erosion control, 910 meters of works are planned, with the bund alignment set back approximately 20 to 25 meters from the current position. This adjustment will help ensure the presence of a high water channel bed with a width of at least 10 meters, further strengthening the bund's resilience to future flood events.

3.6 Old Abad Bund

100. The Old Abad Bund is a critical flood protection embankment located along the Indus River, with a total length of approximately 1.0 kilometer. Its significance is heightened by its proximity to the urban area of Larkana, which is situated less than 10 kilometers away. This closeness to a densely populated city means that any damage or breach of the bund could have severe consequences for the safety and livelihoods of thousands of residents in the region.

3.6.1 Extent of Erosion and Damage

The main body of the Old Abad Bund has suffered significant damage due to erosion. According to the assessment, the severity of the damage at this site is greater than at other locations along the river. The erosion has compromised the structural integrity of the bund, making it more susceptible to potential breaches. Notably, no countermeasures have been implemented thus far to address this erosion, leaving the area highly vulnerable to flooding, especially during periods of high river flow.

3.6.2 Ongoing Studies and Proposed Erosion Control Works

101. Given the critical condition of the Old Abad Bund, a series of erosion control works are currently under study to restore and strengthen the embankment. These proposed measures include raising the height and expanding the cross-section of the bund to enhance its flood protection capacity. Concrete facing is planned as part of the revetment work to shield the bund from further erosion. For landside slope protection, the use of sand-filled mattresses is being considered to stabilize the embankment and prevent soil loss.

3.6.3 Additional Protective Measures

102. Furthermore, protective interventions are also being studied to ensure the long-term stability of the Old Abad Bund. Riprap, which involves placing large stones along the riverside, is being evaluated as a means of foot protection to absorb and dissipate the energy of flowing water. Additionally, the construction of spurs using randomly stacked concrete blocks is proposed to divert the river's flow away from the vulnerable sections of the bund and reduce direct erosive forces. These combined measures aim to provide comprehensive protection and mitigate the risk of future catastrophic levee failure.

3.7 Design Criteria and Design Conditions for Flood Protection Bunds

3.7.1 Design Discharge

103. The design discharge for the project is set at 32,564 cubic meters per second (1,150,000 cubic feet per second). This value is based on the maximum discharge observed at the Sukkur Weir during the 2010 flood event. Using this historical flood data ensures that the design can accommodate extreme flood conditions, thereby enhancing the safety and

reliability of the structure.

3.7.2 Design Water Level (HFL)

104. The design water level, also referred to as the High Flood Level (HFL), is determined according to the specifications provided by the Sindh Provincial Irrigation Department (PID). For the Old Abad Bund, the HFL is set at 53.34 meters (175.0 feet). This level is adopted from the typical cross-sections of the bund, ensuring consistency with regional flood management standards.

3.7.3 Riverbed Slope

105. The riverbed slope between Kotri and Sukkur is estimated at 1/12,000. This value is derived from multiple river topographic data sources, providing a reliable average slope for hydraulic calculations. An accurate riverbed slope is crucial for predicting water surface profiles and ensuring the stability of the embankment during high flows. (refer to Figures 3.3 for Typical Cross Sections).

3.7.4 Proposed High Water Bed Level

106. The proposed high water bed level is set at 49.08 meters (161.0 feet) for the Old Abad Bund. This level is based on the current high water channel bed elevations obtained from recent surveys. Setting the bed level according to up-to-date survey data ensures that the design reflects present river conditions and optimizes flood protection.

3.7.5 Top Width

107. The top width of the embankment is specified as 7.62 meters (25.0 feet) according to the Flood Forecasting Cell (FFC) Design Criteria. The existing bunds have a narrower top width, typically ranging from 10 to 20 feet. Adopting the minimum value specified in the FFC criteria improves the structural integrity and accessibility of the embankment, making it safer and more stable during flood events.

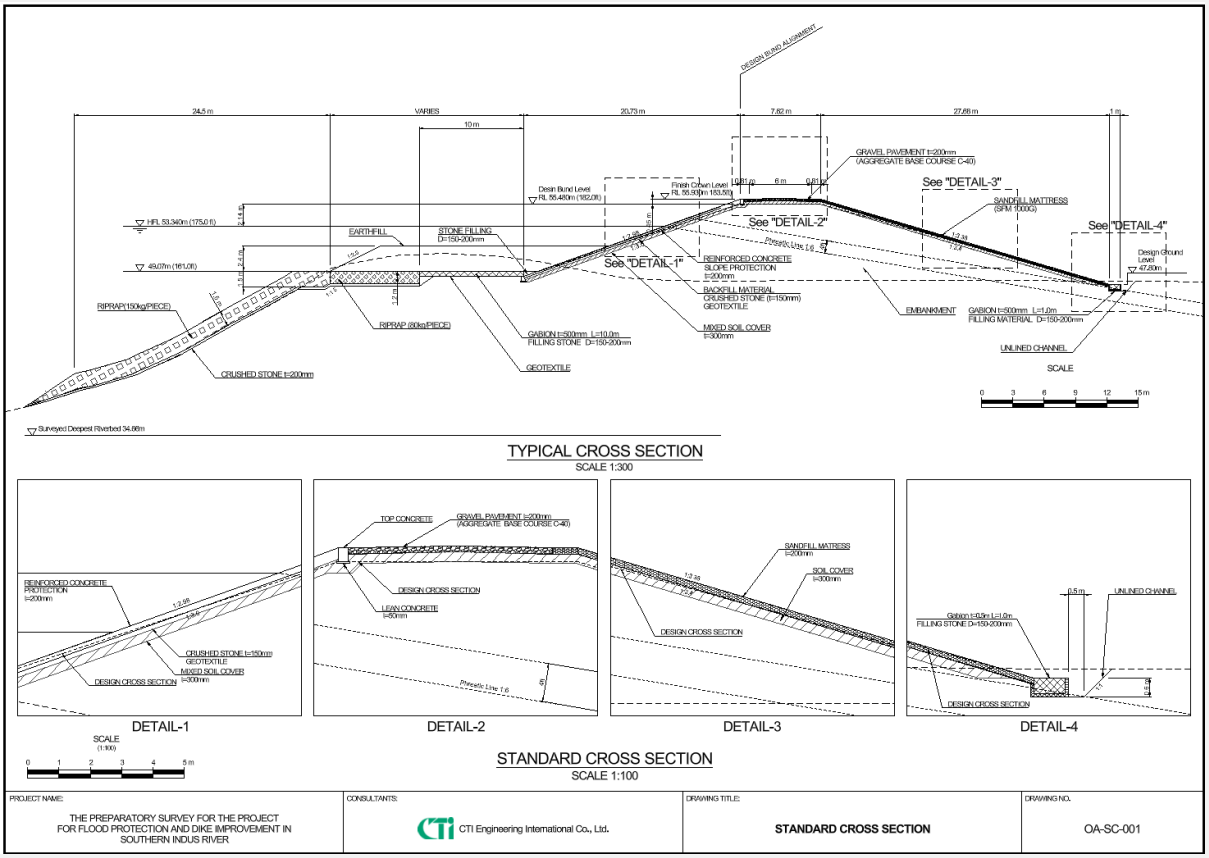


Figure 3.3: Typical Cross Section of Old Abad bund

3.7.6 Slope (Riverside)

108. The riverside slope of the embankment is designed to be 3:1, as per the Bund Manual and FFC Design Criteria. The manual specifies a slope range of 3:1 to 4:1 depending on embankment height, with 3:1 being used for covered slopes. This gentle slope enhances the embankment's resistance to erosion and improves stability under high water conditions. The FFC standardization of a 3:1 slope ensures uniformity and reliability across similar structures.

3.7.7 Slope (Land Side)

109. The design criteria for the landside slope of the embankment are based on the proposed cross-section by the Provincial Irrigation Department (PID) Sindh. The recommended slope is 3:1, with the embankment crest positioned 4 feet above the phreatic line. While the bund manual suggests a two-part slope—2:1 for the upper portion and 6:1 for the lower portion—this would create an excessively wide embankment base, making it impractical for implementation. Therefore, the PID's approach of a single, uniform slope is adopted. This single slope is designed to ensure there is sufficient soil cover above the seepage line, providing both stability and practicality for construction (refer to Figure 3.4 for Existing Slopes).

Figure 3.4: Existing Slopes at the Bund

3.7.8 Berm

110. In this design, no berm is included, as specified by the proposed cross-section from PID Sindh. The decision to exclude a berm aligns with the adoption of the single-slope design, simplifying the embankment profile and construction process. This approach is consistent with the overall planned cross-section and is intended to streamline the embankment structure without compromising stability.

3.7.9 Freeboard

111. The freeboard, the vertical distance between the maximum water level and the top of the embankment, is set at 2.14 meters (7.0 feet). This value is determined based on a memorandum of meeting (MOM) among the Federal Flood Commission (FFC) and Provincial Irrigation Departments (PIDs). The FFC issued a directive specifying that the freeboard should be 7 feet, ensuring an adequate safety margin above the anticipated maximum water level to prevent overtopping during flood events.

3.7.10 Extra Embankment

112. Additional embankment height is provided as a safety margin, amounting to 6.25% of the total embankment height. This extra height is mandated by the bund manual and serves

as a buffer to accommodate potential settlement, unforeseen increases in water levels, or other uncertainties that may arise during the embankment's lifespan. The inclusion of extra embankment height enhances the overall safety and resilience of the structure.

3.7.11 Access Slopes

113. Access slopes are not specifically regulated in domestic standards. However, the design includes the provision of one access slope per kilometer of embankment length. These slopes are intended to facilitate river management and maintenance activities. The access slopes will be installed at intervals of about 1 kilometer, allowing vehicles and personnel to reach the embankment for inspection, repair, or emergency response as needed.

3.8 Current Situation of Access Slopes

Access slopes have been constructed by cutting or leveling the embankments at the Old Abad Bund. At the Old Abad Bund, there are four slopes that extend from the landside up to the top of the bund, but notably, there are no slopes that provide direct access to the river. These existing slopes play a crucial role in facilitating movement for agricultural and maintenance purposes.

3.8.1 Guidelines for Slope Installation

114. There are currently no specific national regulations governing the installation of access slopes on embankments. As a general practice, access slopes leading to floodplains are typically not installed, reflecting a cautious approach to minimize potential vulnerabilities in flood defenses. This lack of regulation leaves room for project-specific decisions based on local needs and risk assessments.

3.8.2 Options for Bund Slope Installation

115. Two primary options are considered for the installation or restoration of bund slopes. The first option is to restore all existing slopes, maintaining the current level of access for local users and river management. The second option is to avoid installing any slopes, except for one slope every kilometer, which would be reserved exclusively for river management purposes. This approach aims to strike a balance between operational access and the structural integrity of the embankments, reducing the number of potential weak points that could compromise flood protection.

3.9 Overview of Temporary Facilities

116. The provided layout outlines the arrangement and specifications of temporary facilities established for a construction or infrastructure project. The facilities are with designated work yards and access routes. The image also details the approach roads leading to the project site, highlighting logistical considerations crucial for project execution.

3.9.1 Old Abad Bund Work Yard

117. The Old Abad Bund area features a work yard with a temporary embankment constructed up to the existing bund height of approximately 3.5 meters. The outlined dimensions for this work yard are 100 meters by 50 meters. Within this area, specific

allocations are made for a site office and stock yard (60m x 50m) as well as a concrete plant yard (40m x 50m). These facilities are essential for supporting on-site operations, storage, and construction activities.

3.10 Approach Road to Site

118. Both work yards are connected to the main site via approach roads. The access route is approximately 5 kilometers long with a width of about 6 meters, ensuring sufficient space for the transportation of materials, equipment, and personnel. The mapped approach road is clearly marked, demonstrating the connectivity between the local road network and the temporary facilities, which is vital for efficient project logistics and timely delivery of resources.

3.11 Procurement Plan Overview

119. The procurement plan for the project emphasizes sourcing most materials and heavy equipment locally, ensuring cost-effectiveness and timely availability. This approach supports local industry and streamlines logistics by reducing dependency on international suppliers.

3.11.1 Major Material Procurement

120. The majority of construction materials, such as crushed stone, embankment fill, subbase material, concrete, asphalt composite, and deformed steel bars, are procured from local sources. This local procurement strategy is chosen due to the ready availability and suitability of these materials within the region. However, certain specialized items, like steel sheet piles and sandfill mattresses, are sourced from third countries. Steel sheet piles are either locally procured or imported from third countries, depending on availability and project requirements, while sandfill mattresses are exclusively imported due to their unavailability in the local market.

121. Temporary materials, including fuel (light oil and gasoline), large sandbags, and scaffolding/support materials, are also obtained locally. This ensures that essential supplies for temporary works and site operations are always accessible, minimizing disruptions to the construction schedule.

3.11.2 Major Heavy Equipment Procurement

122. The list of major heavy equipment required for the project includes bulldozers, backhoes, dump trucks, cranes, graders, rollers, concrete pumps, and asphalt finishers. All these machines are sourced locally, as indicated by the procurement plan. This not only supports local equipment suppliers but also facilitates easier maintenance, faster delivery, and reduced transportation costs. The specifications for each equipment type, such as bulldozers of 21-ton and 15-ton classes, backhoes with 1.2m³ and 0.8m³ capacities, and dump trucks with 10-20 ton loads, ensure that the machinery meets the project's technical demands.

3.11.3 Procurement Rationale

123. The primary reason for local procurement is the availability and adequacy of materials and equipment within the country. For items that are not locally available or do not meet the required standards, the procurement plan allows for sourcing from third countries. This balanced approach ensures that the project can proceed without delays while maintaining quality and cost control. By prioritizing local procurement, the project also contributes to the local economy and builds stronger relationships with domestic suppliers

3.12 Approval Process for PC-1

124. The approval of PC-1 (Planning Commission Form-1) is a critical step that must be completed before any official request for grant aid is made to Japan. This process begins with the preparation of PC-1, which is the responsibility of PID Sindh. The form outlines the project's objectives, scope, and resource requirements, serving as a foundational document for government and donor review.

3.12.1 Sequence of Approvals and Coordination

125. Before the grant agreement (GA) can be signed, it is essential to secure approval from the Planning Commission. The process starts with sharing data and interim reports by the JICA Survey team, followed by obtaining Concept Clearance Proposal (CCP) approval from the relevant forum. Preparatory surveys and explanations on the draft report are also conducted to ensure all stakeholders are informed and aligned.

3.12.2 Detailed Schedule and Responsibilities

126. According to the schedule, the process unfolds over more than a year, beginning in early 2025. The initial months focus on data sharing and CCP approval, with preparatory surveys and PC-1 form preparation taking place in the middle of the year. Once the PC-1 form is completed by FFC and PID Sindh, it is submitted by the Ministry of Water Resources to the Planning Commission via the Economic Affairs Division (EAD). The Central Development Working Party (CDWP) of the Planning Commission then reviews and approves the form.

3.13 Construction Material

127. The construction materials required in the works include the followings:

a) Embankment fill
b) Fine and coarse filters
c) Gravel bedding
d) Riprap stones
e) Cement
f) Fine and coarse aggregates
g) Reinforcement
h) Water

128. The materials used for the construction of the sub-project proposed bunds include coarse aggregates, fine aggregates (sand), rock for stone pitching and riprap, earth, water, cement, and steel.

129. The contractor will be allowed to purchase natural materials, such as coarse aggregate, stones, and coarse filters, from licensed crushing plants or material suppliers approved by the relevant department of the Sindh Government, specifically the Mines and Mineral Development Department and the Sindh Environmental Protection Agency (SEPA). No purchase of material from illegal crushing plants or non-approved material suppliers will be allowed. This should be made part of the agreement for each of the contractors with the project.

130. The water would be obtained from tube wells installed by the Contractors. The contractor shall be strictly bound not to use the community tube well, as this may compete for

the local water resource in the dry season when the water table declines. The contractor will conduct an Electrical resistivity surveying test along with a pump-out test to assess the groundwater potential required for the construction activities before the tube wellbore. This condition will be included in the bid document as contractual binding. After the completion of the subproject, the recipient of this borehole will be the community representative or notable. Handing over documents will be signed by both community and contractor representatives. Solar-operated tube wells will be preferred if diesel generators are used, then the contractor has to keep an eye on CO_2 impacts. This condition will be included in the bid document as contractually binding.

131. Cement will be procured from Hyderabad and Karachi cities. Most of the other construction supplies, such as fuel, steel, and lubricants, can also be arranged from big cities like Karachi and Hyderabad.

3.14 Manpower Requirement

132. For unskilled laborers, local people will be preferred. Machinery, including loaders, dumpers, trucks, and tractor trolleys, will be used to bring earth material from the designated sites. Local operators/drivers will be preferred with valid driving licenses, having experience driving vehicles like trucks, dumpers, and Dozers, etc.. This does not include the drivers, which will carry the stone from the quarry and other items like cement and steel from the local market.

133. During surveys and consultations, the major demand of the community was the provision of jobs during the construction phase. Sufficient labor, particularly unskilled, is available in the sub-project area.

134. The contractor will be bound through the contractor's code of conduct and contractual obligations to provide jobs to local people for unskilled labor from the communities. If local unskilled labor is not available in the sub-project area, then the contractor can hire from outside the project area. Local operators/drivers will be preferred with valid driving licenses, having experience driving vehicles like (trucks, dumpers, dozers, and stone, cement & steel carriers, etc.). This process would be initiated with the consultation of elders of different communities in an equitable manner, hence there would be no need to set up a large-scale camp[7].

135. The workforce requirement is based on best estimates and is subject to revision. The final requirement would be determined after the finalization of the bid documents by the contractor(s)

3.15 Contractor's Camps

136. For the construction of the sub-project, small scale camp/s will be established on the government land near the subproject area a minimum of 500 m away from settlements to house 30-35 individuals. The contractor will prepare workers' code of conduct plans and Camp layout plans and get them approved by the Resident Engineer. The camp will be established after the approval of the layout plan. The size of the camp would be atleast 3 acres and after completion of the project, this will be restored to the previous conditions.

137. Keeping in view the number of settlements and labor pool small number of local labors will go back to their homes after completion of daily work including drivers, operators and semi-skilled labors, for outside labors residential accommodation with requisite amenities will be

[7] *Very small = less than 10, Small= 11 to 20, Medium= 21-50, large = 51 to 200, very Large = more than 200*

provided.

138. The contractor will be bound to provide facilities like dormitories, kitchen/washing/bathing/ latrine with septic tanks and medical checkups (including communicable disease related) to laborers. The health screening of laborers and workers will be conducted at the start of the project. The contractor will prepare workers' code of conduct plans and Camp layout plans and get them approved by the Resident Engineer and PIU for implementation at the site. The camp will be established after the approval of the layout plan. All these interventions have been discussed and a consensus was built from the community during the public consultations.

3.16 Borrow Material

139. The fill for the earthwork can be obtained from borrowed areas where suitable soil is available. The Contractors will identify them borrow areas as per their arrangement and get approval from PIU. The contractor will be bound to procure the material from authorized quarries. Before the start of the work, the contractor will get approval. Priority will be given to getting the earth fill material from the licensed contractors, where the use of agricultural land is unavoidable private land will not be taken until a prior written agreement (with local tradition) and documentation of relevant details of compensation (on prevailing market rates) are signed between the owner/s and relevant authorities. For reference, the list of authorized queries areas is given in Table 3.1

Table 3-1: List of Authorized Queries Areas

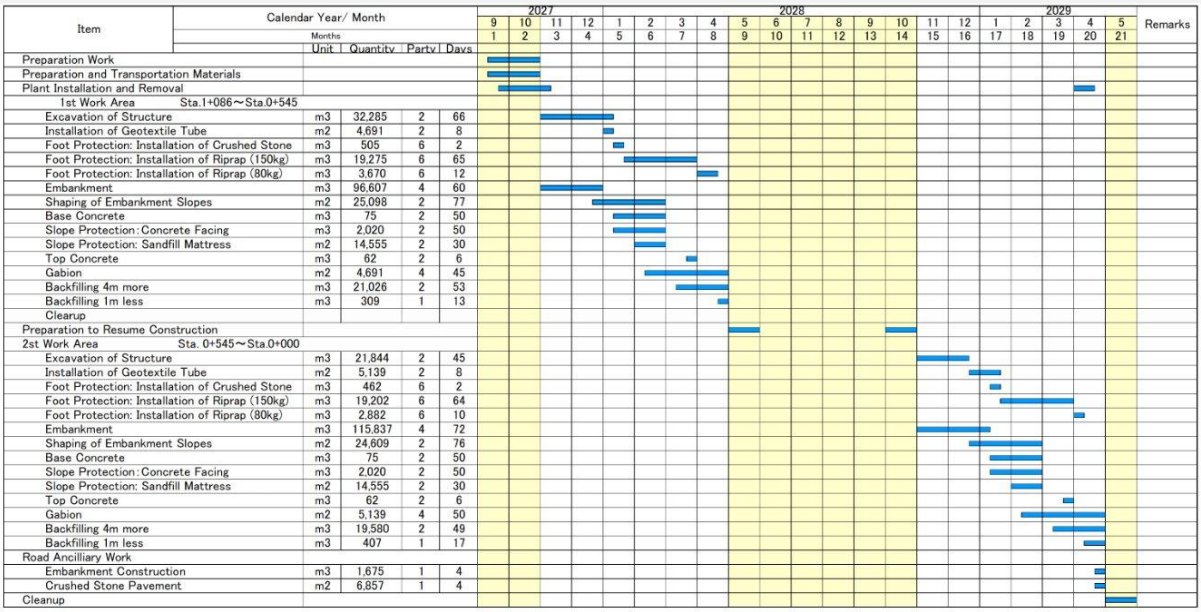
S. No	District	Name	Quarry Code
1	Sukkur	Rohri Lime Stone	SIN-252
2	Khairpur	Ubhan Shah	SIN-243
3	Sanghar	Khaddro Soil Quarry	SIN-211
4	Jamshoro	Goth Akro Quarry	SIN-052
5	Jamshoro	Indus River dunes	SIN-053

3.17 Construction Time

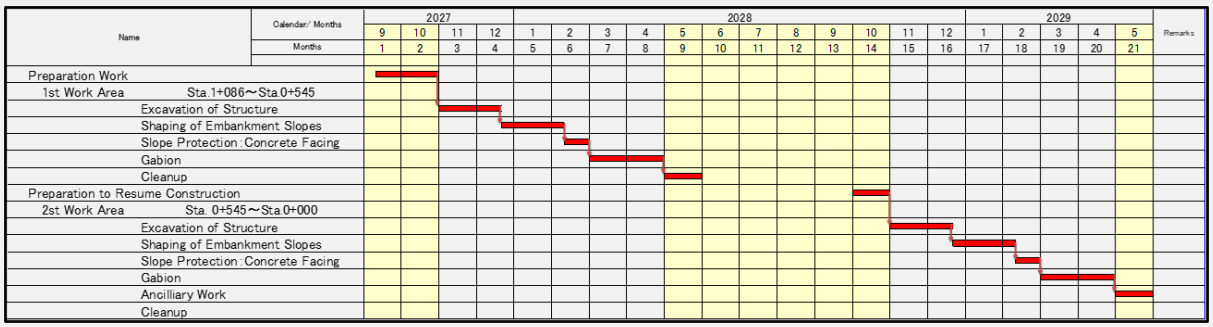
140. The execution works of the sub-project are proposed to be completed in the stipulated time (PIU determined to ensure project completion in 1 year) after the approval of PC-1 and the bidding process according to the procurement plan approved by the World Bank.

Old Abad Bund Process Chart

Item	Unit	Quantity	Party	Days
Preparation Work				
Preparation and Transportation Materials				
Plant Installation and Removal				
1st Work Area Sta.1+086～Sta.0+545				
Excavation of Structure	m3	32,285	2	66
Installation of Geotextile Tube	m2	4,691	2	8
Foot Protection: Installation of Crushed Stone	m3	505	6	2
Foot Protection: Installation of Riprap (150kg)	m3	19,275	6	65
Foot Protection: Installation of Riprap (80kg)	m3	3,670	6	12
Embankment	m3	96,607	4	60
Shaping of Embankment Slopes	m2	25,098	2	77
Base Concrete	m3	75	2	50
Slope Protection: Concrete Facing	m3	2,020	2	50
Slope Protection: Sandfill Mattress	m2	14,555	2	30
Top Concrete	m3	62	2	6
Gabion	m2	4,691	4	45
Backfilling 4m more	m3	21,026	2	53
Backfilling 1m less	m3	309	1	13
Clearup				
Preparation to Resume Construction				
2st Work Area Sta. 0+545～Sta.0+000				
Excavation of Structure	m3	21,844	2	45
Installation of Geotextile Tube	m2	5,139	2	8
Foot Protection: Installation of Crushed Stone	m3	462	6	2
Foot Protection: Installation of Riprap (150kg)	m3	19,202	6	64
Foot Protection: Installation of Riprap (80kg)	m3	2,882	6	10
Embankment	m3	115,837	4	72
Shaping of Embankment Slopes	m2	24,609	2	76
Base Concrete	m3	75	2	50
Slope Protection: Concrete Facing	m3	2,020	2	50
Slope Protection: Sandfill Mattress	m2	14,555	2	30
Top Concrete	m3	62	2	6
Gabion	m2	5,139	4	50
Backfilling 4m more	m3	19,580	2	49
Backfilling 1m less	m3	407	1	17
Road Ancilliary Work				
Embankment Construction	m3	1,675	1	4
Crushed Stone Pavement	m2	6,857	1	4
Cleanup				



Old Abad Bund Critical Path Schedule



CHAPTER - 4: PROJECT ALTERNATIVE CONSIDERED

4.1 General

141. In assessing the proposed project aimed at strengthening the bunds along the lower Indus River, it is essential to explore various alternatives that could enhance the project's effectiveness and sustainability. This chapter examines three primary alternatives: the "No Project" option, design alternatives, and construction method alternatives. Each of these alternatives offers distinct implications for flood risk management, economic viability, and community resilience, and their evaluation is crucial for informed decision-making.

4.2 No Project Option

4.2.1 Overview

142. The "No Project" option serves as a fundamental baseline for evaluating the proposed bund improvement initiative. By maintaining the current state of the existing bunds without any enhancements, the vulnerabilities that threaten the communities along the lower Indus River, particularly in Sukkur and Larkana, would remain unaddressed. This alternative highlights the risks associated with inaction in the face of rising river discharges and increasing flood threats.

4.2.2 Implications

143. Choosing the "No Project" option carries significant and potentially devastating consequences. The existing bunds, which are already susceptible to flooding, would continue to deteriorate, leading to an increased likelihood of bund failures. Historical data suggests that such failures could result in extensive damage to infrastructure and property, loss of life, and significant economic setbacks for affected communities. Moreover, without proactive measures, community resilience would be undermined, leaving populations unprepared for future disasters. Ultimately, the "No Project" option underscores the urgent need for intervention to safeguard lives and property in the region.

4.3 Design Alternatives

In this project, a comparative study of revetment structures (slope protection works) was conducted from the perspectives of constructability, cost, and applicability. As a result of the study, concrete facing was selected. Because the cost of stone materials is high, concrete facing, which involves fully covering the surface with reinforced concrete, can be constructed at a lower cost. As the Project aims to rehabilitate and strengthen an existing river embankment, the consideration of alternatives is limited to construction methods. Accordingly, a comparative assessment was conducted for different types of revetment structures (slope protection works). In terms of impacts on the living environment, compared with sandfill mattress works and vegetative protection, construction methods such as concrete facing, dry stone pitching, and concrete block pitching are expected to result in relatively higher noise impacts during construction. However, as there are few residential houses in the vicinity of the project area, the extent of such impacts is considered to be limited. On the other hand, regardless of the construction method selected, no changes to the resettlement plan will be required. Therefore, no significant differences are anticipated in the magnitude of environmental and social impacts among the alternative construction methods.

Table 4-1: Comparison of Design Alternatives

Construction Method	Concrete Facing	Riprap	Sandfill Mattress	Concrete Block Lining	Vegetative Protection
Construction Examples Photos			 Source: Manufacturer's materials		
Method Overview	Protection of the entire slope using reinforced concrete (thickness t = 200 mm), together with crest works and foundation works. Includes crushed stone foundation and filter material to prevent soil washout.	Stone pitching using natural stones placed on the slope surface.	Installation of sand-filled mattresses on embankment or vegetated sheet.	Precast concrete blocks are manufactured and installed on the slope, together with crest and foundation works. Resistance is provided by interlocking of blocks.	Seeding on embankment or vegetation sheet.
Constructability	Few applications on existing embankments, but technically feasible.	Currently used on existing embankments.	No application examples on existing embankments, but technically feasible.	Few applications on existing embankments, but technically feasible.	Technically feasible, but establishment is difficult depending on climatic conditions.
	○	○	○	○	△
Unit Cost (Reference) (PKR/m²)	12,300	19,600	2,500	28,000	-
Applicability (Riverside)	Sufficient protection against strong flow is expected.	Erosion damage is observed under current conditions.	Not suitable for high-velocity flow at the riverside.	Sufficient protection against strong flow is expected; however, higher cost compared with concrete facing.	Difficult establishment due to climatic conditions; not suitable for high-flow riverside areas.
	◎	△	△	○	×
Applicability (Landside)	Economically disadvantageous.	Economically disadvantageous.	Most economical option.	Economically disadvantageous.	Difficult establishment due to climatic conditions.
	△	△	○	△	△
Environmental Aspect	Temporary noise generation is expected; however, as there are few residential houses in the surrounding area, the impact range is limited.	Temporary noise generation is expected; however, as there are few residential houses in the surrounding area, the impact range is limited.	There are few residential houses in the surrounding area, the impact range is limited, and noise generation is minimal.	Temporary noise generation is expected; however, as there are few residential houses in the surrounding area, the impact range is limited.	There are few residential houses in the surrounding area, the impact range is limited, and noise generation is minimal.
	○	○	◎	○	◎
Social Aspect	At Old Abad Bund, resettlement of 5 households (24 persons) will occur, and 12 households (46 persons) will be affected by land acquisition and other land-related impacts. However, such situations is not likely to affect significantly to the implementation of the project.	Same as left.	Same as left.	Same as left.	Same as left.
	○	○	○	○	○
Overall Evaluation	1st Recommendation (Sufficient protection for the water-impacted sections is expected, and no significant environmental or social impacts are anticipated.)	Not recommended (Erosion damage is already observed under the current conditions, and the mitigation effectiveness is considered limited.)	Not recommended (Not applicable to the water-impacted sections.)	2nd Recommendation (Sufficient protection for the water-impacted sections is expected and no significant environmental or social impacts are anticipated; however, it is more costly than concrete facing.)	Not recommended (Not suitable for application to the water-impacted sections.)

CHAPTER - 5: BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

5.1 General

144. For the Initial Environmental Examination (IEE) of the Flood Protection and Dike Improvement Project along the Indus River in Sindh Province, a comprehensive approach was adopted to establish the environmental and social baseline conditions. This baseline assessment is critical for understanding the existing conditions before project implementation and evaluating potential project impacts.

145. The baseline information was primarily gathered through a series of structured interviews, formal and informal scoping sessions, and group discussions with residents of various settlements situated along the Indus River and in proximity to the proposed construction sites. These participatory methods ensured that the perspectives, concerns, and traditional knowledge of local communities were incorporated into the baseline assessment. Special attention was given to vulnerable groups whose livelihoods and safety are directly linked to the river and its floodplain.

5.2 Purpose of the Baseline

146. During the process of conducting IEE studies for any project, documenting baseline conditions is considered a crucial priority. This step aims to establish a comprehensive database that enables the prediction and management of project impacts. Therefore, it encompasses all environmental parameters expected to be influenced by the project.

147. Documentation of environmental baseline conditions has two major objectives.

a) Provide the proponent of the project and stakeholders sufficient knowledge of the area about:
   - Physical and Biological environment
   - Sociological base
   - Understanding current problems and
   - Rationalization of decisions according to the ground realities.

b) To allow planners to evaluate the potential efficacy of actions to mitigate adverse impacts and enhance benefits.

148. This needs to provide a broad overview of regional resources, including those unlikely to be impacted by the project. Additionally, it entails offering a detailed qualitative description of resources that could potentially be affected by the project.

5.3 Physical Resource

5.3.1 Geology

149. Larkana lies in the northwest part of Sindh province, Pakistan, situated near the west bank of the Indus River.The geology of Sindh, which includes Larkana, can be broadly divided into three main regions:

- The mountain ranges of Kirthar and Pab in the west, containing minor hills.
- The alluvial plains of the Indus River dominate the central and eastern parts of the district.
- The riverine belt, influenced by the Indus River and its distributaries.

150. The surface geology is dominated by Quaternary deposits—these are relatively recent sediments laid down by extinct and active streams, as well as older terrace deposits as refer to Figure 5.1.

151. Larkana itself is primarily situated on the alluvial plains, which are composed of recent river deposits brought by the Indus and its tributaries. These alluvial soils are fertile and have contributed to the region's agricultural productivity.

5.3.2 Geography

152. District Larkana lies in 67 056” 20’ to 68 029” 34’ east longitudes and 27 07” 31’ to 27 056” 2’ north latitudes. This district is bounded by the districts of Shikarpur and Khairpur to the east, Jacobabad to the north, Qamber Shahdadkot and Dadu to the west, and Naushero Feroz to the south. The geography of the district is shown in Figure 5.2.

5.3.3 Soils

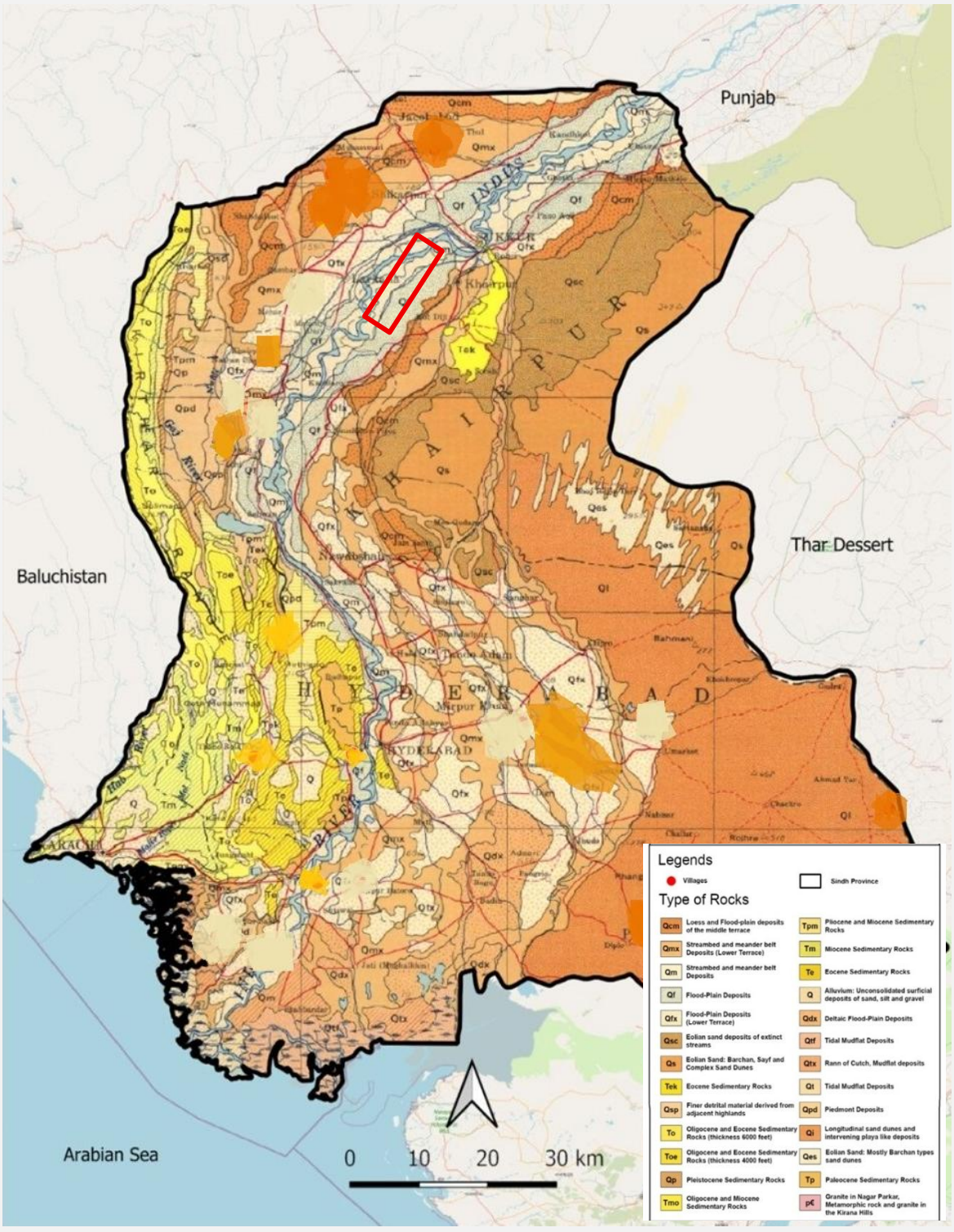
153. Soils of the district are classified as silty clay and loam texture. The electrical conductivity of soil has an average value of (<one dsm-1). For pH, however, is medium alkaline (pH 7.6-8.3). The soils are generally brown to greyish brown with CaCO3 percentage content between 5 to 15%. Salinity and waterlogging are common in irrigated areas, particularly near the canal.

5.3.4 Seismicity

154. The map illustrated in Figure 5.3 shows that all sub-project areas fall within Zone 2A, where the Peak Ground Acceleration (PGA) ranges from 0.08 to 0.16g, as per the Pakistan Building Code (2007). This classification indicates a low-damage risk zone, suggesting that these areas have a reduced likelihood of experiencing significant earthquakes. Notably, none of the sites fall within Zone 4, designated as the High Damage Risk Zone.

5.3.5 Topography

The topography within a 3-kilometer radius of Lārkāna is essentially flat, with a maximum elevation change of 15 meters and an average elevation above sea level of 53 meters. Within 16 kilometers is essentially flat (30 meters). Within 80 kilometers, there are only modest variations in elevation (1,010 meters).

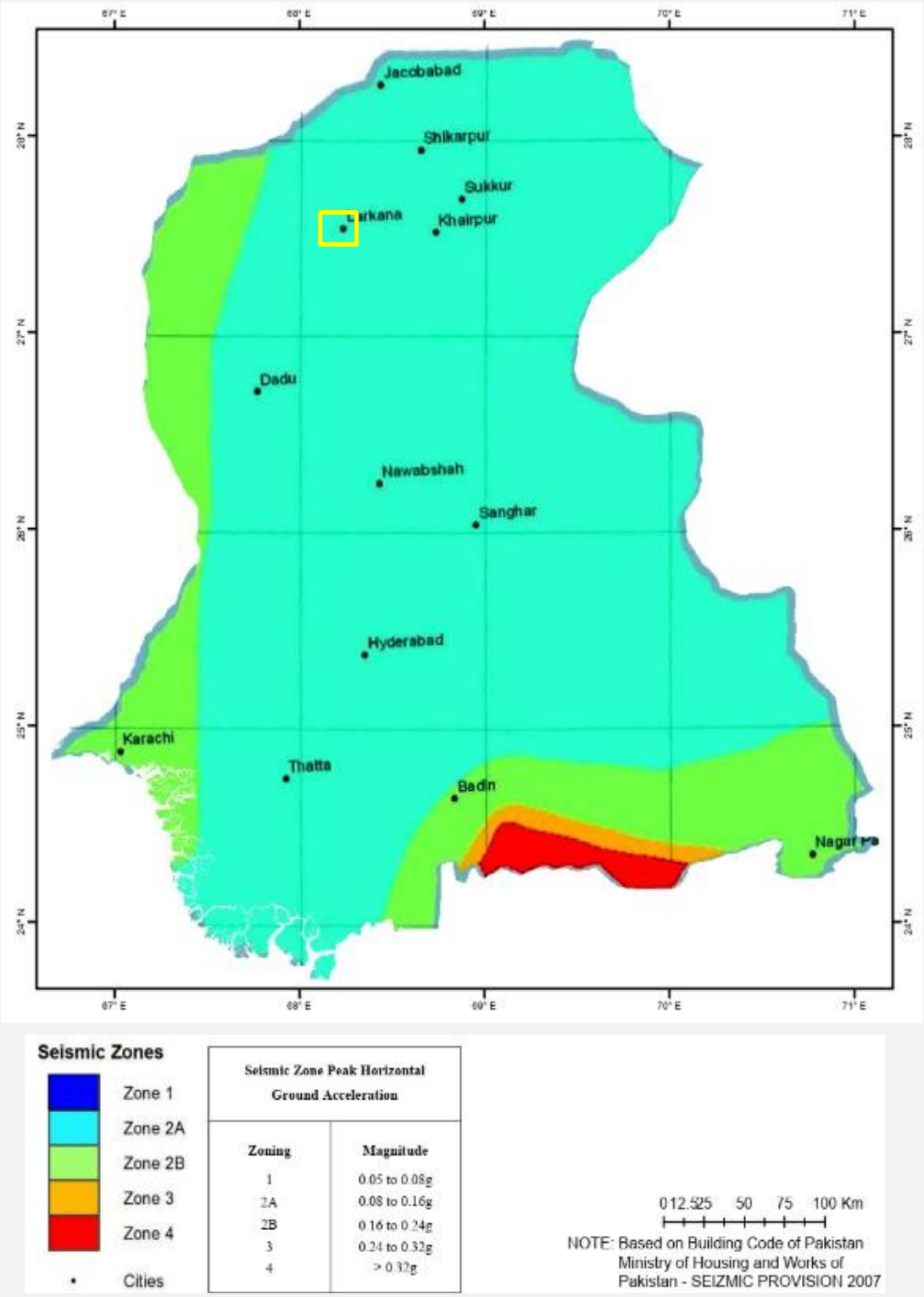


Source: Geological Survey of Pakistan (GSP)

Figure 5.1: Geological Map of Project Area

Source: satellite imagery combined with geographic information system (GIS) data sourced from organizations like the Pakistan Meteorological Department

Figure 5.2: Geographic Map of Sub-Project Area



Source: Building Code of Pakistan, Ministry of Housing and Works of Pakistan - SEISMIC PROVISION 2007

Figure 5.3: Seismic Zone Map of the Project Area

5.4 Water Resource

5.4.1 River Indus at Larkana

155. Larkana is situated on the west bank of the Indus River, a primary hydrological feature that shapes the district's landscape, water availability, and flood risk. The Indus provides water for irrigation, supports agriculture, and is central to the district's drainage network.

156. Major floods in 1976, 2010, 2015, and 2022[8] have severely impacted the district, with the 2022 flood causing prolonged high water levels and stagnant conditions in the Larkana plain due to poor drainage.

157. Key contributors to flood risk include rainfall intensity, proximity to the river, low elevation, gentle slope, soil texture (clay-rich soils), and limited drainage infrastructure. Over 70% of the district is classified as high or very high flood risk[9].

5.4.2 Main Canals Serving Larkana

158. Rice Canal: The Rice Canal is a major irrigation channel, specifically designed to feed the rice-growing areas of Larkana during the Kharif season. It is approximately 76 km long and is crucial for the region's rice production, which is among the highest in Sindh[10].

159. Dadu Canal: This canal, about 80 km in length, also supplies irrigation water to Larkana and neighboring districts. Like the Rice Canal, it is vital for both Kharif and Rabi crops (refer to Figure 5.4 for Water Resources in the Project Area).

160. Warah Canal: Another important canal contributing to the irrigation of Larkana's agricultural fields.

161. Kirthar (North Western) Canal: This canal not only irrigates parts of Larkana but also extends into Balochistan, supporting agriculture in both provinces.

162. Saifullah Magsi Canal: Also part of the irrigation network, though less prominent than the others.

5.4.3 Groundwater

163. The aquifers are generally recharged by infiltration from the Indus River and irrigation canals, but over-extraction and reduced recharge during dry periods can lead to declining water tables and increased salinity. While specific quantitative data on groundwater reserves is limited in the recent literature, studies indicate that groundwater is widely accessed via hand pumps and electric motor bores, particularly in rural and peri-urban areas[11].

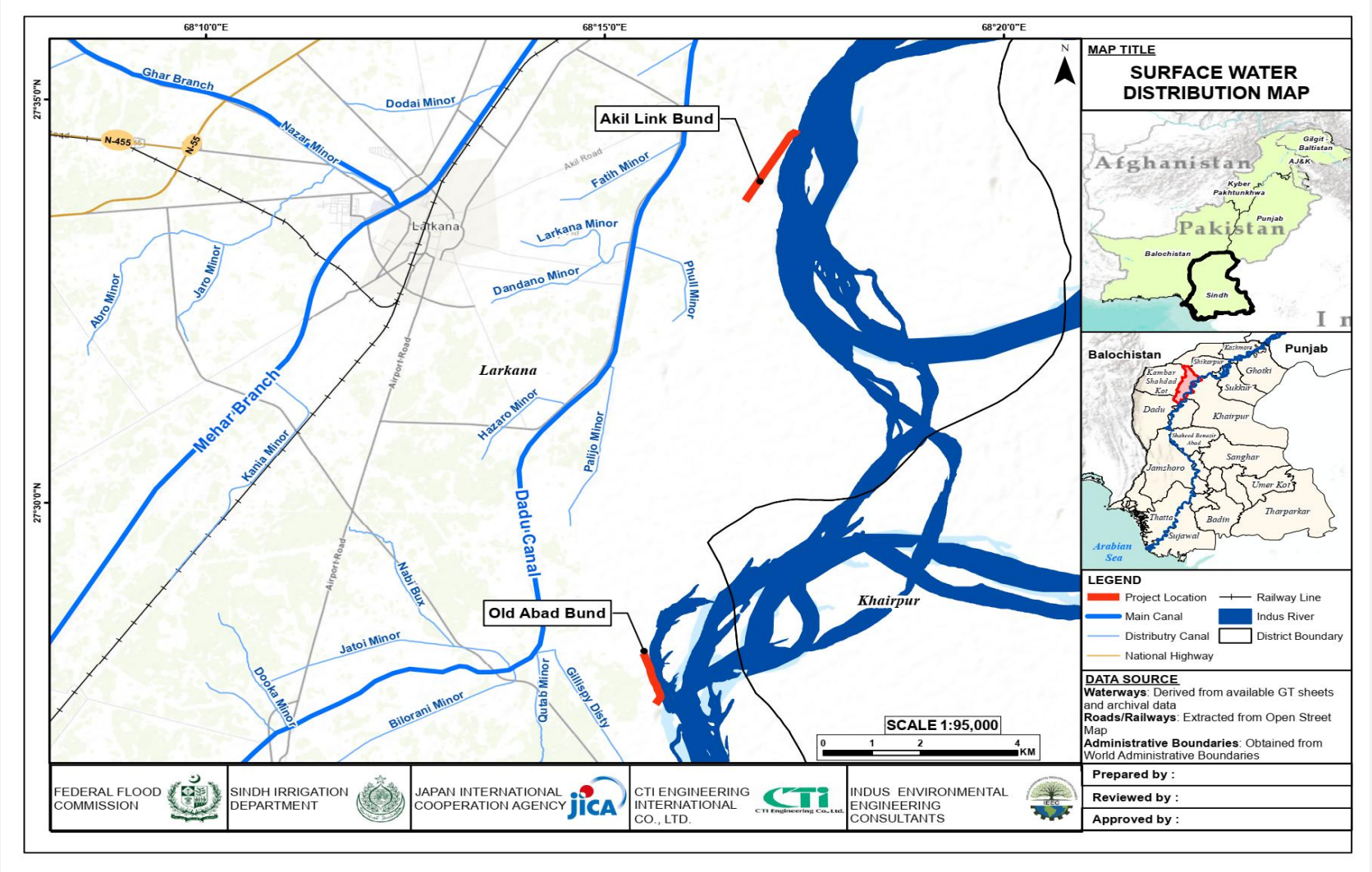
164. According to the Synthetic Pollution Index (SPI), about 49% of samples are moderately polluted, 30% highly polluted, and 21% unsuitable for drinking.

165. The Water Quality Index (WQI) classified 53.5% as good, 18.6% poor, 16.3% very poor, and 11.6% unsuitable for drinking. The Pollution Index of Groundwater (PIG) found 55% insignificant, but 13.95% each as highly polluted and unsuitable for drinking. Quality varies across the district, due to local geology, proximity to sources of contamination, and depth of

[8] *http://cpjrc.imde.ac.cn/en/sr/rp/202210/P020221009570596145762.pdf*
[9] *https://pmc.ncbi.nlm.nih.gov/articles/PMC12009972/*
[10] *https://rspn.org/success/wp-content/uploads/2016/05/Larkana-District-profile.pdf*
[11] *https://www.academia.edu/105188501/Assessment_of_Groundwater_Quality_of_Taluka_Larkana_Sindh_Pakistan*

wells12.

[12] *https://www.sciencedirect.com/science/article/abs/pii/S2352801X21000898*



Source: GIS-based Data Source

Figure 5.4: Water Resources in the Project Area

5.5 Climatic Data

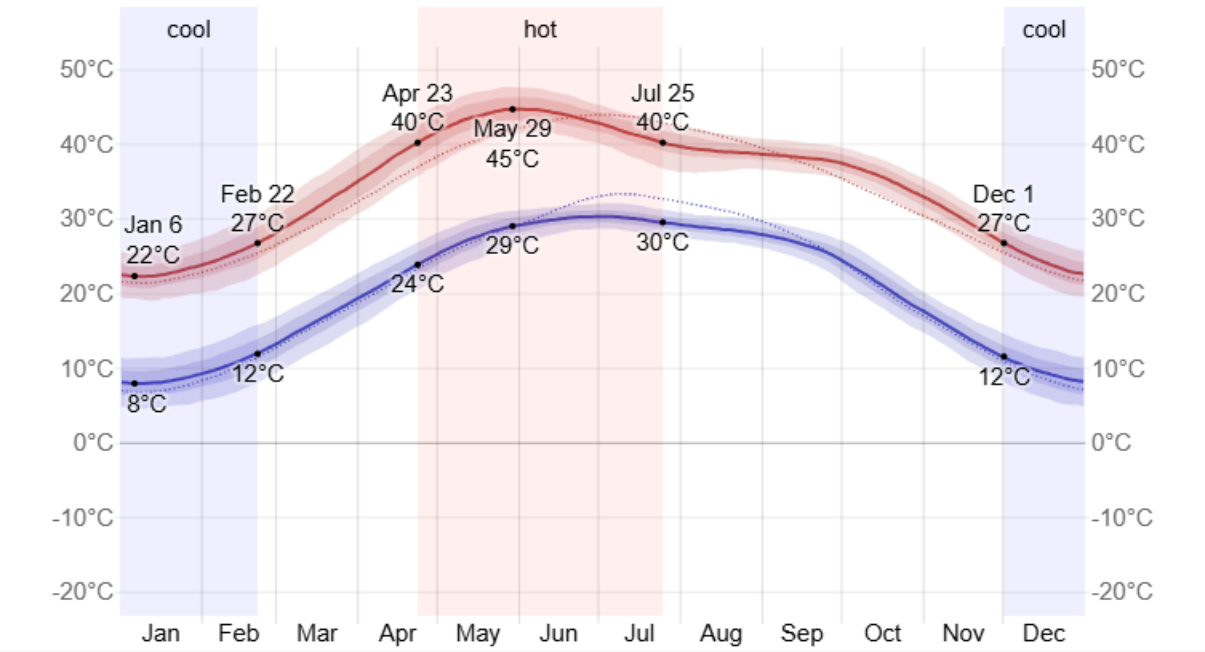
166. The climate of Sindh is arid and hot. According to the classification made by UNESCO. The region has been divided into three zones: Coastal, south of Thatta; Southern, from Thatta through Hyderabad to Nawabshah (Shaheed Benazirabad); and Northern, from Nawabshah (Shaheed Benazirabad) to Jacobabad.

167. In Larkana, the summers are sweltering and humid, the winters are brief and cool, and the climate is generally dry and mostly clear throughout the year. Over the year, the temperature typically varies from 8°C to 45°C and is rarely below 5°C or above 48°C.

5.5.1 Temperature

168. The hot season lasts for 3.0 months, from April 23 to July 25, with an average daily high temperature above 40°C. The hottest month of the year in Larkana is June, with an average high of 44°C and a low of 30°C.

169. The cool season lasts for 2.7 months, from December 1 to February 22, with an average daily high temperature below 27°C. The coldest month of the year in Larkana is January, with an average low of 8°C and high of 23°C as depicted in Figure 5.5.



Source: https://weatherspark.com/y/106600/Average-Weather-in-L%C4%81rk%C4%81na-Pakistan-Year-Round

Figure 5.5: Average High and Low Temperature in Larkana

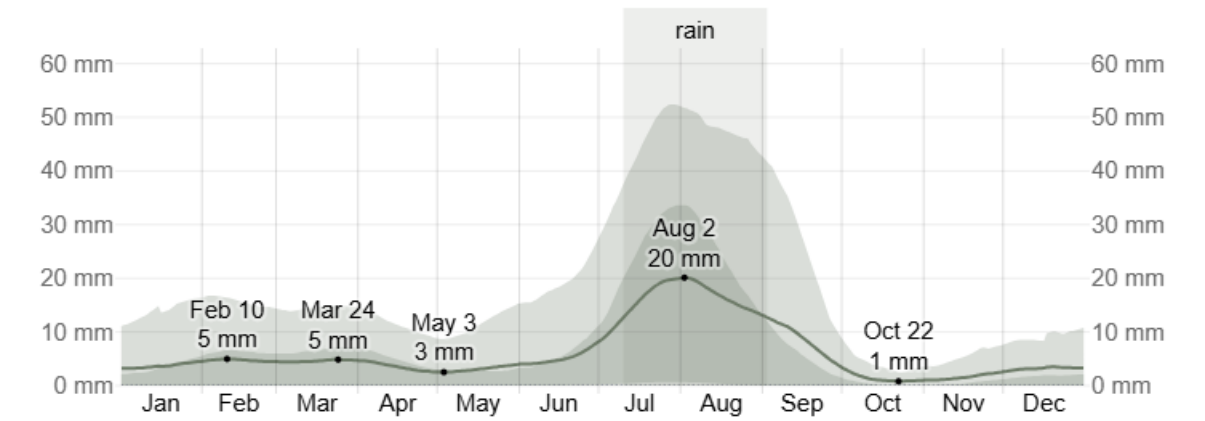
5.5.2 Precipitation & Rainfall

170. The wetter season lasts 1.5 months, from July 8 to August 23, with a greater than 6% chance of a given day being a wet day. The month with the most wet days in Larkana is July, with an average of 2.7 days with at least 1 millimeter of precipitation.

171. The drier season lasts 11 months, from August 23 to July 8. The month with the fewest wet days in Larkana is October, with an average of 0.2 days with at least 1 millimeter of

precipitation.

172. Among wet days, we distinguish between those that experience rain alone, snow alone, or a mixture of the two. The month with the most days of rain alone in Larkana is July, with an average of 2.7 days. Based on this categorization, the most common form of precipitation throughout the year is rain alone, with a peak probability of 12% on July 26. Refer to Figure 5.6 for average monthly rainfall.



Source: https://weatherspark.com/y/106600/Average-Weather-in-L%C4%81rk%C4%81na-Pakistan-Year-Round

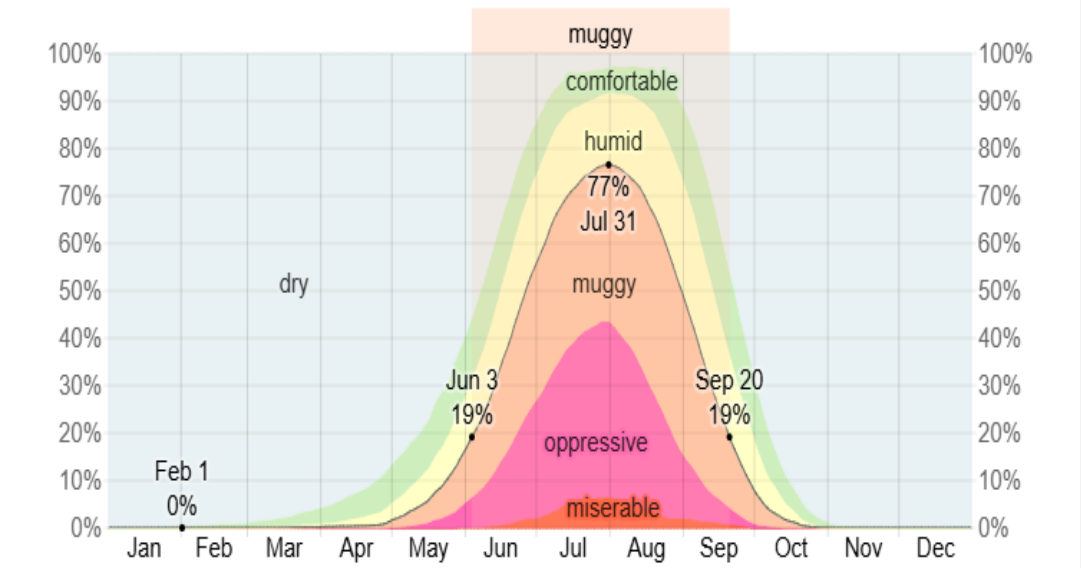
Figure 5.6: Average Monthly Rainfall

173. The rainy period of the year lasts for 1.8 months, from July 10 to September 2, with a sliding 31-day rainfall of at least 13 millimeters. The month with the most rain in Larkana is August, with an average rainfall of 17 millimeters.

174. The rainless period of the year lasts for 10 months, from September 2 to July 10. The month with the least rain in Larkana is October, with an average rainfall of 1 millimeter.

5.5.3 Humidity

175. Larkana experiences extreme seasonal variation in the perceived humidity. The muggier period of the year lasts for 3.5 months, from June 3 to September 20, during which time the comfort level is muggy, oppressive, or miserable at least 19% of the time. The month with the most muggy days in Larkana is July, with 21.8 days that are muggy or worse, as depicted in Figure 5.7.

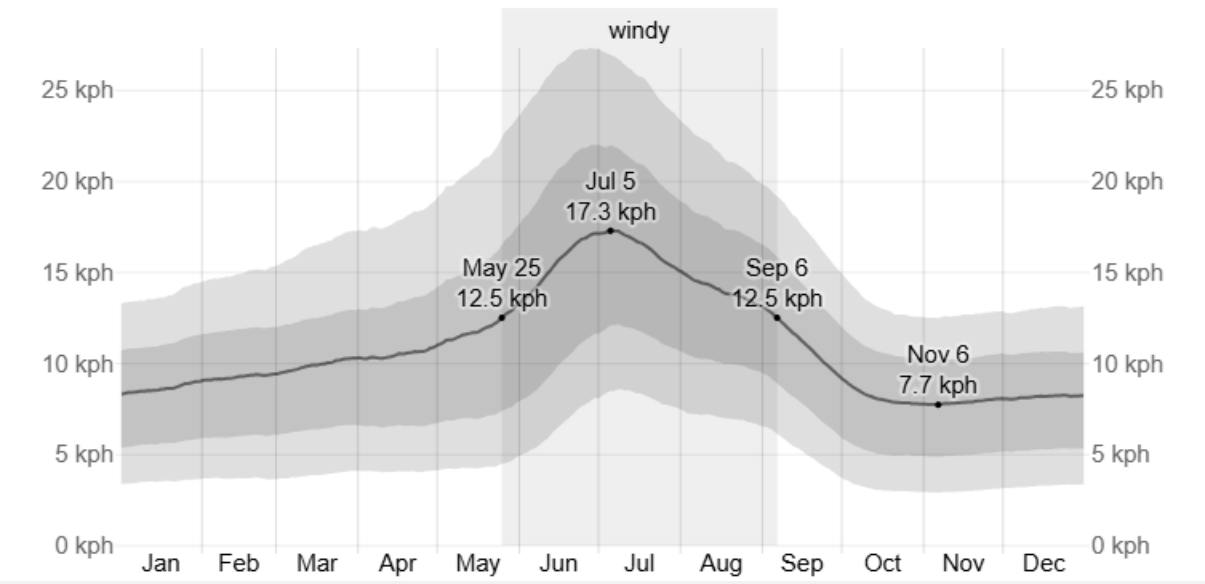


Source: https://weatherspark.com/y/106600/Average-Weather-in-L%C4%81rk%C4%81na-Pakistan-Year-Round

Figure 5.7: Humidity Comfort Levels

5.5.4 Wind & Wind Direction

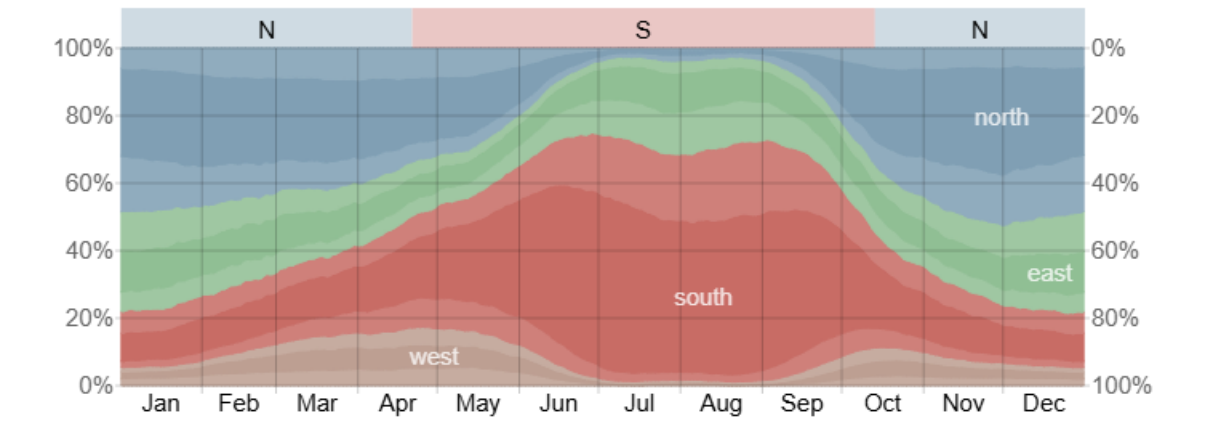
176. The average hourly wind speed in Larkana exhibits significant seasonal variation throughout the year. The windier part of the year lasts for 3.4 months, from May 25 to September 6, with average wind speeds exceeding 12.5 kilometers per hour. The windiest month of the year in Larkana is July, with an average hourly wind speed of 16.4 km/h. (refer to Figure 5.8) The calmer time of year lasts for 8.6 months, from September 6 to May 25. The calmest month of the year in Lārkāna is November, with an average hourly wind speed of 7.9 km/h.



Source: https://weatherspark.com/y/106600/Average-Weather-in-L%C4%81rk%C4%81na-Pakistan-Year-Round

Figure 5.8: Average Wind Speed

177. The wind is most often from the south for 5.7 months, from April 21 to October 13, with a peak percentage of 73% on July 5. The wind is most often from the north for 6.3 months, from October 13 to April 21, with a peak percentage of 48% on January 1. Refer to Figure 5.9 for a graphical representation.

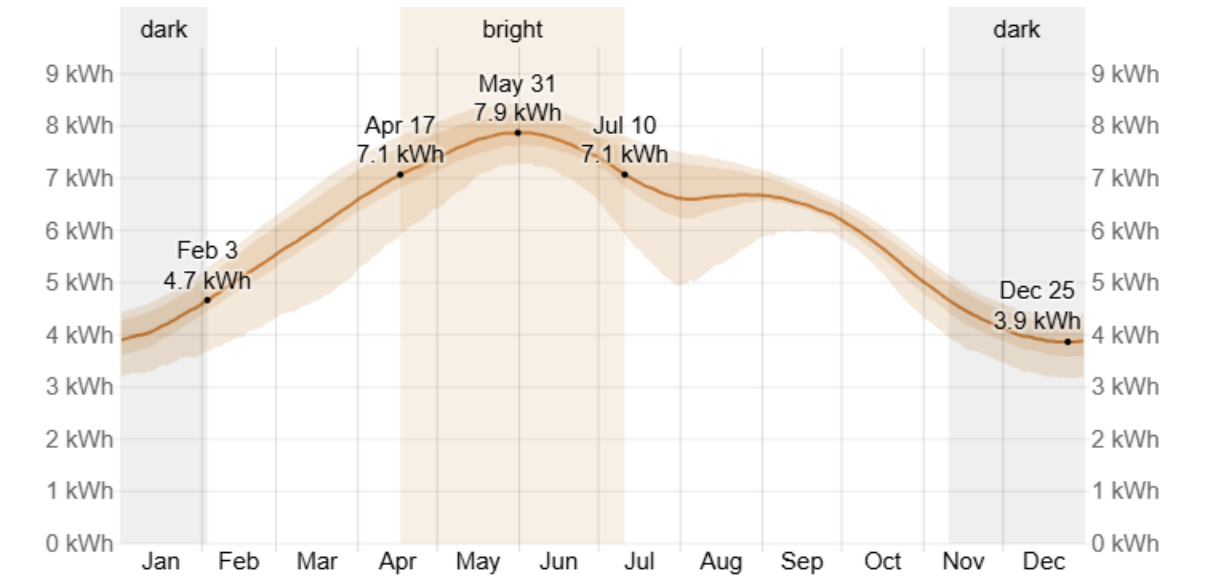


Source: https://weatherspark.com/y/106600/Average-Weather-in-L%C4%81rk%C4%81na-Pakistan-Year-Round

Figure 5.9: Wind Direction in Larkana

5.5.5 Solar Energy

178. The average daily incident shortwave solar energy experiences significant seasonal variations throughout the year. The brighter period of the year lasts for 2.8 months, from April 17 to July 10, with an average daily incident shortwave energy per square meter above 7.1 kWh. The brightest month of the year in Larkana is May, with an average of 7.7 kWh. The darker period of the year lasts for 2.8 months, from November 10 to February 3, with an average daily incident shortwave energy per square meter of less than 4.7 kWh. The darkest month of the year in Larkana is December, with an average of 3.9 kWh as depicted in Figure 5.10.



Source: https://weatherspark.com/y/106600/Average-Weather-in-L%C4%81rk%C4%81na-Pakistan-Year-Round

Figure 5.10: Average Daily Incident Shortwave Solar Energy in Larkana

5.6 Baseline Environmental Monitoring

179. Sampling across various locations within the proposed project area was conducted by experts from the Imperial Environmental Research Laboratory, which is approved by SEPA. The selection of monitoring sites was carefully planned, prioritizing areas near sensitive receptors. Final decisions on monitoring locations were made during the baseline survey, which included a site walkover and exploration of the surrounding environment. Table 5-1 outlines the reasoning behind the chosen sampling sites, while Figures 5.11 and 5.12 present maps and photographic documentation of these locations. Detailed Scan reports are provided in Annexure II.

Table 5-1 Baseline Environmental Monitoring Plan

Sr. No	Receptors	Monitoring Parameters	Locations	Location Coordinates	Quantity Samples	Monitoring & Reporting	Selection Detail
01.	Drinking water quality	Compliance with all parameters as per SEQS	Near Old Abad Bund Site	27.457123 N, 68.261305 E	Grab Sampling (02)	Baseline Environmental Monitoring	The selection of the Drinking water sampling point is intended to assess the Hand Pump (groundwater) near the Site at the proposed project site.
02.	Surface water quality	Compliance with all parameters as per SEQS	River Indus (Old Abad Bund)	27.4603 N 68.262857 E	Grab Sampling (04)	Baseline Environmental Monitoring	The selection of the Surface water sampling point is intended to assess the River Indus & Dadu Canal near by the Site at the proposed project site.
			Dadu Canal Near Old Abad Bund	27.513915 N 68.236227 E			
03.	Noise level	Compliance with dB (A) Parameter as per SEQS	Near Old Abad Bund Site	27.460416 N 68.262532 E	24 Hours Monitoring (02) Spot (08)	Baseline Environmental Monitoring	The selection of the ambient Noise monitoring sampling point is intended to assess the Noise quality at the proposed project site.
04.	Ambient air quality	Monitoring of SO_2, NO_2, NO, CO, O_3, $PM_{2.5}$, PM_{10}, SPM, Lead as per SEQS	Near Old Abad Bund Site	27.460416 N 68.262532 E	24 Hours Monitoring (02)	Baseline Environmental Monitoring	The selection of the ambient air monitoring sampling point is intended to assess the air quality at the proposed project site.
05	Vibration Monitoring	-	Near Old Abad Bund Site	Mentioned in Results Table	Spot (06)	Baseline Environmental Monitoring	The selection of the Vibration monitoring sampling point is intended to assess the Vibration at the proposed project site.

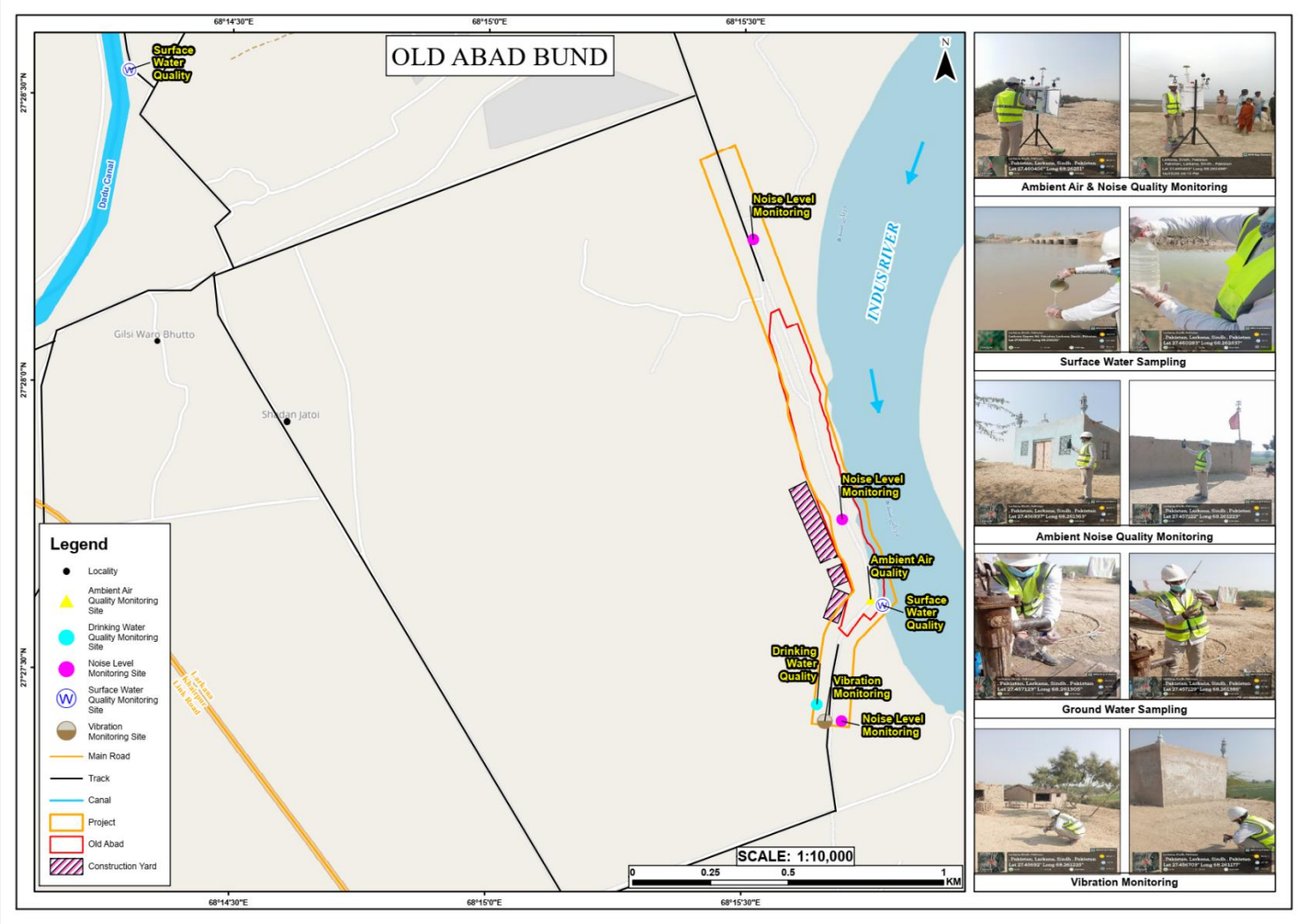


Figure 5.11: Baseline Environmental Monitoring Locations at Old Abad Bund Site

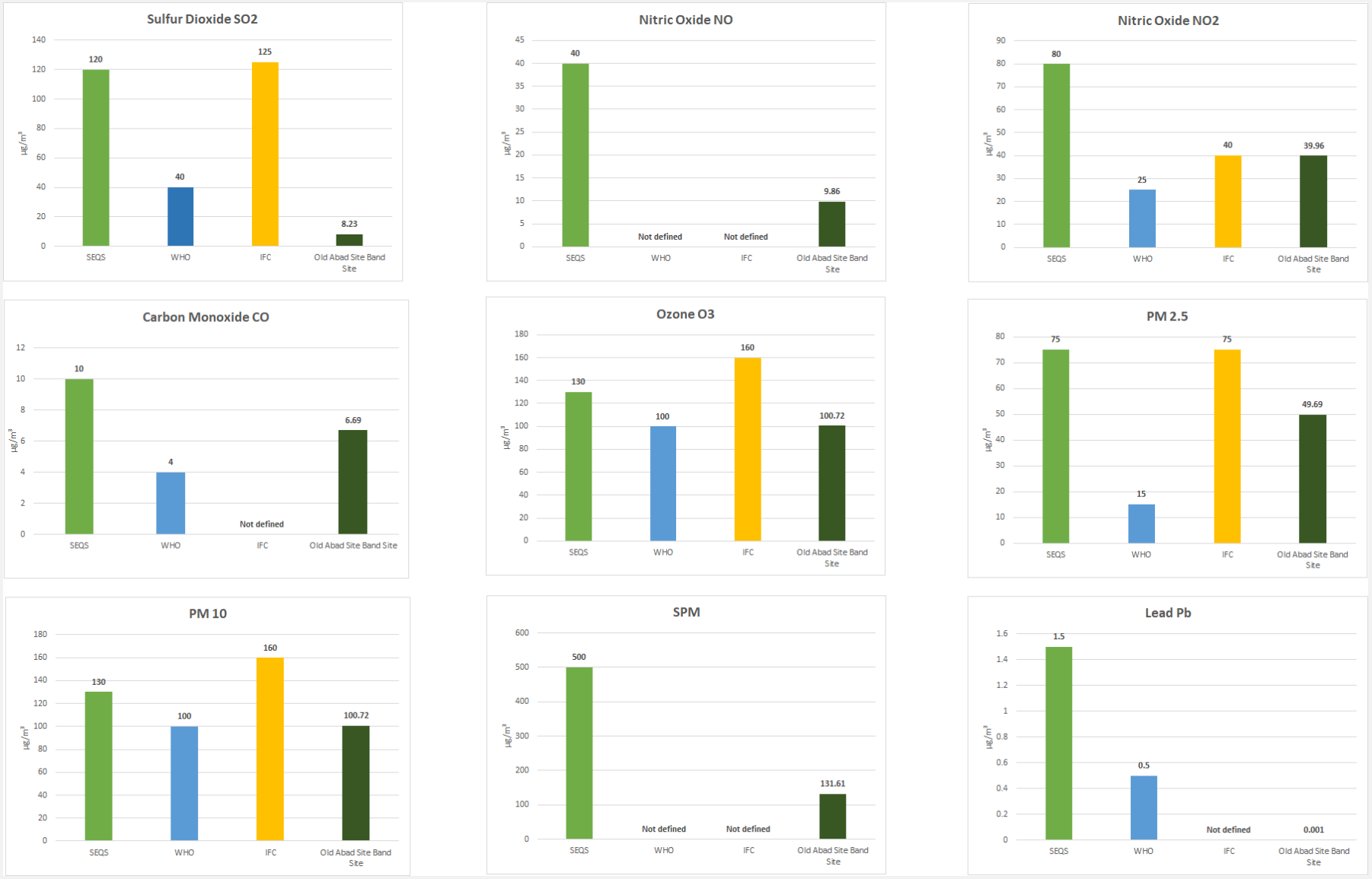


Figure 5.12 Ambient Air Quality Monitoring Chart

5.6.1 Metrological Data

180. During the intervention at the Old Abad Bund Site, various meteorological parameters were recorded, as shown in Table 5.2. On February 14, the wind speed ranged from 0.5 m/s to 2.3 m/s, with pressure fluctuating between 1000 mbar and 1002 mbar. The temperature remained relatively stable, ranging from 23 to 28°C, while the relative humidity (RH) varied from 16% to 20%. The following day, February 15, saw an increase in wind speed, peaking at 3.2 m/s at 8:00 a.m., with pressure reaching 1013 hPa. The temperature ranged from 22°C to 29°C, and RH increased to 35% by the afternoon.

Table 5-2: Metrological Data Old Abad Bund Site

Date	Time	w/s (m/s)	Pressure (mbar)	w/d (degree)	Temp (˚C)	RH (%)
14/03/2025	05:00 pm	0.5	1001	40	28	20
14/03/2025	06:00 pm	1.1	1000	50	28	18
14/03/2025	07:00 pm	1	1001	35	23	17
14/03/2025	08:00 pm	1	1000	35	23	17
14/03/2025	09:00 pm	2.3	1002	35	23	16
14/03/2025	10:00 pm	0.8	1002	40	26	19
14/03/2025	11:00 pm	1.2	1002	35	25	17
15/03/2025	12:00 am	0	1001	35	25	18
15/03/2025	01:00 am	1.2	1001	40	24	18
15/03/2025	02:00 am	1.2	1001	45	24	19
15/03/2025	03:00 am	1.7	1002	50	23	19
15/03/2025	04:00 am	1.4	1002	45	22	23
15/03/2025	05:00 am	2.4	1002	220	24	26
15/03/2025	06:00 am	3	1013	225	25	31
15/03/2025	07:00 am	2	1001	320	24	29
15/03/2025	08:00 am	3.2	1002	35	25	28
15/03/2025	09:00 am	1.3	1003	40	25	29
15/03/2025	10:00 am	2.3	1003	40	26	31
15/03/2025	11:00 am	2.3	1002	335	26	31
15/03/2025	12:00 pm	2.4	1005	40	27	32
15/03/2025	01:00 pm	1.3	1001	40	28	32
15/03/2025	02:00 pm	2.6	1002	60	28	33
15/03/2025	03:00 pm	1.3	1001	320	28	33
15/03/2025	04:00 pm	1.2	1002	75	29	35

Ambient Air Quality Monitoring Data

181. The air quality monitoring data from the sampling point, Old Abad Bund Site, collected on February 14 and 15, 2025, reveal significant insights into the levels of various pollutants.

182. At the Old Abad Bund Site, located at coordinates 27.460416N 68.262532E, the 24-hour average concentrations of pollutants were as follows: Sulfur Dioxide (SO2) measured 8.23 µg/m³, which is well below the SEQS standard of 120 µg/m³ and WHO's guideline of 40 µg/m³. Nitric Oxide (NO) recorded a level of 9.86 µg/m³, while Nitrogen Dioxide (NO2) was at 39.96 µg/m³, close to the WHO guideline of 40 µg/m³. The Carbon Monoxide (CO) level was 6.69 mg/m³, exceeding the WHO standard of 4 mg/m³. Ozone (O3) levels were measured at 100.72 µg/m³, which is above the WHO guideline of 100 µg/m³ but below the IFC standard of 160 µg/m³. For particulate matter, PM2.5 was measured at 49.69 µg/m³, significantly higher than the WHO guideline of 15 µg/m³. Meanwhile, PM10 was recorded at 104.53 µg/m³, exceeding both the WHO and IFC standards of 45 µg/m³ and 150 µg/m³, respectively. The Suspended Particulate Matter (SPM) level was 131.61 µg/m³, and Lead was detected at 0.001

μg/m³, which is below the WHO guideline of 0.5 μg/m³.

5.6.2 Noise Level Monitoring Data

183. The noise level data collected from the sampling point for the client, IEEC, provide insights into sound levels measured in decibels (dB(A)) over various times of the day.

184. Old Abad Bund Site: At the Old Abad Bund Site, located at coordinates 27.460416N 68.262532E, the noise levels were recorded on February 14 and 15, 2025. The measurements indicate that the noise levels fluctuated throughout the day, as shown in Figure 5.13. For instance, at 5:00 PM, the noise level was 47.2 dB(A), which increased to 51.4 dB(A) by 7:00 PM. The highest recorded level during this period was 51.4 dB(A) at 7:00 PM, while the lowest was 44.5 dB(A) at 10:00 PM.

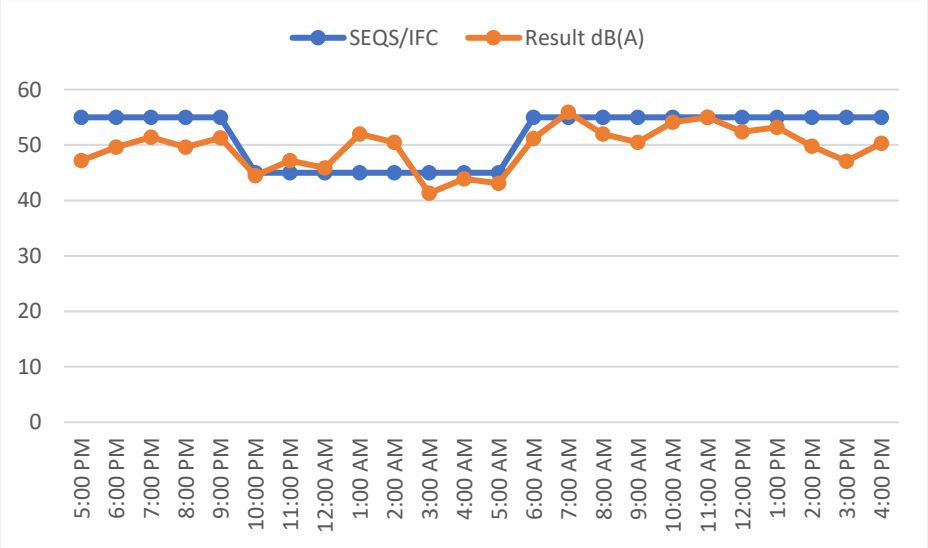


Figure 5.13: Ambient Noise Quality Monitoring – Old Abad Bund

5.6.3 Vibration Monitoring

185. The vibration monitoring intervention conducted for the client, IEEC, took place at the site on February 14 and 15, 2025. At the Old Abad Bund Site, measurements were taken at three locations using the Vibration Meter AS63A. The results indicated the following vibration levels: near the Masjid, 0.09 m/s²; near the Bund, 0.20 m/s²; and near the Otaq, 0.16 m/s².

186. International standards such as ISO 10816-3/20816-1 recommend using vibration velocity as the main indicator for machine vibration evaluation. Values below 1.115 m/s^2 typically indicate satisfactory or better conditions.[13]

187. These measurements are crucial for assessing the vibration impact in these areas, ensuring that any potential issues can be addressed promptly.

5.6.4 Drinking Water Analysis

188. Old Abad Bund Site: The groundwater sample collected from the Bund site on February 15, 2025, showed a temperature of 25.6°C and a pH level of 7.4, indicating neutral water quality. The sample was found to have an acceptable odor and a color measurement of less than 5 TCU. The total hardness was recorded at 150 mg/l, while the total dissolved solids (TDS) were 510 mg/l. Turbidity was low at 2.20 NTU. In terms of chemical composition,

[13] *https://www.cbmconnect.com/simplified-vibration-monitoring-iso-10816-3-guidelines/*

chloride levels were at 95 mg/l, with no residual chlorine detected. Trace metals such as aluminum, antimony, barium, and boron were all present at 0.001 mg/l. Fluoride was measured at 0.6 mg/l, and nitrate and nitrite levels were 0.141 mg/l and 0.02 mg/l, respectively. Arsenic was detected at 0.02 mg/l, while cadmium and chromium were both at 0.001 mg/l. Notably, no E. coli or total coliform bacteria were found in the sample.

Table 5-3: Drinking Water Quality Analysis

S.No.	Parameter	Ref: Method	Unit	Result -Old Abad Bund
1	Temperature	APHA 2550	°C	25.6
2	pH @ 25°C	APHA 4500-H+ B	-	7.4
3	Odor	APHA 2150 B	-	Acceptable
4	Colour	APHA 2120 B	TCU	<5
5	Taste	APHA 2150 B	-	Acceptable
6	Total Hardness	APHA 2340 C	mg/l	150
7	Total Dissolved Solids	APHA 2540 C	mg/l	510
8	Turbidity	APHA 2130 B	NTU	2.20
9	Chloride	APHA 4500-Cl B	mg/l	95
10	Chlorine, Residual	APHA 4500-Cl G	mg/l	0.00
11	Aluminium	APHA 3111 B	mg/l	0.001
12	Antimony	APHA 3111 B	mg/l	0.001
13	Barium (Ba)	APHA 3111 B	mg/l	0.001
14	Boron	APHA 3111 B	mg/l	0.001
15	Fluoride	APHA 4500-F C	mg/l	0.6
16	Nitrate	APHA 4500-NO3- F	mg/l	0.141
17	Nitrite	APHA 4500-NO2- E	mg/l	0.02
18	Arsenic	APHA 3111 B	mg/l	0.02
19	Cadmium	APHA 3111 B	mg/l	0.00
20	Chromium	APHA 3111 B	mg/l	0.001
21	Copper	APHA 3111 B	mg/l	0.001
22	Cyanide	APHA 4500-CN- G	mg/l	0.001
23	Lead	APHA 3111 B	mg/l	0.001
24	Manganese	APHA 3111 B	mg/l	0.003
25	Mercury	APHA 3111 B	mg/l	0.00
26	Nickel	APHA 3111 B	mg/l	0.00
27	Phenols	APHA 4500-P	mg/l	0.00
28	Selenium	APHA 3111 B	mg/l	0.00
29	Zinc	APHA 3111 B	mg/l	0.001
30	Total Coliform	APHA 9221 B	Cfu	0
31	E-Coli	APHA 9221 G	Cfu	0

5.6.5 Surface Water Analysis

189. River Indus, Old Abad Bund Site: The surface water sample from the River Indus at the Old Abad Bund site had a temperature of 25.8°C and a pH of 7.8. The TDS was measured at 360 mg/l, with a biological oxygen demand (BOD) of 35 mg/l and a chemical oxygen demand (COD) of 88 mg/l. Total suspended solids (TSS) were low at 7 mg/l, and oil and grease were recorded at 2 mg/l. Cadmium and copper were detected at 0.001 mg/l and 0.002 mg/l, respectively, while iron was present at 0.04 mg/l. Manganese levels were higher at 0.672 mg/l, and mercury was found at 0.002 mg/l. Chloride levels were at 84 mg/l, with no chlorine detected. Fluoride was measured at 0.6 mg/l, and ammonia was at 1.2 mg/l.

190. The Dadu Canal surface water sample showed a temperature of 25.7°C and a pH of 7.7. TDS was recorded at 190 mg/l, with BOD at 47 mg/l and COD at 117 mg/l. TSS was higher at 23 mg/l, and oil and grease were measured at 5 mg/l. Trace metals such as cadmium,

copper, and iron were present at low levels, while manganese was notably higher at 1.321 mg/l. Chloride levels were recorded at 65 mg/l, with no chlorine detected. Fluoride was measured at 0.7 mg/l, and ammonia was at 1.3 mg/l.

Table 5-4: Surface Water Quality Analysis

S. No.	Parameter	Ref: Method	Unit	River Indus, Old Abad Bund Site	Dadu Canal
1.	Temperature 40 ºC	APHA 2550	ºC	25.8	25.7
2.	pH	APHA 4500-H+ B	-	7.8	7.7
3.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/l	360	190
4.	Biology Oxygen Demand (BOD)	APHA 5210 B	mg/l	35	47
5.	Chemical Oxygen Demand (COD)	APHA 5220 B	mg/l	88	117
6.	Total Suspended Solids (TSS)	APHA 2540 D	mg/l	7	23
7.	Oil & Grease	APHA 5520 B	mg/l	2	5
8.	Sulphide	APHA 4500-S^{2-} E	mg/l	0.08	0.09
9.	Cadmium	APHA 3111 B	mg/l	0.001	0.001
10.	Copper	APHA 3111 B	mg/l	0.002	0.001
11.	Iron	APHA 3500-Fe	mg/l	0.04	0.03
12.	Lead	APHA 3111 B	mg/l	0.001	0.001
13.	Manganese	HACH-8131	mg/l	0.672	1.321
14.	Mercury	APHA 3111 B	mg/l	0.002	0.001
15.	Nickle	APHA 3111 B	mg/l	0.001	0.001
16.	Selenium	APHA 3111 B	mg/l	0.001	0.001
17.	Chromium	APHA 3111 B	mg/l	0.001	0.001
18.	Zinc	APHA 3111 B	mg/l	0.002	0.001
19.	Arsenic	APHA 3111 B	mg/l	0.001	0.001
20.	Chlorine	APHA 4500-Cl G	mg/l	0	0
21.	Chloride	APHA 4500-Cl B	mg/l	84	65
22.	Cyanide	APHA 4500-CN- G	mg/l	0.001	0.001
23.	Fluoride	APHA 4500-F C	mg/l	0.6	0.7
24.	Ammonia	APHA 4500-NH_3 F	mg/l	1.2	1.3
25.	Total Toxic Metals	APHA 3500-Metal B	mg/l	0.003	0.002
26.	Phenolic Compounds (as Phenol)	APHA 5530 C	mg/l	0.002	0.004
27.	Boron	APHA 3111 B	mg/l	0.068	0.081
28.	Barium	APHA 3111 B	mg/l	0.002	0.001
29.	Silver	APHA 3111 B	mg/l	0.001	0.001
30.	An-ionic Detergents	APHA 5540 C	mg/l	1.21	1.41
31.	Sulphate	APHA 4500-SO_4^{2-} E	mg/l	58	42

5.7 Biological Environment

191. Sindh Province in Pakistan faces significant flood risks due to heavy monsoon rains, exacerbated by climate change. The region has experienced severe flooding in recent years, including the devastating floods of 2010 & 2022 and ongoing challenges in 2024.

192. In 2010, the Indus River, which traverses Sindh Province, expanded dramatically from its typical width of about 1 km to approximately 23 km in certain areas. This expansion led to extensive flooding in regions including Larkana District. Similarly, in September 2012, Upper Sindh experienced unprecedented rainfall. Larkana recorded 216 mm of rain between September 5 and 11, marking a record for that month. This deluge resulted in significant flooding, particularly affecting the Larkana. During 2022, the monsoon season brought devastating floods to Sindh, with Larkana being among the hardest-hit areas. The city experienced 762.3 mm of rainfall in August alone, leading to widespread displacement and destruction.

193. Larkana district in Sindh Province has been severely affected by recent flooding events, resulting in significant humanitarian challenges including;

- **Displacement and Shelter:** Thousands of families are currently living in makeshift shelters, facing harsh conditions without adequate access to food, clean water, or sanitation facilities.
- **Health Risks:** The stagnant floodwaters pose significant health risks, including the spread of waterborne diseases, which are exacerbated by the lack of proper sanitation and limited access to healthcare.
- **Economic Impact:** The floods have devastated local agriculture, a primary source of livelihood for many residents. Crop losses have been substantial, further deepening the economic crisis in the region.
- **Infrastructure Damage:** The floods have caused extensive damage to roads and bridges, complicating relief efforts and access to affected areas.

194. To support the affected populations in Larkana as Immediate humanitarian Assistance and to develop the flood management strategies and infrastructure development to mitigate future risks of floods in Sindh, the government of the Sindh has developed a project for Flood Protection and Dike Improvement on Indus River in Larkana District in Sindh Province; “Dike Management Project”. This project is funded by Japan International Cooperation Agency (JICA) and being executed jointly by Federal Flood Commission (FFC) and Sindh Irrigation Department (SID).

195. According to the 2021 regulations of the Sindh Environmental Protection Agency (Sindh EPA), this project falls under the category of “Flood Protection” within the scope of “Water Management, Dams, Irrigation and Flood Protection”, which requires an Initial Environmental Examination (IEE). PID Sindh must submit the IEE report to the Sindh EPA and obtain approval before commencing construction. This biological study was conducted as part of IEE to assess the biological resources in the project area and to find out any negative or positive impacts of the project activities on the biological resources in the project area.

5.7.1 The Study Area for Biodiversity Assessment

196. The study area comprises Old Abad Bund in Larkana District, approximately 1 km in length along the Indus River, with a buffer zone of 3 km surrounding it. The site is located on

eastern side of the city of Larkana along the Indus River at; 27° 27′ 24.6" N 68° 15′ 40.4" E. From ecological point of view, the area represents four types of habitats including; wetlands (River), agricultural lands, sandy areas around the river Indus (desert plains) and ruderal habitats along the bund.

5.7.2 Objectives of the Study

197. The objectives of the study were to;

- Collect and review secondary data on biodiversity (flora and fauna) of the study area
- Prepare taxonomical checklist of recorded plants including grasses, herbs, shrubs and trees
- Prepare taxonomical check lists of recorded amphibians, reptiles, birds and mammals
- Identify any possible threats to the flora and fauna from project activities
- Suggest mitigating measures for identified threats to flora and fauna in the project area

5.8 Survey Methodology for Vegetation / Flora

198. To study the vegetation of the project area, direct observations in the field were made and local residents were interviewed. Observations were made while visiting different habitats. With the help and assistance of local residents, the local names of various plants were recorded. The plants of ethno-botanical importance were identified and classified according to their usage in local area. To study the plant diversity, the line transect method was applied, and to find out the plant community structure and dominant plant species, ocular estimation methods were applied. Economically important plants, medicinal plants, fodder and forage plants, fuel wood plants, timber wood plants, nectar and honey yielding plants and fruit producing plants were also identified. Conservation status of all the recorded plant species according to the IUCN Red List of Threatened Species (IUCN, 2025) was also determined.

5.9 Survey Methodology for Animals / Fauna

199. To record every possible faunal species in the study area, first of all, available literature, including published and unpublished reports, books, gazetteers, research articles, and popular articles, was collected and reviewed. Based on the available literature and secondary data, a checklist of different species was developed, which was subsequently confirmed through observations of these species during the field visit. Interviews with local residents, hunters, agriculturists and officials from wildlife and forest departments and researchers from academia in the study area were conducted to have an idea about the existing wildlife species.

5.9.1 Methodology for Fishes

200. To explore the fish fauna of the study area, sampling was made at different locations in Indus River and its tributaries. Every sampling site was marked with the help of Global Positioning System (GPS) and noted for ready reference. Different types of nets, including hand nets, cast nets, drag nets, and gill nets, were used to collect the fish. Similarly, the fish catches of different fishing parties and individuals were also observed to note the fish diversity in the project area. Sampling was scheduled for morning session from 07:00 am to 11:30 am

and for evening session from 2:00 pm to 5:00 pm. All the collected fish specimens belonging to different species were identified, photographed and then released back into water. Taxonomic identification and classification was done on the basis of morphometric characteristics up to the species level following the identification key given by Mirza, M. R. (1993).

5.9.2 Methodology for Amphibians

201. The study area represents different types of habitats and similarly, some of the amphibians are nocturnal in feeding habits whereas others are diurnal; therefore, different direct and indirect methods were applied to study various groups of amphibians in the study area. Field visits were carried out between 9:00 am to 4:00 pm for diurnal species and for two hours just after dusk for the nocturnal species. Indirect evidences of amphibians were also searched in the study area including amphibian eggs, tadpoles and their mating calls. Amphibian eggs and tadpoles were searched in ponds and puddles at different locations in the order to locate any amphibian species. Mating calls of frogs and toads were herd and existence of some species of frogs and toads was confirmed at some locations. Adult amphibians were also searched during daytime around their potential breeding sites like small water pools, water channels, roadside ponds and puddles and suitable microhabitats of amphibians e.g. stones, pond bunds, crevices, leaf litter, debris, rotten log etc. These places were deliberately uncovered to search the amphibians hiding under such covers. Amphibians were also observed around their feeding grounds i.e. under light posts etc. and around breeding sites like ponds, puddles and streams where they advertise their presence by their crocks.

5.9.3 Methodology for Reptiles

202. Different direct and indirect methods were applied to study various groups of reptiles like snakes, lizards and turtles in the study area. Field visits were carried out between 09:00 am to 3:00 pm for diurnal species and for 2-3 hours just after dusk for the nocturnal species. Different habitats in the study area were searched for any reptilian species both during day time and night. Stone turning, looking at and through bushes, searching basking agamas on stones and trees and walking along microhabitats were the means to find out all possible reptiles in the study area. Freshwater turtles were observed from the banks of the water bodies. All the reptiles encountered during the survey were identified and photographed and field notes for each specimen were recorded in the note book. For the identification of different species, *Amphibians and Reptiles of Pakistan* by Khan, M. S. (2006) was consulted.

5.9.4 Methodology for Birds

203. To study the avian fauna, seasonal surveys are recommended for resident as well as migratory birds. But during the present study, resident birds were studied during the field visits while for the migratory birds, secondary data was used. For recording the avian diversity in the study area, birds were watched in all the potential habitats in the area. Visits were planned during dawn, early morning, in the afternoon and dusk mostly by walking through the core zones of bird habitats. Water fowls and waders were watched especially along river banks and streams and nullahs in agricultural lands using binoculars. The birds that could not be identified at first look were photographed using a zoom lens and identified after consulting the hand book for bird identification (Grimmett *et al.*, 2008).

5.9.5 Methodology for Mammals

204. All the mammalian species were searched in all the identified habitats in the study area. Small mammals like mice, squirrels, mongooses etc. were directly observed during day time whereas for nocturnal small mammals like rats, bats, shrews etc. observations were made at night. Different techniques to observe different small mammals included spot lighting technique, observing active burrows, fresh feces and tracks and use of folding Sherman traps. Traps were set at different locations in the evening and left for whole night. Traps were visited early in the morning before the sunrises and trapped specimens were released after identification and recording necessary morphological data.

205. Different large and medium sized mammals show different feeding habits and some species are diurnal while others are nocturnal. Therefore, different direct and indirect methods were applied to locate various large mammals in the study area. Track and trails, fecal material, body parts, dead animal remains, fur entangled in the bushes, feeding remains etc. of different mammals were observed in different habitats in order to confirm the existence of different animals particularly the nocturnal mammals. Sounds and calls of animals also indicate the presence of animals in a locality, and no sound does not necessarily mean that no animal exists there. Sounds, calls, roar etc. of different mammals were listened at night and existence of different mammals was confirmed.

5.9.6 IUCN Status of the Recorded Animals

206. The conservation status and population trends of all recorded animals were determined by consulting the IUCN Red List of Threatened Species (IUCN, 2025). Any possible threats to the existing fauna from the proposed project activities were identified and mitigating measures were suggested for the identified threats for the safe survival of fauna and flora in the project area.

5.9.7 Flora & Fauna Study Team

207. The study was conducted by a team of five members, including the team leader, field biologist, field facilitator / local guide and a wildlife photographer (Table 5.5).

Table 5-5: Team Members for Biodiversity Assessment in the Project Area

Sr. No.	Name	Expertise	Organization
1	[redacted]	Field Facilitation-Monitoring	Indus Environmental Engineering Consultants
2		Wildlife Ecologist	Pakistan Wildlife Foundation
3		Fish Taxonomy	Pakistan Wildlife Foundation
4		Field Biology/ Herpetology	Pakistan Wildlife Foundation
5		Ornithology	Pakistan Wildlife Foundation

208. To study the biological diversity around the project area, a 5-day field visit was conducted from April 26 to 30, 2025. Old Abad Bund was visited, along with a 3 km buffer zone surrounding it. Biological diversity was studied under the following three headings;

- Habitat Types in the Study Area
- Flora Composition / Vegetation of the Study Area
- Fauna Composition (Amphibians, Reptiles, Birds and Mammals) of the Study Area
- People Interviewed during the Survey

During the field visit, 5 different individuals, including officials from the wildlife departments, farmers, and a teacher, were interviewed to gain an understanding of the existence and distribution of various wild plants and animals in the study area (Table 5-6).

Table 5-6: List of people interviewed during the survey

Sr. No.	Name	Occupation	Location	Contact No. / CNIC
1	[redacted]	Inspector, Wildlife Deptt.	Larkana	[redacted]
2		Inspector, Wildlife Deptt.	Sukkur	
3		Farmer	Old Abad Bund	
4		Farmer	Old Abad Bund	
5		Teacher / Lecturer	Larkana	

5.9.8 Habitat Types in the Study Area

209. Four types of habitats were identified in the project area, as shown in Figures 5.14.

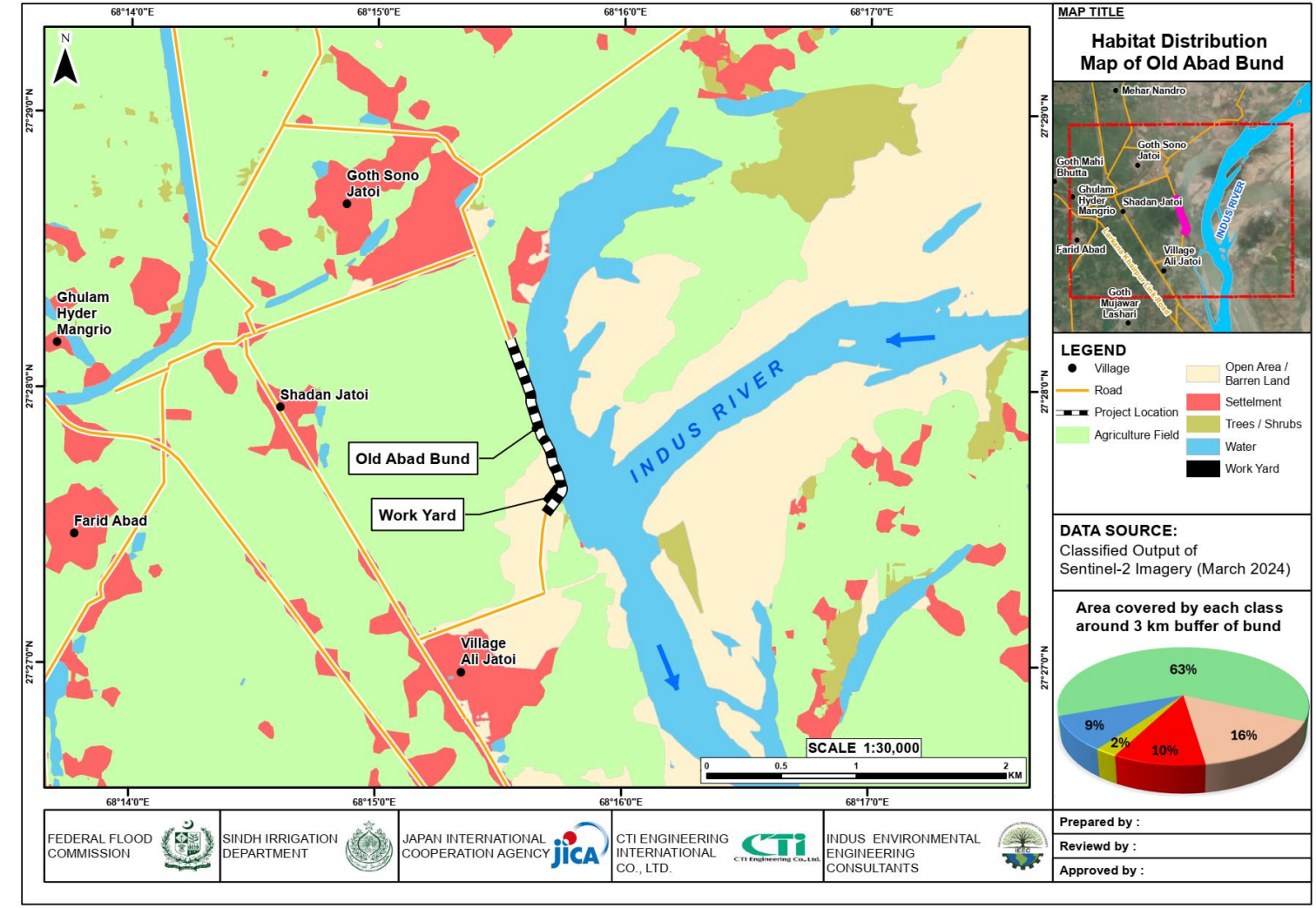
- Wetlands (river, channel in agricultural lands, ponds, seepage water)
- Agricultural Lands with associated Urban Areas
- Sandy Areas along dried river bed / Desert Areas
- Ruderal Habitats along existing Bunds

5.9.9 Wetlands (River, Channel in agricultural lands, Ponds, Seepage water)

210. Wetlands or aquatic habitats in the project area are represented by the River Indus, water channels in agricultural lands, ponds, and seepage water. This type of habitat is characterized by grasses, herbs, shrubs and some trees. Dominant shrubs in this habitat include *Typha sp.* and *Phragmites carca*, while trees such as Eucalyptus, Prosopis juliflora, and Acacia nilotica are found along the bunds in the project area. In contrast, Tamaryx dioca dominates the riverbanks and dried sandy plains along the River Indus. Stagnant water around these places provides an ideal habitat for different species of amphibians, freshwater turtles, and waterfowl.

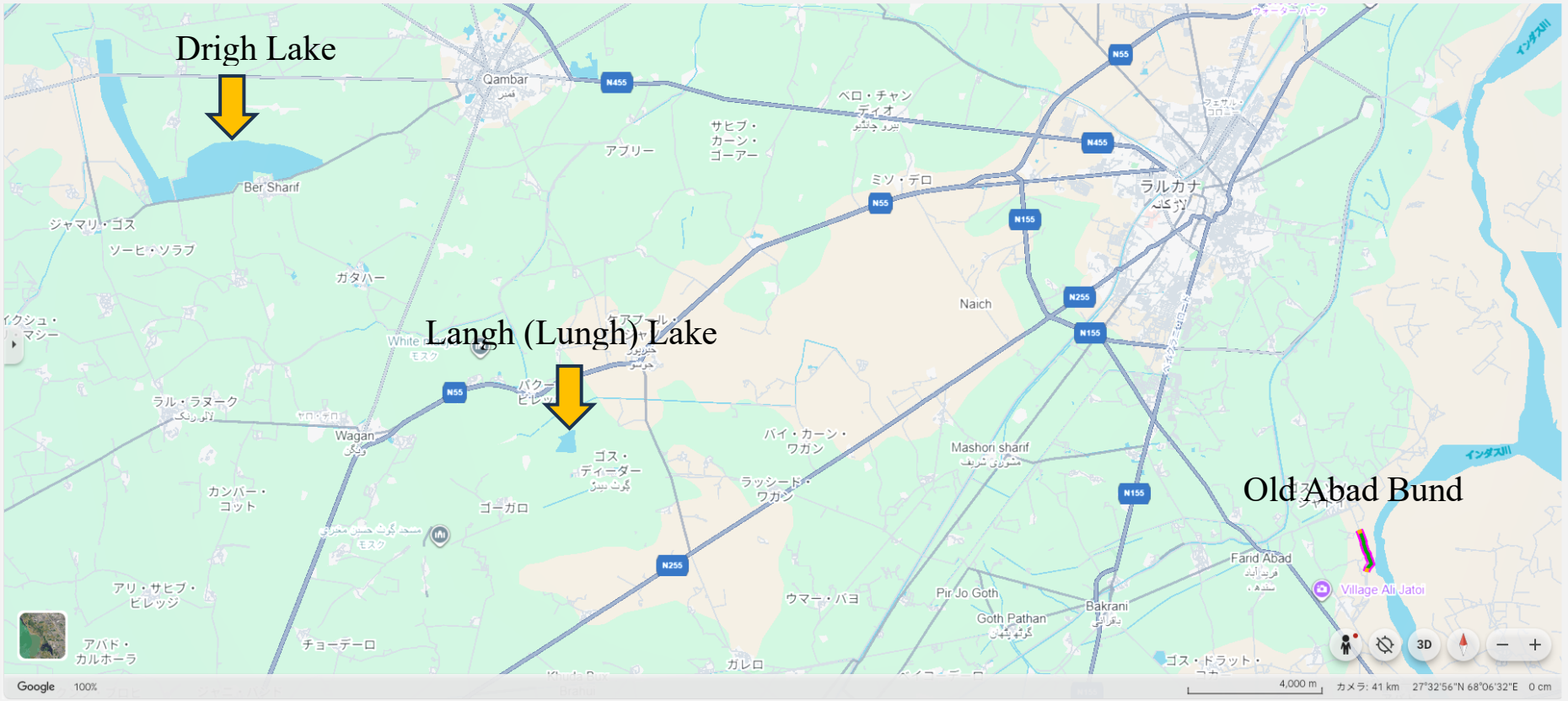
5.9.10 Endemic and Endangered Species

In the context of the sub-project area, no endemic or endangered species of flora or fauna have been identified. Furthermore, there are no protected areas/ Critical habitats in proximity to the proposed sub-project site. (refer to Figure 5-15).



Source: Classified Output of Sentinel-2 Imagery (March 2024)

Figure 5.14 Habitat distribution map of Old Abad Bund



Source: IBAT

Figure 5.15: Protected Area near the Proposed Project

Figure 5.16 Aquatic habitat in the study area

5.9.11 Agricultural Lands with Urban Areas

211. Urban areas like towns, villages and hamlets, along with associated agricultural lands represent this type of habitat, which is characterized by agricultural crops and natural vegetation (refer to Figure 5.17). Prominent trees include *Tamarix sp*. *Prosopis juliflora*, *Accacia nilotica, Eucalyptus*, *Ziziphus mauritiana*, date palm and *Dilbergia sisso*. Major shrubs include *Caparis decidua*, *Ziziphus nummularia* and *Calotropis sp.* Natural vegetation in this habitat with seasonal crops provide food and shelter to a number of amphibians, reptiles, mammals and resident as well as migratory passerine birds.

Figure 5.17 Agricultural Lands with Associated Urban Areas

5.9.12 Sandy Areas along Dried River Bed / Desert Areas

212. This type of habitat is represented by sandy plains especially on eastern side of the River Indus and also in the form of small islands and sandy mounds along dried river bed.

Vegetation is of a typical desert habitat with sparsely growing grasses and shrubs like *Caparis deciduas*, *Calotropis* sp. Trees like Mesquite (*Prosopis juliflora*), *Ziziphus nummularia* and *Tamarix dioca* can also be seen at some places in this habitat (Figure 5.18).

Figure 5.18 A view of desert habitat in the Study Area

5.9.13 Ruderal Habitats along Existing Bunds

213. Ruderal habitats are manmade habitats and here in this case the two existing old bunds can be considered as Ruderal Habitats. Such habitats provide equal opportunities for the floral and faunal elements to get established with little interspecific or intera specific competitions refer to Figure 5.19. The old bunds with crevices, cavaties and number of holes provide nesting, resting and breeding sites to a number of amphibian, reptilian and mammalian species. This type of habitat in the project area is charaterised by some grasses, small bushes or shrubs and some tall trees. Dominant plant species in this type of habitat includes Mesquite (*Prosopis juliflora*), *Calotropis* sp., *Eucalyptus* and some grasses. Such type of habitat along the river bank also provides habitat for amphibians, reptiles and mammals.

Figure 5.19 Ruderal Habitat (Bund) along Indus River in the project area

5.9.14 Floral Composition of the Study Area

214. Overall 48 plant species belonging to 28 families were identified from all the four habitat types in the project area. These included 18 (37.5%) trees, 7 (14.5%) shrubs, 12 (25%) herbs and 11 (23%) grasses. None of the recorded plant species is threatened according to the IUCN Red List of Threatened Species (IUCN, 2025).

5.9.15 Trees found in the Project Area

215. A total of 18 tree species, belonging to 11 families, were identified in the project area. Forteen species were found in agricultural lands, three species were found both in agricultural lands and ruderal habitats, while one species, Tamarix dioica, was found in all the habitat types (Table 5-7).

Table 5-7: Tree species found in the Project Area

Sr. No.	Botanical Name	Common Name	Family	Habitat Type	IUCN Status
1	*Mangifera indica*	Mango	Anacardiaceae	Agriculture Land	DD
2	*Phoenix dactylifera*	Date Palm	Arecaceae	Agriculture Land	LC
3	*Azadirachta indica*	Neem	Meliaceae	Agriculture Land	LC
4	*Ficus palmata*	Wild Fig	Moraceae	Agriculture Land	LC
5	*Ficus carica*	Common Fig	Moraceae	Agriculture Land	LC
6	*Morus alba*	White Mulberry	Moraceae	Agriculture Land	LC
7	*Morus nigra*	Black Mulberry	Moraceae	Agriculture Land	DD
8	*Acacia nilotica*	Babool	Mimosaceae	Agriculture Land	LC
9	*Prosopis juliflora*	Mesquite	Mimosaceae	Ruderal Habitat	LC
10	*Prosopis glandulosa*	Honey Mesquite	Mimosaceae	Ruderal Habitat	LC
11	*Eucalyptas lanceolatus*	Safeda	Myrtaceae	Ruderal Habitat	VU
12	*Psidium guajava*	Common Guava	Myrtaceae	Agriculture Land	LC
13	*Albizia lebbeck*	Siris Tree / Sharein	Papailionaceae	Agriculture Land	LC
14	*Dalbergia sissoo*	Shisham / Rosewood	Papailionaceae	Agriculture Land	LC
15	*Punica granatum*	Pomegranate	Punicaceae	Agriculture Land	LC
16	*Zizphus mauritiana*	Indian Plum / Ber	Rhamnaceae	Agriculture Land	LC
17	*Citrus limon*	Lemon / Lemoo	Rutaceae	Agriculture Land	LC
18	*Tamarix dioica*	Ghaz / Khagal	Tamaricaceae	Aquatic and Desert	LC

5.9.16 Shrubs found in the project area

216. Seven species of shrubs were identified in the study area,, belonging to seven families. All the recorded shrubs were found in agricultural habitats as well as in the ruderal habitats (Table 5-8).

Table 5-8: List of Shrubs found in the Project Area

Sr. No.	Botanical Name	Family	IUCN Status	Habitat Type
1	*Rhazya stricta*	Apocynaceae	NE	Ruderal Habitat
2	*Calotropis procera*	Asclepiadaceae	LC	Ruderal and Agriculture
3	*Opuntia littoralis*	Cactaceae	LC	Ruderal and Agriculture
4	*Capparis decidua*	Capparidiceae	LC	Ruderal and Agriculture
5	*Cassia occidentalis*	Caesalpiniaceae	LC	Ruderal and Agriculture
6	*Ricinus communis*	Euphorbiaceae	LC	Ruderal and Agriculture
7	*Ocimum bascilicum*.	Lamiaceae	NE	Ruderal and Agriculture

5.9.17 Herbs and Climber found in the project area

217. Overall 12 species of herbs belonging to nine familiea were identified in the project area. Almost all the species were distributed in agricultural lands and ruderal habitats. Some of the species were also found in the sandy areas (Table 5-9).

Table 5-9: Herbs found in the Project Area

Sr. No.	Botanical Name	Family	IUCN Status	Habitat Type
1	*Parthenium hysterophorus*	Asteraceae	LC	Agriculture and Ruderal
2	*Taraxacum officinale*	Asteraceae	LC	Agriculture and Ruderal
3	*Verbesina encelioides*	Asteraceae	NE	Agriculture and Ruderal
4	*Cannabis sativa*	Cannabaceae	NE	Agriculture and Ruderal
5	*Capparis spinosa*	Capparidiceae	LC	Agriculture and Ruderal
6	*Cucumis melo*	Cucurbitaceae	NE	Agriculture and Ruderal
7	*Equisetum ramosissimum*	Equisetaceae	NE	Agriculture and Ruderal
8	*Euphorbia helioscopia*	Euphorbiaceae	NE	Agriculture and Ruderal
9	*Euphorbia prostrata*	Euphorbiaceae	CR	Agriculture and Ruderal
10	*Typha latifolia*	Typhaceae	LC	Agriculture and Ruderal
11	*Aloe vera*	Xanthorrhoeaceae	NE	Agriculture and Ruderal
12	*Fagonia bruguieri*	Zygophyllaceae	NE	Agriculture and Ruderal

5.9.18 Grasses found in the project area

218. Overall, 11 species of grasses were identified in the study area, belonging to the Poaceae family. All the recorded species were found commonly in all types of habitats (Table 5-10).

Table 5-10: Grasses found in different habitats in the study area

Sr. No.	Botanical Name	Family	IUCN Status	Habitat Type
1	*Saccharum bengalense*	Poaceae	LC	Agriculture and Ruderal
2	*Sacharum spontaneum*	Poaceae	NE	Agriculture and Ruderal
3	*Phragmites australis*	Poaceae	LC	Agriculture and Ruderal
4	*Cymbopogon jwarancusa*	Poaceae	NE	Agriculture and Ruderal
5	*Zea mays*	Poaceae	LC	Agriculture and Ruderal
6	*Dicanthium annulatum*	Poaceae	NE	Agriculture and Ruderal
7	*Desmostachya bipinnata*	Poaceae	LC	Agriculture and Ruderal
8	*Andropogon halepensis*	Poaceae	NE	Agriculture and Ruderal
9	*Persicaria barbata*	Poaceae	LC	Agriculture and Ruderal
10	*Cynodon dactylon*	Poaceae	NE	Agriculture and Ruderal
11	*Arundo donax*	Poaceae	LC	Agriculture and Ruderal

5.10 Faunal Composition of the Study Area

219. Vertebrate wildlife fauna was studied under following five groups in the project area.

- Fishes
- Amphibians
- Reptiles
- Birds
- Mammals

5.10.1 Fishes Recorded from the Project Area

220. Overall, eight species of fish belonging to five orders, five families, and seven genera were recorded from the project area (Table 5-11). According to local residents, fish sellers and fish consumers, five species belonging to Cyprinidae and Bagridae families were found commercially important and desirable fish species, while species belonging to Channidae, Notopteridae, and Mastacembelidae families were found less desirable fish species. (refer to Table 5-12).

Table 5-11: Grasses found in different habitats in the study area

Sr. No.	Zoological Name	Common Name	Family	Order
1	*Channa punctatus*	Spotted Snakehead	Channidae	Perciformes
2	*Notopterus notopterus*	Pari	Notopteridae	Osteoglossiformes
3	*Mastacembelus armatus*	Balm	Mastacemblidae	Mastacembliformes
4	*Cirrhinus mirgala*	Mori	Cyprinidae	Cypriniformes
5	*Barilius modistus*	Indus Baril	Cyprinidae	Cypriniformes
6	*Labeo dyocheilus*	Torkey	Cyprinidae	Cypriniformes
7	*Labeo calbasu*	Kalbance	Cyprinidae	Cypriniformes
8	*Sperata seenghala*	Singhari	Bagridae	Siluriformes

Table 5-12: Food, Feeding habits and commercial value of the recorded fish species

Sr. No.	Zoological Name	Common Name	Feeding Habit	Food Items	Commercial Value
1	*Channa punctatus*	Spotted Snakehead	Omnivore	Crustacean, insects, fish mollusc, debris & plants	-
2	*Notopterus notopterus*	Bronze featherback	Omnivore	Crustacean, insects, fish mollusc, debris & plants	-
3	*Mastacembelus armatus*	Spiny Eel	Carnivore	Crustaceans, insects, shrimps, molluscs, fishes	-
4	*Cirrhinus mrigala*	Mrigal carp	Scavenger	Zooplanktons and decaying vegetation	✓
5	*Barilius modestus*	Indus Baril	Detritivore	Decaying organic matter, rotifers, diatom, mollusc	✓
6	*Labeo dyocheilus*	Ghora mach	Herbivore	Planktons, algae, submerged vegetation	✓
7	*Labeo calbasu*	Karnataka labeo	Detritivore	Decaying organic matter, rotifers, diatom, moluscs	✓
8	*Sperata seenghala*	Singhari	Carnivore	Insects, prawns, fish	✓

5.10.2 Amphibians Recorded from Project Area

221. Applying all the possible direct and indirect observation methods, four species of amphibians, belonging to two families and four genera were recorded. These amphibians

belong to the Order Anura and include one toad and three frogs (Table 5-13).

Table 5-13: Amphibians recorded from the Project Area

Sr. No.	Common Name	Zoological Name	Genus	Family	Order
1	Indus valley toad	*Bufo stomaticus*	*Bufo*	Bufonidae	Anura
2	Skittering frog	*Euphlyctis cyanophlyctis*	*Euphlyctis*	Ranidae	Anura
3	Southern cricket frog	*Fegervarya syhadrensis*	*Fegervarya*	Ranidae	Anura
4	Indian Bullfrog	*Hoplobatrachus tigerinus*	*Hoplobatrachus*	Ranidae	Anura

5.10.3 Observation Records of Amphibians

222. All five recorded amphibian species were observed directly. In contrast, indirect evidence, such as the presence of eggs in water, tadpoles and froglets, mating calls of frogs and toads, and interviews with local residents, hunters, and officials from wildlife and forest departments, also confirmed their existence. (Table 5-14).

Table 5-14: Observation Records of Amphibians in the Project Area

Sr. No.	Species Observed	Direct Observation	Indirect Observations				
			Eggs	Tadpoles	Froglets	Mating calls	Interviews with locals
1	Indus valley toad	✓	✓	-	✓	✓	✓
2	Skittering frog	✓	-	✓	✓	✓	✓
3	Southern cricket frog	✓	-	-	-	-	✓
4	Indian Bullfrog	✓	✓	-	-	✓	✓

5.11 Food and Feeding Habits of the Recorded Amphibians

223. All the recorded amphibians are nocturnal in their feeding habits, meaning they emerge at dusk to feed and remain inactive during the day. Food and feeding habits of the recorded amphibian species is given in Table 5-15.

Table 5-15: Food and Feeding Habits of the Recorded Amphibians

Sr. No.	Recorded Amphibians	Zoological Name	Feeding Habit	Food Items
1	Indus valley toad	*Bufo stomaticus*	Nocturnal	Small insects like flies, mosquitoes and small worms
2	Skittering Frog	*Euphlyctis cyanophlyctis*	Nocturnal	Aquatic insects, beetles, flies, tadpoles, dragonflies, grasshoppers
3	Southern cricket Frog	*Fegervarya syhadrensis*	Nocturnal	Insects, small worms, centipedes, millipedes, juvenile frogs and toads
4	Indian Bullfrog	*Hoplobatrachus tigerinus*	Nocturnal	Insects, mice, shrew, young frogs, earthworms, roundworms, juvenile snakes and small birds.

5.11.1 Ecological Role of Amphibians

224. Amphibians include frogs, toads, salamanders and caecilians but in Pakistan and in the project area, only frogs and toads have been reported to exist so far. Amphibians possess a unique position in an ecosystem. They spend their larval stages in aquatic environment and adult stage on terrestrial environment hence the name “Amphibian” which mean living a double life. So far 24 amphibian species have been recorded in Pakistan. Amphibians play a vital role in an ecosystem both as prey and predator. Mostly the amphibian tadpoles are herbivore while a few are omnivore and all are the prey items for a number of invertebrate and vertebrate predators like small mammals and aquatic birds. On the other hand, adult amphibians including frogs and toads are the best biological pest controllers as they eat several agricultural pest insects and their larvae and thus are beneficial for crops. Near human habitations, the frogs and toads eat different photophillic insects and larvae of flies, mosquitoes etc. and hence protect us from various diseases. Being the important component of food chain in an ecosystem, the decline or extinction of amphibians may have significant impact on whole ecosystem. With a decline of amphibians in an ecosystem, the populations of agricultural pest insects will flourish and cause huge damages to crops. Due to high degree of sensitivity, either during larval stage or as adult, amphibians respond to even very slight change in the environment and hence considered as good ecological indicators. Such responses have been used to indicate habitat fragmentation, ecosystem stress, impact of pesticides and various anthropogenic activities.

Figure 5.20 Skittering Frog

Figure 5.21 Indus valley toad

5.11.2 Economic Importance of Amphibians

225. Amphibians are used as experimental animals for ecological, embryological, physiological and genetic research. Hundreds of thousands of specimens of Indian bullfrog (*Hoplobatrachus tigerinus*) are used every year in various educational institutions as experimental animal to demonstrate various biological systems. In some eastern countries bullfrog is consumed as a good source of food and its breeding and rearing has become a profitable industry.

5.11.3 Reptiles Recorded from the Project Area

226. Overall 21 species of reptiles including 03 freshwater turtles, 07 lizards and 11 snakes were recorded from the project area. These 21 reptiles belong to two orders, 11 families and 20 genera (Table 5-16).

Table 5-16: Reptiles recorded from the Project Area

Sr. No.	Zoological Name	Common Name	Family	Order
1	*Lissemys punctata*	Indian flap-shell turtle	Trionychidae	Chelonia
2	*Hardella thurjii*	Common river turtle	Emydidae	Chelonia
3	*Geoclemys hamiltonii*	Yellow-spotted mud turtle	Emydidae	Chelonia
4	*Calotes versicolor*	Common Tree Lizard	Agamidae	Squamata
5	*Hemidactylus flaviviridis*	House gecko	Gekkonidae	Squamata
6	*Hemidactylus brookii*	Spotted barn gecko	Gekkonidae	Squamata
7	*Cyrtopodion scabrum*	Tuberculate ground gecko	Gekkonidae	Squamata
8	*Acanthodactylus cantoris*	Blue-tailed sand lizard	Lacertidae	Squamata
9	*Eutropis dissimilis*	Striped grass skink	Scincidae	Squamata
10	*Varanus bengalensis*	Bengal monitor Lizard	Varanidae	Squamata
11	*Eryx johnii*	Common sand boa	Boidae	Squamata
12	*Boiga trigonata*	Common cat snake	Colubridae	Squamata
13	*Lycodon striatus*	White-spotted wolf snake	Colubridae	Squamata
14	*Platyceps ventromaculatus*	Cliff racer	Colubridae	Squamata
15	*Psammophis schokari*	Saharo-Sindian ribbon snake	Colubridae	Squamata
16	*Ptyas mucosa*	Rope-snake	Colubridae	Squamata
17	*Spalerosophis diadema*	Blotched diadem Snake	Colubridae	Squamata
18	*Xenochrophis piscator*	Checkered keel-back	Colubridae	Squamata
19	*Bungarus caeruleus*	Common krait	Elapidae	Squamata
20	*Naja naja*	Black cobra	Elapidae	Squamata
21	*Echis carinatus*	Saw-scale viper	Viperidae	Squamata

5.11.4 Observation Records of the Recorded Reptiles

227. Most of the recorded reptiles were observed directly except two snakes; black cobra and Saw-scale viper. The indirect evidences like tracks and trails, burrows, body parts or remains of dead animals and interviews with local residents, hunters and officials of wildlife and forest departments also confirmed the existence of these reptiles (Table 5-17).

Table 5-17: Observation records of the recorded Reptiles

Sr. No.	Species Observed	Direct Observation	Indirect Observations			
			Tracks &Trails	Burrows	Body Parts	Interviews with locals
1	*Lissemys punctata*	✓	-	-	✓	✓
2	*Hardella thurjii*	✓	-	-	-	✓
3	*Geoclemys hamiltonii*	✓	-	-	✓	✓
4	*Calotes versicolor*	✓	-	-	-	✓
5	*Hemidactylus flaviviridis*	✓	-	-	✓	✓
6	*Hemidactylus brookii*	✓	-	-	-	✓
7	*Cyrtopodion scabrum*	✓	-	-	-	✓
8	*Acanthodactylus cantoris*	✓	-	-	-	✓
9	*Eutropis dissimilis*	✓	-	-	-	✓
10	*Varanus bengalensis*	✓	-	-	-	✓
11	*Eryx johnii*	✓	-	-	-	✓
12	*Boiga trigonata*	✓	-	-	-	✓
13	*Lycodon striatus*	✓	-	-	-	✓
14	*Platyceps ventromaculatus*	✓	-	-	-	✓
15	*Psammophis schokari*	✓	-	-	-	✓
16	*Ptyas mucosa*	✓	-	-	-	✓

Sr. No.	Species Observed	Direct Observation	Indirect Observations			
			Tracks &Trails	Burrows	Body Parts	Interviews with locals
17	*Spalerosophis diadema*	✓	✓	-	-	✓
18	*Xenochrophis piscator*	✓	-	-	-	✓
19	*Bungarus caeruleus*	✓	-	-	✓	✓
20	*Naja naja*	-	-	-	-	✓
21	*Echis carinatus*	-	-	-	-	✓

5.11.5 Ecological Role of Reptiles

228. Reptiles are adapted to live in all types of habitats and play an important role in an ecosystem as predator, prey and scavengers. Different species of reptiles are good source of biological control in the natural systems. At some level these become prey for other animals while at others they act as predator to control the populations of other animals.

229. Turtles in aquatic ecosystem eat the dead organic matter and keep the aquatic system clean. In the freshwater ecosystems, different species of freshwater turtles have different roles. Some species are herbivore feeding upon submerged plants, some species are carnivore feeding upon small aquatic animals and some species of freshwater turtles are scavengers feeding on dead organic matter. Thus freshwater turtles play an important role by maintaining the populations of different animals and also removing the dead organic matter from the aquatic ecosystem. Most of the freshwater turtles are responsible for the cleanliness of the aquatic ecosystems. Different insectivore lizards control the populations of various harmful insects e.g. house gecko in and around human habitations, eat and remove different insects and larvae of flies, mosquitoes etc. and hence protect us from various diseases. Herbivore lizards are responsible for the dispersal of seed of various herbs and shrubs. Lizards also become food of a number of snakes and raptors and hence maintain the food chain in an ecosystem.

230. Rodents like mice and rats are serious pests of grains and cause huge damages to crops every year but many snakes depend upon these rodents and control their populations. With a decline of snakes in an ecosystem, the populations of agricultural pests like mice and rats etc. will flourish and cause huge damages to crops. Around 30% snakes are venomous and 70% non-venomous. But due to lack of awareness about importance and ecological role of snakes in our society, every snake is considered venomous and killed. Snakes take rodents, frogs, toads, lizards and small birds as food and at the same time become food of different birds of prey and hence play their role in maintenance of the ecosystem.

5.11.6 Birds Recorded from the Project Area

231. Total 82 bird species belonging to 17 orders were recorded. Most of the birds especially the resident and summer breeders were observed directly in different habitats in the study area whereas, for recording the winter visiting and summer breeding birds, secondary data was consulted. The recorded birds included 50 (61%) resident birds, 20 (24%) winter visitors, 8 (10%) summer breeders and 4 (5%) passage migrants or irregular year-round visitors according to Grimmett *et al*. (2008). None of the recorded birds is endemic to Pakistan (Table 5-18).

Table 5-18: Birds recorded during the survey and their conservation status

Sr. No.	English Names	Zoological Names	Category	Status IUCN 2025
Order 1: Galliformes				
1	Common Quail	*Coturnix coturnix*	Passage migrant	Least Concern
2	Grey Francolin	*Francolinus pondicerianus*	Resident	Least Concern
3	Black Francolin	*Francolinus francolinus*	Resident	Least Concern
Order 2: Anseriformes				
4	Gadwal	*Anas strepera*	Winter visitor	Least Concern
5	Eurasian Wigeon	*Anas penelope*	Winter visitor	Least Concern
6	Mallard	*Anas platyrhynchos*	Winter visitor	Least Concern
7	Common Teal	*Anas crecca*	Winter visitor	Least Concern
8	Northern Pintail	*Anas acuta*	Winter visitor	Least Concern
9	Northern Shoveler	*Anas clypeata*	Winter visitor	Least Concern
Order 3: Piciformes				
10	Yellow-crowned Woodpecker	*Dendrocopos mahrattensis*	Resident	Least Concern
11	Sind Woodpecker	*Dendrocopos assimilis*	Resident	Least Concern
12	Black-rumped Flameback	*Dinopium benghalense*	Resident	Least Concern
Order 4: Coraciiformes				
13	Common Hoopoe	*Upupa epops*	Resident	Least Concern
14	Indian Roller	*Coracias benghalensis*	Resident	Least Concern
15	European Roller	*Coracias garrulus*	Passage migrant	Least Concern
16	White-throated Kingfisher	*Halcyon smyrnensis*	Resident	Least Concern
17	Pied Kingfisher	*Ceryle rudis*	Resident	Least Concern
18	Green Bee-eater	*Merops orientalis*	Resident	Least Concern
19	Blue-cheeked Bee-eater	*Merops persicus*	Summer Breeder	Least Concern
Order 5: Cuculiformes				
20	Asian Koel	*Eudynamys scolopacea*	Summer Breeder	Least Concern
21	Greater Coucal	*Centropus sinensis*	Resident	Least Concern
Order 6: Psittaciformes				
22	Rose-ringed Parakeet	*Psittacula krameri*	Resident	Least Concern
Order 7: Apodiformes				
23	House Swift	*Apus affinis*	Resident	Least Concern
Order 8: Strigiformes				
24	Spotted Owlet	*Athene brama*	Resident	Least Concern
25	Eurasian Eagle Owl	*Bubo bubo*	Resident	Least Concern
Order 9: Caprimulgiformes				
26	Eurasian Nightjar	*Caprimulgus europaeus*	Summer breeder	Least Concern
Order 10: Columbiformes				
27	Rock Pigeon	*Columba livia*	Resident	Least Concern
28	Laughing Dove	*Streptopelia senegalensis*	Resident	Least Concern
29	Collared Dove	*Streptopelia decaocto*	Resident	Least Concern
Order 11: Gruiformes				
30	Common Moorhen	*Gallinula chloropus*	Resident	Least Concern
31	Common Coot	*Fulica atra*	Winter visitor	Least Concern
Order 12: Charadriiformes				
32	Black-winged Stilt	*Himantopus himantopus*	Summer breeder	Least Concern
33	Red-wattled Lapwing	*Vanellus indicus*	Resident	Least Concern
34	Common Snipe	*Gallinago gallinago*	Winter visitor	Least Concern
35	Common Greenshank	*Tringa nebularia*	Winter visitor	Least Concern
36	Common Sandpiper	*Actitis hypoleucos*	Winter visitor	Least Concern
Order 13: Accipitriformes				
37	Black-shouldered Kite	*Elanus caeruleus*	Resident	Least Concern

Sr. No.	English Names	Zoological Names	Category	Status IUCN 2025
38	Black Kite	*Milvus migrans*	Resident	Least Concern
39	Eurasian Sparrow hawk	*Accipiter nisus*	Winter visitor	Least Concern
40	Shikra	*Accipiter badius*	Resident	Least Concern
41	White-eyed Buzzard	*Butastur teesa*	Resident	Least Concern
42	Long-legged buzzard	*Buteo rufinus*	Winter visitor	Least Concern
43	Common buzzard	*Buteo buteo*	Winter visitor	Least Concern
44	Tawny Eagle	*Aquila rapax*	Resident	Least Concern
Order 14: Falconiformes				
45	Common Kestrel	*Falco tinunculus*	Winter visitor	Least Concern
46	Laggar Falcon	*Falco jugger*	Resident	Least Concern
Order 15: Podicipediformes				
47	Little Grebe	*Tachybaptus ruficollis*	Resident	Least Concern
Order 16: Ciconiiformes				
48	Cattle Egret	*Bubulcus ibis*	Resident	Least Concern
49	Grey Heron	*Ardea cinerea*	Winter visitor	Least Concern
50	Indian Pond Heron	*Ardeola grayii*	Resident	Least Concern
Order 17: Passeriformes				
51	Bay-backed Shrike	*Lanius vittatus*	Summer breeder	Least Concern
52	Long-tailed Shrike	*Lanius schach*	Summer breeder	Least Concern
53	Rufous Tree pie	*Dendrocitta vagabunda*	Resident	Least Concern
54	House Crow	*Corvus splendens*	Resident	Least Concern
55	Eurasian Golden Oriole	*Oriolus oriolus*	Passage migrant	Least Concern
56	Black Drongo	*Dicrurus macrocercus*	Resident	Least Concern
57	Bluethroat	*Luscinia svecica*	Winter visitor	Least Concern
58	Indian Robin	*Saxicoloides fulicata*	Resident	Least Concern
59	Black Redstart	*Phoenicurus ochruros*	Winter visitor	Least Concern
60	Pied Bushchat	*Saxicola caprata*	Resident	Least Concern
61	Common Stonechat	*Saxicola torquata*	Summer breeder	Least Concern
62	Common Myna	*Acridotheres tristis*	Resident	Least Concern
63	Bank Myna	*Acridotheres ginginianus*	Resident	Least Concern
64	Barn Swallow	*Hirundo rustica*	Winter visitor	Least Concern
65	Wire-tailed Swallow	*Hirundo smithii*	Summer breeder	Least Concern
66	White-eared Bulbul	*Pycnonotus leucotis*	Resident	Least Concern
67	Red-vented Bulbul	*Pycnonotus cafer*	Resident	Least Concern
68	Rufous-fronted Prinia	*Prinia buchanani*	Resident	Least Concern
69	Plain prinia	*Prinia inornata*	Resident	Least Concern
70	Common Tailorbird	*Orthotomus sutorius*	Resident	Least Concern
71	Common Chiffchaff	*Phylloscopus collybita*	Winter visitor	Least Concern
72	Common Babbler	*Turdoides caudatus*	Resident	Least Concern
73	Jungle Babbler	*Turdoides striatus*	Resident	Least Concern
74	Crested Lark	*Galerida cristata*	Resident	Least Concern
75	Purple Sunbird	*Nectarinia asiatica*	Resident	Least Concern
76	House Sparrow	*Passer domesticus*	Resident	Least Concern
77	Sind Sparrow	*Passer pyrrhonotus*	Resident	Least Concern
78	White wagtail	*Motacilla alba*	Winter visitor	Least Concern
79	Yellow wagtail	*Motacilla flava*	Passage migrant	Least Concern
80	Paddyfield pipit	*Anthus rufulus*	Resident	Least Concern
81	Indian Silverbill	*Lonchura malabarica*	Resident	Least Concern
82	Baya Weaver	*Ploceus philippinus*	Resident	Least Concern

5.11.7 Mammals Recorded from the Project Area

232. Overall 21 species of mammals belonging to six orders, 12 families and 19 genera were recorded from the project area (Table 5-19).

Table 5-19: Mammals recorded from the Project Area

Sr. No.	Common Name	Zoological Name	Family	Order
1	Long-eared Hedgehog	*Hemiechinus collaris*	Erinaceidae	Insectivora
2	Kelaart's Pipistrelle	*Pipistrellus ceylonicus*	Vespertilionidae	Chiroptera
3	Yellow house Bat	*Scotophilus heathii*	Vespertilionidae	Chiroptera
4	Large Mouse-tailed Bat	*Rhinopoma microphyllum*	Rhinopomatidae	Chiroptera
5	Desert Hare	*Lepus nigricollis*	Leporidae	Lagomorpha
6	Five-striped Palm Squirrel	*Funambulus pennantii*	Sciuridae	Rodentia
7	Indian Crested Porcupine	*Hystrix indica*	Hystricidae	Rodentia
8	House Rat	*Rattus rattus*	Muridae	Rodentia
9	House Mouse	*Mus musculus*	Muridae	Rodentia
10	Little Indian Field Mouse	*Mus booduga*	Muridae	Rodentia
11	Short-tailed Mole Rat	*Nesokia indica*	Muridae	Rodentia
12	Balochistan Gerbil	*Gerbillus nanus*	Muridae	Rodentia
13	Indian Gerbil	*Tatera indica*	Muridae	Rodentia
14	Indian Desert Gerbil	*Meriones hurrianae*	Muridae	Rodentia
15	Asiatic Jackal	*Canis aureus*	Canidae	Carnivora
16	Common Red Fox	*Vulpes vulpes*	Canidae	Carnivora
17	Small Indian Civet	*Viverricula indica*	Viverridae	Carnivora
18	Small Indian Mongoose	*Herpestes javanicus*	Herpestidae	Carnivora
19	Grey Mongoose	*Herpestes edwardsi*	Herpestidae	Carnivora
20	Jungle Cat	*Felis chaus*	Felidae	Carnivora
21	Wild Boar	*Sus scrofa*	Bovidae	Artiodactyla

5.11.8 Observation Records of Mammals

233. Out of the recorded 21 mammals, 13 species were directly observed while 08 species were recorded on the basis of indirect evidences like tracks, body parts, faecal materials, nests and territory marking signs. Interviews with local residents, hunters and officials of wildlife and forest departments also confirmed the existence of these mammals (Table 5-20).

Table 5-20: Observation records of mammals in the Project Area

Sr. No.	Species Observed	Direct Observation	Indirect Observations				
			Tracks / Trails	Body parts/ Burrow	Territory marking signs/nest	Fecal material	Interviews with locals
1	Long-eared Hedgehog	✓	-	✓	-	-	✓
2	Kelaart's Pipistrelle	✓	-	-	-	-	✓
3	Yellow house Bat	-	-	-	-	-	✓
4	Large Mouse-tailed Bat	-	-	-	-	-	✓
5	Desert Hare	-	-	-	-	✓	✓
6	Five-striped Palm Squirrel	✓	-	-	✓	-	✓
7	Indian Crested Porcupine	✓	-	✓	-	-	✓
8	House Rat	✓	✓	✓	-	✓	✓
9	House Mouse	✓	-	✓	-	✓	✓
10	Little Indian Field Mouse	✓	-	✓	-	-	✓
11	Short-tailed Mole Rat	-	-	-	-	-	✓
12	Balochistan Gerbil	-	-	-	-	-	✓
13	Indian Gerbil	-	-	-	-	-	✓
14	Indian Desert Gerbil	-	-	-	-	-	✓
15	Asiatic Jackal	✓	-	-	-	-	✓
16	Common Red Fox	✓	-	-	-	✓	✓
17	Small Indian Civet	✓	-	-	-	-	✓

Sr. No.	Species Observed	Direct Observation	Indirect Observations				
			Tracks / Trails	Body parts/ Burrow	Territory marking signs/nest	Fecal material	Interviews with locals
18	Small Indian Mongoose	✓	-	-	-	-	✓
19	Grey Mongoose	✓	-	-	-	-	✓
20	Jungle Cat	-	-	✓	-	-	✓
21	Wild Boar	✓	✓	-	-	-	✓

5.11.9 Ecological Role of Mammals

Figure 5.22 Small Indian Mongoose

234. Every single species whether it is a plant or animal has a significant role in nature and plays its part in keeping the ecosystem in equilibrium. Among the recorded species of mammals some species are primary consumers, some are secondary consumers and some are scavengers and all have important role at their level to maintain the ecosystem. If a few pairs of house rat or house mouse or field mouse are allowed to flourish without any threat, their population may reach in millions within 2-3 year. Nature has deputed Jungle cat, Small Indian civet and other cats to keep hunting the rodents and limit their populations according to the needs of the ecosystem. Similarly, the mongooses are playing their part by limiting the populations of snakes, lizards and many insects. The role of Common red fox is also to keep the populations of different rodents within limits. Asiatic jackal and Wild boar are scavengers in the project area and hence responsible for removing the dead organic matter from environment and keeping it clean. The disturbances in the ecosystem we observe today are due to the fact that the ecological roles of a number of wildlife species has been taken by the human being which is unnatural and will end in the collapsing of the whole ecosystem. In other words, man is changing and replacing the God made natural system with an artificial system. However, the existing mammalian fauna in the project area is neither facing any threat from nature nor it will face from the project activities. Rather a few mammalian species like Indian crested porcupine, Asiatic jackal and wild boar are considered nuisance due to being agricultural pests.

5.12 Conservation Status of The Recorded Species

5.12.1 Conservation Status of Fishes

235. According to the IUCN Red List of Threatened Species (IUCN, 2025), none of the recorded fish species is threatened. All the eight species have been categorized as “Least Concern” with stable population trend. The conservation status of the recorded fish species is given in Table 5-21.

Table 5-21: Conservation status and population trend of the recorded fish species

Sr. No.	Zoological Name	Common Name	IUCN Status (2025)	Population Trend
1	*Channa punctatus*	Spotted Snakehead (Dola)	Least Concern	Stable
2	*Notopterus notopterus*	Bronze featherback (Pari)	Least Concern	Stable
3	*Mastacembelus armatus*	Spiny Eel (Balm)	Least Concern	Stable
4	*Cirrhinus mrigala*	Mrigal (Mori)	Least Concern	Stable
5	*Barilius modestus*	Indus Baril	Least Concern	Stable
6	*Labeo dyocheilus*	Ghora mach (Torkey)	Least Concern	Stable
7	*Labeo calbasu*	Karnataka labeo (Kalbance)	Least Concern	Stable
8	*Sperata seenghala*	Singhari	Least Concern	Stable

5.13 Conservation Status of Amphibians

236. According to the IUCN Red List of Threatened Species (IUCN, 2025), none of the recorded four amphibian species is threatened. All the recorded species have been categorized as “Least Concern” and all are having stable population trend (Table 5-22).

Table 5-22: Conservation status of the recorded Amphibians

Sr. No.	Recorded Amphibians	Zoological Name	IUCN Status (2025)	Population Trend IUCN, 2025
1	Indus valley toad	*Bufo stomaticus*	LC	**Stable**
2	Skittering Frog	*Euphlyctis cyanophlyctis*	LC	**Stable**
3	Southern cricket Frog	*Fegervarya syhadrensis*	LC	**Stable**
4	Indian Bullfrog	*Hoplobatrachus tigerinus*	LC	**Stable**

5.14 Conservation Status of Reptiles

237. Among the recorded 21 reptiles from the project area, three species of freshwater turtles are THREATENED with decreasing population trend whereas; rests of the 18 species are categorized as LEAST CONCERN with either increasing or stable population trend (IUCN, 2025), (Table 5-23).

Table 5-23: Conservation status of the recorded Reptiles

Sr. No.	Zoological Name	Common Ne	IUCN (2025)	Population Trend
1	*Lissemys punctata*	Indian flap-shell turtle	VU	Decreasing
2	*Hardella thurjii*	Common river turtle	EN	Decreasing
3	*Geoclemys hamiltonii*	Yellow-spotted mud turtle	EN	Decreasing
4	*Calotes versicolor*	Common Tree Lizard	LC	Stable
5	*Hemidactylus flaviviridis*	House gecko	LC	Stable
6	*Hemidactylus brookii*	Spotted barn gecko	LC	Stable
7	*Cyrtopodion scabrum*	Tuberculate ground gecko	LC	Stable
8	*Acanthodactylus cantoris*	Blue-tailed sand lizard	LC	Stable
9	*Eutropis dissimilis*	Striped grass skink	LC	Stable
10	*Varanus bengalensis*	Bengal monitor Lizard	LC	Stable
11	*Eryx johnii*	Common sand boa	LC	Stable
12	*Boiga trigonata*	Common cat snake	LC	Stable
13	*Lycodon striatus*	White-spotted wolf snake	LC	Stable
14	*Platyceps ventromaculatus*	Cliff racer	LC	Increasing
15	*Psammophis schokari*	Saharo-Sindian ribbon snake	LC	Stable

Sr. No.	Zoological Name	Common Ne	IUCN (2025)	Population Trend
16	*Ptyas mucosa*	Rope-snake	LC	Stable
17	*Spalerosophis diadema*	Blotched diadem Snake	LC	Stable
18	*Xenochrophis piscator*	Checkered keel-back	LC	Stable
19	*Bungarus caeruleus*	Common krait	LC	Stable
20	*Naja naja*	Black cobra	LC	Stable
21	*Echis carinatus*	Saw-scale viper	LC	Stable

5.15 Conservation Status of Birds

238. All the recorded 82 avian species fall into the “Least Concern” category according to the IUCN Red List of Threatened Species (IUCN, 2025). Most of the recorded species show stable or increasing population trends, while a few have decreasing population trends. None of the recorded birds is endemic to Pakistan.

5.16 Conservation Status of Mammals

239. According to the IUCN Red List of Threatened Species (IUCN 2025), all the recorded mammalian species have been categorized as “Least Concern”. Twelve species have a “Stable” population trend, three species have an “Increasing” population trend, three species have a Decreasing population trend, while the population trend of three mammalian species is “Unknown” (Table 5-24).

Table 5-24: Conservation status of mammals recorded from the Project Area

Sr. No.	Recorded Mammals	Zoological Name	IUCN Status (2025)	Population Trend (2025)
1	Long-eared Hedgehog	*Hemiechinus collaris*	LC	Unknown
2	Kelaart’s Pipistrelle	*Pipistrellus ceylonicus*	LC	Stable
3	Yellow house Bat	*Scotophilus heathii*	LC	Stable
4	Large Mouse-tailed Bat	*Rhinopoma microphyllum*	LC	Stable
5	Desert Hare	*Lepus nigricollis*	LC	Decreasing
6	Five-striped Palm Squirrel	*Funambulus pennantii*	LC	Decreasing
7	Indian Crested Porcupine	*Hystrix indica*	LC	Increasing
8	House Rat	*Rattus rattus*	LC	Stable
9	House Mouse	*Mus musculus*	LC	Stable
10	Little Indian Field Mouse	*Mus booduga*	LC	Stable
11	Short-tailed Mole Rat	*Nesokia indica*	LC	Stable
12	Balochistan Gerbil	*Gerbillus nanus*	LC	Unknown
13	Indian Gerbil	*Tatera indica*	LC	Stable
14	Indian Desert Gerbil	*Meriones hurrianae*	LC	Unknown
15	Asiatic Jackal	*Canis aureus*	LC	Increasing
16	Common Red Fox	*Vulpes vulpes*	LC	Stable
17	Small Indian Civet	*Viverricula indica*	LC	Stable
18	Small Indian Mongoose	*Herpestes javanicus*	LC	Stable
19	Grey Mongoose	*Herpestes edwardsi*	LC	Stable
20	Jungle Cat	*Felis chaus*	LC	Decreasing
21	Wild Boar	*Sus scrofa*	LC	Increasing

5.17 Species Of Special Concern

240. Some of the recorded faunal species are important from conservation point of view while some species are serious agricultural pests like porcupine, jackal and wild boar. Similarly, some of the recorded species are harmful like the venomous snakes and hence considered “Problem Species” or “Species of Special Concern”. A brief description about such species is given below.

5.17.1 Indian Flap-Shell Turtle (Lissemys punctata)

241. This freshwater turtle is found in rivers, canals, lakes and ponds. It as a medium sized turtle widely distributed throughout Pakistan and most common among all the eight freshwater turtles species found in Pakistan. It has a vital role in the aquatic ecosystem. Besides being omnivore, it also serves as scavenger for dead creatures and suspended organic matter in water. Through such scavenging activities, it helps in cleansing of the aquatic ecosystems and hence, controls the aquatic pollution biologically.

Figure 5.23 Indian Flap-shell Turtle (Lissemys punctata)

242. Like all other freshwater turtles, this species is also protected in Pakistan by legislation and listed on CITES Appendix I & II. Moreover, National Council for Conservation of Wildlife (NCCW), have imposed a complete ban on commercial export of all wild mammals and reptiles and all Provincial Wildlife Departments are directed to take timely action against illegal traders. In the China and other countries in the Far East, freshwater turtle meat is used as rich source of protein. There are also some myths that turtle meat and other body parts are aphrodisiac and have medicinal values. Such misconceptions are also a continuous threat for the all the freshwater turtles in Pakistan. During the field visits, neither the turtle hunting was observed nor did any person from the project area report such events in the area.

5.17.2 Common Krait (Bungarus caeruleus)

243. This snake belongs to the Family Elapidae that includes all deadly poisonous snakes. During the survey, one specimen was collected at one of the study site. This snake can easily be identified as its dorsal body color is jet black having narrow transverse whitish bunds usually in pairs. Ventral side of the body is white. This snake lives in holes and crevices in the ground, piles of cut vegetation, bricks and debris etc. It is a nocturnal snake and becomes active just after sunset until dawn. Its food consists of toads, frogs, snakes, lizards and mice.

Figure 5.24 Common Krait (Bungarus caeruleus)

This snake remains inactive during day time and usually do not bite even if it is disturbed. But at night, it is very active and can bite without any reason. Several cases of its bite have been reported even inside of the houses near its habitat. Its venom is neurotoxic and the victim must be given an anti-venom injection within half an hour. People do not spare this snake and

immediately try to kill it whenever it is seen. This snake has a wide distribution and its population is stable and it has been declared as LEAST CONCERN species by IUCN Red List of Threatened Species (IUCN, 2025).

5.17.3 Black Cobra (Naja naja)

244. Although this snake is a deadly poisonous snake but escape from this snake is easy. Whenever a person or an animal gets into its territory, it warns him through hissing sounds and rises up on its anterior portion and flattens its neck in the form of a hood. By this action this snake alerts the person entering its territory and gives the message to keep away from its territory. Its dorsal body color is usually darker while ventral side is clouded with dark. The black cobra inhabits dry wastelands where it lives in holes and crevices in uneven ground. In mountainous areas it lives in caverns and holes in rocks. It feeds on rodents, birds, snakes and lizards and often enters inhabited houses attracted by rodents.

245. Like other Elapid snakes, its venom is also neurotoxic and the victim must be given an anti venom injection within half an hour. People do not spare this snake and immediately try to kill it whenever it is seen. This snake has a wide distribution and its population is stable and it has been categorized as LEAST CONCERN species by IUCN Red List of Threatened Species.

Figure 5.25: Saw-scaled viper (Echis carinatus) (Photo Credit: dreamstime.com)

5.17.4 Saw-scaled Viper (Echis carinatus)

246. This snake belongs to Family Viperidae that includes all deadly poisonous snakes having haemotoxic venom. Although everyone in its distribution range is familiar with this poisonous snake but it is notorious for its secretive behavior. It keeps cool and calm therefore not easy to detect its presence. Its identification is not very difficult even for a common man. Its diet includes frogs, lizards, small snakes, birds, eggs and arthropods. It is a widely distributed snake and inhabits rocky, sandy and alluvial soils with vegetation varying from sparse to moderately dense grass and scrub. This snake is more fearful than other snakes in the sense it often pursues the intruder for some distance thus, causing fear in pedestrians. It can climb the branches of low bushes to avoid heat at the ground and invade nests. When on the defensive, it throws itself into characteristic figure-8-shaped loops. It is also known as Sidewinder snake because of its typical side winding locomotion on sand and on hard surfaces. It is nocturnal in feeding habits but during cooler weather it is sometimes found sunning in the open.

247. There are several myths regarding this snake like it is believed to jump 10-20 ft in air in order to attack its adversary. The most widely used local names for this snake are “Lundi”, “Pissi” and “Jalebi saanp”. It is also one of the prominent figures in folklore as “flying death of Rajputana” or “ghora mar”, a snake that can leap from sand and bite a man on a galloping horse. People do not spare this snake and try to kill it whenever they have a chance. This snake has a wide distribution and its population is stable and it has been categorized as LEAST CONCERN species by IUCN Red List of Threatened Species.

5.17.5 Indian Crested Porcupine (Hystrix indica)

248. Indian crested porcupine is commonly found throughout Pakistan and is an agricultural pest and damages different crops and orchards. In the absence of big carnivores like leopards in most of its distribution range, there is no natural predator of porcupine. Therefore, this species is enjoying a safe existence in the study area. Local farmers try to kill this pest whenever they have a chance. However, banks of different water channels and ruderal habitats along the bunds in the project area provide refuge, shelter and breeding grounds for this agricultural pest. This species has a wide distribution in Pakistan and its population is stable. It has been categorized as LEAST CONCERN species by IUCN Red List of Threatened Species.

Figure 5.26 Indian crested porcupine

5.17.6 Asiatic Jackal (Canis Aureus)

249. Asiatic jackal is a commonly found mammalian species through Pakistan. Occasionally it preys upon poultry around villages and dead chicken around the poultry farms. It is basically a scavenger and depends upon dead organic matter. Being a pest species it is disliked by villagers. Jackal is not facing any serious threat in the study area whereas some people consider it a serious pest and a problem species. Due to being “Haraam” it is not even hunted by any of the hunting parties and this species is enjoying a safe survival in the area. This species has a wide distribution in Pakistan and its population is stable. It has been categorized as Least Concern species by IUCN Red List of Threatened Species.

Figure 5.27 Asiatic jackal (*Canis Aureus*)

5.18 Social Profile of The Project Area

5.18.1 Disruption of Socio-economic Environment

- **Socio-Economic Setup Larkana District**

a) Overview

250. Sindh is the second largest province of Pakistan. The neighboring regions are Baluchistan to the west and north, Punjab in the north, Rajasthan (India) to the east and the Arabian Sea and Gujarat (India) to the south. The province forms the lower Indus basin and lies between 23º and 28º North latitudes and 66º and 71º East longitudes. It is about 579 km in length from north to south and nearly 442 km in its extreme breadth (281 km average). It spread over an area of 140,914 km².

251. Larkana District is located in the Division of Larkana, Sindh, Pakistan. A glance of the map of Sindh reveals that Larkana, from location point of view enjoys a strategic position. After Karachi it is largest city on the west bank of river Indus in Sindh. It lies on 27° 33' North latitude and 65° 16' East longitude. The city is located in upper Sindh at a distance of about 85 km south west of Sukkur.

252. Larkano was founded about 300 years ago by a tribe of Sindh called "Laraks" on the banks of the Ghaad Waah, which was dug at the behest of the Kalhora rulers, it had fruit and flower garden along it and in time settlers like the sailors from 'Laar' came and settled down here which got the place christened Larkana.

b) Administrative Setup of Larkana District

253. The administrative setup of Larkana District follows the general framework observed across other districts of Pakistan. The district administration is headed by the Deputy Commissioner (DC) of Larkana**,** who is supported by the heads of various departmental units. The DC is responsible for overseeing and coordinating the functions of all district departments to ensure effective governance.

254. Key departments operating in Larkana include district administration, judiciary, police, education, health, communication and works, agriculture, forestry, irrigation, telecommunication, livestock, and fisheries**.** Each department is led by a District Officer or Deputy Director, who is accountable for the performance and management of their respective sector.

255. In the judicial domain, the Deputy Director or District Officer is assisted by an Additional District Magistrate**.** On the revenue side, the administrative structure includes an Assistant Deputy Commissioner, who plays a key role in matters related to land revenue and related functions.

This coordinated setup ensures that the district's administrative machinery runs smoothly to cater to the needs of the residents of Larkana and support local development initiatives.

c) Population in Larkana District

256. Larkana has an estimated population of 1,784,453, with around 55% (986,302) living in rural areas and 45% (798,151) in urban centers. The district comprises 321,528 households, with an average household size of 5.55 persons, reflecting traditionally larger family units. The population is growing at a moderate annual rate of 2.11%. The population of the district is

presented in Table 5-25.

Table 5-25: Population (nos.) of District Larkana

Total Population	**1,784,453**
Rural	986,302
Urban	798151
Households	321,528

Source: Pakistan Bureau of Statistics. (2023)

5.19 Social Profile

5.19.1 Housing

257. Housing characteristics, including household size, ownership status, roofing, walls and assets, provide a holistic description of the overall well-being of the household. A description of household characteristics provides a snapshot of how the government can improve target housing conditions as per district-wise deprivations.

258. In District Larkano, 87.5% of the population owns houses, while 12.5% don't own their houses (9.9% rented) compared to 77.7% of the population in Sindh province who own their houses. According to MICS 2018 19, the average number of persons per room in Larkano is 4.4 compared 4.1 persons per room in Sindh. Similarly, the mean household size of District Larkano is 7.7 compared to the mean household size of 6.5 in Sindh.

259. 74.9% of households in Larkano have Pacca roofing compared to 70.7% of households in the province that have Pacca roofing. Similarly, 80.2% of households in Larkano have Pacca walls compared to 70.7% of households in the province that have Pacca walls. The ownership of housing is presented in Table 5-26.

Table 5-26: Ownership of Housing of District Larkana

Location	Own %	Rent %	Others/Missing% %
Sindh	77.7	14.9	7.3
Larkana	87.5	9.6	2.4

Source: Sindh District Profile-2021

5.19.2 Utilities

260. Access to basic facilities like clean drinking water, toilets and sanitation services provides a holistic supply-side service coverage in a district.

261. In District Larkano, 99.8% of households have improved drinking water sources compared to 96.0% households in Sindh having improved drinking water sources. In terms of access to sanitation services, 54.3% of households in Larkano have access to improved sanitation services compared to 65.9% of households in Sindh with access to improved sanitation services. The prevalence of open defecation in Larkano is 9.2% compared to 24.0% in Sindh.

262. To ascertain whether environment-friendly practices are adopted at the household level for cooking, heating and lighting, it is essential to gauge the prevalence of reliance on clean fuels. In District Larkano, 53.8% of the households rely primarily on clean fuels for cooking, compared to 50.2% of households relying on clean fuel for cooking in Sindh. 65.1%

of households in District Larkano rely primarily on clean fuels for space heating, compared to 30.2% of households in Sindh. The source of drinking water is provided in Table 5-27 and access to sanitation is presented in Table 5-28.

Table 5-27: Source of Drinking Water of District Larkana

Location	Basic Service %	Limited Service %	Unimproved %	Surface water %
Sindh	90.3	5.7	2.1	1.9
Larkana	99.7	0.1	0.2	0.0

Source: Sindh Districts Profile-2021

Table 5-28: Access to Sanitation District Larkana

Location	Basic Service %	Limited Service %	Unimproved %	Surface water %
Sindh	58.8	7.1	11.1	24
Larkana	51.3	2.9	36.5	9.2

Source: Sindh Districts Profile-2021

5.20 Health

263. District Larkano has a total of 32 government, departmental, private, and local bodies of hospitals with a capacity of 3,367 beds out of 648 hospitals in Sindh, with a capacity of 30,126 beds. Larkano has a total of 28 Basic Health Units (BHUs) with 56 beds out of 800 BHUs in Sindh with a capacity of 1615 beds. Larkano has a total of 5 Rural Health Centers (RHCs) with a capacity of 48 beds out of 133 RHCs in Sindh, with a capacity of 1703 beds.

264. District Larkano has a total of 229 Dispensaries with 12 beds out of 2996 Dispensaries with a capacity of 715 beds in Sindh. District Larkano has 8 TB Clinics with no beds out of 228 TB Clinics with a total capacity of 42 beds in Sindh. Larkano has 8 Mother & Child Health Centers (MCHCs) with 8 beds out of 227 MCHCs with 181 beds. Similarly, Larkano has 3 Maternity Homes out of 42 in the province. The list of health facilities are presented in Table 5-29.

Table 5-29: List of Health Facilities of District Larkana

Health facility name	Medical Centers	Beds
Basic Health Units (BHUs)	28	59
Rural Health Centers (RHCs)	5	48
Dispensaries	229	12
Government	29	4
Semi Government	7	8
Local Bodies	17	0
Private	176	15
TB Clinics	8	0
Government	8	0
Private	0	0
Mother and Child Health Centers (MCHC)	8	8
Government	0	0
Semi Government	0	0
Local Bodies	0	0
Private	8	8

Health facility name	Medical Centers	Beds
Maternity Homes (Government)	3	0

Source: Sindh Districts Profile-2021

265. Number of indoor patients served in District Larkano is 11,124 out of 744,618 indoor patients in the province. Similarly, the number of outdoor patients served in District Larkano is 1,443,580 out of 43,718,506 outdoor patients in Sindh. The patient record is presented in Table 5-30.

Table 5-30: Patient Record of District Larkana

Indoor Patients			Outdoor Patients		
Male	**Female**	**Total**	**Male**	**Female**	**Total**
5,496 (49%)	5,628 (51%)	11,124	603,266 (42%)	840,314 (5%)	1,443,580

Source: Sindh Districts Profile-2021

266. The number of patients per bed in District Larkano is 501, compared to 1,455 in Sindh. The number of patients per doctor in Larkano is 1,981 compared to 3,159 patients per doctor in Sindh. Patients per nurse in Larkano are 10,349 compared to 12,411 patients per nurse in Sindh. The total number of Government Medical, Nursing & paramedic staff is 763 in District Larkano out of 18,429 Government Staff in Sindh. The total number of Semi-Government Medical, Nursing & Para-Medical Staff is 78 out of 2,985 Semi-Government Staff in Sindh. The total number of Local Bodies Medical, Nursing & Para-Medical Staff in District Larkano is 108 out of 4,119 in Sindh. There are 1,294 reported Private/Missionary Staff in Larkano out of 15,051 in Sindh. The population served by doctor/nurse of district is presented in Table 5-31.

Table 5-31: Population served by Doctor/ Nurse of District Larkana

Patients Per Bed	Patients Per Doctor	Patients Per Nurse
501	1,981	10,349

Source: Sindh Districts Profile-2021

5.21 Education

267. District of Larkano has a total of 1,287 schools out of a total of 49,103 schools in the province of Sindh. Out of 1,287 schools, there are 193 schools for boys, 215 for girls, and 879 for mixed schools. The list of school numbers is presented in Table 5-32.

Table 5-32: List of Number of Schools in District Larkana

Location	Total	Boys	Girls	Mixed
Sindh	49,103	8,617	6,685	33,801
Larkana	1,287	193	215	879

Source: Sindh Districts Profile-2021

268. 1,287 schools in District Larkano have a total enrollment of 265,975, with 152,861 boys (57.5%) and 113,114 girls (42.5%). There are 4,755 male teachers (68.6%) and 2,172 female teachers (31.4%) in the schools in Larkano. The total number of rooms in 1,287 schools in Larkano amounts to 6,019, out of which 4,661 are classrooms. There are 1,123 functional schools in Larkano, while 164 schools are dysfunctional, non-functional, non-viable, or closed. The enrollment of students is reflected in Table 5-33.

Table 5-33: Enrollments of Students in District Larkana

Location	Boys	Girls
Sindh	2,812,000	1,749,140
Larkana	152,861	113,114

Source: Sindh Districts Profile-2021

269. Male literacy rate (15-49 years) in Larkano is 63.5% compared to 59% in Sindh, while the female literacy rate is 38.4% compared to 40.9% in Sindh. The literacy rate of the district is presented in Table 5-34.

Table 5-34: Male and Female literacy rate of District Larkana

Location	Male	Female
Sindh	59%	40.9%
Larkana	63.5	38.4

Source: Sindh Districts Profile-2021

5.22 MPI (Multi-Dimensional Poverty Index)

270. Multi-Dimensional Poverty Index measures the number of people/households that are 'multi-dimensionally' poor. Essentially, it means the number of people (or HHs) deprived in at least one-third of the weighted indicators (H), along with the weighted average number of deprivations poor people experience at the same time (A).

271. In District Larkano, the MPI value is 0.2, slightly lower than the average MPI Value of 0.25 in Sindh. The headcount of households that are multidimensional poor in Larkano is 41% compared to the headcount of 47% in Sindh.

272. In District Larkano, 16.8% of household members are vulnerable to poverty (i.e., deprived in one-fifth to one-third of weighted indicators). Similarly, 16.8% of household members are in severe multi-dimensional poverty (i.e., deprived in more than one-half of weighted indicators). The poverty index of district is presented in Table 5-35.

Table 5-35: Multidimensional Poverty Index of District Larkana

Location	M-Poverty Headcount 2018 (H)	MPI 2018	% Vulnerable to Poverty	% In Severe Poverty
Sindh	0.47	0.25	12.5	28.3
Larkana	0.41	0.20	16.80	16.80

Source: Sindh Districts Profile-2021

5.23 Economic Profile

5.23.1 Agriculture

273. Out of the area under cultivation for major crops, District Larkano contributes to 170,734 hectares (5.6%) out of 3,028,496 hectares in Sindh. In terms of the highest proportions of area under cultivation for major crops, Wheat, Rice, Mustard and Barley are at the forefront in Larkano, with 51,923 hectares. 107,599 hectares, 3,933 hectares and 2,085 hectares under cultivation, respectively in the district. Similarly, Wheat, Rice, Mustard and

Barley production is 165,887 M. Tons, 409,516 M. Tons, 4,626 M. Tons and 1,350 M. Tons.

274. The Irrigated Area in District Larkano is 26,608 hectares and the Un-Irrigated area is 22,802 hectares. Canals are the mode of irrigation for 18,878 hectares in District Larkano out of 1,287,845 hectares irrigated by Canals in Sindh (1.5%). Tube-wells are the mode of irrigation for 7,730 hectares in Larkano out of 361,199 hectares irrigated by Tube-wells in Sindh (2.1%). The crop production of the district is presented in Table 5-36.

Table 5-36: Crop Production of District Larkana

Crops	Area (Hectare)	Share in Acreage (%)	Productions (M.Tons)	Share in Production (%)
Bajra	0	0.0	0	0.0
Barley	2,085	30.7	1,350	33.7
Cotton (in bales)	1,576	0.3	7632	0.2
Gram	1,731	9.1	1673	9.3
Jawar	0	0.0	0	0.0
Maize	0	0.0	0	0.0
Mustard	3,933	8.1	4,626	9.1
Rice	107,599	13.0	409,516	14.4
Sesamum	1,173	11.8	572	12.9
Sugarcane	714	0.2	49,755	0.2
Tobacco	0	0.0	0	0.0
Wheat	51,923	4.8	165,887	4.6

Source: Sindh Districts Profile-2021

5.24 Livestock & Fisheries

275. The livestock head-count in District Larkano is 2,021,031 out of the total livestock count of 46,279,313 in Sindh (4.4%). District Larkano has 216,199 cattle, 531,329 buffaloes, 248,057 goats, and 889,812 poultry. Fish production in Larkano is 5,567 M. Tons out of 133,150 M. Tons in Sindh (4.2%). Larkano has a total of 1,803 fishermen out of 45,013 in Sindh (4.0%). Similarly, Larkano has 507 boats out of 7,215 boats in Sindh (7.0%). The livestock count of the district is presented in Table 5-37.

Table 5-37: Livestock Count of District Larkana

Livestock	Sindh	Larkana	Share of Larkana(%)
Cattle	6,925,022	216,199	3.1
Buffaloes	7,340,162	531,329	7.2
Sheep	3,958,508	52,237	1.3
Goats	12,572,221	248,057	2.0
Camels	278,424	608	0.2
Horses	44,999	521	1.2
Mules	19,512	107	0.5
Asses	1,004,925	82,161	8.2
Poultry	14,135,540	889,812	6.3

Source: Sindh Districts Profile-2021

5.24.1 Role of Women in Larkana District

276. In District Larkana, particularly in rural areas, women experience significant gender-based disparities across nearly all aspects of life. Literacy rates starkly highlight this inequality,

with women lagging far behind men in education an essential indicator of development. This gap is more pronounced in rural communities where female literacy remains critically low.

277. Despite limited rights, women in rural areas contribute substantially to household livelihoods, often working alongside their families. However, differences exist in mobility and work participation between Muslim and Non-Muslim women. Non-Muslim women are actively involved in agricultural labor throughout the crop cycle, from weeding to harvesting, and are directly compensated by farmers. In contrast, Muslim women typically only participate during harvest time and are otherwise less visible in the agricultural workforce.

278. Women's role in household and community decision-making is minimal. They are rarely consulted on critical matters such as marriage, children's education, property transactions, or social engagements. These decisions are predominantly made by the oldest male family member, reinforcing a patriarchal structure. Girls are often kept at home or involved in fieldwork and are usually married early, with exchange marriages being a common practice.

279. Women's contributions within the home and in agriculture remain unpaid and undervalued, severely limiting their economic independence and social status. Cultural norms, especially those discouraging interaction between men and women, further restrict women's access to markets and productive resources, thereby consolidating male control over all economic assets.

280. Overall, the socio-cultural and economic structures in Larkana's rural communities sustain gender inequality, leaving women with little autonomy and limited opportunities for personal or professional growth. The summary of concerns and suggestions of females are provided in Table-5-38.

Table 5-38: Summary of FGDs with Females

Concerns	Suggestions
• Local community women said that the bund construction has significantly enhanced flood protection in the area, effectively reducing the risk of water intrusion and safeguarding nearby communities and infrastructure. • Local community women shared that this project has the potential to bring prosperity to the area by creating job opportunities, improving infrastructure, boosting local economic activity, and enhancing the overall quality of life for residents. • Health and education facilities are missing in the area and road conditions is not good so many pregnant women have been died before reaching the hospital during pregnancy and delivery. • Agricultural land and houses falling within the right of way would be destroyed during bund construction. • They expressed concern that the community people may not be able to gain employment opportunities as preference may only be given to notables of the area.	• Local people should engage in employment in the area. • Health and school facilities should improve than life will be easier to access facilities in the area. • R.O plants should be installed in the area as local people can avail drinkable water. • Girls' high schools should be established in towns where girls can acquire quality education and control the dropout ratio. • Vocational institutes should be established at the district level where adolescent girls can get technical education and earn a handsome amount for their butter and bread.

Concerns	Suggestions
• It is very tough to cook on wood on hot days and rainy seasons, so many women face different diseases due to smoke. • They said that women were not treated well in the houses and were only responsible for chores and the care of livestock and children, but they were not involved in livelihood activities as they could earn some money to ease their lives.	

CHAPTER - 6: STAKEHOLDER CONSULTATION AND INFORMATION DISCLOSURE

6.1 Overview of Consultation

281. The purpose of holding consultations is to share relevant information on the project interventions including potential environmental and social, (positive and negative) impacts with stakeholders. Stakeholder consultation also presents an opportunity for mutual information sharing and dialogue between the project proponent and stakeholders. An effective public consultation provides concrete suggestions that can help aid in improving project design, resolve conflicts at an early stage, identify management solutions to mitigate potentially adverse consequences and enhance perceived positive impacts. Project Affected People (PAPs) and stakeholders are generally able to understand the implications of the project activities.

282. The present IEE/ RAP has been prepared by consultations with local communities, non-governmental organizations (NGOs) and concerned government departments/ organizations. This included Forest Department, Wildlife Department, Sindh Environment Protection Agency (SEPA), Irrigation Department, Revenue Department and Fisheries Department. These documents prioritize public consultation and participation in designing and implementing a socially and environmentally compliant project.

6.2 Identification of Stakeholders

283. Stakeholders are individuals or organizations with an interest in the proposed project or understanding that would provide insight into concerns or affect the decision-making related to the proposed project. Based on interest and role criteria, two types of stakeholders for the proposed project have been identified;

6.2.1 Primary Stakeholders:

284. Primary stakeholders are the entities directly affected by the project and the general public, including men, women, and children residing in the project area. These individuals are directly affected by the project's impacts, although they may not receive any direct benefits.

6.2.2 Secondary Stakeholder:

285. Secondary stakeholders are the people, departments, institutions, and/or organizations that may not be directly affected by the project however, they may influence the project, its execution and implementation. They include concerned departments that may have a role during various phases of the project, regulatory agencies such as Sindh EPA, Sindh Forest Department, Sindh Wildlife Department, Sindh Irrigation Department, other relevant departments such as Local Government Department, PDMA, Non-Governmental Organizations (NGOs), the broader interested communities including academia & journalists, and the general public.

The following public sector entities also fall under this category:

- Sindh Environmental Protection Agency (SEPA)
- Forest Department
- Wildlife Department
- Education Department
- Agriculture Department including Fishery
- Local Govt. and Rural Development Departments
- NGOs in the Project Area.

6.3 Consultation & Participation Process

286. The project utilizes various engagement methods as part of its continuous interaction with the project stakeholders. For the engagement process to be effective and meaningful, various techniques were applied that were specifically tailored to the identified stakeholder groups. For ascertaining the perceptions of different stakeholders about the project, consultations/ meetings were carried out at the different levels:

6.4 Preliminary Survey:

The project team carried out a preliminary reconnaissance survey on February 16, 2025, to assess the project area and gather essential baseline information for planning future activities. This visit helped identify individuals affected by the project particularly those experiencing land, crop, and housing losses and facilitated the collection of their contact details in preparation for the upcoming Public Consultation Meetings (PCMs) on both sides of the project area.

6.5 Public Consultation Meeting (PCM)

287. Public Consultation Meetings (PCMs) were held separately at Old Abad Bund on April 10, 2025. The primary objective of these meetings was to inform the local communities about the project's scope, objectives, and potential impacts and to gather their feedback, concerns, and suggestions. The consultation provided an important platform for community members to voice their opinions and helped ensure their concerns were considered in the project planning process. Detailed reports from the PCM has been shared in Annexure - III.

6.5.1 Consultation with Government Officials of Sindh Government

288. All relevant government officials and NGOs were invited to both Public Consultation Meetings (PCMs) through formal invitation letters, and their participation was confirmed upon receipt of the letters. Additionally, follow-up telephone calls were made to ensure their attendance and clarify any queries. While most invitees participated in the PCMs, a few government officials were unable to attend. To ensure their input was still captured, the project team proactively visited their offices to discuss the planned interventions, address concerns, and assess potential impacts on local communities and the environment. These one-on-one discussions helped maintain transparency, gather valuable feedback, and ensure that all key stakeholders remained informed and involved in decision-making.

289. During these meetings, government officials were briefed on the key aspects of the project, including its components, planned activities, and the associated environmental and social impacts. The discussions focused on the concerns and priorities of the project-affected persons (PAPs) and the proposed measures to address them. Key topics included local environmental challenges, the involvement of PAPs in resettlement planning, the grievance redress mechanism, and the development of an entitlement matrix for affected individuals.

290. Officials were also informed about the evaluation criteria for impacting buildings and structures, the methodology for determining compensation rates for land, houses, and infrastructure, and the broader compensation framework. The importance of ensuring transparency, fairness, and timely compensation and the role of affected communities in project implementation was emphasized. Socio-economic issues such as livelihood restoration, access to basic services, and community engagement strategies were also discussed. Table 6-1 presents the list of stakeholders consulted during the engagement process. A summary of participants, key discussion points, concerns raised, and suggestions provided is included in Table 6-2.

Table 6-1: List of Consulted Government Officials in Larkana

S.no.	Stakeholder	Designation	Department	District
1	Mr. Amir Jhatyal	Mukhtiyarkar	Revenue Department	Larkana
2	Mr. Abid Mugheri	Assistant Mukhtiyarkar	Revenue Department	Larkana
3	Mr. Ayaz Ali Bhutto	Deputy Director	Fisheries Department	Larkana
4	Mr. Asif Ali Bhutto	Director	School Education	Larkana
5	Mr. Asad Solangi	Deputy Director	Agriculture Extension	Larkana
6	Mr. Kareem Bux Mangrio	Range Forest Officer, Larkana	Forest Department	Larkana

Table 6-2: Feedback and Concerns of Government Officials

Concerns	Suggestions
• The livelihood activities of the locals would be affected. • Local people are not involved in employment opportunities in the area even contractor labor hire from other districts or province. • As the local communities are completely dependent on agriculture and livestock, hence these sources of income should be protected by adopting appropriate mitigation measures. • The topography of the area will be affected. • The vegetation of area may have affected during execution.	• To minimize the project's social adverse impacts on the existing communities, every effort should be made to uplift the social indicators of the area. • Community development work in area focusing lower class suffering from the enduring education, poverty, unemployment and social underdevelopment should be carried out. • Potable water resources should not be contaminated by proposed project activities • Community should be compensated if houses and lands are impacted during project. Compensation should be paid based on the replacement cost determined by market value and all national and international guidelines should be followed. • Effects monitoring of the proposed activities should be conducted during the execution of the protects to evaluation the adverse impacts • Client should initiate plantation at major area of the project. • Client should improve area infrastructure such as education, health, roads etc. • Measures should be taken to minimize the impact on flora and fauna of the area.

6.6 Consultation with Non-Governmental Organizational (NGO) Officials

291. The purpose of conducting consultation meetings with NGOs was to share the salient features of the project so that they could share their concerns and suggestions regarding the project. Since NGOs/CSOs are often involved with the community at the grassroots level, they have a better understanding of the community's concerns, and hence, their feedback is crucial for the formulation of the Initial Environmental Examination (IEE) and Resettlement Action Plan (RAP). The NGO representatives were requested to share their feedback regarding the project through the contact details provided by IEEC. Table 6-3 presents the list of stakeholders consulted during the engagement process. A summary of participants, key discussion points, concerns raised, and suggestions provided is included in Table 6-4.

Table 6-3: In-depth Interview (IDIs) with CSOs

District	Name of NGOs	Theme
Larkana	• HANDS • HAWA • SRSO • PPHI	• Working on Disasters • Working on Education and Health • Working on Housing Projects, Social Mobilization, Poverty Reduction, Infrastructure Projects

Table 6-4: Consultation with NGO/CSOs

Concerns	Suggestions
• Land and houses falling within the right-of-way in agriculture would be affected. They also expressed concern that the proponent would make false promises or raise false hopes among locals. • They expressed concern that the community people may not be able to gain employment opportunities, as preference may only be given to notables of the area. • The area's flora and fauna will be affected. • The local community will lose their houses and livelihood.	• Compensation should be provided to the project-affected people promptly and as per government rules. • A community should benefit by gaining employment in project-related activities. This will help reduce poverty in local areas. • Seminars and awareness sessions should be conducted regarding the negative aspects of burning wood. • Advised to respect local cultural norms and environment.

6.7 Consultation with Affectees (Primary Stakeholders)

292. Focus Group Discussion is a qualitative research tool to explore the meaning of survey findings that cannot be explained statistically. In the project context, focus group discussions (FGDs) and consultation meetings were conducted in villages or settlements within the study area to understand the villagers' socio-economic conditions and concerns about the project.

293. Google Earth was used to identify settlements that were lying within the study area. The coordinates were marked on the map and located on the field with the help of GPS tracking unit.

294. A project brief was developed, which included the salient features of the project along with a map, to familiarize stakeholders with the project's context. An authorization letter for

holding focus group discussions (FGDs) and consultation meetings was prepared by the local government for the field team. The authorization letter listed the names of the field team members and the purpose of the visit.

295. A field study team comprised of 3 males and 2 females. Females are responsible for conducting all female FGDs and consultation meetings, while males are assigned to all the male FGDs and consultation meetings. A brief orientation session for the field study team was held at Gambat prior to the commencement of fieldwork.

296. Before conducting the FGDs and consultation meetings in each village, the village elders are informed, and their consent has been obtained. The venue and timing for the FGDs and Interviews are then decided according to the convenience of the villagers. Following the discussion, participants will receive a brief introduction to the project's features. Photos are taken after obtaining consent from them. The field team transcribed notes on the discussion paper. Table 6-5 presents the list of primary stakeholders and s/villages consulted during the engagement process. A summary of participants, key discussion points, concerns raised, and suggestions provided is included in Table 6-6.

Table 6-5: Primary Consultation with Males

S.no.	Settlements/Village Name	Coordinates	Male / Female Participants	Union Council, Tehsil (Taluka)	District
Old Abad Bund					
1	Shadan Jatoi Goth	27°27'25.3"N 68°15'41.2"E	15/8	Fareedabad, Bakrani Taluka	Larkana
3	Nauabad Near	27°28'12.94"N 68°15'31.49"E	20/12	Fareedabad, Bakrani Taluka	Larkana
4	Mitho Khan Jatoi	27°28'34.5"N 68°15'07.8"E	15/7	Fareedabad, Bakrani Taluka	Larkana

297. In Old Abad Bund, 36 participants attended the 1st PCM, and 35 attended the 2nd PCM. The attendance sheets for both the 1st and 2nd PCMs are attached as Annexure.

Table 6-6: Summary of Consultation with Men

Concerns	Suggestions
• Local community men said that the bund's construction has significantly enhanced flood protection in the area, effectively reducing the risk of water intrusion and safeguarding nearby communities and infrastructure. • Local community men shared that this project has the potential to bring prosperity to the area by creating job opportunities, improving infrastructure, boosting local economic activity, and enhancing the overall quality of life for residents. • Community members expressed serious concerns about the potential loss of agricultural land due to the project. As farming is their primary source of income and livelihood, any destruction or reduction of cultivable land could severely impact their economic stability and food security. • Concerns were raised regarding the lack of inclusion of local labor in non-technical roles. It was noted that employment opportunities often go to individuals associated with influential or notable families rather than to local residents, leading to perceptions of favoritism and social exclusion. • The local communities highlighted that existing health facilities in the area are inadequate, both in terms of availability and quality. They recommended that the project proponent, in coordination with relevant government departments, ensure the establishment or enhancement of accessible and standardized healthcare services for the marginalized and vulnerable groups in the project area. • The community was concerned about potential resettlement issues, including lack of clarity on compensation mechanisms, relocation plans, and post-resettlement support. Communities emphasized the need for transparent, fair, and participatory processes to address any displacement or loss of assets.	• The local community was told to conduct a transparent and participatory land acquisition and compensation process, ensuring fair-market-value compensation for any lost agricultural land. • Crop compensation and other affected assets should be paid according to market rates. • They said that to ensure that resettled families have access to adequate housing, utilities, schools, and markets. And provide transitional support such as relocation allowances, temporary shelters, and food aid during resettlement. • Local labor should be considered 100% employment opportunities for technical and non-technical project-related activities. • Local cultural norms should be respected.

6.8 Response to Public Concern and Sharing Information with Affectees of the Project

298. The District Administration will carry out the final determination of land ownership, crops, and other assets. The study will identify and map different categories of land, the number of residential structures, and trees likely to be affected or submerged by various project components. However, accurate estimations will only be available after on-ground

verification and measurements are conducted by district officials in collaboration with local villagers and community elders (Jirga).

299. All findings and impact details will be formally presented to the Sindh Environmental Protection Agency (Sindh EPA), which is mandated to protect the rights and interests of affected persons per applicable environmental and social laws.

A summary of the major issues (at Old Abad Bund) is given below:

Table 6-7: Summary of the Major Issues at Old Abad Bund

Summary Table of Major Issues Old Abad Bund	
Issue Area	**Key Concerns**
Accurate identification of affected persons and assets	Community participation ensured all eligible individuals and assets were included for compensation.
Fair, market-based compensation	PAPs requested compensation based on current market rates for justice and effective recovery.
Local labour engagement	The community advocated for hiring local workers to boost employment and project support.
Unobstructed access during construction	Villagers requested uninterrupted access and construction of ramps or paths for safe movement.
Advance notice for relocation	PAPs are requested at least one month's notice before any relocation for adequate preparation.
Omission and correction of landowners	Initial exclusion of some landowners was identified and corrected through clarification and resurvey.
Accurate recording of joint land ownership	Joint owners' shares were verified and recorded to ensure fair compensation.
Submission of ownership documents	Landowners are submitting legal documents for verification and record-keeping.
Validation of land ownership	Official documents (e.g., Form VII) are being used to confirm and validate land ownership.

6.9 Some Gender Related Issues Raised During The 2nd PCM

300. The women expressed optimism that employment opportunities in the area would increase as a result of the project. They also mentioned that, following the construction of the bund, access to essential services such as healthcare and education would become easier. Improved infrastructure may lead to better transportation and mobility, enhancing the overall quality of life in the community.

301. The women emphasized that if their houses or lands are affected by the project, they should receive fair and timely compensation. They emphasized the importance of transparent procedures, proper asset valuation, and clear communication to ensure that any displacement or loss is handled respectfully and equitably. Special attention should be given to vulnerable

households to prevent economic hardship.

302. The privacy and safety of women must be respected at all times. Construction activities should be located at a reasonable distance from residential areas, particularly from the village, to minimize noise, dust, and intrusion. Proper barriers and signage should also be installed to prevent unauthorised access and ensure community comfort.

CHAPTER - 7: PROJECT IMPACTS AND MITIGATION ACTIONS

7.1 General

328. This chapter describes the potential impacts of the Project on the environmental and social setting of the project area. The chapter also outlines the proposed actions for mitigating the project's requirements.

329. IEE has been carried out in line with guidelines issued by the Sindh – EPA and JICA GL. The assessment has generally been based on the factual site condition, taking into account experience gained from similar projects and discussions held with local communities and knowledgeable individuals.

7.2 Project Area and Study Area (Area of Influence)

330. Before proceeding with the environmental analysis of the Project, it is essential to delineate the project area and the study area.

7.2.1 Project Area

331. The project area refers to the location that the Project will directly impact. It includes areas where major construction activities are planned for the project structures, as well as the construction of bunds, working yards, camps, borrow pits, quarries, and spoil disposal areas and the construction of access and haul tracks.

332. Strictly speaking, the project area is directly related to the circumstances in which land is to be acquired; people are affected, particularly in cases involving physical displacement or relocation. Likewise, the removal of vegetative cover for construction may also be considered a primary impact.

7.2.2 Study Area

333. Besides the project area referred to above, construction-related and subsequently, traffic-borne noise and air pollution may also affect areas at a considerable distance from the primary affected areas. The Project's construction and operational activities may have various direct and indirect effects on the physical, biological, and human resources of the project area and its surrounding environment. For the proposed Project, the study area will be up to 500 m[14] buffer zone from the bund area.

334. The study area depends on several factors related to environmental settings, types of resources, and project-related parameters. The situation becomes even more complicated when the indirect impacts are also taken into consideration. For example, game reserve areas or habitats located even at a relatively large distance from the construction areas may come under stress due to the increased number of visitors resulting from improved access conditions. Even noise levels may be disturbing to the wildlife. Similarly, it may enhance the benefits of archaeological and recreational sites due to an increase in the number of visitors.

[14] The 500-meter parameter (environmental impact for this project) reflects a pragmatic approach to impact mitigation in project design, guided by environmental monitoring data and engineering best practices rather than a nationwide regulatory threshold.

7.3 Impact Characteristics[15] (Assessment of Significance)

335. The assessment of effects and identification of residual significance take into account any incorporated mitigation measures adopted due to the impact of Project activities, and are largely dependent on the extent and duration of the change, the number of people or size of the resource affected, and their sensitivity to the change. Impacts can be both adverse and beneficial, and the methodology defined below has been applied to identify both the beneficial and adverse impacts of the Project.

336. The criteria for determining significance are specific for each environmental and social aspect; however, the magnitude of each impact is generally defined in conjunction with the sensitivity of the receptor. Generic criteria for defining magnitude and sensitivity are summarized below:

7.3.1 Magnitude

337. The assessment of magnitude will be undertaken in two steps. Firstly, the key issues associated with the Project are categorized as beneficial or adverse. Secondly, impacts will be categorized as major, moderate, minor or negligible based on consideration of the parameters such as:

- Duration of the impact;
- Spatial extent of the impact;
- Reversibility;
- Likelihood (something probable)

338. The magnitude of impacts will generally be identified according to the categories outlined in Table 7.1.

Table 7-1: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Minimal
Duration of the potential impact.	Long-term beyond the life span of the project.	Medium Term The lifespan of the project.	Limited to the construction period.	Temporary with no detectable potential impact.
The spatial extent of the potential impact.	Widespread far beyond the project's area of influence.	Beyond immediate project components, the project's area of influence.	Within the project's area of influence.	A specific location within the project's area of influence with no detectable potential impact.
Reversibility of potential impacts.	The potential impact is effectively permanent, requiring considerable intervention to return to baseline	The baseline requires a year or so with some interventions to return to the baseline.	Baseline returns naturally or with limited intervention within a few months	Baseline remains constant.

[15]Source: Handbook of Environmental Impact Assessment, Volume II, Judith Petts, 1999. Blackwell Science Ltd.

Parameter	Major	Moderate	Minor	Minimal
Legal standards and established professional criteria.	Breaches national standards and or international guidelines/ obligations.	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters.	Meets minimum national standard limits or international guidelines.	Not applicable
Likelihood of potential impacts occurring.	Occurs under typical operating or construction conditions (Certain)	Occurs under worst-case (negative impact) or best-case (positive impact) operating conditions (Likely).	Occurs under abnormal, exceptional or emergency conditions (occasional).	Unlikely to occur.

7.3.2 Sensitivity

339. The sensitivity of a receptor will be determined based on a review of the population (including proximity, numbers, and vulnerability) and the presence of strategic or sensitive features on the site or in the surrounding area. The criteria for determining receptor sensitivity are outlined in Table 7.2. Each assessment will define sensitivity about its topic.

Table 7-2:Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very High	The vulnerable receptor with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.
High	The vulnerable receptor with little or no capacity to absorb proposed changes or limited opportunities for mitigation.
Medium	The vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation
Low	The vulnerable receptor with a good capacity to absorb proposed changes and/or good opportunities for mitigation

7.4 Rapid Environment Assessment (REA) Checklists

340. A rapid environmental assessment of the project area was conducted, as outlined in Table 7. 3.

Table 7-3: Rapid Environmental Assessment (REA) Checklist

SCREENING QUESTION	YES	NO	REMARKS
A. Project Planning Is the project area adjacent to or within any of the following environmentally sensitive area?			
❖ Protected area		✔	There are no documented Protected areas within a 500-meter radius of the proposed project area.
❖ Wetland		✔	No wetland is present near the proposed project site. Lungh Lake (Lung

SCREENING QUESTION	YES	NO	REMARKS
			Lake) is the nearest, which is 23 km from the proposed project area.
❖ Mangrove		✔	There are no mangrove forests near Larkana. Mangroves in Pakistan are found exclusively along the southern coastline, particularly in the Indus River Delta region of Sindh Province, which is several hundred kilometers south of Larkana.
❖ Estuarine		✔	There are no estuarine areas near Larkana. Larkana is an inland district located on the west bank of the Indus River in Sindh province, far from the coastal zone where estuaries typically occur
❖ Buffer Zone of protected area		✔	Based on available environmental and official documentation, there are currently no formally designated buffer zones for protected areas specifically within or adjacent to Larkana district
❖ Special area for protecting biodiversity		✔	There are no documented Protected areas within a 500-meter radius of the proposed project area.
B. Potential Environmental Impacts Will the project cause.			
❖ Loss of precious ecological valves (e.g. rules of encroachment into forests / swamplands or historical / cultural buildings / areas, disruption of hydrology of natural waterways, Regional flooding and drainage hazards.		✔	Drigh Lake (a wildlife sanctuary and a Ramsar-listed site) and Langh (Lungh) Lake (a wildlife sanctuary) are important wetlands for migratory birds and other wildlife; however, even the nearest one, Langh (Lungh) Lake, is located approximately 23 km from the project site.
❖ Loss of archaeological, historical or cultural monuments?		✔	Mohenjo-Daro is a UNESCO World Heritage Site 18 km from proposed project area.
❖ Dislocation or involuntary resettlement of people?	✔		RAP will be prepared for IR
❖ Disruption/ destruction of tribal groups/ indigenous peoples?		✔	No indigenous people have been identified in the project area.
❖ Conflicts on water supply rights and related social conflicts?		✔	The Construction Contractor will make his arrangements for water during construction.
❖ Air pollution resulting from emissions of hydrocarbons from process equipment, accidents, inadequate equipment maintenance, and poor planning?	✔		Air pollution stems from hydrocarbon emissions caused by process equipment leaks, accidental releases, inadequate maintenance practices, and insufficient operational planning. During operations, scrubbers will be installed to regulate emissions within permissible environmental quality standards (SEQS), with regular maintenance to ensure their effectiveness. Third-party, EPA-certified monitoring will be conducted on a routine basis.
❖ Increased incidence of waterborne or water-related Diseases?	✔		During the construction phase, particularly in monsoon seasons.

SCREENING QUESTION	YES	NO	REMARKS
❖ Noise and dust from construction activities?	✔		The ambient noise level is expected to rise between 80-90 dB (A) due to construction activities, maintenance workshops, and the use of earthmoving equipment. To mitigate this, all stationary noise-producing equipment will be equipped with acoustic enclosures. During construction, there may be a brief increase in dust pollution, which will be mitigated through the use of environmentally friendly equipment and water sprinkling.
❖ Deterioration of water quality?	✔		Discharge of Untreated Sewage and Wastewater from work yard and camp areas.Leak Detection and Repair Programs & Develop and regularly update response plans for accidental releases. Train staff, communities, and worker in best practices for pollution control, resource management, and emergency response.
❖ Environmental problems arising from uncontrolled human migration into the area, made possible by access roads and transmission lines?		✔	Not envisaged that locals would be preferred for on-site non-skilled & semi-skilled jobs.
❖ Impediments to movements of people and animals?	✔		During construction, diversion will be made.
❖ Labor–related social problems, especially when workers from different areas are hired?	✔		Labour Management Plan will be prepared by the construction contractor .
❖ Public health and safety hazards due to air pollution and possible groundwater contamination	✔		Implementing scheduled water spraying and restricting heavy equipment movement to designated times effectively reduces dust emissions during construction.Dust generation is confined to a three-month excavation period and does not occur during the production phase. Additionally, a sour water stripper will be installed to facilitate wastewater reuse, thereby minimizing environmental impacts

A –Impacts and Mitigations during the Design and Construction Stage

7.5 Land Resources

341. This section explains how the proposed Project could potentially affect land resources through changes in land use, soil erosion, and contamination, and describes mitigation measures to manage these impacts.

7.5.1 Impacts on Land Use and Resources

342. A summary of the anticipated impact of the proposed project area is described in the tabular form below. A detailed discussion of these impacts is narrated in the subsequent section. .

7.5.2 Land Productivity and Use

343. Major considerations about the land productivity and use are as follows.

- It is envisaged that the need for borrowed material other than that acquired from excavated material will be very limited. This particularly applies to earth material. However, whatever the cause, it will result in the loss of some of the fertile plough layer, thus leading to a decrease in land productivity.

- Borrow pits and other landscape depressions, if left open, may prove hazardous to human beings, livestock, and wildlife. Moreover, impoundments of rainwater in open pits can pose a potential health hazard to both humans and livestock due to mosquito breeding and the pollution caused by water stagnation.

Mitigation Measures

344. The measures to be taken are given below.

- Project facilities, viz., construction camp and workshop, will be located at a minimum distance of 500 m from existing plantation, wildlife habitats, and settlements. This limit will be 1,000 m in the case of a concrete batching plant. If there are constraints to meet these conditions due to hilly terrain, the Contractor will consult the Engineer–in–Charge to resolve the matter. Before commencing construction activities, the Contractor shall submit a layout and location plan of the facilities to the Engineer-in-Charge for scrutiny and approval.

- Where the use of agricultural land is unavoidable for the borrowing of earth material, the top 30 cm of the plough layer will be stripped and stockpiled for redressing the land after the required borrow material has been removed. If deep ditching is carried out, the top 1 m layer of the ditch will be stripped and stockpiled. The ditch will initially be filled with spoil material from construction, then levelled with the stockpiled topsoil to match the rest of the area. It shall be ensured that the spoil does not contain any material that would contaminate soil or water resources.

- Transportation of excavated material out of the project area is uneconomical due to the long distances involved. Therefore, where possible, barren lands on slopes will be used for dumping excess excavated material.

- In case of access roads, drains will be constructed along the toe to prevent flooding on the carriageways and surrounding areas.

- The design will incorporate culverts/bridges in the road design to meet the drainage requirements of the area. Furthermore, these facilities will be regularly monitored and cleaning activities will be implemented during both the construction and operation phases to enhance the cross-drainage facilities of the area.

7.5.3 Soil Erosion

345. Significant excavation and slope cutting are expected from the Project to uphold level differences. Construction works may temporarily alter the natural ground surface grading, and

due to the instability of the topsoil surface, soil erosion may occur. Soil erosion may also occur during the construction phase in the Project area as a result of improper runoff drawn from the equipment washing yards and improper management of construction activities. Unmanaged material extraction at quarry areas may also cause soil erosion. While every effort will be made to minimize excavation by optimizing the use of existing contours, the cutting and filling operations may lead to erosion due to the loosening of topsoil. Excavation of soil may alter the topography and may also lead to soil erosion. Excavation may also result in the loss of top fertile soil. Apart from soil erosion, cut-and-fill designed channels mostly result in high risk and damage to bund stability. The majority of excavated spoil will be formed into consolidated embankments. These will need to be protected during the construction phase before being permanently stabilized for the long term.

Mitigation Measures

346. By adopting the following measures, impact would be finally of low significance:

- The stability of bund will be ensured by contractors by the provision of safe support structures wherever cuts and fills are vulnerable, or unstable, or not sustainable;
- Bund sides and embankments will be shaped to conform with slopes not exceeding 1 in 2 (26.6 degrees);
- Land clearance will be confined to the ROW;
- Avoid, wherever possible, clearing areas of highly erodible soils and steep slopes which are prone to water and wind erosion;
- Erosion control measures, such as ramming of topsoil immediately after excavation and silt controls, will be provided to minimize erosion.
- Construction work will not be carried out during heavy monsoon rains;
- Construction activities will be planned in a manner that minimizes the area of soil exposed during times of the year when the potential for erosion is high, for example, during summer when intense rainstorms are common.
- Keep vehicles/traffic/machinery on well-defined haul roads; Photographic record will be maintained for pre-project, during-construction and post-construction conditions of the sites;
- Monitoring during the project execution will ensure compliance with the above mitigation measures and their adequacy;
- The Contractor would prepare a material borrowing and disposal plan;
- Avoid cultivated fields for borrowing material to the extent possible;
- Obtain written consent of the landowner for material (soil) borrowing;
- Keep a photographic record (before, during, after) for borrow and disposal areas;

- Levelling of borrow sites;
- As far as possible, wasteland or natural areas with an elevation will be demarcated for borrowing earth material;
- The fertile topsoil will be removed with due care and preserved safely for reuse purposes;

7.6 Water Resources

347. This section explains how the proposed Project may affect the water resources of the Project area, consumptive and non-consumptive use of water during construction and operation phases, contamination of water bodies and groundwater, and alterations in drainage pattern, etc. The section also describes mitigation measures to manage these impacts.

7.6.1 Use of Local Water Resources

348. The project area's water resources comprise both groundwater and surface water. There will be a need for water during construction and 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 Canal. This impact will be of moderate significance

349. The results of the impact analysis regarding change in flow regime are summarised below.

Mitigation Measures

350. Mitigation measures regarding the use of local water supplies as follows:

- The Contractor, prior to the start of construction activities, will ensure the availability of water for campsite facilities and construction purposes. As per the Local Government Act, the Contractor will seek approval from the Local Government for the exploitation of the water resources.
- Use of groundwater by the Contractor will be monitored and controlled by the supervising consultant
- 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.

7.6.2 Contamination of Surface and Ground Water Resources

351. The water resources, both surface and subsurface, may be polluted from hazardous construction materials, wastewater effluent, solid waste, silt from construction and soil erosion, etc. 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:

352. Implementation of the Project may aggravate the pollution of both surface and subsurface 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.

353. 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.

Mitigation Measures

354. By adopting following measures, impact would be finally of low significance:

- 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 any drain, soak or waterway. Similarly, the wastewater effluent from the campsite will be treated before disposal.

- 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.

- 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 will be at a safe distance from the water body or their functional Distributaries.

- No washing of vehicles will be done in or near the already functional distributaries/ water courses.

- To overcome the drinking water contamination issue, at the construction camp/s, the contractor shall install a solar-operated domestic water filter/150GDP with Ultraviolet (UV) to ensure safe and healthy drinking water for the workforce.

7.7 Physical Resources

355. This section discusses the impact of construction and operation on ambient air quality and noise levels within the project area. It also describes the mitigation measures to manage these impacts.

7.7.1 Impact on Air Quality

356. Dust**:** The activities that potentially contribute to air pollution include the construction of bunds and allied structures, the construction of access roads, and earthwork, all of which are expected to generate dust impacts.

357. All construction sites will potentially produce fugitive dust from material storage areas, waste dump sites, concrete mixing, excavation, and general site usage, especially under prevailing wind conditions. Areas most vulnerable to dust generation are temporary construction sites and other locations where surface soil is disturbed. A potentially important dust source is the temporary batching plant, where concrete is mixed in bulk for distribution to construction sites. Due to the sparse nature of settlement in this area, site management measures will be primarily needed at construction sites located near village areas. In these areas, the Contractor shall be required to include all necessary measures to reduce air pollution and dust development that would impact public health.

358. Gaseous Air pollution: Construction machinery, diesel generators and project vehicles will release exhaust emissions containing carbon monoxide (CO), sulphur dioxide (SO_2), oxides of nitrogen (NO_X), and particulate matter (PM_{10}). These emissions can temporarily affect the ambient air quality at the project site and along the haulage roads leading to the site. However, overall, the impact will be moderate to negligible in significance.

Mitigation Measures

359. Presently, the air quality of the Project area is good and within the required limits of SEQS and IFC/WHO guidelines. To reduce airborne dust emissions in the construction area resulting from material transport and construction activities, provisions will be made for sprinkling water in areas where earth filling and excavation are being carried out. It will be ensured that the construction debris is removed daily. All construction-related impacts could be mitigated by adopting sound environmental practices during construction. By adopting the following measures, the impact would have negligible significance:

- The fitness certificate must be produced by the Contractor to avoid unacceptable emissions. CO and smoke emission & noise monitoring tests will be carried.
- Proper PPEs should be issued to the site workers and measures should be adopted to ensure that the workers will wear the PPEs properly when working on-site.
- The plant must be a zero-emission plant installing a new plant/ computerized and automatic plant. This will include using washed aggregated and enclosed cyclones with an automatic injection system of the material into the mixing chamber.
- The plant area should be constructed and maintained on an impermeable layer to prevent contamination of water bodies from surface runoff.

360. The possibility of excessive dust generation can be reduced by adopting best construction practices, including precautions such as periodic watering, covering of construction materials, and the use of low-emission equipment during construction.

- During windy conditions, stockpiles of fine material will be wetted or covered with plastic;

- Take dust suppression measures, such as promptly watering exposed areas when visible dust is observed.
- Implement a program for sprinkling water on access roads used for the movement of construction machinery, equipment, and labour.
- In no case will loose earth be allowed to pile up along the approach roads;
- Any temporary concrete batching plant(s) to be located more than 500m from any dwelling place and should be equipped with 2m high dust curtains on the perimeter fence. All dust suppression measures listed above will also apply to batching plants.
- Ensure that all vehicles and machinery are fitted with appropriate emission control equipment, maintained properly and serviced according to the manufacturer's specifications;
- Fit and maintain appropriate mufflers on earthmoving and other vehicles on the site;
- Smoke from internal combustion engines will not be visible for more than ten seconds;
- Idling of delivery trucks or other equipment will not be permitted during periods of unloading or when they are not in active use;
- All vehicles and other equipment used during construction will be properly and regularly tuned and maintained;
- All permanently deployed vehicles' exhausts will be monitored against SEQS/ WHO;

7.7.2 Noise Pollution

361. During the baseline survey, the recorded ambient noise level was found to be below the acceptable limit of 75 dB (A). When project activities begin, the existing noise level will likely be amplified. The major sources of noise pollution during construction activities include slope cutting, excavation, loading, transportation, loading and unloading of materials, and operation of construction equipment.

362. The vibrators used for concreting also produce noise. The amplified noise levels will be temporary and easily mitigated. At most construction sites, there are no major sensitive receptors, except for some native reptiles that may inhabit the proposed sites. Schools and Basic Health Units do not fall within the right-of-way (RoW) of the bund and are at a reasonable distance from the construction site. There will be insignificant impact on schools. The hospitals are at a safe distance from the construction camps, and there would be no noise issues.

363. Noise will be generated from vehicular movement, excavation machinery, concrete mixing, and construction activities during the construction phase. The sources of noise during construction will include excavators, generators, a concrete batching plant, and other construction machinery and vehicles. Increased noise and vibration levels during construction

activities can be a nuisance for locals and a disturbance to wildlife.

Mitigation Measures

364. Enhanced noise levels will be prevented and mitigated through careful planning of machinery operations, the use of low-noise equipment, and scheduling operations only during the daytime to reduce these levels. Though the impact of noise may be of a temporary nature, the following measures shall be considered and implemented:

- The Contractor shall provide equipment only of the size and power required to complete each task.
- The Contractor shall plan their operations to be completed preferably based on a six-day working week from 8:00 a.m. to 6:00 p.m., including road haulage of materials. Should the Contractor require additional working hours or weekend work, he shall) Submit a request to the supervising consultant for permission to work extended hours, providing full reasons for the request. Approval to such requests will not be granted for works within 200m of sensitive receptors.
- The Contractor will regularly monitor noise levels at sensitive receptor sites to ensure that they do not exceed ambient levels by more than 5 dB from ambient level. In such an eventuality, contractors will adopt appropriate noise attenuation measures to reduce noise generation from construction activities and utilize noise barriers to mitigate the impact.
- Construction activities near any school or medical center will be scheduled to coincide with school vacations or long holidays.
- High noise emitting equipment, if any, will be fitted with noise reduction devices such as mufflers and silencers wherever possible;
- For the protection of construction workers, earplugs would be provided to those working very close to the noise-generating machinery;
- High noise emitting equipment, if any, will be used during regular working hours to reduce the potential of creating a noise nuisance during the night. Regular inspection and maintenance of the construction vehicles and equipment will be carried out;
- The Contractor shall notify potentially affected people and communities before undertaking noisy work activities and reach an agreement on temporary noise mitigation measures for sensitive receptors.

7.8 Biological Resources

365. The impact on flora and fauna and corresponding mitigation measures are described in the following paragraphs:

7.8.1 Impacts on Flora and Fauna

a) Flora

366. According to the IUCN Red List of Threatened Species (IUCN, 2025), none of the recorded 48 plant species is threatened. Fruit trees like mango, date palm, common fig, mulberry, babool, eucalyptus, guava, sharein, shisham, pomegranate, sidr (ber) and citrus trees are found mostly in agricultural lands and cultivated by local farmers under agro-forestry. Other than orchards of these fruit trees, the farmers do not like these trees in agricultural fields due to being shady trees that affect their cash crops like maize, wheat, rice and vegetables. Therefore, such trees were usually found around common lands and along the paths in the study area.

367. Wild trees like mesquite, wild fig, sidr (*Ziziphus nummularia*) and Khaggal (*Tamaryx dioca*) are usually found in the wild lands like sandy plains and dried river bed in the project area. Among these trees, *Tamaryx dioca* is a commonly found tree in the river bed and banks of the river, and also along wild lands in the project area. Similarly, mesquite (*Prosopis juliflora*) the other commonly found wild tree in the project area is considered a nuisance by local residents because of its long and hard spines. Other wild trees are either rarely found or do not attain much height because the cutting of wild trees for fuel wood is a common practice in the area. This habitat represents totally wild plants including trees of moderate height, shrubs, herbs and grasses. All the plant species are plentiful and commonly found in this habitat. Therefore, the project activities will not have any negative impacts on flora of this part of the proposed bunds.

368. Ruderal habitats in the project area mainly comprise of old bunds that provide shelter, refuge and cover to several reptilian and mammalian species. Flora around this type of habitat comprises some shrubs like Calotropis procera, Capparis decidua, and herbs like *Citrulus colocynthis* and grasses like *Saccharum bengalense*, *Cynodon dactylon*, etc. This habitat also hosts some wild trees like Mesquite (*Prosopis juliflora*) and Gazz (*Tamaryx dioca*) and some cultivated trees like Safeda (*Eucalyptas lanceolatus*). Reconstruction of these bunds will not involve cutting down trees.

Mitigations

369. The Forest Department will undertake the replanting with the ratio of 1:5. Activities will be coordinated with the Irrigation Department's representative (s) during favourable planting seasons. The Forest Department will be responsible for care and maintenance until the end of the Contract. After that, the plantation will be handed over to the Sindh Irrigation Department.

370. The tree species will be selected by the Contractor in consultation with the Forest Department, taking into account the soil feasibility and water conditions of the project area, as well as their ability to serve as windbreaks.

371. The Forest Department will provide care and maintenance for all replanted areas as follows.

- Personnel will be assigned to care for and maintain the plants.
- The survival count will be conducted by the Forest Department at the end of the dry season following planting.

- The Forest Department will replant the same species if any plant is found to be damaged, withered, or dead.

b) **Fauna**

i) Mammals and Reptiles

372. The impact on mammals and reptiles will include the following.

- All the recorded species of mammals from the project area have “Least Concern” status according to IUCN Red List of Threatened Species. Three species, the porcupine, Wild boar, and Asiatic jackal, are considered pest and problem species as they damage poultry and agricultural crops. With an increasing population trend (IUCN, 2025), these pest and problem species are flourishing in Pakistan and pose no threat; rather, they have become a nuisance for local communities. The continuous increase and range extension of these species are due to the fact that neither are they hunted for meat purposes nor do they have any natural predators, such as the Common leopard and the Indian wolf.

- Some species, such as the Small Indian mongoose and the Grey mongoose, have adapted to live in close proximity to human habitations due to the easy availability of food. Being potential enemies of snakes, mongooses are considered human-friendly in the project area. It was found that at some places, people feed and keep these animals as pets. So, mongooses, being human-friendly, do not pose any threat in the study area and are enjoying their safe survival.

- All the snakes and lizards reported from the project area have been categorized as of Least Concern by the IUCN. The construction of bunds will not have any negative impacts on these creatures; rather, these bunds are a potential source of shelter, cover, and refuge for reptiles like lizards and snakes. From an ecological point of view, snakes and lizards may be disturbed during the construction phase of bunds, but this disturbance will be limited in time. The animals under such circumstances retreat to adjacent, similar habitats and return to the same habitats when the disturbance is over.

- Due to the establishment of labor camps, food storage, and the setting up of kitchens, the production of sewage and wastewater may result in the multiplication of rodents, such as rats and mice, as well as vectors like mosquitoes, bugs, and flies, which will have a negative impact.

ii) Birds-Avian Fauna

373. Birds will try to find shelter and food elsewhere and tend to move away from the project area due to the activities mentioned above, fearing they will be hunted or trapped.

374. The proposed project will not have any negative impact on migratory birds, as these birds have so many options to spend the winter season in the southern parts of Sindh. But the project may have negative impacts on resident birds through habitat loss and the displacement of birds. The project activities like infrastructure installation, vehicle movements and other anthropogenic activities especially during construction phase may disturb the resident avian fauna.

375. The permanent project activities could potentially deter some birds from using that site and its surroundings and thus effectively resulting in a disturbance impacts that will ultimately lead to the displacement of some of the bird species.

iii) Aquatic Fauna

376. There is no commercial fishery in the area. Even traditional anglers do not exist. However, some fishing activities are carried out for household use and recreational purposes.

iv) Amphibian Fauna

377. Four species of amphibians were recorded from the study area, all of which are Least Concern species with stable population trends, according to the IUCN Red List of Threatened Species (IUCN, 2025). The same four amphibian species have also been reported from plains areas in the Sindh, Punjab, and Balochistan provinces. With a vast distribution and being commonly found, these species are unlikely to face any serious threats from the proposed project activities.

378. Three freshwater turtles have been recorded from the project area, and the allee turtle has been classified as Threatened by the IUCN (IUCN, 2025). These include: Indian Flap-Shell Turtle (*Lissemys punctata*), Common River Turtle (*Hardella thurji*i), and Yellow-Spotted Mud Turtle (*Geoclemys hamiltonii*). Although these three species are threatened, they have a wide distribution range throughout the river system in Pakistan. They can commonly be seen along paddy fields, rivers, canals, lakes, and ponds throughout Pakistan's plains.

Mitigation Measures

i) Mammals and Reptiles

379. Mitigation measures include the following.

- The construction of the proposed bunds does not pass through any wetlands, canals, or distributaries. Therefore, the proposed project will not affect the habitats of the jungle cat and other small, medium-sized, and large mammals; hence, it will have no negative impacts on the mammalian fauna of the project area.
- The construction of bunds will also be beneficial to mongooses by creating new habitats for them. The jungle cat, also known as the swamp cat or reed cat, is typically found in association with wetlands, swamps, littoral and riparian areas with dense vegetation.
- Hunting, poaching, and harassment of wild animals will be strictly prohibited, and the Contractor will be required to warn its labor accordingly through the Code of Conduct and TBT.
- Noise-generating activities will not be carried out during the night.
- Camps will be located at least 500 meters away from the nearest wildlife area and its source of food and water.

- The camps will be properly fenced and gated to prevent the entry of wild animals in search of edible goods. Similarly, waste from the camps will be properly disposed of to prevent it from being eaten by wild animals, as it may be hazardous to them.

ii) Birds

380. Mitigation measures include the following.

- There are a number of alternate and adjacent habitats to accommodate the displaced birds. Secondly, all the recorded birds in the project area are very common and listed as Least Concern by IUCN Red List of Threatened Species (IUCN 2025). Thirdly, most of the recorded birds are farmer-friendly and remain in close proximity to human habitations. The construction and post construction activities of the proposed project may certainly cause the displacement of some of the birds. But there are security zones for animals and birds where they shift during any disturbance and adapt accordingly.

- Similarly, the learning process among birds is very fast and they can adapt themselves with the changing environment, habitat and climatic conditions. Any alteration in the existing habitat is well noticed by the birds and soon they adapt accordingly and learn how to avoid such negative factors. Therefore, the resident birds have the ability to adapt according to the changing environment whereas; migratory birds have so many safe and suitable options to land and spend the winter season. Hence, the effects of disturbance and displacement can be neglected.

- Staff working on the Project should be given clear orders not to shoot, snare, or trap any bird.

iii) Freshwater Turtle

381. The proposed project in the project area is expected to have no negative impacts on the existing populations of these freshwater turtles. Rather, the construction of bunds will create new ruderal habitats with equal opportunities for all reptilian and mammalian species to occupy these newly developed habitats. Secondly, freshwater turtles are not gill breathers like fish and are not entirely aquatic creatures; rather, they are lung breathers and semiaquatic animals that also require a terrestrial component as part of their habitat. The construction of bunds will enhance the existing habitats of freshwater turtles along the western bank of the river. The real threat to these freshwater turtles is from their live trapping and poaching for their illegal trade

7.9 Human Resources

382. This section describes the impacts of the proposed Project on local communities, construction workers Indigenous and vulnerable people, as well as on structures and sites of cultural and religious significance.

7.9.1 Identification of Social Impacts

303. This resettlement and livelihood loss impact assessment is conducted based on the

demarcated boundaries of the sub-project sites and the proposed design. All affected structures and assets in the sub-project areas have been assessed and the owners/ occupiers present and willing to these affected assets have been enumerated and interviewed to finalize the inventory of losses, determine title/ ownership and assess the socio-economic status of the Project Affected Persons (PAPs) and Affected Households (AHs).

304. The following type of social and resettlement aspects are associated with both Flood Protection and Dike Improvement on Indus River (Larkana District, Sindh), for which this impact assessment has been carried out: Identification and compensation for PAPs falling under the sub-project areas in line with their assets present in the sub-project areas

7.9.2 Assessment of Impacts

305. The Resettlement and Assets Inventory Survey for Old Abad Bund was a foundational step in ensuring that the proposed interventions' social and economic impacts were properly identified and addressed. The survey aimed to document the assets, livelihoods, and socio-economic conditions of individuals and households likely to be affected by project activities, including land acquisition and construction-related displacement. Detailed fieldwork was conducted at both bund sites in April 2025, encompassing permanent structures, temporary shelters, agricultural land, religious structures, and community infrastructure.

306. All affected land and structures within the highlighted boundaries, based on the resettlement impacts, were enumerated, and the inventory of losses (IOL) was finalized through a detailed social impact assessment. Additionally, the owners/ occupiers of such impacted land, structures, and business places were enumerated and interviewed to assess the socio-economic status of the PAPs and AHs. Discussions with the local community and the general public were carried out during field surveys and continued during this impact assessment, census, and socio-economic survey to inform the preparation of this RAP.

307. Based on a detailed census survey, it was concluded that the following number of households and structures would be affected through the sub-projects:

308. Compensation costs related to resettlement will be incurred; however, since the occupant does not own the land, no land acquisition cost will be incurred. There is 1 handpump subject to resettlement. Since it is community-owned asset, only resettlement costs will be incurred. Since there is no private land within the ROW, land acquisition will not be required. The breakdown of compensation type is given below.

7.9.3 Old Abad Bund

309. According to the detailed asset assessment from the Old Abad Bund Assets Survey Data, there are 5 residential structures subject to resettlement. Compensation costs related to resettlement will be incurred; however, since the occupants do not own the land, no land acquisition cost will be incurred. Land acquisition applies to private land within the ROW (7.72acres) and does not apply to government land. If the land is used for agricultural purposes, compensation for crops will be provided regardless of whether it is government land or private land. No compensation will be provided for government land that is classified as barren land.

310. Notably, no commercial structures were found during the survey, highlighting the locality's primarily residential and agricultural nature, with limited economic or institutional development (refer to Table 7-4). These findings are instrumental in informing resettlement planning, infrastructure development, and compensation frameworks for affected stakeholders.

Further details of the structures and the areas where these were encountered are provided in the RAP report.

Table 7-4: Summary of Identified Structures during RAP at Old Abad Bund

No.	Type of Compensation	Land Type / Asset	Ownership Type	House hold	Area	Remarks
1-1	Land Acquisition	Agricultural Land	Private	6	2.62 (acres)	Subject to both land and crop compensation
1-2		Barren Land	Private	2	5.10 (acres)	Crop compensation not applicable
2-1	Crop	Agricultural Land	Private	6	2.62 (acres)	Same as above
2-2		Agricultural Land	Government	4	0.72 (acres)	Land acquisition is not applicable for gov. land
3	Resettlement	Residential Structures	Government: 4 households Other's Private: 1 household	5	3,817 (sq ft)	Since the land does not belong to them, land acquisition is not required.

7.9.4 Socio-economic Impacts

311. The construction activity would involve people of the labor class frequenting the area for the entire length of the construction period. Individuals who closely identify with a particular set of cultural values tend to reside in the surrounding residential area. Given that the area is part of a rural setting, it is quite uncommon for residents to experience and easily adjust to the presence of outsiders in their area for any extended period. The significance of the impact is considered moderate.

7.9.5 Sensitive Receptor

312. Socially Sensitive receptors along the proposed project have been depicted in Figures 7.1.

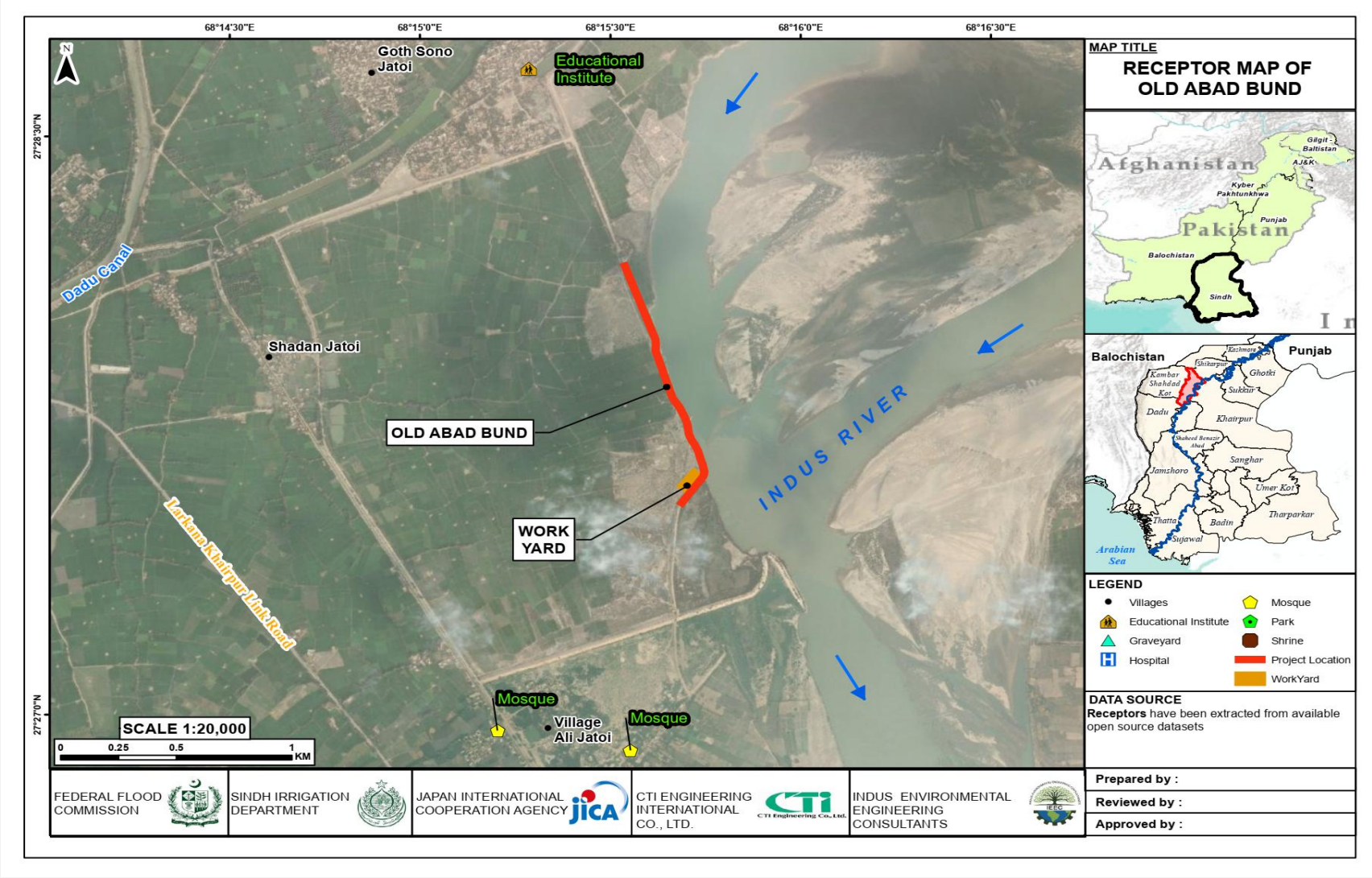


Figure 7.1: Sensitive Receptor of Old Abad Bund

Mitigation Measures

313. By adopting the following measures, the impact would be of low significance:

- If people from outside the area are involved in the construction or operation of the project activities, this may result in cultural conflicts with the local communities. Therefore, it is imperative to engage the local workforce as much as possible and also develop and implement a strong community communication and participation plan;

- The Contractor will develop a construction camp management plan to manage labour and other construction camp-related issues. The Contractor would be liable to engage at least 50% of its required (unskilled) labor force from within or around the project area.

7.9.6 Gender Issues

314. Rural women actively participate in various outdoor socio-economic activities, including livestock rearing, working in crop fields, and collecting drinking water. Their privacy may suffer due to the project activities. Moreover, it will hinder the mobility of local women in their work, such as working in the field, herding livestock, bringing drinking water, and picking firewood. The induction of outside labor may create social issues due to a lack of awareness of local customs and norms.

Mitigation Measures

315. Mitigation measures regarding gender issues include the following:

- The Contractor will need to select specific timings for construction activities, particularly near settlements, to minimize disturbance to the local population, especially women, considering their peak movement hours.

- The Contractor will need to conduct the construction activities in a manner that does not interfere with the open field latrine usage timings of the local community, particularly women. The normal times for rural women to use the toilet facilities are early in the morning and late at night. The Contractor will limit construction works to between 8 am and 6 pm if it is to be carried out in or near settlements.

- The Contractor will take due care of the local community, and sensitivity toward local customs and traditions will be encouraged. The contractor will strictly warn the staff not to be involved in any unethical activities and to comply with local norms and cultural restrictions, particularly those related to women.

- During construction activities, if the privacy of nearby households is affected, the Contractor will inform the house owners to make some 'parda' arrangements.

7.9.7 Gender Base Violence (GBV), Sexual Exploitation and Abuse (SEA)/Sexual Harassment (SH)

316. Although the influx of workers will be minimal as discussed earlier, new workers

(outside of their social spheres) may form close social relationships with local communities. This can lead to unacceptable and/or illegal behavior, ranging from unwanted aggressive advances, SEA/SH against women and children.

Mitigations related to GBV/SEA/SH

317. As part of the mitigation strategy, training/orientation sessions will be conducted to sensitize Project Implementation Consultant (PIC) and the Contractor's staff/workers on the importance of addressing GBV/SEA/SH risks at the project level. The contractor will be required to have a written contract with their workers materially consistent with the objective of JICA GL, following the procedures as specified in the Procurement Regulations. The workers will be required to sign a Code of Conduct (CoC) prepared by the Contractors and reviewed and approved by PIC.

7.9.8 Safety Hazards

318. The occurrence of accidents and incidents during construction activities, particularly those related to excavation, is a common phenomenon. The Safety of the general public residing close to excavation work will particularly be at stake. The local people, particularly the children and women, may get injuries or even fatalities. Contractor staff who work with heavy machinery are at risk of sustaining injuries.

Mitigation Measures

319. Mitigation measures regarding the safety hazards will include the following:

- The Contractor will ensure the provision of medical services, medicines, first aid kits, and a vehicle at both the campsite and the workplace. For this purpose, the Contractor will install, staff, equip, and operate a clinic on-site.
- The Contractor will cordon off the work areas to control access by local communities.
- The storage of all solid waste shall be practiced to prevent the attraction, harbourage or breeding of insects or rodents and to eliminate conditions harmful to public health or which create safety hazards, odours, unsightliness, or public nuisances.
- The Contractor will brief local communities on site dangers and post signs around construction sites and access roads, alerting the community to the dangers.

7.9.9 Working Environment (Including Occupational Safety)

320. The project area is classified as "Danger Level 2 (Avoid non-essential travel)" according to the Ministry of Foreign Affairs of Japan's Overseas Safety Information. While travel is not prohibited, there is a risk of incidents such as terrorism, kidnapping, robbery, and other crimes. Therefore, comprehensive safety protocols will be followed based on the safety measures manual established by the JICA Pakistan Office. The project has outlined six fundamental principles for the safety management plan:

321. Adherence to the three core safety principles: avoid attracting attention, avoid

predictable actions, and remain vigilant at all times.

- Maintaining a high level of crisis management awareness.
- Ongoing collection and monitoring of security information.
- Clear identification and communication of location and contact details.
- Ensuring reliable channels are in place for emergency communication.
- Strict observance of a non-resistance policy.
- Within the project site, a combination of physical, personnel, and communication safety measures will be implemented:
- A 2.5-meter-high steel boundary wall topped with barbed wire will enclose the site, with barricades and steel gates installed at all access points.
- Emergency generators and uninterruptible power supply (UPS) systems will be available at the site office to support short-term barricading and emergency response capabilities.
- Surveillance will be maintained through eight cameras positioned at each corner of the premises, as well as additional cameras at gates and office entrances, enabling 24/7 monitoring.
- Armed security guards will be stationed at two diagonal points within the site, working in three shifts to provide round-the-clock protection.
- For communication, an internal telephone system will link the security room and site office. Satellite mobile phones and Wi-Fi routers will also be provided to ensure immediate communication in emergencies such as unauthorized entry.
- A construction safety supervisor will visit the site at the start of construction and at intermediate stages to provide guidance and ensure the contractor adheres to safety protocols.

7.9.10 Health & Safety of Workers

322. Health risks and work safety problems may arise in the workplace if working conditions provide an unsafe and/or unfavourable environment, as well as during the storage, handling, and transportation of hazardous construction materials.

Mitigation Measures

323. Contractors shall ensure that:

- Reasonable steps are taken to protect any person on the site from health and safety risks;
- The construction site is a safe and healthy workplace;
- PPE will be distributed to workers as appropriate – including hearing protection, dust goggles and protective footwear;
- For work near water, sharp drops will be fenced and flotation equipment will be within easy access;
- machinery and equipment are safe;

- Adequate training or instruction for occupational health and Safety is provided.
- Adequate supervision of safe work systems is implemented.
- The Contractor will conduct daily inspections and weekly audits to ensure the work area is safe and hygienic for farmers and community members who pass through or use the area.
- Induction and regular toolbox talks on the proposed Project EHS requirements will be held. Emergency preparedness and response plans, as well as emergency escape routes, shall be identified, and all workers will be made aware of them.
- Signs are provided to improve the understanding of all health and safety instructions and precautions for workers. Signage will be in languages appropriate to the workforce employed.

7.9.11 Graves, Cultural and Historical Sites

347. At present, no graveyard will be disrupted due to this Project. No historical or archaeological sites have been observed or reported. Therefore, no mitigation measures are needed for cultural and historical gravesites.

Mitigation Measures

348. Currently, no graveyard is affected by this Project. There are no cultural sites located within the study area and no impacts on archaeological sites are envisaged. The sites or items of heritage significance could be found in the course of development work. The “chance finds” procedure covers the actions to be taken from the discovery of a heritage site or item to its investigation and assessment for siting and designing a project to avoid significant adverse impacts to the culture the client is responsible for heritage.

However, the Contractor will be required to instruct the construction crews and site supervision on archaeological site recognition, conservation procedures, and temporary site protection. In the event of a chance finding during excavation, the Contractor shall protect the site and notify the Executing Agency, which will inform the Department of Archaeology and Museums through the Irrigation Department and follow the directions provided by the Department of Archaeology and Museums.

B –Impacts and Mitigations during Operational and Maintenance Stage

7.10 Operational and Maintenance Stage

349. In general, the operation of the irrigation scheme is expected to have a positive socio-economic impact, primarily due to increased agricultural yields. The farmers will be connected to the markets, and their livelihoods will also improve. However, the Project may also pose a few accessibility issues. Moreover, the Project would ultimately enhance the quality of life for communities.

350. However, the increase in agricultural capability of the command area will likely lead to an increase in population, with an influx of additional farm workers, returning landholders, and service providers. Similar to the potential impact of the influx of construction workers during

the construction period, it is noted that the resident population of the area will have a certain set of cultural values, and residents may not easily adjust to the presence of outsiders settling permanently in their area. Additionally, the increased population will put pressure on existing community services, which, according to the household survey and public consultation findings, may not be able to accommodate extra usage. The significance of the impact is considered high.

7.10.1 Reduction in Number of People Affected

351. Strengthening the Old Abad Bund is projected to protect between 710,333 and 789,998 people from flooding, depending on whether an upstream breach occurs. Decrease in Flooded Area

352. The area protected from flooding also varies depending on the intervention. Strengthening the Old Abad Bund is estimated to reduce the flooded area by 3,270 to 3,500 square kilometers.

7.10.2 Reduction in Flood Damage Cost

353. Economic benefits from bund strengthening are substantial. The Old Abad Bund improvement is expected to reduce flood damage costs by 302,516 to 347,805 million PKR.

7.10.3 Protection of Critical Infrastructure

354. Both interventions also significantly reduce the number of critical infrastructure facilities affected by flooding. For the Old Abad Bund, the number of protected hospitals ranges from 34 to 42, roads from 1,567 to 1,714 km, and railways from 110 to 119 km.

CHAPTER - 8: ENVIRONMENTAL & SOCIAL MANAGEMENT AND MONITORING PLAN

8.1 General

355. This chapter outlines the strategies for managing identified impacts and risks, including mitigation measures, control mechanisms, and monitoring protocols. The Environmental and Social Management & Monitoring Plan (ESMMP) is structured around management plans, institutional arrangements, and capacity enhancement initiatives and highlights key monitoring indicators. Each section addresses specific measures for mitigating and controlling impacts, adhering to the mitigation hierarchy and control hierarchy wherever possible. The subsequent segments detail management strategies and monitoring criteria for addressing impacts and risks.

8.2 Contractors' Qualification

356. To ensure compliance with quality, environmental, and occupational health and safety standards, it is recommended that all project contractors adhere to ISO 9001 for Quality Management, ISO 14001 for Environmental Management, and ISO 45001 for Occupational Health and Safety Management. SID will enforce these requirements by incorporating ISO certification criteria during contractor prequalification or technical evaluations. Furthermore, subcontractors working under primary contractor/s will undergo audits for ISO 14001 and ISO 45001 by the main contractor throughout the Project duration.

8.3 Various Control Measures

357. The ESMP incorporates various mitigation and control measures and sub-plans to address significant impacts and risks:

i. Project-specific and, whenever feasible, site-specific mitigation measures for major and higher impacts and risks are outlined in Chapters 7 and 8.

ii. General and non-site-specific measures are provided in Environmental and Social Codes of Practice (ECPs) in Annexure - IV, which cover general construction and operational concerns. Contractors are expected to utilize these ECPs alongside the mitigation measures outlined in Chapter 7.

iii. Contractors are required to develop a Construction Environmental and Social Management Plan (C-ESMP), encompassing site-specific and contract-specific management plans.

iv. Contractors are tasked with preparing Occupational & Community Health and Safety Management Plan (OCHSMP) processes and Standard Operating Procedures (SOPs), within a framework outlined in Annexure - V.

v. Proposed plans within the ESMP are designed to address significant impacts comprehensively.

8.4 Environmental and Social Codes of Practices for Construction

358. The Environmental and Social Codes of Practice (ECPs) will guide best operational practices and environmental management protocols to be followed by contractors for the sustainable management of all environmental and social concerns. These ECPs draw on lessons learned from the construction of similar projects, including those funded by donor agencies in Pakistan, and align with international industry practices. The list of ECPs prepared for the Project includes:

ECP 1: Waste Management

ECP 2: Fuels and Hazardous Goods Management

ECP 3: Water Resources Management

ECP 4: Drainage Management

ECP 5: Soil Quality Management

ECP 6: Erosion and Sediment Control

ECP 7: Topsoil Management

ECP 8: Topography and Landscaping

ECP 9: Quarry Areas Development and Operation

ECP 10: Air Quality Management

ECP 11: Noise and Vibration Management

ECP 12: Protection of Flora

ECP 13: Protection of Fauna

ECP 14: Protection of Fish (if any)

ECP 15: Road Transport and Road Traffic Management

ECP 16: Labour Influx Management and Construction Camp Management

ECP 17: Cultural and Religious Issues

ECP 18: Workers Health and Safety

8.5 Constructor's Environmental and Social Management Plan

359. The Contractor will be responsible for preparing a 'Contractor's Environmental and Social Management Plan' (C-ESMP), detailing their approach to compliance with Site-Specific Management Plans, Environmental Construction Plans (ECPs), and the mitigation measures outlined in the Initial Environmental Examination (IEE) Report. The C-ESMP must be submitted prior to commencing any construction activities or mobilization, within a maximum of 45 days, and must receive approval from the Engineer or Project Implementation Consultant. This plan will be integrated into the contract documents and utilized as a supervisory tool for ensuring compliance. Failure to comply with the requirements will result in corrective actions or penalties imposed on the Contractor. The C-ESMP will include the following sub-plans:

i. Tree Plantation plan
ii. Traffic Management Plan
iii. Sustainable Water Supply Management and Monitoring Plan (SWSMMP)
iv. Occupational & Community Health and Safety Management Plan (OCHSMP)
v. Emergency Response Plans
vi. Camp Management Plan
vii. Waste management plan
viii. Spoil Management Plan
ix. Consultation Plan
x. Labor Influx Management Plan

8.6 BOQs & Bidding Documents

360. The following items will be included in the bills of quantities (BOQs) of bidding documents.

361. The Contractor will develop and submit two distinct plans, The C-ESMP and the OCHSMP Plan, ensuring compliance with this IEE, JICA GL, and SEQS. The preparation, revisions, and updates of these plans will be itemized in the Contract documentation.

362. Allocation of personal protective equipment (PPE) quantities for all project personnel, including contractors, Project Implementation Unit (PIU) members, and Engineer/Project Implementation Consultant (PIC), alongside provisions for first-aid boxes, ambulance services, and healthcare facilities staffed with doctors and nurses licensed by the Pakistan Medical Commission.

363. Deployment of Environmental and Occupational Health and Safety (OHS) staff throughout the construction duration.

364. Provision and upkeep of Dust Measurement Meters for on-the-spot measurements (3 units).

365. Spot monitoring of atmospheric parameters (CO, O_3) at active construction site.

366. Quarterly 24-hour Ambient Air Quality Monitoring will be conducted at diffrent locations, measuring SPM, PM_{10}, $PM_{2.5}$, NO_2 and SO_2 levels.

367. Continuous 15-minute noise monitoring will be conducted near settlements during construction activities.

8.6.1 Payment Mile Stones

368. Contractor payments will be tied to their environmental, health, and safety performance and evaluated based on the completion of prescribed mitigation measures in the C-ESMP and control measures outlined in th plan. In instances of non-compliance resulting in damage or significant harm to the environment, workers, public or private property, or resources, the Contractor will be obligated to either rectify the damages within a specified timeframe agreed upon with the engineer (PIC), or reimburse the expenses.

369. Repeated non-compliance will result in penalties for the Contractor. The penalty for non-compliance with the CESMP and OHS Plan requirements will amount to 3% of the total Civil Works Value as Stated in the Interim Payment Certificate (IPC). This penalty will be enforced after all contractual measures have been applied and upon issuance of a Non-Compliance Report (NCR) by the Engineer.

8.7 Institutional Arrangements for ESMP Implementation

8.7.1 Project Management Office

370. The SID serves as the implementing agency for the Project, having established a dedicated Project Management Office (PMO) to oversee and coordinate all implementation efforts.

371. The PMO, under the leadership of the Project Director (PD), manages various aspects of the project, including procurement, supervision through two consulting teams (one for construction and the other for monitoring and evaluation), and ensuring that compensation is provided to project-affected individuals prior to Contractor mobilization.

372. Additionally, the PMO oversees the recruitment and supervision of Project Implementation Consultants (PIC) or Engineers, as well as the engagement of third-party Monitoring and Evaluation (M&E) Consultants.

373. The Environmental and Social Unit (ESU) operates within the Project Management Office (PMO) to address environmental and social considerations. Institutional arrangements for ESMP implementation are illustrated in Figure 8-1.

8.7.2 Environmental and Social Unit/PMO

374. SID has an existing 'Environmental and Social Unit, for the management of environmental and social impacts of the Program. SID will depute these specialists to PMO to ensure the effective implementation of ESMP. The responsibilities of the environmental and social staff of ESU are:

(i) Supervising, facilitating and coordinating the implementation of environmental, social, health and safety plans and RAP;
(ii) inclusion of ESMP in the contract documents and, preparation of relevant specifications and conditions, and review of the bidding documents
(iii) ensuring that contractors follow SEPA regulations, JICA guidelines, and other requirements mentioned in the ESMP and RAP;
(iv) identifying any issues of non-compliance and report them;
(v) suggesting mechanisms to link contractor performance in relation to the ESMP at the time of Interim Payment Certificate, incentives or penalties;
(vi) interacting with stakeholders for their concerns about the construction activities,
(vii) development of social development programs, implementation of livelihood restoration and improvement plan, and prepare quarterly monitoring reports on ESMP implementation.

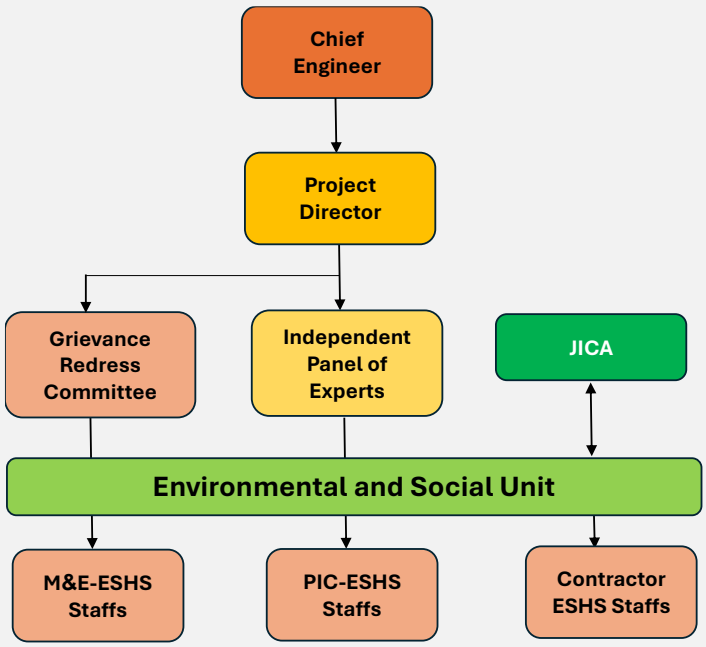


Figure 8.1: Organogram for Environmental and Social Management of the Project

8.7.3 The Project Implementation Consultant or the Engineer (PIC)

375. The Project Implementation Consultants (PIC) will function as the Engineer and oversee contractors' compliance with the C-ESMP implementation. To fulfill this role effectively, the PIC will appoint dedicated environmental, social, health, and safety (ESHS) staff members to supervise the implementation of environmental and social management plans throughout the project. These staff members will closely monitor contractors' adherence to the mitigation

and control measures outlined in the ESMP and will also oversee the monitoring of the impacts of these measures.

376. The PIC's environmental and social safeguard staff during construction will include:

- Environment Expert
- Resettlement and Social Development Specialist
- OHS and Safety Specialist
- Environmental, Social, and Health and Safety (ESHS) Inspectors (2 staff)

377. These ESHS staff members will closely oversee construction activities to ensure that all environmental, social, health, and safety commitments are integrated into the work processes. Their specific responsibilities include:

- Supporting and supervising contractor to fulfill their responsibilities as outlined in the C-ESMP.
- Reviewing and approving the Contractor's site-specific plans related to the C-ESMP and OCHSMP Plan.
- Conducting regular safety inspections at worksites.
- Issuing engineer's instructions and non-compliance reports to contractors.
- Providing input, advice, and approval on activity-specific work plans related to the C-ESMP and OCHSMP Plan.
- Supervising the implementation of activity-specific work plans.
- Conducting ESHS training.
- Assisting the PMO in addressing and resolving ESHS complaints and grievances.
- Responding to environmental incidents as required.
- Managing compliance reporting for the Project and preparing monthly ESHS compliance reports.
- Collaborating with the PMO to ensure effective environmental, social, health, and safety management at the site.;

8.7.4 Contractor

378. The contractor is mandated to appoint environmental staff to oversee the implementation of the ESMP in the field, with a particular focus on mitigation measures. The contractor will develop various plans addressing health, safety, environmental, and social issues, seeking approval from both the Project Implementation Consultant (PIC) and the Project Management Office (PMO). Additionally, the contractor will be responsible for training its staff in ESHS aspects before commencing physical work on-site. The Contractor's ESHS team will comprise the following members:

- Environmental Officer
- Social officer (SEA/ SH)
- OHS Specialist
- Flagmen

8.8 Environmental Approvals and Permits Required for Project Implementation

379. During the Project implementation, environmental clearances and permits, as outlined in Table 8-1, will be necessary. SID and its Contractor will be responsible for obtaining these approvals from the relevant government departments.

Table 8-1: Environmental Approvals/ Permits Required during Implementation

Sr. No	Details of Approval and Permits	Issuing Authority	Requirements	Responsible Agency	Timing
1	**Environmental Approval:** for the overall construction of the Project	SEPA	Submission of the IEE	PIC/ PMO/ SID	Prior to the Construction of the Project.
2	**Environmental Approval** for Establishing Crushing Plants	SEPA	Submission of Environmental Checklist (EC) Application	Contractor	During the construction phase.
		Industries Department	Submission of Request with layout and location maps	Contractor	During the construction phase
		Mines and Mineral Department	Submission of Request	Contractor	During the construction phase
3	**Permit for the use of quarry and excavated material**	Mines and Mineral Department	Submission of a request with the location map of the quarry area	SID will sign the lease agreement and hand it to the contractor	During the construction phase
4	**Batching Plant**	SEPA	A NOC is not required for establishing a batching plant; however, the project must inform SEPA about the facility, ensuring that all necessary mitigation measures to control pollution will be adopted.	Contractor	During the construction phase
5	**Environmental Approval for the operation of the Project**	SEPA	Submission of a compliance report on the implementation of conditions and recommendations given in the Environmental Approval for construction.	Contractor/ PMO/ SID	After completion of the Construction and prior to operation

8.9 Construction Stage Site-Specific Management Plans

380. The Contractor will be required to prepare site-specific management plans and include them in the C-ESMP, along with the ECPs, prior to mobilization and commencement of construction works, for approval by the PMO and PIC. Thekey sub-plans are described below.

- **Spoil Management Plan** The Contractor will develop a Spoil Management Plan aimed at averting accidents during the transportation, disposal, and storage processes. This plan will encompass detailed considerations regarding site conditions, transportation and disposal methodologies, designated routes, and road conditions. The Contractor should suggest alternative routes for assessment and approval by the Engineer. Additionally, the Contractor must commit to restoring any local roads to their original condition if damage occurs due to the heavy traffic associated with the Project.
- **Pollution Prevention Plan:** A Pollution Prevention Plan will be developed as a

component of the C-ESMP and executed by contractors following the guidelines outlined in the ECPs and IFC Guidelines, which will be included in the bidding documents. Prior to contractor mobilization, this plan will be submitted to the Project Investigator (PIC) for review and approval.

- **Construction Camp Management Plan:** The Construction Camp Management Plan, based on ECP 16, will be prepared by the contractor as part of the C-ESMP. This plan will detail the camp layout, and facility provisions including supplies, storage, and waste disposal. Before establishing the camp, the plan will be submitted to the PIC for their review and approval.
- **Labor Influx Management Plan:** A Labor Influx Management Plan, integrated into the C-ESMP, will be implemented by contractors in accordance with the ECPs and IFC Guidelines provided in the bidding documents. Prior to contractor mobilization, this plan will be submitted to the PIC for review and approval.

8.10 Environmental and Social Management during Construction

8.10.1 Design/Siting Stage & Construction Stage Mitigation Plans

381. Detailed mitigation plans for construction stage impacts have been prepared based on the detailed impact assessment presented in Chapter 7 and Table 8-2. These plans are project-specific and, to the extent possible, site-specific. However, contractors will be required to carry out further detailing of key aspects and prepare site-specific management plans as part of the C-ESMP for review and approval by the PMO.

8.10.2 Construction Stage Monitoring Plans

382. Table 8-3 presents the proposed monitoring plan for the construction phase of the Project, aimed at verifying contractors' adherence to mitigation measures. The table outlines monitoring indicators and their corresponding frequencies. The PIC will assume responsibility for overseeing the execution of this plan.

Table 8-2: Environmental & Social Management Plan (ESMP)

Sr. No	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Supervision
	Planning and Design Phase				
1	Land Acquisition	Land acquisition and resettlement	All the activities requiring land acquisition are being planned and carried out by SID. Most of the Private land has been acquired under the 1894 Land Acquisition Act and the cost of that land has been paid to the Revenue Department, which is responsible to pay owners. An appropriate framework agreement will be completed and signed by all the concerned parties.	Executing Agency	Executing Agency
2	Grievance Redress Mechanism	A procedure to receive and respond to community complaints arising from construction activities	The project Grievance Redress Mechanism will be organized and commenced before construction work begins. This will comprise establishing complaint receipt, processing, and recordkeeping procedures.. Publicizing GRM and its functions, entry points and contacts in local communities and on signposts at work sites.	PIC	PMO
	Construction Phase				
3	Waste management	Soil and water contamination.	Solid waste will be disposed of at designated locations, and the contractor will obtain a No Objection Certificate (NOC) from the district governments for the disposal of any material at existing disposal points. • If the project area does not have any accessible disposal site, the contractor will undertake the following measures: • An informal project disposal site may be selected after consultation with the local community and with the approval of the supervising consultant and EA. • An impervious liner shall be laid at the waste site and approved by the supervising consultant before the dumping of solid waste. • After the dumping of solid waste, it will be covered by scarified material and stabilized. • Good housekeeping practices within the campsite shall be adopted to minimize waste generation. The contractor will arrange for proper collection and storage of solid waste in residential camps, workshops, material storage facilities, and all other locations generating solid waste. • The contractor will be required to train its workforce in the storage and handling of materials like oils, diesel, petrol, other chemicals,	Construction Contractors	Supervision Consultants

Sr. No	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Supervision
			concrete and cement, etc., that can potentially cause soil contamination. • Vehicles and equipment shall not be repaired in open fields; • If unavoidable, impervious sheathing shall be used to avoid soil and water contamination. • 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 bunded areas.		
4	Soil erosion/ stability	Phenomena may pose serious environmental impacts like landslides, slumps, slips, and other mass movements.	The stability of bund and dike will be ensured by contractors through the provision of safe support structures wherever cuts and fills are vulnerable, or unstable or not sustainable. • embankments will be shaped to conform with slopes not exceeding 1 in 2 (26.6 degrees); • Land clearance will be confined to the ROW; • Avoid, wherever possible, clearing areas of highly erodible soils and steep slopes that are prone to water and wind erosion; • Erosion control measures, such as ramming of topsoil immediately after excavation and silt controls, will be provided to minimize erosion. • Construction work will not be carried out during heavy monsoon rains; Construction activities will be planned in a manner that minimum the area of soil exposed during times of the year when the potential for erosion is high, for example, during summer when intense rainstorms are common. • Keep vehicles/traffic/machinery on well-defined haul roads; • Photographic record will be maintained for pre-project, during-construction and post-construction conditions of the sites; • Monitoring during the project execution will ensure compliance to the above mitigation measures and their adequacy; • The contractor would prepare a material borrowing and disposal plan; • Avoid cultivated fields for borrowing material to the extent possible; • Obtain written consent of the landowner for material (soil) borrowing; • Keep a photographic record (before, during, after) for borrow and disposal areas;	Construction Contractors	Supervision Consultants

Sr. No	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Supervision
			• Levelling of borrow sites; • As far as possible, wasteland or natural areas with a high elevation will be demarcated for borrowing earth material; • The fertile topsoil will be removed with due care and preserved safely for reuse purposes; • Ditches or borrow pits that cannot be fully rehabilitated will be landscaped, and • Landowners will be compensated according to the terms of the lease agreement.		
5	Disposal of spoil	Negative impacts, including silt runoff, change of land use, sedimentation of receiving water bodies, and loss of aesthetic values, may be caused on the receiving lands due to improper disposal of spoil.	A Spoil Management and Disposal Plan will be prepared during the pre-construction phase of the project and approved by the Executing Agency (EA) before works commence. It will cover site storage, storage duration, haulage routes, and disposal sites and procedures. Haulage routes and disposal sites will be identified based on the selection criteria outlined in the plan, with the final selections made by the contractor and approved by the EA.	Construction Contractors	Supervision Consultants & EA
6	Domestic waste	Inadequate disposal of waste could contaminate the land. The waste not handled properly will cause nuisance and diseases.	Contractor will make waste management plan and will disposed of waste accordingly. • Domestic waste generated at labour camp and site offices will be collected and temporarily stored at the designated bonded area within the camp area before disposed off-site by the contractor. • The temporary domestic waste storage area will be prepared, maintain and visually inspected on regular basis by the contractor & consultant to stop contaminating the adjacent land of waste disposal site. • The location of construction waste disposal site will be such that no tree cutting, crop destruction or private land acquisition occurs. • A third-party contractor will be employed and waste will be disposed of in a licensed facility.	Construction Contractors	Supervision Consultants & EA
7	Surface or Ground water contamination	The water resources, both surface and subsurface, may get polluted from hazardous construction materials, wastewater effluent, solid waste, silt from construction and soil erosion	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 any drain, soak or waterway. Similarly, the wastewater effluent from the campsite will be treated before disposal. • All types of hazardous waste will have to be collected on site separately and stored in appropriate containers to be finally	Construction Contractors	Supervision Consultants

Sr. No	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Supervision
			removed from site and be brought to adequate handling, recycling or disposal facilities. • 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 will be at a safe distance from the drainage channel or their functional Distributaries. No washing of vehicles will be done in or near the already functional distributaries/water courses. • Water contaminated with concrete will have to be collected in sedimentation ponds and, if required, will have to neutralised before being discharged to any drain, soak or waterway. Contamination of the Main canal or their functional distributaries with concrete or cement will be avoided.		
8	Use of local water resources	The water resources of the project area comprise groundwater and surface water. There will be need for water not only for construction purposes (of concrete side slopes and structures) but also for meeting the needs of the campsites, workshop, and washing yard	The Contractor prior to start of construction activities will ensure availability of water for campsite facilities and construction purposes. As per Local Government Act, the contractor will seek approval from the Local Government for exploitation of the water resources. • Use of groundwater by the contractor will be monitored and controlled by supervising consultant • 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.	Construction Contractors	Supervision Consultants
9	Air Pollution	Dust and exhaust emissions may cause nuisance to the local resident	**Gaseous Emissions** • All vehicles, used during construction activities, shall be in good condition and shall be properly tuned and maintained by the contractor 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;	Construction Contractors	Supervision Consultants

Sr. No	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Supervision
			• Open burning of solid waste from contractor's camps shall not be allowed. • SEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery will be enforced during construction works.		
			Dust Emission • Possibility of excessive dust generation may be reduced by adopting the best construction practices, precautions such as periodic watering, covering of construction material and usage of low emission equipment's during construction. • During windy conditions, stockpiles of fine material will be wetted or covered with plastic; • Take dust suppression measures, such as promptly watering exposed areas when visible dust is observed. • Implement a programme for sprinkling water on the roads under use for movement of construction machinery / equipment/ labour. • In no case, loose earth will be allowed to pile up along the approach roads; • Any temporary concrete batching plant(s) to be located more than 500m from any dwelling place and should be equipped with 2m high dust curtains on perimeter fence. • All dust suppression measures listed above will also apply to batching plants.	Construction Contractors	Supervision Consultants
10	Noise and vibration	Disturbances to local residents in the form of increased noise levels and vibration due to movement of construction machinery	The contractor shall provide equipment only of the size/power required to complete each task. • The contractor shall plan his operations to be completed preferably based on a six-day working week from 8am to 6pm, including road haulage of material. Should the contractor require additional working hours, or weekend working, he shall) submit a request to the supervising consultant for permission to work extended hours, giving full reasons for the requests. Approval to such requests will not be granted for works within 150m of sensitive receptors. • The contractor will monitor the noise levels regularly at sensitive receptor sites to ensure that these do not exceed ambient levels by more than 5dB. In such eventuality, contractors will adopt appropriate noise attenuation measures to reduce the noise generation from construction activities and noise barriers to reduce the impact.	Construction Contractors	Supervision Consultants

Sr. No	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Supervision
			• Construction activities close to any school or medical centre will be timed to coincide with school vacation or long holidays. • High noise emitting equipment, if any, will be fitted with noise reduction devices such as mufflers and silencers wherever possible; • For protection of construction workers, earplugs would be provided to those working very close to the noise generating machinery; • High noise emitting equipment, if any, will be used during regular working hours so as to reduce the potential of creating a noise nuisance during the night; • Regular inspection and maintenance of the construction vehicles and equipment will be carried out; • Replacement of worn out and noise producing parts of construction machinery will be timely done; and • The contractor shall notify potentially affected people and communities prior to undertaking noisy work activities and reach agreement on temporary noise mitigation measures for sensitive receptors.		
11	Accidental damage to utilities in excavated areas	Damage to existing utilities like temporary water supply scheme causing inconvenience to the local people.	Coordination between different utility departments shall be maintained to get the details of existing utilities (if any) before starting construction of the proposed Project.	Construction Contractors	Supervision Consultants
12	Physical cultural resources	Respect for local cultural sites and chance finds procedure	In case of a chance finding during excavation, the contractor will protect the site and notify the EA who will inform Department of Archaeology & Museums through the Irrigation Department and follow the directions from the Department of Archaeology & Museums. • The contractor will ensure that construction crews and supervisors are alert for buried historic, religious, and cultural objects and follow the chance find procedures if such objects are discovered. Provide incentives for reporting of objects and disincentives for their destruction.	Construction Contractors	EA & Supervision Consultants
13	Traffic disruption	Construction traffic may disturb the existing traffic and community access and activities.	A Traffic Management Plan will be prepared for each worksite by the contractor and approved by the EA. The plan will cover: • Blockage of local roads and routes. (If unavoidable, consultation with the affected communities will be carried out and alternate routes identified). • Requests for closure of public roads will be made in advance to the relevant authority (highways department or local authority).	Construction Contractors	Supervision Consultants

Sr. No	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Supervision
			• The contractor will notify affected people and communities prior to movement of any major plant or equipment, which may cause disruption. • Speed and weight restrictions. • Repair of ruts and scars resulting from project operations, which will be undertaken and funded by the contractor. • Construction traffic hindrance will be avoided by providing proper diversion and signage.		
14	Occupational Health and Safety	Health risks and work safety problems	Contractors shall ensure that: • All reasonable steps are taken to protect any person on the site from health and safety risks; • the construction site is a safe and healthy workplace; • PPE will be distributed to workers as appropriate –including hearing protection, dust goggles and protective footwear; • For work near water, sharp drops will be fenced and flotation equipment within easy access; • machinery and equipment are safe; • adequate training or instruction for occupational health and safety is provided; • adequate supervision of safe work systems is implemented • means of access to and egress from the site are without risk to health and safety; • The contractor will carry out daily inspections and weekly audits to ensure the works area is safe and hygienic for farmers and community members passing through or using the areas; • Induction and regular tool box talks on subproject EHS requirements will be held; Emergency preparedness and response plan and emergency escape routes shall be identified and all the workers will be made aware of them; • Signs to improve the understanding of all the health safety instructions and precautions for workers are provided. • Signage will be in languages appropriate to the workforce employed. • The movement of construction workers from outside the communities along the road will have potential for the spread of infection, in particular, communicable diseases. The EA and CSC will work with contractors to ensure that the risk of diseases is assessed and measures taken in line with the Advisory.	Construction Contractors	Supervision Consultants

Sr. No	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Supervision
15	Biodiversity	Loss of biodiversity values due to footprint of construction activities and sites and disturbance from the scale of activities	Mitigation measures are set out for wildlife and habitats during construction. All requirements of biodiversity will be strictly adhered to. These comprise: • Construction site boundaries and site use • Timing of construction (with respect to breeding seasons). • Construction site survey before work starts to identify areas to avoid • Limitations on noise, vehicle movements. • Worker awareness, training and induction • Domestic waste management • Poaching patrols • Liaison and collaboration with line department.	Construction Contractors	Supervision Consultants & EA
16	Impacts on local communities and livelihoods	During the construction phase, the general mobility of the local residents and their livestock in and around the project area is likely to be hindered. Likewise, access to the natural resource may be affected. This particularly applies to the women and children.	The contractor will ensure that the mobility of local communities, particularly women and children, and their livestock is not hindered by the construction activities. The contractor will provide an alternate and safe track for the community quite a distance away from the construction areas. Similarly, appropriate crossing points will be provided at the access road during its construction for daily works and having free access to the natural resources of the local population.	Construction Contractors	Supervision Consultants
17	Social disruption	The presence of outside construction workers inevitably causes some degree of social disruption and even active disputes with the local community as a result of social/cultural differences.	In case, people from outside the area are engaged in the construction or operation of the project activities, this might result in cultural conflict with the local communities. Therefore, it is imperative to engage local workforce as much as possible, and also develop and implement a strong community communication and participation plan; • The Contractor will develop a construction camp management plan for the management of labour and other construction camp-related issues. • The contractor would be liable to engage at least 90% of its required (unskilled) labor force from within or around the project area, subject to safe restrictions.	Construction Contractors	Supervision Consultants
18	Gender Issues	Rural women actively participate in outdoor socio-economic activities such as livestock rearing, bringing of potable water, etc. which may also be affected by the project activities. The introduction of outside labor may create social and gender issues due to the unawareness of local customs and norms.	The Contractor will select specific timings for the construction activities particularly near the settlements, so as to cause least disturbance to the local population particularly women considering their peak movement hours. • The Contractor will undertake construction activities in such a way that the open field latrine usage timings by the local community particularly women, will not be affected. The normal timings to use the toilet	Construction Contractors	Supervision Consultants

Sr. No	Aspect	Project Impact	Mitigation Measures	Responsibility	
				Execution	Supervision
			facilities by the rural women are early in the morning and at late in the evening. • The Contractor will limit construction works to between 8 am and 6 pm if it is to be carried out in or near settlements. • Contractor will take due care of the local community and sensitivity towards local customs and traditions will be encouraged. • Contractor will warn the staff strictly not to involve in any un-ethical activities and to obey the local norms and cultural restrictions particularly with reference to women. • During construction activities, if privacy of the nearby households is affected, the Contractor will inform the house owner to make some 'parda' arrangements.		

Table 8-3: Environmental & Social Monitoring Plan

Parameter	Means of Monitoring	Location	Frequency	Responsibility	
				Implementation	Supervision
Erosion	Visual inspection of erosion prevention measures and the occurrence of erosion	worksite	Monthly	Contractor	PIC, PMO
Wastewater discharges from batching plants, and campsites	Visual inspection to ensure clear water leaving the site	batching plant discharges	Weekly	Contractor	PIC, PMO
	Sampling and analysis of wastewater discharges for the following parameters given in SEQS; Temperature, pH, TDS, BOD, COD, TSS, Oil & Grease, Sulphide, Cadmium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Chromium, Zinc, Arsenic, Chlorine, Chloride, Cyanide, Fluoride, Ammonia, Total Toxic Metals, Phenolic, Compounds, Boron, Barium, Silver, An-ionic, Detergents, Sulphate	2 sites (including batching, camp discharges)	every three months	Contractor	PIC, PMO
Surface water quality	Sampling and analysis of river water quality for the following parameters by comparing with the SEQS threshold levels. Temperature, pH, TDS, BOD, COD, TSS, Oil & Grease, Sulphide, Cadmium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Chromium, Zinc, Arsenic, Chlorine, Chloride, Cyanide, Fluoride, Ammonia, Total	2 sites in the river	every three months	Contractor	PIC, PMO

Parameter	Means of Monitoring	Location	Frequency	Responsibility	
				Implementation	Supervision
	Toxic Metals, Phenolic, Compounds, Boron, Barium, Silver, An-ionic, Detergents, Sulphate				
	Visual inspection of the storage condition of petroleum products.	worksite	Weekly	Contractor	PIC, PMO
Air Quality (dust)	Visual inspection to ensure that appropriate equipment is being used and that dust suppression measures such as water spraying are being implemented.	worksite	Daily	Contractor	PIC, PMO
Atmospheric monitoring	Spot and 8-hour measurements for CO、O3	worksite	every three months	Contractor	PIC, PMO
Ambient Air Quality	Air quality monitoring for 24 hours for the following parameters specified in SEQS SO2,NOx,O3,SPM,PM10,PM2.5	worksite	every three months	Contractor	PIC, PMO
Noise and vibration	24-hour noise monitoring	worksite	Monthly & daily in case of major construction works	Contractor	PIC, PMO
Emissions from plant and equipment	Visual Inspection of maintenance status of vehicles	All vehicles	Monthly	Contractor	PIC, PMO
Waste Management	Visual inspection of spoil disposal	At disposal site	Monthly	Contractor	PIC, PMO
	Availability of dust bins at worksites and camp	At camp and work site	Monthly	Contractor	PIC, PMO
	Collection and treatment of organic waste	At camp site	Monthly	Contractor	PIC, PMO
	Collection and treatment of recyclable and hazardous waste by the waste management contractor.	At camp and work site	Monthly	Contractor	PIC, PMO
Traffic Safety	Placement of traffic signs and traffic control personnel	Near the construction site	Monthly	Contractor	PIC, PMO,
Local Roads	Visual inspection to ensure local roads are not damaged	Access road to Old Abad Bund	Monthly	Contractor	PIC, PMO,
Cultural and Sites	Visual observation for cultural sites	Excavation site	Monthly	Contractor	PIC, PMO,
Drinking water and sanitation	Water quality analysis for the following drinking water parameters specified in SEQS Temperature (During Sample Collection), Color, pH, Turbidity, Total Hardness, Total Dissolved Solid (TDS), Fluoride F-, Chloride(Cl-), Nitrate (NO3)-, Odor, Taste, Arsenic (As), Zinc (Zn 2+), Nitrite, Boron, Aluminum, Antimony, Cadmium, Mercury, Nickel, Selenium, Barium, Chromium, Copper, Lead, Cyanide (CN),	At the camp site	Monthly	Contractor	PIC, PMO,

Parameter	Means of Monitoring	Location	Frequency	Responsibility	
				Implementation	Supervision
	Manganese, Residual chlorine, Phenol, Total Coliforms, Fecal Coli forms (E.Coli)				
Safety of workers	Usage of Personal Protective Equipment	worksite	Daily	Contractor	PIC, PMO,
Labor engagement and GBV risks (including SEA/SH risks)	Interaction with labors and review of GRM	worksite	Monthly	Contractor	PIC, PMO
Grievances	GRM entry points are established at different locations of the project site and the Project Office. Staff are recruited at the PMO and Supervision Consultant, as well as by the Contractor.	worksite	Before the commencement of physical works	PMO, PIC and Contractor	PIC, PMO,
Land acquisition/ resettlement	Compensation based on the resettlement plan	worksite	Once at the time of compensation payment Once per month after compensation	PIC	PMO
Livelihoods / Living conditions (restriction of movement of people and animals)	Provide appropriate compensation to affected households subject to farmland acquisition, in accordance with the Resettlement Action Plan (RAP).	worksite	Once, at the time of compensation payment	PIC	PMO
	Ensure access routes for local residents—especially women and children—as well as livestock.	worksite	Monthly	Contractor	PIC, PMO
Use of local water resources	Utilize water resources only with approval from the relevant local authorities.	worksite	Monthly	Contractor	PIC, PMO
Vulnerable groups (gender)	Implement construction activities with consideration for women's movement time and daily routines.	worksite	Monthly	Contractor	PIC, PMO
Communicable Diseases	Tests by an approved laboratory	camp site	Bi-annually	Contractor	PIC, PMO
Camp site management	Visual Inspection for Proper Management of camp site	camp site	Monthly	Contractor	PIC, PMO
Capacity building/ Training	Implementation status of training and capacity building activities	camp site	every three months	Contractor	PIC, PMO
E&S staff assignments	Activities conducted by E&S staff	worksite	Monthly	PIC	PMO

8.10.3 Monitoring Form

383. The monitoring forms for the “Before & During Construction” phase are shown below.

(a) Air Pollution

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Inspection of construction machinery and vehicles and machinery.	Monthly		
	Regular air quality monitoring	Every three months		SO2, NOx, O3, SPM, PM10, PM2.5
	Spot measurements and 8-hour measurements of construction-related impacts	Every three months		O3, CO
	Use of appropriately rated equipment and implementation of dust suppression measures such as water spraying.	Daily		

Air Pollution Monitoring Parameters and Standard Values

No.	Parameters	SEQS	
		Avg. Time	Standard
1	SO2	Annual Mean 24 hrs	80 ug/ m3 120 ug/ m3
2	CO	8 hrs	5 mg/ m3
		1 hr	10 mg/ m3
3	NO2	Annual Mean	40 ug/m3
		24 hrs	80 ug/m3
4	O3	1 hr	130 ug/m3
5	SPM	Annual Mean	360 µg/ m3
		24 hrs	500 ug/ m3
6	PM10	Annual Mean	120 µg/ m3
		24 hrs	150 µg/m3
7	PM2.5	Annual Average	15 ug/m3
		24 hrs.	35 ug/m3
		1 hr	15 ug/m3

(b) Water Pollution/ Ground Subsidence

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Proper storage of fuels and oils	Weekly		
	Regular inspection of rivers	Every three months		Temperature, pH, TDS, BOD, COD, TSS, Oil & Grease, Sulphide, Cadmium, Copper, Iron, Lead, Manganese,

Basic Information	Monitoring Item	Frequency	Result	Remarks
				Mercury, Nickel, Selenium, Chromium, Zinc, Arsenic, Chlorine, Chloride, Cyanide, Fluoride, Ammonia, Total Toxic Metals, Phenolic, Compounds, Boron, Barium, Silver, An-ionic, Detergents, Sulphate
	Proper management and treatment of waste and wastewater from site offices and batching plants	Weekly		
	Regular monitoring of wastewater from site offices and batching plants	Every three months		Temperature, pH, TDS, BOD, COD, TSS, Oil & Grease, Sulphide, Cadmium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Chromium, Zinc, Arsenic, Chlorine, Chloride, Cyanide, Fluoride, Ammonia, Total Toxic Metals, Phenolic, Compounds, Boron, Barium, Silver, An-ionic, Detergents, Sulphate
	Analysis of drinking water quality parameters	Monthly		Temperature (During Sample Collection) Color pH Turbidity Total, Hardness Total Dissolved Solid (TDS) Fluoride F- Chloride(Cl-) Nitrate (NO3)- Odor Taste Arsenic (As) Zinc (Zn 2+) Nitrite Boron Aluminum Antimony Cadmium Mercury Nickel Selenium Barium Chromium Copper Lead Cyanide (CN) Manganese

Basic Information	Monitoring Item	Frequency	Result	Remarks
				Residual chlorine Phenol Total Coliforms Fecal Coli forms (E.Coli)

Water Quality Parameters and Standard Values

No	Parameters	Unit	SEQS
1	Temperature 40 ºC	ºC	40=< 3
2	pH	-	6-9
3	Total Dissolved Solids (TDS)	mg/l	3500
4	Biology Oxygen Demand (BOD)	mg/l	80
5	Chemical Oxygen Demand (COD)	mg/l	150
6	Total Suspended Solids (TSS)	mg/l	200
7	Oil & Grease	mg/l	10
8	Sulphide	mg/l	1.0
9	Cadmium	mg/l	0.1
10	Copper	mg/l	1.0
11	Iron	mg/l	8.0
12	Lead	mg/l	0.5
13	Manganese	mg/l	1.5
14	Mercury	mg/l	0.01
15	Nickel	mg/l	1.0
16	Selenium	mg/l	0.5
17	Chromium	mg/l	1.0
18	Zinc	mg/l	5.0
19	Arsenic	mg/l	1.0
20	Chlorine	mg/l	1.0
21	Chloride	mg/l	1000
22	Cyanide	mg/l	1.0
23	Fluoride	mg/l	10
24	Ammonia	mg/l	40
25	Total Toxic Metals	mg/l	2.0
26	Phenolic Compounds	mg/l	0.1
27	Boron	mg/l	6.0
28	Barium	mg/l	1.5
29	Silver	mg/l	1.0
30	An-ionic Detergents	mg/l	20
31	Sulphate	mg/l	600

Drinking Water Quality Parameters and Standard Values

No.	Parameters	Unit	National Standards for Drinking Water Quality
1	Temperature (During Sample Collection)	℃	-
2	Color	TCU	≤15
3	pH	-	6.5-8.5
4	Turbidity	NTU	<5
5	Total, Hardness	mg/L	<500.00
6	Total Dissolved Solid (TDS)	mg/L	<1000.00
7	Fluoride F-	mg/L	≤1.5
8	Chloride(Cl-)	mg/L	<250
9	Nitrate (NO3)-	mg/L	≤50
10	Odor	-	Non-Objectionable / Acceptable
11	Taste	-	Non-Objectionable / Acceptable

No.	Parameters	Unit	National Standards for Drinking Water Quality
12	Arsenic (As)	mg/L	≤ 0.05
13	Zinc (Zn 2+)	mg/L	5.0
14	Nitrite	mg/L	≤3
15	Boron	mg/L	0.3
16	Aluminum	mg/L	≤ 0.2
17	Antimony	mg/L	≤0.005
18	Cadmium	mg/L	0.01
19	Mercury	mg/L	≤0.001
20	Nickel	mg/L	≤0.02
21	Selenium	mg/L	0.01
22	Barium	mg/L	0.7
23	Chromium	mg/L	≤0.05
24	Copper	mg/L	2
25	Lead	mg/L	≤0.05
26	Cyanide (CN)	mg/L	≤0.05
27	Manganese	mg/L	<0.5
28	Residual chlorine	mg/L	0.2-0.5 at consumer and 0.5-1.5 at source
29	Phenol	mg/L	-
30	Total Coliforms	cfu/100ml	0
31	Fecal Coli forms (E.Coli)	cfu/100ml	0

(c) Waste

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Proper disposal of spoil (excavated material)	Monthly		
	Provision of waste bins	Monthly		
	Collection and treatment of organic waste	Monthly		
	Collection and disposal of recyclable waste and hazardous waste	Monthly		

(d) Soil Contamination

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Erosion control measures	Monthly		Interviews with workers

(e) Noise and Vibration

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Noise Level Measurement	Monthly & daily in case of major construction works		

Noise Measurement Parameters and Standards

No	Category of Area/ Zone	dB(A) Leq	
		SEQS	
		Daytime	Nighttime
		06:00 - 22:00	22:00 - 06:00
1	Residential area (A)	55	45

(f) Biodiversity

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Construction area control, scheduling adjustment, noise and vehicle restrictions, worker training, and waste management.	Monthly		

(g) Involuntary Resettlement /Land Acquisition

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Implementation of relocation and land acquisition	Once at the time of compensation payment Once per month after compensation		On-site inspection

(h) Livelihoods / Living conditions (restriction of movement of people and animals)

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Compliance with RAP	Once at the time of compensation payment		On-site inspection
	Existence of a route	Monthly		

(i) Use of local water resources

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Construction Water Source Management	Monthly		

(j) Vulnerable Social Groups (gender)

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Observing working hours	Monthly		

(k) Cultural and Sites

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Visual inspection for cultural heritage sites and historical monuments	Monthly		On-site inspection

(l) Working Environment (including occupational safety)

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Engagement with site workers and verification of the Grievance Redress Mechanism (GRM)	Monthly		
	Use of Protective Equipment	Daily		

(m) Health, Safety and Security of Local Communities

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Testing conducted by accredited laboratories	Bi-annually		
	Installation of Traffic Signs and Deployment of Traffic Controllers	Monthly		
	Local Roads Conditions	Monthly		

(n) Grievance Redress

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Establishment of a grievance reception point and designation of responsible personnel	Before construction		
	Grievance status	Monthly		

(o) Camp site management

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Including information boards, telephones and computers, solar-powered or other refrigerators for medical supplies (with generators if required), labor camp accommodations and related facilities (sanitation facilities, washrooms, water supply, etc.)	Before construction Monthly		

(p) Capacity building/ Training

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Implementation of various training programs	Every three months		

(q) E&S staff assignments

Basic Information	Monitoring Item	Frequency	Result	Remarks
Date/Time: Surveyor's Name: Location:	Activities of staff responsible for environmental, HSE, and social affairs	Monthly		

8.11 Reporting on ESMP Compliance

384. Both the PIC and Contractors will collaboratively prepare periodic monitoring reports to assess the implementation status of the ESMP. These reports will be submitted to the PMO for review and feedback. The specifics of these reports, including their content, are provided in Table 8-4.

Table 8-4: ESMP Monitoring and Compliance Reports

Sr. No.	Title of the Report	Contents of the Report	Frequency of Report Preparation	Report to be prepared by
1	OHS and ESMP Monitoring Report	The report encompasses the compliance status of the Project concerning environmental and social mitigation and monitoring measures. Additionally, it addresses: • ESMP implementation progress report • Environmental incidents; • Leading indicators (inspections, walk-throughs by supervisors, OHS Officer and management, workobservation, training, tool-box talk, meetings, reward and recognition.) • Lagging indicators (fatalities, lost-time injuries, medical treatment cases, first-aid cases and near-misses); • Usage of PPE by workers • Worker accommodations • Worker's grievances • Community grievances • Chance Finds (if any)	Monthly	Contractor
2	ESMP & OHS/CHS Monitoring Report	The compliance status of the overall Project with ESMP & OHS/CHS requirements	Monthly	Contractor
3	ESMP & OHS/CHS Monitoring Report	The ESMP & OHS/CHS implementation progress reports	Quarterly	PIC
4	Incident Reports	Incident flash reports, Incident investigation reports for all major incidents covering details of the incident, root cause analysis, and actions taken to address the future recurrence of this event	Initial investigation report within 24 hours, Detailed Investigation Report within seven days	Contractor/ PIC
5	Project Completion Environmental, Health and Safety	One year after the completion of construction, the ESU SID, with the support of PIC, will submit a Project Completion Environmental Monitoring Report, which will summarize the overall	After the physical work is completed	PIC/PMO

Sr. No.	Title of the Report	Contents of the Report	Frequency of Report Preparation	Report to be prepared by
	Monitoring Report	environmental and social impacts and risks from the project.		

8.12 Capacity Building and Training

385. Environmental and social training will be pivotal in ensuring that all project personnel fully comprehend and adhere to the requirements of the ESMP. Pieces of training will be tailored for different professional groups, including managers, skilled workers, unskilled laborers, and camp staff. The primary objective of capacity building will be to enhance the environmental management and social development skills of PMO staff. Safeguard staff within the PMO, tasked with supervising environmental and social mitigation measures, will receive training in environmental management, quality control, ecology, environmental awareness, labor conditions, and social development. Additionally, contractors will be mandated to provide environmental and social training to their staff to ensure the effective implementation of the ESMP. The training plan will encompass intermittent sessions covering topics outlined in **Table 8-5**, conducted initially during staff induction and repeated throughout the project duration.

Table 8-5: Environmental and Social Training Programs

Contents	Participants	Trainer	Schedule
Environmental and social impacts of the Project and ESMP requirements of the Contractor; JICA Guidelines.	All the technical Staff of PMO/ ESU, and relevant technical staff of SID. Site Engineers and EHS staff of the Engineer/ PIC.	ESHS staff of the PIC.	During the initial stages of the Project implementation. The training will be repeated every six months.
Occupational Health and Safety, Job Hazard Analysis Incorporation of EHS in Method Statement	Site Engineers of the Contractor, PMO, and the PIC	E&S staff of the PIC, PMO	Prior to the start of the construction activities and during the construction activities (To be repeated as needed.)
Code of Coduct	Construction Staffs	Contractors ESHS Staff	On Induction
Road safety, Defensive driving, waste disposal, cultural values, and social sensitivity.	Drivers;	Contractors	Before and during the field operations. (To be repeated as needed.)

Contents	Participants	Trainer	Schedule
386. Importance and use of PPE and emergency communication, Excavation, Cranes and Rigging, Working at heights, scaffolding,	Workers	Contractors	Before and during the field operations. (To be repeated as needed.)

8.13 Grievance Redress Committee

387. The Grievance Redress Committee (GRC) will provide a platform for project stakeholders or members of the community to voice and discuss their concerns, address environmental and social (E&S) issues, including resettlement concerns, at the community level, and work with the project management team to communicate these issues. The purpose of the community GRC is to maintain close relationships and coordination with affected individuals and community members throughout the project implementation. The Social Development Specialist (SDS) of the PMU, with the support of the SC will facilitate the establishment of a Community GRC that is representative of the community's ethno-cultural and gender diversity. The Community GRC will consist of the following six members, with one serving as the committee chair:

388. • Three male members (from the PAPs or community members);Three male members (from PAPs or community members).

389. The project's environmental and social (E&S) and engineering staff will work with the community GRC to review and address any issues or concerns related to resettlement planning or implementation, as well as environmental and social concerns, within five working days of receiving the complaint. If the issue cannot be resolved at the community GRC level, it will be forwarded to the next tier for further review and resolution.

390. The Sub-project GRC will consist of the following members:

- Project Manager (PM), as head/convener of sub-project GRC;
- Environment, SDS and Gender specialists of PMU;
- E&S specialists of Supervision Consultant (SC)
- Resident Engineer of supervision consultant;
- A representative (E&S specialist) of contractor (if required); and
- A representative of local community.

8.14 Grievance Redress Mechanism

391. A three-tier Grievance Redress Mechanism (GRM) has been devised to ensure timely, transparent, and equitable resolution of grievances from Project Affected Persons (PAPs) and other stakeholders regarding the environmental and social management of each project.

392. All complaints, whether verbal or written, will be meticulously documented and recorded in the Complaint Management Register(s). Every effort will be made to address complaints through the project-specific GRM, and complainants will be encouraged to utilize this mechanism for redressal. Should the complainant remain dissatisfied with the resolution, they reserve the right to escalate their complaint to higher government administration or relevant courts.

393. The GRM has been designed to accommodate anonymous complaints and all grievances will be treated with utmost confidentiality. Personal data revealing the identity of complainants will not be disclosed without their consent. In cases where the complainant chooses not to remain anonymous, contact details may be provided upon request.

394. Additionally, the contractor will be mandated to establish a worker GRM on-site in accordance with their HR policy, a requirement that will be stipulated in the contractor's bidding documents.

8.14.1 First Tier of GRM

395. The PMO's project site office will serve as the initial tier of the Grievance Redress Mechanism (GRM), offering a swift and accessible avenue for resolving grievances at the local level. A local Grievance Redressal Committee (GRC), chaired by the Project Director and comprising relevant stakeholders such as the Director-ESU, Land Acquisition Collector, representatives from contractors and consultants, relevant departmental representatives, and members from each Project Affected Persons (PAP) Committee, will be established for this purpose. The designated E&S staff at the PMO site office will strive to resolve complaints within two to 10 working days, depending on the nature of the grievance.

396. The Project Director will convene informal meetings of the local GRC to facilitate amicable settlements between the parties involved within 10 days of receiving a complaint, whether verbal or written. Proceedings of the GRM meetings will be documented, and copies will be provided to the concerned parties. Grievances will be recorded with personal details unless anonymity is requested, and a tracking number will be assigned to each complaint. Should the grievance remain unresolved or the affected person remain unsatisfied with the decision, they may escalate the grievance to the Program-level grievance redress committee, led by the head of the PMO.

8.14.2 Second Tier of GRM:

397. Unresolved grievances or issues will be referred to the second tier of the GRM, the PMO central level Grievance Redress Committee (GRC), by the E&S staff at the PMO. This central level GRC, established by SID, will comprise senior management representatives, the head of the PMO as the secretary, Project Directors, representatives from the District Commissioner's office, Project Implementation Consultants (PIC), Chief Resident Engineers of the Consultants, representatives from relevant government offices, and selected representatives from PAPs.

398. The GRC will convene as necessary to address grievances and suggest corrective measures within 15 working days, depending on the nature of the grievance. Despite efforts to resolve complaints through the project-specific GRM, complainants will retain the option to seek redressal through government administrative or judicial remedies if they remain unsatisfied with the decision.

8.14.3 Third Tier of GRM

399. If a grievance cannot be resolved by the second tier GRC or if the complainant remains dissatisfied with the decision, they may pursue alternative redress through the Chief Executive Officer, district administration, Secretary of the Irrigation Department, higher-level administrative authorities, the Pakistan Citizen Portal, or the court of law, as appropriate.

400. Grievance Redressal Committee: SID will establish the central-level Grievance

Redress Committee (GRC) as a continuous and functional structure, involving personnel from the PMO and other relevant parties. The composition and functions of the central GRC and project site level GRC will be specified in the Resettlement Action Plan (RAP) of the proposed project.

401. Monitoring and Reporting: Monitoring reports on RAP and ESMP implementation will include progress on grievance resolution, including the number of cases registered, the level of jurisdiction (first, second, and third tiers), the number of hearings held, decisions made, and the status of pending cases. Lists of cases in process and already decided upon will also be prepared, detailing information such as complainant names, complaint numbers, application dates, hearing dates, decisions, remarks, and actions taken to resolve grievances.

CHAPTER - 9: ESTIMATED ENVIRONMENTAL COST

9.1 General

402. This chapter deals with the cost related with the environmental and resettlement aspects of the Project. This also includes the cost of additional works incorporated in the design to minimize the socio–environmental risks. Environmental costs are based on the environmental setting, social aspect and ecology of the surrounding area required to neutralize the impacts, arising from the construction of the project.

324. Environmental cost comprises six main components, which are:

a) Environmental Monitoring Cost during Construction

b) Environmental and Social Management Cost

9.1 Environmental Monitoring Cost

403. The monitoring costs typically include the services of third-party environmental Laboratories responsible for conducting water quality, air quality, and noise level tests during the project's construction phase. SEPA-approved laboratories will be engaged for this monitoring following SID's approval. The unit rates for various parameters outlined in Table 9.1 remain competitive for the year 2025.

9.2 Resettlement Cost Estimates

404. Resettlement costs pertain to the permanent acquisition of land and the disruption of public and private infrastructure. The cost for land acquisition is currently tentative/indicative prices; the actual price will be the one fixed by the Commissioner of Land under the Land Acquisition Act 1894 in consultation with the people. In many instances, transactions are verbal and lack documentation. Regarding the cost of infrastructure disruption, it has been evaluated based on replacement cost considerations.

9.3 Environmental and Social Management Cost

325. Environmental and Social Management Costs included:

- All HSE-related activities e.g. TBTs, PPEs, decent work, safety signage, emergency preparedness, etc.
- Camp Management incl. information boards and telephone/computer, solar or other refrigerators (with generators if needed) for medical supplies, labor camp accommodations & related requirements (sanitation, washrooms, water supply
- Monitoring of disturbance of habitats through encroachment, noise and other construction activities.
- Solid Waste Management; Collection, segregation, transportation, disposal and management of domestic, commercial, and construction wastes.
- GRM establishment and running coat + Social Welfare and Development Cost; Based on the regular consultations with stakeholders including affectees and nearby community, through basic need assessment by the contractor and verified by PMO coordinating the district social welfare department.
- Capacity building/Training Cost; Literature preparation, printed material such as posters & pamphlets trainer(s), and venue, etc.
- Environmental, HSE & Social staff Salaries of the contractors.

326. Details of all these costs with their unit rates are given in Table 9-1.

Table 9-1: Environmental Mitigation Cost (Old Abad Bund)

Sr. No.	Parameter	Mechanism	Frequency/ unit	Unit Rate (PKR)	Quantity	No of samples	Cost (PKRs)	Remarks
A	**CONSTRUCTION PHASE**							
A-1	**Environmental Monitoring Cost during construction**							
1	Water Resources/ Water Quality	Discrete grab sampling and laboratory testing of water samples by SEPA approved Laboratory for monitoring.	Quarterly (every three months)	25,000	1	5.6	140,000	
2	Drinking Water Quality	Discrete grab sampling and laboratory testing of water samples by SEPA approved Laboratory for monitoring.	Quarterly (every three months)	25,000	1	5.6	140,000	
3	Noise Levels	dBA Leq. as per SEQS 2014	Monthly	5,000	4	17	340,000	four locations
4	Emission Monitoring	spot	Quarterly (every three months)	10,000	7	5.6	392,000	for 17 months (for 07 no's of machinery)
5	Ambient Air Monitoring	Monitoring of CO, SO2, NO_x, SPM and $PM_{2.5}$ PM_{10} by SEPA approved Laboratory	Quarterly (every three months)	35,000	1	5.6	196,000	
						Sub-Total (A):	**1,208,000**	

Sr. No.	Parameter	Mechanism	Frequency/ unit	Unit Rate (PKR)	Quantity	No of samples	Cost (PKRs)	Remarks
B	**Environmental and Social Management Cost**							
6	HSE	All HSE related activities e.g. TBTs, PPEs, decent work, safety signage, emergency preparedness, etc.	Monthly/no	40,000	17	-	680,000	Cost for PPEs, extinguishers, emergency lights, housekeeping equipment, safety signage and barricade, emergency preparedness kit, first aid kit, etc.
7	Camp Management	(incl. information boards and telephone/computer, solar or other refrigerators (with generators if needed) for medical supplies, labor camp accommodations & related requirements (sanitation, washrooms, water supply)	Monthly/no	25,000	17	-	425,000	
8	Ecological and Biodiversity Monitoring & Management	Monitoring of disturbance of habitats through encroachment, noise and other construction activities.	Monthly/no	15,000	17	-	255,000	
9	Solid Waste Management	Collection, segregation, transportation, disposal and management of domestic, commercial, construction wastes	Monthly/no	15,000	17	-	255,000	
10	GRM establisment and running coat + Social Welfare and Development Cost	Based on the regular consultations with stakeholders including affectees and nearby community, through basic need assessment by the contractor and verified by PMU/PIU coordinating the district social welfare department.	Lump sum	150,000	1	-	150,000	Different social welfare and development Projects i.e. easy loans for affectees, rehabilitation of schools, roads, tracks, irrigation channels etc.
11	Capacity building/ Training Cost	Literature preparation, printed material such as posters & pamphlets trainer(s), and venue, etc.	Quarterly (every three months)	150,000	5.6	-	840,000	This is the tentative cost with logistics at the site.

Sr. No.	Parameter	Mechanism	Frequency/ unit	Unit Rate (PKR)	Quantity	No of samples	Cost (PKRs)	Remarks
12	Communicable Diseases	Tests should be performed by approved laboratory	Bi-annually	150,000	1.4	-	210,000	This is the tentative cost for one-year period for medical tests of kitchen staff at each camp site.
13	E&S Staff	Environmental, HSE & Social staff Salaries	Monthly	45,000	17	2	1,530,000	two different persons will be deputed on site
						Sub-Total (B):	**4,345,000**	
						Grand Total (A+B):	**5,553,000**	
		Contingency Charges:	10% of Grand Total	-	-	-	**555,300**	
						Grand Total with Contingencies:	**6,108,300**	

CHAPTER - 10: CONCLUSION AND RECOMMENDATIONS

10.1 Conclusions

327. This Initial Environmental Examination (IEE) report presents a thorough assessment of the proposed Flood Protection and Dike Improvement Project along the Indus River in Sindh Province, focusing on the vulnerable areas of Larkana and Sukkur. The project falls under Schedule II, Category G(3) of the Sindh Environmental Protection Agency regulations, requiring an IEE due to its significant but manageable environmental and social impacts. The assessment finds that, while certain construction activities may result in temporary adverse effects such as localized air and noise pollution, loss of some vegetation, and minor disruptions to community life these impacts are generally of low to moderate significance and can be effectively mitigated through the implementation of a robust Environmental and Social Management Plan (ESMP).

328. The project's anticipated benefits are substantial. Strengthening and upgrading the embankments will significantly reduce flood risk for over a million residents, protect critical infrastructure, and enhance agricultural productivity in the region. Community consultations reveal strong local support, provided that fair compensation, livelihood restoration, and environmental safeguards are ensured. The project's design also incorporates best practices for environmental protection, biodiversity conservation, and social inclusion, setting a precedent for sustainable flood risk management in Pakistan.

10.2 Recommendations

- Strict ESMP Implementation: Ensure all contractors and project partners rigorously follow the ESMP, including site-specific management plans for air, water, noise, waste, and biodiversity, with regular monitoring and transparent reporting.
- Compensation and Livelihood Restoration: Provide fair, timely compensation for any land acquisition, crop loss, or resettlement, in accordance with prevailing laws and in consultation with affected communities.
- Community Health and Safety: Prioritize local hiring for construction and maintenance, implement occupational health and safety protocols, and conduct awareness campaigns on health, hygiene, and environmental stewardship.
- Stakeholder Engagement: Maintain ongoing, inclusive stakeholder consultations throughout the project lifecycle, ensuring that women, marginalized groups, and local leaders are actively involved in decision-making.
- Sustainable Water Management: Monitor and manage water resources carefully to prevent contamination and ensure continued access for local communities and ecosystems.
- Grievance Redressal: Operate a robust grievance mechanism to address complaints promptly and transparently, fostering trust and accountability.
- Capacity Building: Invest in training for project staff, local government, and community members to strengthen environmental and social management skills.

10.3 Overall Conclusion

329. The IEE confirms that the Flood Protection and Dike Improvement Project offers significant social, economic, and environmental benefits for the Sindh region, with most adverse impacts being temporary and readily mitigable. The project is recommended for implementation, provided that the outlined environmental and social safeguards are strictly adhered to. With its focus on resilience, inclusivity, and sustainability, the project will protect lives and livelihoods, promote local development, and serve as a model for future flood risk management initiatives in Pakistan.

Annexures

ANNEXURE - I: Scoping Checklist as per JICA format

Classification	Item	Main Check Items	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, basis, mitigation measures, etc.)
1 Permits and approvals	(1) Environmental Assessment and Environmental Permits	(a) Has an Environmental Impact Assessment Report (EIA Report) been prepared? (b) Are the EIA Report, etc., written in the official language or a widely used language of the relevant country? (c) Have the EIA Report, etc., been approved by the government of the relevant country? (If not approved, specify the anticipated approval date in the "Specific Environmental and Social Considerations" section.) (d) Is the approval of the EIA Report subject to conditions? If so, are these conditions being met? (e) Have any additional environmental permits or approvals required by local authorities been obtained? (f) Are all items listed in Annex 2 of the Guidelines covered? (The scope and level of detail may be adjusted depending on the potential impacts of the project.) (g) Has an environmental and social consideration review been conducted for the entire scope of the target project, cumulative impacts, derivative/secondary impacts, and inseparable integrated projects?	(a)N (b)Y (c)N (d)N (e)Y (f)Y (g)N	a) Submission of an IEE report is required. Within this project, we will prepare a draft IEE report and provide support to obtain approval from the Sindh EPA. (b) The IEE report will be prepared in English. (c) The IEE report will be finalized by January 2026, with approval from the Sindh EPA targeted for January 2026. (d) Confirm the presence or absence of conditions attached during the IEE application process. (e) Examine the necessity for other permits or approvals during the IEE application process. (f) This project is a Category B project but covers all items required for the IEE. (g) There are no cumulative impacts or inseparable integrated projects.

Classification	Item	Main Check Items	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, basis, mitigation measures, etc.)
	(2) Explanation and consultation with local residents	(a) Have local stakeholders been appropriately analyzed and identified? (b) Have appropriate explanations been provided to local stakeholders regarding the project's content and impacts, including through a process that ensures meaningful consultation, and have their understanding been obtained? (c) Are meeting records, including the gender and other attributes of participants, created for consultations with local stakeholders? (d) Have comments from residents and others been reflected in the project content?	(a) Y (b) Y (c) Y (d) Y	(a) Local stakeholders were identified as primary stakeholders (residents) and secondary stakeholders (EPA Sindh, Revenue Department, Forest Department, Wildlife Department, Education Department, Agriculture Department including Fisheries, Local Government and Rural Development Departments, and local NGOs). (b) The first stakeholder consultation was held on April 10, 2025, and the second stakeholder consultation was held on June 25, 2025. During the meeting, an explanation was provided regarding the project content, impacts, mitigation measures, etc. Participants raised concerns such as appropriate compensation for affected residents and the employment of local workers. On the other hand, there was no opposition to the project. (c) During the stakeholder consultations, a participant list including gender and meeting records were created. (d) This project will develop a resident relocation plan and provide appropriate compensation. Additionally, on-site workers will be employed primarily from the local community. When applying for an IEE, the project will collaborate with relevant departments.
	(3) Consideration of Alternative Options	(a) Is the scope of alternative project/plan options appropriate? (b) Have feasible alternative options been considered from technical, financial, and environmental and social perspectives, including measures to reduce greenhouse gas emissions as necessary, in relation to environmental and social aspects? (c) Has a comparison been made with the option of not implementing the project?	(a) Y (b) Y (c) Y	(a) A comparative study was conducted on bank protection (revetment). (b) A comparative analysis was conducted considering factors such as constructability, cost, applicability, and environmental and social considerations. (c) Alternative options, including those that do not involve implementing the project, were compared.
2 Pollution Countermeasures	(1) Water Quality	(a) Will the implementation of the project result in changes to downstream river flow (primarily water level reduction), thereby causing sections that fail to meet environmental standards? (b) Will the construction have adverse effects? Are mitigation measures prepared for such effects?	(a) N (b) N	(a) This is a renovation and reinforcement project for existing river embankments, and changes in river flow are not anticipated. (b) Construction will be carried out during a period avoiding the monsoon season. However, water levels during this period are extremely low, and excavation below water level will not occur. Temporary embankments or similar measures are not required; however, if absolutely necessary, countermeasures will be implemented using large sandbags.

Classification	Item	Main Check Items	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, basis, mitigation measures, etc.)
	(2) Waste	(a) If large amounts of excavated soil or dredged sediment are generated, will they be properly treated and disposed of in accordance with the regulations of the relevant country? (b) Will the construction have any adverse effects? Are mitigation measures prepared for such effects?	(a) Y (b) Y	(a) Excavated soil will be reused as a cover material by mixing it with purchased sand and gravel. (b) Industrial waste such as construction debris generated during the construction work will be transported to the disposal site designated by PID Sindh and properly disposed of.
	(3) Ground subsidence	(a) Is there a risk of groundwater level decline or ground subsidence due to excavation? (b) Will the construction have adverse effects? Are mitigation measures prepared to address such effects?	(a) Y (b) N	(a) There is a risk of ground subsidence due to embankment construction. (b) Based on geological surveys, the soil conditions are relatively good, and the design ensures that settlement will remain within the allowable limits for the embankment's excess fill, resulting in minimal impact.
3. Natural Environment	(1) Protected Area	(a) Is the site located within a protected area designated by the laws and international treaties of the relevant country? (b) Does the project affect the protected area? (c) Will the construction cause adverse effects? Are mitigation measures prepared to address such effects?	(a) N (b) N (c) N	(a) There are no protected areas in the vicinity of the site. (b) No impact is expected. (c) No adverse effects from construction are anticipated.

Classification	Item	Main Check Items	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, basis, mitigation measures, etc.)
	(2) Biodiversity	(a) Does the project site include primary forests, tropical natural forests, or ecologically important habitats (e.g., coral reefs, mangrove wetlands, tidal flats, etc.)? (b) Does the project site include habitats of endangered species protected under national laws or international treaties? (c) Does the project involve significant conversion or degradation of important habitats or important forests, raising concerns about significant impacts on biodiversity? If so, are appropriate measures to address impacts on biodiversity being implemented? (d) Does the project cause adverse impacts on aquatic organisms, flora, fauna, and ecosystems in downstream areas due to reduced flow or seawater intrusion? (e) Does the project cause changes in river flow conditions that have negative impacts on the riverine environment? (f) If there are concerns about significant impacts on biodiversity, will measures be taken to reduce such impacts? (g) Will construction cause negative impacts? Are mitigation measures prepared to address such impacts?	(a) N (b) Y (c) N (d) N (e) N (f) Y	(a) The project area consists primarily of farmland and barren land, and does not include primary forests, tropical natural forests, or ecologically important habitats. (b) Regarding flora, a total of 48 plant species were identified within the project area and its surroundings. Among the recorded plant species, one Vulnerable (VU) species and one Critically Endangered (CR) species, both listed as threatened on the IUCN Red List, were confirmed. However, these species were identified outside the project area. Furthermore, tree felling due to construction is not anticipated. Regarding fauna, 8 fish species, 4 amphibian species, 21 reptile species (3 freshwater turtle species, 7 lizard species, 11 snake species), 82 bird species, and 21 mammal species were identified within the project site and its surrounding areas. Among these, all fish, amphibians, birds, and mammals were classified as Least Concern (LC) on the IUCN Red List. However, among the freshwater turtles classified as reptiles, one species was classified as Vulnerable (VU) and two species were Endangered (EN). Nevertheless, these species are widely distributed in rice paddies, rivers, lakes, and marshes throughout Pakistan, and it is considered unlikely that their populations will be directly threatened by this project. (c) This project does not involve significant conversion or degradation of important habitats or significant forests. (d) This project involves the repair and reinforcement of existing river embankments; a reduction in flow or saltwater intrusion is not anticipated. (e) No other significant impacts are anticipated. (f) Guidance must be provided to prevent illegal hunting or poaching by field workers.
	(3) Hydrological conditions	(a) Will changes in the water system caused by the project have a negative impact on surface water or groundwater flow? (b) Will construction activities have negative impacts? Are mitigation measures prepared to address such impacts?	(a) N (b) N	(a) The project involves the renovation and reinforcement of existing river embankments, and no negative impacts on surface water and groundwater flow are anticipated. (b) The project involves the renovation and reinforcement of existing river embankments, and no negative impacts on surface water and groundwater flow are anticipated.

Classification	Item	Main Check Items	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, basis, mitigation measures, etc.)
	(4) Topography and Geology	(a) Will the construction of rivers or waterways result in significant alterations to the topography and geological structure of the surrounding area? (b) Will the construction have negative impacts? If so, are mitigation measures in place?	(a) N (b) N	(a) This involves the renovation and reinforcement of existing river embankments, and no significant alterations to the topography or geology are anticipated. (b) This involves the renovation and reinforcement of existing river embankments, and no significant impacts on terrain or geology are anticipated as a result of the construction work.
4 Social Environment	(1) Resident Relocation and Land Acquisition	(a) Will land acquisition involving involuntary resident relocation occur as a result of the project? If so, specify the scale of land acquisition and resident relocation. (b) Will efforts be made to minimize the impacts of relocation? Will other land acquisition or loss of livelihood occur? (c) Will appropriate explanations regarding compensation and livelihood reconstruction measures be provided to residents prior to relocation? (d) Will surveys be conducted for resident relocation, and will a relocation plan be established that includes compensation based on replacement value and the restoration of living infrastructure after relocation? (e) Are compensation payments made prior to relocation? (f) Is the compensation policy documented in writing? (g) Does the plan adequately consider the needs of socially vulnerable groups, including women, children, the elderly, the poor, persons with disabilities, refugees, internally displaced persons, and minorities? (h) Are the agreed compensation terms explained in writing to the affected residents, and can prior consent be obtained from the displaced residents? (i) Will the necessary mechanisms be established to ensure the proper implementation of resident relocation? Will sufficient implementation capacity and budgetary measures be secured? (j) Is monitoring of the impacts of relocation planned? (k) Is there a system in place for handling complaints?	(a) Y (b) Y (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) Y (k) Y	(a) This project will result in the relocation of 5 households (24 residents) at Old Abad Bund, while 12 households (46 residents) will be affected by land-related impacts such as land acquisition. The land acquisition area is 7.72 acres (3.12 ha). (b) Agricultural land acquisition will occur, but a resettlement plan has been prepared and crop compensation will be provided. (c) Project details and impacts were explained during stakeholder consultations (June 25, 2025). (d) A resettlement plan has been developed following a field survey. (e) Compensation related to resettlement/land acquisition will be provided prior to relocation. (f) A resettlement plan has been developed. (g) A resettlement plan considering vulnerable groups has been developed. (h) Agreement on resident relocation will be obtained prior to relocation. (i) An implementation structure is being established within the resident relocation plan. (j) Monitoring is planned within the resident relocation plan. Monitoring will be conducted once at the time of compensation payment and once monthly after compensation, with results reported in a monitoring report. (k) A grievance mechanism is being established within the resident relocation plan.

Classification	Item	Main Check Items	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, basis, mitigation measures, etc.)
4 Social Environment	(2) Living Conditions and Livelihoods	(a) Will the project have a negative impact on residents' livelihoods? If so, will measures be taken to mitigate such impacts? (b) Will water use (surface water, groundwater) such as water abstraction by the project have negative impacts on fisheries and water use in surrounding areas and downstream areas? (c) Will the project have negative impacts on ecosystem services (supply and regulation), thereby affecting community health and safety (particularly for indigenous peoples and others dependent on such services)? (d) Will construction activities have negative impacts? Are mitigation measures prepared to address such impacts?	(a) Y (b) N (c) N (d) Y	(a) As stated in (1) (a) (b) No commercial fishing activities are conducted, and there are no residents or fishing organizations whose livelihood depends on fishing. While instances of small-scale fishing for household consumption or recreation by some residents were confirmed, these are limited and intermittent activities, and their impact on local livelihoods and biodiversity is judged to be minor. (c) This involves the repair and reinforcement of existing river embankments, and no particular impact on ecosystem services, etc., is anticipated. (d) As stated in (a)
	(3) Socially Vulnerable Groups	(a) Will appropriate consideration be given to socially vulnerable groups such as women, children, the elderly, the poor, persons with disabilities, refugees, internally displaced persons, and minorities? (b) Will the construction have adverse effects on these groups? Are mitigation measures prepared to address such effects?	(a) Y (b) Y	(a) Construction work around the settlement will be conducted with consideration for women's commuting times and daily routines, limiting working hours in principle to 8:00 AM to 6:00 PM. This will minimize impacts on local residents while respecting local customs and traditions. (b) As described in (a)
	(4) Cultural Heritage	(a) Is there a risk that the project may damage archaeological, historical, cultural, or religious heritage sites or other significant sites? Are measures prescribed by the host country's domestic laws taken into consideration? (b) Will construction activities have adverse impacts? Are mitigation measures prepared to address such impacts?	(a) N (b) N	(a) There are no cultural heritage sites designated in the target area. (b) There are no designated cultural heritage sites in the target area.
	(5) Landscape	(a) If there are landscapes that require special consideration, will the project have a negative impact on them? (b) Will the construction have a negative impact? Are mitigation measures in place to address such impacts?	(a) N (b) N	(a) There are no landscapes requiring special consideration. (b) There are no landscapes requiring special consideration.

Classification	Item	Main Check Items	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, basis, mitigation measures, etc.)
	(6) Minority groups, indigenous peoples	(a) Are measures taken to mitigate the impact on the culture and way of life of the country's minority groups and indigenous peoples? (b) Are the rights of ethnic minorities and indigenous peoples to their lands and resources respected? (c) Are indigenous peoples' plans developed and made public when necessary? (d) Are efforts being made to ensure that sufficient information is provided to minority groups and indigenous peoples and that their free prior consent is obtained? (e) Will the construction have adverse effects? Are mitigation measures prepared for such effects?	(a) N (b) N (c) N (d) N (e) N	(a) No ethnic minorities or indigenous peoples have been identified in the target area, and no impact is anticipated. (b) In the target area, no ethnic minorities or indigenous peoples have been identified, and no impacts are anticipated. (c) No ethnic minorities or indigenous peoples have been identified in the target area, and no impacts are anticipated. (d) No ethnic minorities or indigenous peoples have been identified in the target area, and no impacts are anticipated. (e) No ethnic minorities or indigenous peoples have been identified in the project area, and no impact is anticipated.
	(7) Working environment	(a) Are the laws of the relevant country regarding labor safety and health being complied with in the project? (b) Are safety measures, such as the installation of safety equipment for accident prevention and the management of hazardous substances, implemented to ensure the physical safety of project personnel? (c) Are soft measures, such as the development of safety and health plans and the implementation of safety education for project personnel (including traffic safety and public health), planned and implemented?	(a) Y (b) Y (c) Y	(a) The contract explicitly states that the working environment is appropriately managed in accordance with the law. (b) Safety measures are implemented for project stakeholders. (c) Plan and implement measures to address the soft aspects of project stakeholders.
	(8) Public Health, Safety, and Security in the Local Community	(a) Are there any negative impacts on hygiene (including infectious diseases such as HIV) due to the influx of workers associated with the project? Are mitigation measures prepared for such impacts? (b) Are there any negative impacts on community safety, such as deterioration of public order, due to the influx of workers associated with the project? Are mitigation measures prepared for such impacts? (c) If the host country or other relevant parties employ security personnel or other personnel for safety purposes in connection with the formation or implementation of the project, will appropriate measures be taken to ensure that such personnel do not exercise their security capabilities except for preventive and self-defense purposes? (d) Will the construction cause adverse impacts? Are mitigation measures in place to address such impacts?	(a) Y (b) Y (c) Y (d) N	(a) On-site workers are primarily hired locally, so significant impacts are not anticipated; however, guidance on infection prevention measures will be provided. (b) The influx of workers may lead to unwanted contact with local women and children, as well as risks of sexual exploitation and abuse, sexual harassment, and other related issues. Awareness-raising activities will be conducted regarding gender-based violence (GBV), sexual exploitation and abuse (SEA), and sexual harassment (SH). (c) Appropriate measures will be taken to ensure that security personnel involved in the project do not infringe upon the safety of project personnel or local residents. (d) No significant adverse impacts from construction activities are anticipated.

Classification	Item	Main Check Items	Yes: Y No: N	Specific environmental and social considerations (Reasons for Yes/No, basis, mitigation measures, etc.)
5 Other	(1) Monitoring	(a) Are monitoring plans and implementation in place for the environmental and social items listed above that may be affected? (b) How are the items, methods, frequency, etc., of the monitoring plan specified? (c) Will the operator's monitoring system (including organization, personnel, equipment, budget, and their continuity) be established? (d) Are the methods, frequency, etc., for reporting monitoring results from the operator to the competent authority or relevant entities specified? (e) Is a complaint handling mechanism related to environmental and social considerations established?	(a) Y (b) Y (c) Y (d) Y (e) Y	(a) Monitoring is planned for items of concern. (b) Specified in the environmental monitoring plan. (c) Specified within the implementation structure. (d) Specified within the implementation structure. (e) Establish a complaint handling mechanism.
6 Points to note	(1) Reference to other environmental checklists	(a) If necessary, evaluate by adding the relevant check items from the forest-related checklist. (b) If necessary, evaluate by adding the relevant check items from the port-related checklist.	(a) N (b) N	(a) No activities that affect forests are anticipated in this project. (b) This project does not anticipate any activities that will affect the port.
	(2) Notes on the use of the environmental checklist	(a) If necessary, confirm the impact on transboundary or global environmental issues (e.g., transboundary waste disposal, elements related to global warming issues, etc.). (b) For projects expected to result in the emission of greenhouse gases exceeding a certain threshold, has an estimate of the total greenhouse gas emissions been conducted prior to project implementation?	(a) N (b) N	(a) Transboundary waste disposal or global warming is not anticipated. (b) This project does not fall under the category of projects where "direct greenhouse gas emissions from the project exceed 25,000 CO2 equivalent tons per year."

ANNEXURE - II: Baseline Environmental Monitoring Reports

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IERL-SEPA CERTIFICATE NO.		EPA/LAB/CERTIFICATE 01/31/2022	
Lab Reference.No.	IERL/IEEC/02/2025	Site ID.	Old Abad Bund Site
Report to.	M/S Indus Environmental Engineering Consultant	Reporting Date	07/04/2025
Sample Collection Date	14/02/2025	Sample Description:	Ambient Air Quality Monitoring (24 Hours)
Sample Collected/Submitted by:	IERL Representative	Sampling Location:	Old Abad Bund Site (27.46049, 68.262551)

Analytical Test Report of Ambient Air Quality Monitoring

Date	Time	SO_2	NO	NO_2	CO	O_3	$PM_{2.5}$	PM_{10}	SPM	Lead
14-02-2025	05:00 am	9.46	13.35	27.4	6.65	182.3	25	47	66	0.001
	06:00 am	7.65	12.65	29.1	4.87	177.4	17	40	60	0.001
	07:00 am	8.36	10.87	13.9	5.43	160.5	18	67	104	0.001
	08:00 pm	7.59	9.34	71.5	7.23	95.3	64	135	180	0.001
	09:00 pm	8.36	8.45	74.5	6.43	66.1	69	105	126	0.001
	10:00 pm	9.65	8.46	72.9	4.87	64.5	87	141	179	0.001
	11:00 pm	7.84	9.36	68.3	4.76	80	104	165	208	0.001
15-02-2025	12:00 am	8.53	8.58	42.6	5.22	83.1	107	149	176	0.001
	01:00 am	7.26	9.57	56.6	7.98	50.1	98	133	155	0.001
	02:00 am	6.22	9.58	39.3	8.12	80.4	75	103	119	0.001
	03:00 am	8.34	9.45	53	5.87	100.5	61	85	99	0.001
	04:00 am	8.94	8.47	23.34	6.65	145.4	32.74	47	76	0.001
	05:00 am	7.96	9.76	54.75	6.35	154.3	26.43	49	98	0.001
	06:00 am	8.43	9.98	43.73	4.87	143.7	31.54	54	98	0.001
	07:00 am	8.08	10.05	33.82	3.98	123.4	30.64	126	143	0.001
	08:00 am	9.36	9.09	43.98	4.36	98.3	28.76	187	154	0.001
	09:00 am	8.26	9.65	27.47	10.76	86.6	32.65	143	198	0.001
	10:00 am	9.46	8.54	22.65	9.65	65.4	35.87	132	143	0.001
	11:00 am	8.45	10.03	33.87	7.35	76.3	38.87	121	162	0.001
	12:00 pm	8.58	9.35	31.65	8.35	74.2	37.94	111	186	0.001
	01:00 pm	7.68	10.65	39.65	9.43	70.3	37.65	123	143	0.001
	02:00 pm	8.31	11.66	29.27	7.36	87.9	34.76	87	97	0.001
	03:00 pm	7.23	9.23	23.34	8.36	65.4	37.65	65	97	0.001
	04:00 pm	8.11	8.46	54.75	4.45	54.98	44.52	76	87	0.001
SEQS		120	40	80	10	130	75	150	500	1.5
Unit		µg/m³	µg/m3	µg/m3	mg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
Maximum		9.65	13.35	74.5	10.76	182.3	107	187	208	0.001
Minimum		6.22	8.45	13.9	3.98	50.1	17	40	60	0.001
Average		8.23	9.86	39.96	6.69	100.72	49.69	104.53	131.61	0.001

❖ *Sindh Environmental Quality Standards for Ambient Air (The Sindh Govt Gazette No.M324/2016) Part -I, Page 32, 28-Jan-2016.*

Sample Analyzed by

Head of Imperial Environment Research Lab.

Date 7/4/25

Terms & Condition:

❖ *Report is valid for current batch (sample).*
❖ *This Report is not valid for any other certification, or court matters.*

ISO 9001 QUALITY MANAGEMENT

UKAS MANAGEMENT SYSTEMS 0015

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IERL-SEPA CERTIFICATE NO.		EPA/LAB/CERTIFICATE 01/31/2022	
Lab Reference No.	IERL/IEEC/02/2025	**Site ID.**	Old Abad Bund Site
Report to.	M/S Indus Environmental Engineering Consultant	**Reporting Date**	07/04/2025
Sample Collection Date	14/02/2025	**Sample Description:**	Ambient Air Quality Monitoring (24 Hours)
Sample Collected/Submitted by:	IERL Representative	**Sampling Location:**	Old Abad Bund Site (27.46049, 68.262551)

Meteorological Data Sheet

Date	Time	w/s (m/s)	Pressure (mbar)	w/d (degree)	Temp (°C)	RH (%)
14/03/2025	05:00 pm	0.5	1001	40	28	20
14/03/2025	06:00 pm	1.1	1000	50	28	18
14/03/2025	07:00 pm	1	1001	35	23	17
14/03/2025	08:00 pm	1	1000	35	23	17
14/03/2025	09:00 pm	2.3	1002	35	23	16
14/03/2025	10:00 pm	0.8	1002	40	26	19
14/03/2025	11:00 pm	1.2	1002	35	25	17
15/03/2025	12:00 am	0	1001	35	25	18
15/03/2025	01:00 am	1.2	1001	40	24	18
15/03/2025	02:00 am	1.2	1001	45	24	19
15/03/2025	03:00 am	1.7	1002	50	23	19
15/03/2025	04:00 am	1.4	1002	45	22	23
15/03/2025	05:00 am	2.4	1002	220	24	26
15/03/2025	06:00 am	3	1013	225	25	31
15/03/2025	07:00 am	2	1001	320	24	29
15/03/2025	08:00 am	3.2	1002	35	25	28
15/03/2025	09:00 am	1.3	1003	40	25	29
15/03/2025	10:00 am	2.3	1003	40	26	31
15/03/2025	11:00 am	2.3	1002	335	26	31
15/03/2025	12:00 pm	2.4	1005	40	27	32
15/03/2025	01:00 pm	1.3	1001	40	28	32
15/03/2025	02:00 pm	2.6	1002	60	28	33
15/03/2025	03:00 pm	1.3	1001	320	28	33
15/03/2025	04:00 pm	1.2	1002	75	29	35

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Lab Reference No.	IERL/IEEC/02/2025	Site ID.	Old Abad Bund Site
Report to.	M/S Indus Environmental Engineering Consultant	Reporting Date	07/04/2025
Sample Collection Date	14/02/2025	Sample Description:	Ambient Noise Quality Monitoring (24 Hours)
Sample Collected/Submitted by:	IERL Representative	Sampling Location:	Old Abad Bund Site (27.46049, 68.262551)

Analytical Test Report of Ambient Noise Quality Monitoring

S.No.	Sampling Site Location	Time		Result dB(A)	SEQS Limits	Remarks
1.	Old Abad Bund Site	05:00 pm	Day Time	47.2	55	Within Limits
2.		06:00 pm		49.6	55	Within Limits
3.		07:00 pm		51.4	55	Within Limits
4.		08:00 pm		49.6	55	Within Limits
5.		09:00 pm		51.3	55	Within Limits
6.		10:00 pm	Night Time	44.5	45	Within Limits
7.		11:00 pm		47.2	45	Out of Limits
8.		12:00 am		45.9	45	Within Limits
9.		01:00 am		52	45	Out of Limits
10.		02:00 am		50.5	45	Out of Limits
11.		03:00 am		41.3	45	Within Limits
12.		04:00 am		43.9	45	Within Limits
13.		05:00 am		43.1	45	Within Limits
14.		06:00 am	Day Time	51.2	55	Within Limits
15.		07:00 am		55.9	55	Within Limits
16.		08:00 am		52	55	Within Limits
17.		09:00 am		50.5	55	Within Limits
18.		10:00 am		54.1	55	Within Limits
19.		11:00 am		55.0	55	Within Limits
20.		12:00 pm		52.4	55	Within Limits
21.		01:00 pm		53.2	55	Within Limits
22.		02:00 pm		49.8	55	Within Limits
23.		03:00 pm		47.1	55	Within Limits
24.		04:00 pm		50.3	55	Within Limits

❖ *Sindh Environmental Quality Standards*

Sample Analyzed by	Head of Imperial Environment Research Lab

Imperial Environment Research Laboratory Date 7/4/25

Terms & Condition:

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IERL-SEPA CERTIFICATE NO.		EPA/LAB/CERTIFICATE 01/31/2022	
Lab Reference No.	IERL/IEEC/02/2025	**Site ID.**	Old Abad Bund Site
Report to.	M/S Indus Environmental Engineering Consultant	**Reporting Date**	07/04/2025
Sample Collection Date	14/02/2025	**Sample Description:**	Ambient Noise Quality Monitoring (Spot Monitoring)
Sample Collected/Submitted by:	IERL Representative	**Sampling Location:**	Old Abad Bund Site (27.46049, 68.262551)

Analytical Test Report of Ambient Noise Quality Monitoring

Sr. #	Locations	Method*	SEQS Limit*	Unit	Results	Remarks
1.	Near River Indus	ASTM E1503	55	dB (A)	51	Within Limit
2.	Near Masjid	ASTM E1503	55	dB (A)	49	Within Limit
3.	Near Bund	ASTM E1503	55	dB (A)	48	Within Limit
4.	Near Otaq	ASTM E1503	55	dB (A)	53	Within Limit

- ASTM = American Society for Testing and Materials
- SEQS= *Sindh Environmental Quality Standards*

Sample Analyzed by	**Head of Imperial Environment Research Lab**

Environment Research Laboratory Date: 7/4/25

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IERL-SEPA CERTIFICATE NO.		EPA/LAB/CERTIFICATE 01/31/2022	
Lab Reference No.	IERL/IEEC/02/2025	**Site ID.**	Old Abad Bund Site
Report to.	M/S Indus Environmental Engineering Consultant	**Reporting Date**	07/04/2025
Sample Collection Date	14/02/2025	**Sample Description:**	Vibration Monitoring (Spot Monitoring)
Sample Collected/Submitted by:	IERL Representative	**Sampling Location:**	Old Abad Bund Site

Analytical Test Report of Vibration Monitoring

Sr. #	Locations	Method*	Unit	Results
1.	Near Masjid	Vibration Meter AS63A	m/s^2	0.09
2.	Near Bund	Vibration Meter AS63A	m/s^2	0.20
3.	Near Otaq	Vibration Meter AS63A	m/s^2	0.16

Sample Analyzed by	Head of Imperial Environment Research Lab

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IERL-SEPA CERTIFICATE NO.		EPA/LAB/CERTIFICATE 01/31/2022	
Lab Reference No.	IERL/IEEC/02/2025	**Site ID.**	Old Abad Bund Site
Report to.	M/S Indus Environmental Engineering Consultant	**Reporting Date**	07/04/2025
Sample Collection Date	15/02/2025	**Sample Type**	Ground water (D.w)
Sample Receiving Date	16/02/2025	**Sample Location**	Old Abad Bund Site
Sample Collected/Submitted by:	IERL Representative	**Sampling Location:**	27.457123, 68.261305

Analytical Test Report of Drinking Water Quality Monitoring

S.No.	Parameter	Ref: Method	Unit	SEQS Limit	Result	Remarks
1	Temperature	APHA 2550	°C	40 ≤ 3	25.6	Within Limit
2	pH @ 25°C	APHA 4500-H+ B	-	6.5-8.5	7.4	Within Limit
3	Odor	APHA 2150 B	-	Acceptable	Acceptable	Within Limit
4	Colour	APHA 2120 B	TCU	15	<5	Within Limit
5	Taste	APHA 2150 B	-	Acceptable	Acceptable	Within Limit
6	Total Hardness	APHA 2340 C	mg/l	500	150	Within Limit
7	Total Dissolved Solids	APHA 2540 C	mg/l	1000	510	Within Limit
8	Turbidity	APHA 2130 B	NTU	<5	2.20	Within Limit
9	Chloride	APHA 4500-Cl B	mg/l	<250	95	Within Limit
10	Chlorine, Residual	APHA 4500-Cl G	mg/l	0.2 - 0.5	0.00	Within Limit
11	Aluminium	APHA 3111 B	mg/l	0.2	0.001	Within Limit
12	Antimony	APHA 3111 B	mg/l	0.005	0.001	Within Limit
13	Barium (Ba)	APHA 3111 B	mg/l	0.7	0.001	Within Limit
14	Boron	APHA 3111 B	mg/l	0.3	0.001	Within Limit
15	Fluoride	APHA 4500-F C	mg/l	1.5	0.6	Within Limit
16	Nitrate	APHA 4500-NO3- F	mg/l	0.5	0.141	Within Limit
17	Nitrite	APHA 4500-NO2- E	mg/l	3	0.02	Within Limit
18	Arsenic	APHA 3111 B	mg/l	0.05	0.02	Within Limit
19	Cadmium	APHA 3111 B	mg/l	0.01	0.00	Within Limit
20	Chromium	APHA 3111 B	mg/l	<0.05	0.001	Within Limit
21	Copper	APHA 3111 B	mg/l	2	0.001	Within Limit
22	Cyanide	APHA 4500-CN- G	mg/l	0.05	0.001	Within Limit
23	Lead	APHA 3111 B	mg/l	<0.05	0.001	Within Limit
24	Manganese	APHA 3111 B	mg/l	0.5	0.003	Within Limit
25	Mercury	APHA 3111 B	mg/l	0.001	0.00	Within Limit
26	Nickel	APHA 3111 B	mg/l	<0.02	0.00	Within Limit
27	Phenols	APHA 4500-P	mg/l	NGVS	0.00	Within Limit
28	Selenium	APHA 3111 B	mg/l	0.01	0.00	Within Limit
29	Zinc	APHA 3111 B	mg/l	5	0.001	Within Limit
30	Total Coliform	APHA 9221 B	Cfu	0/100ml	0	Within Limit
31	E-Coli	APHA 9221 G	Cfu	0/100ml	0	Within Limit

Sindh Environmental Quality Standards for Drinking Water
(NGVS No Guideline Value Standard)

Sample Analyzed by	Head of Imperial Environment Research Lab

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- The sample will be discarded after one week of issuance of report, unless otherwise informed by the client.

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IERL-SEPA CERTIFICATE NO.		EPA/LAB/CERTIFICATE 01/31/2022	
Lab Reference No.	IERL/IEEC/02/2025	**Site ID.**	Old Abad Bund Site
Report to.	M/S Indus Environmental Engineering Consultant	**Reporting Date**	31/01/2025
Sample Collection Date	15/02/2025	**Sample Type**	Surface water
Sample Receiving Date	16/02/2025	**Sample Location**	River Indus (Old Abad Bund Site)
Sample Collected/Submitted by:	IERL Representative	**Sampling Location:**	27.460283, 68.262837

Analytical Test Report of Surface Water Quality Monitoring

S. No.	Parameter	Ref: Method	Unit	Result
1.	Temperature 40 °C	APHA 2550	°C	25.8
2.	pH	APHA 4500-H+ B	-	7.8
3.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/l	360
4.	Biology Oxygen Demand (BOD)	APHA 5210 B	mg/l	35
5.	Chemical Oxygen Demand (COD)	APHA 5220 B	mg/l	88
6.	Total Suspended Solids (TSS)	APHA 2540 D	mg/l	7
7.	Oil & Grease	APHA 5520 B	mg/l	2
8.	Sulphide	APHA 4500-S^{2-} E	mg/l	0.08
9.	Cadmium	APHA 3111 B	mg/l	0.001
10.	Copper	APHA 3111 B	mg/l	0.002
11.	Iron	APHA 3500-Fe	mg/l	0.04
12.	Lead	APHA 3111 B	mg/l	0.001
13.	Manganese	HACH-8131	mg/l	0.672
14.	Mercury	APHA 3111 B	mg/l	0.002
15.	Nickle	APHA 3111 B	mg/l	0.001
16.	Selenium	APHA 3111 B	mg/l	0.001
17.	Chromium	APHA 3111 B	mg/l	0.001
18.	Zinc	APHA 3111 B	mg/l	0.002
19.	Arsenic	APHA 3111 B	mg/l	0.001
20.	Chlorine	APHA 4500-Cl G	mg/l	0
21.	Chloride	APHA 4500-Cl B	mg/l	84
22.	Cyanide	APHA 4500-CN- G	mg/l	0.001
23.	Fluoride	APHA 4500-F C	mg/l	0.6
24.	Ammonia	APHA 4500-NH_3 F	mg/l	1.2
25.	Total Toxic Metals	APHA 3500-Metal B	mg/l	0.003
26.	Phenolic Compounds (as Phenol)	APHA 5530 C	mg/l	0.002
27.	Boron	APHA 3111 B	mg/l	0.068
28.	Barium	APHA 3111 B	mg/l	0.002
29.	Silver	APHA 3111 B	mg/l	0.001
30.	An-ionic Detergents	APHA 5540 C	mg/l	1.21
31.	Sulphate	APHA 4500-SO_4^{2-} E	mg/l	58

Sample Analyzed by

Head of Imperial Environment Research Lab

Terms & Condition:

- Report is valid for current batch (sample).
- This Report is not valid for any other certification, or court matters

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IERL-SEPA CERTIFICATE NO.		EPA/LAB/CERTIFICATE 01/31/2022	
Lab Reference No.	IERL/IEEC/02/2025	**Site ID.**	Old Abad Bund Site
Report to.	M/S Indus Environmental Engineering Consultant	**Reporting Date**	07/04/2025
Sample Collection Date	15/02/2025	**Sample Type**	Surface water
Sample Receiving Date	16/02/2025	**Sample Location**	Dadu Canal (Near Old Abad Bund Site)
Sample Collected/Submitted by:	IERL Representative	**Sampling Location:**	27.513915, 68.236227

Analytical Test Report of Surface Water Quality Monitoring

S. No.	Parameter	Ref: Method	Unit	Result
1.	Temperature 40 °C	APHA 2550	°C	25.7
2.	pH	APHA 4500-H+ B	-	7.7
3.	Total Dissolved Solids (TDS)	APHA 2540 C	mg/l	190
4.	Biology Oxygen Demand (BOD)	APHA 5210 B	mg/l	47
5.	Chemical Oxygen Demand (COD)	APHA 5220 B	mg/l	117
6.	Total Suspended Solids (TSS)	APHA 2540 D	mg/l	23
7.	Oil & Grease	APHA 5520 B	mg/l	5
8.	Sulphide	APHA 4500-S^{2-} E	mg/l	0.09
9.	Cadmium	APHA 3111 B	mg/l	0.001
10.	Copper	APHA 3111 B	mg/l	0.001
11.	Iron	APHA 3500-Fe	mg/l	0.03
12.	Lead	APHA 3111 B	mg/l	0.001
13.	Manganese	HACH-8131	mg/l	1.321
14.	Mercury	APHA 3111 B	mg/l	0.001
15.	Nickle	APHA 3111 B	mg/l	0.001
16.	Selenium	APHA 3111 B	mg/l	0.001
17.	Chromium	APHA 3111 B	mg/l	0.001
18.	Zinc	APHA 3111 B	mg/l	0.001
19.	Arsenic	APHA 3111 B	mg/l	0.001
20.	Chlorine	APHA 4500-Cl G	mg/l	0
21.	Chloride	APHA 4500-Cl B	mg/l	65
22.	Cyanide	APHA 4500-CN- G	mg/l	0.001
23.	Fluoride	APHA 4500-F C	mg/l	0.7
24.	Ammonia	APHA 4500-NH_3 F	mg/l	1.3
25.	Total Toxic Metals	APHA 3500-Metal B	mg/l	0.002
26.	Phenolic Compounds (as Phenol)	APHA 5530 C	mg/l	0.004
27.	Boron	APHA 3111 B	mg/l	0.081
28.	Barium	APHA 3111 B	mg/l	0.001
29.	Silver	APHA 3111 B	mg/l	0.001
30.	An-ionic Detergents	APHA 5540 C	mg/l	1.41
31.	Sulphate	APHA 4500-SO_4^{2-} E	mg/l	42

Imperial Environment Research Laboratory Date: 7/4/25

Sample Analyzed by	Head of Imperial Environment Research Lab

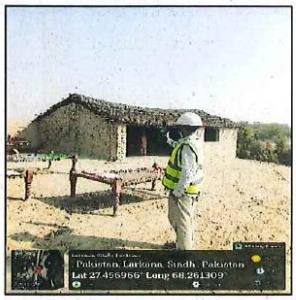
Terms & Condition:

- Report is valid for current batch (sample).
- This Report is not valid for any other certification, or court matters

nqa ISO 9001 QUALITY MANAGEMENT — UKAS MANAGEMENT SYSTEMS 0015

PICTURE GALLERY

	
Ambient Air & Noise Quality Monitoring	Ambient Air & Noise Quality Monitoring
	
Ambient Air & Noise Quality Monitoring	Ambient Air & Noise Quality Monitoring
	
Ambient Air & Noise Quality Monitoring	Ambient Air & Noise Quality Monitoring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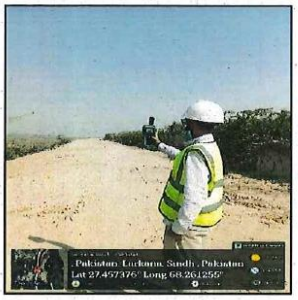	
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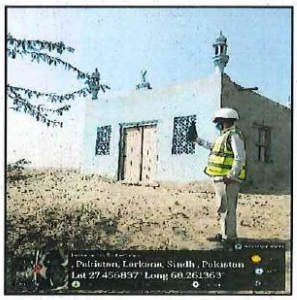
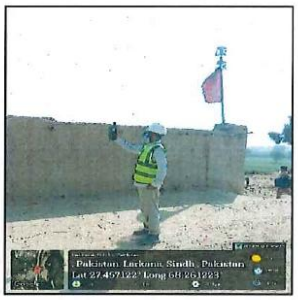
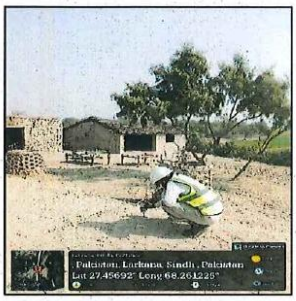
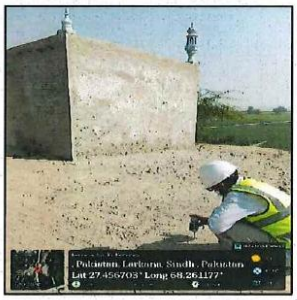
	
Ambient Noise Quality Monitoring	Ambient Noise Quality Monitoring

	
Vibration Monitoring	**Vibration Monitoring**
	
Vibration Monitoring	**Ground water sampling**
	
Ground water sampling	**Ground water sampling**

	
Surface water sampling (River Indus)	Surface water sampling (River Indus)
	
Surface water sampling (Dadu Canal)	Surface water sampling (Dadu Canal)

ANNEXURE - III: Public Consultation Report (PCM)

1ST PUBLIC CONSULTATION MEETING – OLD ABAD BUND	
Date:	10th April 2025
Location:	Zulifqar Jatoi Otaq at Sono Khan Jatoi Village
Project	**INITIAL ENVIRONMENTAL EXAMINATION (IEE) AND RESETTLEMENT ACTION PLAN (RAP) FOR THE PREPARATORY SURVEY FOR THE PROJECT FOR FLOOD PROTECTION AND DIKE IMPROVEMENT ON INDUS RIVER IN SINDH PROVINCE**
Meeting Agenda	• Overview of current flood risks and challenges in Sindh Province. • Presentation of proposed dike improvement and flood protection measures. • Discussion on stakeholder roles, collaboration, and resource mobilization. • Open forum for feedback and recommendations.

Introduction

During the public consultation meeting, it was highlighted that the Islamic Republic of Pakistan remains highly vulnerable to natural disasters such as floods, landslides, and earthquakes — with floods being the most frequent, particularly along the Indus River and its tributaries during the monsoon season. Participants were reminded of the severe socioeconomic impacts caused by past flood events, most notably the devastating floods of 2010 and 2022.

In response to the growing intensity and frequency of such disasters, stakeholders were informed that the Government of Pakistan has prioritized the renovation and reinforcement of river infrastructure under the National Flood Protection Plan-IV (NFPP-IV), covering FY 2015/16 to FY 2024/25, under the leadership of the Federal Flood Commission (FFC). Moreover, reference was made to the Post-Disaster Needs Assessment (PDNA) carried out after the 2022 floods, and the subsequent 4RF (Pakistan Floods 2022: Resilient Recovery, Rehabilitation, and Reconstruction Framework), which emphasized the urgent need to strengthen and ensure the safety of flood protection bunds.

The purpose of the project was discussed with community members and stakeholders, emphasizing its aim to reduce the risk of bund failure in the lower Indus River basin in Sindh through bund strengthening and upgrading. The expected outcome is to minimize economic losses during disasters and support the long-term goal of building a resilient society capable of withstanding future flood events.

The preparatory survey for the Project for Flood Protection and Dike Improvement in the Southern Indus River highlights the increasing risk of bund (embankment) failures due to anticipated rises in river discharges. This risk is especially pronounced in low-lying downstream areas like the Sukkur-Larkana region. These bunds' failures could significantly damage accumulated assets and vital infrastructure.

Project Overview

The project's main purpose is to reduce the risk of bund failure in the lower Indus River basin in Sindh by upgrading and strengthening the embankments. Additionally, the project aims to decrease the risk of economic losses during disasters and to help build a resilient society capable of withstanding such events.

The project involves several key components. These include renovating and enhancing river bunds, focusing on seepage control and erosion protection. Consulting services will be provided for detailed

design, bidding assistance, and procurement management. The project will also cover procurement and construction, with Japanese and local procurement methods being considered tentatively.

The area targeted by this project is the southern Indus River, specifically Sindh (Larkana, Sindh). The Federal Flood Commission (FFC) and the Sindh Irrigation Department will serve as the executing agencies for the project.

Purpose of PCM

The main purpose of a Public Consultation Meeting (PCM) is to ensure that all relevant stakeholders are fully informed about the proposed project, including its scope, objectives, and potential impacts. By clearly communicating project details, the meeting enables stakeholders to understand how they may be affected. Additionally, the PCM serves as a platform for gathering feedback from affected communities and key stakeholders, allowing them to share their concerns, expectations, and suggestions. This input is valuable for shaping project planning and execution, ensuring that diverse perspectives are considered. Finally, the PCM promotes transparency and compliance by maintaining open dialogue, which builds trust and ensures the project meets regulatory requirements. This process upholds accountability and transparency throughout all stages of the project.

Objective of PCM

To achieve these purposes, the PCM sets out several objectives. First, it seeks to address community concerns by engaging directly with local communities to identify their specific issues regarding the project. This targeted engagement enables the development of more tailored and effective solutions, while also fostering a sense of inclusion among stakeholders. Second, the PCM provides a forum for discussing mitigation measures, where potential risks associated with the project are outlined and strategies to address these risks are presented. This reassures stakeholders that their concerns are being taken seriously and that proactive steps are being taken to minimize negative impacts. Finally, the PCM aims to outline clear future steps for the project, ensuring that all stakeholders understand what to expect as the project moves forward. This includes explaining how stakeholder feedback will be integrated into the project's ongoing development, reinforcing the commitment to a transparent and participatory process.

PCM Proceedings in the form of MOM

Name of Expert	Mr. Farooq Ahmed, Environmental Specialist at IEEC
	
Discussion Points	He delivered a detailed presentation highlighting the project's objectives, scope, and environmental implications.

- No specific river plan has been formulated for the Sukkur Barrage.
- Key parameters set include design discharge, design water level, and flood reference discharge at Sukkur Barrage.
- Bunds have been constructed with a freeboard of 1.8 m (6 ft) above the 2010 flood level, which is considered the most recent significant flood.
- The probability scale for a flood like the 2010 event at Sukkur Barrage is about 32 years; floods over the 2010 level can be expected within 100 years if there is no upstream breach or significant rainfall along tributaries such as the Chenab River.
- In the vulnerability assessment of the "Dike Management Project," Old Abad Bund and Akil Link Bund were identified as the most vulnerable sites.
- Old Abad Bund will be prioritized for rehabilitation due to:
- Serious erosion damage to the bund body, making it highly urgent.
- Water depth of more than 5 meters even during ordinary times, requiring robust and costly countermeasures.
- Recognition by PID Sindh of the necessity for priority rehabilitation.
- For Akil Link Bund, an outline design study will be conducted as part of the preparatory study.
- Site selection and prioritization are based on bund condition, susceptibility to flood forces, and the potential scale of damage in case of a breach.

Name of Expert	Mr. Wijai Kumar, Social Expert at IEEC
	
Discussion Points	He discussed key concerns and shared initial findings from field surveys conducted by the consultant team, offering insight into the community's social dynamics and potential impacts of the project.

- The construction period is estimated to be approximately three years, depending on the quantity and type of construction identified in the previous survey.
- Construction activities will be avoided during the monsoon season (June to September).
- Erosion protection for the bund and riverbank and seepage control for the bund and foundation ground are the main countermeasures; no special or advanced construction technology is required.
- Site offices and concrete plants will be installed on the land side of the bund near the Old Abad Bund.
- Rest areas, Islamic houses of worship, and construction yards will be set up at each site.
- The existing bund crown (about 6 meters or more wide) will be used for approaching roads, and widening is unnecessary.
- Identify affected households and businesses impacted by land acquisition.
- Establish fair compensation mechanisms for those affected
- Provide support and assistance during the relocation process
- Implement strategies to restore and improve the livelihoods of affected individuals and communities.
- Ensure compliance with applicable legal frameworks and JICA's resettlement policy.
- If private land exists within the construction area, temporary access road and construction yard, it is necessary for the Pakistani side to carry out resident relocation and land acquisition.
- If land acquisition or resident relocation is required, compensation must be provided in accordance with Pakistan's legal system and JICA's policy on resident relocation before the bidding announcement for the construction contract.
- Resident relocation and land acquisition must be completed prior to the commencement of construction work.

Name of Expert	Mr. Mumtaz Shah, Regional Director of SEPA (Larkana),
	
Discussion Points	He spoke on the environmental aspects of the project, noting that while it is designed for public benefit and is expected to have minimal environmental risks, SEPA will still conduct a thorough review and issue the necessary No Objection Certificate (NOC).
• Approval of Environmental Requirement: According to the 2021 regulations of the Sindh Environmental Protection Agency (Sindh EPA), this project falls under the category of "Flood Protection" within the scope of "Water Management, Dams, Irrigation and Flood Protection," which requires an Initial Environmental Examination (IEE). • PID Sindh must submit the IEE report to the Sindh EPA and obtain approval before construction. • Systematically assess how the proposed project may affect natural ecosystems, water resources, air quality, soil, and biodiversity. • Identify both direct and indirect environmental effects that could result from project activities. • Propose practical measures to avoid, reduce, or compensate for any negative environmental impacts identified. • Modifications to project design or operations are recommended to minimize harm. • Involve local communities, government agencies, NGOs, and other interested parties in the assessment process. • Gather input, address concerns, and incorporate local knowledge to improve project outcomes.	

Community Notable	Local resident Mr. Fayaz Hussain Jatoi
	
Discussion Points	
• Expressed appreciation for the proposed project and acknowledged its importance for the community.	

- Stated that the project would significantly enhance community safety by reducing risks associated with future flood events.
- Highlighted that improved flood management infrastructure would help protect homes, businesses, and public facilities from flood damage.
- Emphasized that the project would safeguard agricultural land and local livelihoods, ensuring continued income and food security for residents.
- Noted that better preparedness and resilience to flooding would reduce economic losses and disruption to daily life.
- Recognized that the project would promote long-term stability and well-being for vulnerable populations in flood-prone areas.
- Suggested that the initiative would foster greater confidence among community members in their ability to withstand and recover from natural disasters.

NGOs	Mr. Babar Mangi, Taluka Engineer at SRSO
	
Discussion Points	

- Expressed strong support for the new initiative, recognizing its importance and timeliness for the region's development.
- Highlighted the initiative's potential to significantly enhance agricultural productivity by improving access to water resources, modernizing irrigation systems, and introducing advanced farming techniques.
- Emphasized the wide-ranging benefits for overall community well-being, including increased food security, better health outcomes, and improved economic opportunities for local residents.
- Noted the critical significance of the initiative, given the area's heavy reliance on the Indus River for irrigation, drinking water, and sustaining daily life.
- Stressed the importance of sustainable resource management to ensure the long-term availability of water and other natural resources, which are essential for maintaining local livelihoods.
- Pointed out that effective resource management can help prevent environmental degradation, reduce vulnerability to climate change, and support the resilience of both the agricultural sector and the broader community.
- Advocated for collaborative efforts among stakeholders-including government, local communities, and development partners to maximize the initiative's positive impact and ensure its sustainability.

Photolog for PCM






Attendance Sheet

Public Consultation Meeting on
Initial Environmental Examination (IEE) and & Resettlement Action Plan (RAP) for
The Flood Protection and Dike Improvement on Indus River in Sindh Province
Arranged By: CTI Engineering International Co. LTD and
Indus Environmental Engineering Consultants (IEEC)
Funding by: Japan International Cooperation Agency (JICA)

Location: Zulifqar Inter Otaq at Sono Khan Inter village

Subproject Name:

Date: 10th April, 2025

Signature/ Thumb Impression	Address Village Name, Taluka	Occupation/ Profession	CNIC No./ Mobile No.	Fathers Name	Name	Sr. No.

[redacted]

Page 1 of 4

Signature/ Thumb Impression	Address Village Name, Taluka	Occupation/ Profession	CNIC No./ Mobile No.	Fathers Name	Name	Sr. No.

[redacted]

Page 2 of 4

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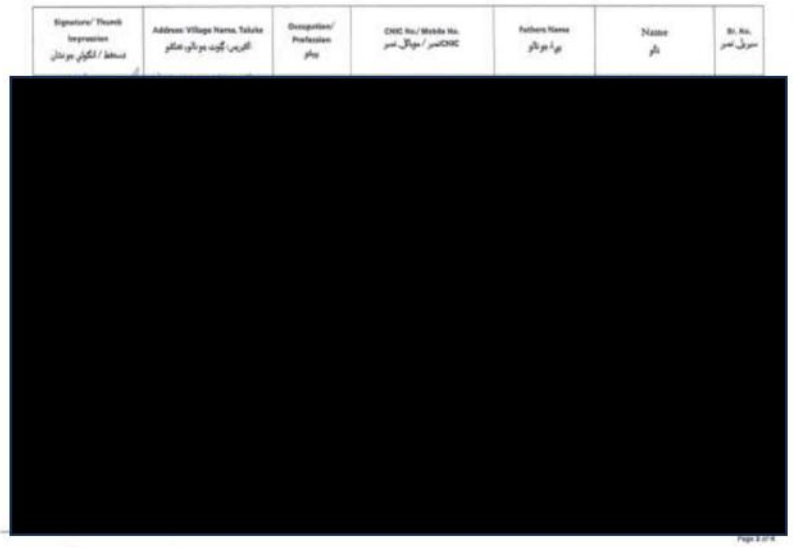

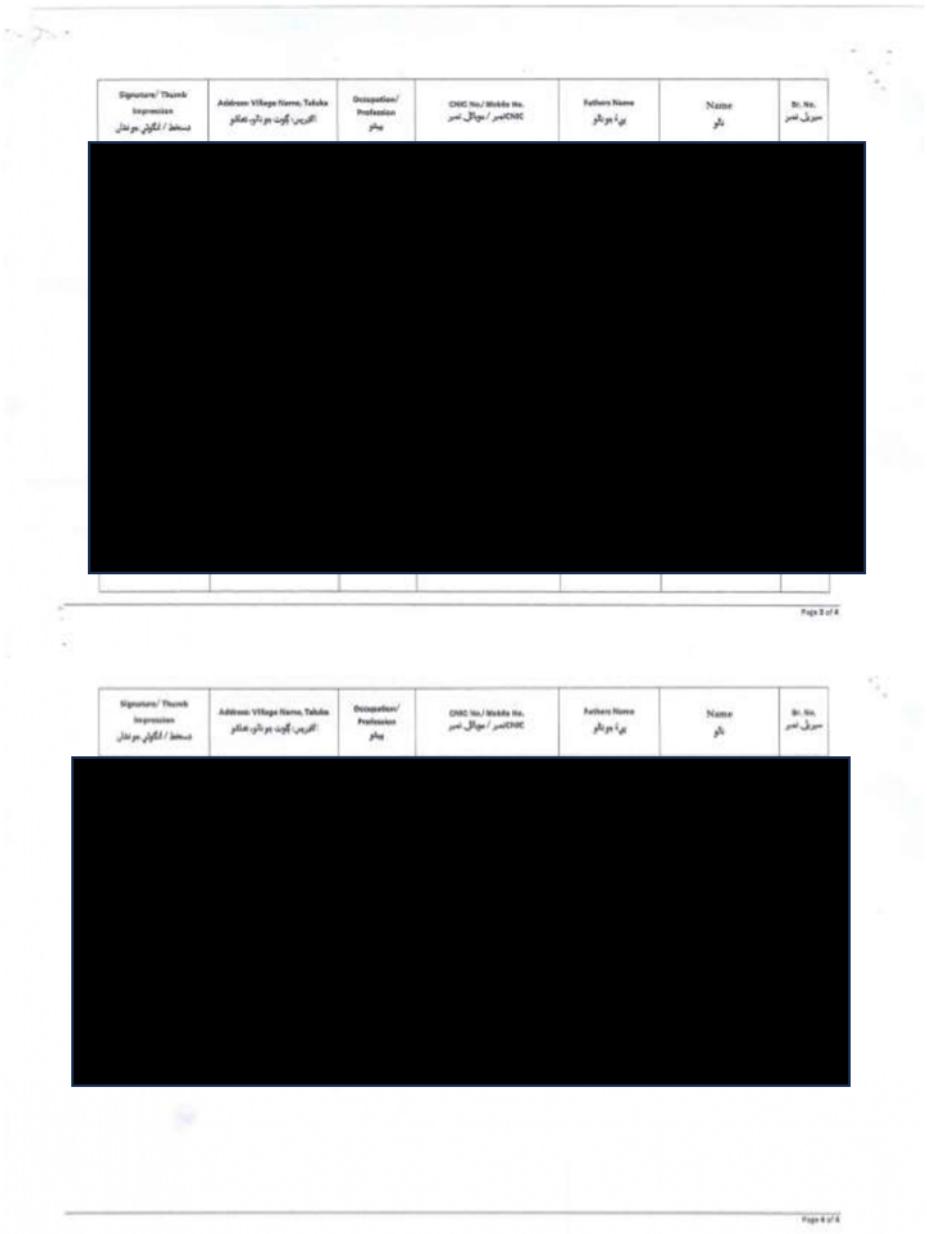

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2nd PUBLIC CONSULTATION MEETING – OLDABAD BUND	
Date:	**25th June 2025**
Location:	**Zulifqar Ali Outaq at Sono Khan Jatoi**
Project	**SHARING THE FINDINGS OF INITIAL ENVIRONMENTAL EXAMINATION (IEE) AND RESETTLEMENT ACTION PLAN (RAP) FOR THE PREPARATORY SURVEY FOR THE PROJECT FOR FLOOD PROTECTION AND DIKE IMPROVEMENT ON INDUS RIVER IN SINDH PROVINCE**
Target Audience	• Local Community and Key Stakeholders
Meeting Agenda	• Briefed about Environment & Social Baselines conditions, anticipated impacts and proposed mitigation measures. • Brief about them on Resettlement, Social-related impacts and their mitigation. • Cut-off date to ensure completeness and accuracy of documentation • Discussion on stakeholder roles, collaboration, and resource mobilization • To gather feedback from affected communities and key stakeholders

➢ **Introduction**

During the public consultation meeting, it was highlighted that the Islamic Republic of Pakistan remains highly vulnerable to natural disasters such as floods, landslides, and earthquakes, with floods being the most frequent, particularly along the Indus River and its tributaries during the monsoon season. Participants were reminded of the severe environmental & socio-economic impacts caused by past flood events, most notably the devastating floods of 2010 and 2022.

➢ **Project Overview**

The project's primary objective is to mitigate the risk of bund failure in the lower Indus River basin in Sindh by upgrading and strengthening the embankments. Additionally, the project aims to mitigate the risk of economic losses during disasters and to contribute to building a resilient society capable of withstanding such events.

The project involves several key components. These include renovating and enhancing river bunds, with a focus on controlling seepage and protecting against erosion. Consulting services will be provided for detailed design, bidding assistance, and procurement management. The project will also cover procurement and construction, with Japanese and local procurement methods being considered tentatively.

The area targeted by this project is the southern Indus River, specifically Sindh (Larkana, Sindh). The Federal Flood Commission (FFC) and the Sindh Irrigation Department will serve as the executing agencies for the project.

➢ **Purpose of PCM**

The primary purpose of the 2nd Public Consultation Meeting (2nd PCM) is to ensure that all relevant stakeholders are fully informed about the IEE & RAP findings, especially the potential environmental and social impacts associated with the proposed project and the suggested mitigation measures. By clearly communicating project details, the meeting enables stakeholders to understand how they may be affected. Additionally, this 2nd PCM serves as a platform for gathering feedback from affected communities and key stakeholders, allowing them to share their concerns, expectations, and suggestions. This input is valuable

for shaping project planning and execution, ensuring that diverse perspectives are considered. Ultimately, the PCM fosters transparency and compliance by maintaining open dialogue, which in turn builds trust and ensures the project meets all regulatory requirements. This process upholds accountability and transparency throughout all stages of the project.

- **Objective of 2nd PCM**

To achieve its goals, the PCM establishes several key objectives. Firstly, it aims to address community concerns by engaging directly with local populations to identify specific issues related to the project. This focused engagement not only supports the development of customized and practical solutions but also enhances stakeholder trust and fosters a sense of ownership and inclusion.

Secondly, the PCM serves as a platform to discuss mitigation strategies for a wide range of potential impacts, including those affecting the Environment and community land acquisition & resettlement. Environmental risks such as habitat disruption, pollution caused by machinery movement and camp setup, or resource depletion are openly examined, along with potential social impacts like displacement, loss of livelihood, or changes to traditional land use. The PCM ensures that clear, proactive measures are presented to minimize these risks and that communities are informed about how these measures will be implemented and monitored.

The PCM also facilitated the cut-off date meeting to ensure transparency and inclusiveness in the land acquisition & resettlement process. During this meeting, project-affected persons (PAPs) and local villagers were allowed to verify that all eligible individuals and structures had been properly identified in the socio-economic survey. If any persons or assets were erroneously excluded, community members could raise these concerns, allowing for timely corrections and additions. This process is critical for ensuring that no affected household is left out of the Resettlement Action Plan (RAP) and that compensation and livelihood restoration measures are accurately planned. Moreover, the cut-off date helps prevent speculative claims by clearly defining the eligibility criteria, reinforcing fairness and accountability in the resettlement process.

Lastly, the PCM outlines transparent next steps for project implementation, ensuring that all stakeholders understand the project timeline, future engagements, and how their feedback will shape project outcomes. This includes a strong emphasis on integrating environmental safeguards, as per the JICA Guidelines and the resettlement plan, into project planning and execution. By doing so, the PCM reinforces a commitment to inclusive development, environmental sustainability, and the protection of affected communities.

2nd PCM Proceedings in the form of MOM

Name of Expert	Mr. Farooq Ahmed, Environmental Specialist at IEEC
	
Discussion Points	He delivered a detailed presentation that highlighted the event's objectives and environmental-related findings from the IEE.

- No rare or endangered plant species were observed in the immediate project area.
- No vegetation will be disturbed during construction, particularly along access routes.
- Common animal species observed included small mammals, reptiles, and birds typical of rural landscapes.
- No endangered or threatened species were found during the field assessment.
- No significant waste accumulation was observed; however, minor household and agricultural waste were scattered in some locations.
- The area has limited access to clean surface and groundwater sources. Local communities depend primarily on hand pumps and small canals.
- Noise levels in the area are currently low due to minimal traffic and rural surroundings.

Name of Expert	Mr. Wijai Kumar, Social Expert at IEEC
	
Discussion Points	He discussed key concerns and shared RAP findings from asset surveys conducted by the consultant team, offering insight into the Community's social dynamics and potential impacts of the project.

- Several households will be fully affected due to land acquisition and bund construction.
- Both privately owned agricultural land and common land will be impacted.
- Affected landowners requested compensation based on current market rates
- Many residential and semi-permanent (katcha or thatched) structures are located within the ROW. These structures will require relocation or reconstruction support.
- Livelihood disruption is expected for farmers and laborers
- Vulnerable households (including elderly, women-headed, and low-income families) were identified and will be eligible for additional assistance.
- Community-related structures, including mosques, outaq, and hand pumps, are affected.

The major discussion took place during the 2nd PCM and the Cut-off date.

1. All local villagers and project-affected persons participated in compiling a comprehensive list of affected structures and households, ensuring that these were accurately identified for compensation purposes. This collaborative effort aimed to verify that no eligible individual or asset was overlooked, strengthening the integrity of the compensation process. Community involvement in this identification phase also helped build trust and transparency.

2. The Project Affected Person (PAP) stated that compensation should be provided based on the prevailing market rate. They emphasized that fair market-based compensation would ensure

justice and help them recover their losses more effectively, especially given current land and asset values.

3. The influential community members of the area suggested that local laborers should be engaged in the construction activities. They emphasized that involving local workers would not only provide them with a source of income but also contribute to community support for the project by promoting local employment and enhancing a sense of ownership among residents.

4. The villagers requested that their access routes remain unobstructed during the construction phase. They also recommended constructing a ramp or access path from the bund to the village to ensure smooth and safe movement. Maintaining uninterrupted access is crucial for daily activities, emergency services, and the overall well-being of the Community throughout the project's duration.

5. The Project Affected Persons requested to be informed at least one month in advance of any relocation. This notice period would allow them sufficient time to make necessary arrangements and secure alternative accommodation or shelter.

6. During the meeting, it was brought to our attention by Mr. Hazar Khan Jatoi and Mr. Zulfiqar Jatoi that their names are missing from the list of affected persons. They clarified that they also own agricultural land located adjacent to the property of their nephew, Mr. Jalal Khan Jatoi.

7. During the asset survey, Mr. Jalal Khan was recorded as having suffered a loss of agricultural land. However, he only provided his name, citing that the legal documents for the land are registered under his father's name. This has led to the exclusion of Mr. Hazaro Khan and Mr. Zulfiqar Jatoi from the records, despite their claim to shared or adjoining ownership. This oversight was later clarified during the cut-off meeting, where it was confirmed that all three individuals jointly own the land in question. The total affected area is 0.75 acres. To ensure accuracy and fairness, the land was subsequently resurveyed and divided equally among the three rightful owners. As a result, each person, Mr. Jalal Khan, Mr. Hazaro Khan, and Mr. Zulfiqar Jatoi, has been recorded as having a 0.25-acre share of the affected land. The survey photo is attached in **Annexure-1.**

8. During the Project Coordination Meeting (PCM), several landowners who possess legal ownership of the affected land informed the team that they will be submitting their ownership documents shortly for verification and record purposes.
9. One of the landowners, Mr. Deedar, has already submitted his **Form VII**, which officially confirms his legal ownership of the land. This submission marks an important step toward validating land claims and ensuring rightful inclusion in compensation and resettlement processes. The land document of Mr. Deedar Jatoi is attached as **Annexure-II.**

A summary of the major issues is given below:

Summary Table of Major Issues Oldabad Bund	
Issue Area	**Key Concerns**
Accurate identification of affected persons and assets	Community participation ensured all eligible individuals and assets were included for compensation.
Fair, market-based compensation	PAPs requested compensation based on current market rates for justice and effective recovery.
Local labour engagement	The community advocated for hiring local workers to boost employment and project support.

Unobstructed access during construction	Villagers requested uninterrupted access and construction of ramps or paths for safe movement.
Advance notice for relocation	PAPs are requested at least one month's notice before any relocation for adequate preparation.
Omission and correction of landowners	Initial exclusion of some landowners was identified and corrected through clarification and resurvey.
Accurate recording of joint land ownership	Joint owners' shares were verified and recorded to ensure fair compensation.
Submission of ownership documents	Landowners are submitting legal documents for verification and record-keeping.
Validation of land ownership	Official documents (e.g., Form VII) are being used to confirm and validate land ownership.

Some gender related issues raised during the 2nd PCM

1. The women expressed optimism that employment opportunities in the area would increase as a result of the project. They also mentioned that, following the construction of the bund, access to essential services such as healthcare and education would become easier. Improved infrastructure may lead to better transportation and mobility, enhancing the overall quality of life in the community.

2. The women emphasized that if their houses or lands are affected by the project, they should receive fair and timely compensation. They highlighted the importance of transparent procedures, proper valuation of assets, and clear communication to ensure that any displacement or loss is handled respectfully and equitably. Special attention should be given to vulnerable households to prevent economic hardship.

3. The privacy and safety of women must be respected at all times. Construction activities should be located at a reasonable distance from residential areas, particularly from the village, to minimize noise, dust, and intrusion. Proper barriers and signage should also be installed to prevent unauthorised access and ensure community comfort.

Photos of PCM of Oldabad



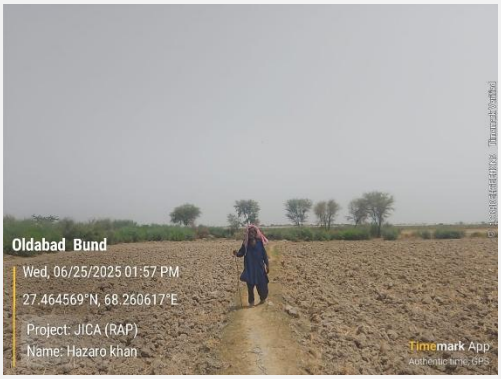




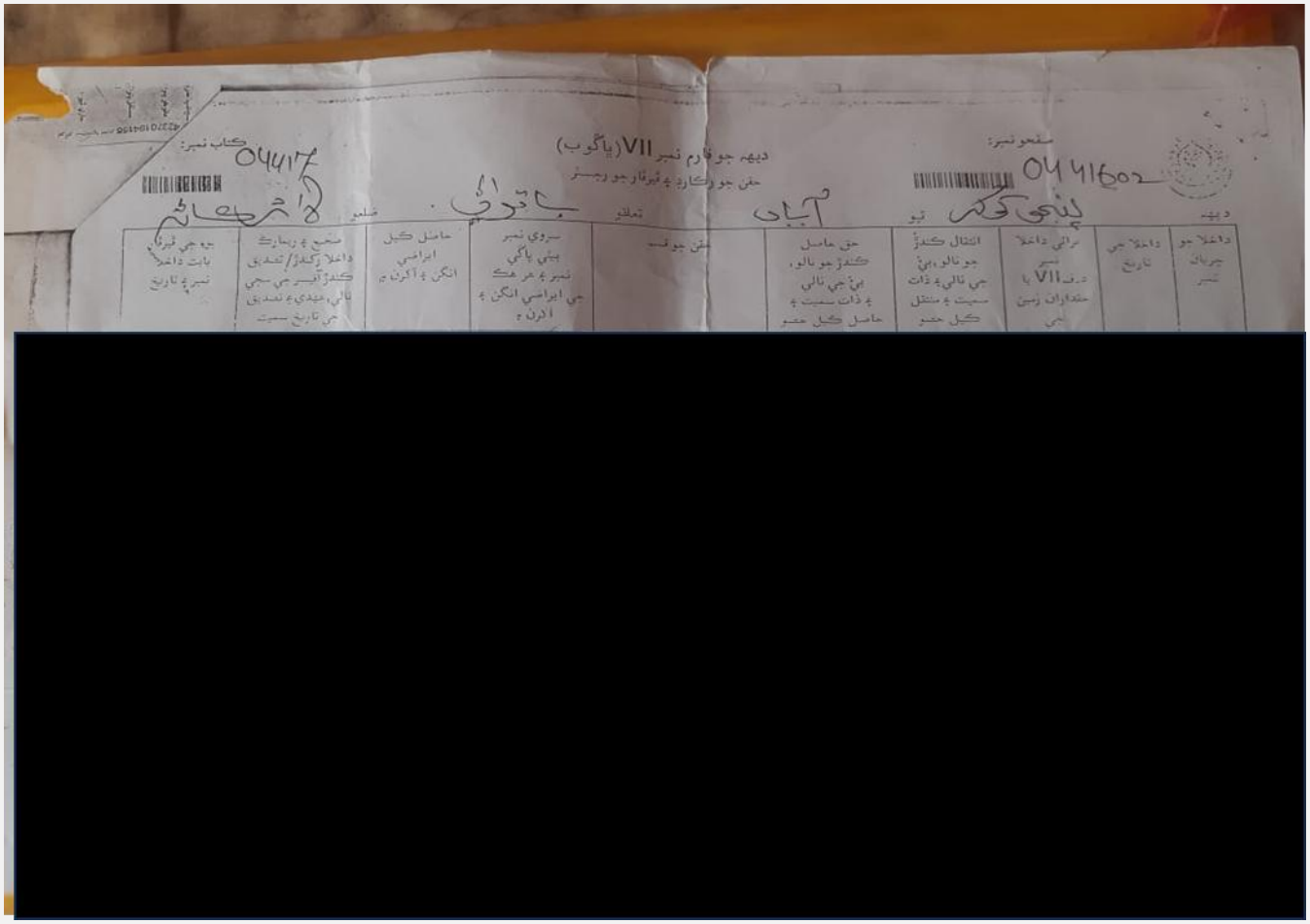




Annnxure-1: Photos of Survey and Structures

	
Resurveyed the land	Resurveyed the land

Annexure-II: Landownership Document of Mr. Dedar Ali



Attendance Sheet of Old Abad Bund PCM

2nd Public Consultation Meeting on
Initial Environmental Examination (IEE) and & Resettlement Action Plan (RAP) for
The Flood Protection and Dike Improvement on Indus River in Sindh Province
Arranged By: CTI Engineering International Co. LTD and
Indus Environmental Engineering Consultants (IEEC)
Funding by: The Japan International Cooperation Agency (JICA)

ٻيون عوامي مشاورت واري گڏجاڻي
شروعاتي ماحولياتي جائزو (IEE) ۽ ٻيهر آبادڪاري منصوبو(RAP) سنڌ صوبي
۾ درياءِ سنڌ تي ٻوڏ کان بچاءُ ۽ بند جي بهتري لاءِ
منعقد ڪندڙ: سي ٽي آءِ انجنيئرنگ انٽرنيشنل ڪمپني لميٽيڊ ۽ انڊس ماحولياتي انجنيئرنگ صلاحڪار
مالي سهڪار: جاپان انٽرنيشنل ڪوآپريشن ايجنسي

Dated: 26-06-2025

جڳهه/Location: ذوالفقار علي خوڙو جي اوطاق

سب پروجيڪٽ جو نالو/Subproject Name::

تاريخ/Date: 25-6-20

Signature/ Thumb Impression دستخط / آڱوٺي جو نشان	Address: Village Name, Taluka ائڊريس: ڳوٺ جو نالو، تعلقو	Occupation/ Profession ڌنڌو	CNIC No./ Mobile No. CNICنمبر / موبائل نمبر	Fathers Name پيءُ جو نالو	Name نالو	Sr. No. سيريل نمبر
[redacted]						

Page 1 of 5

Signature/ Thumb Impression دستخط / انگوٹھے جو نشان	Address: Village Name, Taluka ايڊريس: ڳوٺ جو نالو تعلقو	Occupation/ Profession	CNIC No./ Mobile No.	Fathers Name پيءُ جو نالو	Name نالو	Sr. No.
[redacted]						

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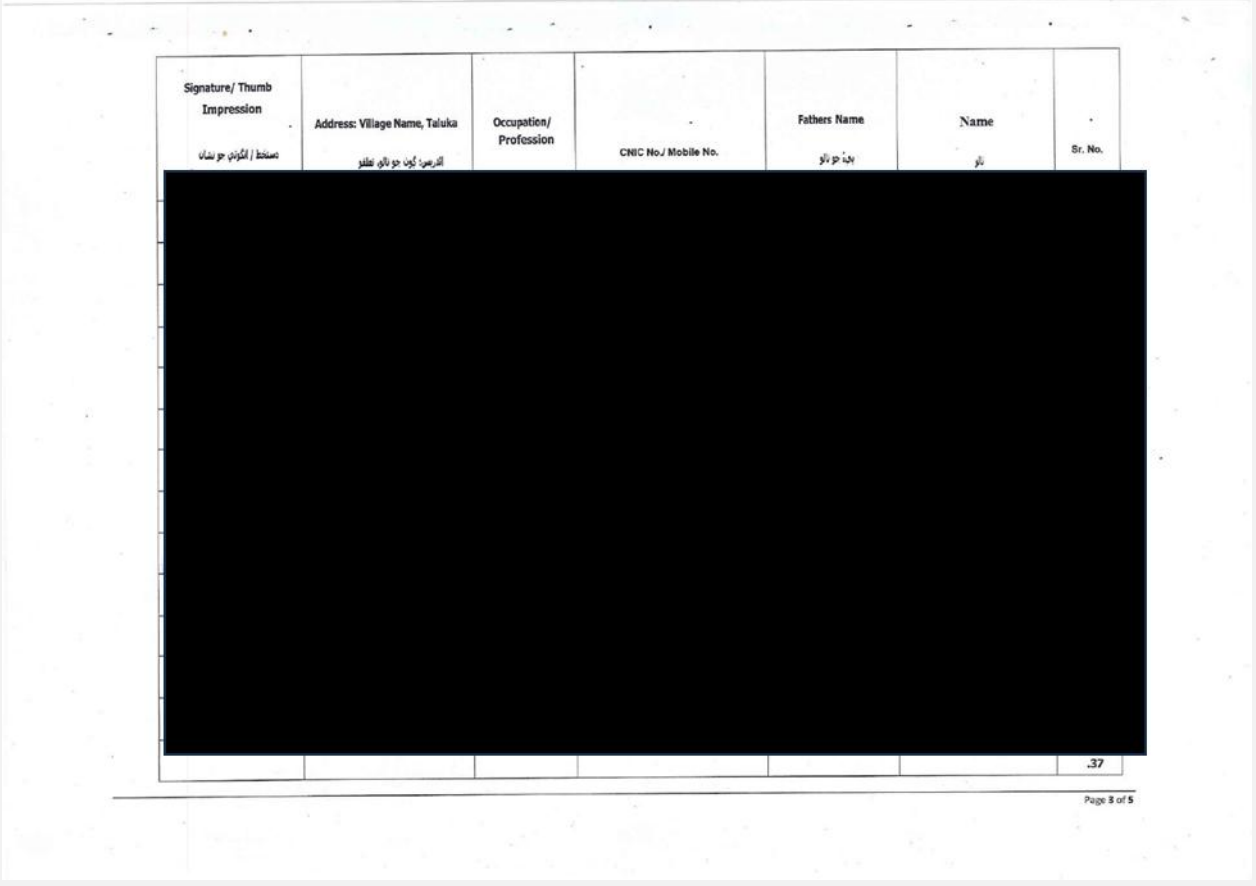

Signature/ Thumb Impression دستخط / انگوٹھے جو نشان	Address: Village Name, Taluka ايڊريس: ڳوٺ جو نالو تعلقو	Occupation/ Profession	CNIC No./ Mobile No.	Fathers Name پيءُ جو نالو	Name نالو	Sr. No.
[redacted]						
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ANNEXURE - IV: Environmental Code of Practices

The Environmental Code of Practices (ECPs) aims to mitigate potential construction-related impacts throughout the project implementation. These guidelines offer best practices and environmental management protocols for contractors to ensure sustainable environmental management. The ECPs will be integrated into the general conditions of all contracts, including subcontracts, associated with the project. Below is the list of ECPs prepared for the project.

- ECP 1: Waste Management
- ECP 2: Fuels and Hazardous Goods Management
- ECP 3: Water Resources Management
- ECP 4: Drainage Management
- ECP 5: Soil Quality Management
- ECP 6: Erosion and Sediment Control
- ECP 7: Topsoil Management
- ECP 8: Topography and Landscaping
- ECP 9: Quarry Areas Development and Operation
- ECP 10: Air Quality Management
- ECP 11: Noise and Vibration Management
- ECP 12: Protection of Flora
- ECP 13: Protection of Fauna
- ECP 14: Protection of Fish (if any)
- ECP 15: Road Transport and Road Traffic Management
- ECP 16: Labour Influx Management and Construction Camp Management
- ECP 17: Cultural and Religious Issues
- ECP 18: Workers Health and Safety

ECP 1: Waste Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	The Contractor shall • Develop a waste management plan for various specific waste streams (e.g., reusable waste, flammable waste, construction debris and food waste.) prior to commencing of construction and submit to CSC for approval. • Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of the disposal site, so as to cause less environmental impact. • Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. • Segregate and reuse or recycle all the waste, wherever practical. • Prohibit burning of solid waste • Collect and transport non-hazardous wastes to all the approved disposal sites. Vehicles transporting solid waste shall be covered with tarps or nets to prevent spilling waste along the route • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. • Request suppliers to minimize packaging where practicable. • Place a high emphasis on good housekeeping practices.

		• Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.

ECP 2: Fuels and Hazardous Goods Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Fuels and hazardous goods.	Materials used in construction have the potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous goods/materials on-site, and potential spills from these goods may harm the environment or health of construction workers.	The Contractor shall • Prepare spill control procedures and submit the plan for CSC approval. • Train the relevant construction personnel in the handling offuels and spill control procedures. • Store dangerous goods in bunded areas on a top of a sealedplastic sheet away from watercourses; and also, under rainwater shed (to prevent contact with rainwater). • Refueling shall occur only within bunded areas. • Make available MSDS for chemicals and dangerous goods on-site. • Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site approved by KPEPA or sold to KPEPA registered vendors. • Provide absorbent and containment material (e.g., absorbent matting) where hazardous material is used and stored, and personnel trained in the correct use. • Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use. • Make sure all containers, drums, and tanks that are used forstorage are in good condition and are labeled with the expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. • Put containers and drums in temporary storage in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill. • Put containers and drums in permanent storage areas on animpermeable floor that slopes to a safe collection area in the event of a spill or leak. • Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution..

ECP 3: Water Resources Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Hazardous Material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	The Contractor shall • Follow the management guidelines proposed in ECPs 1 and2. • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, stormwater systems or underground water tables
Discharge from construction sites	Wastewaters from construction sites and work camps. The construction works will modify groundcover and topography changing the surface water drainage patterns of the area including infiltration and storage of stormwater.	The Contractor shall • Minimize the amount of exposed soil at any one time (only clear vegetation immediately before construction is about to begin) • Install temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials • Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from the site • Divert runoff from undisturbed areas around the construction site • Stockpile materials away from drainage lines. • Prevent all solid entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting and transport to an approved waste disposal site or recycling depot • Collect, transport and discharge the septic tank waste from the construction camps in the nearby municipal wastewater treatment plants • Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This shall be done in every exit of each construction vehicle to ensure the local roads are kept clean.
Soil Erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall • Ensure that sealed roads used by construction vehicles are swept regularly to remove sediment. Water the material stockpiles, access roads and bare soils on an as-required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g., high winds)

ECP 4: Drainage Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Excavation and earthworks, and construction yards	Lack of proper drainage for rainwater/liquid waste or wastewater owing to the construction activities harms the environment in terms of water and soil contamination, and mosquito growth.	The Contractor shall • Prepare a program for preventing/avoid standing waters, which CSC will verify in advance and confirm during implementation • Provide alternative drainage for rainwater if the construction works/earth-fillings cut the established drainage line • Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there • Rehabilitate road drainage structures immediately if damaged by contractors' road transports. • Build new drainage lines as appropriate and required for wastewater from construction yards connecting to the available nearby recipient water bodies. Ensure wastewater quality conforms to the relevant standards provided by SEQS, before it being discharged into the recipient water bodies. • Ensure the internal roads/hard surfaces in the construction yards/construction camps that generate has stormwater drainage to accommodate high runoff during a downpour and that there is no stagnant water in the area at the end of the downpour.
		• Construct wide drains instead of deep drains to avoid sand deposition in the drains that require frequent cleaning. • Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the drainage system to avoid drainage congestion • Protect natural slopes of drainage channels to ensure adequate stormwater drains. • Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem. • Reduce infiltration of contaminated drainage through stormwater management design
Ponding of water	Health hazards due to mosquito breeding	• Do not allow ponding of water especially near the waste storage areas and construction camps • Discard all the storage containers that are capable of storing water, after use or store them in the inverted position

ECP 5: Soil Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Storage of hazardous and toxic chemicals	Spillage of hazardous and toxic chemicals will contaminate the soils	The Contractor shall • Strictly manage the wastes management plans proposed in ECP1 and storage of materials in ECP2 • Construct appropriate spill contaminant facilities for all fuel storage areas • Establish and maintain a hazardous material register detailing the location and quantities of hazardous substances including the storage, use of disposals • Train personnel and implement safe work practices for minimizing the risk of spillage • Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site • Remediate the contaminated land using the most appropriate available method to achieve required commercial/industrial guideline validation results
Construction material stockpiles	Erosion from construction material stockpiles may contaminate the soils	The Contractor shall • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds

ECP 6: Erosion and Sediment Control

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities and material stockpiles	The impact of soil erosion is (i) Increased runoff and sedimentation causing a greater flood hazard to the downstream, (ii) destruction of aquatic environment in nearby lakes, streams, and reservoirs caused by erosion and/or deposition of sediment damaging the spawning grounds of fish, and (iii) destruction of vegetation by burying or gullying.	The Contractor shall • Locate stockpiles away from drainage lines • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds • Remove debris from drainage paths and sediment control structures • Cover the loose sediments and water them if required • Divert natural runoff around construction areas prior to any site disturbance • Install protective measures on-site prior to construction, for example, sediment traps • Observe the performance of drainage structures and erosion controls during rain and modify them as required.

ECP 7: Topsoil Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earthworks	Earthworks will impact the fertile topsoil that is enriched with nutrients required for plant growth or agricultural development.	• The Contractor shall • Strip the topsoil to a depth of 15 cm and store in stockpiles of height not exceeding 2m. • Remove unwanted materials from topsoil like grass, roots of trees and similar others. • The stockpiles will be carried out in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil. • Locate topsoil stockpiles in areas outside drainage lines and protect them from erosion. • Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. • Spread the topsoil to maintain the physio-chemical and biological activity of the soil. The stored topsoil will be utilized for covering all disturbed areas and along with the proposed plantation sites • Before the re-spreading of topsoil, the ground surface will be ripped to assist in the bunding of the soil layers, water penetration, and revegetation
Transport	Vehicular movement outside right of way of existing roads or temporary access roads will affect the soil fertility of the agricultural lands	• Limit equipment and vehicular movements within the approved construction zone • Construct temporary access tracks to cross concentrated water flow lines at right angles • Plan construction access to make use, if possible, of the final road alignment • Use vehicle-cleaning devices, for example, ramps or wash-down areas

ECP 8: Topography and Landscaping

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earthworks	Construction activities especially earthworks will change topography and disturb the natural rainwater/floodwater drainage as well as will change the local landscape.	The Contractor shall • Ensure the topography of the final surface of all raised lands (construction yards, approach roads and access roads.) are conducive to enhance natural draining of rainwater/flood water; • Keep the final or finished surface of all the raised lands free from any kind of depression that insists waterlogging. • Undertake mitigation measures for erosion control/prevention by grass-turfing and tree plantation, where there is a possibility of rain-cut that will change the shape of topography. • Cover immediately the uncovered open surface that has no use for construction activities with grass-cover and tree plantation to prevent soil erosion and bring improved landscaping.

ECP 9: Quarry and Borrow Areas Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Development and operation of Quarry and borrow areas. The project will use approved quarry sites available near the project site. This ECP will be used only when a new quarry or borrow area is to be developed.	Quarry areas will have impacts on local topography, landscaping and natural drainage.	The Contractor shall • Use only quarry and borrow sites that are licensed by the provincial government and approved by the project management unit/Implementation Consultants • Identify new borrow and quarry areas in consultation with Project Director, if required. • Reuse excavated or disposed of material available in the project to the maximum extent possible. • Store topsoil for reinstatement and landscaping. • Develop surface water collection and drainage systems, anti-erosion measures (berms and re-vegetation.) and retaining walls and gabions where required. Implement mitigation measures in ECP 3: Water Resources Management, ECP 6: Erosion and Sediment Control • The use of explosives will be used in as much minimum quantity as possible to reduce noise, vibration and dust. • Control dust and air quality deterioration by application of watering and implementing mitigation measures proposed in ECP 10: Air Quality Management • Noise and vibration control by ECP 11: Noise and Vibration Management. • In compliance to KP Bonded Labor System (Abolition) Act, 1995 and The Khyber Pakhtunkhwa Prohibition of Employment of Children Act, 2015, use of all forms of forced labor and child labors for quarry sites shall strictly be prevented.

ECP 10: Air Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	The Contractor shall • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in a fuel-efficient manner • Cover haul vehicles carrying dusty materials moving outside the construction site • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions • Control the movement of construction traffic • Water construction materials prior to loading and transport • Service all vehicles regularly to minimize emissions • Limit the idling time of vehicles to not more than 2 minutes
Construction machinery	Air quality can be adversely affected by emissions from machinery and the combustion of fuels.	The Contractor shall • Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize contaminant emissions. Proof of maintenance register shall be required by the equipment suppliers and contractors/subcontractors • Focus special attention on containing the emissions from generators • Machinery causing excess pollution (e.g., visible smoke) will be banned from construction sites • Service all equipment regularly to minimize emissions • Provide filtering systems, duct collectors or humidification or other techniques (as applicable) to the concrete batching and mixing plant to control the particle emissions in all its stages, including unloading, collection, aggregate handling, cement dumping, circulation of trucks and machinery inside the installations
Construction activities	Dust generation from construction sites, material stockpiles and access roads are a nuisance in the environment and can be a health hazard.	• Water the material stockpiles, access roads and bare soils on an as-required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g., high winds). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted • Minimize the extent and period of exposure of the bare surfaces Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary, to avoid periods of high wind and if visible dust is blowing off-site • Store the cement in silos and minimize the emissions from silos by equipping them with filters. • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Crushing of rocky and aggregate materials shall be wet- crushed or performed with particle emission controlsystems

ECP 11: Noise and Vibration Management

roject Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	The Contractor shall • Maintain all vehicles in order to keep them in good working order in accordance with manufactures maintenance procedures • Make sure all drivers will comply with the traffic codes concerning the maximum speed limit and driving hours. • Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noiseon the worksite
Construction machinery	Noise and vibration may have an impact on people, property, fauna,livestock and the natural environment.	The Contractor shall • Appropriately site all noise-generating activities to avoidnoise pollution for local residents. • Use the quietest available plant and equipment • Modify equipment to reduce noise (for example, noise control kits, the lining of truck trays or pipelines) • Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures. Equipment suppliers and contractors shall present proof of the maintenance register of their equipment. • Install acoustic enclosures around generators to reducenoise levels. • Fit high-efficiency mufflers to appropriate construction equipment • Avoid the unnecessary use of alarms, horns and sirens
Construction activity	Noise and vibration mayhave an impact on people, property, fauna,livestock and the naturalenvironment.	The Contractor shall • Notify adjacent landholders prior to any typical noise eventsoutside of daylight hours (6 pm to 7 am) if the construction works are being carried out near residential areas • Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions • Employ the best available work practices on-site to minimize occupational noise levels • Install temporary noise control barriers where appropriate • Notify affected people if major noisy activities are undertaken, e.g., pile driving • Plan activities on-site and deliveries to and from site to minimize the impact • Monitor and analyze noise and vibration results and adjustconstruction practices as required.

roject Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		Avoid undertaking the noisiest activities, where possible, when working at night (6 pm to 7 am) near the residential areas.

ECP 12: Protection of Flora

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Local flora is important to provide shelters for the birds, offer fruits and/or timber/firewood, protect soil erosion and overall keep the environment very friendly to human-living. As such damage to flora has a wide range of adverse environmental impacts.	The Contractor shall • Reduce disturbance to surrounding vegetation • Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. • Get approval from the supervision consultant for the clearance of vegetation. • Make selective and careful pruning of trees where possible to reduce the need for tree removal. • Control noxious weeds by disposing of them at a designated dump site or burn on site. • Plant only native species that are approved by the local forest department (to confirm that they are not invasive) for plantation in the construction yards and project sites. • Clear only the vegetation that needs to be cleared in accordance with the plans. These measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill and construction of diversion roads. • Before excavation, mark the trees that must remain on the site and cannot be removed. • Do not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. • Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of the roadside it came from.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Avoid work within the dripline of trees to prevent damage to the tree roots and compacting the soil. • Minimize the length of time the ground is exposed, or excavation left open by clearing and re-vegetate the area atthe earliest practically possible. • Ensure excavation works occur progressively and re-vegetation is done at the earliest • Provide adequate knowledge to the workers regarding nature protection and the need to avoid felling trees duringconstruction Supply appropriate fuel in the work caps to prevent fuelwood collection

ECP 13: Protection of Fauna

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Clearance of vegetation may impact shelter, feeding and/or breedingof animals	The Contractor shall • Restrict the tree removal to the minimum required. • Retain tree hollows on-site, or relocate hollows, whereappropriate • Leave dead trees where possible as habitat for fauna • Identify the trees that require specific attention (e.g., the hollow-bearing trees) and fall them in a manner that reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated orrendered assistance if injured. After felling, hollow-bearingtrees will remain unmoved overnight to allow animals to move of their own volition.
Construction camps	Illegal poaching	• Provide adequate knowledge to the workers regarding the protection of flora and fauna, and relevant government regulations and punishments for illegal poaching. • The contractor's code of conduct shall include on the protection of flora and fauna, and a ban on tree cutting and hunting of animals. Employees found violating would be subject to strict actions including fines and termination of employment.

ECP 14: Protection of Fish

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities in River	The main potential impacts to fisheries are hydrocarbon spills and leaks from riverine transport and disposal ofwastes into the river	The Contractor shall • Prepare procedures for the protection of fish and submit them for supervision consultant approval. • Ensure the construction equipment used in the river are well maintained and does not have oil leakage to contaminate river water. • Contain oil immediately on the river in case of accidental spillage from equipment; make an emergency oil spill containment plan (under the Fuels and Hazardous Substances Management Plan) to be supported with enough equipment, materials and human resources. • Do not dump wastes, be they hazardous or non-hazardousinto the nearby water bodies or in the river.

ECP 15: Road Transport and Road Traffic Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Increased traffic use of the road by construction vehicles will affect the movement of normal road traffics and the safety of the road-users.	The Contractor shall • Prepare and submit a traffic management plan to the CSC for their approval before the commencement of construction. • Include in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs/lights, and road signs. • Provide signs at strategic locations of the roads complying with the schedules of signs contained in the Pakistan TrafficRegulations. • Install and maintain a display board at each important road intersection on the roads to be used during construction, which shall clearly show the following information in the local language: • Location: chainage and village name • Duration of the construction period • Period of proposed detour / alternative route • Suggested detour route map • Name and contact address/telephone number of the concerned personnel • Name and contact address/telephone number of theContractor • Inconvenience is sincerely regretted.

	Accidents and spillage offuels and chemicals	• Restrict truck deliveries, where practicable, to daytimeworking hours (7 am to 6 pm). • Restrict the transport of oversize loads. • Operate road traffics/transport vehicles, if possible, duringnon-peak periods to minimize traffic disruptions. • Enforce on-site speed limit

ECP 16: Labor Influx Management and Construction Camp Management

Project Activity/ ImpactSource	Environmental Impacts	Mitigation Measures/ Management Guidelines
Siting and Location of construction camps	Campsites for construction workers are important locations that have significant impacts such as health and safety hazards on local resources and infrastructure of nearby communities.	The Contractor shall • Prepare a management plan for construction of workers camp in accordance with IFC Guidance on Workers Accommodation and submit the plan for supervision consultant's approval. • Locate the construction camps within the designed sites or at areas that are acceptable from the environmental, cultural or social point of view; and approved by the supervision consultant. • Consider the location of construction camps away from communities in order to avoid social conflict in using natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • Submit to the supervision consultant for approval a detailed layout plan for the development of the construction camp showing the relative locations of alltemporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the constructioncamps. • Local authorities responsible for health, religion and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over publichealth, social and security matters.
Construction Camp Facilities	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	The contractor shall provide the following facilities in the campsites • Adequate accommodation, transportation, and basic services including water, sanitation, and medical care for the workers working on that project Safe and reliable water supply, which will meet SEQS. Drinking water to be chlorinated at the source and ensure the presence of residual chlorine 0.1 ~ 0.25 ppm as a minimum after 30 minutes of chlorine contact time (WHO guideline). • Hygienic sanitary facilities and sewerage systems. The toilets and domestic wastewater will be collected through common sewerage. Provide separate latrines and bathing places for males and females with total isolation by location. The minimum number of toilet facilities required is one toilet for every ten persons. • Treatment facilities for sewerage of toilets and

Project Activity/ ImpactSource	Environmental Impacts	Mitigation Measures/ Management Guidelines
		domestic wastes. • Stormwater drainage facilities. • Paved internal roads. • Provide child crèches for women working on construction sites. The crèche will have facilities for a dormitory, kitchen, and indoor and outdoor play area. Schools will be attached to these crèches so that children are not deprived of education whose mothers are construction workers. • Provide in-house community/common entertainment • facilities. Dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Workers Accommodation	All workers in the camp will have adequate accommodation facilities	The Contractor shall provide the following: • The labor will be provided with accommodation on twin sharing basis made of insulating material and locally available building material.; • The migrant workers with families shall be provided with individual accommodation comprising a bedroom, sanitary and cooking facilities; • The units will be supported by common latrines and bathing facilities duly segregated for male and female labor; • An adequate number of toilets shall be provided in the accommodation facilities. A minimum of 1 unit for 15 males and 1 unit for 10 females shall be provided; • The contractor shall provide a kitchen facility for the construction workers and the food will be of appropriate nutritional value and will consider religious/cultural backgrounds; • All doors and windows shall be lockable and mobile partitions/curtains shall be provided for privacy; • Facilities for the storage of personal belongings for workers shall be provided within the campsite only; • Dustbins shall be provided for collection of garbage and will be removed on a daily basis; • It is also required to provide first aid boxes in adequate numbers; and • Ventilation will be appropriate for the climatic conditions and provide workers with a comfortable and healthy environment to rest and spend their spare time.
Disposal of waste	Management of wastes is crucial to minimize impacts on the environment	The Contractor shall • Ensure proper collection and disposal of solid wastes within the construction camps • Insist waste separation by source; organic wastes in one pot and inorganic wastes in another pot at the household level. • Store inorganic wastes in a safe place within the household and clear organic wastes on a daily basis to waste collectors. Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed.

Project Activity/ ImpactSource	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Dispose of organic wastes in a designated safe place on a daily basis. At the end of the day cover the organic wastes with a thin layer of sand so that flies, mosquitoes, dogs, cats, and rats are not attracted. One may dig a large hole to put organic wastes in it; take care to protect groundwater from contamination by leachate formed due to the decomposition of wastes. Cover the bed of the pit with an impervious layer of materials (clayey or thin concrete) to protect groundwater from contamination. • Locate the garbage pit/waste disposal site min 500 m away from the residence so that people are not disturbed by the odor likely to be produced from the anaerobic decomposition of wastes at the waste dumping places. Encompass the waste dumping place with fencing and tree plantation to prevent children from entering and playing with it. Do not establish site-specific landfill sites. All solid waste will be collected and removed from the work camps and treated by composting.
Fuel supplies for cooking purposes	Illegal sourcing of fuelwood by construction workers will impact the natural flora and fauna	The Contractor shall • Provide fuel to the construction camps for their domestic purpose, in order to discourage them from using fuelwood or any other biomass. • Made available alternative fuels like natural gas or kerosene on ration to the workforce to prevent them from using biomass for cooking. Conduct awareness campaigns to educate workers on preserving the protecting biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.
Health and Hygiene	There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices. There will be an increased risk of work crews spreading sexually transmitted infections and HIV/AIDS.	The Contractor shall • Provide adequate health care facilities within construction sites. • Provide first aid facility round the clock. Maintain stock of medicines in the facility and appoint full-time designated first aider or nurse. • Provide ambulance facilities for the laborer's during an emergency to be transported to the nearest hospitals. • Initial health screening of the laborer coming from outside areas • Inspect all camp facilities regularly to ensure o Daily sweeping of rooms and houses shall be undertaken; o Regular cleaning of sanitary facilities shall be undertaken; o The kitchen and canteen premises shall be established under good hygiene conditions;

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		○ Daily mealtimes shall be fixed for the labor; ○ Smoking and alcohol consumption shall be prohibited in the workplace; ○ Waterlogging shall be prevented at areas near the accommodation facilities and adequate drainage is to be provided; and ○ Checklists pertaining to the daily housekeeping schedule shall be maintained and displayed at houses, toilets, and kitchens. • Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work • Provide HIV awareness programming, including STI (sexually transmitted infections) and HIV information, education and communication for all workers on a regular basis • Complement educational interventions with easy access to condoms at campsites as well as voluntary counselling and testing. • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellent sprays during monsoon. Carry out short training sessions on best hygiene practices to be mandatorily participated by all workers. Place display boards at strategic locations within the camps containing messages on best hygienic practices.
Safety	Inadequate safety facilities to the construction camps may create security problems and fire hazards	The Contractor shall • Provide appropriate security personnel (police/home guard or private security guards) and enclosures to prevent unauthorized entry into the camp area. • Maintain a register to keep track of the headcount of persons present in the camp at any given time. • Encourage the use of flameproof material for the construction of labor housing/site office. Also, ensure that these houses/rooms are of sound construction and capable of withstanding windstorms/cyclones. • Provide the appropriate type of firefighting equipment suitable for the construction camps • Display emergency contact numbers clearly and prominently at strategic places in camps. Communicate the roles and responsibilities of labourers in case of an emergency in the monthly meetings with contractors.
Site Restoration	Restoration of the construction camps to	The Contractor shall

Project Activity/ ImpactSource	Environmental Impacts	Mitigation Measures/ Management Guidelines
	their original condition requires demolition of construction camps.	• Dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates at the completion of the construction work. • Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed • Give prior notice to the labourers before demolishing theircamps/units • Reuse the demolition debris to a maximum extent. Disposeof remaining debris at the designated waste disposal site. • Hand over the construction camps with all built facilities asit is if an agreement between both parties (contractor and landowner) has been made so. • Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner. Not make false promises to the labourers for future employment in O&M of the project.

ECP 17: Socio-cultural and Religious Issues

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities near residential areas	Disturbance from construction activities (dust, noise, traffic, conflicts with contractor's workforce.)	The Contractor shall • Establish a system for receiving complaints from the community and address them (the community can also make complaints to the GRM established under the project) • Shall ensure all the construction workers follows the following code of conduct: • All workers are strictly forbidden to establish any kind of relationship with local women and bring any unrelatedwomen to the project site. • All workers will avoid sexual harassment and child abuse. • All workers must not leave the camps or work sites unless written authorization is issued by the respective supervisor • The contractors will advise and prohibit the local populationand its authorities or representatives not to enter the project operation areas (campsites and colonies.) in order to minimize the potential risk of incidents related to the operations.
Construction activities near-religious and cultural sites	Disturbance from construction works to thecultural and religious sites, and contractors' lack of knowledge on	The Contractor shall • Communicate to the public through community consultation and newspaper announcements regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restrictions. • Do not block access to cultural and religious sites,

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	cultural issues cause social disturbances.	whereverpossible
		• Restrict all construction activities within the footprints of the construction sites. • Stop construction works that produce noise (particularly during prayer time) shall there be any mosque/religious/educational institutions close to the construction sites, and users make objections. • Take special care and use appropriate equipment when working next to a cultural/religious institution. • Stop work immediately and notify the site manager if, during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until approval to continue is given by theCSC/PMU. • Provide separate prayer facilities to the construction workers. • Show appropriate behavior with all construction workers especially women and elderly people • Allow the workers to participate in praying during construction time • Resolve cultural issues in consultation with local leaders and supervision consultants • Establish a mechanism that allows local people to raise grievances arising from the construction process. • Inform the local authorities responsible for health, religion and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters.

ECP 18: Worker Health and Safety

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Best practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction workers willbe exposed to a number of (i) biophysical health risk factors, (e.g., noise, dust, chemicals, construction material, solid waste,	The Contractor shall • Implement suitable safety standards for all workers and sitevisitors which shall not be less than those laid down on theinternational standards (e.g., International Labor Office guideline on 'Safety and Health in Construction; World BankGroup's 'Environmental Health and Safety Guidelines') and standards applicable in US/UK/Australia/or any other developed country can also be used. • Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of hazards in the work areas, • Provide personal protection equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with damaged ones.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	wastewater and vector transmitted diseases.), (ii) risk factors	
	resulting from human behavior (e.g., STD and HIV.) and (iii) road accidents from construction traffic.	• Safety procedures include the provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job • Appoint an environment, health and safety manager to lookafter the health and safety of the workers • Inform the local authorities responsible for health, religion and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters
	Child and pregnant labor	The Contractor shall • not hire children of less than 18 years of age and pregnant women or women who delivered a child within 8 preceding weeks, in accordance with the National Labor Laws
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	• Provide health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations shall be easily accessible throughout the place of work • Document and report occupational accidents, diseases, andincidents. • Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice. • Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. • Provide awareness to the construction drivers to strictly follow the driving rules • Provide adequate lighting in the construction area and along the roads
Construction Camps	Lack of proper infrastructure facilities, such as housing, watersupply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ECP 15 • Adequate ventilation facilities • Safe and reliable water supply. • Hygienic sanitary facilities and sewerage systems. The toilets and domestic wastewater will be collected through common sewerage. • Treatment facilities for sewerage of toilet and domestic wastes • Stormwater drainage facilities. • Recreational and social facilities • Safe storage facilities for petroleum and other

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		chemicals in accordance with ECP 2 • Solid waste collection and disposal system in accordance with ECP1. • Arrangement for training
		• Paved internal roads. • Security fence at least 2 m in height. • Sickbay and first aid facilities
Water and sanitation facilities at the construction sites	The lack of water sanitation facilities at construction sites causes inconvenience to the construction workers and affects their personal hygiene.	• The contractor shall provide portable toilets at the construction sites if about 25 people are working the whole day for a month. The location of portable facilities shall be at least 6 m away from the storm drain system and surface waters. These portable toilets shall be cleaned once a day and all the sewerage shall be pumped from the collection tank once a day and shall be brought to the common septic tank for further treatment. • The contractor shall provide bottled drinking water facilities to the construction workers at all the construction sites.
Other ECPs	Potential risks to the health and hygiene of construction workers and the general public	The Contractor shall follow the following ECPs to reduce health risks to the construction workers and the nearby community • ECP 2: Fuels and Hazardous Goods Management • ECP 4: Drainage Management • ECP 10: Air Quality Management • ECP 11: Noise and Vibration Management • ECP 14: Road Transport and Road Traffic Management

ANNEXURE - V: OCCUPATIONAL AND COMMUNITY HEALTH AND SAFETY MANAGEMENT PLAN (OCHSMP)

1 Overview

This Chapter presents a plan for the occupational and community health and safety management system (OCHSMP) during the construction and operation stages. In Chapter 7 occupational hazards and risks associated with the construction and operation are briefly covered. This chapter will enhance those discussions in detail. The OCHSMP comprises high-level corporate policies of the Contractors, Processes and Standard Operating Procedures (SOPs). A relevant list of Processes and SOPs are presented in this Chapter and they will be further developed by the Contractors during construction with the site and operation-specific information.

2 Purpose

The guidance provided in this chapter is a plan meant to help the Contractor prepare their own specific Occupational Health and Safety (OHS) Management Plan and Community Health and Safety (CHS) Plan. Its core purpose is to ensure that all activities are planned, carried out, controlled and directed with consistent, approved, health, safety, and security management practices, procedures, or standards.

This document is a plan for the Contractor providing a practical approach to manage OHS and CHS risks as per World Bank Group Environmental Health and Safety Guidelines (EHSGs), and Provincial regulatory framework, and requirements (please refer to Chapter 2 for country's Acts and Regulations). In addition, a few international guidelines are recommended to be followed by the Contractor

3 Scope

This plan is applicable to all construction and operational activities related to the MHPP. Some of the key high-risk activities may involve the following:

- Blasting;
- Working at height;
- Confined space;
- Working near water;
- Vehicles and driving;
- Operation of mobile equipment on site and on community roads including passenger vehicles, and jumbo.;
- Material haulage;
- Manual handling;
- Lifting and cranage;
- Scaffolding;
- Hot work;
- Maintenance and operation of the site camp and other facilities like workshop;
- Use of security forces; and

- Electrical works.
- Site security: access, the safety of visitors, separation of work and rest areas and signage.
- Over-exertion, and ergonomic injuries and illnesses (repetitive motion and manual handling.).
- Slips and falls (due to poor housekeeping, such as excessive waste debris, loose construction materials and liquid spills.).
- Struck by objects.
- Working in excavations and trenches.
- Handling of raw materials (earthwork, gravel, crushed rock and sand.), handling of other materials causing dust development (such as cement), handling of hydrated lime and other activators and additives, and handling of asphalt.
- Handling of flammable materials.
- Management of hazardous materials.
- Maintenance of vehicles and machinery.

4 Objectives and Targets

This plan is developed on the following objectives:

Safe operation with Zero harm to community members and all site personnel including Contractor's Staff and visitors;

5 Maintain a healthy workforce and labor pool in the community; and

Contribute to the improved health, safety and well-being of the local community in the areas of influence; and Meet or exceed the contractual safety obligations

Project-specific measurable targets to achieve, along with the above objectives, will be established by the Contractor. The determination of these targets will be based on Contractor's continual improvement philosophy, external peer group benchmarking and stakeholders' input. The Contractor will establish targets for each project site for every fiscal year. Some examples of these targets are listed below to guide the contractor:

- Total Recordable Injury Rate of 1.5 or less (or based on the Contractor's previous yearly trend)
- Lost Time Injury Frequency Rate of 0.5 or less (or based on the Contractor's previous yearly trend) Community health indicators may include, but not be limited to:
- Rates of communicable disease in the Project workforce
- Rates of communicable disease in the community

6 Project-related safety and security incidents in the community

Number of grievances or claims of Project-related impacts on the community. Rates of Dengue, and other vector-borne diseases Community health aspects (i.e., rate of STI's, TB, HIV/AIDS).

Senior Leadership of the Contractor (Project Manager, Construction Manager and Technical Director) will need to be fully committed to achieving the above-mentioned targets. Leading

and lagging indicators will be established by the Contractor to drive performance to meet these targets. Following are some leading indicators showing senior management commitment. Complete details of all Key Performance Indicators (KPIs) will be presented in “PR12: Measurement” Process of the Contractor’s project-specific OHS plan (the OHS processes are discussed later on in the Chapter).

6.1 All Project Managers are to complete 1 Walk-through Inspection per month.

All Construction Managers are to complete 2 Walk-through Inspections per month with their assigned Health and Safety and Community Relations Officers.

6.2 All OHS supervisors complete 1 site inspection weekly.

The risks and potential project impacts to community health, safety, and security can emanate from both within and outside the so-called "project fence." For this reason, the scope of this plan focuses on the management of aspects associated with the interaction of construction activities, the workforce, and the community.

The central element of the plan is a set of control measures designed to avoid or control the hazards posed by project activities on the health, safety, and security of the community, while at the same time, enhancing the beneficial effects and capitalize on opportunities that may contribute to improving overall community well-being.

6.3 Working Together for Success

The responsibility for safety cannot simply be “delegated” to “OCHSM Officers or HSE Managers”. The Contractor will ensure that OHS staff will support line management by assisting in job site training, serving as trained and knowledgeable observers, providing administrative assistance, monitoring and evaluating the success of the safety program and acting to continuously improve OHS and CHS plans. While this role is important, commitment and active participation by everyone, every day, on every task, is necessary if the Contractor is to achieve the level of safety excellence that PEDO expects.

The Contractor will follow a hierarchy of control for OCHSMP implementation. Mandatory requirements are established by the HSE policy, followed by the agreed OCHSMP Management system standard, linked to other OCHSMP system controls such as; standards, codes of practices, safe job procedures, safe work practices and facility / site-specific safety instructions and any other safe systems of work that fosters a safe environment at the work execution level

Requirements at any level must meet and support the requirements at higher levels. The Health and Safety policy and OCHSM management system standard apply to all activities covered in the scope of this plan.

All relevant OCHSM documents and tools are available and held by the Contractor’s OHS and Community Relations Officers.

7 Review and Revision of Plans

OCHSMP Plan will be live documents and undergo routine review and updates when any of the following happens: There is a change in the scope of the project, or

- A yearly periodic review, or
- There is a change in construction methodology/technique based on site condition, or
- Following a significant OCHSM hazard or a major accident, and instructed by the Engineer, or
- Emerging social change and community health issues such as new communicable or non-communicable diseases, or
- At the end of the Project (to allow for improvements in subsequent projects).
- The Contractor's OHS and Community Relations Officers are responsible for the review and update.

In addition, the Contractor can also prepare, submit and implement OCHSM sub-plans and SOPs to address specific construction hazards either as a separate document or as part of the Method Statement.

8 Risk Assessment

Risk assessment is a process to identify hazards and risk factors that have the potential to cause harm (hazard identification), analyze and evaluate the risk associated with that hazard (risk analysis, and risk evaluation), and determine appropriate ways to eliminate the hazard, or control the risk when the hazard cannot be eliminated (risk control). Performing regular risk assessments can help construction and O/M stakeholders comply with regulations. Risk assessments can help health and safety and technical teams implement corrective measures to protect workers from health and safety threats during construction and operation stages.

8.1 Risks Assessment Codes

The principle behind the Risks Assessment System and the assignment of Risks Assessment Codes (RACs) is to identify and control workplace hazards. RACs are based on the hazard severity, probability of occurrence, and number of people exposed or potentially adversely affected in the event of an accident. While all hazards will be resolved as soon as possible, the Job Hazard Analysis is a health and safety risk ranking method to assist in making informed decisions concerning hazard control while providing decision-makers with a consistent and defensible approach for prioritizing health and safety hazard abatement efforts based on available resources and with consideration towards competing demands and priorities.

8.2 Likelihood and Consequence of Hazards

RACs require assigning values for the likelihood or probability of an outcome occurring, and the consequence or severity of a potential outcome. Based on these assigned values, a matrix format is used to place the specific hazard within a specific location of the matrix. This location can then be used to determine an RAC number for that hazard activity.

8.3 Risks Assessment Matrix

The risk assessment matrix is presented in Table. This matrix helps OCHSM team to prioritize workplace hazards by identifying them as high, substantial, moderate, and low. Those hazards identified as high will require the most stringent controls available as well as immediate attention. They may even demand that such activities be canceled from the Project. Specific workplace controls can be applied so that the associated hazards are more effectively controlled and therefore, result in a revised assessment category to a more acceptable level. Note that the box at the bottom indicates that if we can eliminate the hazard (such as eliminating the task that subjects the worker to the hazard or allowing an outside specialized contractor to complete the task for the worker), the hazard no longer exists and therefore can be removed from a project's control process – this is the ultimate hazard control.

8.4 Summary of Assessed Risks

The project's potential risks and their significance have been assessed using the methodology described as per Risk matrix and will be revisited by the Contractor once construction details are available.

8.4.1 Policies

The contractor's operating policies are the highest-level document. They provide direction when the Contractor operates in different geographies of the world. These are based on the Contractor's senior management commitments and they guide in day-to-day operations. Typical policies of the Contractor consist of the following:

- Human rights policy;
- Health and Safety Policy;
- Alcohol and Drug Policy; and
- Business Conduct and Ethics Code

8.4.2 Management System Processes

Management System Process forms a vital component of the Contractor OCHSM management (OCHSMP Plan) and these will be the Contractor's second-tier documents after policies. The Contractor will need to develop the following health and safety Management System Processes based on the project and site requirements:

8.5 Standard Operating Procedures (SOP), Work Instructions and Forms

Standard Operating Procedures and Work Instructions are mostly technical in nature and are third-tier documents in the overall risk management approach. Forms and checklists provide support for implementing the controls mentioned in these SOPs. The following SOPs need to be developed by the Contractor based on project-specific risk assessment and be part of the health and safety Plan (this is a non-exhaustive list and additional SOPs may need to be developed for the Project as appropriate/needed):

- SOP 01: Explosives – Storage, Transport and use SOP 02: Work at Height
- SOP 03: Excavation
- SOP 04: Mobile Equipment SOP 05: Barricading and signs SOP 06: Cell Phone Use
- SOP 07: Safe Driving

- SOP 08: Drilling
- SOP 09: Material Haulage
- SOP 10: Traffic Interface Planning
- SOP11: Severe Weather
- SOP 12: Lifting and Hoisting SOP 13: Scaffold Erection
- SOP 14: Working Near or Over Water SOP 15: Illumination
- SOP 16: Ground Support
- SOP 17: Water Management - Tunneling SOP 18: Ventilation
- SOP 19: Fire
- SOP 20: Electrical Systems
- SOP 21: Hazardous Material Management
- SOP 22: Equipment Inspection and Maintenance SOP 23: First Aid
- SOP 24: Worker Welfare Facilities SOP 25: Camp Management
- SOP 26: Emergency Response Plan (ERP) SOP 27: Tunneling Operation
- SOP 28: Operation of Crushing and Batching Plants SOP 29: Confined Space Entry
- SOP 30: Contractor Security Management SOP 31: Cofferdam Construction SOP 32: Manual Handling
- SOP 33: Stringing of Conductors
- SOP 34: Working with Compressed Air
- SOP 35: Community Health and Safety Awareness SOP 36: Contractor's Code of Conduct for SEA/SH SOP 37: Management of Communicable Disease
- Others (if required) as pointed out earlier in the "Scope" of this OHS/CHS.

8.6 Project Organization

In this section, the Contractor's Organogram and OCHSMP Organogram will be included. The company organogram will show the general structure of the company hierarchy. The OCHSMP organogram will clearly show the roles and hierarchy of the team responsible for upholding all project-related HSE issues.

8.7 Contractor Organogram

A typical Contractor's organogram is presented in Figure. And efforts will be made to maintain an organogram like this, especially to make a direct link between health and safety and the Project Manager (Senior Leadership)

8.8 Organogram Roles and Responsibilities

These typical roles and responsibilities provide a holistic understanding of the implementation of the OCHSMP Plan, which encompasses multiple processes and Standard Operating Procedures (SOPs). However, each process and SOP may also have additional specific requirements pertaining to a specific role.

8.8.1 General Project Manager

Overall accountability for the development, implementation and maintenance of the Health and Safety Plan.

- Accountable for the allocation of sufficient resources for the execution of the plan.
- Ensure that empowered and competent personnel are available for the execution of the plan
- Make sure that senior leadership (all directors, Construction Managers and other line management personnel) are fully aware of their responsibilities as per the Processes and SOPs of the Health and Safety Plan.
- Discourage achievement of operational results at the cost of safety violations
- Develop a culture where it is safe to speak up and provide the time, people and resources to respond to OHS concerns identified by their workers
- Review Executive Summary of incidents, and ensure that Root Causes are being identified and resources are provided for the closure of Preventive and Corrective Actions

8.8.2 Project Manager

Overall accountability for the development, implementation and maintenance of the Health and Safety Plan.

- Accountable for the allocation of sufficient resources for the execution of the plan.
- Ensure that empowered and competent personnel are available for the execution of this plan
- Make sure that Sr. Leadership (all directors, Construction Managers and other line management personnel) are fully aware of their responsibilities as per the Processes and SOPs of the Health and Safety Plan.
- Demonstrate visible leadership, walk to talk behavior to reinforce the implementation of the Health and Safety Plan
- Attend monthly Health and Safety Committee/Progress Review Meeting and monitor the performance through leading and lagging indicators.
- Discourage achievement of operational results at the cost of safety violations
- Develop a conducive culture where Personnel are authorized to *STOP unsafe work without fear of retribution
- Develop a culture where it is safe to speak up and provide the time, people and resources to respond to Health and Safety concerns identified by their workers.
- Ensure that the Work Observation program is utilized, and all incidents are fully investigated
- Review Executive Summary of incidents, ensure that Root Causes are being identified and resources are provided for the closure of Preventive and Corrective Actions
- Encourage reward and recognition where personnel demonstrate safe behavior or identify hazards and fairly apply disciplinary process when personnel are cut short.
- *ILO COP 2.2.12. Where there is an imminent danger to the safety of workers, the employer will take immediate steps to stop the operation.

8.8.3 OCHSMP Officer

Be a Subject Matter Expert of the Health and Safety Plan. Provide training and awareness regarding the implementation of the Health and Safety Plan that includes multiple Processes and SOPs

- To be familiar with all local, national, and international laws that are applicable to Operations.
- Raise concern in the monthly Health and Safety Committee/Progress Review meeting regarding the implementation of controls stipulated in the Health and Safety Plan.
- Provide training to staff on the Health and Safety Plan. Conduct regular sessions for all project team members to inculcate the requirements of the Health and Safety Plan.
- To report to the Contractor's Management Team on implementation progress, and monthly KPIs.
- To ensure that sufficient training and induction of all personnel is being provided and maintained.
- Ensure that visit induction is given to all visitors before they are allowed to visit the site.
- To develop the Health and Safety awareness of all personnel employed on the project and ensure their participation in all aspects of the health and Health and Safety program
- Provide guidance for the purchase of personal protective equipment
- Regular inspection of construction safety and security
- Provide guidance to employees regarding their emergency response responsibilities.
- Decide whether a potential rescue service or team is adequately trained and equipped to perform permit space rescues of the kind needed at the facility and whether such rescuers can respond in a timely manner, and organize drills
- Review of Health and Safety management plan annually.

8.8.4 OCHSMP Staff/ Supervisor

Perform the assigned inspections and discuss the findings with OHS Officer

- Ensure communication procedure and system to communicate emergency events to site technical supervisor and emergency authorities (e.g., Incident Response Center (IRC) and/or Police, health centers)
- Communicate with construction site personnel to help them understand the hazards of the site and understand the demands of the operating personnel about Health and Safety matters.
- Site Technical Supervisors (part of the technical team)
- They allocate tasks and check that the project workers are implementing Health and Safety requirements to standard. They provide feedback and guidance on Health and Safety implementation.
- Ensure that the controls stipulated in the Permit to Work (if needed) are implemented and STOP the work when critical controls are missing or compromised
- Discuss Job Hazard Analysis (JHA) and conduct effective Tool Box Talk with all project workers. Ask questions to ensure that they have a good understanding.
- Ensure that all new employees receive training as per PR01: Induction Process and PR05: Short Service Worker Process
- Conduct worksite observations, discuss safety concerns with project workers
- Develop a culture where it is safe to speak up and provide the time, people and resources to respond to Health and Safety concerns identified by their workers. They are also responsible for escalating issues that can't be resolved by the project workers or at the supervision level to the Health and Safety Team or senior management.

- Responsible for making an incident scene safe and secure and for ensuring that hazards, near misses and incidents are entered into the reporting system.
- Ensure all project workers use appropriate PPE and train them how to use PPE.
- Workers Conduct Personal Risk Assessment Take 5 (Stop, Look, Assess, Control, and Monitor) and do not proceed to work if unsafe to do.
- Use authority to STOP work if observed unsafe work by a fellow worker or SSW.
- Report hazards and at-risk behavior and help the Contractor management to develop a conducive safety culture.
- Use PPE as provided.
- Conduct a visual inspection of equipment at the beginning of the operation and ensure that equipment is de-energized before working on a piece of equipment.
- Ensuring that they wear appropriate PPE for the activity that they undertake.
- Be aware and mindful of hazards related to any work activity; do not undertake a job or task if physically or mentally not fit.
- Seek clarification for uncertainty relating to a task with the Supervisor.
- Do not undertake a job if not competent to do so.
- Raise improvement opportunities.
- Report near misses and actual incidents immediately to the supervisor.

8.8.5 Medical Doctor/Coordinator

- Responsible for health support coordination, delivery and implementation of health services to the workforce
- Ensure health specifications and programs/procedures meet Country health regulatory requirements
- Develops and coordinates the implementation of health inspection and audit programs to monitor compliance with health requirements
- Provides a review of disease prevalence data and recommends changes to address disease prevalence and severity.
- Security and Community Relations Officer
- In consultation with the Medical Doctor/Coordinator, identify and evaluate community health risks
- Identifies mitigation steps to address community health issues affected by project activities
- Conducts inspections and audits for effective implementation of community health programs
- Management and coordination of security guards employed by the Project
- Management of security incidents which occur both on the Project site and outside the site
- Collects, analyses data, reports on and provides recommendations on initiatives for continuous improvement in the community health program performance and compliance.

8.9 Subcontractor Integrity Program

The Contractor will be clear about its expectations of subcontractors during all phases. The Contractor will continually monitor and evaluate subcontracting companies' performance,

including performing spot checks on-site, to ensure that the expected level of safety culture is being adhered to. The Contractor will be contractually responsible for the subcontractors' performance and legally liable to the employer for any non-compliances caused by the subcontractor. The subcontractor integrity program will be far-reaching and include, but not be limited to the performance regarding the following:

- General traffic safety;
- Hazardous materials management;
- Community health and safety;
- Occupational health and safety; and
- Adherence to construction standards stated in the general and specific conditions of the main contract.

8.10 Audit

The Contractor will conduct a bi-annual internal occupation and community health and safety audit to evaluate the ethical compliance, comprehensiveness and effectiveness of the Occupation and Community Health and Safety Plan. Periodically the plan may be audited by qualified external auditors to verify the internal auditing.