

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

THE ARKADIANS PROJECT

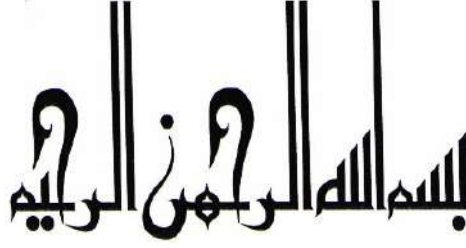
CREEK DEVELOPERS (PVT.) LIMITED

DECEMBER - 2024



**EMC Pakistan
Private Limited**

THE
ARKADIANS



In The Name of Allah, The Most Beneficent, The Most



Environment Impact Assessment (EIA) **Creek View & Terraces – The** **Arkadians, Creek Developers (Pvt.)** **Limited**

Final Report

June 2024

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EXECUTIVE SUMMARY

INTRODUCTION

The Environmental Impact Assessment (EIA) study for the proposed project of The Arkadians has been conducted by EMC Pakistan Pvt. Ltd. at the request of project proponent i.e. M/s. Creek Developers Pvt. Ltd. The EIA has been prepared in compliance with the requirements under Section 17 of Sindh Environmental Protection Act (SEPA) 2014 and SEPA IEE/EIA Regulations 2014 for Residential/commercial high-rise buildings / apartments from 15 stories and above.

The Sindh Environmental Protection Act (SEPA) 2014 empowers the Sindh EPA as the principal authority for environmental management in Sindh. It has also established the requirement for environmental assessment of any project in place prior to commencement of work.

Project Owner has planned to conduct Environmental Impact Assessment (EIA) study for the proposed The Arkadians Project in order to mitigate and manage project's environmental impacts and to fulfil all the relevant legal obligations including environmental approval from Sindh EPA.

CATEGORIZATION OF THE PROJECT

The Proposed Project, The Arkadians falls in Schedule-III of SEPA EIA/IEE Regulation 2021 require an EIA at planning stage. The Project would be placed in Category I-(2) Residential, Commercial High-rise buildings subject to compliance of building bylaws of relevant organizations more than 500,000 sq. feet. Accordingly, an EIA study has been conducted and the report will be submitted to Sindh EPA for review and approval.

OBJECTIVES OF ENVIRONMENTAL ASSESSMENT

The main purpose of this Environmental Impact Assessment study is to ensure that:

All major and minor positive or negative impacts on the environment (physical, biological, social and ecological environment) during the different stages of inception as well as construction and operation of The Arkadians are identified.

Appropriate and adequate mitigation measures are provided to minimize the adverse impacts, which are suggested and procedures for their implementation are provided.

Environmental Management Plan (EMP) for sustainable operation of the project forms an essential part of the EIA document.

SCOPE OF ASSESSMENT

The EIA study has taken into consideration, all the relevant national legislations and regulations, followed by site visits and details of construction and operation activities of proposed project. Environmental and socio-economic baseline has been taken from

previous reports, books and other literature available specifically of the DHA area. The baseline has been further investigated and confirmed during site visits.

METHODOLOGY OF EIA

The EIA process requires identification and assessment of all potential significant environmental effects arising from the proposed project. The effects likely to occur due to Physical, Ecological, and Social aspects are identified during this EIA study. The critical aspects are highlighted for construction and post-construction (operation) phases of the project according to the nature of activities and their sequence and interconnectivity associated with the project. The effects of each activity resulting into consequences are then perceived and quantified either qualitatively or quantitatively.

The significant impacts arising during each phase of the project have been highlighted and appropriate mitigation measures have been suggested to minimize the impacts. For operation phase a perpetual Environmental Management Plan (EMP) has been proposed that will continue to adopt and implement measures for sustained environmental compliance in operations and maintenance of standards.

OVERVIEW OF PROJECT

The project is located in Zone G / Creek View & Terraces of DHA Waterfront Development Master Plan. The project site is located at 214, Zulfikar Street No.1, Opposite DHA Country & Golf Club, Phase VIII, DHA, Karachi.

THE ARKADIANS comprises 13 residential towers (34/36 and 24/26 storey high), six office enclaves and a shopping mall in Zone G of the DHA Waterfront Development Area. The Arkadians will provide a perfect blend of luxurious and world-class lifestyle, modern design and peaceful living that is ideal for both living and doing business in one of Karachi's most desired neighbourhoods.

This high-end development spanning over an area of 43.24 acres with only 26% constructed area comprises of high-rise to mid-rise residential towers, office towers and a retail component supported with high-quality infrastructure, ample car parking, vast landscaping and recreational facilities.

SCREENING OF IMPACTS

The assessment of impacts has primarily focused on the construction activities and later on the operations of The Arkadians. The major areas covered in the impact analysis include wastewater, solid waste, occupational safety and socio-economic factors as well as traffic management.

The findings of impact study and visual inspections of existing environment of the project area in the present scenario indicates following main impacts along with simultaneous relevant and appropriate mitigation measures:

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	The Arkadians – Creek Developers (Pvt.) Limited			
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During construction of the proposed site waste may be generated due to the activities such as dust emissions, erosion of land, generation of construction waste, vibration induced noise, traffic problems and damage to surrounding structures. This may be avoided by proper management and planned construction work. Work may be avoided or keeping at minimum scale at night to avoid community disturbances with regards to noise and traffic congestion. In order to avoid damages, engineering study of sub-soil structure is conducted.

Excessive water consumption may result in water shortage and increased demand of water for construction as well as operation of the proposed project. This may be avoided by water management to prevent illogical water use. Storage tanks for water to be made leak proof.

Wastewater discharge to local nearby sewer without any treatment may increase the load of contaminant, which can be reduce to prescribed SEQS limits by use of septic tanks during construction and by wastewater treatment plant at operational stages of The Arkadians.

Purchase of non-environment friendly items not only increase the concentration of air pollutants on burning, but also input its share in requiring greater storage capacity of huge amount of solid waste and expensive treatment. This impact may be reduced by selection of environment friendly items that may be reused or recycled at source and take part in the environmental improvement rather than deterioration.

During construction, the project has minimal impact on traffic congestion. Critically loading and unloading will be conducted on site and avoid congestion on nearby roads. Traffic management plan will be developed and implemented.

The Arkadians will have the provision of sustainable, environmental friendly technologies in the residential cum office complex and retail mall.

ENVIRONMENTAL MANAGEMENT PLAN

Regardless of above impact assessment and mitigation measures, there is a need of Environmental Management Plan (EMP) to execute the mitigation measures by allocating roles and responsibilities and by monitoring its effectiveness. Therefore, an EMP has been created and compiled for the assistance of M/s. Creek Developers Pvt. Ltd. Management shall supervise and monitor all the mitigation measures and their effectiveness. It explains and assigns the roles and responsibilities of work to relevant individuals from management and makes it easy to handle the issues with care. Several Procedures like waste management and emergency response plan are made part of this EMP. The main aspects covered in the EMP guidelines includes: 1) processes involved in EMP, 2) management approach, 3) organizational structure indicating roles and responsibilities and 4) implementation stages of EMP such as planning and design considerations, monitoring and mitigation plans during construction, and operation and needs of training.

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Project Owner and their subsequent contractor(s) are required to follow the EMP. It is recommended that where necessary, M/s. Creek Developers Pvt. Ltd. shall amend this EMP as per gaps that arise.

CONCLUSION

The project proponent shall comply with the findings, conclusions and based on the approval of the environmental assessment of the study, the proposed mitigations as suggested in the form of Environmental Management Plan for ensuring sustainable development in the project area.

The study therefore recommends that the EIA report should be approved with the provision that the suggested mitigation measures will be adopted and the Environmental Management Plan will be followed in letter and spirit.

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1.0 INTRODUCTION

1.1 Context

Sindh Environmental Protection Agency has issued an approval of IEE of DHA Waterfront Development (WFD) Project in 2008 vide letter No. EPA/2008/01/16/IEE/118/196 to Defence Housing Authority for all future projects to be planned in WFD zones.

In WFD project, Land use features were planned in their respective zones which are summarized in the following table:

Table 1-1: Prominent land use features according to their respective zones

Zone A	50 % of the land allocated for parking for around 3000 vehicles and tramway terminal
	Rest of the land reserved for fifty-commercial stores and office building complex with enchanting landscaping
Zone B	Monumental tower of about 600 feet height
	Revolving restaurant
	Indoor games facilities
	Viewers decks, promenades, children parks
	Water slides and swimming facilities
Zone C	An exclusive amusement park
	An offshore amphitheatre with a capacity to accommodate 6000 audience
	Food courts for numerous restaurants
Zone D	Jogging track and Promenade
Zone E	One 6 star hotel
	Tourist Resort
	High Rise Residential Complex
	Vacational Dwellings
	Mosque
Zone F	Water sports viz. sport fishing, snorkelling, diving, swimming, yachting, etc.
	Dolphin park and aquarium
Zone G	Creek Vistas
	Creek View & Terraces (The Arkadians)
	Creek Marinas
	Creek Towers
	Creek City Hospital
	DHA Shopping Mall

In compliance with the approval of WFD project, the proponent i.e. M/s Creek Developers has started construction of the project i.e. The Arkadians and was managing its activities according to the EMP laid down in the IEE of WFD project.

The Arkadians project comprises 13 residential towers (34/36 and 24/26 storey high), six office enclaves and a shopping mall in Zone G of the DHA Waterfront Development

Area. The project site is located at 214, Zulfiqar Street No.1, Opposite DA Country & Golf Club, Phase VIII, DHA, Karachi.

The Sindh Environmental Protection Act (SEPA) 2014 empowers the Sindh EPA as the principal authority for environmental management in Sindh. It has also established the requirement for environmental assessment of any project in place prior to commencement of work.

Sindh EPA was taken up the issue as to treat this project separate and a comprehensive Environmental assessment report which comply SEP Act 2014 and SEPA regulations 2021, to be prepared and submitted to Sindh EPA. The construction work must be stopped until the report will be duly approved by Sindh EPA.

As EIA team started the work for EIA Study, Construction of two towers on the project site is underway. Therefore, EMC has conducted an Environmental Audit (as discussed in section 4.2) to verify the current status of the project and to check the compliance against EMP.

EMC team has visited the proposed site and its immediate locality to collect the present situation and primary baseline data with reference to social and environmental aspects.

A. Project Status

Up until the month of July:

Construction of tower A i.e. 30 storeys completed

Construction of tower B i.e. 22 storeys completed

Complete pile driving for the other works





Figure 1-1: Construction site status during Environmental Audit

Proponent is committed to conduct Environmental Assessment for the proposed The Arkadians Project in order to mitigate and manage project's environmental impacts and to fulfil all the relevant legal obligations including environmental approval from Sindh EPA. In this connection, this report has been prepared and submitted to EPA to seek the approval.

1.2 General

This Environmental Impact Assessment (EIA) Report presents the assessment of environmental impacts of The Arkadians Project by M/s Creek Developers (Pvt.) Limited. This document has been prepared in compliance with the mandatory requirements of Section 17 of Sindh Environmental Protection Act (SEPA) 2014. Compliance with the Provisions of SEPA 1997, Section 17 requires that "no proponent of a project will commence construction or operation unless he has filed with the Agency an environmental impact assessment, and has obtained from the Agency approval in respect thereof".

M/s EMC Pakistan Private Limited have been contracted by M/s Creek Developers (Pvt.) Limited to assess the project's environmental viability through various environmental components like air, water, noise, including land, biological along with the parameters of human interest and to prepare Environmental Management Plan (EMP) for mitigation of adverse impacts along with chalking out of post project

	Environmental Impact Assessment			
	The Arkadians – Creek Developers (Pvt.) Limited			
	Doc. No.: CDPL/EIA/01	Rev.: 00	Chapter 1	

environmental monitoring programme. This report presents baseline data collected for air, water, noise including land, biological and socio-economic components of environment, identification, prediction and evaluation of impacts and preparation of environmental management plan for mitigation of adverse impacts that may arise due to the proposed project.

1.3 Location of the Project

The project is to be implemented in Zone G / Creek View & Terraces of DHA Waterfront Development Master Plan. The project site is located at 214, Zulfiqar Street No.1, Opposite DHA Country & Golf Club, Phase VIII, DHA, Karachi.

Location map of the project area, indicating the project site, is mentioned in Figure 1.1.

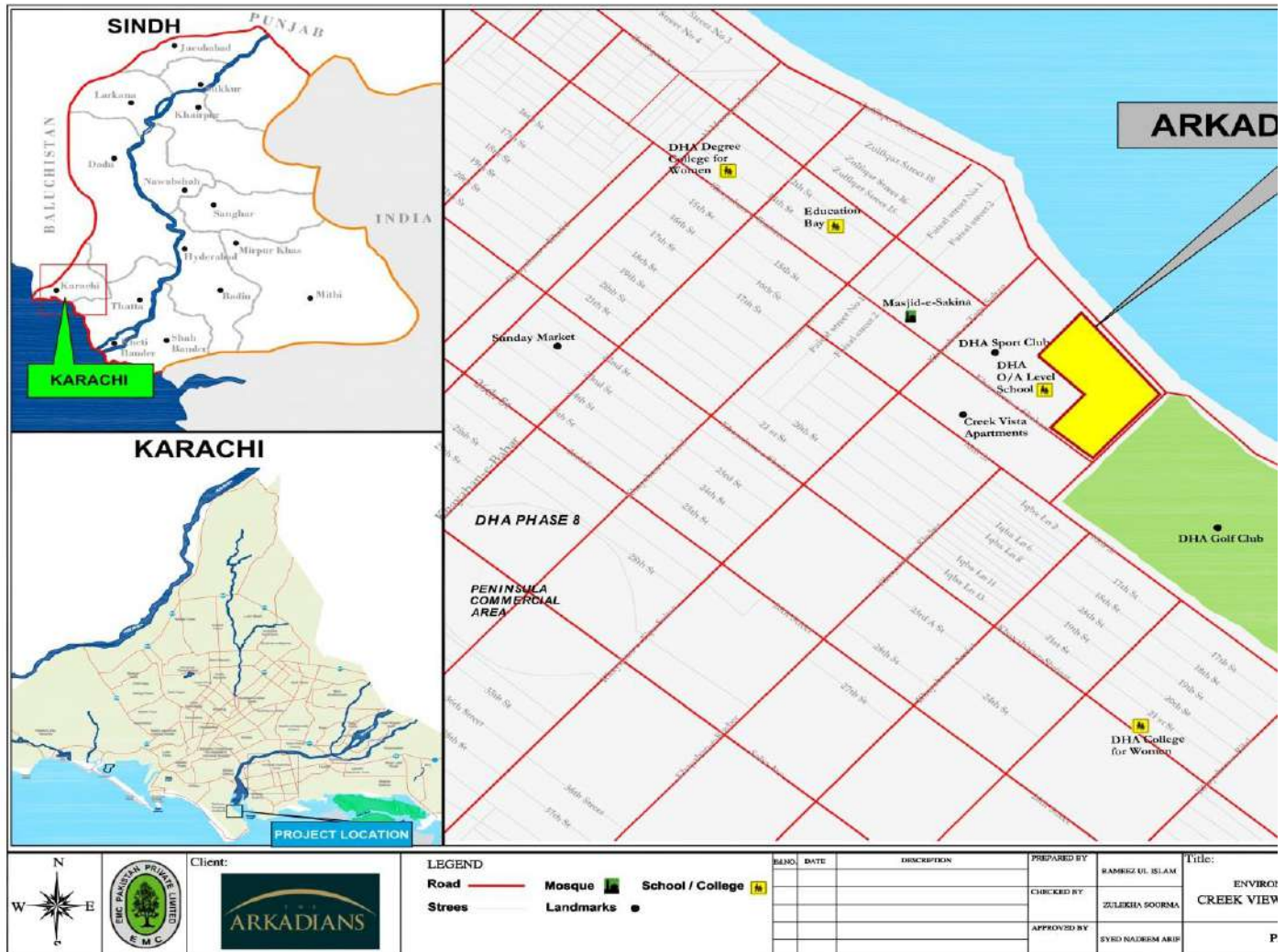


Fig. 1.2: The Arkadians Project Location Map

1.4 Overview of the Project

Slated as Pakistan's tallest residential project, THE ARKADIANS comprises 13 residential towers (32 and 24 storey high), six office enclaves and a shopping mall. The Arkadians will provide a perfect blend of luxurious and world-class lifestyle, modern design and peaceful living that is ideal for both living and doing business in one of Karachi's most desired neighbourhoods.

This high-end development spanning over an area of 43.24 acres comprises of high-rise to mid-rise residential towers, office towers and a retail component supported with high-quality infrastructure, ample car parking and recreational facilities.

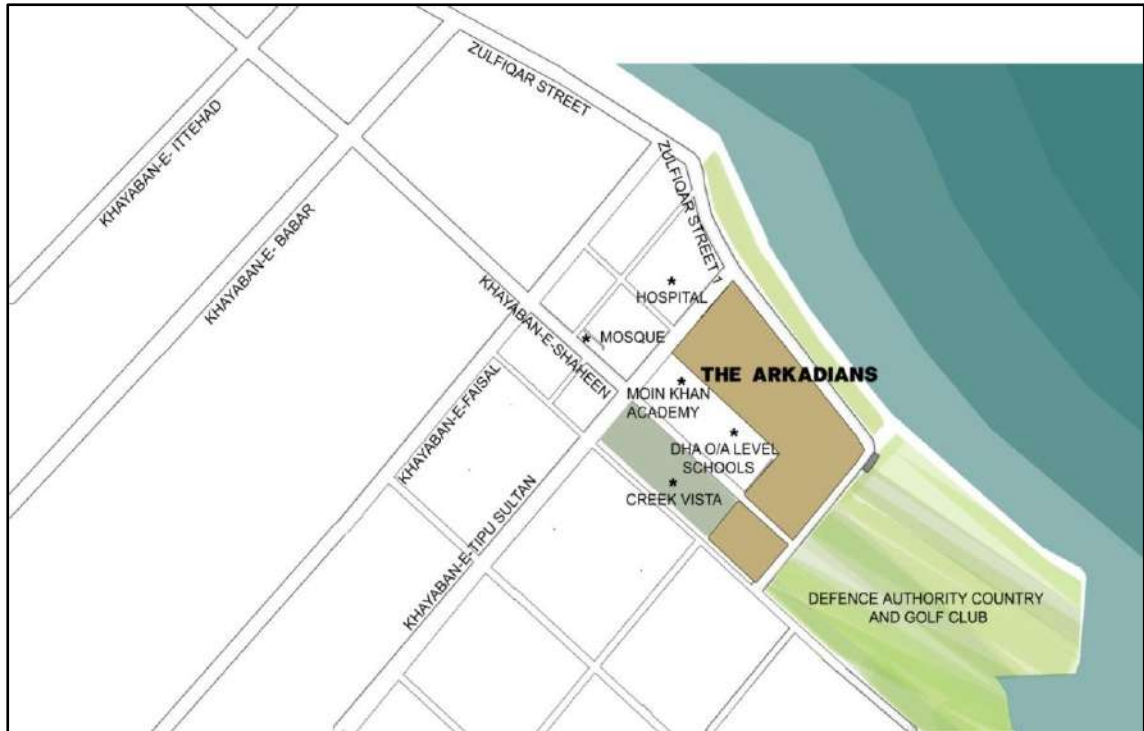


Fig 1.3: Location of the Proposed The Arkadians Project



Fig 1.4: Master Plan of the Proposed The Arkadians Project

1.5 About Creek Developers (Pvt.) Limited and The Arkadians

Creek Developers (Pvt.) Limited is part of the AKD Group of Companies.

Starting in 1947 with interests in real estate, followed by stock-broking, late Haji Abdul Karim Dhedhi laid the foundation of what today is the AKD Group, one of the premier business enterprises in Pakistan.

Mr. Aqeel Karim Dhedhi, son of (late) Haji Abdul Karim Dhedhi, is the Chairman of the Group. Led by the Chairman's vision, the group has evolved into a vibrant set of business enterprises operating in key sectors of Pakistan's economy, including financial services, telecom, infrastructure, manufacturing and natural resources.

Creek Developers (Pvt.) Limited (CDPL) are undertaking a mega-scale mixed-use development – Creek View & Terraces in DHA Phase-VIII, Karachi. This high-end development spanning over an area of about 43 acres comprises high-rise to mid-rise residential towers, office towers and a retail component supported with high-quality infrastructure, ample car parking and recreational facilities.

The master plan of the highly distinctive, contemporary architecture of The Arkadians has been prepared by The Architects -Studio Tariq Hassan for the Residential Tower, M/s ARCOP for Office Towers and M/s Habib Fida Ali for the Retail/Mall. Principal contractor services are provided by Creek Developers (Pvt.) Ltd. The Master Plan draws from the topography of the area. The building designs and walkways emulate the waves of the Arabian Sea. The buildings and individual apartments aim to maximize views and the entire design concept is in harmony with climate and maximizes the natural ventilation provided by the coastal breeze and use of natural light has been incorporated into the design.

Creek Developers (Pvt.) Limited (hereinafter referred to as Proponent) has acquired the land on which the proposed project is located, from DHA for 99 years of lease for Residential cum Commercial development activities.

Table 1.2: Contact Details	
Project Proponent	EIA Consultant
Creek Developers (Private) Limited , 214, Zulfiqar Street #1, Opp. DHA Country & Golf Club, Phase VIII, DHA, Karachi, Pakistan. Phone +9221- 35250361-7 Fax: +9221-35250368 Website: www.thearkadians.com	EMC Pakistan Private Limited 503, Anum Estate, Opp. Duty Free Shop, Main Shahrah-e-Faisal, Karachi Tel: (+) 92 21 34382860 Fax: (+) 92 21 34311467 Email: mail@emc.com.pk

1.6 Project Need

DHA has played a leading role in the development of emerging residential communities and development of Karachi. The latest endeavour of DHA is the Waterfront

Development Project stretching over 14 kilometres along the coastline, which is coherent with the requirements and demand of recreational facilities and need to go vertical for residential complexes on modern lines for DHA's residents and Karachiites.

The entire 14 km of the coastal stretch has been divided into 7 zones named Zone A to Zone G. Each zone becomes a hub of activity independently integrated into a Master Plan. The parking areas are given due priority in zones. These parking zones are planned to accommodate 4000 to 5000 vehicles and will be connected with a tramway and a canal running parallel to the tram-track for operation of a ferry services.

The proposed The Arkadians Project is located in Zone G which is reserved for high-rise residential complexes to be developed on modern lines.

1.7 Justification and Categorization of EIA Study

The Sindh Environmental Protection Act 2014 empowers the SEPA as the principal authority for environmental management in Sindh Province. It has also established the requirement of environmental assessment of any project in place prior to commencement of work.

Section 17 of "Sindh Environmental Protection Act 2014" and other regulatory document such as "Sindh Environmental Protection Agency (SEPA) Review of IEE/EIA Regulations 2021" requires that every new project in Pakistan has to be preceded by an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) depending upon the size and severity of impacts anticipated on commissioning of the project.

SEPA Review of IEE and EIA Regulations 2021 categorizes projects in two separate schedules which require either an IEE (Schedule-II) or an EIA (Schedule-III) as follows:

Schedule II: A project falls in Schedule II if it is likely to have adverse environmental impacts, but of lesser degree or significance than those for category 'A' and all the mitigation measures to handle the impact is manageable. Such types of projects need IEE report including EMP.

Schedule III: Projects are categorized in Schedule III if they generate significant adverse environmental impacts that require a comprehensive management plan, or if the project is located within or passes through: a) Areas declared by the Government of Pakistan as environmentally sensitive (National Parks/Sanctuaries/Game Reserve), b) Areas of international significance (e.g. protected wetland as designated by the RAMSAR Convention), or c) Areas designated by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) as cultural heritage sites.

The Arkadians Project falls in Schedule III requiring an EIA as the project is categorized as:

I. Urban development and tourism (2) Residential, Commercial High rise buildings subject to compliance of building by laws of relevant organizations more than 500,000 sq.feet.

- The Arkadians project comprises 13 residential towers (34/36 and 24/26 storey high), six office enclaves and a shopping mall.

Therefore, following EIA has been developed to evaluate the environmental impact of proposed Project under guidelines of Sindh Environmental Protection Act (SEPA), 2014.

1.8 Objectives of Environmental Impact Assessment

The Objective of the study is to fulfil the requirement for obtaining an environmental permit from the Sindh Environmental Protection Agency (SEPA). EIA report will form part of the documentary evidence in support of a permit application to the EPA.

The main objectives of an EIA are to identify the environmental and socio-economic impacts both positive and negative that may result from a project. The EIA provided recommendations to mitigate negative impacts and maximize benefits on all aspects of the surrounding environment (physical, biological, social).

The objectives outlined for this EIA study are given below:

Identify the characteristics of the proposed project that are likely to give rise to social and environmental impacts;

Develop a baseline of its current environmental scenario as well as socioeconomic conditions;

Identify what type of impacts may arise;

Determine social aspects and environmental resources which are particularly sensitive to impacts and categorize impacts on the basis of their severity;

Evaluate impacts due to construction and operational activities of The Arkadians Project with the relevant environmental regulations of Pakistan

Evaluation of impacts' severity / degree and providing necessary mitigation measures.

Provide recommendations/ suggestions for the environmental monitoring and management of social and physical environment in the surroundings of project area.

Ensure that all the impacts of the project have been taken care and all the relevant stakeholders are aware of the impacts.

1.9 Methodology for Environmental Assessment

The environmental assessment (examination and evaluation) is based on comparative evaluation of the environmental quality before and after establishment of the project. For this purpose the baseline or the profile project area was developed by collecting data, records and information on physical, ecological as well as socioeconomic environment of DHA and its environs, in particular the surrounding areas in its neighbor-hood. An assessment of impact of construction activity at the different phases of the project, i.e. pre-construction, construction, and operation/completion stages. The changes anticipated in the critical environmental aspects e.g. in the ambient environmental parameters that may be significant have been identified. This leads to identification of significant impact, for which necessary mitigation measures have been proposed.

Figure 1.4 shows the step by step process for the completion of an EIA study;

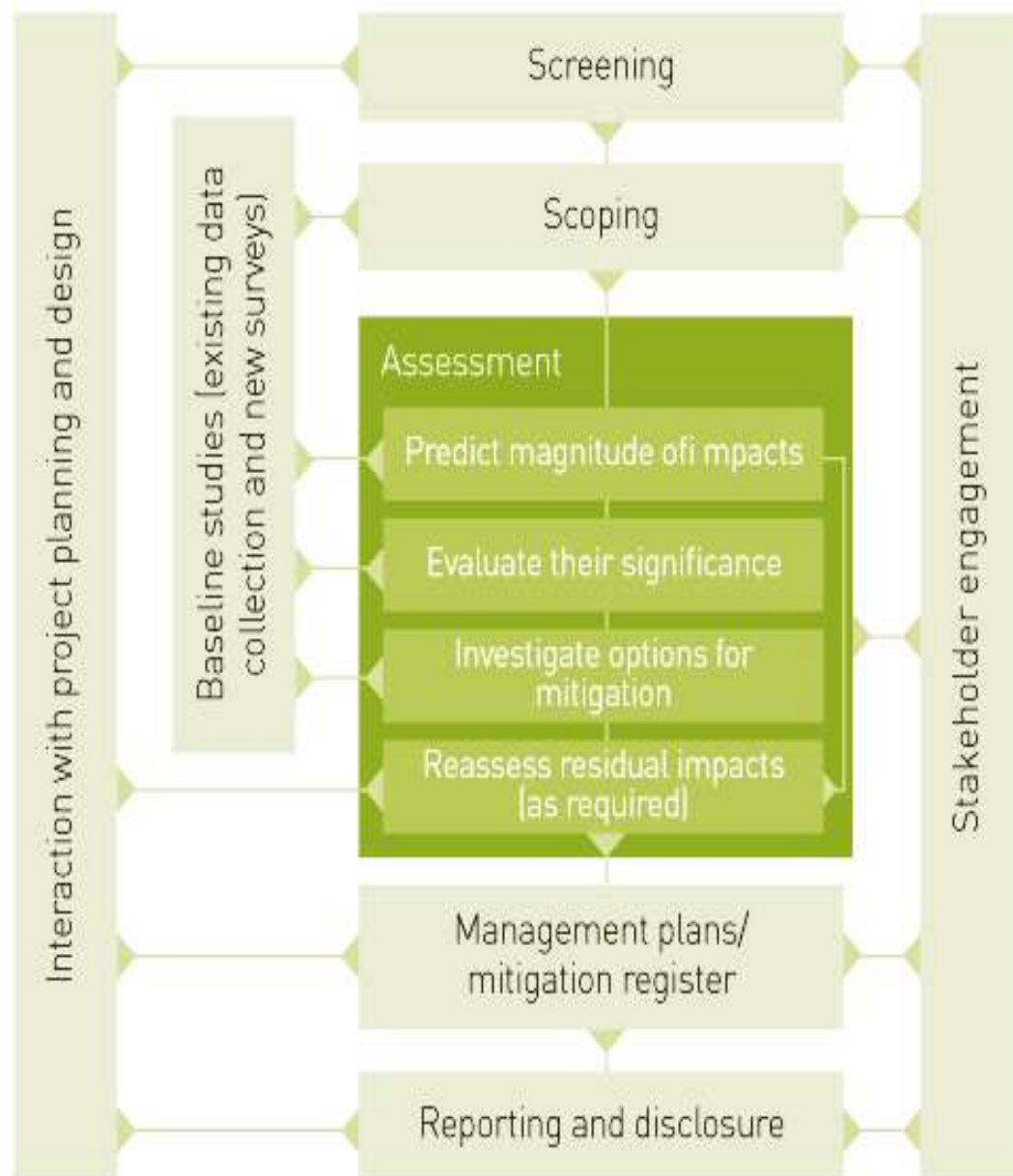


Fig 1.5: EIA Completion Steps

1.9.1 Acquiring Project Specific Data

This was the very first step to embark on the study initiated through meetings held with the officials of M/s Creek Developers (Pvt.) Limited. In the meetings, discussions were held to clarify the nature and extent of project in environmental perspectives. Basic information on the form of raw input received from the proponent was analyzed by the experts to comprehend the project and to assess its influence on the environment.

1.9.2 Literature Review

While the project details were being acquired, desktop study was also initiated simultaneously to draft environmental baseline information of the project area. The desktop study comprised of literature review, collection of updated authenticated

published/printed data on the physical and social environment related to the focused area. The same was also used to delineate the scope of surveys which would then form the basis of environmental assessment.

1.9.3 Stakeholder Consultation

Stakeholder consultations were held to involve the public in the decision making process and to have a fair interaction with all community groups and assuring them that every attempt would be made to reduce the negative impacts of the project, and that adequate remedial measures would be taken to recompense the loss of the affected persons, if any.

1.9.4 Reconnaissance and Detailed Surveys

Preliminary surveys of project location were organized by EMC in which experts visited the area and assessed the physical scenario in order to plan various detailed studies. The relevant surveys were carried out under the supervision of environmental experts. Preliminary socio-economic evaluation was also undertaken.

This was followed by detailed and comprehensive surveys which were carried out in order to investigate various domains of environment and socio-economic sector to highlight various issues, and concerns that may lead to the identification of aspects and subsequent assessment of impacts.

1.9.5 Aspects Identification

The EIA process requires development of an inventory of all possible environmental and socio-economic aspects, which provide the basis of categorization and evaluation of impacts and their likelihood to occur due to the materialization of the project. Aspects are those which are the causes of positive or negative impacts. Those aspects are primarily associated with activities performed during construction and operation phases of the project.

1.9.6 Impact Assessment and Mitigation Measures

Based on the developed aspects inventory, experts analyzed the aspects for their logical outcome as potential impacts on the physical and social environment. These impacts have been identified, assessed and weighed for different activities during construction, commissioning and operational phases of the project.

Mitigation and control measures were also proposed for various activities i.e. pre-construction, construction and operation of project in order to minimize the potential impacts during its life span.

1.9.7 Environmental Management and Monitoring Plan

In the light of impacts identified and mitigations proposed an Environmental Management Plan (EMP) has been developed which has a pivotal role in assigning

tasks to personnel for the environmental management and implementation of mitigation measures as well as to monitor its effectiveness throughout the life cycle of the project. It also provided monitoring plans/procedures to be followed for checking and compliance maintenance of environmental quality and legal requirements through suggested mitigation measures.

1.9.8 Documentation Review and Conclusion

This is the final step to complete the environmental assessment and compile all the work done in shape of a report. Report writing started just after the initiation of environmental assessment. The report has been written by experts of EMC and compiled by the office staff in coordination with the experts. At the end of the study, the entire report is reviewed by the team leader followed by recommendations and conclusion in the light of the assessment.

1.10 Structure of EIA Report

The EIA report has been structured on the standard format, prescribed by the Federal EPA. The Report has been presented in the following sections:

Chapter 1: Provides an introduction and overview of the project

Chapter 2: Details the project description, its objective, location of the facilities and construction /operation related project details along with proposed schedule for implementation

Chapter 3: Gives an overview of policy and legislation along with international guidelines relevant to the project

Chapter 4: Provides description of the microenvironment and macro environment of the project area. This chapter contains the description of the Physical environment, Biological environment and built environment of the area

Chapter 5: Provides details of stakeholder consultation and the issues and concerns raised by the stakeholders and interested parties.

Chapter 6: Describes the potential environmental and social impacts of the Arkadians Project. General and project specific guidelines were used to assess the potential environmental impacts at the various - designing, construction and operations – stages of the project.

Chapter 7: Presents the cumulative impacts of the proposed project on the environment.

Chapter 8: Presents the Environmental Management Plan and Monitoring Program for the project

Chapter 9: Summarizes the report and presents its conclusions.

The main text of the report is supported by a series of Annexures which provide auxiliary information including: Respective sections of prominent National and International Environmental Laws, Guidelines and management plans which form part of the environmental study are provided in the Annexures.

1.11 EIA Study Team

This EIA report has been prepared by Environmental Management Consultants (EMC) organized and coordinated with the team mentioned in Table 1.3 for the purpose of conducting environmental assessment and preparing of the report:

Table 1.3: List of IEE Team Members		
S. No.	Name	Position in EIA Study Team
1.	Mr. Syed Nadeem Arif	Project Manager
2.	Dr. Muhammad Haseeb	Team Leader/Senior Environmental Specialist
3.	Mr. Ahmed Zohair	Environmental & Social Considerations Specialist / Project Coordinator
4.	Ms. Haider Bin Nasir	HSE Advisor
5.	Dr. Shahid Amjad	Marine Sciences Expert
6.	Dr. Syed Omar Arif	Environmental Engineer
7.	Mr. Shayaan Ansari	Environmental Scientist
8.	Mr. Raja Nazakat	Sociologist
9.	Ms. Imaan Sheraz	Sociologist

2.0 PROJECT DESCRIPTION

2.1 The Project

Slated as Pakistan's tallest residential project, THE ARKADIANS comprises 13 residential towers (32 and 24 storey high), six office enclaves and a shopping mall in Zone G of the DHA Waterfront Development Area. The Arkadians will provide a perfect blend of luxurious and world-class lifestyle, modern design and peaceful living that is ideal for both living and doing business in one of Karachi's most desired neighbourhoods.

This high-end development spanning over an area of 43.24 acres comprises of high-rise to mid-rise residential towers, office towers and a retail component supported with high-quality infrastructure, ample car parking and recreational facilities.

This section provides detailed account of the project and its salient features, such as location, components and various phases.

2.2 Project Location

The project site for Proposed The Arkadians Project is located in Zone G of DHA Waterfront Development Area, Phase VIII, DHA, Karachi at the following coordinates:

Table 2.1: Location Coordinates		
CORNER #	LOCATION	COORDINATES
C 1	Near Convention Centre end	N 24° 46'33.0 E 067°05 37.7
C2	DHA Golf Club (near front side) Project Office	N 24° 46'55.0 E 067°05 32.6 N 24° 46'42.6 E 067°05 43.8.
C3	In front of Corner of Creek Vista	N 24° 46'36.8 E 067°05 33.4
C4	Corner of DHA School	N 24° 46'40.6 E 067°05 36.9
C5	Near DHA Early Learning Centre Corner	N 24° 46'50.2 E 067°05 25.7
C6	Along Khayaban e Tipu Sultan Road	N 24° 46'54.7 E 067°05 29.7

The particular site has many advantages e.g., its location within a developed housing estate area, availability of most of the utilities such as Electricity, Water, & Telephone, adequate Road System, etc.

The site comprising of 43.24 acres of reclaimed land is located in Zone G of the DHA Waterfront Development in Phase VII of DHA, Karachi. The Moin Khan Academy is located at the North, Creek Vista at the South, the DHA Golf Club on the East and Creek Marina on the North of the Project Site.

2.2.1 Project Land

Project Land has been acquired by the proponent from DHA for 99 years of lease for Residential cum Commercial development activities.



Fig 2.1: Location of Proposed The Arkadians Project in Zone G of DHA Phase VIII

2.3 Screening of Alternatives

The project is being undertaken in a developed housing estate and no project alternative has been identified.

2.4 Project Scope

The project aims to follow a comprehensive plan for construction of the proposed thirteen high rise residential towers, six office Towers and Retail/Mall.

The construction schedule for the project is as follows:

Residential Towers: 5 years

Office Towers: 5 years

Retail /Mall: 4 years

The scope of this assessment and report covers all the likely impacts arising from the project implementation, identification of impacts which require further investigations, mitigation measures to reduce the impacts to acceptable levels and formulation of monitoring plan.

The report includes impacts on physical and ecological resources, human and economic development and finally quality of life values including socio-economic values, public health issues, aesthetics and cultural values.

2.5 The Project at a Glance

Table 2.2: Project at a Glance	
Criteria	Details
Location	Zone G, DHA Waterfront Development, Phase VIII, DHA, Karachi
Total Development Area	43.24 Acres
Residential Area	26.79 Acres or 62%
Offices Area	9.86 Acres or 22.8%
Retail/ Mall	6.59 Acres or 15.2%
Floor Area ratio (Residential Area)	1:4 as per agreement with DHA
Residential Development: 13 Towers	Total Apartments: 1707 Total Parking: 7354 cars (Ground and 2 Basements)
Tower – A (Combo 3,2,4 Duplex) + 2 Penthouses	No of Floors: 28+2 No of Apartments: 140 Car Parks / Building: 312
Tower – B (Combo 3,3,4 Duplex) + 2 Penthouses	No of Floors: 20+2 No of Apartments: 100 Car Parks / Building: 224
Tower – C (3 Beds) +3 Penthouses	No of Floors: 30+2 No of Apartments: 181 Car Parks /Building: 368
Tower - D (4 Beds) +4 Penthouses	No of Floors: 22+2 No of Apartments: 134 Car Parks/Building: 406
Tower - E (Combo 3, 2, 4 Duplex) + 2 Penthouses	No of Floors: 30+2 No of Apartments: 15061 Car Parks / Building: 334
Tower - F (5 Beds Duplex) + 3 Penthouses	No of Floors: 24+2, No of Apartments: 74, Car Parks / Building: 225
Tower - G (5 Beds Duplex) + 3 Penthouses	No of Floors: 24+2, No of Apartments: 74, Car Parks / Building: 225
Tower - H (Combo 3, 2, 4 Duplex) + 2 Penthouses	No of Floors: 30+2, No of Apartments: 150, Car Parks / Building: 334
Tower - I (Combo 3, 3, 4 Duplex) + 2 Penthouses	No of Floors: 24+2, No of Apartments: 120, Car Parks / Building: 268
Tower - J (3 Beds) + 3 Penthouses	No of Floors: 30+2, No of Apartments: 181, Car Parks / Building: 368
Tower - K (3 Beds) + 2 Penthouses	No of Floors: 22+2, No of Apartments: 132, Car Parks / Building: 268
Tower - L (Combo 3, 2, 5 Duplex) + 2 Penthouses	No of Floors: 30+2, No of Apartments: 150, Car Parks / Building: 334
Tower - M (3 Beds) + 3 Penthouses	No of Floors: 20+2, No of Apartments: 121, Car Parks / Building: 248
Office Area Development – 11 Towers	Each Tower comprising of Basement plus Ground plus eighteen (18) Storeys Parking Space for: 2240 cars
Retail/Mix Development	Ground plus five (5) storeys Parking Space for: 1200 cars



Fig. 2.2: Conceptual View of the Arkadians Project

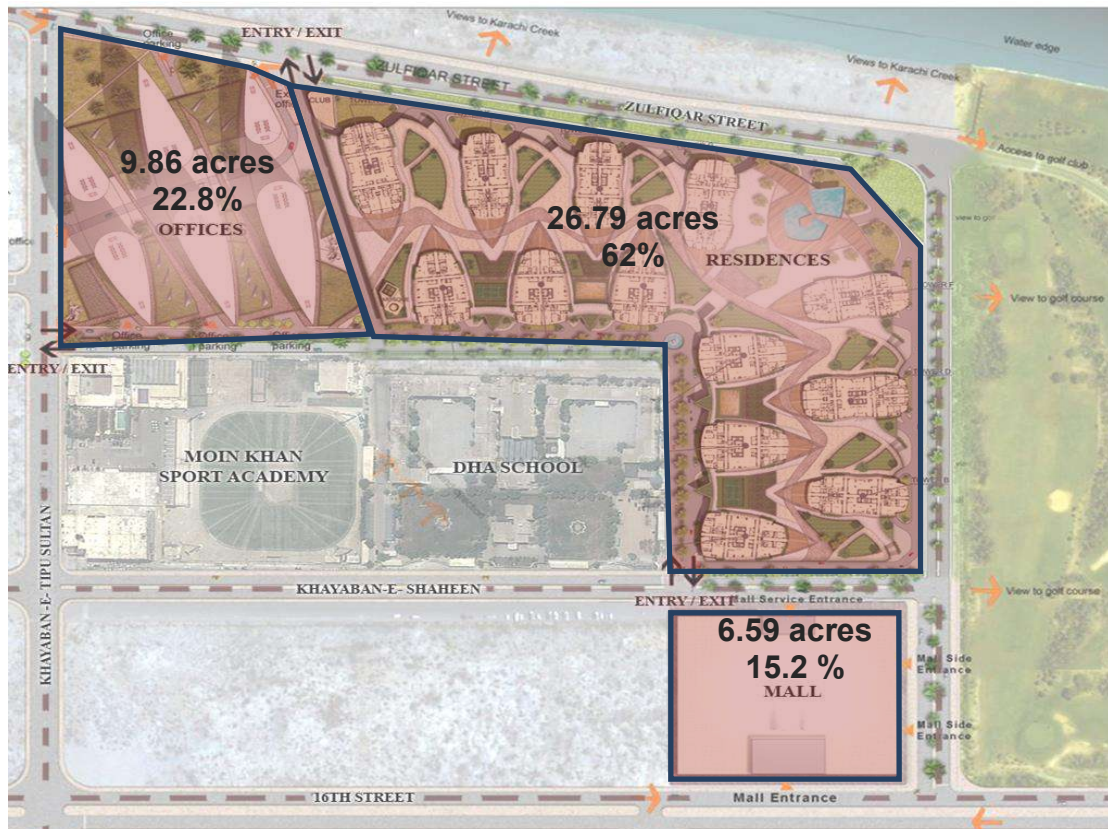


Fig 2.3: Area allocation for The Arkadians Project in Zone G of DHA Phase VIII



Fig. 2.4: Overall Master Plan of Proposed The Arkadians Project in Zone G of DHA Phase VIII

2.5.1 Design of The Arkadians Project

The master plan of the highly distinctive, contemporary architecture of The Arkadians Residential Buildings has been prepared by The Architects -Studio Tariq Hassan. Principal contractor services are provided by Creek Developers (Pvt.) Ltd. The Master Plan draws from the topography of the area. The building designs and walkways emulate the waves of the Arabian Sea. The buildings and individual apartment aim to maximize views and the entire design concept is in harmony with climate and maximizes the natural ventilation provided by the coastal breeze and use of natural light has been incorporated into the design.

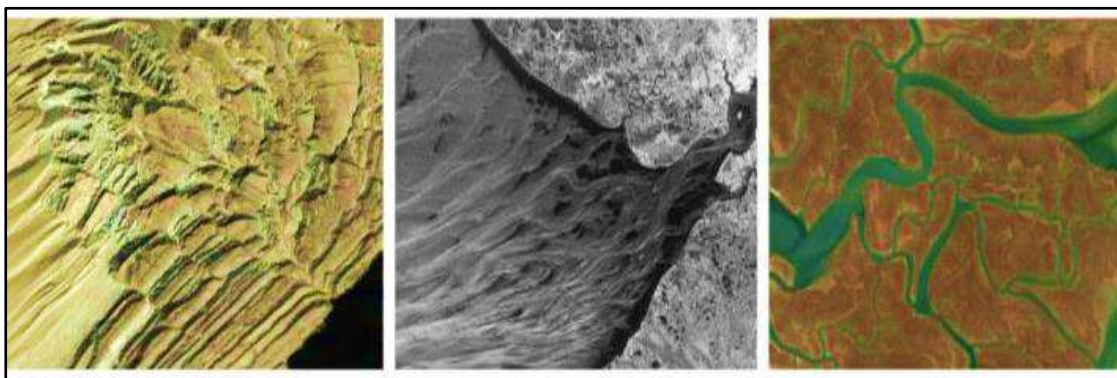


Fig. 2.5: Concept of the Design from the Local Landscape

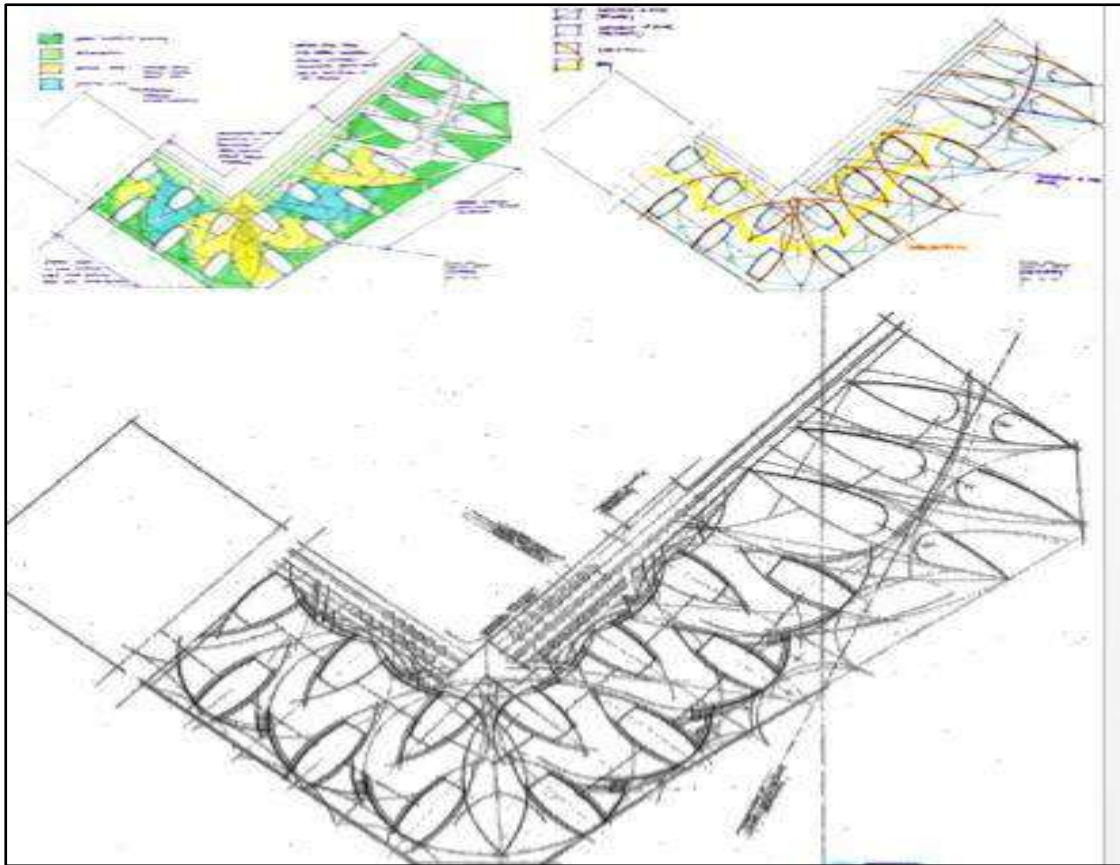


Fig. 2.5: Conceptual Development of The Arkadians

2.5.2 Details of the Residential Towers

A. Layout of the Residential Towers

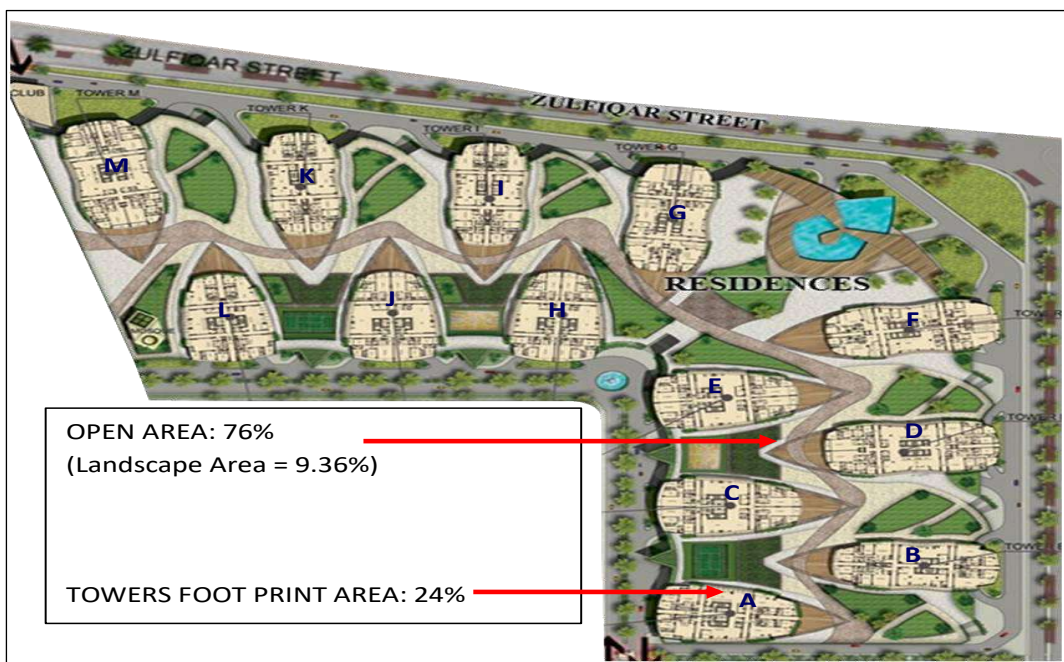


Fig. 2.6: Layout of the Residential Towers

B. Distances Between the Towers

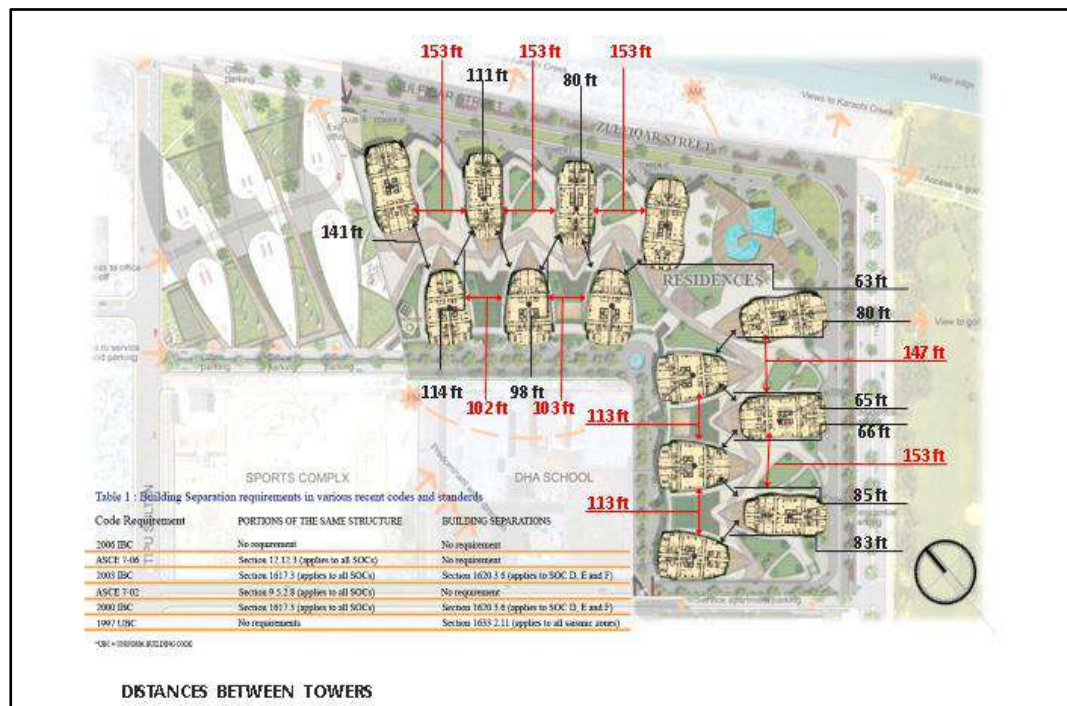


Fig. 2.7: Distances between the Towers

The International guidelines for distances between the high rise towers have been followed.

C. Salient Features of the Residential Towers

Monolithic Structure

Colored Concrete panels

Continuous 6 feet wide balconies

Low-E Glass walls

Wind Channels

Naturally ventilated baths

The great roof

Panoramic city view

D. Interiors

Luxurious lobbies with **high-gloss granite** tiles.

The reception & waiting areas are spacious and welcoming.

Access to lobbies is by **exclusive security-code** for the residents.



Fig 2.8: Lobby Area

E. Materials and Finishes

Exteriors

Durable Exteriors

Buildings are external fair face concrete.

Resistant to weathering.

Require no maintenance.

Outdoor Tiles:

Easy to maintain

Weather-resistant materials

Floor Tiles

Non-slip, durable porcelain tile floors

Railings

Corrosion-resistant stainless-steel railings are used, protected from exposure to the elements by installing them on the inside, behind the glazing, where possible.

Window Frames

The window frames are in Aluminum, which is resistant to corrosion and is especially desirable for coastal projects. An energy-efficient Low-E glass sandwich panel with security film inside to protect from break-ins.

Doors

Impact-resistant wood panel doors are used for the apartment entrance, combining elegance with security. Interior doors are painted flush doors to minimize on maintenance.

Walls

Wall-to-wall glazing in the rooms ensures maximum views of the creek and golf-course. The window frames are corrosion-free UPVC with energy-efficient Low-E glass sandwich panel, which provides security from break-ins while minimizing heat-gain.

Imported Kitchens

Residents will have a variety of imported kitchens of various standards to choose from. All counter-tops, in the kitchen and bathrooms, are granite and marble.



Fig 2.9: Exteriors and Interiors of The Arkadians Project



Fig. 2.10: View towards Tower A & B

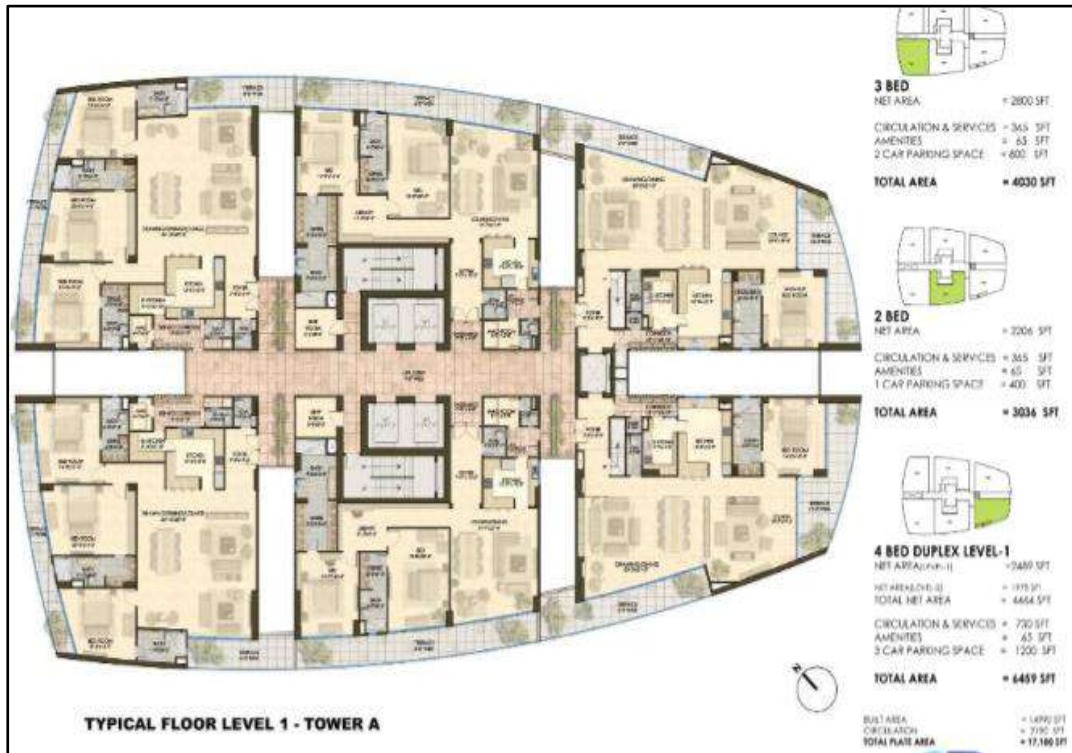


Fig. 2.11: Typical Floor Level 1 and Apartment Details Tower A

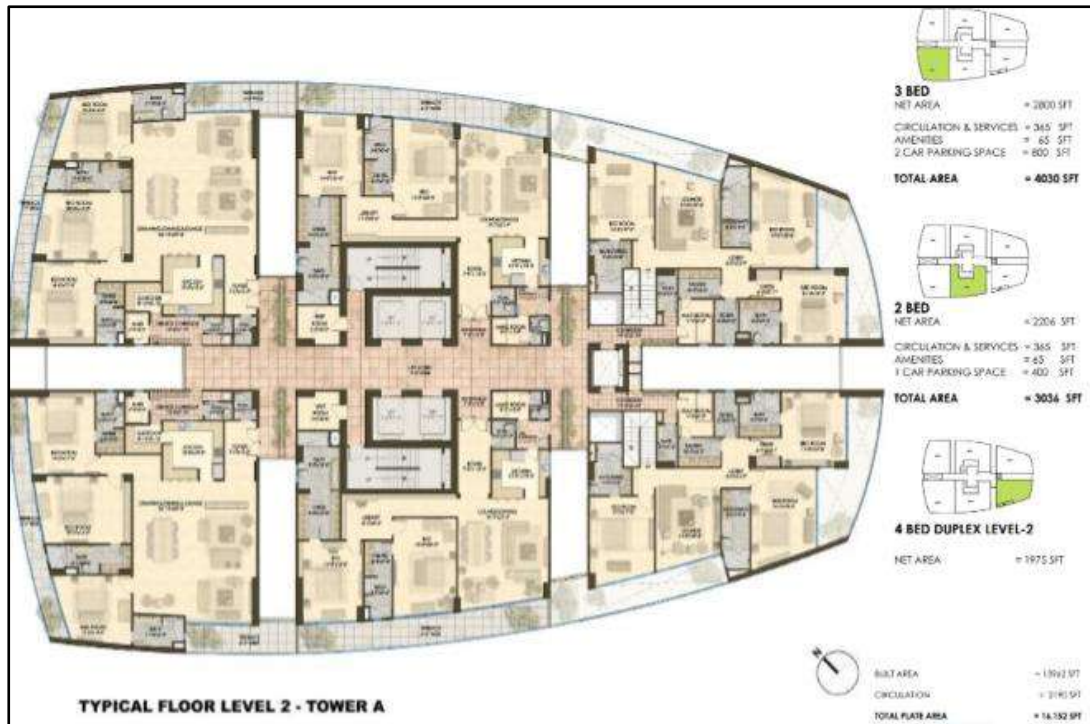


Fig. 2.12: Typical Floor Level 2 and Apartment Details Tower A

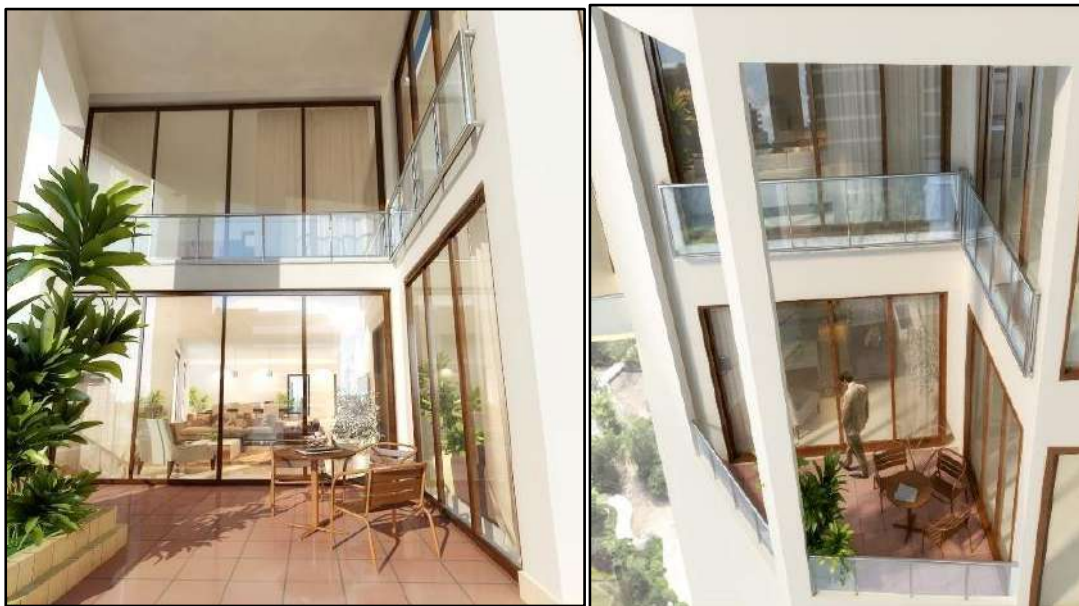




Fig. 2.13: Interiors of the Residential Towers Apartments



Fig. 2.14: Details of Penthouse Level 1 Tower A

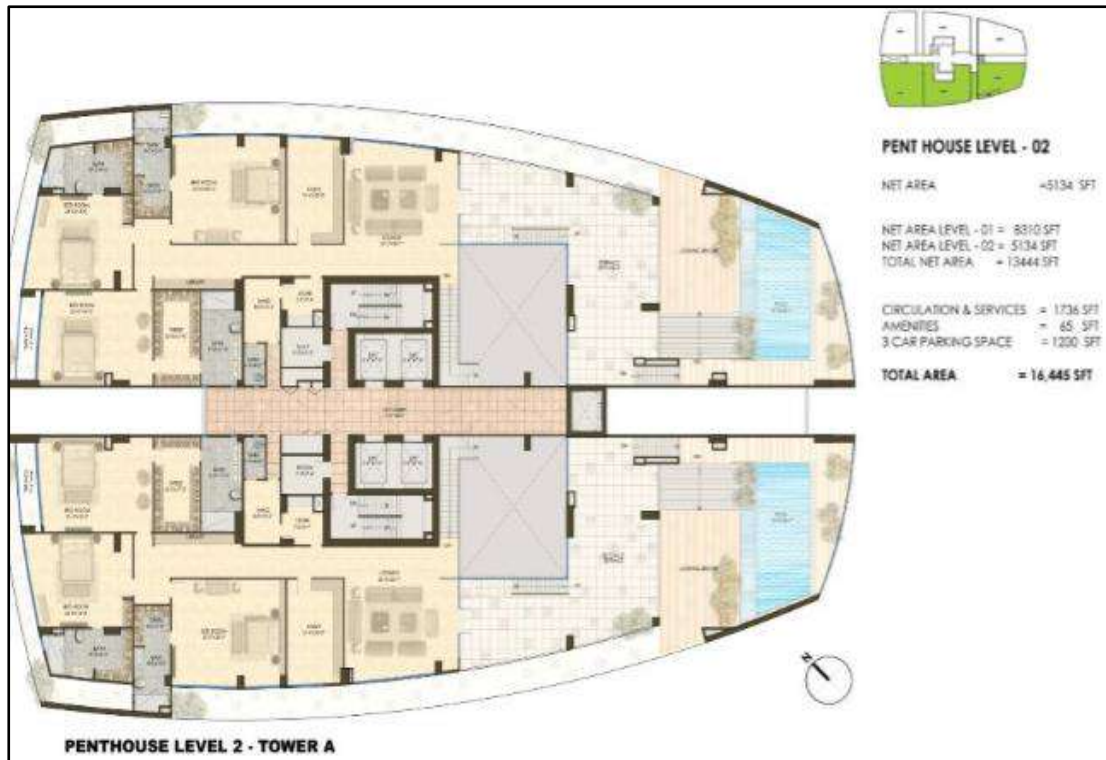


Fig. 2.15: Details of Penthouse Level 2 Tower A

2.5.3 Details of Office Towers

The six Office Towers are located before the Residential Towers as per layout and Site Plan below:



Fig. 2.16: Location of the Office Towers



Fig. 2.17: Site Plan of the Office Towers



Fig. 2.18: Conceptual View of the Office Towers



Fig. 2.19: Front View of the Office Towers

2.6 Construction and Commissioning

The sequence of proposed activities from the pre-construction to operation stage is given below:

2.6.1 Pre-Construction Phase

This is an essential phase that will provide the basis for the construction program, the methodology to be adopted and the technologies to be involved. The project site for the proposed unit will be assessed in terms of its geology, seismicity and seismotectonics.

Extensive soil testing has already been done. Furthermore, it is conducted again prior to initiation of pile works for any tower.

2.7 Construction Phase

2.7.1 Site Preparation

Construction will start from pile driving and ground works followed by concrete works for installations once the sub-base of the site has been prepared and foundations laid for the process equipment and supporting infrastructure. Sealed site roads and paved areas will be constructed.

Topsoil will be removed and stored and not disposed off separately. Typical activities that will be conducted during civil construction are:

Excavation for foundations

Laying of foundations

Masonry work

Concrete work

Asphalt work (pavement, roads etc.)

Finishing (plastering, painting etc.)

Civil work comprises of construction of the Residential Towers, Office Towers and Retail/Mall besides site levelling, roads, drainage, sewerage and all other infrastructure within the hospital boundaries. The general specifications/details in respect of type of structures, grade of concrete, materials, etc. for all major units have been assumed to confirm the standard practice of civil works.

2.7.2 Summary of Pile Works

Diameter of Pile- 30 inches

Depth of Pile – 135 ft from NGL

No of Piles:

- Tower A – 461
- Tower B – 324

General strata

- 0'-85' Medium fine sand
- 85'-135'- Conglomerate/ Sandstone/ Siltstone

5. Capacity of Pile

- Allowable recommended by Geotechnical Engineer-386/328 Tons
- Recommended as per Pile Load Test-315 Tons
- Actual maximum used in design – 275 Ton

2.7.3 Use of Post Tensioned (PT) Slab

Use of PT Slab saves time by reducing form work removal time and therefore speedy construction. In Post Tensioned concrete slab cables comprising of strands and anchors are used to introduce pre compression in expected flexural tensile zones. High strength concrete of 5000psi and pre compression minimizes flexural cracks, resulting in durability and long life. PT Slab allows longer spans with lesser depths without beams as compared to RCC.

Steel structures will include column bracings, rafters, roof trusses, purlins, side runners, roof bracings, stairs, ladders, handrails, columns, floor beams (both rolled and built-up plated sections), Main equipment to be used in the civil works is given in Table 2.3.

Table 2.3: List of Equipment's /Machinery for Civil Works	
S. No.	Equipment/ Machinery
1.	Graders/ Levels
2.	Excavators
3.	Pneumatic chisels / Hammers
4.	Scaffolding Pipes and Fittings
5.	Concrete mixers or Readymade mixed concrete trucks
6.	Vibrators and grouting pressure pumps
7.	Survey equipment like theodolite, leveling instruments and compass
8.	Dumpers
9.	Steel Shuttering
10.	Compactors
11.	Road Rollers
12.	Mobile Cranes
13.	Concrete Lifters
14.	Tractors with trolleys
15.	Welding sets including auto / MIG welders
16.	Air Compressors
17.	Gas cutting sets

Bearing capacity, settlement, static and dynamic loading conditions will be considered during design stage. Seismic conditions according to seismic zoning of Karachi and project site area will be taken into account. Wind and all environmental conditions have been duly considered in the design. Colour and finishing have been chosen with the aim of enhancing the visual aesthetics.

After the completion of construction the construction campsite will be rehabilitated.

2.7.4 Site Restoration

On the completion of the construction phase, the entire site will be built-up thus no site restoration to original condition is required. External sites are not being used.

2.7.5 Waste Streams during the Construction Phase

The initial source of emissions to air during construction activities will be the exhaust gases from diesel engine generators. Other emission sources include construction machinery and vehicle exhaust emissions.

Fugitive dust emissions from construction activities and movement of vehicles will be the other main sources of air emissions. The sewage will be treated in a closed system and the sludge will be transported to the nearest municipal facility. The grey water will be sprinkled on unpaved sections within the construction corridor.

Recycling or reuse of waste material is the preferred option. However, where it is not possible, waste will be treated and appropriately disposed of as per proponent's policy and other contractual obligations.

2.8 Details of Utilities and Other Facilities

2.8.1 Public Utility Infrastructure at Site

The concerned utility agencies are responsible to provide all basic services, i.e. electricity, gas, water and sewerage for the Project. Natural gas will be provided by Sui Southern Gas Pipeline Ltd. (SSGCL) as described below while electricity will be provided by K-Electric.

A. Water Supplies

Water requirement for construction activities will be fulfilled through bowzers.

The main water supply source to the project site is the Karachi Water & Sewerage Board. Water; for the project will be supplied by KW&SB through dedicated water pipelines.

For the operation phase, breakdown of water requirements for Residential Towers, Offices and Retail Mall is as follows:

Residential Towers: 367,000 gallons per day. Two main reservoirs having a capacity of 100,000 gallons each have been provided for fire fighting. Water will be stored in Underground (U.G) tank and Overhead (O.H) tank.

Office Towers: Daily Water Requirement: 180,000 Gallons (including 50,000 gallons reserved for fire fighting and 10,000 gallons /day for landscaping)

Retail/Mall: Daily Water Requirement: 100,000 Gallons (including 50,000 gallons reserved for fire fighting and 15,000 gallons/day for landscaping).

Total water requirement in operation phase will be 647,000 gallons/day of say **0.65 MGD**.

B. Natural Gas Requirement

Natural Gas is readily available throughout Pakistan and is the fuel of choice in terms of price and its environment friendly characteristics. Natural gas will be delivered to the towers through a low pressure dedicated pipeline to be provided by Sui Southern Gas Pipeline Ltd. (SSGPL). Gas requirements breakdown is as follows:

Residential Towers: 3,000 m³ per day

Office Towers: 500 m³ per day

Retail/Mall: 5,000 m³ per day

Total: 8,500 m³ per day

C. Electricity Requirement

Electricity requirement for construction activities will be fulfilled through diesel generators. Diesel engine driven generator exhaust is the primary source of air emissions from construction activities. Other emission sources include the construction machinery and vehicular emission exhaust.

Electricity requirements breakdown is as follows:

Residential Towers: 26 MW per day

Office Towers: 25MW per day

Retail/Mall: 32 MW per day

Total: 83 MW per day or say 85 MW

D. Other Utilities

Packaged A/C Units, HVAC systems will be provided as required in the Office Towers and Retail / Mall. The residential areas shall have packaged A/C Units installed as required.

2.8.2 Wastewater and Storm Water System

It is estimated that wastewater will be generated from project at the rate of 300,000 gallons per day. All the wastewater will be discharged to the municipal wastewater system. Before disposal into the municipal system, the wastewater will pass through sewerage treatment plant to be provided at the basement of tower. Kitchen waste shall discharge into the grease Interceptor prior to disposal to infrastructure sewer line.

Storm Water Drainage design is based on the existing topography of the area and will cater to the storm water that may flow through that area. The storm water will be discharged to the municipal storm water system through gravity.

2.8.3 Site Drainage

Storm water run-off from the site will be collected through storm water drainage system.

2.8.4 Waste Management

The solid waste generated on site will be collected daily by a solid waste contractor who will dispose it off in a responsible manner as per waste management plan. Numbers of trash bins will be located inside the building and people will be appointed for collection of solid waste. The solid waste disposal route has been defined and the solid waste contractor will collect the waste on daily basis.

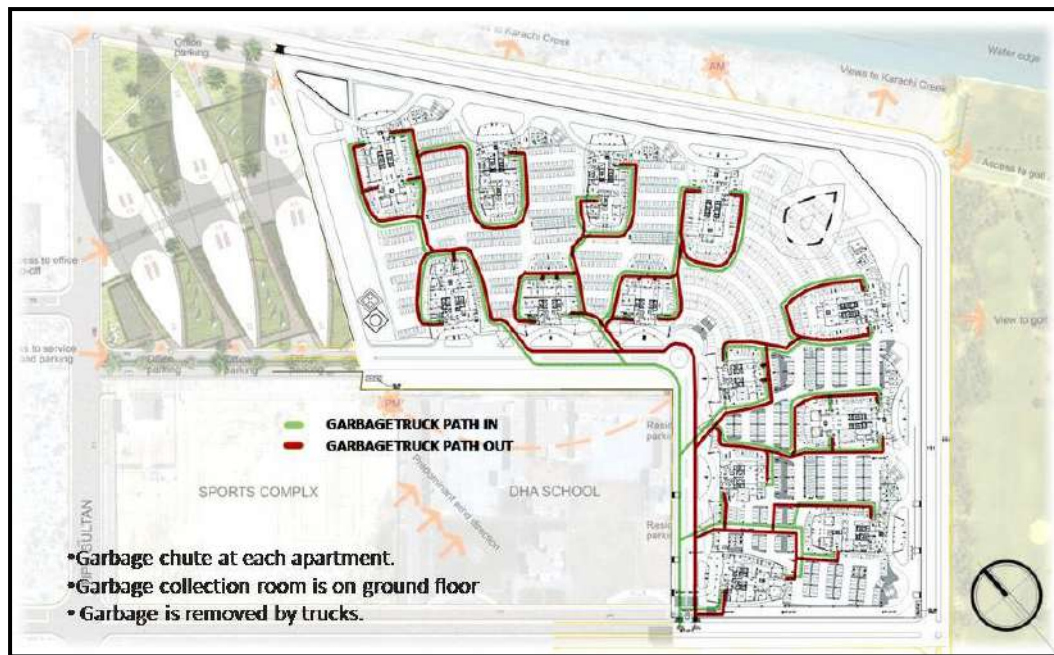


Fig 2.20: Garbage Collection Route for the Arkadians

2.8.5 Traffic Management

A comprehensive access point and traffic load management plan for the proposed project has been developed keeping in view the traffic from adjoining areas of DHA Golf Club, DHA School, Moin Khan Sports Academy, Mosque, Hospital and The Place. The traffic load management plans for the Residential Towers, Offices and Retail/mall is as below:

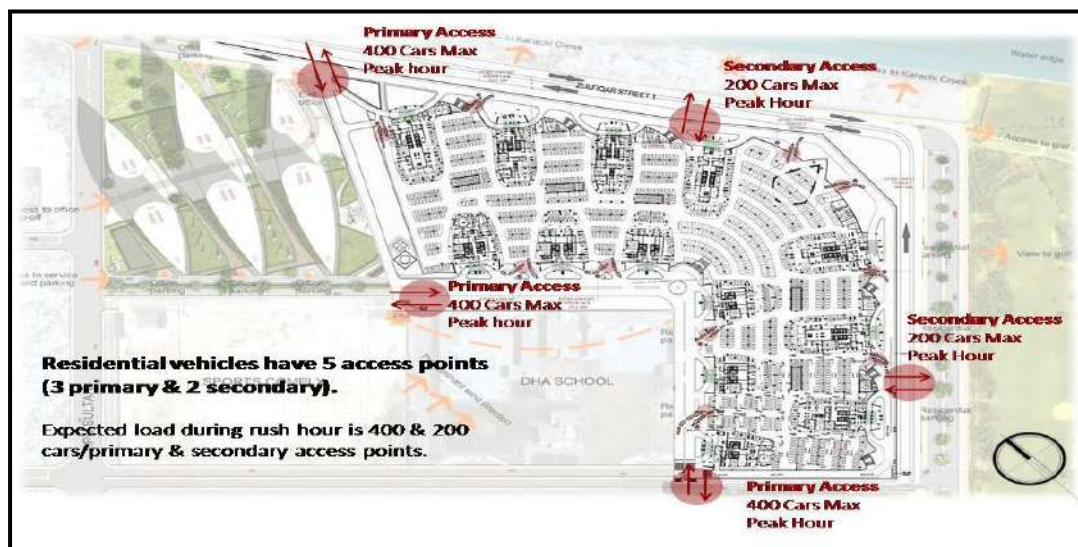


Fig 2.21: Access Point & Traffic Load Management Plan for the Residential Towers



Fig 2.22: Internal Traffic Flow Plan for Residential Towers



Fig 2.23: Traffic Load Management Plan for Office Towers

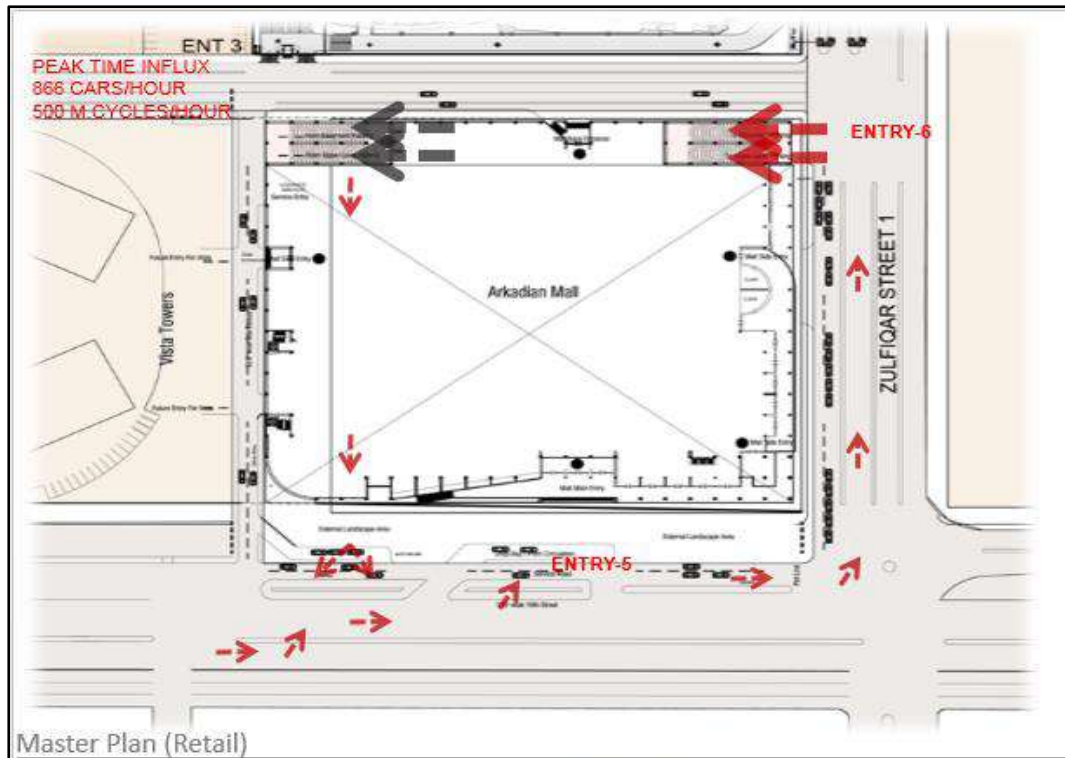


Fig 2.24: Traffic Load Management Plan for The Arkadians Mall

The car parking at grade ensures free flow of cars with minimum waiting time.

2.8.6 Facilities Management

A facility management company shall be employed which will be responsible for the following services:

Day-to-day maintenance

Security

Water management

Power management

Amenities maintenance and management

Amenities Include

Swimming Deck

Basket Ball Court

Tennis Courts

Community Hall

Play Area

Spa

Library

Mosque



Fig 2.25: Facilities Management Plan for Arkadians Project

Besides that a 24 hour health care facility is being provided in the project as well as a grand mosque is planned to be built at the project site.

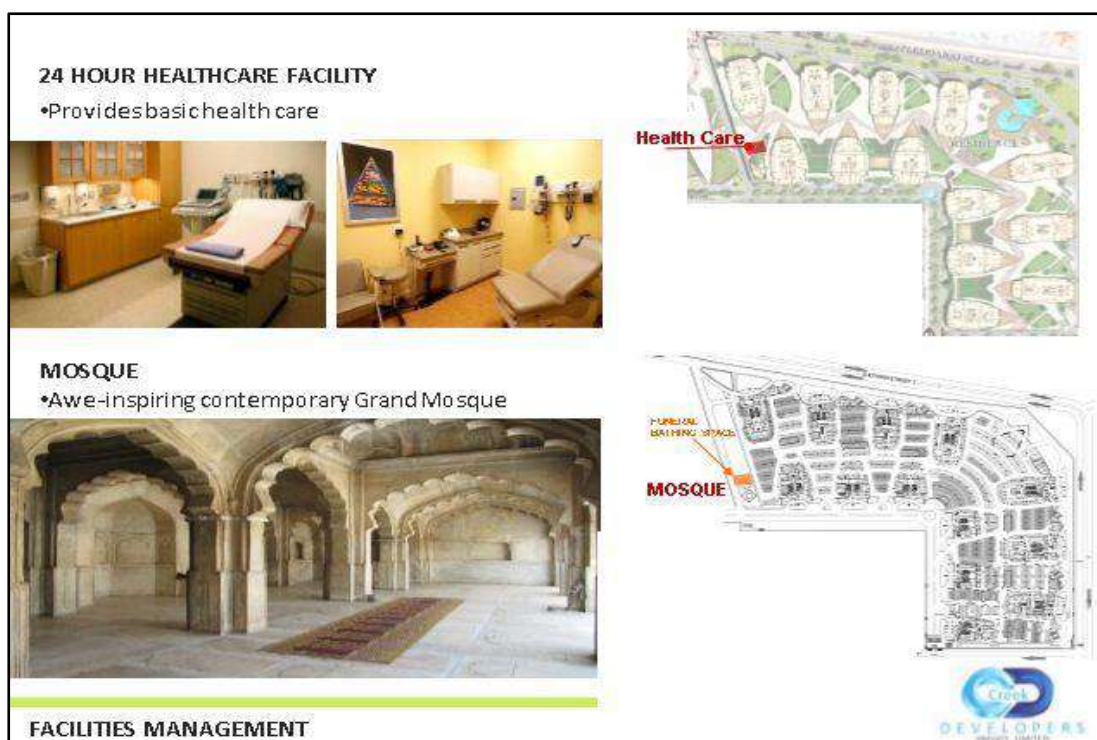


Fig 2.26:Provision of 24 Hour Healthcare Facility and Grand Mosque



Fig 2.27: Swimming Pool and Tennis Courts at Project Site

2.8.7 Disaster Management

Earthquake resistance of buildings and materials used has been incorporated into the design of the project buildings. Details are as below:

Earthquake resistant design according to Building Code of Pakistan Zone 2B – Moderate Seismic Zone

Buildings provided with RCC Central Core

Raft foundation is supported on piles with a capacity of 300 tons and above

Super-structures and sub-structure designed fulfilling the requirements of Uniform Building Code -977 and ACI 318-0

2.8.8 Fire Detection and Suppression

A. Fire Detection

Smoke detectors shall be installed in all the apartments and lobbies and the smoke detectors have been integrated with Building Information Modelling (BIM) software.

B. Fire Rated Walls

The stairwell walls are designed to have a fire rating of 2 hours. Apartment partition walls and internal walls have a fire rating of 60 mins and 30 mins respectively.

C. Pressurized Stairs

The stairwells are closed and pressurized

D. Fire Hose Cabinets

Fire Hose cabinets shall be provided at regular intervals on all floors. Firefighting lines supply water from two main water reservoirs in the complex and each reservoir shall have a reserve capacity of 100,000 gallons of water for firefighting.

E. Emergency Vehicle Route

Emergency vehicle route has been planned to ensure the entry of snorkels and fire engines to the project site.

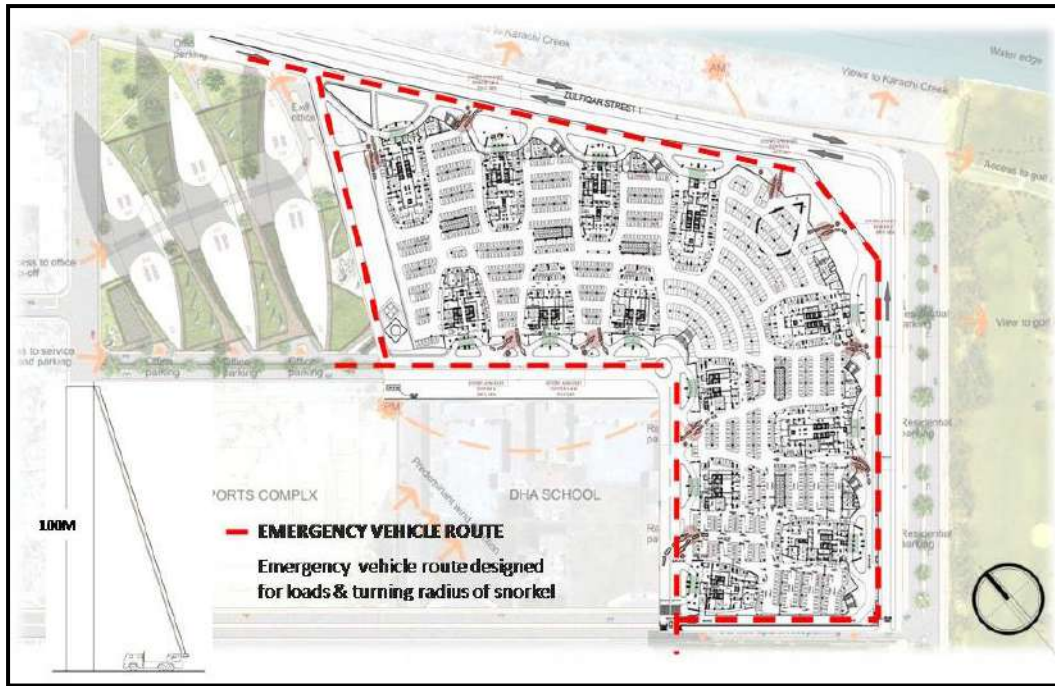


Fig 2.28: Emergency Vehicle Route at The Arkadians Project

2.8.9 Security Arrangements

State of the art security arrangements have been planned for entire The Arkadians project.

Vehicles of Residents are identified and non-resident vehicles are allowed to enter after car registration and colour are provided as per Entrance Protocol

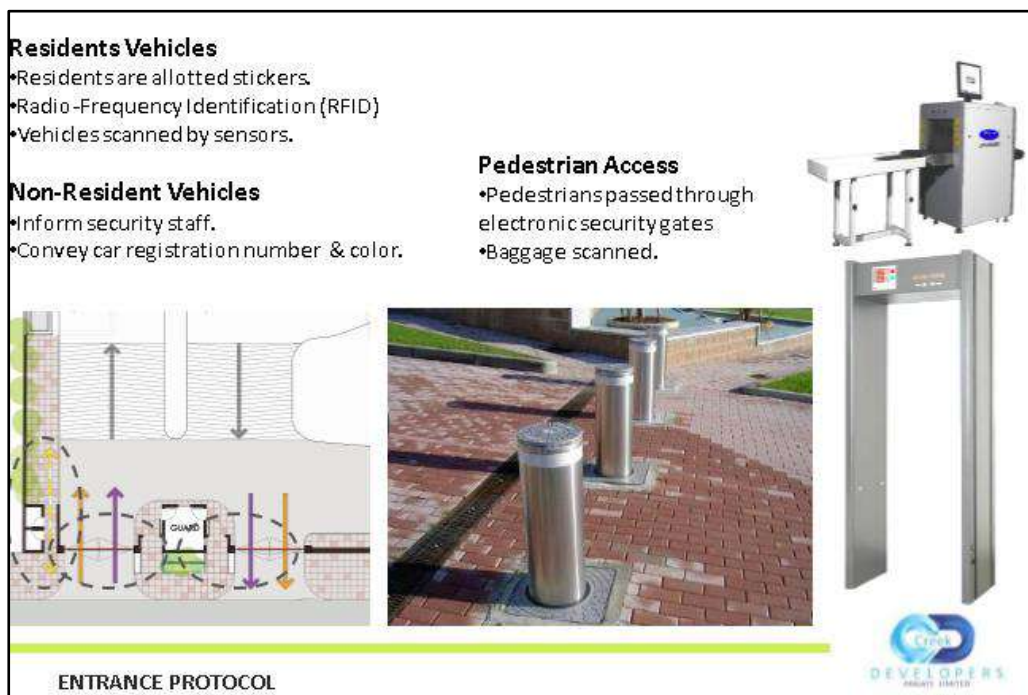


Fig 2.29: Entrance Protocol at The Arkadians Project

Security guards are present at building entrance. Residents access is by security code and face recognition. The lifts are CCTV secured. Security code and facer recognition software will be installed and a central database software shall be installed to facilitate security measures.



Fig 2.30: Security System at Entrance of The Arkadians.

3.0 LEGISLATIVE FRAMEWORK ENVIRONMENTAL REGULATIONS AND GUIDELINES

3.1 Introduction

This section provides detailed review of policies, legislation, and guidelines that have relevance to the proposed project and review of administrative framework as well as institutional set-up relevant to the environmental and social management of the proposed subproject:

3.2 National Environmental Laws & Legislations

Pakistan's statute books contain a number of laws related to the regulation and control of the environmental and social aspects. However, the enactment of comprehensive legislation on the environment, in the form of an act of parliament, is a relatively new practice. Most of the existing laws on environmental and social issues have been enforced over an extended period of time, and are context-specific. After the Eighteenth amendment in the Constitution of Pakistan, many federal subjects devolved to provincial legislation. The Concurrent List in fourth schedule of the Constitution containing entries of subjects wherein federal and provincial legislation could legislate has been abolished. Since project coverage is in province of Sindh; therefore, only those national laws and regulations are discussed here which have application in the project. There are still several federal laws which have not been repealed by the provinces and applicable in provinces with its original titles. The laws relevant to the proposed subproject are briefly reviewed below.

3.2.1 National Environmental Policy, 2005

The National Environmental Policy, 2005 aims to protect, conserve and restore Pakistan's environment in order to improve the quality of life for the citizens through sustainable development. It provides an overarching framework for addressing the environmental issues facing Pakistan, particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of biodiversity, desertification, natural disasters and climate change. It also gives direction for addressing the cross sectorial issues as well as the underlying causes of environmental degradation and meeting international obligations.

The National Environmental Policy, 2005 while recognizing the goals and objectives of the National Conservation Strategy, National Environmental Action Plan and other existing environment related national policies, strategies and action plans, provide broad guidelines to the Federal Government, Provincial Governments, Federally Administrated Territories and Local Governments for addressing environmental concerns and ensuring effective management of their environmental resources.

3.2.2 National Conservation Strategy, 1992

The Pakistan National Conservation Strategy (NCS) is the principal policy document for environmental issues in the country. The NCS was developed and approved by the Government of Pakistan in 1992. The NCS works on a ten-year planning and implementation cycle. It deals with fourteen core areas as follows:

- Maintaining soils in cropland;
- Increasing irrigation efficiency;
- Protecting watersheds;
- Supporting forestry and plantations;
- Restoring rangelands and improving livestock;
- Protecting water bodies and sustaining fisheries;
- Conserving of biodiversity;
- Increasing energy efficiency;
- Developing and deploying material and energy renewable;
- Preventing and abating pollution;
- Managing urban wastes;
- Supporting institutions for common resources;
- Integrating population and environmental programs;
- Preserving the cultural heritage

3.2.3 Pakistan Climate Change Act, 2017

The Prime Minister established Pakistan Climate Change Council which coordinates and supervises the enforcement of the provisions of the Act, monitor implementation of the international agreements relating to climate change, approve and monitor implementation of comprehensive adaptation and mitigation policies, strategies, plans, programs, projects and other measures formulated by the authority to meet Pakistan's international obligations, monitor the implementation of National Adaptation Plan and its constituent provincial and local adaptation action plans, approves guidelines for the protection and conservation of renewable and nonrenewable resources, species, habitats and biodiversity adversely affected or threatened by climate change.

The Act is applicable to proposed project as the proposed project involves the solid waste management activities that may contribute to generation of greenhouse gases

3.2.4 Pakistan Penal Code, 1860

The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents.

The provisions of the Penal Code, 1860 are applicable to the Project in terms of penalties for effecting human lives and public property. It also addresses the control of noise, air emissions and effluent disposal.

3.2.5 National Disaster Management Act, 2010

National Disaster Management Act, 2010 was passed by Parliament of Pakistan in 2010. The Act applies to whole Pakistan. The Act was passed in backdrop of 2010 Floods in Pakistan and strengthens Disaster Management system.

3.2.6 Building Code of Pakistan, 2007

The provision of Building Code of Pakistan shall apply for engineering design of building-like structure and related components. The construction in violation of the building code shall be deemed as violation of professional engineering work. Moreover, a certificate for the proposed action will be obtained from Provincial Building Control Authority.

These codes shall be used in structural design of building area components constructed under this proposed Project.

3.2.7 Guidelines for the Preparation and Review of Environmental Reports, 1997

These guidelines describe the format and content of IEE/EIA reports to be submitted to EPA for obtaining NOC/approval.

The guidelines present:

- The environmental assessment report format;
- Assessing impacts;
- Mitigation and impact management and preparing an environmental & Social management plan;
- Reporting;
- Review and decision making;
- Monitoring and auditing; and
- Project Management.

These guidelines serve to describe the format, practices, and procedures to be employed when reporting environmental assessments.

3.2.8 Guidelines for Environmental Assessment

Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental & Social management of different types of development Projects. The guidelines that are relevant to the proposed Project are listed below.

- Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997;
- Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May, 1997; and
- Sectoral Guidelines: Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997.

3.2.9 Land Acquisition Act, 1894¹ and Land Acquisition (Sindh Amendment) Act 2009

The primary law for acquisition of land for public purposes in Pakistan is the “Land Acquisition Act (LAA), 1894” (hereinafter referred as the Act). The land acquired under the Act vests in the province and it is only thereafter that the province may transfer it to someone else. The Sindh Amendment 2009 of LAA 1894 specifically related to Section 16, Section 23, Section 24 and Section 28-A.

3.3 Sindh Environmental Protection Act, 2014

The Sindh Environmental Protection Act, 2014 (2014 Act) was passed by the Sindh Assembly on February 24, 2014. The 2014 Act is the basic legislative tool empowering the provincial government to frame regulations for the protection of the environment. The 2014 Act envisages protection, improvement, conservation & rehabilitation of environment of Sindh with the help of legal action against polluters and green awakening of communities. It equally lays emphasis for the preservation of the natural resources of Sindh and to adopt ways and means for restoring the balance in its eco-system by avoiding all types of environmental hazards. The 2014 Act is applicable to a broad range of issues and extends to air, water, industrial liquid effluent, marine, and noise pollution, as well as to the handling of hazardous wastes.

The following provisions of the SEPA 2014 have a direct bearing on the proposed Project:

- Section 11(1): ‘Subject to the provisions of this Act and the rules and regulations therein, no person shall discharge or emit or allow the discharge or emission of any effluent, waste, pollutant, noise or any other matter that may cause or likely cause pollution or adverse environmental effects, as defined in Section 2 of this Act, in an amount, concentration or level which is in excess to that specified in Sindh Environmental Quality Standards...’
- Section 11(2): ‘All persons, in industrial or commercial or other operations, shall ensure compliance with the Environmental Quality Standards for ambient air, drinking water, noise or any other Standards established under section 6(1)(g)(i); shall maintain monitoring records for such compliances; shall make available these records to the authorized person for inspection; and shall report or communicate the record to the Agency as required under any directions issued, notified or required under any rules and regulations.’
- Section 14 (1): ‘Subject to the provisions of this Act and the rules and regulations, no person shall cause any act, deed or any activity’, including;
 - ❖ (b) disposal of solid and hazardous wastes at unauthorized places as prescribed;
 - ❖ (c) dumping of wastes or hazardous substances into coastal waters and inland water bodies; and

¹ The Land Acquisition Act 1894 (Act of 1894) <http://punjablaws.gov.pk/laws/12.html>

- ❖ (d) release of emissions or discharges from industrial or commercial operations as prescribed.
- Section 15 (1): 'Subject to the provisions of this Act, no person shall operate or manufacture a motor vehicle or class of vehicles from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the Sindh Environmental Quality Standards or, where applicable, the standards established under sub-clause (i) of clause (g) of sub-section (1) of section 6'.
- Section 17(1): 'No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof'
- Section 17(2): The agency shall;
 - ❖ a) review the initial environmental examination and accord its approval, subject to such terms and conditions as it may prescribe, or require submission of an environmental impact assessment by the proponent; or
 - ❖ (b) review the environmental impact assessment and accord its approval subject to such terms and conditions as it may deem fit to impose or require that the environmental impact assessment be re-submitted after such modifications as may be stipulated or decline approval of the environmental impact assessment as being contrary to environmental objectives.
- Section 17(3): 'Every review of an environment impact assessment shall be carried out with public participation and, subject to the provisions of this Act, after full disclosure of the particulars of the project'.
- Section 17(4): 'The Agency shall communicate its approval or otherwise within a period of two months from the date that the initial environmental examination is filed, and within a period of four months from the date that the environmental impact assessment is filed complete in all respects in accordance with the regulations, failing which the initial environmental examination or, as the case may be, the environmental impact assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations'.
- Section 20(1): 'The Agency shall from time to time require the person in charge of a project to furnish, within such period as may be specified, an environmental audit or environmental review report or environmental management plan containing a comprehensive appraisal of the environmental aspects of the project'.
- Section 20(2): The report of a project prepared under sub-section (1) shall include:
 - (a) analysis of the predicted qualitative and quantitative impact of the project as compared to the actual impact;
 - (b) evaluation of the efficacy of the preventive, mitigation & compensatory measures taken with respect to the project; and
 - (c) recommendations for further minimizing or mitigating the adverse environmental impact of the project.

- Section 20(3): 'Based on its review of the environmental audit report, the Agency may, after giving the person in charge of the project an opportunity of being heard, direct that specified mitigation and compensatory measures be adopted within a specified time period and may also, where necessary, modify the approval granted by it under section 17'.
- Section 31(1): 'The Agency shall cause relevant details of any proposed project regarding which an Environmental Impact Assessment has been received to be published, along with an invitation to the publish to furnish their comments thereon within a specified period'.
- Section 31(3): 'All comments received under sub-section (1) and (2) shall be duly considered by the Agency while reviewing the environmental impact assessment or strategic impact assessment, and decision or action taken thereon shall be communicated to the persons who have furnished the said comments.

3.4 Sindh EPA (Review of IEE and EIA) Regulations, 2021

The Sindh Environmental Protection Agency (Environmental Assessment) Regulations 2021, revised from the preceding document introduced in 2014, define Schedules (I, II, & III) of projects falling under the requirement of an Environmental Checklist, IEE, or EIA respectively.

Schedule I: The project falls into Schedule I if it is considered as having minimal environmental impact, and the screening of the project through a checklist, documents its environmental compliance.

Schedule II: The project falls in Schedule II if it is likely to have adverse environmental impacts, but of lesser degree or significance and all the mitigation measures to handle the impact is manageable. Such types of projects need IEE report inducing EMP.

Schedule III: Projects are categorized in Schedule III if they generate significant adverse environmental impacts that require a comprehensive management plan, or if the project is located within or passes through: a) Areas declared by the Government of Pakistan as environmentally sensitive (National Parks/Sanctuaries/Game Reserve), b) Areas of international significance (e.g. protected wetland as designated by the RAMSAR Convention), or c) Areas designated by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as cultural heritage sites.

According to Sindh Environmental Protection Agency Environmental Assessment Regulations, 2021, a project falling in any category listed in Schedule III shall file an EIA with the Sindh Environmental Protection Agency (SEPA). This specific project can be categorized as:

Schedule III: Projects Requiring an EIA

Category (I) Urban Development and Tourism

(2) Residential, Commercial High-rise buildings subject to compliance of building bylaws of relevant organizations more than 500,000 sq. feet

Filing: Regulation 9 requires submission of two hardcopies and two electronic copies accompanied by an application form (schedule-V), copy of receipt of payment of review fee, NOC from relevant departments (where applicable).

Preliminary scrutiny: Regulation 10 states that at any time after the submission of the report, the agency shall review the report and inform the proponent for submission of the need for any additional information at any time.

Review: The agency shall review the report after issuing confirmation of completeness as per Regulation 9.

Validity: Regulation 15 defines the validity period of approval of an IEE or EIA to be three years from date of construction and must start within three years of report approval. A three-year extension at a time may be granted upon the agency's discretion with or without the submission of a fresh IEE or EIA.

3.5 Guidelines for Public Consultation

Public consultation is mandated under 2014 Act. Regulation 11 of the 2014 Regulations provides the general requirements whereas the sectoral guidelines indicating specific assessment requirements are provided in the Guidelines for Public Consultation 1997 (the 'Guidelines'). These are summarized below:

Objectives of Public Involvement: 'To inform stakeholders about the proposed project, to provide an opportunity for those otherwise unrepresented to present their views and values, providing better transparency and accountability in decision making, creating a sense of ownership with the stakeholders';

Stakeholders: 'People who may be directly or indirectly affected by a proposal will clearly be the focus of public involvement. Those who are directly affected may be project beneficiaries, those likely to be adversely affected, or other stakeholders. The identification of those indirectly affected is more difficult, and to some extent it will be a subjective judgment. For this reason, it is good practice to have a very wide definition of who should be involved and to include any person or group who thinks that they have an interest. Sometimes it may be necessary to consult with a representative from a particular interest group. In such cases the choice of representative should be left to the group itself. Consultation should include not only those likely to be affected, positively or negatively, by the outcome of a proposal, but should also include those who can affect the outcome of a proposal';

Mechanism of consultations: 'Provide sufficient relevant information in a form that is easily understood by non-experts (without being simplistic or insulting), allow sufficient time for stakeholders to read, discuss, consider the information and its implications and to present their views, responses should be provided to issues and problems

raised or comments made by stakeholders, selection of venues and timings of events should encourage maximum attendance’;

Timing and Frequency: Planning for the public consultation program needs to begin at a very early stage; ideally it should commence at the screening stage of the proposal and continue throughout the EIA process;

Consultation Tools: Some specific consultation tools that can be used for conducting consultations include; focus group meetings, needs assessment, semi-structured interviews; village meetings & workshops;

Other Important Considerations: The development of a public involvement program would typically involve consideration of the following issues; objectives of the proposal and the study; identification of stakeholders; identification of appropriate techniques to consult with the stakeholders; identification of approaches to ensure feedback to involved stakeholders; and mechanisms to ensure stakeholders’ consideration are taken into account’.

As above, the Guidelines for Public Consultation introduces effective ways to inform the contents of the project to the general public during the planning stage and that eventually consensus building toward the implementation of project is reached. However, there are instances where in middle of a project on direction of tribunal or court environmental assessment carried out with public consultation.

Incorporating public involvement into the stages of environmental assessment is explained in the guidelines that public consultation meeting has to be carried out after the works on "developing options and assessing and mitigating impacts" for comments and assessment

3.6 Sindh Environmental Quality Standards

On January 28, 2016, the Sindh Environmental Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Air, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards, 2015 have been notified by Sindh EPA.

Table 3.1 shows Sindh environmental quality standard for ambient air.

Table 3.1: Sindh Environmental Quality Standard for Ambient Air			
Pollutant	Time-weighted average	Concentration in Ambient Air	Method of measurement
Sulfur Dioxide (SO ₂)	Annual Average*	80µgm ³	Ultraviolet Fluorescence Method
	24 hours**	120µgm ³	
Oxides of Nitrogen as (NO)	Annual Average*	40µgm ³	Gas Phase Chemiluminescence
	24 hours**	40µgm ³	
Oxides of Nitrogen as (NO ₂)	Annual Average*	40µgm ³	Gas Phase Chemiluminescence
	24 hours**	80µgm ³	
O ₃	1 hour	130µgm ³	Non dispersive UV absorption method
	Annual Average*	360µgm ³	High volume Sampling,

Table 3.1: Sindh Environmental Quality Standard for Ambient Air			
Pollutant	Time-weighted average	Concentration in Ambient Air	Method of measurement
Suspended Particulate Matter (SPM)	24 hours**	500µgm ³	(Average flow rate not less than 1.1m ³ /minute)
Respirable Particulate Matter (PM10)	Annual Average*	120µgm ³	B Ray absorption method
	24 hours**	150µgm ³	
Respirable Particulate Matter (PM2.5)	Annual Average*	40 µg/m3 ***	B Ray absorption method
	24 hours**	75 µg/m3	
	1 hour	15 µg/m3	
Lead (Pb)	Annual Average*	1µgm ³	ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	1.5µgm ³	
Carbon Monoxide (CO)	8hours**	5mg/m ³	Non Dispersive Infra Red (NDIR) method
	1hours	10mg/m ³	
*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.			
**24 hourly / 8 hourly values should be met 98% of the in a year. 2% of the time, it may exceed but not on two consecutive days.			

Table 3.2 shows the standards for motor vehicle noise.

Table 3.2: The Motor Vehicle Ordinance (1965) and Roles (1969)		
Parameter	Standards (maximum permissible limit)	Measuring method
Noise	85dB(A)	Sound-meter at 7.5meter from the source

Table 3.3 shows the proposed national environmental quality standard for noise.

Table 2.3: Sindh Environmental Quality Standard for Noise			
S. No.	Category of Area / Zone	Effective from 1 st January, 2015	
		Limit it in dB(A) Leq*	
		Day Time	Night Time
1	Residential area (A)	55	45
2	Commercial area (B)	65	55
3	Industrial area (C)	75	65
4	Silence Zone (D)	50	45
Note: 1	Day time hours: 6.00 a. m to 10.00 p. m		
2	Night time hours: 10.00 p. m to 6.00p. m		
3	Silence zone; Zone which are declared as such by competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts.		
4	Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.		
*dB(A)Leq	Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.		

The SEQS for effluents are shown in Table 3.4

Table 3.4: Sindh Environmental Quality Standard for Municipal & Liquid Industrial Effluents					
S. #	Parameter	Into Inland Waters	Into Sewage Treatment	Into Sea	Unit
1	Temperature or Temp. increase	<3	<3	<3	°C
2	pH value (H ⁺)	6-9	6-9	6-9	
3	Biological Oxygen Demand (BOD) ₅ at 20°C	80	250	80	mg/l
4	Chemical Oxygen Demand (COD)	150	400	400	mg/l
5	Total Suspended Solids (TSS)	200	400	200	mg/l
6	Total Dissolved Solids (TDS)	3500	3500	3500	mg/l
7	Oil and Grease	10	10	10	mg/l
8	Phenolic Compounds (as Phenol)	0.1	0.3	0.3	mg/l
9	Chloride (as Cl ⁻)	1000	1000	SC	mg/l
10	Fluoride (as F ⁻)	10	10	10	mg/l
11	Cyanide (as CN ⁻)total	1.0	1.0	1.0	mg/l
12	An-ionic detergents (as MBAS)	20	20	20	mg/l
13	Sulphate(SO ₄ ²⁻)	600	1000	SC	mg/l
14	Sulphide (S ²⁻)	1.0	1.0	1.0	mg/l
15	Ammonia (NH ₃)	40	40	40	mg/l
16	Pesticides	0.15	0.15	0.15	mg/l
17	Cadmium	0.1	0.1	0.1	mg/l
18	Chromium (trivalent and hexavalent)	1.0	1.0	1.0	mg/l
19	Copper	1.0	1.0	1.0	mg/l
20	Lead	0.5	0.5	0.5	mg/l
21	Mercury	0.01	0.01	0.01	mg/l
22	Selenium	0.5	0.5	0.5	mg/l
23	Nickel	1.0	1.0	1.0	mg/l
24	Silver	1.0	1.0	1.0	mg/l
25	Total toxic metals	2.0	2.0	2.0	mg/l
26	Zinc	5.0	5.0	5.0	mg/l
27	Arsenic	1.0	1.0	1.0	mg/l
28	Barium	1.5	1.5	1.5	mg/l
29	Iron	8.0	8.0	8.0	mg/l
30	Manganese	1.5	1.5	1.5	mg/l
31	Boron	6.0	6.0	6.0	mg/l
32	Chlorine	1.0	1.0	1.0	mg/l

The SEQS for drinking water are shown in Table 3.5.

Table 3.5: Sindh Environmental Quality Standards for Drinking Waters (mg/l)					
S.#	Properties / Parameters	Standard Values for Pakistan	S.#	Properties / Parameters	Standard Values for Pakistan
Bacterial			Chemical		
1	All water intended for drinking (E.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Essential Inorganics (mg/liter)		
			3	Aluminum (Al) mg/l	≤ 0.2
			4	Antimony (Sb)	≤ 0.005
2	Treated water entering the distribution system (Ecoli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	5	Arsenic (As)	≤ 0.05
			6	Barium (Ba)	0.7
			7	Boron (B)	0.3
3	Treated water in the distribution system	Must not be Detectable in any 100	8	Cadmium (Cd)	0.01
			9	Chloride (Cl ⁻)	< 250

Table 3.5: Sindh Environmental Quality Standards for Drinking Waters (mg/l)					
S.#	Properties / Parameters	Standard Values for Pakistan	S.#	Properties / Parameters	Standard Values for Pakistan
Bacterial			Chemical		
	(E.coli or thermo tolerant coliform and total coliform bacteria)	ml sample. In case of large supplies, where sufficient samples are examined, must not be resent in 95% of the samples taken throughout any 12 month period.	10	Chromium (Cr)	≤ 0.05
			11	Copper (Cu)	2
			Organic (mg/L)		
			12	Phenolic compounds	<0.0002
			Toxic Inorganics (mg/liter)		
			13	Cyanide (CN)-	≤ 0.05
			14	Fluoride (F)	≤ 1.5
			15	Lead (Pb)	≤ 0.05
			16	Manganese (Mn)	≤ 0.5
Physical			17	Mercury (Hg)	≤ 0.001
4	Color	< 15 TCU	18	Nickel (Ni)	≤ 0.02
5	Taste	Non objectionable/ Acceptable	19	Nitrate (NO ₃)-	≤ 50
6	Odor	Non objectionable/ Acceptable	20	Nitrite (NO ₂)-	≤ 3
7	Turbidity	< 5 NTU	21	Selenium (Se)	≤ 0.01
8	Total Hardness as CaCO ₃	< 500 mg/l	22	Residual Chlorine	0.2-0.5 At consumer end 0.5-1.5 at source
9	TDS	<1000			
10	pH	6.5-8.5			
Radioactive					
11	Alpha Emitters bq/L	0.1	23	Zinc (Zn)	5.0
12	Beta emitters	1			

3.7 Sindh Prohibition of Child Employment Act, 2017

Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines or any other hazardous employment. In accordance with this Article, the Prohibition of Child Employment Act (PCEA) 2017 disallows the child labor in Sindh. The PCEA defines a child as a person who has not completed his/her fourteenth years of age, and an adolescent means a person who has completed fourteenth year of age but has not completed eighteenth years of his age. No child shall be employed or permitted to work in any establishment including construction but an adolescent can be employed or permitted to work under strict guidelines provided in the PCEA and rules. An adolescent shall not be employed in any hazardous work included in the schedule to the PCEA

3.8 Archaeological Relics

After the Eighteenth amendment in the constitution the subject of “Ancient and historical monuments, archaeological sites and remains” the entry No.37 of the concurrent legislative list has also devolved to provincial legislations. There are two laws that are directly relevant for archaeological relics. The first is The Antiquities Act, 1975, which ensures the protection of Pakistan’s cultural resources. The Act defines “antiquities” as ancient products of human activity, historical sites or sites of

anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the GoP to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the Project proponents are obligated to ensure that no activity is undertaken within 61 m (200 ft.) of a protected antiquity, and to report to the GoP's Department of Archaeology any archaeological discovery made during the course of the project. The second is The Sindh Cultural Heritage (Preservation) Act, 1994, which is the provincial law for the protection of cultural assets. Its objectives are similar to those of the Antiquity Act. Heritage Foundation has catalogued 600 historic buildings declared heritage sites under the Sindh Cultural Heritage (Preservation) Act, 1994.

Since Chief Minister House is a Protected Building under Government of Sindh notification No OSD/CHC/CLQ-01-49/2017 dater 18th December 2017 and proposed project area is within 200 feet of protected area, hence Sindh Cultural Heritage (Preservation) Act, 1994 is applicable.

3.9 Pakistan Penal Code, 1860 (PPC)

Chapter XIV of the PPC deals with the offences affecting the public health, safety, convenience, decency and morals. Person may be guilty of public nuisance if his act or omission causes common injury, danger or annoyance to the public or results in spread of infection of disease dangerous to life. The chapter also deals with environmental pollution.

3.10 Sindh Solid Waste Management Board Act, 2014

The Sindh Solid Waste Management Board (SSWMB) Act, 2014 was enacted to establish a Board for collection and disposal of all solid waste, to arrange effective delivery of sanitation services, to provide pollution free environment and to deal with other relevant matters. The Board established under the Act headed by the Chief Minister or his nominee and constitutes of thirteen other ex officio members of other relevant departments. Some of the salient features and functions of the Board are; it has the right over the solid waste related issues, assets, funds and liabilities of the Councils and shall possess sole rights on all kinds of solid waste within the limits of all Councils established under the Local Government Act 2013, it has the authority to grant permission to individuals, institutions industries, factories, workshops, furnaces, compost making and power generation from the solid waste, for segregation of the recyclable material from the waste, collection, treatment, sale and purchase, recycling or disposal of any kinds of waste.

Solid waste management of the area falls under the jurisdiction of SSWMB. The condition of solid waste management in the project area is good. The project area is quite clean and the residents are satisfied with the solid waste management in the area.

3.11 Disaster Management Act, 2010

This Act was enacted to provide for the establishment of a National Disaster Management System for Pakistan. Sindh Disaster Management Authority enforces the Act. The Act defines ‘disaster’ as a catastrophe or a calamity in an affected area, arising from natural or man-made causes or by accident which results in a substantial loss of life or human suffering or damage to, and destruction of, property. Disaster management includes preparedness and response. The Act provides establishment of disaster management authorities at national, provincial and district levels. The authorities require preparing and implementing disaster management plan for their area.

3.12 Sindh Drinking Water Policy, 2017

Public Health Engineering & Rural Development Department, Government of Sindh, with the approval of Chief Minister Sindh issue the drinking water policy on 3rd May 2017.

Principles: The main principles of Sindh Drinking Water Policy, adopted from the National Drinking Water policy 2009, and aligned with the Sustainable Development Goals, are as follows:

- Access to safely managed drinking water is a fundamental right of every citizen and that it is the responsibility of the Government to ensure its provision to all citizens,
- Water allocation for drinking purpose shall be given priority over other uses,
- In order to ensure equitable access, special attention shall be given to removing the existing disparities in coverage of safe drinking water and for addressing the needs of the poor and the vulnerable on priority basis.
- Recognizing that inadequate and unsafe water supply and sanitation are a major cause of diarrhea and nutritional deficiency in children, which as a consequence contribute towards child mortality. Safely managed drinking water supply and sanitation shall be integrated in health, nutrition and school health programs.
- Access shall be increased to high quality nutrition-sensitive services, including access to water, sanitation facilities, and hygiene.
- Key hygiene actions (safe drinking water, hand washing with soap, safe disposal of excreta, food hygiene) shall be integrated as essential components in all nutrition programs.
- Realizing the fact that access and availability of safe drinking water affects all aspects of life of a citizen, a multi sectoral approach, involving different departments of the government, shall be adopted to address the issues related to safe drinking water.
- Being cognizant of the fact that women are the main providers of domestic water supply and maintainers of hygienic household environment, their participations in planning, implementation, monitoring and operation & maintenance of water supply systems shall be ensured, and WASH shall be integrated in maternal and neonatal health programs.

- Responsibilities and resources shall be delegated to local authorities to enable them to discharge their assigned functions with regard to provision of safe water supply.
- A supportive policy framework shall be developed that encourages alternate options through private provision, public private partnerships, the role of NGOs and community organizations
- The execution of component-sharing model for government programs and projects shall be promoted to ensure financial sustainability and community and private sector involvement in development and O&M.
- Low-cost technologies in water and sanitation, that are easy and cost-effective to maintain shall be developed and used.

Goals and Objectives:

Overall Goal: The goal of the Sindh Drinking Water Policy is to improve the quality of life of people of Sindh by reducing morbidity and mortality caused by water-borne diseases through provision of safely managed and potable drinking water to the entire population that is located on premises, available when needed, and free from contamination, affordable and of sufficient quantity, and in a way, that is efficient, equitable and sustainable.

Objectives: Introduce legislative measures and regulations to create an enabling framework for safely managed drinking water supply, regulation of water usage, extraction, treatment, transportation and distribution.

- Ensure that all drinking water resources and supply systems are protected with community involvement.
- Develop district level drinking water availability plans for urban and rural areas to ensure improved planning for equitable access.
- Enhance the coverage of safely managed drinking water supply in the province to achieve the Sustainable Development Goals (SDGs) targets of universal access.
- Develop criteria for installation of new drinking water supply schemes and ensure that all new schemes are safely managed, rationalized and constructed through need-based criteria so that all areas and communities are served.
- Develop standardized service delivery models for both urban and rural drinking water supply schemes to improve efficiency, cost-effectiveness, monitoring & sustainability.
- Develop mechanisms for reuse, recycle and recharge of wastewater for other municipal and productive uses.
- Ensure that all drinking water supply systems are designed and constructed in line with the national drinking water quality standards and all municipal discharges comply with National Environment Quality Standards (NEQS).
- Install water treatment plants at existing drinking water supply schemes where required and incorporate water treatment facilities in all new drinking water supply schemes.
- Ensure development of water safety plans for all drinking water supply systems.

- Develop and sustain regular drinking water quality monitoring & surveillance, and institute mechanisms for remedial action.
- Increase public awareness about water borne and water related diseases (including polio), nutrition and hygiene, and enhance the role of communities for household water treatment/storage, water safety and conservation, and safe hygiene practices.
- Ensure that drinking water supply projects are nutrition sensitive and integrated in health, nutrition and school health programs.
- Institutionalize Water, Sanitation & Hygiene (WASH) in schools (infrastructure and 3 starts) and introduce curricular change to incorporate health, nutrition and hygiene and improve safe water and sanitation practices among school children.
- Institute adaptation measures and disaster risk reduction and mitigation strategies to minimize the impact of climate events on drinking water supply system.

The proponent shall ensure supply of clean drinking water to the construction staff

3.13 Sindh Sanitation Policy, 2017

The goal of the Provincial Sanitation policy is to ensure that the entire population of Sindh has access to a safely managed sanitation service and sanitary environment that is also nutrition- sensitive and hygienic. The motto of the policy was ‘Saaf Suthee Sindh’ (Neat and Clean Sindh).

The key targets of this policy are:

1. To eradicate open defecation from Sindh province by 2025, while 70% villages of 13 high priority districts achieve the status of open defecation free by 2020.
2. That 100% household in Sindh have access to and use sanitary latrines by 2025, while 70% of rural households in high priority districts will achieve this by 2020.
3. To strengthen and implement liquid waste management with sewer lines and covered/improved drains with 85% coverage of urban areas and 60% coverage in rural areas.
4. To create and develop wastewater treatment mechanisms to cover 75% of urban areas and 40% rural areas by 2025.
5. To implement integrated solid waste management with 100% coverage in urban area and 60% in rural areas by 2025

3.14 Laws and Regulations on Urban Development

Sindh Government also has some laws and regulations for building control:

- 1) Buildings Control Ordinance, 1979
- 2) Karachi Building Control Licensing Regulations, 1982

3) Sindh Regulation & Control (Use of Plots & Construction of Buildings) Ordinance, 2002

Karachi Building Control Authority (KBCA) has been established under these ordinances, in order to implement and enforce the above regulations. The Government of Sindh on 14th February 2011 notified extension of the jurisdiction of KBCA to the whole of Sindh and renamed the KBCA to Sindh Building Control Authority (SBCA). The SBCA (Karachi region) is responsible to oversee that the land development process & construction activities do not violate the Karachi Building and Town Planning Regulations, 2002.

Karachi Building and Town Planning Regulations, 2002 is the fundamental regulation for 'Building & Town Planning' for the whole City District of Karachi, except for the cantonment areas and the projects of National Security declared by the Federal Government, which supersedes 'Karachi Building and Town Planning Regulations-1979'. Eight (8) public agencies are individually designated as 'Concerned Authorities for respective areas and purposes', following City District Government Karachi (CDGK), such as:

- Cantonment Boards of the Ministry of Defense
- Karachi Port Trust (KPT)
- Pakistan Railways (PR)
- Ministry of Works, Government of Pakistan (GOP)
- Sindh Industrial Trading Estates, Karachi (SITE)
- Sindh Katchi Abadis Authority
- Board of Revenue

For reference, there are many agencies holding lands in Karachi and no dominant ones. An outline of existing condition of land holdings in Karachi is illustrated as follows.

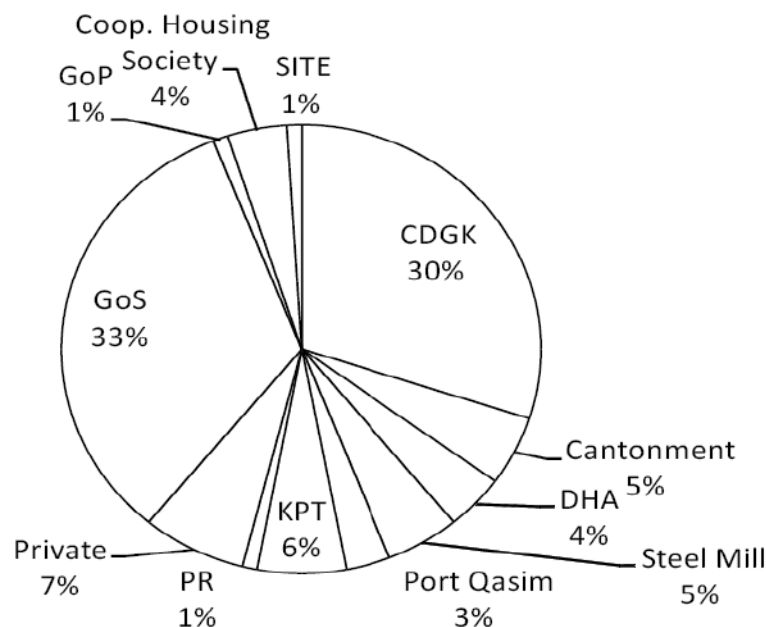


Figure 2.2: Land Holdings by Agency in Karachi (Source: KMP 2020)

The above-mentioned regulations have been quite frequently amended as needs arose, since its commencement, especially among the detailed provisions.

3.15 Civil Aviation Rules, 1994

The Civil Aviation Rules 1994 has mandated it for all the builders and developers to obtain No Objection Certificate (NOC) from Civil Aviation Authority (CAA) under rule 68, section-3 of Civil Aviation Rules, 1994 for “Height Clearance” for projects/buildings within the radius of 25 km of all airports. The rule 68, section 3 (Safe Guarding at Aerodromes (68) Limitation of obstructions) reads as under: “No person shall erect any temporary or permanent structure, nor position a vehicle or other mobile object on or in the vicinity of any aerodrome to which these rules are applicable, that will be within the clearance area, or will protrude through an obstacle limitation surface, at that aerodrome”.

For height clearance of the project, No Objection Certificate (NOC) from CAA will be obtained and submitted in due time.

3.16 Building Code of Pakistan, Fire Safety Provisions 2016

The Building Code of Pakistan-Fire Safety Provisions-2016 provide rules for fire prevention, life safety in relation to fire and fire protection of building and structures as prescribed. All the federal and provincial governments, organizations, authorities, both public and private are mandated to adopt and implement Building Code of Pakistan-Fire Safety Provisions-2016, as notified. Any construction and modification of buildings in violation of Building Code of Pakistan (Fire Safety Provisions-2016) shall be considered as violation of professional engineering works as specified under clause (xxv) of section 2 of the Act.

The implementation and enforcement of this bye-law shall vest with the Authority Having Jurisdiction (AHJ) within their respective jurisdictions and circles as follow:

- 1) Building Control, Housing and Development Authorities
- 2) District Administration
- 3) Tehsil or Town Administration
- 4) Municipal Administration
- 5) Station Headquarters (Army, Air Force and Navy)
- 6) Cantonment Administration
- 7) Union Council Administration
- 8) Autonomous Bodies
- 9) Industrial Estates
- 10) Directorates of Civil Defense
- 11) Export Processing Zones

12) Other Federal/Provincial Authorities as and when notified

This Bye-law shall come into force upon being notified and all the concerned AHJs shall implement the same immediately in the prescribed manner.

All relevant AHJs shall ensure compliance and implementations of this Code and accordingly adopt or amend their relevant regulations, Bye-laws or rules as the need be.

This Bye-law shall apply to both new and existing buildings.

- buildings permitted for construction after the adoption of these Provisions shall comply with the provisions stated herein for new buildings forthwith.
- existing buildings constructed prior to adoption of these provisions shall comply with the provisions stated herein as soon as possible but not later than three years of notification of these provisions; and
- minimum fire protection requirements such as provision of fire alarm and detection system, fire extinguishers, emergency response plans and fire drills shall however be in place as soon as possible but not later than one year of notification of these provisions.

Any person who fails to comply with this Bye-law or fails to carry out an order made pursuant to these provisions, or violates any condition attached to a permit, approval, or certificate shall be subject to the penalties in accordance with the regulations of AHJ.

In operational phase, the fire safety provisions will be followed accordingly:

3.17 The Sindh Occupational Safety and Health Act, 2017

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

During construction and operational phase, the health and safety of workers and the maintenance staff shall be considered in accordance with Sindh Occupational Safety and Health Act 2017

3.18 IFC General EHS Guidelines

The EHS guidelines published by IFC are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects; however, these guidelines have been benefited from for other projects as well. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during construction, operation, and

decommissioning phase of a project or facility. Environmental issues associated with the construction and maintenance activities may include, among others, noise and vibration, soil erosion, and threats to biodiversity including habitat alteration and impacts to wildlife.

Examples of the impacts addressed in the General EHS Guidelines include:

- Construction site waste generation;
- Soil erosion and sediment control from materials sourcing areas and site preparation activities;
- Fugitive dust & other emissions (e.g. from vehicle traffic, land clearing activities, & materials stockpiles);
- Noise from heavy equipment and truck traffic;
- Potential for hazardous materials and oil spills associated with heavy equipment operation and fuelling activities.

4.0 ENVIRONMENTAL BASELINE

4.1 Introduction

This section describes the environmental conditions of the project area. Information for this section was collected from a variety of sources, including published literature, reports of other studies conducted in the area by the EMC and archives of the experts, consultations with institutions, Nongovernment Organizations (NGOs) and field surveys conducted for this study by the team of EMC.

Description of the environment of the project requires baseline data on the existing resources of its microenvironment and macro-environment, the following in particular:

Physical Resources

Biological and Ecological Resources

Social and Cultural Environment

In order to carry out environmental assessment study, it is first necessary to demarcate the existing environmental features in and around the proposed project on the existing environment section describes the environmental setting of the project area.

Baseline data reported here pertain to the physical, biological and ecological aspects of the macro-environment as well as the microenvironment of proposed project site. The project is located in Phase VIII of Defence Housing Authority (DHA) adjacent to DHA Golf and Country Club of Karachi in the province of Sindh. Information available from electronic/printed literature relevant to baseline of the area, surroundings and Karachi was collected at the outset and reviewed subsequently. This was followed by surveys conducted by experts to investigate and describe the existing status and scenario.

4.2 Environmental Audit at Project

As EIA team started the work for EIA Study, Construction of two towers on the project site is underway. Therefore, EMC has conducted an Environmental Audit.

Following are the key findings of the Audit:

A. Project Status

During the Environmental Audit, following construction work is underway:

Construction of tower A i.e. 30 storeys completed

Construction of tower B i.e. 22 storeys completed

Complete pile driving for the other works

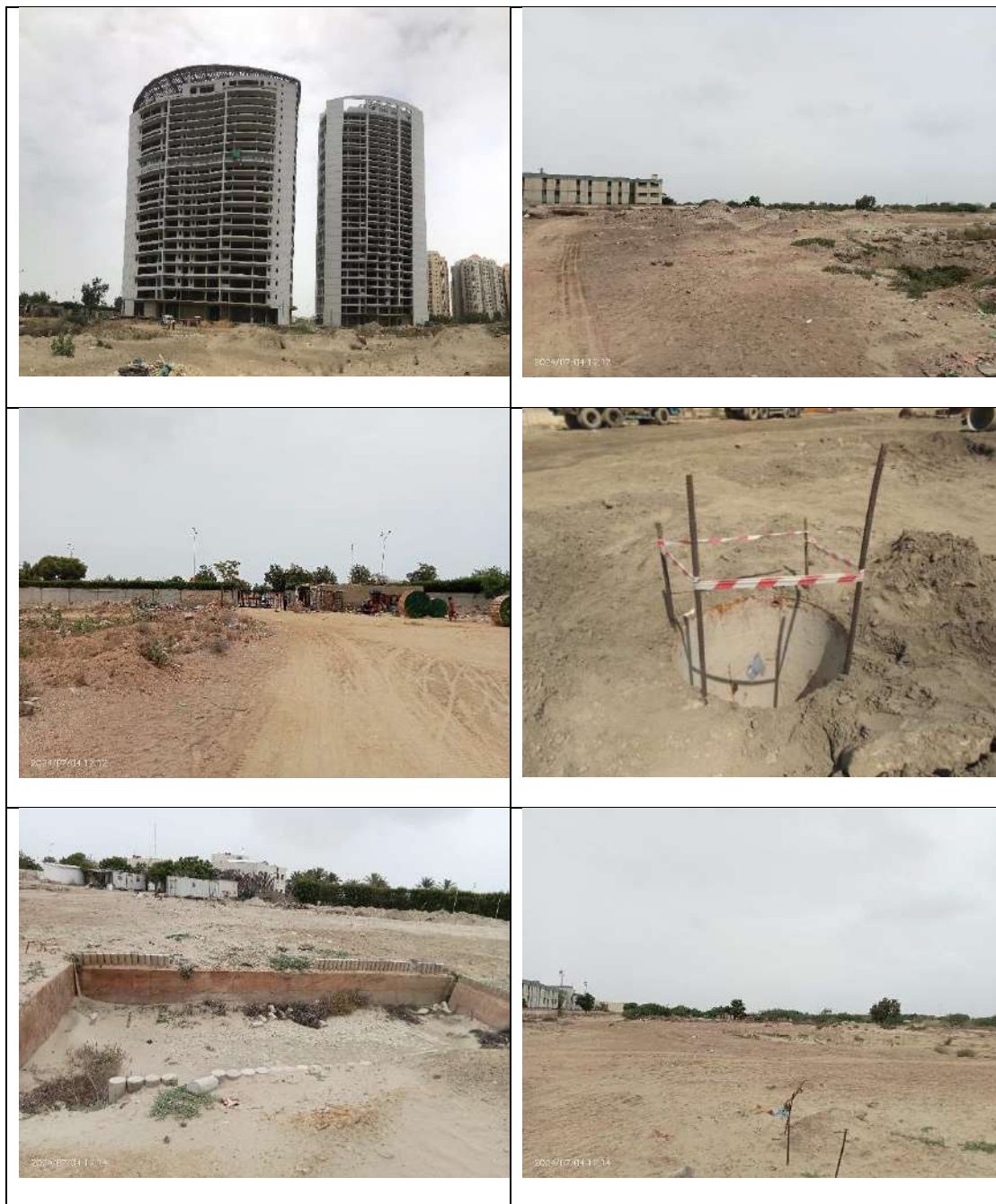


Fig 4.0: Current Status of Project Site

B. Ambient Air Quality and Ambient Noise

Ambient air quality of the project site was monitored on 8 hourly basis. The parameters checked were SO₂, NO, NO₂, CO, O₃, SPM, PM₁₀, PM_{2.5}, and Pb.

The results of ambient air quality are in compliance with the SEQS for ambient air except for PM₁₀ and PM_{2.5}. The results are also discussed in section 4.4.20. These results are above the SEQS limits due to pollution caused by traffic and construction activities of other projects and road construction activities in the vicinity of the

Arkadians Project site. The results of Ambient Noise are well within the SEQS Limits for day time noise Commercial Area (B) Category/Zone.

C. Waste and Wastewater Management

A dedicated waste collection point was established at the site which is properly barricaded to restrict access. Construction waste was collected at this point and recyclable waste after segregation was stored ready to be sold to recyclers.

There was zero wastewater generated from the site during the audit as the construction activity was halted.

D. Other Measures

Exposed surface was regularly wetted to effectively keep airborne dust levels to minimum.

Cautions signs were in placed outside the construction site and at the junction of connecting road.

Heavy Construction traffic was parked at its dedicated location.

Site access was restricted from the outsiders for their own safety through steel net and administratively by allocating security guards.

4.3 Macro-environment of the Project

The macro-environment of the proposed project is at large scale comprises of Defence Housing Authority (DHA) on the whole. The project area is located in Phase VIII of DHA, which is located at Zulfikar Street No.1 under DHA Water Front Development Project.

“The ARKADIANS” is located in DHA which maintains one of the posh localities of Karachi with a huge infrastructure, high end shopping malls and neat and clean environment. This area is a hub of commercial activity and development of residential with commercial projects is in progress in the area. The project site is dedicated for commercial and residential use. There are many Educational Institutions, Mosques, Parks and Markets near the project site. The Fig 4.1 shows the map of Defence Housing Authority (DHA), Karachi.

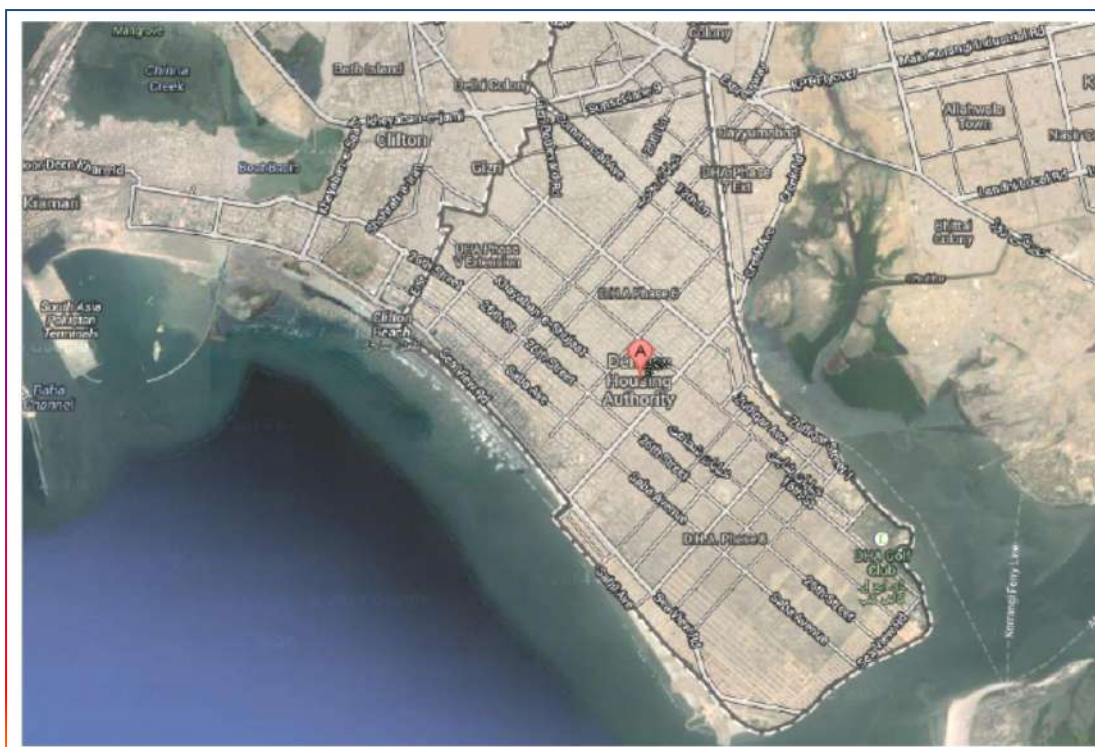


Fig 4.1: Macro-Environment of Project Site

4.4 Microenvironment of the Project

The microenvironment of the proposed project “The Arkadians” comprises of commercial and Residential Buildings, which is in close proximity of Zulfiqar Street No1. The proposed project is surrounded on the South west by Creek Vista Apartments, on the South East to DHA Golf Club, on the North by Korangi Creek and on the West by a rest of the residential area of DHA Phase VIII Figure below shows the microenvironment of the project area.

The project site is dedicated for commercial and residential use. There are many Educational Institutions, Mosques, Parks and Markets near the project site i.e. DHA School, DHA Golf Club, Moin Khan Sports Academy, Mosque and Cineplex Cinema etc. Figures below shows the important landmarks in the microenvironment of project site.

Table 4.1: Landmarks in the Microenvironment of the Project	
S. No.	Landmarks
1	DHA Golf Club
2	Moin Khan Sports Academy
3	DHA School
4	Creek Vista Apartments
5	Cineplex Cinema
6	Masjid – e- Sakina

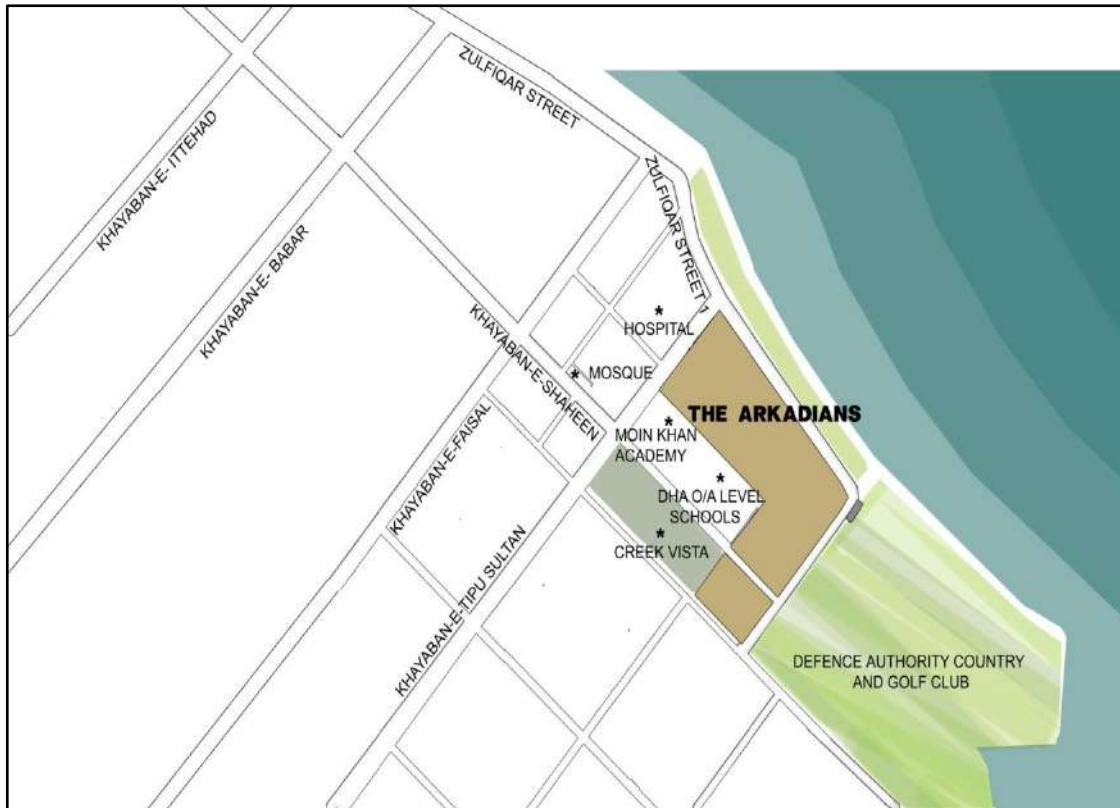


Fig. 4.2: Micro Environment of Project Site

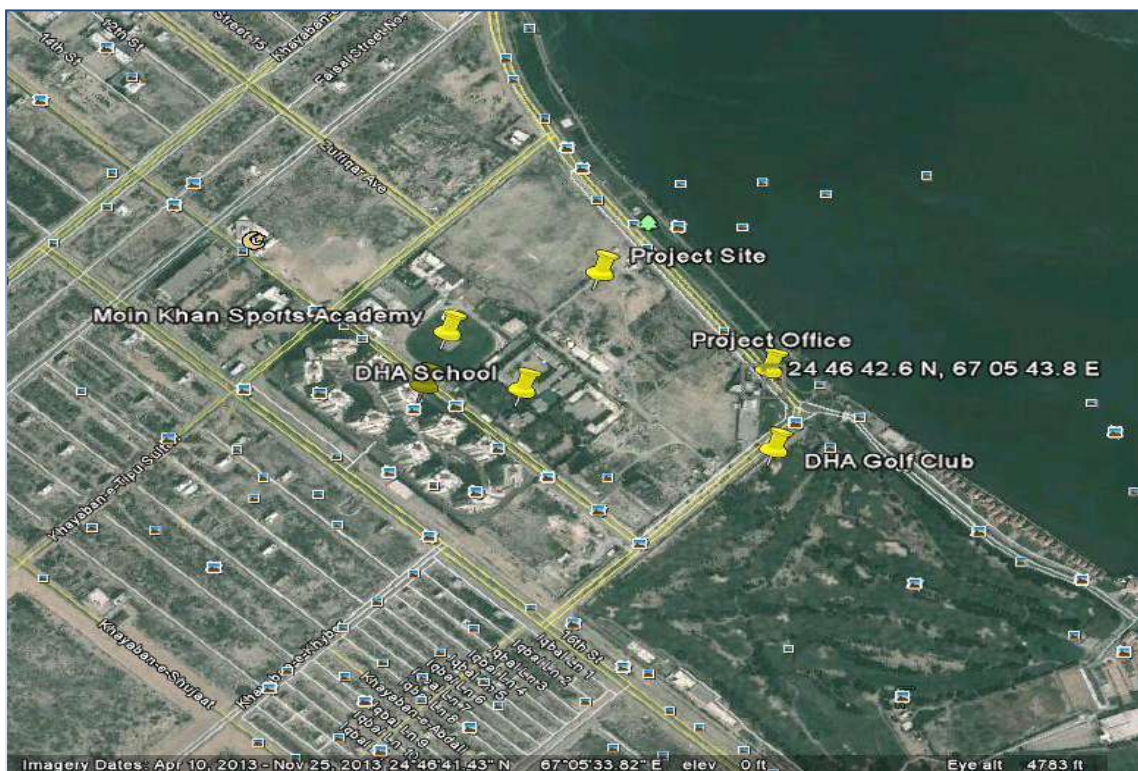


Fig. 4.3: Layout of Project Site with Coordinates

4.5 Physical Environment

4.5.1 Topography and Geology

The coast located at the east of Karachi Harbor entrances (at Clifton) is very flat. The sand is very fine and very different from the sand found at Manora. A significant accretion takes place at the Clifton beaches. This coastline has for the period of last 100 years been reported to advance at an average rate of 30 ft/year. The sediments consist of very fine silt with varying contents of coarser mica flakes. The coast east of Clifton Beach is sandy and extends up to Ghizri Creek where the Malir River carrying the industrial effluents from the Landhi Industrial Area and Korangi Industrial Area, mixed with untreated urban wastewater, drains into the sea. Following three types of coastal sediments have been identified in the DHA Area and its Vicinity and as shown in Figure 4.1

Sand bar deposits: The sand bar deposits comprise of medium to coarse sand, micaceous and shifting sand dunes.

Coastal sand dune deposits: These are medium sized and shifting sand dunes.

Beach sand deposits: These are medium to coarse grained, unconsolidated sand with pebbles and broken shells. These have been marked but keep on shifting by wind into small coastal dunes.

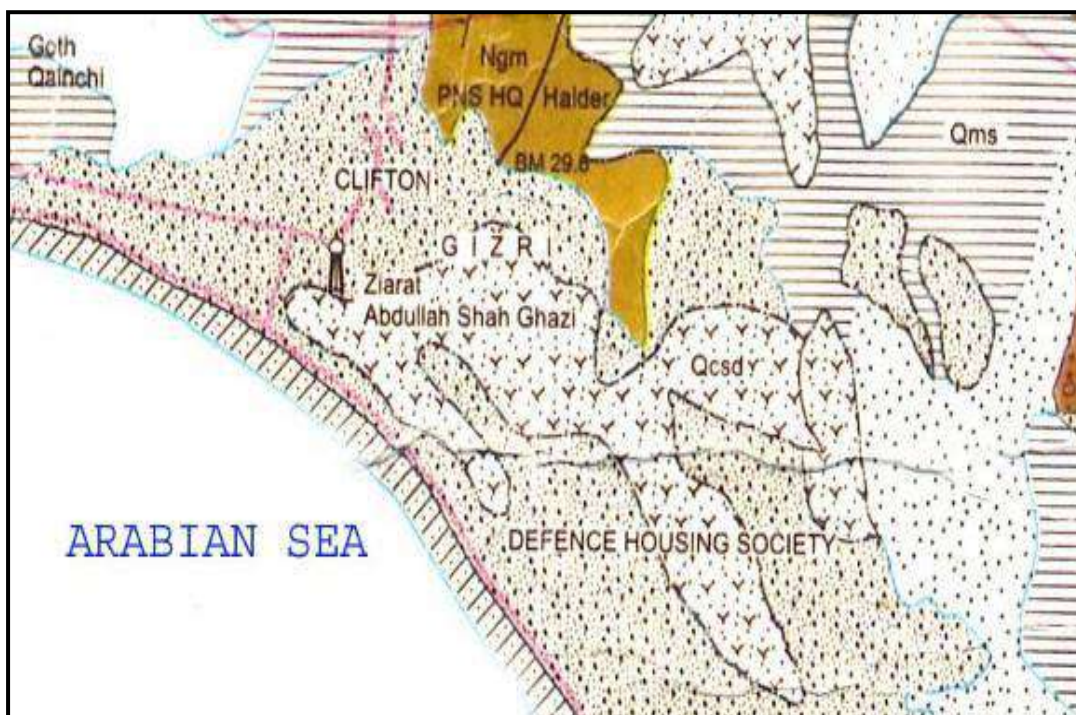


Fig 4.4: Surface Geology Map of DHA & Clifton Area

The geology and structural details of Karachi urban and coastal zone areas lying within Karachi synclinorium is known relatively with less certainty if an active fault lies concealed a few meters below the surface. The coastal zone lies in the south of Karachi region. It consists of vegetated tidal mud flats, beach sands, coastal dunes, coastal terraces, rock arches; wave cut platforms, bars and pits. The coast is emergent type. Offshore bars, beach barriers like sandspit indicate coastal emergence in recent times. Sandspit and Manora islands are part of an offshore bar behind which a lagoon is formed. This lagoon serves as Karachi Harbour.

The Project in DHA is part of the coastal zone of Karachi. There are extensions of the active faults from east (Rann of Kutch Fault), west (Jhill and Manghopir faults) and north (Pab and Surjan faults) under the Karachi Metropolis, which might be running through coastal zones and also underneath Clifton and DHA buildings. In addition to the above faults, other such structures may be present concealed under the recent sediments.

4.5.2 Sediment Budget

The coastal areas of Karachi get sand supplements from both the ocean and the land sources. Ocean currents can move sediments from the open oceanic area along the coast to build beaches. Unrestricted movement of dry silt/fine sand dunes on the coast and other landward sand deposits provide sand to coastal areas and beaches in response to the forces of wind and waves. Coastal lands may experience long-term erosion under some conditions. For instance, if sea level is rising, the beach must eventually migrate landward or drown. This causes coastal land behind the beach to erode. Also, if the supply of sand from the landward or seaward side is reduced, the beach will erode the land behind it to maintain a constant sediment supply. This creates a condition called coastal erosion.

According to Dr Asif Inam from National Institute of Oceanography, Karachi, “the land subsidence and increasing sea intrusion posed a serious threat to Karachi. Sediment deposition in the sea is almost negligible. Recent data suggests that much of the land sediment is only reaching the upper Indus shelf for the last 7000 years. Erosion now dominates the modern sediment-starved Indus Delta. Tidal flats have extended landward,” he pointed out, while expressing the possibility that land subsidence might have played a role in the 2010 and 2011 devastating floods”. (DAWN 23 May 2014).

Khawaja, Faran Ali 2010 predicted potential erosion rates in coastal areas of Sindh, for the summer months of June, July, and August (0.63–1.22 mm month⁻¹; average, 0.90 mm month⁻¹) are substantially larger than for other months (0.01–0.21 mm month⁻¹; average, 0.05 mm month⁻¹) and suggest that 87% of the gross erosion takes place in these three summer months. (Water Resources Research, Vol. 46, August 2010). Extrapolating the data for 10 years in coastal areas the sediment losses would exceed accretion by 102 mm.

High energy waves during the SW Monsoon period of June July and August will cause the beach to change its shape (or profile). This is due to the fact that the additional wave energy has to be absorbed, the beaches and dunes will give-up sand to the waves which carry it seaward and drop it on the bottom. This raises the seafloor and flattens the overall profile of the beach. Waves then shoal and break further offshore, minimizing their erosive effects. This typically happens in response to seasonal shifts in wave energy, from SW to NE Monsoon periods. Beaches recover from these natural changes when smaller waves move the sand back onto the beach and winds blow it into the dunes to be captured by coastal vegetation.

4.5.3 Subsurface Geology

The subsurface geology was studied by bore hole data collected from soil samples of different depths. The data shows that major sediments include i) filled material (water saturated) upto 6 meters depth, ii) silty fine sand, medium hard siltstone and clay stone sediments occur upto 15 meters below the surface. Whereas, below this depth, there is solid strata comprising of hard sandstone and siltstone upto the depth of 46 meters (Table 4.2).

Table 4.2: Subsurface Geology in the Clifton Area, Karachi	
0-6 meters	Fill Material
6-8 meters	Grey, loose to medium
	Dense, silty, fine Sand,
	trace to little mica
8-15 meters	Grey, medium dense, silty, fine, Sand,
	Grayish brown, medium hard, Siltstone / Claystone,
	Low plasticity
15-33 meters	Grey, friable to medium
	Hard, Sandstone,
	Fine to Medium grained
33-34.5 meters	Grey, medium hard, Siltstone
34.5-46 meters	Grey, friable to medium hard, SANDSTONE, fine grained

4.5.4 Soil

The underlying rocks are mostly of marine origin, highly folded, faulted and fissured everywhere. They consist mainly of limestone and clay. The soil of the islands is alluvium with plenty of clay derived from land drainage and river discharge. It is rich in salts like sodium chloride, sodium carbonate and nitrates with some calcium, which comes from shell fragments. The muddy and clay-based soil is poor in other mineral substances. It is very badly drained and is not permeable.

The pH of the soils ranges from 8.2 to 8.4. The subsoil water table is at a depth of 5 to 10 feet conforms to the sea. The subsoil water is completely brackish. The particular soil formation in and around the project area revealed the presence of (Qsb) sand bar deposits (which is occupying around 60 percent of the DHA proposed area) comprising of medium to coarse sand, and micaceous shifting sand dunes. The second largest formation is (Qcsd) coastal sand dune deposits and beach sand deposits (Qbs) and whereas (Qms) mangroves swamp deposits are also found in the area.

4.5.5 Sea Level Rise

Sea level rise caused either by climate change or man-made structure could increase flood related deaths, damage to property as well as the environment, including the loss to territorial sea resulting in the negative change in the relative value of the coastal areas.

It has been concluded by a number of researchers that extreme events may become more frequent as a result of sea level rise. The increased ocean temperature may result in the change in the frequency, duration and intensity of tropical cyclones. Moreover, the effect of storm surges could be intensified by higher sea levels. Inundation of coastal areas is already common during tropical cyclones and any increase in the extent or frequency of inundation may render numerous densely populated areas to become marginal or inhabitable altogether.

Sindh coastal zone is more vulnerable to sea level rise than Baluchistan coast; the area nearby Karachi is more vulnerable to coastal erosion and accretion than the other deltaic regions mainly due to human activities combined with the natural phenomenon such as wave action, strong tidal currents and the rise in sea level.

The UNEP in its regional seas program of 1989 has included Pakistan in a group of countries, which are vulnerable to an impact of rising sea level. The increasing trend was observed in various studies conducted for this purpose which notified that, if the present trend of sea level rise (SLR) at Karachi continues that way, the sea level rise along the Pakistan Coast will become 50 mm in the next 50 years. Since the rising rates of sea level at Karachi happen to be within the global range of 1-2 mm/year, the trends may be treated as eustatic sea level rise i.e. the rise is due to thermal expansion of sea water. However, the higher base provided by SLR for storm surges and tides would be particularly important for the Indus delta, where the beach slope is only about 0.1 degree (Wells and Coleman, 1984).

Historical air temperature and sea surface temperature (SST) data of Karachi also show an increasing pattern and has registered rising trend of about 0.67°C in the air temperature over the past 35 years, whereas the mean SST in the coastal waters of Karachi has also registered an increasing trend of about 0.3°C in a previous decade. The long-term trend of mean sea level for Karachi Harbor is taken from the study conducted by Quraishie in 1988 wherein the increasing pattern in sea level about 1.1 mm/year at Karachi Harbor has been taken as a base reference to study the impact of sea level rise along Pakistan coast.

4.5.6 Liquefaction Factor

Liquefaction is a total loss of strength due to undrained restructuring. Disturbance, by shearing or vibration, destroys soil skeleton, with loss of grain contact and decrease of porosity, soil load is transferred to pore water, water pressure > normal stress = 0, and soil acts as a liquid. Drainage reduces pore water pressure, allows grain contact and thixotropic recovery of strength (Waltham, 2002). Strong shaking produces liquefaction

in the fine sands and silts during the earthquake. This causes the mineral grains to settle and expel their interstitial water to the surface. If the pore-water pressure rises to a level approaching the weight of overlying soil, the granular layer behaves as a viscous liquid rather than a solid and leads to collapse of even engineered structures. Liquefaction has been abundant in areas, where groundwater lies within 10 meters of the ground surface (Husain et al., 2004). Investigators typically have designated sites as "Liquefied" on the basis of the presence of surficial liquefaction features, such as venting of sediment to the surface (i.e., sand boils), ground cracking associated with liquefaction (e.g., lateral spreading), or surface settlements. Other evidence of liquefaction includes tilting or settling of overlying structures and floating of underground structures (Olson et al., 2002).

The liquefaction process is extremely damaging to all sorts of engineered structures, it has caused major destruction in both Alaska and San Francisco (Pinty, 2003). The ground failure that resulted from liquefaction during New Madrid, Bhuj and Hazara-Kashmir earthquakes was severe, which included the vertical displacement of 3 to 6 feet and lateral displacement up to 33 feet (Tuttle, 2001). A recurrence of that type of event would have severe consequences for engineered structures. The Bhuj earthquake provided an opportunity to study an earthquake that was very similar to the New Madrid event - it was a very large earthquake and it occurred in an intraplate like setting (Tuttle, 2001). The New Madrid and Kutch regions are both located more than 300 km from active plate boundaries. A study of modern earthquakes that produce liquefaction can better interpret the geologic record of liquefaction during past events. This would help anticipate what is likely to happen in the future, so that informed decisions about reducing and mitigating hazards can be made (Tuttle et al., 2002).

4.5.7 Seismicity

Seismotectonic Study for macroenvironment of Project site aims at elucidating the impact of tectonic movement induced seismicity on the microenvironment. Karachi is Pakistan's largest city with population exceeding 18 million and is amongst the top five most congested cities in the world. Karachi has experienced no earthquake related damage in the recorded history of past ~ 175 years. Yet, Karachi is located in a seismically active tectonic setting often compared to Los Angeles with active plate boundary faults and triple junctions within a radius of ~ 150 km. This discrepancy in earthquake history and seismotectonic setting has led to diverse seismic hazard assessments for Karachi ranging from assignment of seismic hazard zones I (least severe) to IV (most severe). The Building Code of Pakistan (2007) assigns an intermediate seismic hazard value of 0.16–0.24 g (Zone IIB) to Karachi, which is broadly accepted but sometimes criticized to be an underestimation. A recent study entitled "Seismic sources for southern Pakistan and seismic hazard assessment of Karachi", based on a new active faults compilation and seismic sources definition together with incorporation of maximum possible information on historical earthquakes (up to 893AD), has led to a re-assessment of seismic hazard for Karachi using probabilistic and deterministic seismic hazard assessment approaches. The main findings of this study are:

- Karachi is assessed to be prone to ground motions ~ 0.25 g with metropolitan areas having hazard values between 0.21 and 0.25 g for 10% probability of exceedance in 50 years (475-year return period).
- The deterministic seismic hazard analysis suggests maximum that peak ground acceleration (PGA) varies from 0.19 to 0.99 g in Karachi and its higher values are concentrated around the Nagar Parker fault that is controlling and hazardous for Karachi.

Despite a safe seismic history spanning past about 175 years, Karachi is located in a tectonic setting, which is considered amongst the most active in the world. The active Chaman transform fault marking plate boundary between the Indian and Eurasian plates is located only 120 NW of Karachi. Karachi itself is located at the southern tip of N–S trending Kirthar active foreland thrust-fold belt at the western deformed edge of the Indian plate. The triple junction between the Indian, Arabian and Eurasian Plates is located 110 km to the SW of Karachi.

Seismic activity in the region is the result of the triple junction as well as the Karachi Arc, located in southeastern Pakistan, as a large fold and thrust belt that shows Neogene thin-skinned eastward movement. Seismic activity in and around the region shows that the Karachi Arc has been active since long in prompting the eastward movement of the delta. It is possible that the movement is related to the rebound that takes place after mass shift. Sarwar has suggested that the eastward creep of Karachi Arc is directly related to active subsidence of the Hyderabad graben that underlies it and also defines the northern and southern limits of the Karachi Arc².

It may be added that subsidence such as that on Southern coast of Sindh, occurs naturally as a result of plate tectonic activity above active faults, and in places where fluid is expelled from underlying sediments and is common at river deltas that may have receded. Earthquakes arise and result from the release of the force along the growth fault plane. As a result, many different growth faults are created as sediment loads shift basin ward and landward.

4.5.7.1 Seismic Coefficient

According to uniform building code (1997) the soil profile type of the project falls in category "Sc" corresponding to "Soft Rock/Very Dense Soil". Details are annexed in Subsoil Geotechnical Investigation Report. Following parameters can be adopted:

Seismic Zone	= 2B
Zone Factor	= 0.2
Soil Profile Type	= Sc
Seismic Coeff. "Ca"	= 0.24

² Sarwar, G., 2004. Earthquakes and the Neo-Tectonic Framework of the Kutch-Hyderabad-Karachi Triple Junction Area, Indo-Pakistan. Pakistan Journal of Hydrocarbon Research, 14, 35-40

Seismic Coeff. "Cv" = 0.32

4.5.7.2 Earthquakes

Historically the coastal region has suffered a number of earthquakes. Detailed review of the geological history including the modern time reveals the occurrence of deep-sea earthquakes at different times, throughout history in the North Arabian Sea, as presented below:

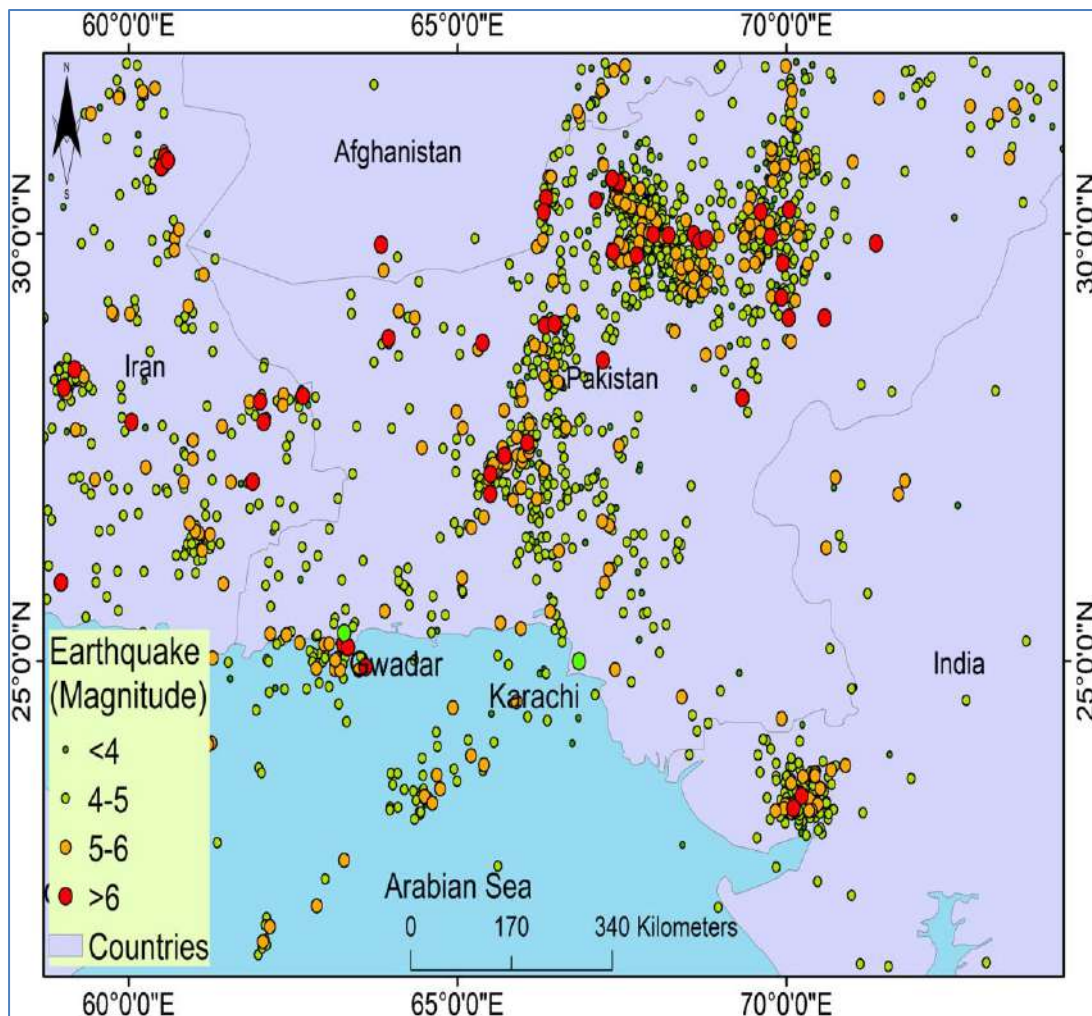


Figure 4.5: Earthquake recorded (1950–2019) in the Arabian Sea and its surroundings³

4.5.7.3 Seismicity of the Site

According to the Uniform Building Code (1997), Karachi and its adjoining areas fall in Seismic Zone-2B.

³ Aslam, B., Ismail, S., & Maqsoom, A. (2020). Geospatial mapping of Tsunami susceptibility of Karachi to Gwadar coastal area of Pakistan. *Arabian Journal of Geosciences*, 13(17), 1-12.

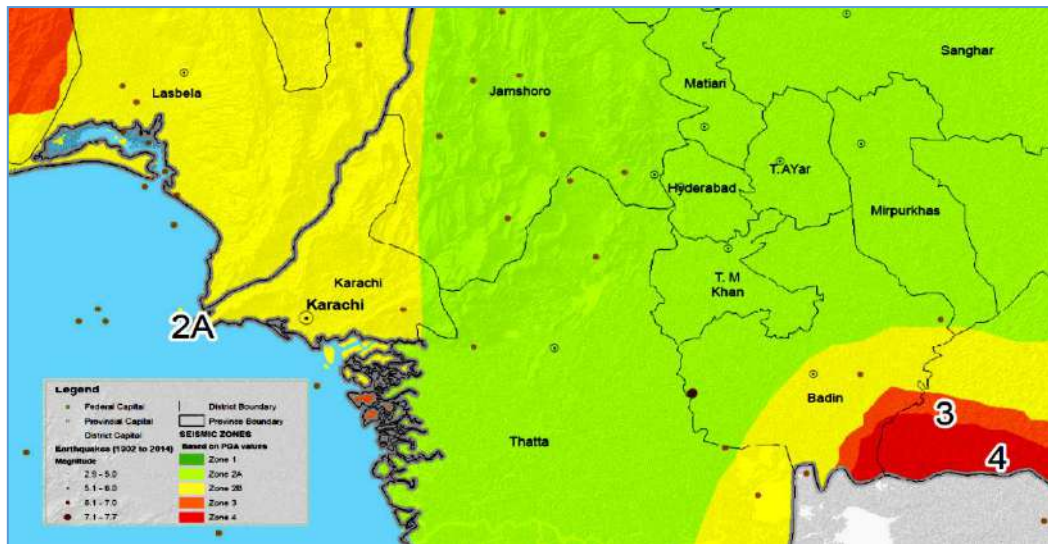


Figure Error! No text of specified style in document..6: Seismic Zones in Karachi⁴

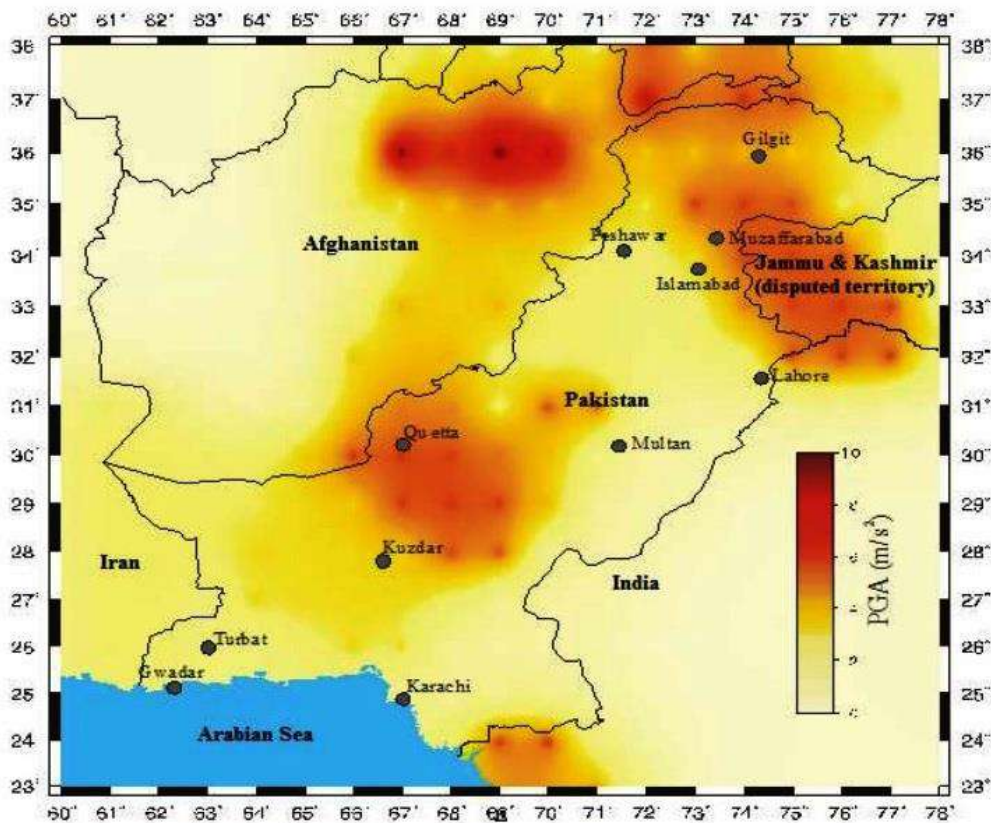


Figure Error! No text of specified style in document..7: Seismic Hazard for Pakistan in terms of Peak Ground Acceleration (PGA)⁵

4.5.8 Liquefaction Features Caused by Earthquakes

Liquefaction is a total loss of strength due to un-drained restructuring. Disturbance, by shearing or vibration, destroys soil skeleton, with loss of grain contact and decrease of

⁴ Map data source(s): PMD, GSP, Pakistan Engineering Council – Prepared by Al Hasan Systems Private Ltd.

⁵ PMD Seismic Monitoring and Early Tsunami Warning Centre - <http://seismic.pmd.gov.pk/seismicnew/map2.html>

porosity, soil load is transferred to pore water, water pressure > normal stress = 0, and soil acts as a liquid. Drainage reduces pore water pressure, allows grain contact and thixotropic recovery of strength (Waltham, 2002). Strong shaking produces liquefaction in the fine sands and silts during the earthquake. This causes the mineral grains to settle and expel their interstitial water to the surface. If the pore-water pressure rises to a level approaching the weight of overlying soil, the granular layer behaves as a viscous liquid rather than a solid and leads to collapse of even engineered structures. Liquefaction has been abundant in areas, where groundwater lies within 10 meters of the ground surface (Husain et al., 2004). Investigators typically have designated sites as “Liquefied” on the basis of the presence of surficial liquefaction features, such as venting of sediment to the surface (i.e., sand boils), ground cracking associated with liquefaction (e.g., lateral spreading), or surface settlements. Other evidence of liquefaction include tilting or settling of overlying structures and floating of underground structures (Olson et al., 2002).

The liquefaction process is extremely damaging to all sorts of engineered structures, it has caused major destruction in both Alaska and San Francisco (Pinty, 2003). The ground failure that resulted from liquefaction during New Madrid, Bhuj and Hazara-Kashmir earthquakes was severe, which included the vertical displacement of 3 to 6 feet and lateral displacement up to 33 feet (Tuttle, 2001). A recurrence of that type of event would have severe consequences for engineered structures. The Bhuj earthquake provided an opportunity to study an earthquake that was very similar to the New Madrid event – it was a very large earthquake and it occurred in an intraplate like setting (Tuttle, 2001). The New Madrid and Kutch regions are both located more than 300 km from active plate boundaries. A study of modern earthquakes that produce liquefaction can better interpret the geologic record of liquefaction during past events. This would help anticipate what is likely to happen in the future, so that informed decisions about reducing and mitigating hazards can be made (Tuttle et al., 2002).

4.5.9 Coastal Physiography

Most of the parts of the coastal areas of Pakistan are sparsely inhabited except for Karachi city which is the largest industrial and business centre of the country. There are more than 6000 various industrial units in Karachi which include almost all sorts of industries such as chemical industries, metal industries, oil refineries, textile, fish processing etc. As such, the city of Karachi generates more than 400 million gallons per day of domestic and industrial waste water (Qureshi et al. 2001), which is drained into the sea without any prior treatment via natural outfalls namely the Lyari River and Malir River and partly through sewers and drains along the coast. In addition, the oil discharges from oil tankers and cargo vessels entering the Karachi Port and Port Qasim and fishing boats also pollute the coastal environment along Karachi. Being the dumping ground of untreated industrial and sewage wastes generated from the city of Karachi, the coastal areas of Karachi including Manora channel, Sandspit, Clifton, Gizri creek, and Korangi creeks are severely polluted. The increasing coastal pollution in the vicinity of Karachi will have significant adverse effects on biodiversity of the intertidal and sub-tidal regions, forest and fisheries.

Furthermore, reclamation continues to be a significant means in providing land to meet the needs of expanding population particularly by DHA along Karachi coast. The reclamation brings several changes in coastal environment. Its implementation involves the input of various disciplines for example physical geology, soil mechanics, loose boundary hydraulics, land drainage, coastal engineering in the planning and design of reclamation and coastal ecology with the increasing concern on loss of natural habitat. Therefore while reclamation process continues special and serious attention should be given on various environmental issues and their impact on marine ecosystem, biodiversity, coastal population and their socio-economy.

4.5.10 Coast Line of Karachi

The coast line of Karachi is about 90 Km long. It is generally oriented NW-SE. On the west it is bounded by the Hub River and on the east by the mangrove swamp and creeks of the Port Qasim area. Karachi coast shows the characteristic features of a sub-tropical semi -desert. The prominent features of the Karachi coast are the large number of shallow lagoons, break water, sea cliffs, sea stacks, raised beaches, marine terraces and dune fields. The coast line is broken by four major inlets viz. Karachi Harbour, Korangi Creek, Phitti Creek and Khuddi Creek. Karachi coastal area can be broadly divided in to three sections: west coast, south coast and southeast coasts which are briefly described as under:

A. West Coast:

The west coast lies between Hub River Fall, Cape Monze up to the Manora Break water wall. It can be divided into two sections viz. Hub River Fall up to Buleji coast, and Hawks Bay-Sandspit coast up to Manora Break water wall. The rockyshores with terraces, cliffs and boulders are common features between Hub River Fall and he Cap Monze, Pacha, Paradise Point up to the Buleji coasts. Cap Monze has high cliffs projecting from the Arabian Sea. Close to Cap Monze there are frequently occurring raised beaches in between the river beds and the low slopes of the adjoining hill sand dunes are frequent. There are sandy beaches conceivable between Paradise Point and Pacha coast. The shore terraces and sea cliffs are common form Buleji towards the west. There is bay (HawksBay) between Buleji and Manora coast with sandy beaches along Sandspit coast.

B. South Coast:

The front south coast lie between Keamari coast and Korangi Creek mouth and has fine sandy beaches of Clifton and DHA with a very low angle of beach slope resulting in large shallow inter-tidal and sub-tidal area spreading up to 1-5 Km. Karachi Harbour, Boat Basin and western backwaters are also located in the south cost. Karachi harbour inlets and the Korangi Creek inlets are situated at thewestern and eastern boundaries of south coast respectively. The coast front along Clifton and DHA beach is about 14 Km long extending up to the Gizri creek at the eastern end. It has very gentle surface gradient of about 1:50 and a beach slope with a very low angle resulting in large shallow inter tidal and sub tidal areas spreading up to 1-5 Km offshore. The beach

sediments are composed of gray-colored fine Micaceous sand. A small crescent shaped bar exists at the mouth of the Korangi creek.

C. Southeast Coast:

The southeast coast lies between Korangi creek inlet and Khuddi creek. It borders the front coastline of four islands i.e. Bundal Island, Buddo Island, Miran Island and Khuddi Island and has two large and deep openings namely Phitti creek mouth (approaching the channel of port Qasim) and the Khuddi Creek mouth. The eastern coast has tidal creek with mangrove and mudflats which are linked with a network of creeks of Indus delta and cover the most extensive and ecologically sensitive area of Karachi coast. The sea bed, at the eastern and south-eastern coast, is generally smooth and regular as depicted by the bed contours. The bed slope is gentle, usually being in the order of 1:500 to 1:1000.

4.5.11 Composition of Beaches

A. Clifton Beach

The beach is located in the transition zone between the rocky / sedimentary coastline and the Indus Deltaic Creeks. The beach has higher concentration of fine sand and silt at its northern and northwestern part and more sand and less silt sand at its southern part. A considerable accretion has taken place on this beach particularly in the northern part. The sea wall demarcate boundary between the sea and land. The bottom of the sea wall is located at tidal height of about 2 - 2.5 meters. The actual beach starts from the bottom of the sea wall and extends up to several km towards the sea. The intertidal area has a very gently slope and the low water mark is about 1 - 3 km. The fine sand and silt has considerable quantities of mica and is black in colour.

B. DHA Beach

This is a long beach which is southeast extension of Clifton beach and is mostly sandy. The fine sand and silt constitute the most part while the high water zone has some coarse sand in addition to the fine sand. The black sand and mica is also present at this beach. The intertidal sand dunes near high water zone mostly constitute fine sand. The sea wall starting from Clifton beach also continues all along this beach. There is a large accretional area near the confluence of the southern tip of this beach and the Gizri Creek. The beach slope along this beach is also very gentle. The beach slopes from the bottom of about 5 meter high sea wall upto the low water mark. The intertidal area is very wide (1 - 3 km) and the distance of the 5 meter depth contour is about 6-10 km from the high water mark of this beach.

4.5.12 Hydrology

The Arkadians Project is located in Phase VIII of DHA adjacent to the DHA Country and Golf Club.

The site is very near to the creek therefore keeping in mind all the impacts and proper mitigation measures should be adopted to reduce them. DHA Beach is a long beach which is southeast extension of Clifton beach and is mostly sandy. The fine sand and

silt constitute the most part while the high waterzone has some coarse sand in addition to the fine sand. The black sand and mica is also present at this beach. The intertidal sand dunes near high water zone mostly constitute fine sand. The sea wall starting from Clifton beach also continues all along this beach. There is a large accretion area near the confluence of the southern tip of this beach and the Gizri Creek. The beach slope along this beach is also very gentle. The beach slope forms the bottom of about 5 meter high sea wall up to the low water mark. The intertidal area is very wide (1 - 3 km) and the distance of the 5 meter depth contour is about 6-10 km from the high water mark of this beach.

4.5.13 Floods and Fresh Water Flows

Flood in the Indus River bring approximately 50 million tons of sediment loads and deposit it in the delta (Milliman et al 1984). During the peak flood season (Aug- Sep) that coincides with the SW monsoon the distribution of flood water along with the sediment influence Phitti creek through Gharo Drain, as well as, infiltration of run off from Malir river via Korangi to the north of the Bundal Island. The aerial survey of 1996 showed that the mixing of Korangi creek water with Phitti Creek water has observed during high water. The runoff from the surrounding land area of the Korangi, Phitti and Gharo creek also contribute towards the input of the fresh water and silt into the creek system.

The annual rainfall is less than 250 mm and most of it (75%) is downpours as torrential rain in a short spell of 2 to 7 days. During floods the quantities of suspended material increase. The soil cover in the deltaic area is of drift type made up of material transported by rivers. The mixing of floodwater with sea water during high tide creates excessive siltation and erosion in coastal areas.

The suspended data collected in 1996 studied in conjunction with the information collected in present study reveals that due to change in precipitation records it has been observed that sediment supply in the coastal area through river inputs has decreased considerably. The decrease in the sediment replenishment associated with rain fed material has also enhanced the erosion in the deltaic creek, as well as, the erosion at the south east coast of Karachi.

List of Notable floods in Karachi: Most of the flooding in Karachi occurs due to the monsoon season. But due to the enhancement of the city's infrastructure flooding has been controlled. But still excessive and irregular rains can lead to major flooding in the metropolis. Following are some of the major floods in the city;

- On 7 August 1953, the city received its record-breaking 24-hour rainfall causing widespread flooding about 278.1 millimetres (10.95 in) rain was recorded.
- On 1 July 1977, Karachi received its third highest rainfall of 207 millimetres (8.1 in) in 24 hours, it caused massive flooding in the city and killed 248 people in the city.
- In 2003, massive flooding during monsoon season devastated the Sindh, two days of rainfall of 284.5 millimetres (11.20 in) created havoc in the city.

- In 2006, after two year of drought period heavy rainfall lashed the city during the monsoon season, but the city came to standstill on 17 August when widespread rainfall of 77 millimetres (3.0 in) created flood-like situation in the city killing 13 people and submerging roads, low-lying areas and underpasses with rainwater.
- In 2007, almost all the rains that occurred in this monsoon season brought flooding with it, During the month of June Cyclone Yemyin created havoc in the city from 21 June to 26 June 2007 110.2 millimetres (4.34 in) of heavy downpour was recorded which killed 228 Karachiites on 23 June, then from 9 August to 11 August a strong tropical depression brought massive flooding in the city with 191 millimetres (7.5 in) of rain killing 21 people and submerging low-lying areas and underpasses. While on 22 August a monsoon depression once again flooded the city with 80 millimetres (3.1 in) of rainfall killing 10 people.
- On 18 July 2009, there was severe flooding due to a tropical depression, in which city's second highest rainfall of 245 mm (9.6 in) occurred in just 4 hours, killing 20 and injuring 150 people. Another flooding event occurred on August 31, 2009 when a well-marked low pressure was present over Sindh, the rainfall was recorded to be around 147 mm (5.7 in).
- On September 13, 2011, life was crippled in the city due heavy rainfall that caused urban flooding in the city. The rainfall was recorded to be around 145 mm (5.7 in).
- In Aug & Sep 2019, life in the city was crippled due to multiple spells of heavy rain that caused urban flooding and loss of life and property.
- On 6th Jul 2020, spell of heavy rain caused urban flooding in several areas of city, causing loss of life and property.
- The hours-long spell, which began before sunrise and continued till night, broke previous records of rainfall recorded in the city during August 2020. The Met department said that Karachi had received 345mm of rainfall so far in August, breaking the previous record of 298mm reported in August 1984.
- On September 23, 2021, heavy monsoon rains cause urban flooding in portions of Karachi, Pakistan's largest metropolis. Roads were inundated, and cars were stranded.



4.5.14 Water Quality of Clifton and DHA Beaches

Like other populated and industrialized coastal regions in the world, water quality in the coastal waters of Karachi are severely affected by pollutants (domestic and industrial effluents) discharged from the city into the marine environment. This is very significantly threatening to the marine life (mangrove forest and marine food chain, etc.) and water quality along Karachi coast. Pollution in the vicinity of Karachi such as Karachi Harbour, Clifton and DHA beaches, Gizri creek, Korangi creek and Port Qasim area is constantly increasing due to untreated discharges. Preliminary investigations of pollutants in Karachi Harbour during eighties also provide some information about metal pollution. The concentrations of Zn, Co, Fe, and Mn are indicative of increased metal concentration in Karachi Harbour. The results also show that the level of trace/heavy metals decreased gradually from mouth of Lyari River discharging industrial and sewage wastes in Karachi Harbour towards Manora Channel where flushing takes place. The water quality of the creek deteriorated due to many reasons. One of the adverse incidents which contributed to the deterioration of water quality was related to an oil tanker "Tasman Spirit" carrying 67,000 tons of Iranian Light crude oil when it ran into ground on 27 July, 2003, while entering into Karachi Harbour thus causing major oil spillage in the area.

4.5.15 Tsunamis

Tsunamis in Indo-Pak region are relatively rare. Destructive tsunamis that may have occurred in the Arabian Sea have not been documented. The oldest known tsunamis in North Indian Ocean are:

326 BC

1st April and 9th May 1008

1884

26th June 1941

27th/28th November 1945 (origin Makran)

The 1945 Tsunami having a magnitude of 8.3 on Richter Scale was the deadliest. It originated off the Makran coast in Pakistan and was centred at 97.6 kilometres SSW of Pasni, 98.5 kilometres SE of Gwadar, and 408 kilometres W of Karachi. It reached a height of 40 feet in some Makran ports and caused great damage to the entire coastal region. The fishing village of Khudi, some 30 miles west of Karachi, was wiped out completely. All the inhabitants and their huts were washed away. The towns of Pasni and Ormara were badly affected. Both were reportedly under water after the tsunami.

At Karachi, the tsunami arrived from the direction of Clifton and Gizri. It ran along the oil installations at Keamari and flooded a few compounds. The waves were 6.5 feet or 2.0 meter high when they reached Karachi. There was a delay of more than one hour between the main shock and arrival of the damaging tsunami at Karachi.

The sea is 3.36 meter (11ft) below the road level and 2.7 meters (8.8 ft) below the average ground level at Project site in DHA. This would suggest that a tsunami of magnitude similar to the 1945 Tsunami would affect the 2.5 meter contour on the beach front. The Project site is at the end of Manora Channel but also exposed to the beach front. A tsunami wave of much higher magnitude than 5 meter may be a matter of concern to the area but such events are less likely to occur in the north of the Arabian Sea. However the Ground floor of the residential towers of the Arkadians Project is being built at a height of 17' 6" for enhanced protection.

4.5.16 Storms

Movement of cyclone storms in the Arabian Sea is generally in the west-north-westerly direction. The one that moved into the coastal area on May 12, 1999 changed direction and hit the coastal area of Badin while Karachi was in the peripheral area and only rain showers of moderate intensity were recorded. This coast is otherwise classified outside the zone of cyclone activity for the Arabian Sea. Thunderstorm frequency is also low and is reported to occur at an average rate of 10thunderstorms/year.

The extended period of sunshine over Pakistan during the summer of 2007 raised the heat content of the Arabian Sea that is adjacent to the heat zone of Pakistan. This had upset the heat balance and hence the water balance of the region. Northern Areas of Pakistan was lashed by windstorm in late May. This was followed by the Tropical Cyclone Gonu in the first week of June, and then by Tropical Cyclone 03A from the south of Mumbai, and thereafter in the third week of June by Tropical Cyclone 04B nicknamed Yemyin, and then a series of depressions traveling almost directly to the heat zone in Pakistan. This time again Karachi remained in the periphery of the cyclone activity zone but it did receive 61 mm rainfall during the cyclone movements about 100 km offshore.

List of cyclones that affected Karachi and the Sindh coast: Cyclones that form in the Arabian Sea do not usually hit Karachi or the Sindh coast, during 1902, 1907, 1944, 1964, 1985, 1999, 2007 and 2010, cyclones made landfall in the Sindh coast including Karachi. Other cyclones that are listed below caused rains as remnants.

- In May 1902, a cyclonic storm struck the coast in the vicinity of Karachi.
- In June 1907, a tropical storm struck the coast near Karachi.
- On 27 July 1944, a cyclone left some 10,000-people homeless in Karachi.
- On 12 June 1964, a deadly cyclone made landfall near Karachi.
- On 15 December 1965, a powerful cyclone slammed the city with 10,000 casualties.
- In May 1985, a cyclonic storm made a landfall in the eastern direction of Karachi. The cyclonic storm in 1985 which was moving towards Karachi actually had weakened over the sea while still a few 100 Kilometers away south of Karachi.
- In November 1993, a category 1 cyclone approached the Sindh-Gujarat border but dissipated due to high vertical shear over open waters.
- In June 1998, remnants of the category 3 Gujarati cyclone (the 5th strongest cyclone of the Arabian Sea) killed 12 people near and in the city.

- In May 1999, again a category 3 major cyclone (the 4th strongest cyclone of Arabian Sea) hit near the city; this Cyclone killed 700 people in Sindh including Karachi. It is the strongest cyclone recorded in Pakistan.
- In May 2001, the powerful category 3 cyclone (the 3rd strongest cyclone of the Arabian Sea) hit the Indian border of Gujarat. It caused rain along the Sindh coast, but no damage was reported.
- In October 2004, a severe cyclonic storm, Cyclone Onil, approached the Sindh coast but later recurved back to the sea; it caused heavy rain that killed 9 people in Karachi.
- In early June 2007, Super cyclonic storm Gonu (the strongest cyclone in the Arabian sea) caused strong gusty winds in the metropolis with light rainfall as the storm was moving towards Oman.
- In June 2007, a cyclonic storm, Cyclone Yemyin, passed near the city and killed 200 people before moving towards Balochistan where it killed 380 people.
- In November 2009, remnants of Cyclone Phyan caused gusty winds along the Sindh coast including Karachi. However, six Pakistani fishermen were trapped in the storm later rescued by the Indian Navy.
- In June 2010, Cyclone Phet (the 2nd strongest cyclone in the Arabian Sea), once a powerful category 4 cyclone, made landfall near the city as a weak tropical depression, with a total 14 casualties in and near the city.
- In November 2010, remnants of Cyclone Jal caused drizzle with dusty winds in Karachi while it caused light to moderate rainfall in southeastern Sindh.
- In November 2011, the outerbands of cyclone Keila brought drizzle to the city while moderate showers to the Makran coast.
- Cyclone Vayu, June 2019, caused minor storm surges in coastal areas of Sindh, also exacerbated the heavy in Karachi.
- Cyclone Kyarr, October 2019, caused flooding in coastal areas of Karachi and Sindh.
- Cyclone Nisarga in June 2020 caused rough seas in Karachi and Sindh coastal areas.
- 18 May 2021, Cyclone Tauktae's landfall in Gujarat caused a roof to collapse in Karachi, killing four people.
- 30 September 2021, a developing depression, later named Shaheen, produced gusty winds and rainfall in Karachi. A person died in Orangi from electrocution.

4.5.17 Meteorology and Climate

Karachi has an arid climate (Köppen Climate Classification: BWh) dominated by long summer season but moderated by marine influence from the Arabian Sea. There is a minor seasonal intervention of a mild winter from mid-December to mid-February followed by a long hot and humid summer extending from April to September, with monsoon rains from July to mid- September. The characteristic climatic feature of the four seasons of Karachi is presented in Table 4.4.

Table Error! No text of specified style in document.:4: Seasonal Characteristics of the Climate of Karachi

Season	Temperature	Rainfall	Wind
Summer (Mid-March to Mid-June)	The summer is hot with temperature increasing from 26.2 °C in March, rising up to 40 °C in June.	There are less frequent rain showers in summer with no more than 1 or 2 rainy days in summer. Average total amount of rain in summer is around 10 mm	The wind speed in summer is variable. It is around 2.5 m/s in March and rises up to 18 m/s in April and drops to 4 m/s for the rest of the season. The direction mostly remains blowing from West
Monsoon (Mid-June to mid-September)	The temperature in monsoon remains high but relatively lower than summer and oscillates around 32°C.	Almost 80 % of the yearly rain occurs in the monsoon with July and August being the wettest month.	The wind direction in the monsoon is mostly blowing from East.
Post-Monsoon Summer (Mid-September to November)	The average temperature post monsoon drops and average min temperature may reach 12 °C in November.	The post-monsoon period remains mostly dry and rainfall in November is around 1.8 mm.	The wind speed in September is around 3.7 m/s and drops to 1.4 m/s in November.
Winter (December to mid-March)	The winter is mild with January being the coolest month where average minimum temperature falls to 6 °C.	Like the other seasons, except monsoon, there is little occasional rainfall. The rainfall in winter is less than 50 mm.	The wind speed in the winter season increases from 1.4 m/s in December to 2.6 m/s in March. The wind direction for most part winter season is blowing from NE and changes its course to blowing from West in early March

A. Temperature

The air temperature in Karachi Division and its coastal areas are generally moderate throughout the year due to presence of sea. Climate data generated by the meteorological station at Karachi Air Port represents climatic conditions for the region. The mean monthly maximum and minimum temperatures, recorded during 2001-2023 in Karachi to describe the weather conditions are shown in Table 4.5 and 4.6 respectively.

Table 4.5: Mean Monthly Maximum Temperature °C in Karachi													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	27.2	29.6	33.1	34.6	35.1	34.9	32.2	32.3	33.1	36.0	33.5	30.4	32.7
2002	27.0	28.2	33.3	35.4	35.6	35.1	32.2	31.6	31.4	36.5	32.7	28.1	32.3
2003	27.6	28.5	32.4	36.6	35.7	34.9	34.1	32.6	32.5	37.0	32.2	28.3	32.7
2004	26.6	29.9	36.2	35.4	36.8	35.6	33.8	32.7	32.8	33.7	33.1	29.4	33.0

Table 4.5: Mean Monthly Maximum Temperature °C in Karachi

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2005	24.9	26.3	31.5	35.3	35.4	36.0	33.2	32.2	34.2	35.2	33.1	28.4	32.1
2006	26.0	31.3	31.8	34.0	34.6	35.3	33.8	31.0	34.2	35.0	33.4	26.3	32.2
2007	26.9	29.4	31.4	37.7	36.0	36.4	N/A	N/A	N/A	N/A	N/A	N/A	33.0
2008	24.4	26.9	34.3	34.4	33.9	35.1	33.5	31.9	34.7	35.5	32.5	27.2	32.0
2009	26.2	29.8	33.0	36.0	36.8	35.7	34.5	33.0	32.8	35.9	33.0	28.6	32.9
2010	27.5	29.2	34	35.7	36.5	34.7	34.6	33.2	34.5	35.9	32.7	28	33.0
2011	26.9	28.5	33.2	35.8	35.3	35.3	34.2	32.8	32.9	N/A	N/A	N/A	N/A
2012	25.7	26.9	31.7	35.1	35.5	34.6	33.2	32.7	33.2	35.0	32.7	28.2	32.0
2013	26.7	28.0	33.3	34.0	35.1	36.5	33.8	32.1	33.0	35.7	32.3	28.3	32.4
2014	25.5	28.0	31.7	35.1	35.9	36.5	34.0	33.7	33.8	36.3	32.9	28.7	32.7
2015	26.3	28.9	31.5	35.9	36.0	37.7	34.1	32.3	34.6	35.8	33.0	28.6	32.9
2016	27.8	30.3	33.3	34.7	35.7	36.1	33.6	33.0	32.9	34.0	33.3	31.0	33.0
2017	25.4	30.2	32.8	35.5	36.2	36.3	33.1	33.8	33.4	36.6	32.3	28.2	32.8
2018	28.5	30.4	34.4	36.2	38.7	35.4	33.8	31.9	32.6	36.8	33.8	28.2	33.4
2019	26.3	26.8	31.3	35.4	36.0	37.2	34.7	32.5	35.7	35.8	31.5	27.1	32.5
2020	24.3	30.1	31.2	36.2	36.6	37.3	36.7	34.6	35.0	36.2	31.4	28.1	33.1
2021	26.6	31.3	34.6	37.3	37.5	36.1	34.5	32.6	36.3	34.8	34.0	27.6	33.6
2022	24.6	30.1	35.2	37.4	36.8	35.7	33.3	32.1	33.7	35.7	32.9	29.6	33.1
2023	25.6	30.9	33.3	34.5	35.5	35.9	35.0	31.4	34.4	35.1	33.0	29.4	32.8

Source: Pakistan Meteorological Department

Table 4.6: Mean Monthly Minimum Temperature °C in Karachi

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	11.5	14.9	19.6	23.8	28.1	29.0	27.1	26.5	25.9	24.4	18.6	15.8	22.1
2002	12.8	13.8	19.5	23.9	27.0	28.2	29.6	25.6	24.8	22.5	17.7	14.9	21.7
2003	12.7	16.9	19.8	24.2	26.5	28.2	23.6	27.0	25.3	20.9	15.2	12.0	21.0
2004	12.9	14.5	19.1	24.8	27.3	28.8	27.5	26.3	25.3	22.4	18.0	15.4	21.9
2005	12.3	11.3	20.3	23.0	26.4	28.3	27.2	26.6	26.6	22.9	18.9	13.0	21.4
2006	11.7	18.1	19.6	24.5	27.5	28.5	28.3	26.3	26.8	25.7	19.4	14.0	22.5
2007	13.0	17.3	19.7	24.7	27.6	28.6	N/A	N/A	N/A	N/A	N/A	N/A	21.8
2008	10.1	11.1	19.6	24.0	27.3	29.1	27.9	26.8	26.6	23.8	17.6	14.9	21.6
2009	14.7	16.5	20.8	23.8	27.6	28.7	28.1	27.5	26.5	22.6	17.0	13.9	22.3
2010	12.2	14.7	21.3	25.1	28	28.2	28.3	27.2	25.8	23.9	17.4	11.1	21.9
2011	11.0	14.5	19.7	23.1	27.1	28.8	27.8	28.6	26.5	N/A	N/A	N/A	N/A
2012	11.2	11.9	19.1	24.5	27.2	28.0	27.9	26.9	26.4	22.7	19.6	14.2	21.5
2013	11.6	15.1	19.2	24.2	27.1	29.3	28.0	26.6	25.5	25.4	18.1	13.0	21.9
2014	9.9	13.1	18.9	24.4	27.0	29.2	28.3	27.1	26.8	23.3	19.5	13.1	21.7
2015	12.6	16.4	19.2	25.7	27.7	29.8	28.4	26.9	26.3	24.9	18.6	12.6	22.4
2016	14.8	14.9	21.7	24.6	27.9	27.9	28.1	27.1	26.4	24.0	17.1	15.5	22.5
2017	12.5	18.2	20.3	24.4	27.8	29.2	27.7	27.0	26.2	23.5	16.8	13.0	22.2
2018	12.9	15.8	20.9	25.3	27.7	28.8	28.1	26.3	25.5	23.0	19.3	13.1	22.2
2019	13.3	15.3	19.0	24.0	26.6	28.9	28.1	26.8	27.2	24.0	19.4	13.7	22.2
2020	10.8	15.3	19.1	24.7	27.7	29.7	29.4	28.1	27.3	22.7	16.0	12.5	21.9
2021	9.2	15.0	21.6	25.1	28.9	29.6	28.5	27.4	28.0	23.1	17.6	13.9	22.3
2022	12.8	15.9	21.6	25.5	28.1	28.6	27.4	27.1	26.8	22.7	19.3	13.2	22.4
2023	10.6	15.4	20.9	24.3	27.5	29.3	28.9	27.0	27.1	25.7	20.0	14.8	22.6

Source: Pakistan Meteorological Department

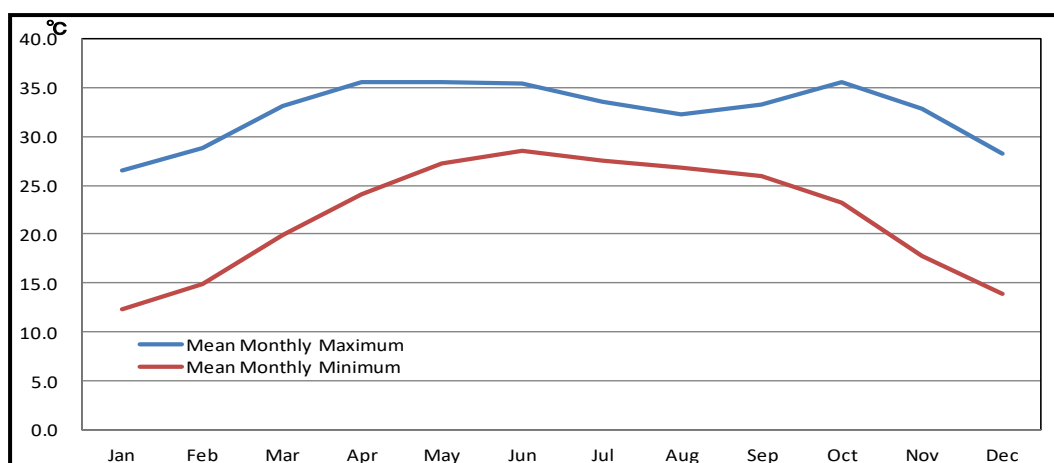


Fig 4.7: Mean Monthly Maximum & Minimum Temperature in Karachi

B. Precipitation

The main source of precipitation is rainfall which is received mostly in the months of July to September during SW Monsoon winds. It is very erratic as some years are very dry and there is no rain. The average rainfall is 217 mm and most of it is received in the month of July.

Occasional winter rains are also received in the months of December –February as result of NE winds which count 15-25% of total rainfall.

Table 4.7: Monthly Precipitation (mm) at Karachi Air Port													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	0.0	0.0	0.0	0.0	0.0	10.6	73.6	16.2	N/A	0.0	0.0	0.0	100.4
2002	0.0	2.4	0.0	0.0	0.0	N/A	N/A	52.2	N/A	0.0	0.5	0.4	55.5
2003	6.4	21.8	0.0	0.0	0.0	16.3	270.4	9.8	N/A	0.0	0.2	0.0	324.9
2004	13.7	0.0	0.0	0.0	0.0	N/A	3.0	5.6	N/A	39.3	0.0	4.3	65.9
2005	6.6	12.8	N/A	0.0	0.0	N/A	N/A	0.3	54.9	0.0	0.0	17.1	91.7
2006	N/A	0.0	N/A	0.0	0.0	0.0	66.2	148.6	21.9	0.0	3.1	61.3	301.1
2007	0.0	13.2	33.4	0.0	0.0	110.2	N/A	N/A	N/A	N/A	N/A	N/A	156.8
2008	8.0	Trace	1.1	0.0	0.0	0.0	54.0	37.5	Trace	0.0	0.0	21.0	121.6
2009	3.0	Trace	0.0	Trace	0.0	2.6	159.9	44.0	68.9	0.0	0.0	1.5	279.9
2010	0.0	0.5	0.0	0.0	0.0	97.0	120.4	111.5	212.9	0.0	0.0	0.0	372.9
2011	8.5	1.6	0.0	0.0	0.0	0.0	72.5	61.5	36.5	4.0	0.4	12.3	225.1
2012	0.2	0.0	0.0	0.0	0.0	Trace	Trace	8.1	121.0	0.0	0.0	22.8	152.1
2013	Trace	20.0	2.8	30.0	0.0	Trace	5.5	105.4	4.0	1.2	0.0	0.0	168.9
2014	Trace	0.0	12.4	0.0	1.3	Trace	1.1	9.9	1.4	0.0	4.6	0.0	30.7
2015	0.3	2.1	2.8	0.0	0.0	Trace	46.6	1.4	Trace	0.0	0.0	0.0	53.2
2016	3.1	0.0	Trace	0.0	0.0	65.8	1.9	96.9	Trace	0.0	0.0	0.0	167.7
2017	41.5	Trace	0.0	0.0	0.0	58.8	33.3	65.6	26.4	0.0	0.0	6.6	232.2
2018	Trace	Trace	0.0	0.0	0.0	Trace	Trace	0.8	Trace	0.0	0.0	Trace	0.8
2019	39.4	Trace	2.2	0.0	0.0	1.6	66.3	204	51.7	1.2	Trace	Trace	367.3
2020	Trace	2.6	0.5	0	0	Trace	101.2	366.8	Trace	0	3.1	0	474.2

2021	0	0	0	0	0	Trace	45.4	Trace	88.3	17.2	0.0	16.9	167.8
2022	28.5	0.4	0	0	0	21.6	348.3	127.9	43.4	0	2.6	0	572.7
2023	0.0	0.0	5.7	2.2	14.9	4.0	40.4	Trace	4.6	0.0	5.5	0.0	77.3
Source: Pakistan Meteorological Department													

The record for rainfall of PMD at Karachi Airport (2001-2023) suggests that July and August are the wettest months and that the maximum rainfall recorded in Karachi during 2001-2023 period was 270.4 mm during the month of July 2003, while the maximum annual rainfall was 372.9 mm during the year 2010, followed by 474.2 mm in 2020 and 572.7 mm in 2022.

The probability that precipitation will occur has been found to vary from different days of July and August at Karachi throughout the 1992-2012 period. Precipitation most likely occurs around August 4, in 35% of all days. Precipitation is least likely around April 27, occurring in 2% of all days.

Thunderstorms are the most severe type of precipitation observed during days was 38% precipitation. They are most likely around August 12, when it is observed during 12% of all days. Drizzle is the most severe precipitation observed during 34% of those days with precipitation. It is most likely around July 30, when it is observed during 14% of all days. Moderate rain is the most severe precipitation observed during 22% of those days with precipitation. It is most likely around July 28, when it is observed during 8% of all days. When precipitation does occur, it is most often in the form of thunderstorms (40% of days with precipitation have at worst thunderstorms) and cloud burst, drizzle (36%), moderate rain (19%), and light rain (5%).⁶

Inundation due to Heavy Rainfall Events: Highest rainfall events have occurred in July 1994: 256.3mm, July 2003: 270.4mm and August 2006: 77mm in 3 hours. According to observations recorded for the year 2007, August 10 and 11 were witnesses to unusually high rainfall of 107 mm in 24 hours compared with the normal of about 60 mm for August. The wettest August ever experienced by the city was in 1979, when over 262mm of rainfall was recorded. The record for the maximum rainfall within 24 hours in the eighth month was 166mm of rain on August 7, 1979. The heavy rainfall was not unusual since it was caused by the general monsoon system that travels from across Rajasthan and lays over Sindh. The monsoon weather system did not move towards Baluchistan but the penetration of moist currents from Sindh brought scattered to heavy rain in southern Baluchistan, particularly along its coastal regions. Major inundation and land submergence was noticed in Karachi in July 2003 and August 2006. On both occasions, precipitation pattern and intensity were almost similar. The downpour on both occasions was a cloud burst. For estimating the impact of inundation on the six corridors, the maximum intensity of Rainfall of 18th August 2006 at 77mm in about 3 hours i.e., 25.7mm/hour will be considered critical and adopted for making estimates on land submergence.

⁶ Average Weather for Karachi (<https://weatherspark.com/averages/32864/Karachi-Sindh-Pakistan>).

C. Humidity

The relative humidity typically ranges from 25% (dry) to 70% (humid) over the course of a year, rarely dropping below 20% (very dry) and reaching as high as 90% (very humid):

Table Error! No text of specified style in document..8: Mean Monthly Relative Humidity (Mean) at 1200 UTC (%)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2014	25.0	27.0	35.0	47.0	57.0	61.0	64.0	61.0	60.0	36.0	36.0	31.0	45.0
2015	38.0	41.0	37.0	45.0	60.0	56.0	69.0	67.0	56.0	47.0	28.0	31.0	47.9
2016	46.0	25.0	41.0	47.0	60.0	60.0	68.0	70.0	63.0	57.0	34.0	38.0	50.8
2017	38.0	25.0	36.0	44.0	59.0	62.0	70.0	67.0	63.0	44.0	29.0	20.0	46.4
2018	36.0	37.0	33.0	45.0	46.0	65.0	65.0	68.0	63.0	40.0	32.0	30.0	46.7
2019	40.4	33.9	36.6	48.0	55.6	58.8	64.8	72.6	67.6	41.1	34.6	29.7	48.6
2020	29.9	28.1	34.2	44.4	57.1	56.8	65.0	74.8	62.4	38.1	32.9	29.1	46.1
2021	31.3	34.1	41.2	43.3	54.3	60.3	67.5	64.5	63.0	46.5	27.6	38.7	47.7
2022	40.5	39.1	37.7	47.1	55.3	62.1	74.7	79.1	66.3	42.0	49.4	36.5	52.5
2023	25.5	42.2	39.3	46.7	57.7	62.4	67.8	71.0	59.5	54.9	32.5	28.7	49.0

Source: Pakistan Meteorological Department

D. Wind Speed & Direction

The wind direction and speed between the summer and winter monsoon seasons are rather unsettled and large variations are noted both with respect to speed and direction.

Table Error! No text of specified style in document..9: Wind Speed (m/s) at 12:00UTS													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	2.6	3.4	4.3	5.6	7.5	8.1	6.8	7.3	5.5	3.7	2.0	2.4	4.9
2002	3.6	3.9	4.0	6.5	8.5	8.2	9.8	7.3	7.7	3.3	2.9	3.2	5.7
2003	4.0	5.0	5.4	5.2	7.7	8.8	6.7	7.1	6.0	3.2	3.1	3.0	5.4
2004	3.4	3.7	4.0	6.0	8.0	9.0	10.0	9.5	7.3	3.8	1.0	2.5	5.7
2005	3.6	4.2	4.8	5.1	7.1	7.5	9.0	6.9	6.4	3.9	2.0	1.5	5.2
2006	2.0	3.0	3.0	6.2	8.0	7.7	8.3	6.2	4.7	4.2	2.2	3.0	4.9
2007	2.0	3.7	4.0	4.0	6.0	6.3	N/A	N/A	N/A	N/A	N/A	N/A	4.3
2008	4.3	7.6	8.2	10.5	12.6	7.6	11.0	9.3	8.7	6.6	5.1	3.9	7.9
2009	7.0	7.2	7.9	9.3	9.8	9.7	9.5	9.3	9.1	6.1	5.0	3.9	7.8
2012	5.8	6.6	9.3	9.8	12.3	12.8	13.1	11.2	8.4	7.1	5.7	5.8	9.0
2013	5.2	6.9	9.0	10.3	11.5	10.8	12.0	11.2	10.3	7.7	5.1	4.5	8.7
2014	5.9	8.9	8.6	11.5	12.4	13.4	12.8	11.6	11.7	8.3	6.0	4.5	9.6
2015	6.9	10.3	10.1	11.5	12.8	12.3	13.7	12.3	10.5	8.7	5.6	5.8	10.0
2016	7.5	8.7	4.8	1.1	13.0	11.7	11.8	10.5	12.1	9.2	5.5	5.2	8.4
2017	7.0	8.0	10.8	12.1	12.8	11.5	12.1	10.3	8.7	8.5	5.4	7.4	6.9
2018	6.3	7.0	9.5	10.2	10.8	11.1	12.3	12.4	12.2	8.7	6.1	6.8	9.4
2019	6.7	8.9	10.2	11.7	12.1	11.7	13.7	9.1	8.5	8.0	6.9	7.4	9.6
2020	9.0	9.4	9.0	10.5	13.3	10.9	10.1	8.9	9.4	7.3	6.2	5.5	9.1
2021	6.1	7.6	9.7	8.5	11.7	12.7	12.6	11.1	8.8	8.1	6.7	6.6	9.2
2022	6.8	7.9	8.9	9.9	12.5	12.5	9.5	7.0	8.8	7.0	6.1	4.8	8.5
2023	7.0	7.7	9.2	10.1	11.7	11.5	11.3	12.3	9.1	7.9	6.9	6.6	9.3

Source: Pakistan Meteorological Department

Table Error! No text of specified style in document..7: Wind Direction at 12:00UTS												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	S54W	S43W	S42W	S45W	S46W	S45W	N52W	S59W	S44W	N56W	S45W	S06W

2002	S67W	S52W	S51W	S55W	S51W	S42W	S54W	S45W	S48W	S56W	N54W	S41W
2003	S60W	N50W	S45W	S48W	S45W	S68W	S60W	S47W	S43W	S54W	S50W	S27W
2004	N27E	S46W	S53W	S49W	S52W	S54W	S54W	S62W	S56W	S47W	S45W	N86E
2005	N63E	S51W	S50W	S52W	S63W	S48W	S54W	S49W	S87W	S54W	S52W	N23W
2006	S48W	S62W	S50W	S57W	S64W	S60W	S67W	S78W	S51W	S53W	S49W	N79E
2007	S30W	S62W	S47W	S55W	S58W	S47W	S41W	S55W	S60W	S48W	S48W	N45E
2008	N45E	S47W	S54W	S51W	S52W	S39W	S50W	S52W	S46W	S39W	S38W	N
2009	N45E	S45W	S41W	S58W	S46W	S46W	S56W	S49W	S56W	S42W	S39W	S45E
2012	S3E	N56E	S62W	S46W	S61W	S51W	S66W	S51W	S53W	S41W	S41W	N9W
2013	N39W	S54W	S56W	S54W	S61W	S40W	S53W	S52W	S55W	S47W	S17W	N50W
2014	S72E	S54W	S43W	S46W	S46W	S45W	S54W	S48W	S85W	S45W	S49W	S45E
2015	S72E	S54W	S43W	S48W	S50W	S40W	S54W	S55W	S50W	S41W	S	S58W
2016	S43W	S36W	S48W	S54W	S54W	S45W	S48W	S36W	S51W	S45W	S43W	S36W
2017	S83E	S56W	S51W	S45W	S45W	S44W	S66W	S57W	S48W	S51W	S59W	N45E
2018	S39W	S39W	S46W	S51W	S50W	S45W	S45W	S48W	S46W	S46W	S42W	S18W
2019	S24W	S65W	S45W	S44W	S42W	S37W	S48W	S46W	S53W	S35W	N59E	N55E
2020	N31E	S12W	S52W	S55W	S49W	S44W	S47W	S55W	S47W	S38W	S4E	N35E
2021	S21W	S38W	S44W	S42W	S52W	S53W	S55W	S48W	S40W	S41W	S22E	S40E
2022	N45E	S54W	S57W	S59W	S57W	S56W	S62W	S59W	S60W	S48W	S32W	S32W
2023	S22E	S45W	S40W	S58W	S65W	S38W	S56W	S74W	S57W	S53W	S40E	S84E
Source: Pakistan Meteorological Department												

4.5.18 Physical Oceanography

A. Waves

The waves on Karachi Coast vary with the seasons. During NE winter monsoon when winds are around 10 knots the coastal waters are almost calm and the wave height is less than 1 meter. During SW summer monsoon when the winds are around 25 knots the waves on the Karachi Coast are more than 4 meters. In the interim month i.e. post SW monsoon and pre-SW monsoon the waves are around 1.5 to 2.5 meters.

B. Tides

Tides along Karachi Coast are semi-diurnal but diurnal inequality is also present. The effect of this shows up in daily tidal cycle as there are two High Waters and two Low Waters which also vary considerably from each other in tidal heights. These are classified as HHW, LHW, LLW and HLW. The tides move from west to east i.e. the tide at the Hub River Coast arrives about 20 minutes earlier than Karachi. Similarly the tides at Karachi Harbour arrive at about 10 minutes earlier than entrance of Port Qasim. When tides progress up the Phitti Creek its magnitude increases and there is time lag. The tides reach Port Bin Qasim after 22 minute which is about 20 miles from Karachi and is located about 15 miles up to creek from the sea. At Gharo Creek tides fall down rapidly due to frictional effects and the gradual weakening of the tidal forces. At Gharo, 35 miles from the Phitti Creek entrance, the tides are almost half of the mean sea tides at the entrance.

C. Currents

The speed of the current is generally low, about ½ knot. The speed increases up to 1 knot during SW monsoon. The direction of the set is directly related with the prevailing wind system. The set is generally easterly in the SW monsoon and westerly in the NE

monsoon. The slight difference in direction in the Western and Eastern part of the Karachi Coast is due to circulatory pattern of the current around gyres which are usually formed at the center of the sea. There is a clockwise gyre during SW monsoon and anti-clockwise gyre during NE monsoon (Quraishie, 1988). Quraishie (1984, 1988) has also observed the existence of warm core eddies in the offshore areas of Pakistan.

D. Water Circulation Pattern

The circulation in the offshore areas at west coast and southeast coast is under the influence of the monsoonal circulation patterns i.e. clockwise in the summer monsoon and anti-clockwise in the northeast monsoon. The water circulation along Manora and Clifton coast is complex due to tidal influx from Karachi harbour, local topography, and influx of bottom water from off shore area from south and west. Following two circulation patterns are observed:

Clockwise Circulation: The dominant direction of the seawater enters the coastal water from southwest. This water then moves along the coast circulating in the clockwise direction i.e. the major flux of the sea water from the offshore area moves towards the east and then towards the southeast direction forming a big clockwise gyre. This pattern is common during summer monsoon, as a consequence of monsoonal winds blowing during this period.

Anti-clockwise Circulation: The sea water circulation reverses its direction in response to the direction of the prevailing monsoonal winds. The anticlockwise circulation is mostly restricted from December through February periods. The anticlockwise circulation pattern, during winter monsoon in the shallow water offshore Karachi coast, is observed in the developed current. This also indicates the presence of dominant tidal stream that is rotary in its characteristics

Two distinct flow patterns are discussed below:

a) West Coast

The movements of the water indicate that on an average the predominantly westerly flow exists during the ebb, whereas during the flood the flow direction changes considerably from NE to NNW mainly due to the variation in tidal range and partially due to the effect of sea bed contours. Maximum velocities were observed during mid-tide, while the minimum velocities were observed at high and low tides. In general, the course of the surface and sub-surface floats showed similar alignment.

b) South East Coast

A varying circulation pattern was observed during spring tide. The variation in circulation pattern was probably due to the position of deployment at flood and ebb. The deployed floats near the position 24° 40' (Northing) and 67° (Easting) show N to NE movement during the flood tide from HW to LW a westerly movement. However, at a location southeast of the above position the movement was towards the east and

south during flood and ebb, respectively. This confirms the coastal circulation pattern off Bundal Island alignment.

E. Sea Water Temperature

According to UNESCAP Report (1996) the average annual sea surface temperature innear shore waters along Karachi coast range between 20.7 to 29.3°C. During winter months the temperature range is 20.70 to 23.80°C whereas during summer months the range is between 27.9 to 29.3OC. In the creeks along Indus Delta the sea surface temperature generally ranges between 23.4 to 29.5°C. Water temperature in tidal channels in the Indus Delta creeks have been reported form 19°C in January to 30°C in June. The temperatures at a depth of 100 m are lower and generally have an annual range between 19.5 to 24.5°C.

4.5.19 Urban Heat Island (UHI) Effect

The term "heat island" describes built environment that are hotter than nearby natural areas. An urban heat island refers to a city or metropolitan area that is significantly warmer than its surrounding natural areas due to human activities. The temperature difference usually is larger at night than during the day and is most apparent when winds are weak. UHI is most noticeable during the summer and winter seasons. It is estimated that the annual mean air temperature of a city with 1 million or above inhabitants can be 1–3°C warmer than its surroundings. In the evening, the difference can be as high as 12°C. The heat island can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality.

The city of Karachi has been growing exponentially in terms of urbanization and population growth. The city hosts more than 20 million population with a growth rate of 4.10⁷. Rapid urbanization and global warming have initiated UHI effect over the city. A strong incidence of UHI is generally associated with a severe heat wave hazard in terms of sensible temperature. UHI effect is the unique feature of the June 2015 heat wave in Karachi. It is expected that with growing global warming incidence and poor coping strategies, UHI would become a major health risk for the vulnerable segment of population in mega-cities around the globe such as Karachi.

Causes of Urban Heat Island Effect: The principal reason for the night time warming is the retention of short-wave solar radiation absorbed during the day time by the building material consisting of concrete and asphalt. These materials are commonly used in urban areas for pavement and roofs that have significantly different thermal and radiative properties compared to the surrounding rural areas. This causes a change in the energy balance of the metropolitan area, often leading to higher temperatures than surrounding rural areas. This energy is then slowly released during the night as a long wave radiation, making cooling a slow process. Because of this phenomenon, the

⁷ Pakistan bureau of statistics

minimum temperatures of Karachi remained extremely high during the heat-wave event.

There are several causes of an urban heat island effect in Karachi.

- Reduced and slow process of evapotranspiration due to shrinking green areas and spaces in the city. With a decreased amount of vegetation, the city loses the shade, cooling effect of trees and the removal of carbon dioxide.
- Geometric effects in terms of rising number of tall buildings are a significant contributing factor to urban heat island effect. Over the years, the number of tall buildings within the city has increased that provide multiple surfaces for the reflection and absorption of sunlight, and thus increasing the efficiency with which the city is heated. This is called the "urban canyon effect". Another effect of increased number of buildings is the blockage of wind, which also inhibits cooling by convection and pollution from dissipating.
- Waste heat from automobiles, air conditioning, industry, and other sources also contributes to the UHI. High levels of pollution in urban areas can also increase the UHI, as many forms of pollution change the radioactive properties of the atmosphere.

Aside from the effect on temperature, UHI can produce secondary effects on local meteorology, including the altering of local wind patterns and humidity, which have been discussed in the previous section. The UHI effect described above has been one of the major causes of unprecedented large number of heats related deaths in Karachi. Future climate scenarios suggest that the frequency of this kind of disasters may increase with the rise of temperature in future

4.6 Ambient Air Quality

The project is planned to be built along the coastal belt near Golf Club. Secondary Data from the IEE of the DHA Waterfront Development Project with respect to air quality is available. However ambient air monitoring has been conducted to obtain baseline data. The data was collected at four locations representing the project area. These locations are as below:

Near Project Office of CDPL

Near Boundary wall of Cricket Stadium

In front of Main Gate #2 – Tower B

DHA School Boundary Wall – Tower A

Since all the sites are located along the Waterfront where the vehicles flowing along the coastal road and oil tankers sailing deep into the sea, construction work on new projects, disruption of the biological processes due to ocean waves are the main sources of air pollution at the project site

A. Methodology and Equipment

Air and noise monitoring was conducted through an EPA certified Laboratory. Mobile laboratory equipped with online US EPA designated ambient air analysers for all criteria pollutants were used for monitoring.

Ambient Air Quality Results

The Ambient Air Quality Results are as below:

Table 4.7 :Ambient Air Quality Results: In front of Main Gate #2 – Tower B										
Parameters		SO ₂ (µg/m ³)	NO (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	O ₃ (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	Lead (µg/m ³)
SEQS LIMITS										
Date	Time	120	40	80	5	130	500	150	35	1.5
22/5/2014	13:00	84.6	11.9	52.78	3.2	103.4	295	200*	55*	0.7
22/5/2014	13:15	87.4	13.2	56.84	3.1	101.3				
22/5/2014	13:30	81.8	14.5	46.69	2.8	103.4				
22/5/2014	13:45	81.8	15.8	50.75	2.6	103.4				
22/5/2014	14:00	73.3	13.2	52.78	3.1	105.5				
22/5/2014	14:15	76.1	14.5	56.84	3.2	103.4				
22/5/2014	14:30	87.4	18.5	52.78	2.8	101.3				
22/5/2014	14:45	90.2	15.8	58.87	3.6	103.4				
22/5/2014	15:00	95.9	19.8	56.84	3.1	103.4				
22/5/2014	15:15	81.8	18.5	58.87	2.8	101.3				
22/5/2014	15:30	90.2	15.8	56.84	3.1	99.2				
22/5/2014	15:45	87.4	14.5	58.87	2.8	90.7				
22/5/2014	16:00	73.3	13.2	56.84	3.0	86.5				
22/5/2014	16:15	76.1	15.8	58.87	2.8	86.5				
22/5/2014	16:30	84.6	13.2	56.84	2.6	88.6				
22/5/2014	16:45	95.9	14.5	58.87	2.5	86.5				
22/5/2014	17:00	90.2	13.2	48.72	3.6	82.3				
22/5/2014	17:15	84.6	13.2	50.75	3.2	73.9				
22/5/2014	17:30	90.2	14.5	52.78	3.1	67.5				
22/5/2014	17:45	95.9	17.2	58.87	2.7	67.5				
22/5/2014	18:00	98.7	19.8	56.84	2.8	63.3				
22/5/2014	18:15	93.1	15.8	56.84	3.2	61.2				
22/5/2014	18:30	90.2	13.2	52.78	3.1	61.2				
22/5/2014	18:45	87.4	17.2	58.87	3.1	52.8				
22/5/2014	19:00	84.6	18.5	54.81	2.8	54.9				
22/5/2014	19:15	95.9	17.2	50.75	2.6	59.1				
22/5/2014	19:30	93.1	21.1	52.78	2.8	50.6				
22/5/2014	19:45	87.4	17.2	50.75	2.3	48.5				
22/5/2014	20:00	98.7	18.5	48.72	3.2	42.2				
22/5/2014	20:15	87.4	15.8	50.75	2.8	42.2				
22/5/2014	20:30	90.2	14.5	52.78	3.0	40.1				
22/5/2014	20:45	84.6	17.2	50.75	3.1	33.8				

Table 4.8 Ambient Air Quality Results: DHA School Boundary Wall – Tower A										
Parameters		SO ₂ (µg/m ³)	NO (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	O ₃ (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	Lead (µg/m ³)
SEQS LIMITS										
Date	Time	120	40	80	5	130	500	150	35	1.5
22/5/2014	21:00	70.5	13.2	52.8	2.8	31.7				
22/5/2014	21:15	67.7	14.5	50.8	2.3	29.5				



Table 4.8 Ambient Air Quality Results: DHA School Boundary Wall – Tower A

Parameters		SO ₂ (µg/m ³)	NO (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	O ₃ (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	Lead (µg/m ³)
22/5/2014	21:30	64.9	13.2	48.7	2.3	31.7	320	174*	48*	0.5
22/5/2014	21:45	56.4	10.6	46.7	1.8	29.5				
22/5/2014	22:00	59.2	11.9	46.7	2.3	29.5				
22/5/2014	22:15	62.0	11.9	40.6	2.0	29.5				
22/5/2014	22:30	70.5	10.6	42.6	2.3	27.4				
22/5/2014	22:45	64.9	11.9	40.6	1.8	27.4				
22/5/2014	23:00	56.4	10.6	38.6	2.3	25.3				
22/5/2014	23:15	59.2	11.9	40.6	2.2	25.3				
22/5/2014	23:30	56.4	10.6	42.6	2.3	27.4				
22/5/2014	23:45	62.0	10.6	40.6	2.1	29.5				
23/5/2014	0:00	56.4	9.2	44.7	2.3	25.3				
23/5/2014	0:15	53.6	9.2	44.7	2.0	23.2				
23/5/2014	0:30	50.8	10.6	46.7	2.2	25.3				
23/5/2014	0:45	47.9	9.2	40.6	2.3	21.1				
23/5/2014	1:00	53.6	10.6	42.6	1.8	25.3				
23/5/2014	1:15	50.8	9.2	40.6	2.0	23.2				
23/5/2014	1:30	53.6	10.6	44.7	2.2	29.5				
23/5/2014	1:45	56.4	7.9	50.8	2.3	25.3				
23/5/2014	2:00	50.8	10.6	46.7	1.8	21.1				
23/5/2014	2:15	47.9	9.2	40.6	2.0	19.0				
23/5/2014	2:30	53.6	10.6	42.6	1.5	16.9				
23/5/2014	2:45	53.6	10.6	40.6	1.6	19.0				
23/5/2014	3:00	45.1	7.9	44.7	2.3	21.1				
23/5/2014	3:15	50.8	10.6	46.7	1.8	25.3				
23/5/2014	3:30	53.6	9.2	40.6	2.0	21.1				
23/5/2014	3:45	53.6	10.6	42.6	2.2	23.2				
23/5/2014	4:00	56.4	7.9	40.6	2.1	23.2				
23/5/2014	4:15	50.8	10.6	44.7	2.0	21.1				
23/5/2014	4:30	53.6	9.2	46.7	1.8	21.1				
23/5/2014	4:45	56.4	10.6	50.8	2.3	21.1				

Table 4.9: Ambient Air Quality Results: Near Boundary Wall – Cricket Stadium

Parameters		SO ₂ (µg/m ³)	NO (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	O ₃ (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	Lead (µg/m ³)
SEQS LIMITS										
Date	Time	120	40	80	5	130	500	150	35	1.5
23/5/2014	5:00	64.9	10.6	40.6	2.2	21.1	315	167*	43*	0.3
23/5/2014	5:15	62.0	10.6	42.6	2.2	19.0				
23/5/2014	5:30	53.6	9.2	40.6	2.0	16.9				
23/5/2014	5:45	50.8	10.6	44.7	2.3	19.0				
23/5/2014	6:00	47.9	10.6	46.7	1.7	21.1				
23/5/2014	6:15	53.6	9.2	44.7	2.0	27.4				
23/5/2014	6:30	84.6	11.9	50.8	1.8	33.8				
23/5/2014	6:45	53.6	13.2	52.8	2.2	33.8				
23/5/2014	7:00	56.4	15.8	50.8	2.3	38.0				
23/5/2014	7:15	64.9	10.6	52.8	2.6	40.1				
23/5/2014	7:30	70.5	11.9	58.9	2.8	42.2				
23/5/2014	7:45	64.9	11.9	60.9	3.1	44.3				
23/5/2014	8:00	56.4	13.2	50.8	2.8	42.2				
23/5/2014	8:15	59.2	15.8	58.9	2.6	48.5				
23/5/2014	8:30	62.0	13.2	52.8	3.1	52.8				
23/5/2014	8:45	70.5	14.5	50.8	2.8	61.2				
23/5/2014	9:00	64.9	15.8	48.7	3.1	63.3				
23/5/2014	9:15	56.4	13.2	50.8	2.8	63.3				
23/5/2014	9:30	59.2	14.5	52.8	2.6	67.5				

Table 4.9: Ambient Air Quality Results: Near Boundary Wall – Cricket Stadium

Parameters		SO ₂ (µg/m ³)	NO (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	O ₃ (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	Lead (µg/m ³)
23/5/2014	9:45	73.3	14.5	50.8	3.6	73.9				
23/5/2014	10:00	81.8	15.8	58.9	3.2	73.9				
23/5/2014	10:15	56.4	13.2	52.8	3.1	76.0				
23/5/2014	10:30	59.2	13.2	56.8	3.0	82.3				
23/5/2014	10:45	56.4	11.9	58.9	3.4	84.4				
23/5/2014	11:00	64.9	10.6	56.8	3.0	84.4				
23/5/2014	11:15	67.7	13.2	58.9	3.3	86.5				
23/5/2014	11:30	56.4	15.8	60.9	3.2	88.6				
23/5/2014	11:45	70.5	13.2	62.9	3.1	86.5				
23/5/2014	12:00	64.9	14.5	60.9	3.6	88.6				
23/5/2014	12:15	81.8	13.2	58.9	3.1	90.7				
23/5/2014	12:30	64.9	14.5	60.9	3.2	95.0				
23/5/2014	12:45	73.3	15.8	58.9	3.4	101.3				

Table 4.10: Ambient Air Quality Results: Near Project Office – CDPL

Parameters		SO ₂ (µg/m ³)	NO (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	O ₃ (µg/m ³)	SPM (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	Lead (µg/m ³)
SEQS LIMITS										
Date	Time	120	40	80	5	130	500	150	35	1.5
23/5/2014	13:00	81.8	13.2	67.0	3.1	103.4				
23/5/2014	13:15	79.0	13.2	67.0	2.8	103.4				
23/5/2014	13:30	73.3	15.8	50.8	3.1	105.5				
23/5/2014	13:45	81.8	14.5	52.8	2.6	107.6				
23/5/2014	14:00	84.6	15.8	50.8	3.2	109.7				
23/5/2014	14:15	87.4	13.2	58.9	3.1	103.4				
23/5/2014	14:30	90.2	18.5	58.9	2.8	101.3				
23/5/2014	14:45	93.1	15.8	54.8	3.0	99.2				
23/5/2014	15:00	84.6	13.2	56.8	3.1	101.3				
23/5/2014	15:15	90.2	15.8	58.9	3.2	99.2				
23/5/2014	15:30	84.6	18.5	52.8	3.6	97.1				
23/5/2014	15:45	81.8	15.8	58.9	3.2	95.0				
23/5/2014	16:00	79.0	19.8	56.8	3.1	88.6				
23/5/2014	16:15	81.8	18.5	54.8	2.8	86.5				
23/5/2014	16:30	84.6	15.8	58.9	3.1	82.3				
23/5/2014	16:45	81.8	13.2	58.9	3.6	80.2				
23/5/2014	17:00	79.0	15.8	60.9	3.0	82.3	350	195*	48*	0.6
23/5/2014	17:15	81.8	18.5	58.9	2.8	82.3				
23/5/2014	17:30	84.6	14.5	56.8	2.6	76.0				
23/5/2014	17:45	90.2	13.2	54.8	3.1	73.9				
23/5/2014	18:00	84.6	15.8	58.9	2.8	71.7				
23/5/2014	18:15	95.9	18.5	56.8	3.2	67.5				
23/5/2014	18:30	90.2	15.8	52.8	3.1	61.2				
23/5/2014	18:45	87.4	19.8	56.8	2.8	59.1				
23/5/2014	19:00	87.4	14.5	58.9	3.0	54.9				
23/5/2014	19:15	81.8	15.8	56.8	3.4	52.8				
23/5/2014	19:30	81.8	13.2	54.8	3.1	50.6				
23/5/2014	19:45	84.6	14.5	50.8	2.8	52.8				
23/5/2014	20:00	79.0	13.2	48.7	3.0	42.2				
23/5/2014	20:15	81.8	11.9	50.8	3.3	38.0				
23/5/2014	20:30	81.8	13.2	46.7	3.2	31.7				
23/5/2014	20:45	79.0	13.2	50.8	3.1	29.5				

The results of Ambient air quality are in compliance with the SEQS for ambient air except for PM₁₀ (Limits 150µg/m³) and PM_{2.5} (Limits 35µg/m³) as indicated by * in the results reported in Tables 4.5 – 4.8 above. These results are above the SEQS limits due to pollution caused by traffic and construction activities of other projects and road construction activities in the vicinity of The Arkadians Project site. Constant watering of unprotected piles is being carried out by CDPL project management to reduce the dust generation.

4.6.1 Noise and Vibration

Noise monitoring at 8 designated points was conducted and the results are as below:

Table 4.11: Ambient Noise Levels in Project Area						
S.No.	Location/Source	SEQS Limits : 65dB(A)				
		Noise Level Readings				
		1	2	3	Mean	
1	In front of Main Gate # 2	63	64	64	63.6	
2	Tower A Front Side	66	67	66	66.3*	
3	Tower B Front Side	67	67	66	66.6*	
4	DHA School Boundary Wall	66	65	66	65.6*	
5	Corner of A Block Near Creek Vista	65	64	64	64.3	
6	In Front of Generator Area	69	70	68	69*	
7	Near Boundary Wall Back Side of Cricket Stadium	65	65	66	65.3*	
8	Near Project Office Arkadians Developers	63	64	63	63.3	

* SEQS Limits for Commercial Area (B). Category/Zone Sindh Environmental Protection Act, 2014 No.PAS/Legis-B-06/2014

Four out of eight readings are higher than SEQS limit for ambient air (65 dB(A)) due to traffic noise and construction activities of other projects especially drilling being carried out for the road construction project in the vicinity of The Arkadians project site.

4.6.2 Water Resources of Karachi

4.6.2.1 Surface Storm Water

Hydrogeologically, the city of Karachi lies in the Hub River Basin and the Malir River Basin. The Malir River Basin is drained by the Malir River and the Lyari River. The aquifer of Karachi is, therefore, mainly recharged by seepage from Hub River, Hub Dam as well as the Malir and the Lyari Rivers.

The Malir River system is the 2nd largest river system of the region after the Hub River with eight tributaries which contribute to the flow of the Malir River. The Malir River flows from the northeast to the center of the city and finally drains into the Arabian Sea. Small tributaries named Mol Nadi, Khadeji Nadi, Jarnado Nadi, Bazar Nadi, Konkar, Sukkun Nadi, and Thaddo Nadi join the Malir River at a distance of 48 kilometers north

of Karachi. There are few small dams located in the northern and northwestern parts of the Malir River Basin including Konkar, Thaddo, Khar weir, Lath Dam, and many others which are used to store rainwater for irrigation purpose. The total area of the Malir Basin is 2,252 Km² out of which 930.5 Km² is located in the Karachi City.⁸

4.6.2.2 Water Supply, Demand and Sewerage System

The Karachi City Water Supply System supplies approximately 650 MGD of water to Karachi citizens by means of bulk supply from the Indus River (Kinjhar Lake) and the Hub Dam and wells as shown in Figure 4.8. However, currently the water supply capacity is far below the water demand and NRW rate is up to 35%, which results in the shortage of water supply in many areas of the city. In response to this, the KIV project (described later) is being implemented to substantially increase the bulk supply from the Kinjhar⁹



Figure 4.8: Major Water Facilities in Karachi City¹⁰

⁸ Zaidi, A., & Zafar, S. (2018, May). Karachi: An Expanding City with Rising Disasters. In World Environmental and Water Resources Congress 2018: Watershed Management, Irrigation and Drainage, and Water Resources Planning and Management (pp. 337-342). Reston, VA: American Society of Civil Engineers

⁹ https://openjicareport.jica.go.jp/pdf/12367207_01.pdf

¹⁰ https://openjicareport.jica.go.jp/pdf/12367207_01.pdf

Sewerage Facilities: Karachi city consists of three treatment districts, TP-1, TP-2 and TP-3. However, the amount of sewage treated at these treatment plants are only about 1/3 of the total planned amount of 472 MGD, which is the amount of sewage expected from the water supply. Currently, most of the sewage generated in Karachi is discharged into rivers and seas without any treatment. KWSB is working on the S III project (see below) to strengthen/construct new interceptors and sewage treatment plants. Under this project, the current situation of untreated effluent will be greatly improved by guiding water to sewage treatment plant through interceptors constructed on the right bank of the Lyari River and the left bank of the Malir River. Of the three sewage treatment plants, TP-1 and TP-2 use the trickling filter process, and TP-3 uses the stabilization pond process. The outline of the sewage treatment districts in Karachi city are shown in Figure 4.9. In addition to the sewage treatment plant, Karachi city owns 6 nos. of disposal stations, 32 sewage lift pumping stations, 5,670 km of sewer pipes, and 250,000 manholes as sewage transmission facilities. Since the amount of sewage actually flowing in is smaller than the amount of sewage expected from the treatment district of each sewage treatment plant, it is presumed that the sewer pipes are damaged or clogged¹¹.

¹¹ https://openjicareport.jica.go.jp/pdf/12367207_01.pdf

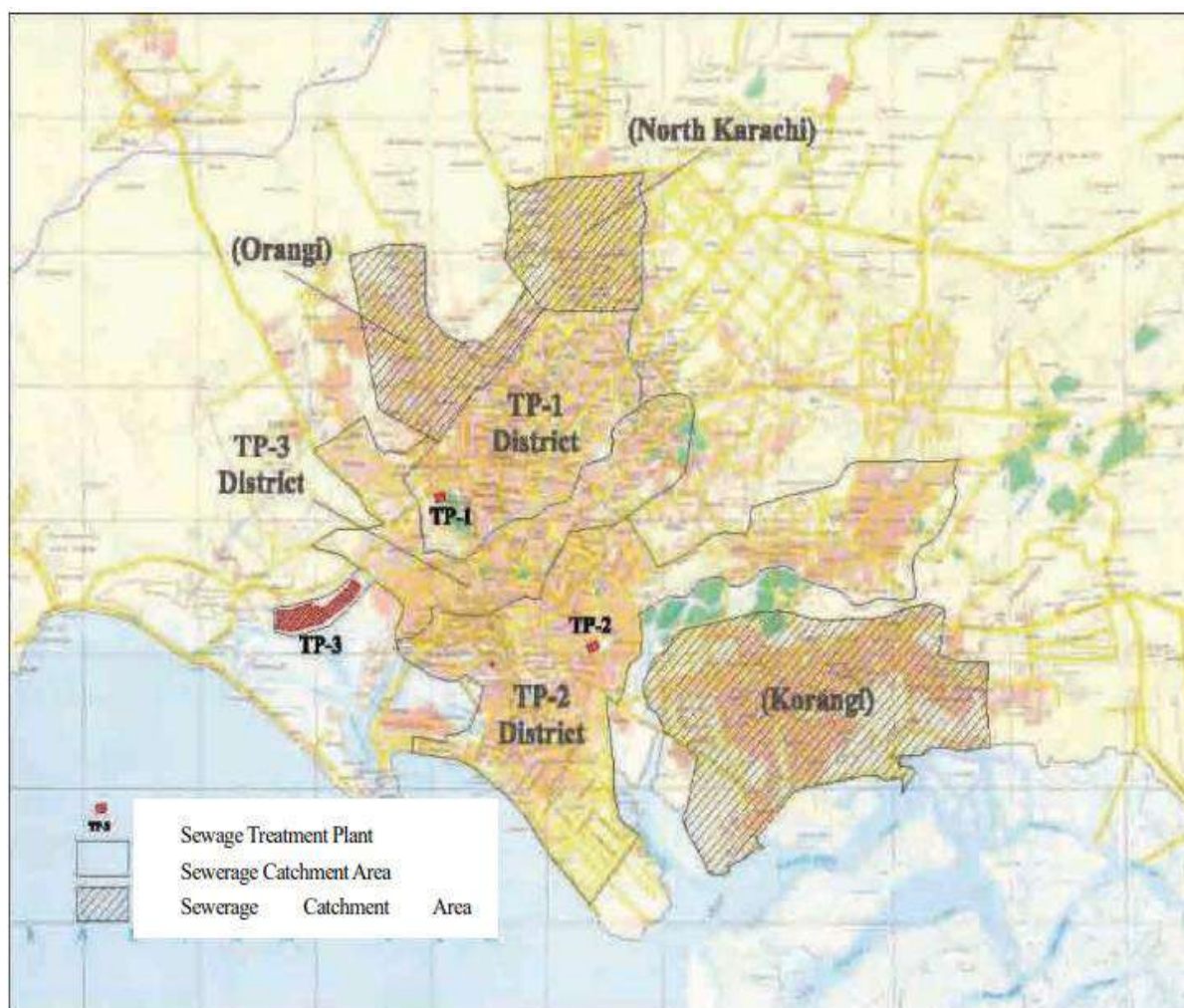


Figure 4.9 Karachi's Sewage Treatment Districts

4.6.2.3 Water Quality

Drinking water quality is one of the greatest factors affecting human health. However, drinking water quality in many countries, especially in developing countries is not desirable and poor drinking water quality has induced many waterborne diseases. The shortage of water in Karachi city due to rapid increase in population and industrial activities, has forced people to meet their water requirements from alternative supplies such as privately-owned ground water sources which extract, process and sell groundwater at a very high commercial cost¹². However, the quality of groundwater is very poor in Karachi mainly due to the excessive pumping of groundwater by farmers, seepage of domestic wastewater in groundwater, huge amounts of chemical constituents in industrial wastewater and sea water encroachment, rendering it medically unfit for human consumption if consumed without prior treatment.

A study conducted by PCRWR in 2021 to assess of the water quality of cities of Pakistan revealed that Karachi, inhabits approximately 16.025 million (Population Census Report, 2017) people and houses about 60% of the industries of the country

¹² KWSB. (2010). Environmental Management Framework-Karachi Water Supply and Sewerage Improvement Project.

(UN Census, 2021). The water supply of Karachi is dependent on surface water and groundwater sources. Surface water sources include Haleji Lake, Keenjhar Lake and Hub Dam, while 44 groundwater source includes Dumlottee well-fields. Altogether, 28 fixed sources were monitored for drinking water quality. Out of these sources, 93% were found as unsafe for drinking (Table 28). The groundwater of the city belongs to mainly Sodium-Chloride (92%) and a minor involvement from Sodium-Bicarbonate (8%). This indicates the presense of seawater belonging to the Sodium-Chloride facies and permanent type water hardness. The situation of water quality in Karachi continues to worsen since 2002 (23%) and no remarkable improvement could be seen up to the recent study of 2020 (7%)¹³.

These findings suggest that the water as received by the residents is not safe for drinking. Although water quality has not been tested yet, groundwater pollution by nitrates, pesticides, heavy metals and hydrocarbons discharged into the environment is not negligible. The salinity of groundwater in Southern Sindh, particularly in the coastal areas has increased since over pumping has induced seawater to flow in, causing what is known as seawater intrusion. The fact, also acknowledged by KW&SB that 150 mgd (681,900 m³/day) of water supplied to the consumers is chlorinated and bypasses the KW&SB filter plants is an important indicator of the need of addressing this issue on a priority basis

4.6.3 Solid Waste Management

Karachi city generates more than 10,000 ton / day of municipal solid waste and dumped at the landfill site without proper planning and segregation. Out of the total amount of municipal solid waste 60% of the total amount of municipal solid waste are dumped on the landfill site and rest of 40% remain on the street and did not collect from the towns.

Out of 18 former towns, only eleven towns such as, Gulshan, Gulberg, Gaddap, Korangi, Liaquatabad, Landhi, Malir, North-Nazimabad, North Karachi, Shah Faisal and Bin Qasim towns dumped their garbage at the Jam Chakro landfill site and too much without any proper planning and segregation of the garbage. Rest of four towns dumped their waste at the Gond Pass landfill town near Hub River due to its being much near to the town as compared to Jam Chakro landfill site. Three towns of them i.e., Jamshed town, Saddar town and S.I.T.E town are those that dumped their waste at both landfill sites.

Out of the total municipal solid waste generated, 80% contains recyclable material and the remaining 20% is organic type waste. On the basis of analysis of the municipal solid waste, the study reveals that pH is slightly alkaline, moisture content is less than 50% and the amount of heavy metal like, Lead, Cadmium, Chromium and Nickel are beyond the permissible limits. They are responsible for casting adverse impacts on the environment as well as for contaminating groundwater in the vicinity of the landfill site sites through leaching formation.

¹³ <https://pcrwr.gov.pk/wp-content/uploads/2021/10/Drinking-Water-Quality-in-Pakistan-2021.pdf>

The existing system of solid waste management in the city is inefficient and inadequate to cope with the present and future need of increasing solid waste quantities. There are no planned disposal sites for the city. The current practice of the illegal dumping of solid waste in and around the city has created a serious environmental and public health problem. For sustainable development, it is essential to establish sound, economical and technical methods of solid waste management.

Sindh Solid Waste Management Board – SSWMB has been established under the Sindh Solid Waste Management Board Act 2014 for effective Integrated Solid Waste Management in Sindh including Karachi. SSWMB is embarking in garbage collection from door to door and construction of garbage transfer stations, material recovery facilities, construction of composting facilities and energy generation etc. SWEEP project is being implemented under SSWMB financed by Worldbank for the establishment of landfill cells and garbage transfer stations in Karachi.

4.7 Ecological Environment & Biological Resources

This section provides an overview of the eco-zones, wild flora and fauna, and the habitat conditions prevailing in the project area.

4.7.1 Biological Environment of the Project Area

Inadequate availability of surface water has reduced the biodiversity as well as vegetation in the macro environment in general but particularly in the microenvironment. Brackish groundwater and the generally saline marine environment have left no footprint of terrestrial flora. Further inland however, the species of flora and fauna typical of the arid environment do exist. The flora and fauna recorded for the macro environment are described hereunder:

4.7.2 Terrestrial Flora

The area located along coastline still continuing with moisture in the ground has some natural vegetation mostly scrubs/brushes. Further inland the macro environment has short height shrubs / bushes and also large trees bearing witness that the area was fertile land. Data concerning to vegetation is summarized in Table below. Among 43 species *Prosopis juliflora* also attained the constancy class V while five species (*S. monoica*, *C. cretic*, *Tamarix indica* Willd, *slasolabaryosma* Pandey, *Aeluropus* specie) had constancy class IV.

Native terrestrial vegetation comprises a wide variety of bushes and shrubs as shown in Table 4.13.

Table 4.13: No. of Stands in which the species are leading dominant				
No.	Communities	Plant Species		
1	<i>P. juliflora</i> 123	18	-	-
2	<i>S. monoica</i> 36	114	-	-
3	<i>H. recurvum</i>	-	53	114
4	<i>A. maurorum</i>	-	-	86

Source: EMC Database from EIA/IEE Studies

Four communities based on landing dominant species were correlated with the edaphic factors.

Prosopis Community: Prosopis juliflora formed main association with disturbed species Aervajavanica (juss), Cassia holosericea (pies), Abutilon inicum (Sweet), Calotropis procera (R.Br) and with halophytes (C. cretica, H. curassavicum. Aleuropus sp.)

This community preferred higher percentage of total sand (81.27%) with low percentage of silt and clay (9.36%). Water holding capacity of the soil was low (26.50%). The pH was also low percentage of soluble and organic matter. The soil of this community contained appreciable amount of calcium carbonate (25.81%).

Suada Community: Suadamonoica with other halophytic species Desmostachy bipinnata (stapt), Saudabaryosma, Tamarix indica, Aeluropus sp, Cassia cretica also preferred high percentage of total sand (78.21 %) and low silt and Clay (10.80 %). The soil had moderate maximum water holding capacity and it was more (30.55%) than that of previous community. However soluble salts and amount of organic matter were higher. The level of pH was also higher (8.94) as compared with the previous community.

Haloxylon Community: This community was also found on such soil which has higher percentage of silt and Clay (12.97%). The maximum water holding capacity is moderate and pH was 8.73. This community also preferred high amount of CaCO₃ (23.02%) and low percentage of organic matter (0.79%). However, it preferred higher amount of soluble salts (4.25%) as compared with others.

Alhaji Community: Alhaji community is distinct from the other three communities described. This community preferred better soil conditions. Such as comparatively low percentage of total sand (64.20%) and higher amount of silt and clay fractions (17.86%). The soil has also better maximum water holding capacity (38%) and organic matter contents (1.80%). The percentage of CaCO₃ was lower in this community, than in the other communities. However, pH and soluble salts are higher.

Alhajimaurorum community: is present on such soil which showed high level of pH as compared to Prosopis, Suaeda and Haloxylon community. Moreover, this community preferred to grow on better textured soil which had maximum water holding capacity.

4.7.3 Terrestrial Fauna

Animal species in the area and its surrounding are normally categorized into aquatic & land fauna and birds species. A brief on those is given below:

A. Aquatic Fauna

Aquatic fauna have been studied by various workers, such as Hasan (1960), Mac Nae (1968), Espinoza et al, (1979), Choudhry et al (1980) and Trimizi and Barbafi (1983). Insect fauna of coastal area particularly find at Gizri Creek and Korangi Creek. The

blood suckling insects are injurious to animal health. The insects were identified as sand fly and horsefly. These flies attack on man and other domestic animal and also vector of nematode worm.

Table 4.14: Flies of aquatic nature found in the project area		
Species Name	Distribution	Characteristics
Simulium sp.(sand fly)	Coastal Belt	Sand fly attack on men and other domestic animals in daylight. It carries Onchocerciasis in man and also some protozoa which are pathogenic to birds.
Tabanus sp. (Horse fly)	Coastal Belt	Female are blood feeder while males depend on nectar. It transmits Trypanosomevansi which causes surra in domestic animals like horse, camel, cattle, elephant and dogs.
Source: EMC Database from EIA/IEE Studies		

B. Birds and Reptiles

The mangroves of Indus Delta as well as mangrove forest in the vicinity of Karachi provide an ideal habitat for many species of birds either migratory or resident. Although the birds in the vicinity of the Karachi coast have been observed casually since long i.e for more than hundred years, however first detail study conducted by Khanum and Ahmed conducted during mid-eighties along Clifton, Defence Society back waters, Mauripur back waters and Sandspit were published in 1988. Later in 1997 Ghalib and Hasnain (1997) presented a detail account of the birds of Karachi. Earlier Karim (1988) gave a detail account of birds of mangrove forest of Sindh including Karachi.

Clifton and DHA beaches along Karachi coast serve as good feeding ground for migrating and resident birds. Khanum and Ahmed (1988) conducted four months study (July - October, 1985) along Karachi Coast from Clifton to Hawksbay including backwaters and reported 34 species of these 12 species were resident and 22 species were migratory. They also observed two predator eagle species which were found in large numbers. Although the migratory birds had started arriving and still they were coming therefore they could not give detail about them in their study. Ghalib and Hassani (1997) have reported 75 species of water birds belonging to 6 orders and 14 families from Clifton beach. The majority of them are waders or shorebirds such as oystercatcher, avocet, stilt, plovers, whimbrel, curlew, godwit, sandpipers, shanks, turnstones, stint, knot, dunlin, sanderling, etc. Besides the shore birds, egrets, herons, gulls, terns, flamingos are commonly observed at Clifton. Rare water fowls like velvet, Scoter and Red breasted Merganser have also been recorded from this region.

The shore birds usually feed in the intertidal zone particularly during low tide or when the tide is receding as they can capture the prey easily. The food available for these birds along Clifton beach include annelids polychaetes; molluscs (gastropod and bivalves; crustaceans, crabs, shrimps and their juveniles). These birds take their food either from the surface of the substrat in by probing into the substrate which is soft and the birds insert their bill into the sediment. Egrets, herons, gulls, tern and other birds feed on fish in this area.

List of birds and reptiles recorded in macro-environment of the project area are given in Table 4.15 and 4.16 respectively.

Table 4.15 : List of Birds Recorded in macro-environment of Project Area		
S. No.	Zoological Names	Common Names
1	Ardeograjii	Indian Pond Heron
2	Egrettaularis	Reef Heron
3	E. intermediate	Intermediate Egret
4	Egrettaalloa	Large Egret
5	Ardeapurplea	Grey Heron
6	Ardeapurplea	Purple Heron
7	Platalealeucorodia	White Spoonbill
8	Phoenicopterusruber	Greater Flamingo
9	Pandionhaliaetus	Osprey
10	Elanuscaerulens	Black Shouldered Kite
11	Haliaeetuspercnopterus	Brahminy Kite
12	Neophronpercnopterus	Brahminy Kite
13	Aquila heliaca	Imperial Eagle
14	Aquilaapaxvindhiana	Tawny Eagle
15	Aquilaapaxvindhiana	Lesser Steppe Eagle
16	Accipiter badirs	Indian Shikra
17	Gallinago gallinago	Common Snipe
18	Larus argentatus	Herring Gull
19	Larus brunicephalus	Brown Headed Gull
20	Sterna hirundo	Common Tern
21	Sterna alba	Little Tern
22	Ceryle rudis	Pied Kingfisher
23	Halcyon smyrnensis	White Breasted Kingfisher
24	Rostratula bengalensis	Painted Snipe
25	Haematopus ostralegus	Oystercatcher
26	Pluvialis dominica	Golden Plover
27	Charadrius hiaticula	Ringed Plover

Table 4.15 : List of Birds Recorded in macro-environment of Project Area		
28	Tringastagnatilis	Marsh Sandpiper
29	Calidrisminuta	Little Stint
30	Calidrisferruginea	Curlew Sandpiper
31	Coroussplendens	House Crow
32	Egretta garzetta	Little Egret
33	Larusichthyaetus	Great Black-headed Gull
34	Sterna repressa	White Checked Tern
Source: EMC Database from EIA/IEE Studies		

Table 4.16: List of Reptiles Recorded in macro-environment of Project Area		
S. No.	Zoological Names	Common Names
1	Cyrtodactyluskachhensis	Warty Rock Geek
2	Hemidactylusbrooki	Spotted Indian House Gecko
3	Agama agilis	Brilliant Agama
4	Ablepharuspannonieus	Mediterranean Dwarf Skin
5	Calotesversicolor	Indian Garden Lizard
6	Acanthodactylus cantoris	Indian Fringe Toed Sand Lizard
7	Maburageclissimilis	Striped Grass Skin
8	Typhlopsporrectus	Slender Blind Snake
9	Coluberventromaculants	Glossy Bellied Racer
Source: EMC Database from EIA/IEE Studies		

Lizards were generally spotted by the locals in the area. The activities of reptiles are highly seasonal and are influenced by the variation of weather even on a daily basis due to their ectodermic and cryptic nature. Some diurnal reptiles' lizards are active in mid-morning whereas, nocturnal reptiles such as snakes and rodents are active only at night.

Most reptiles go into hibernation during winter; therefore, surveys in winter months will under-estimate such species. Many reptiles such as snakes and lizards are timid, secretive, fast-moving and cryptically color. This renders survey of reptiles difficult. Detection is another limitation in reptilian surveys, with all methods possible it is impossible to efficiently capture or record all individuals present at a site.

C. Macro Fauna

The common benthic macro-fauna observed along Clifton and DHA beaches include worms, molluscs, echinoderms and crustaceans. The worms are most common and are represented by tube-building and burrowing species. The molluscs are mainly represented by gastropods, and bivalve and scaphopods (Dentalium). Razor clams inhabit deep burrows as they are highly sensitive to vibration. Echinoderms are found beyond the intertidal area in the subtidal region and include brittle stars, sea stars, etc. The crustaceans are represented by spider crab, hermit crab and ghost crab. The juveniles and larvae of penaeus and metapenaeus are also found in coastal water along these beaches. Fishermen catch small fishes along Clifton and DHA beaches using small boats. The fishes commonly found along these beaches include Mulletts, catfish, sciaenid fish, lady fish, file fish and others. The fishing in this area is generally carried during southwest monsoon when the fisherman cannot go in open ocean for fishing due to strong S.W. monsoon. Marine animals commonly observed along Clifton and DHA beaches are listed in Table 4.17 below.

Table 4.17: Marine Animals Commonly Found along DHA and Clifton Beaches	
Family Name	Marine Animals
SEA PENS	Vergulariasp
POLYCHAETES	Diopatra sp.
MOLLUSCS:	Tonna maculate
	Naticavitellus (Moon shell)
	Naticadidyma
	Natica lineate
	Babylonia spirata
	Tibia curta
	Cymia sp.
	Solentruccatus (Razor clam)
	Siliqua radiate
	Arca sp.
	Thais sp.
	Pinna sp.
	Donax sp.
	Mactra sp.
	Cardium sp.
	Dentalium sp.
	Crepidula sp.
	Rapanabulbosa
CRUSTACEANS:	
(Crabs)	Ghost Crabs
	Stomatopods
	Spider Crabs
	Hermit crabs
(Shrimps)	Penaeus
	Metapenaeus
ECHINODERMS	Star fish (Asterinasp)
FISHES:	Scatophagussp
	Mulletts (Liza sp.)
	Catfish (Arius sp.)
	Pseudotricanthus sp.
	Leiognathus sp.
	Sciaenid fish

4.7.4 Ecosystem Sensitivities

The receiving water body of effluent from the proposed project is Korangi Creek where the main drain is discharged. Korangi creek is considered to be the worst affected area because of the large-scale discharge of effluent from Korangi, Landhi, and Karachi Export Processing Zone.

The marine environment of the creek system is most vulnerable to the impact of land based pollution. Various operations including industrial, municipal, transportation and port activities have all contributed in raising the pollution level. This phenomenon magnifies the adverse impacts of the pollutants on the local fauna and flora.

The creek ecosystem has terrestrial plants and mangrove forest. Among the mangrove *A.marina* and *Rhizophora* sp. are dominant species found in the this region. *Rhizophora* is being planted under a rehabilitation program conducted by IUCN. There are many reasons for the decline of this important habitat, including pollution, scarcity of fresh water, hardly any rains and indiscriminate cutting and grazing of trees due to lack of awareness of the value of the resources on part of local inhabitants along the creek.

Eutrophication due to organic pollution has changed the benthic communities at Korangi Creek / Phitti Creek system. The reduction in the benthic fauna has severely decreased the bird population in the area as birds have difficulty in finding their food.

The discharge of properly treated effluent from these projects and other such units might actually be helpful for the creek ecosystem in its own small way, as the wastewater is essentially sweet water. After proper treatment, the pollution load gets down to reasonable levels while the hydraulic load is beneficial for the mangroves.

4.7.5 Land Use and Development

The project is being executed in the area earmarked in Zone G of the DHA Waterfront Development.

4.8 Socio Economic Baseline of Project Area

4.8.1 General

In almost every coastal city of the world, living on the sea side is always a dream for many people and is quite expensive too, as compared with the areas far from the sea. In Pakistan, Karachi is the most important coastal metropolitan in which two main options are available for the residential properties i.e., apartments and bungalows (on open residential plots).

The land near the coast is more expensive than the land far from the sea. In both categories the prices have some (difference in ratio) between close to sea and far from sea. Here are some of the main reasons for costly residences on the sea side:

The location of Central Business District (CBD) with headquarters of almost all banks, money exchanges, business offices, provincial assembly building and secretariats, Karachi Port Trust (KPT), Port Qasim Authority (PQA), Korangi Industrial Area, wholesale markets, franchises, corporation and multinational companies (MNC) offices, cargo terminals, educational institutions and business centers etc. near the coast make people envy to those who live near the coast and have to travel small distances for performing their various day to day activities.

Living near the coast may also be associated with better health as some researchers have pointed out i.e. Seaside environment reduces stress as people who took trips to the coast experienced more feelings of calmness and relaxation than those who visited urban parks or the countryside. About 1 percent of the people living within half a mile of the sea reported good health than the people living more than 30 miles away from the sea. However, it's too soon to advise people to hit the beach to improve health, Wheeler said. The study only found an association, not a cause-effect link, and it's possible that other factors could explain the results. For instance, it could be that people who are wealthier, and therefore healthier, are more able to move to desired locations such as the coast, Wheeler said, a phenomenon known as the migrant effect

But the study did find that the association between coastal living and better health was strongest for those living in the most deprived areas, which perhaps indicates that wealth cannot explain the results, it's not clear whether the findings would apply to other populations.

Dr. David Katz, director of the Prevention Research Center at Yale University School of Medicine, said: "I know I find the smell of the ocean and the sound of the surf a wonderful tonic." If future studies confirm the results, the next step would be to find out what it is about coastal environments that benefits health. Researcher said it may then be possible to bring those benefits to people living in other areas, through virtual environments, for instance.

4.8.2 Aim of the Baseline Study

The baseline statistics used in this study on the proposed project "The Arkadians" relate to the socio-economic environment of the area during planning, construction and operational activities.

This study would aid in understanding the prevalent macro and micro environment of this project and would enable assessment of possible environmental impacts that may arise as a result of the activities associated with the project. It would also assist the design team in defining the mitigation measures that would be required to minimize if not eliminate the negative impacts which are pointed out in this study.

4.8.3 Methodology

Information for macro and micro environment was collected from different sources including electronic and print media, studies previously conducted in DHA phase VIII by EMC and archives of the experts, consultations with institutions, Non-government

Organizations (NGOs) and field surveys conducted by the team of Environmental Management Consultants (EMC) etc.

4.8.4 The Macro Environment

The macro environment of The Arkadians Building project consists of DHA phase I to VIII. The project is surrounded by DHA phases I to VII, Clifton, Saddar Town, Karachi Port Trust, Arabian Sea, Malir River and few islands (Bundle & Buddu etc.) at few kms away in the sea. This also includes the recently developed areas of Creek Vista Residential Project and Gold Club, however some other residential projects under construction are also in process e.g., Emaar Crescent Bay Project.

DHA is an independent authority and it is developed into phases from 1 to VIII and phase 9 is developed recently on Super highway. DHA phase VIII comprises of 4,800 acres of land of which approximately having 60% of the area being utilized for plotting purpose while the rest is used for roads, parks and parking. The minimum size of the road is 35 feet wide. This area is along with Khyaban-e-Shaheen, Zulfiqar Street, golf club road and Khayaban-e-Tipu Sultan.

The other roads near the project site are Beach Avenue (120 feet wide road), Sahil Avenue (60 feet wide road) along the beach, Khayaban-e-Iqbal, Khayaban-e-Khalid, Khayaban-e-Babar and Khayaban-e-Faisal. All the streets in the area are known as Sahil Streets and there are total 37 Sahil Streets with cutting of 300 and 500 square yards plots.

Authority is spread over an area of 8,797 Acres. It has 81,489 members of all categories of Armed Forces Officers, Civilians and legal heirs of deceased members.

DHA, today, has an elaborate network of roads, to the extent of 466 Km; water supply covering 605 km; and sewerage arrangements spanning 470 km. DHA has, thus, come a long way in emerging as the largest and most prestigious residential estate of the country. Through a well-managed and regulated administration, it provides the best educational, recreational, cultural and civic facilities in an aesthetically dynamic environment. Cardinal factors stated above have made the DHA's land such a precious estate property.

The DHA has Malir & Jamshoro districts on its North, Thatta district and Arabian sea on the South, Jamshoro, Karachi East and Thatta districts on the east, and Karachi South, Karachi Central, Karachi West and Lasbela district of Baluchistan province on the West.

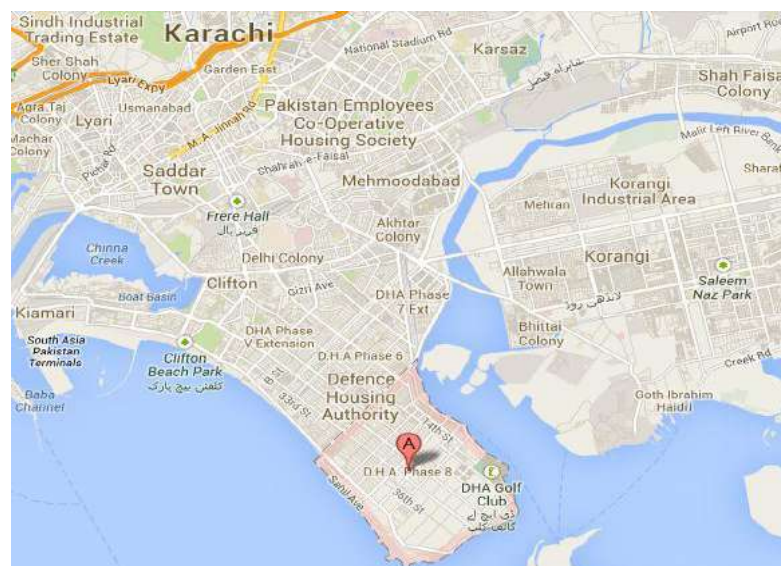


Fig. 4.11: Map of DHA and its Surrounding Areas

A. History

The Defence Housing Authority, Karachi or DHA, Karachi, is one of the front runners in development in Pakistan with many exclusive projects to its credit. Being the biggest setup of its kind in Asia, today DHA is considered to be the first-choice residential area for the affluent class of Karachi. Pakistan Defence Officers Co-operative Housing Society Limited (DOCHSL), Karachi was registered in March 1953.

In August 1980, in lieu of the Co-operative Housing Society, the Pakistan Defence Officers Housing Authority was created¹⁴. Defence Officers Housing Authority, as the name implies, primarily came into being for the welfare of the serving and retired officers of the Armed Forces of Pakistan. The Housing Society, which made a humble start with allotment of a mere 76.2 acres of land, has come along way since then. It was through the artistic development, of mostly barren land, meticulous master planning, provision of enviable civic amenities, and arrangement of quality living environments to its residents, that DHA has attained a status which serves as a benchmark for quality community, living unparalleled to its class.

B. The Administrative Setup

The functioning of the DHA is vested in the two bodies: The Governing body headed by Secretary, Ministry of Defence, and, Executive board headed by Corps Commander posted at Karachi. The Executive board exercises all administrative, executive and financial powers and thus all acts and things which may be exercised or done by the authority. The Administrator is the Executive Head of the Authority and exercises all executive powers, delegation or otherwise in accordance with the policy laid down by the Governing body and the directions or the decisions of the Executive board.

¹⁴Through President's Order No. 7 of 1980, whereby, the post of Managing Director was re-designated as Administrator. (7 Aug 1980)[3]

4.8.5 The Micro Environment

The Arkadians Project lies between 24°46'40 north latitudes and 67° 05'41" east longitudes and is approximately 43.24 acres of land and it is only at 200-meter distance from the coastal side of the Beach.

4.8.6 Socioeconomic Aspects of the Project

A. Population

The population of Karachi has continued to show remarkably rising trend, in comparison to the other cities of the country. Karachi's population initially increased by leaps and bounds at the time of Pakistan's independence in 1947, as a result of migration of refugees from India, which completely changed its demographic and cultural characteristics of the city. Over the years, Karachi became a high density city with a cosmopolitan culture with an annual growth rate of 4.5%.

The current population of Karachi is estimated at 18 million, which is projected to increase to 20.7 million in the year 2020. The Karachi metropolitan area is made up of 07 contiguous districts. The Karachi Master Plan 1974-85 was prepared but could not be implemented fully due to varied reasons. Subsequently the Karachi Master Plan 2000 was initiated but that too could not be implemented on account of instability and conflict in various sectors. However, yet another strategic master plan is currently under preparation. The geographic location and economic potential of Karachi has drawn both labor and capital for many decades, but the full potential of the city remains yet to be harnessed.

DHA is one of the costliest and most posh residential areas of the city with an estimated population of 660,931. DHA is characterized with highly skilled people with well-planned and luxury housing infrastructure for the elite of the country. DHA Phase VIII has now become focus of the new and big residential and commercial projects which after few years would increase population of DHA manifold.

Besides very highly affluent society, more than 40% population lives below the poverty line without basic facilities and it includes a large number of homeless people. The study, conducted by the IUCN, in nearby coastal area indicated ethnic group of KhasKheli, Jat and Debla clans. Fishing and related activities are the predominant occupation for most of the people who earn a meagre income per month.

B. Economic Growth Potential of Karachi

Karachi, the capital of Sindh is the commercial hub and the gateway to Pakistan. It contributes about 95% of Pakistan's foreign trade and about 30% of Pakistan's industrial production. Almost 90% head offices of banks, multinationals are located in this city. Karachi's share in the national GDP is about 25%, while it generates 40% of the provincial revenues. Its share in the national employment in large scale inclusively is 40% with 4500 industrial units in the formal sector and large scale cottage industries in informal sector.

Karachi is home to the largest stock exchange of Pakistan: the Karachi Stock Exchange. Karachi Stock Exchange achieved the milestone of the best performing stock market of the world in early 2005. This financial boom helped Pakistan to achieve its ambitious goal of over 8 percent GDP growth which is the highest in Asia after China during fiscal year 2004-05. The recent trend of ICT (Information and Communications Technology), Electronic Media, and Call Centers have become significant part of Karachi business hierarchy.

The two sea ports, Karachi Port and Port Qasim, handle over 43 million tons of cargo annually and the container handling is 1.24 millions in number respectively during 2003-04. Karachi has 40 km of coastline, some sectors of which like Sands-pit, Hawks-bay, Paradise Point and Sea-view have been developed for recreational use for the general public. However, Karachi coast as such has yet to achieve its full potential and state of the art infrastructure development.

Role of DHA in Economic Development

DHA (Pakistan Defence Officers Housing Authority) Karachi is the foremost real estate development and a model in Pakistan. It is the forerunner to other DHAs of Lahore and Islamabad because of efficient development and maintenance of infrastructure facilities. A well-managed and regulated administration of DHA provides educational, recreational, business and civic facilities for its residents.

C. Employment Opportunities Created from the Arkadians Project

The Arkadians will have positive socioeconomic impacts in generating direct and indirect employment. Large number of local manpower, including semi-skilled labor would be in demand. The mega scale developmental activities would substantially enhance opportunities for the construction, services, and manufacturing thereby creating employment in local market.

Not only in construction phase, but also in operational phase of the project a lot of manpower would be required to run luxurious restaurants, parks, clubs and modern offices and these business activities will boost the economy and local business opportunities. The sharing of international knowledge and expertise with local workers would be an added benefit. The project site is situated on the outskirts of the city of Karachi at coastal belt, which has a vast variation regarding socioeconomic conditions. The broader view of the proposed project activities indicates that the existing businesses should, in the medium to longer term, benefit significantly from increase in visitor, high consumptions, and greater demands. In the short term, the development is likely to increase local competition in cultural, social and recreational sectors. However, in the medium to longer term, it should increase visitor numbers and demand for those facilities, and raise DHA profile as a centre for the exhibition and further development of arts, entertainment, conventions and exhibitions.

4.8.7 Education and Literacy Rate

Educational facilities in the surrounding area of the project are excellent. Availability and access to all levels of education is well provided because of efficient and effective management system to facilitate and promote higher education. Literacy rate among females is comparable with males. Training in technical skills is equally adequate. Skilled labor consisting of drivers, mechanics, water pump attendants which are estimated to be less than 10 percent of the total population in the project area, is provided by UCs in the surrounding Towns.

As many as 22 educational institutions are established at DHA out of which 5 are Colleges and the rest are the Schools/Educational Institutions. The DHA area also houses other elite non-DHA educational institutions like Bayview High, The CAS School etc. Every DHA educational institution, right from Montessori to Degree level, has shown a phenomenal progress within very short span of time. DHA now intends establishing a University of its own for which a charter has already been granted by Government of Sindh.

4.8.8 Status of DHA Road Network

Existing road network has almost reached its full capacity. On some roads congestion has also been observed. In future, after full development of Phase VIII, the number of vehicles plying on the road is expected to increase manifold which would require increase in their capacity.

DHA taking cognizance of the situation conducted a Traffic Study through NESPAK (henceforth called DHA Traffic Study) which showed that by 2026 the traffic within DHA would increase from 440,000 VPD to 990,000 VPD. DHA may require its own internal public transport system, comprising of LRT or monorail in addition to Shuttle services. Some measures initiated by DHA include: provisions of shoulders, footpaths, diversion of main arteries to less crowded adjacent roads, service roads on main roads, design of intersections for smooth traffic flow and improvement of road surfacing etc.

Following are the major roads in the entire network:

Korangi Road / National Highway which connects DHA to Shahrah-e- Faisal on one side and Korangi on the other. It runs in Phase I and Phase II.

Sunset Boulevard connects DHA with Punjab and Dehli Colonies and Korangi road. Sunset Boulevard runs in Phase-II.

Khayaban-e-Shamsheer meets up with Gizri Boulevard on one end and Seaview Road on the other. It runs perpendicular to Khayaban-e-Hafiz. Landmarks on Shamsheer include the Saudi Embassy. It runs in Phase V.

Khayaban-e-Ittehad meets up with Korangi Road on one side and Seaview Road on the other. Khayaban-e-Ittehad curves shortly after its intersection with 5th street and from that point onwards, runs at an angle of 45° from the vertical. It meets most of the

roads that run in DHA. It runs in Phase VI & Phase VII. It is the Biggest IT Infrastructure in DHA.

Khayaban-e-Hafiz connects Gizri on one side and goes deep into Phase VIII on the other side. Landmarks on Hafiz include the Saudi Embassy and the Sultan Masjid. It runs in Phases V, VI & VIII.

Khayaban-e-Shaheen runs parallel to Hafiz. It connects Zamzama on one side and passes through 'Creek City' on the other side. Landmarks on Shaheen include ShaikhZaid's 'Mehel'. It runs in Phases V, VI & VIII.

Gizri Road is mainly a commercial road. Gizri connects Khayaban-e-Hafiz on one side and ChaudryKhaliq-uz-Zaman Road on the other. Landmarks on Gizri include the 'Submarine Chowk'. Gizri has its own system of streets and lanes known as the 'Gizri Streets' and 'Gizri Lanes'. It runs in Phase IV.

Zamzama Road is another commercial road that is continuous with Khayaban-e-Shaheen on one side and ends at 'Two Talwar' on the other side. Zamzama also has its own system of streets and lanes, known as 'Commercial lanes' (not to be confused with the commercial lanes in Phase IV) and 'Zamzama streets'. It runs in Phase V.

Khayaban-e-Bahria runs perpendicular to Khayaban-e- Hafiz. It meets up with Khayaban-e-Ittehad on one side and Seaview Road on the other. Landmarks on Bahria include the Sultan Masjid. It runs in Phase V and Phase VII.

26th Street runs parallel to Khayaban-e-Hafiz. It meets up with Abdullah Shah Ghazi Road / Shahrah-e-Firdousi on one side and goes deep into Phase VIII on the other. 26th street runs in Phases V, VI & VIII.

Seaview Road/Beach Avenue runs along the sea, hence its name and connects Defence with Mai Kolachi on one side and goes deep into Phase VIII on the other side. Seaview Road runs in Phase V, Phase VI and Phase VIII.

Commercial runs parallel to Khayabane- Hafiz and meet up with Khayaban-e-Jami on one side and Khayaban-e-Ittehad on the other. Commercial Avenue has its own system of streets and lanes, known as 'Commercial Streets' and

'Commercial Lanes' (not to be confused with Zamzama's commercial lanes) is also known as the 'naalaywaleesarak' (road with the drainage line) due to the fact that a drain runs through the middle of the road. Landmarks on Commercial Avenue include the Imam Bargah and the DHA School Phase IV branch. Commercial Avenue runs through Phase IV and Phase VI.

Zulfiqar Street 1 starts at Khayaban-e-Ittehad and ends at Seaview Road. Creek Club, Marina Club, Carlton Hotel, Area 51 and Golf Club are all located on Zulfiqar Street No.1. It also meets up with Creek City and runs through Phase VIII.

4.8.9 Mosques

There are 33 mosques in the DHA area, out of which 8 are exclusively maintained by DHA. These mosques are characterized by beautiful architecture and spacious areas where faithful come and pray five times a day.

4.8.10 Sports and Other Recreational Facilities

Sports and other recreational facilities include a cricket stadium, a football stadium, clubs for golf, yachting facility, 6 numbers of Futsol Pitches, Rahat football ground etc. for members and non-members also. DHA has played a leading role for the emerging residential communities and development for Karachi in particular and country as a whole.

In the Waterfront Development Project stretching over 14 kilometres along the coastline that comes under DHA control, numerous sports and recreational facilities have been provided for members of clubs and other residents of the Authority.

4.8.11 Shopping Centers

The commercial areas of DHA comprises of both large and small shopping centres of Karachi. Shopping centres are, however, scattered all over the city but Zamzama and Dolman Mall are the nearest places. Most of the commercials facilitate people of DHA residents to buy from nearby markets close to their house like Badar Commercial, Tohid Commercial, Sahar Commercial and Shahbaz Commercial etc. But some famous shopping areas in the nearby areas but not in the boundary of DHA are Park Towers, Ocean Mall, Forum, Dolman Mall, Gulf Shopping Center etc. There are also many large and small markets dealing in everyday household items to clothing, fabrics and electronics. People like the more modern malls and pick all the items under one roof, so many other projects are in the Master Plan of DHA, which will be materialized in the coming years.

4.8.12 Healthcare Facilities

Health problems of the project area are generally associated with lifestyle. As such lifestyle diseases like hypertension, heart attack, diabetes, liver disease, depression, and cancer are commonly reported in Clifton area. Health facilities are quite adequate and of high standard. Ziauddin University of Health Sciences and South City hospital have the state-of-the-art facilities for treatment of many of the above ailments. Other medical facilities that are present in the area are listed below:

Aga Khan University Hospital – Clifton Medical Services

Australian Concept Infertility Medical Center

DHA Medical Centre & DHA Clinics

Health Care Hospital

Medi Link

Parklane Hospital

Shaukat Khanum Diagnostic Centre and Clinic

4.8.13 Archaeological and Religious Sites

No known archaeological site is present within or around the project area. However, few places of historical significance are located near DHA area. The cultural and archaeological heritage sites are as mentioned below:

Shrine of Mistri Shah: The Shrine of Mistri Shah is located at about 4 km from the project site.

Clifton beach: Situated near the proposed project, it is a prize evening resort. It has beautiful parks and a baradari tower which is known commonly as Jehangir Kothari Parade. A beautiful promenade built of sand stone, known as Lloyd's Pier, leads all the way from the Clifton bluff to the beach nearly half kilometre away by a series of stairs with level walks in between. It commands a breath-taking panoramic view of the Arabian Sea, the sprawling city and the harbor of Karachi. The beach can also be approached by road winding round the high ground. Clifton's recreational areas, both old and the new one, attract a large number of visitors every evening.

Frere Hall: Built in memory of Sir Walter Frere, governor of Bombay. This was opened in 1865 and is one of the most striking buildings in Karachi. Though small in size, it has a charm of its own.

Abdullah Shah Ghazi (Shrine): The shrine of Abdullah Shah Ghazi (at 2.5 km from project site) attracts the pilgrims from all over the country who come to pay respects to one of the great saint of Sindh.

Mohatta Palace: It is considered as one of Karachi's landmark buildings. It was built in the 1920s in the "Rajistan Moghul" style as a private residence for a prominent merchant. It later served as the Ministry of Foreign Affairs and as the formal residence of Quaid-e-Azam Mohammad Ali Jinnah. The current restoration foresees the creation of a museum of Pakistani and regional decorative arts.

4.8.14 Law and Order Situation

Karachi has witnessed increasingly worst situation as far as law-and-order situation is concerned. Street crimes, dacoities and target killings have disturbed the peace of the city for last few decades. However, the residents of DHA have witnessed safe and secure environment with one of the lowest crime rates as compared to other areas of the city. The security personnel, police and Law Enforcement Agencies (LEAs) have a good track record in DHA. Due to this the future of DHA seems promising with full of life commercial and residential areas.

5.0 STAKEHOLDER CONSULTATION

The proposed project is to be implemented within DHA Phase VII of Karachi. Although the plot is not facing any social issues arising out of land acquisition proceedings or dislocation of authorized or unauthorized users of the proposed project site, the public consultation has been carried out and a social survey was undertaken to obtain the perceptions of the public regarding the project and whether the suggested remedial measures are necessary and that these shall be sufficient.

Stakeholder consultation is a tool for initiating and managing communications amongst the project proponent, stakeholders, and other affected persons/groups. It provides an avenue for the reviewing agencies and the project proponent to improve their decision-making capabilities, while nurturing an environment of understanding by actively involving organizations, groups, and individuals directly affected by, or involved in, the project. The purpose of involving the public in general and project affected persons; in the decision-making process is to have a fair interaction with all community groups and assuring them that every attempt would be made to reduce the negative impacts of the project, and that adequate remedial measures would be taken to recompense the loss of the affected persons, if any.

5.1 Identification of Stakeholders

Stakeholders are people, groups, or institutions that may be affected by, can significantly influence, or are important to the achievement of the stated purpose of a proposed intervention. The Primary and secondary stakeholders were identified based on standard following definitions:

Primary Stakeholders: People, groups or institutions affected positively (beneficiaries) or negatively by the project. For the purpose of this project, the primary stakeholder is Defence Housing Authority.

Secondary Stakeholders: People, groups, or institutions that are important intermediaries in the project delivery process e.g. the institutions, research organizations, government line agencies, or NGOs etc. The list of these stakeholders is provided in Table 5.1.

It is important to identify early in the process the key stake holders in the project. Their needs must be recognized, understood and incorporated at the very beginning of the project. Consultation will enable the proponent to understand the stakeholder's requirements and concerns as well as for the stakeholders to develop an understanding of the project.

Following are the secondary stakeholder identified for the proposed Arkadians Project:

Table **Error! No text of specified style in document.-2:** Secondary Stakeholders List

Secondary Stakeholders in the Project
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• Sindh Environmental Protection Agency (SEPA)
• International Union for Conservation of Nature (IUCN)
• Shehri- CBE (an NGO)
• Nearby Educational Institutions
• Clifton Cantonment Board

5.2 Purpose of the Stakeholder Consultation

The main purpose of conducting stakeholders' consultation is to influence the positive and negative outcomes. It gives an idea as well as it determines to some extent which consultation processes will be effective. In the earlier step it is not enough to pay attention to the immediate issues and the stakeholders who are affected. The aim, scope, the intended time span and history, all have an important influence on consultation. Sometimes the consultation has been done in order to gather information and more that. If, so the use of a low-key method of accessing a well-chosen sample may be adequate. Generally, a maximum diversity sample may work best. This comprehensive methodology has been adopted for the public consultation and for this EIA report.

5.3 Objectives of Stakeholder Consultation

The main objective of this public consultation is to get people's concerns and disseminate information about the project to the communities and its expected impact amongst the stakeholders. Another main objective of public consultation is to determine the severity of the impact of project activities on the environment. The specific objectives of stakeholder consultation are as follows:

To inform and acquire feedback from the secondary stakeholders on project activities

Obtain approval of all secondary stakeholders for carrying out project activities.

Obtaining stakeholder concerns and incorporating them into EMMP documents.

Increase public participation for the project hence making it easier for its implementation.

Take the people into confidence as well as providing them the opportunity that their views will be heard without biases.

5.4 Public Consultation

The general public consultation process is based on a three-stage process. This three-stage process was followed for the consultation of this project.

In the first stage, the preparation of formal public consultation document soliciting stakeholders' comment was done.

In the second stage, consultation document was finalized.

This was followed by actual field survey and information was collected and later transcribed.

In addition to the formal method of gathering data, informal consultations were performed as well, such as public consultation meetings, to gather additional information or to clarify information that is received. In the last stage, the data is analysed and published.

During the consultation period, flexible informal means of gathering additional information or clarifying the overall project and its outcomes were utilized. Before holding a public consultation, survey questions were asked from secondary stakeholders.

5.4.1 Stakeholders Concerns and Their Responses

In order to gather information several discussions were held with a number of private and Government departments about the land and the people, public sector infrastructure, possible impact if any, of project activities on the surrounding environment and any private or public concerns about the project under review.

Following are the concerns raised by the stakeholders with respect to the project:

Table Error! No text of specified style in document.-3: Stakeholder Concerns

Person/Community/ Organization	Concern Raised
Mr. Naeem Ahmed Mughal (Director General) Sindh EPA	Mr. Naeem Ahmed Mughal (Director General) Sindh EPA gave his comments to Mr. Syed Nadeem Arif. In his comments he showed some concerns regarding the issue of increase in traffic due to this project. Lot of traffic is expected while in construction phase. This area specifically has lots of recreational spots located in the vicinity of the project area like Golf Club, Moin Khan Academy, DHA-Schools etc., as well as the high risers like Creek Vista and upcoming Creek Marina. And now this huge development is coming up in this vicinity certainly increase the traffic manifolds. He suggested that the proponent should develop a proper traffic management plan to cater the traffic generated by the proposed project. He also emphasized that the wastes should not be dumped in the nearby shoreline and proper waste management plan. He suggested to have sewage treatment plant for this project.
Consultation with Ali Amjad Jaffari (DHA)	He emphasized that proponent of the proposed project should abide all the DHA Rules and Regulations and comply with the conditions on which the proponent of the project has been awarded the possession of the proposed plot for building The Arkadians project.
Consultation with Humaira Mahmood Khan (ADR)	She told that by looking at the conceptual view of The Arkadians project as provided to them in the concept plan appears impressive and comparable with good buildings of the developed countries. Further, she emphasized to prevent any ill effects that the residents of the DHA may face after the completion of the proposed project.

	The proponent of the project should ensure the availability of the required infrastructure and the utility services, which should commensurate with the requirements of the project and its surrounding area. She is hopeful that the project proponent has taken into consideration provisions required for planning such as overall security requirements, prevention of traffic congestions; required provision of water, electric power, gas, sewage system, garbage disposal, etc., which on the completion of the project shall be a drain and strain on the requirements of the residents living in the vicinity as well as far off areas of DHA.
Consultation with Dr. Shahid Amjad (IoBM):	He encouraged the project proponent to plant tall trees at the periphery, inside and outside the project boundary wall. A DHA school and sports complex exists in the immediate neighborhood. Plantation trees will help to absorb and reduce the noise levels. Plantation of soil tolerant trees/vegetation will assist mop up subsoil salinity. The greening of the project will facilitate the micro-environment, and reduce the salt-contents in the atmospheric aerosols. The proposed site is a reclaimed coastal area. The project proponent must ensure load bearing capacity of the soil. Ensure safe guard against subsoil liquefaction. The project proponent should also be encouraged to install renewable energies (solar/wind etc.) to illuminate the outdoor areas.
Consultation with Dr. Kaneez Fatima Mamdani (Dept. of Sociology)	She told that there should be adequate parking space in the proposed project to cater the needs of residents of apartments, visitors of the shopping mall and employees of the offices. Environmental Management Plan (EMP) proposed in the Environmental Impact Assessment (EIA) should be specific to the proposed project. It is suggested to the proponent of the project to conduct a detail social survey of the community residing around the proposed project area to have a clear view of the concerns related to the development of the proposed project as well as various other high-rise building projects which are being developed in the same area. The construction material used in the proposed project should be earthquake, cyclone and sea intrusion resistant.
Consultation with Dr. Omm-e-Hany (IES)	She told that high rise buildings are the symbol of urban character in our time of technological progress and economic prosperity so their development should be based on eco-friendly manner. The proposed project should develop a number of green belts in and around it in order to eliminate health problems and enhance clean air in the project area. Alternative energy options should be explored for The Arkadians to conserve natural resources like apartments should all be west-open to minimize the use of electrical energy. The proposed project should be insulated to conserve energy during summer season

5.4.2 Consultation Process and Meetings

The meetings were conducted in Urdu and English. Project description was given out in detail yet explained in simple language.

5.4.3 Outcome of the Stakeholder Consultation Meeting

All the respondents/ stakeholders have expected the following from the proposed project

Compliance of DHA Rules & regulations

Landscaping around the project to mitigate noise and air emissions

Safeguard against sub-soil liquefaction

Traffic Management

Waste water treatment and recycling options

Transportation and parking problems

Security issues

The proposed project will provide benefit of quality residential and commercial facilities catering to the high-end population of Karachi in general and DHA in particular.

6.0 POTENTIAL ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION MEASURES

6.1 Introduction

This section presents the screening process that identifies the environmental aspects and makes assessment of impact of different activities during the pre-construction, construction and operation phases of the proposed The Arkadians Project in Zone G, DHA Phase VIII, Karachi. The screening process has been a thorough review of literature, primary as well as secondary baseline data, and expert judgment, made assessment of the potential impacts of the said activities on the physical, biological and socioeconomic environment of the project. Mitigation measures have been proposed to reduce, minimize or compensate for the identified potential negative impacts.

Environmental impact of a project is worked out using various factors, so that an environmental management plan can be evolved to take mitigation measures.

Impacts arising from different stages of the project are summarized as per Fig. 6.1 below:

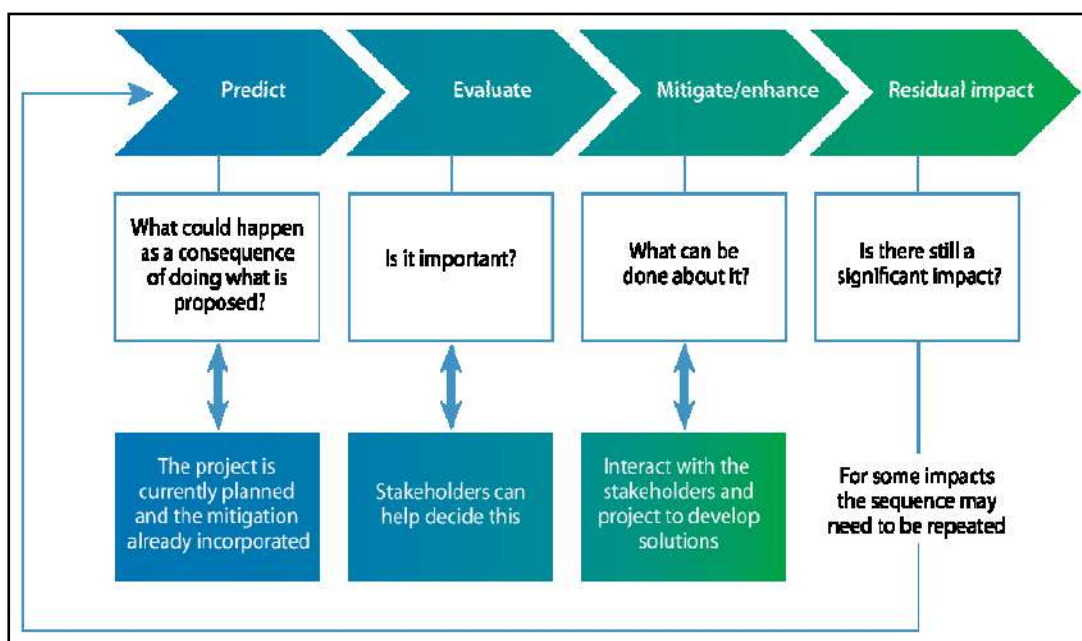


Figure Error! No text of specified style in document.-2: Schematic Diagram of Impact Assessment Process

The proposed The Arkadians Project is located in Zone G, DHA Phase VIII, Karachi and will involve the construction and operation phase impacts associated with the

proposed activities of the project at the proposed site. The environmental aspects of the project as identified by situation analysis which are based on the following:

Physical environment, particularly siting of the project

Biological environment, and Socio-economic environment.

The following section provides a summary of issues associated with the proposed The Arkadians Project in Zone G , Phase VII, DHA that occur during the construction and operations phases, along with recommendations for their management. Recommendations for the management of issues common to most large industrial facilities during the construction and operation phases are provided in the section below:

Environmental issues associated with the operational phase of proposed The Arkadians Project Area, primarily include the following:

Topography, Geology

Seismicity, Vulnerability to seismic shocks and Tsunamis

Liquefaction

Present Land use (Reclaimed land)

Siltation of waterways

Sediments migration

Vulnerability to soil erosion

Vulnerability of site to storm water drainage

Vulnerability of site to Wave action

Effect on marine ecology

Operation of traffic

Noise and other forms of nuisance during construction at site

Noise and other forms of nuisance in the microenvironment and macroenvironment of site

Air pollution due to fugitive dust emission and operation of equipment during construction

Social Impacts

Employment

Security issues

6.2 Methodology for Impact Assessment

Potential environmental impacts of the proposed “The Arkadians” Project on different features of micro and macro-environment pertain to construction and operation of 34/36 and 24/26 stories high rise residential towers, office enclaves and utility spaces.

The screening process proceeds by identifying the potential environmental aspects of siting the project, identifying the potential environmental impacts at pre-construction, construction and operational stages of the project and identifying the residual impacts after adoption of mitigation measures that may be needed at the outset of activities. The impacts on environmental resources from the proposed project will be short-term and temporary in nature.

A systematic strategy was developed to provide an assessment of the likely impacts on the micro and macro-environment of the Project site. The strategy included:

Review of General Guidelines;

Identification of potential environmental impacts by conducting survey, public consultation and using checklists;

Assessment of the intensity and significance of potential impacts by obtaining expert opinion and carrying out environment analysis;

Defining mitigation measures to reduce impacts to as low as practicable;

Predicting any residual impacts, including all long-term and short-term, direct and indirect, and beneficial and adverse impacts;

Monitoring of residual impacts

Guidelines and checklists were used for the verification of permissible levels of environmental parameters during project operation and classification of the site with respect to its pollution status, soil, and ecology including fauna, flora and wildlife, historical and archaeological sites.

The environmental aspects of the project were identified by situation analysis related to present land use, damage to vegetation, noise and other forms of nuisance during construction at site, air pollution due to fugitive dust emission and operation of equipment during construction, air pollution due to burning of wastes.

Site Visits have been carried out prior to proceeding with impact assessment with and objective are important in carrying out impact assessment based on following are to:

To assess environmental, social and safety status of site. This will involve walking the site.

To develop an understanding of the history of the site, the facility, and the surrounding properties to understand whether there might be historic contamination, permitting issues, or community issues.

To check history of the site age, surrounding properties and the kinds of activities that occur on them.

To check the current status of environmental permits and land use permits, and any restrictions placed on the facility, signs of spills, soil subsidence, or stressed vegetation.

To check the housekeeping of the facility (Housekeeping is often an important indicator of the capacity and drive for environmental compliance), age and type of equipment.

To check the type of pollution control equipment and the maintenance schedule, types of waste produced and where and how disposed.

To identify types of liquid effluents, where and how disposed and develop an understanding of the facility's health and safety regime. Check the availability and use of personnel protective equipment such as goggles, hard hats, safety gloves etc.

Assessment of impact of different activities, and of the resulting emission of noise and gases, and wastewater discharges during construction and subsequent operation of the proposed "THE ARKADIANS" are addressed in this section. The entire screening procedure was designed in such a way so as to provide a complete assessment of the impacts on the macro-environment and microenvironment of the project.

6.3 Screening of impacts due to Siting of the Project

The Project responds to the need of the segment of population that is seeking safety, security and improvement in quality of life. Availability of infrastructure facilities for establishment of "The Arkadians" a residential cum commercial complex and its location in the posh area of Phase VIII of Defence Housing Authority (DHA) ideally suits the siting of residential as well as commercial projects. Advantage of this aspect has already been taken by other builders and developers who have gone ahead with the construction of residential and commercial ventures in DHA.

It may be reiterated that stimulation of the economy of the country lies in the housing sector and hence in the building industry. Other sectors are not likely to help the economy as much as would the housing sector. Moreover, the centrifugal force that has been driving the population resident in the core areas is also being followed by the centripetal force in that there are scores of people who are seeking residence in the core areas. Building of high risers in the form of residential and commercial buildings responds just to sustain the equilibrium between the centrifugal and centripetal forces.

Approval from Environmental Protection Agency Sindh would also be sought through submission of this EIA of “The Arkadians”.

The posh area of DHA i.e. the project’s macro-environment already has a number of residential and commercial centers while yet another few are under construction. Siting of the “The Arkadians” would not add to the negative impacts such as water, air, and noise pollution already incurred due to the said centers, or to the existing level of pollution that has been allowed for densification and also because it is offset from Traffic Congested Area.

This Project would least likely cause any annoyance to the living environment, or disturb the peace and tranquillity of its surroundings, because a little bit of nuisance is created by the already established residential area which no regard for environmental protection and conservation.

The project has provided provision for parking of 6,650 cars on Ground and Basement for the residents of the building as well as visitors.

“The Arkadians” will be an add-on facility to the living environment that already enjoys a better quality of life and is set to transform from the traditional to modern lifestyle. The social environment that is in transition state but is set to transform, may offer resistance to changes that the siting of the Project may bring about.

“THE ARKADIANS” project has thirteen 13 residential towers (6 towers comprising of 34/36 floors and 7 towers comprising of 24/26 floors), 6 office towers and One retail/mall.. The segment of population is not likely to induce alteration in the quality of built environment or have impact on the social and cultural values of the population in the microenvironment.

“The Arkadians” will be having its own 24-hour security arrangement. Therefore, the Project is not likely to pose any significant risk in terms of safety, sanctity, serenity and security as well as privacy to the neighbourhood.

“The Arkadians” site has no sensitive areas such as protected sites including wildlife sanctuaries, game reserves or national parks, or any archaeological, historical or cultural heritage in its immediate neighbourhood; as such its siting would have no sensitivity in this regard. “The Arkadians” site is part of DHA when completed will not need much time to become a component of the ecosystem; as such this add-on housing / commercial complex will have no significant impact on the precious ecology. Removal of trees or greenery would not be involved.

The project when completed would require about 0.65 MGD water plus 25% of the total requirement to be reserved for fire fighting.

The air-shed of the site of “The Arkadians” has, according to the assessment of ambient air quality been classified as lowly to least polluted. The air quality of the air-shed of the macro-environment as well as that of the site itself will have no significant impact due to siting of the Project on the service lane of the project site.

The value of the adjacent properties would get increased as a result of the commercialization of the subject plot.

6.4 Screening of Potential Impacts at Planning & Designing (Pre-Construction) Phase

There are some of the environmental aspects which will be taken into account in the planning and designing phase of “The Arkadians” so that these may not impact the environment in both construction and operational phase. These impacts are as follows:

6.4.1 Land Acquisition

Creek Developers (Pvt.) Limited has acquired the land from DHA for 99 years of lease for Residential cum Commercial development activities. Hence there is no issue pertaining to land acquisition.

6.4.2 Structural Stability

The seismic zone map of Pakistan has divided the country into 4 seismic zones ranging in term of major, moderate, minor and negligible zones with respect to ground acceleration values.

Under this zoning the “The Arkadians” project site lies in Zone 2B in with minor to moderate damaging impact.

The recently developed guidelines for earthquake design of buildings in Karachi have assigned an expected Peak Ground Acceleration'(PGA) value of 0.20g for larger buildings such as the “The Arkadians” project.

“The Arkadians” project area lies into the Uniform Building Code (UBC) Zone 2B. As recommended by UNDP for Tsunami affected areas, the building structure would be reinforced concrete. The building design complies this requirement.

Mitigation Measures

During the construction, it will be important to maintain the stability of excavated area.

However, during monsoons or in the case of ingress of ground water (due to inadequate dewatering) it will be essential to protect the excavation walls with shoring/bracing.

6.4.3 Reduction of Liquefaction Hazard

There are basically three possibilities to reduce liquefaction hazards when designing and constructing new buildings.



A. Avoid Liquefaction Susceptible Soils

The first possibility is to avoid construction on liquefaction susceptible soils. There are various criteria to determine the liquefaction susceptibility of a soil. By characterizing the soil at a particular building site according to these criteria one can decide if the site is susceptible to liquefaction and therefore unsuitable for the desired structure.

There are a number of different ways to evaluate the liquefaction susceptibility of a soil deposit.

Historical Criteria

Observations from earlier earthquakes provide a great deal of information about the liquefaction susceptibility of certain types of soils and sites. Soils that have liquefied in the past can liquefy again in future earthquakes. First, you could investigate previous earthquakes to see if they caused liquefaction at your site. Information is also available in the form of maps of areas where liquefaction has occurred in the past and/or is expected to occur in the future.

Geological Criteria

The type of geologic process that created a soil deposit has a strong influence on its liquefaction susceptibility. Saturated soil deposits that have been created by sedimentation in rivers and lakes (fluvial or alluvial deposits), deposition of debris or eroded material (colluvial deposits), or deposits formed by wind action (aeolian deposits) can be very liquefaction susceptible. These processes sort particles into uniform grain sizes and deposit them in loose state which tends to densify when shaken by earthquakes. The tendency for densification leads to increasing pore water pressure and decreasing strength. Man-made soil deposits, particularly those created by the process of hydraulic filling, may also be susceptible to liquefaction.

Compositional Criteria

Liquefaction susceptibility depends on the soil type. Clayey soil, particularly sensitive soils, may exhibit strain-softening behavior similar to that of liquefied soil, but do not liquefy in the same manner as sandy soils are.

Soils composed of particles that are all about the same size are more susceptible to liquefaction than soils with a wide range of particle sizes. In a soil with many different size particles, the small particles tend to fill in the voids between the bigger particles thereby reducing the tendency for densification and pore-water pressure development when shaken.

The geologic process described above produce rounded particles. The friction between angular particles is higher than between rounded particles, hence a soil deposit with angular particles is normally stronger and less susceptible to liquefaction.

State Criteria

The initial "state" of a soil is defined by its density and effective stress at the time it is subjected to rapid loading. At a given effective stress level, looser soils are more susceptible to liquefaction than dense soils. For a given density, soils at high effective stresses are generally more susceptible to liquefaction than soils at low effective stresses.

B. Build Liquefaction Resistant Structures

If it is necessary to construct on liquefaction susceptible soil because of space restrictions, favorable location, or other reasons, it may be possible to make the structure liquefaction resistant by designing the foundation elements to resist the effects of liquefaction.

A structure that possesses ductility, has the ability to accommodate large deformations, adjustable supports for correction of differential settlements, and having foundation design that can span soft spots can decrease the amount of damage a structure may suffer in case of liquefaction (Committee on Earthquake Engineering, NRC, 1985). To achieve these features in a building there are various aspects to consider:

Shallow foundation Aspects

It is important that all foundation elements in a shallow foundation is tied together to make the foundation move or settle uniformly, thus decreasing the amount of shear forces induced in the structural elements resting upon the foundation. The well-reinforced perimeter and interior wall footings are tied together to enable them to bridge over areas of local settlement and provide better resistance against soil movements. A stiff foundation mat is a good type of shallow foundation, which can transfer loads from locally liquefied zones to adjacent stronger ground.

Buried utilities, such as sewage and water pipes, should have ductile connections to the structure to accommodate the large movements and settlements that can occur due to liquefaction.

Deep foundation Aspects

Liquefaction can cause large lateral loads on pile foundations. Piles driven through a weak, potentially liquefiable, soil layer to a stronger layer not only have to carry vertical loads from the superstructure, but must also be able to resist horizontal loads and bending moment induced deep foundation by lateral movements if the weak layer liquefies. Sufficient resistance can be achieved by piles of larger dimensions and/or more reinforcement. It is important that the piles are connected to the cap in a ductile manner that allows some rotation to occur without a failure of the connection. If the pile connections fail, the cap cannot resist overturning moments from the superstructure by developing vertical loads in the piles.



C. Improve the Soil

The third option involves mitigation of the liquefaction hazards by improving the strength, density, and/or drainage characteristics of the soil. This can be done using a variety of soil improvement techniques.

The main goal of most soil improvement techniques used for reducing liquefaction hazards is to avoid large increases in pore water pressure during earthquake shaking. This can be achieved by densification of the soil and/or improvement of its drainage capacity.

Vibroflotation

Vibroflotation involves the use of a vibrating probe that can penetrate granular soil to depths of over 100 feet. The vibrations of the probe cause the grain structure to collapse thereby densifying the soil surrounding the probe. To treat an area of potentially liquefiable soil, the vibroflot is raised and lowered in a grid pattern. Vibro Replacement is a combination of vibroflotation with a gravel backfill resulting in stone columns, which not only increases the amount of densification, but provides a degree of reinforcement and a potentially effective means of drainage.

Dynamic Compaction

Densification by dynamic compaction is performed by dropping a heavy weight of steel or concrete in a grid pattern from heights of 30 to 100 ft. It provides an economical way of improving soil for mitigation of liquefaction hazards. Local liquefaction can be initiated beneath the drop point making it easier for the sand grains to densify. When the excess pore water pressure from the dynamic loading dissipates, additional densification occurs.

Stone Columns

Stone columns are columns of gravel constructed in the ground. Stone columns can be constructed by the vibroflotation method. They can also be installed in other ways, for example, with help of a steel casing and a drop hammer as in the Franki Method. In this approach the steel casing is driven in to the soil and gravel is filled in from the top and tamped with a drop hammer as the steel casing is successively withdrawn.

Compaction Piles

Installing compaction piles is a very effective way of improving soil. Compaction piles are usually made of pre stressed concrete or timber. Installation of compaction piles both densify and reinforce the soil. The piles are generally installed in a grid pattern and are generally driven to depth of up to 60 ft.

Compaction Grouting

Compaction grouting is a technique whereby a slow-flowing water/sand/cement mix is injected under pressure into a granular soil. The grout forms a bulb that displaces and

hence densifies, the surrounding soil. Compaction grouting is a good option if the foundation of an existing building requires improvement, since it is possible to inject the grout from the side or at an inclined angle to reach beneath the building.

Drainage techniques

Liquefaction hazards can be reduced by increasing the drainage ability of the soil. If the pore water within the soil can drain freely, the build-up of excess pore water pressure will be reduced. Drainage techniques include installation of drains of gravel, sand or synthetic materials. Synthetic wick drains can be installed at various angles, in contrast to gravel or sand drains that are usually installed vertically. Drainage techniques are often used in combination with other types of soil improvement techniques for more effective liquefaction hazard reduction.

6.4.4 Threat to Biodiversity

The site visit of the project area by the EMC team has revealed that there is no significant flora and fauna of biological importance present within the project area. Therefore, there are no major threats will be imposed upon the flora and fauna of the proposed project area during construction and operational phase of the project. If still there is any impact which may impact on biodiversity, then the following measures will be adopted:

Mitigation Measures

Although, there are no visible impacts pertaining to the ecological environment of the proposed project site, but if there is any then, the following measures are imposed:

The vegetation which has been chopped down during the construction of the project will be re-planted.

The fauna removed from the proposed facility will be taken care off i.e. putting it in a protected area.

6.4.5 Archaeological / Cultural / Protected Areas

There is not a protected area which has been marked in the locality of the proposed project. There is not even a trace for the existence of cultural heritage in the close locality of the “The Arkadians”.

There is no evidence of any ancient civilization or there is any site belonging to the list of cultural heritage sites. Hence, no negative effects would likely to be imparted during construction; therefore, no mitigation measure is required.

Mitigation Measures

If any archeological site discovered during the construction stage of the project implementation, the contractor is constrained to:

Put a Halt on working activities;

Label the particular vicinity.

Inform the department of concern.

6.5 Screening of Potential Environmental Impacts at Construction Phase and their Mitigation Measures

The activities that take place during the construction phase of the project are levelling of site, construction and erection of building etc. and associated equipment's. The potential primary and secondary impacts on the environment due to these activities and their mitigation measures are discussed as under:

6.5.1 Erosion of Soil

Generally, the exposed soil after excavation for foundations is vulnerable to erosions and runoff by rains. Such a situation will be of temporary nature and short duration. It lasts only during the landscaping and concreting phase of construction at the site.

Mitigation Measures

The proposed mitigation measures are:

Covering the open soil during the construction phase till such time that the foundation is adequately concreted.

Intensification in fugitive dust emission caused by erosion of soil will be mitigated by appropriate measures to reduce the level of impact to minor significance.

Control of air emissions during construction will be done and the contractors are mandated to adopt the following measures:

- Exposed surface will be regularly wetted to effectively keep airborne dust levels to minimum
- Stockpiles of fine material will be wetted or covered with tarpaulin especially during windy weather conditions.

Site workers will be mandated to wear dust masks especially during dry and windy weather conditions

Other Mitigation Measures

Erosion will be reduced or prevented by adopting the following measures:

The project will be scheduled to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical.

After constructional activities, the site which is cleared temporarily will be re-vegetating promptly.

Off-site sediment transport will be reduced or prevented by the use of settlement ponds, silt fences, water treatment, as well as modifying or suspending activities during extreme rainfall and high winds to the extent practical.

The environmental impact of soil erosion can best be mitigated by removing vegetative cover only from the specific site on which construction is to take place and by disturbing the vegetation in adjacent areas as little as possible.

Disturbing the existing vegetation and natural contour of the land as little as possible can mitigate surface runoff.

Construction activities that result in the soil being laid bare could be scheduled in such a way that some type of vegetative cover appropriate to the site could be established prior to the onset of intense rain or windstorms.

If grass is to be seeded, mulch of straw will help to protect the soil from less extreme erosive forces until vegetative and root development begins.

Exposed surface was regularly wetted to effectively keep airborne dust levels to minimum.

The dredged soil will be contained in an enclosure to reduce the chances of runoff during the seasons of precipitation.

During the windy weather situation, the stockpiles of fine materials will be sprinkled with tarpaulin.

Site workers were mandated to wear dust masks especially during dry and windy weather conditions.

6.5.2 Soil Contamination

During the construction stage, the contamination of land occurs due to unchecked chemicals or fuel spillage through their improper handling, transportation and storage.

The sources of spills are:

- During refueling, the transfer of fuel from one container to the other;
- By the maintenance of vehicle and machinery;
- Leakage from the container or equipment's;
- Traffic Accident.

Mitigation Measures

Actions necessary to manage the risk from contaminated land will depend on factors such as the level and location of contamination, the type and risks of the contaminated media, and the intended land use. However, a basic management strategy will include:

Fuel oils, lubricants, and chemicals will be stored in covered dyked areas, underlain with impervious lining

Vehicles and equipment's maintenance will be taken place at specified site.

Washing of vehicles will be carried out in the designated areas.

Construction vehicles and machinery will be examined on a regular basis for leakage prevention.

Removal of oil and contaminated soil around the fuel and oil storage areas will be made possible by the availability of appropriate implements i.e. shovels, plastic bags and absorbent materials.

Contaminated media will be managed with the objective of protecting the safety and health of laborer at the site, the surrounding residents, and the environment.

The historical use of the land will be understood with regard to the potential presence of hazardous materials or oil prior to initiation of construction activities.

Plans and procedures will be prepared, to respond to the discovery of contaminated media to minimize or reduce the risk to health, safety, and the environment

6.5.3 Construction Waste

Typical construction waste generated during construction activity includes wasted concrete, steel and wooden scaffolding, cement bags, excavated soil, wood remains etc. This waste has the potential to cause negative impact on the surroundings if not properly managed and disposed to approved dumpsites. It could block nearby drainage channels that could ultimately cause localized flooding, particularly during the monsoon season. Irregular storage of this waste may have posed hazards to the workers at site and residents in the neighborhood. Poor waste management practices may have constituted short term as well as long term negative impact. The following measures will be adopted to manage the disposal of construction wastes:

Unusable wastes will be transported to be approved dumpsites.

Excavated soil will be disposed of through the regular channel of the demolition contractor.

Proper solid waste containers of adequate capacity are provided to cater to daily waste generation.

Other Mitigation Measure

Some other mitigation measures laid down as under will help to mitigate the impacts posed due to the constructional phase of the proposed project:

A comprehensive waste disposal plan to be developed to effectively manage this waste in large quantities.

The construction waste which will be sent for recycling like damage pipes left over steel, wooden and plastic pieces. While, the rest of the left-over waste will then be taken away to the dumping sites for disposal.

The construction material will be kept in a cover place, especially during the precipitation season.

The excavated soil will be re-used by adopting different methods, which will be used as a filling material for the construction of the industry.

Various waste containers for different types of waste will be deployed, in order to treat the waste in accordance with its nature.

The waste bins will be properly marked for each type of waste produced during the constructional activities.

The project area will contain the sewage and litter facility to overcome the problem of unchecked dumping of waste.

Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste.

Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time.

6.5.4 Ambient Air Quality

The major source of air pollution during the construction phase will be dust emission due to earth works and gaseous emissions from construction equipment. The major source of air pollution during the operation phase when the Project is functional will be the pollutant emissions from the stand-by generator in case of power breakdown. Impacts from each source and proposed mitigation measures are as follows:

Dust Emissions: Dust emission from construction site is a concern particularly if the site is near residential areas. The main health hazards are the particles smaller than 10 microns (designated as PM₁₀) as they are respirable. In cases where they reach the receptors, the dust is considered a nuisance as it may spoil property and affect visibility. Particulate matter emitted during construction activities may result in deterioration of ambient air quality in the vicinity of the source, and is usually a nuisance to the neighbourhood besides the construction workers. The impact on the environment would be considered significant if there is an increase in suspended particulate matter within and beyond the boundaries of the project site due to activities

at the site, or if the dust affects local property or results in complaints from the community. Potential sources of particulate matter emission during construction activities include earthworks (dirt or debris pushing and grading), exposed surfaces, exposed storage piles, truck dumping, hauling, vehicle movement on unpaved roads, and concrete mixing and batching. The quantity of dust that is generated on a particular day depends on the magnitude and nature of activity and the atmospheric conditions prevailing on the day.

The following mitigation measures will be adopted during the earthwork and construction phase:

Water will be sprinkled daily or when there is an obvious dust problem on all exposed surfaces to suppress emission of dust.

Dust emission from soil piles and aggregate storage stockpiles will be reduced by appropriate measures. These include:

- Keeping the material moist by sprinkling of water at appropriate frequency
- Erecting windshield walls on three sides of the piles such that the wall project 0.5 m above the pile, and covering the pile, for example with tarpaulin or thick plastic sheets, to prevent emissions.

Construction materials that are fragile and vulnerable to raising visible dust will be transported only in securely covered trucks to prevent dust emission during transportation.

The exposure of construction workers to dust will be minimized by provision of dust masks.

Vehicle and Equipment Exhaust: Combustion exhaust from vehicles and construction equipment can affect the ambient air quality of the site surroundings. The impact would be potentially significant when the ambient air quality deteriorates due to emissions from construction equipment and machinery or the construction generators etc. beyond the guidelines especially at the environmental receptors in the neighbourhood. The exhaust emissions will include particulate matter (PM), hydrocarbons, Oxides of Nitrogen, Sulphur, and Carbon (NOx, SO₂, CO).

Mitigation Measures

The emissions from operation of construction equipment and machinery as well as generators is not expected to have been significant as to affect the ambient air quality of the area in view of the observation that the site is located at the waterfront and receives fresh air from the sea. The small amount of exhaust emissions from the operation of generators and equipment are expected to have dispersed with the prevailing wind and may not have had any significant impact on the local air quality. Adoption of following mitigation measures will result in further reduction / prevention of these emissions.

All vehicles, generators and other equipment used during the construction will be properly tuned and maintained in good working condition in order to minimize emission of pollutants.

The stack height of the generators during operation phase will be vented through vertical stacks to minimize exposure at ground level.

6.5.5 Impact on Ambient Noise Levels

The construction work, delivery of building materials by heavy trucks and by the use of machinery/equipment including bulldozers and metal grinders will contribute high levels of noise within the construction site and the surrounding areas.

In general, human sound perception is such that a change in sound level of 3 dB is clearly noticeable, and a change of 10 dB is perceived as a doubling or halving of sound level. The noise in the project area will increase during subsequent construction and completion of the project “The Arkadians” and may result in disturbance to the nearby receptors unless it is contained within the appropriately fenced and covered site of the Project.

Baseline noise measurements were obtained through continuous monitoring for a 24 hour period at the project site. It was found from the noise monitoring that the typical average noise level in the project area was 63-69 dB (A). The National Environmental Quality Standards for noise require that the sound level in residential and commercial areas should not exceed 55 dB and 65 dB respectively during day time and 45 dB and 55 dB respectively during the night time.

A detailed OHS Plan is attached as **Annexure IV** and shall be followed in letter and spirit.

During the construction phase of the “The Arkadians”, noise is likely to be generated by the following activities:

Operation of pile drivers.

Earth moving and excavation equipment.

Concrete mixers.

Transportation of equipment's.

Diesel generator.

Increase in transport noise from within the site from the nearby roads.

Elevated noise levels within the site can affect project workers, residents and passer-by and other persons within the vicinity of the project site.

Mitigation Measures

The following measures are adopted in order to keep the noise within the limits as prescribed by the EPA:

The activities associated with greatest potential to generate noise will be planned during the day period that will result in least disturbance to the nearby residents at night.

Noise control devices will be used such as temporary noise barriers and deflectors for impact activities.

The residential area will be separated from traffic noise zones and the protection of schools and hospitals by green belts, public gardens, etc.

Transport associated with the construction of the project will be avoided or minimized through already existing residential areas.

Noise and vibration will be minimized in the projects site and surrounding areas through sensitization of the truck drivers to switch off vehicle engines while offloading material.

Truck drivers will be instructed to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as mosques, schools and hospitals.

Construction machinery will be kept in good condition to reduce noise generation.

All generators and heavy-duty equipment's will be installed and placed in enclosures to minimize ambient noise levels.

Table Error! No text of specified style in document.-4: Construction Equipment Noise Ranges dB (Average)

Equipment	Peak Noise Range at 15.2 m	Typical Peak Sound level in a Work Cycle	Typical ' Quieted Equipment' Sound Level	Equivalent Noise Level in an 8-hr Shift at Receptor 150m from Source.
Batching plant	82-86	84	81	62.9
Concrete mixers	76-86	85	82	63.9
Cranes	70-94	83	80	54.5
Excavators	74-92	85	82	59.5
Tractors and trolleys	77-94	88	85	62.1
Graders	72-92	85	82	59.5
Bulldozers	65-95	80	75	54.5
Paver	87-89	88	80	62.5
Pumps	68-72	76	75	54.9
Diesel generators	72-82	78	75	58.1
Vibrators	68-82	76	75	50.5

Drilling Machines	82-98	90	87	61.5
Compressors	74-84	81	71	58.1
Dumpers	77-96	88	83	59.5
Road Rollers	73-77	75	72	49.5

6.5.6 Water Consumption

Water will be required during the construction activity for human consumption at the construction stage as well as for the construction activities including sprinkling of water for dust suppression.

Drinking Water: It is estimated that peak water requirement during construction phase will be about 10,000 liters/day for about 150 workers. Potable water is being provided for drinking for the construction workers and regular testing of the water is being conducted.

The local residents rely mostly on bottled water or else water obtained from KWSB supply lines through DHA. The water usage by the building will not affect their water requirement during the construction phase.

Mitigation Measures

Adherence to the following measures will ensure efficient use of water during the subsequent stage of construction:

A complete record of water consumption during the construction phase will be maintained.

Water conservation practices will be adopted to prevent wastage of water.

The water supply lines will be checked and repaired for leaks, if any, in order to reduce wastage of water.

Use of water efficient sanitary fittings such as low flush toilets, water efficient shower heads, and aerators on faucets will be ensured throughout the Project cycle.

A water management plan has been developed for the Project which shall be followed in letter and spirit

6.5.7 Impacts of Wastewater Generation

During the construction phase, the wastewater is generated from the project site is mainly due to the municipal activities, run-off from the project site during the season of precipitation, washing and leakage of fuel from the construction vehicles etc. Construction activities of the project may include the generation of sanitary wastewater discharges in varying quantities depending on the number of workers involved.

The source of wastewater includes toilets, washrooms, laundry and kitchen. The wastewater would be routed to the existing municipal drain/sewerage system. This

wastewater would comply with the SEQS values provided that other hazardous wastes (i.e. paints etc.) are not mixed with it.

The impact of disposal of such wastewater would not be significant since it is expected to comply with the Sindh Environmental Quality Standards (SEQS) for municipal effluent.

The untreated wastewater disposal will deteriorate the water quality of the surface and groundwater resources as well as contaminate the soil quality near the project site. The impacts which will be imposed upon due to the construction activities include the disturbance of flora and fauna of the area.

Mitigation Measures

The following are the recommendations to reduce and control the wastewater generated during the constructional activities:

Maintenance of vehicles and equipment's used in the construction phase of the proposed project, in order to overcome the generation of wastewater at large scale.

Washing of vehicles and construction machinery will be restricted to a designated area.

Wastewater will not be disposed of directly into the water bodies, but first be treated and then the effluent will be disposed of in a proper manner.

Development of wastewater treatment facility i.e. septic tank, at the site of the proposed project area.

The wastewater treatment facility of the project will be leak proof.

Wastewater generation will be minimized by controlling the pollutant at the source.

The oily waste will be contained before disposing the wastewater into the sewer.

Regular monitoring of the wastewater generation will be taken into consideration.

Adequate portable or permanent sanitation facilities serving all workers will be provided at all construction sites.

Sewage will not be mixed with any other waste.

6.5.8 Impacts of Construction Waste

The construction phase of the project is expected to generate wastes including; packing waste; scrap, excess construction materials and debris, domestic wastes from construction camp, empty containers and drums, used lubricating oils and chemicals etc. Besides being an eyesore, the solid waste can also pose health hazards; pollute soil surface and ground water if disposed of improperly.

The impact of solid waste disposal would be significant if the waste management is not carried out appropriately. This may adversely affect the health of workers, cause soil pollution, and deteriorate the quality of surface water and groundwater. Also if excessive wastes are generated, recyclable wastes are not recycled, wastes are scattered, handling of wastes will result in contamination, and wastes are improperly disposed of, the result would be serious degradation of the environment.

Waste generated as a result of construction activity will be inherently less reactive and chemically inert under normal conditions however, its handling and storage may pose adverse impacts of minor nature which could be controlled by employing the recommended mitigation measures in the EMP.

Hazardous waste generated during the construction activities, if not managed properly can pose health hazards, pollute or alter quality of soil, surface and groundwater.

Waste from construction and associated activities will be properly managed by proposed measures described in the following section:

Mitigation Measures

A waste management plan has been developed for the subsequent construction stage of the project. The following are the key elements of the waste management system:

Separate bins will be placed for different type of wastes - plastic, paper, metal, glass, wood, and cotton.

Recyclable material will be separated at source. The recyclable waste will be sold to waste contractors for recycling.

Non-hazardous non-recyclable wastes such as construction camp kitchen wastes will be disposed of in landfill site through municipal administration or approved waste manager/contractor.

No wastes will be dumped at any location outside the site boundary.

All hazardous waste will be separated from other wastes. Hazardous wastes will be stored in designated areas with restricted access and proper marking. Hazardous wastes will be disposed of through approved waste manager/contractor.

Surplus construction materials including partially filled chemical and paint containers will be returned to suppliers. Inert construction wastes will be disposed of onsite as fill material or sold as scrap to contractors.

Records of all waste generated during the construction period will be maintained. Quantities of waste disposed, recycled, or reused will be logged on a Waste Tracking Register.

Training will be provided to personnel for identification, segregation, and management of waste.

The waste management plan developed for construction phase shall be followed in letter and spirit.

6.5.9 Operation of Vehicular Traffic

Learning from experience of the past stage of construction it is envisaged that there would be substantial increase in the traffic volume during the construction and operation / completion of Project. Vehicular traffic management will have to be undertaken seriously to restrain unnecessary traffic jams that may cause annoyance to the commuters. Additional traffic generated by operation of commercial area on completion of the project will induce significant impact if the traffic volume is sufficient to cause congestion and becomes a hassle for the existing road users.

As per the prevailing Building Regulations, the builders and developers of residential and commercial projects are mandated to reserve sufficient car parking space for the residents and their visitors within the project building, in case the builder intends to provide additional parking floors, they are allowed to construct without infringing into the permissible Floor Area Ratio (FAR).

Appropriate building space has been allocated to cater for the parking requirements of the vehicles. Moreover, induction of traffic management plan will result in the smooth flow of traffic during the rush hours.

Mitigation Measures

The following mitigation measures are being adopted to remove the constraints to smooth flow of traffic:

Heavy traffic during construction phase will come to the project site during late night hours.

Project vehicles shall not be fitted with pressure horns.

Speed of vehicles will be regulated during construction phase.

Designated parking areas will be provided for different type of project vehicles within and around the project site.

Traffic management plan will be introduced to manage smooth flow of vehicular traffic and to avoid traffic jam and long queues.

Traffic management plan will be implemented and monitored.

Vehicles will be parked at designated parking areas during operational phase.

Parking of vehicles alongside the road would be prohibited at all time.

Car parking at grade allows for free flow of cars with minimum waiting time.

A detailed traffic study has been conducted through a competent Traffic Consultant.

6.5.10 Materials Selection

General specification/details have been worked out in respect of type of structures, concrete, and all other materials required for the Construction of “The Arkadians” Project. The following measures will be adopted to ensure sustainable development of the Project:

Mitigation Measures

The structures and materials will, in the subsequent construction stage, conform to recommended standards and follow standard practice of civil works.

Materials including paving stones, crush, gravel and sand will be brought from commercial quarries located in Sindh province. Environmentally sound materials and goods will be selected, with priority being accorded to products meeting national and international standards.

Traditionally well-trying materials and components will be selected and selection of construction materials would be based on sustainable source.

Construction site will be adequately isolated to prevent entry of public and general safety measures will be evocatively imposed throughout the construction period.

Temporary inconveniences due to construction works will be minimized through planning and coordination with DHA.

The production, use and disposal of building materials during the construction stage of Project will utilize considerable amount of energy and resources; all attempts will be made towards efficient consumption and minimization of wastage of water, energy and materials

Best practice of energy efficiency will be adopted in the building design. The Project building would be constructed with high level of thermal insulation

Large open spaces have been provided between the Towers for natural lighting and cross ventilation

The environmental impacts arising from selection of building materials and components would take account of the environmental issues during the materials selection process, and introduce Recycling strategies such as Reuse and Reduction of Wastewater.

The design of concrete building structure with use of low energy glass on windows and doors to reduce carbon footprint.

6.5.11 Occupational Health and Safety

Site-specific occupational health and safety hazards are also critical to identify based on job safety analysis or comprehensive hazard or risk assessment. Health and safety management planning should include the adoption of a systematic and structured approach for prevention and control of physical, chemical, and biological health and safety hazards. Contractor shall ensure that Job Hazard Analysis (JHA) is performed prior to commencing jobs. It shall also be ensured that the JHA is reviewed after the following,

Whenever work is stopped

Every time work conditions or the job scope changes

Persons working or visiting the job shall review and acknowledge the JHA by their signature

A. Crane and Lifting Operations

For all Crane & Lifting Operations Contractor shall ensure full compliance with standard operating procedures. Contractor shall develop a site-specific pre-lift checklist which includes the following at minimum:

Crane rigging capacity adequately for load

Condition of slings

Rigging condition adequate for load

Area of swing or travel unobstructed

Multiple crane use

Power line approach distance maintained

Stability and footing

Taglines and spotters

Illumination and weather

Signal operator

Job hazard analysis and other permits

All lifting and rigging activities shall be supervised and conducted by a competent person or team, Contractor shall maintain a lifting gear registry for all lifting gear on-site inclusive of a listing of all lifting gear, copies of equipment certificates (manufacturer, safe working load, serial number) and the inspection/recertification frequency.

B. Forklifts and Non-Road Vehicles

Contractor should ensure forklift and non-road vehicles are fit for purpose and operated according to manufacturer's requirements. Only competent operators are permitted to operate forklifts and non-road vehicles.

At minimum, all forklifts and non-road vehicles shall be equipped with following equipment:

Seat belts

Horn

Emergency Brake

Wheel chock

Labeled Controls

Fire Extinguishers

First Aid Kit

Back-up Alarm

Annual inspection shall be completed by a qualified third party, records of which shall be readily available at site

C. Hazardous Substance Handling and Storage

Contractor should ensure that chemicals are handled and stored in accordance with the manufacturer recommendations found in the MSDS. Chemicals should be stored in a manner which will minimize releases to soil, groundwater or the atmosphere.

Containers and tanks which are used to store hazardous substances shall be,

In good conditions

Compatible with the material stored inside

Closed when material is not being transferred into or withdrawn from them

Flammable or combustible liquids shall not be stored in areas used for exits, stairways, or normally used for safe passages.

Flammable chemicals shall be stored in flammable storage cabinets, room or building when the volume stored exceeds 25 gallons (95 liters).

Electrical pumps shall not be used to transfer flammable or combustible liquids. Toxic chemicals shall be stored and handled as defined in the chemical MSDS. Explosive

products should be handled and stored according to applicable regulations. Explosive storage shall be located away from corrosives, flammable, oxidizers, or acids.

D. Scaffolding

Contractor is responsible to establish periodic inspection, certification and recertification program for scaffold works. Only qualified worker is authorized to erect, inspect and certify scaffold. All scaffolds should have a guardrail system on each open side, up to the access point. It should be equipped with toe boards having suitable access ladder.

E. Over-exertion

Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries at construction site.

Mitigation Measures

Recommendations for their prevention and control include:

Workers will be trained with lifting and materials handling techniques before the construction of the project, including the placement of weight limits above which mechanical assists or two-person lifts are necessary.

Work site layout will be planned to minimize the need for manual transfer of heavy loads.

Tools will be selected and work stations would be designed to reduce force requirements and holding times, which promote improved postures, including, where applicable, user adjustable work stations.

Administrative controls, such as job rotations and rest or stretch breaks will be implemented into the work processes.

F. Slips and Falls

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction site.

Mitigation Measures

Recommended methods for the prevention of slips and falls from, or on, the same elevation include:

Good house-keeping practices, such as the sorting and placing loose construction materials in established areas away from foot paths, would be implemented.

Excessive waste debris and liquid spills will be cleaned up regularly.

Electrical cords and ropes will be located in common areas and marked corridors.

Slip retardant footwear will be used.

G. Work at Heights

Falls from elevation associated with working with ladders and scaffolding are among the most common cause of fatal or permanent disabling injury at construction site. If fall hazards exist, a fall protection plan will be in place which includes one or more of the following aspects, depending on the nature of the fall hazard.

Mitigation Measures

Training and use of temporary fall prevention devices, such as rails or other barriers able to support a weight of 200 pounds, when working at heights equal or greater than two meters or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface.

Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards as well as fall rescue procedures to deal with workers whose fall has been successfully arrested.

Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones, as well as securing, marking, and labeling covers for openings in floors, roofs, or walking surfaces.

H. Struck By Objects

Construction activities of the project may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities.

Mitigation Measures

Techniques for the prevention and control of these hazards include:

Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap.

Temporary fall protection measures in scaffolds and out edges of elevated work surfaces would be used, such as hand rails and toe boards to prevent materials from being dislodged.

Appropriate PPE such as safety glasses with side shields, face shields, hard hats, and safety shoes, would be wore.

I. Moving Machinery

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise.

Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving.

Mitigation Measures

Techniques for the prevention and control of these impacts include:

The location of vehicle traffic, machine operation, walking areas, and controlling vehicle traffic will be planned and segregated through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic.

The visibility of personnel will be ensured through the use of high visibility vests when working in or walking through heavy equipment operating areas as well as training of workers to verify eye contact with equipment operators before approaching the operating vehicle.

Inspected and well-maintained lifting devices will be used that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

J. Other Site Hazards

Construction of site may pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms.

Mitigation Measures

It can be prevented through the implementation of project specific plans and other applicable management practices, including:

Use of waste-specific PPE based on the results of an occupational health and safety assessment, including respirators, clothing/protective suits, gloves and eye protection.

6.5.12 Energy Use

Electricity during construction phase will be produced from diesel generators. A back up diesel operated generator will also be installed in case of emergency or suspension of power supply from the mains. The power produced will be significant in terms of costs both environmental and economic. Since energy produced from non-renewable resource results in CO₂, SO₂, and NO_x emissions, it is important to ensure that energy is used prudently and best management practices are adopted in building design. Energy saving techniques such as Energy efficient mechanical systems and Passive ventilation/cooling will be employed to conserve energy.

6.5.13 Community Health and Safety

A. General Site Hazards

Projects should implement risk management strategies to protect the community from physical, chemical, or other hazards associated with sites under construction.

Risks may arise from inadvertent or intentional trespassing, including potential contact with hazardous materials, contaminated soils and other environmental media, buildings that are under construction or excavations and structures which may pose falling and entrapment hazards.

Mitigation Measures

Risk management strategies may include:

Access to the site will be restricted through a combination of institutional and administrative controls.

Removing hazardous conditions on construction sites that cannot be controlled affectively with site access restrictions, such as covering openings to small confined spaces, ensuring means of escape for larger openings such as trenches or excavations, or locked storage of hazardous materials.

B. Disease Prevention

Increased incidence of communicable and vector-borne diseases attributable to construction activities represents a potentially serious health threat to project personnel and residents of local communities.

Mitigation Measures

The mobility of the community living in the area will be restricted from the project site in order to prevent from catching any type of communicable diseases.

Any laborer found to catch any type of disease will leave the site immediately; and would be given proper medical facilities.

C. Traffic Safety

Construction activities may result in a significant increase in movement of heavy vehicles for the transport of construction materials and equipment increasing the risk of traffic-related accidents and injuries to workers and local communities.

Mitigation Measures

The incidence of road accidents involving project vehicles during construction will be minimized through a combination of education and awareness-raising, and the adoption of procedures.

6.6 Screening of Potential Environmental Impacts at Operational Stage and their Mitigation Measures

During operational phase of the project, various activities may have impact on some or other environmental parameters. Various environmental attributes are to be studied during this phase for their overall impact on the surrounding environment.

6.6.1 Solid Waste Generation and Disposal

The Project will generate solid waste from residential and commercial units of the project. The solid waste will mainly include food waste, paper and packaging material, plastic bottles and glass. If not properly managed and disposed of this can pose serious environmental threat of pollution not only to the residents and visitors to the complex but also to the surrounding settlements.

The quantity of solid waste to be managed will be categorized into organic and recyclable components. Nearly half of the waste generated is expected to be of organic nature i.e. biodegradable and the remaining as recyclables. Therefore, waste segregation can solve much of the solid waste management problem. The viable options after storing, collecting and transportation of segregated waste components for its ultimate safe disposal are composting and recycling, respectively which needs to be carefully designed and managed properly.

Mitigation Measures

The following measures would reduce the negative impacts of solid waste disposal:

All solid waste shall be segregated into organic and recyclable waste at source and then collected, stored, and transported for ultimate safe disposal.

Handling and disposal of such waste shall be managed by a dedicated waste management contractor.

The solid waste management plan developed shall be followed and facilities for collection, storage and transportation will be established and organized.

The viable options after storing, collecting and transportation of segregated waste components for its ultimate waste disposal are composting and recycling respectively which needs to be carefully designated and managed properly.

Other Mitigation Measures

The following other mitigation measures would be adopted to combat from the impacts imposed upon the project site due to the solid waste generation activities in the operational phase:

Storage facilities will be created and established by taking into account quantities of waste generation in the apartment complex and the population densities.

A storage facility will be so placed that it is accessible to resident of the project.

A storage area will be allocated for storage and pre- treatment of the waste. This storage area will be covered and the pollutants from the waste would not affect the surrounding.

Local authorities will provide different colored bins for different categories of waste.

All solid waste will be segregated into organic and recyclable waste at source and then collected, stored and transported for ultimate safe disposal.

Handling and disposal of such waste will be managed by a dedicated waste managing contractor.

The solid waste management plan will be developed and facilities for collection, storage and transportation will be established and organized.

Adequate provision will be made for storage of solid waste.

Flats and multi-storied buildings will have bulk dustbin type containers

6.6.2 Wastewater Generation and Disposal

“The Arkadians” on becoming functional will generate wastewater which will be mainly sewage. Small quantities of hazardous waste will also be produced during the maintenance activities in the building (such as oily waste etc.).The cleaning waste generated by the use of surfactant and cleaning agents used during the operational phase of the luxury apartments.

The wastewater generated can be a potential source of pollution to the surface and ground water resources of the area.

All type of wastewater generated (i.e. drainage of sewage, showers and kitchen effluent etc.) will be directed to the wastewater treatment plant prior to disposal into a nearby out fall sewer. This will ensure the specifications stipulated in SEQS will comply.

Mitigation Measures

Following measures will be adopted for effective management of wastewater during the operational phase of the project:

Grease interceptor and/ or oil skimmer to be installed on kitchen effluent to maintain oil levels within SEQS limits.

Waste segregation measures would be employed to minimize entry of solid waste into the wastewater stream.

Water conservation strategies will be employed to avoid wastage of water.

Periodic preventive maintenance of pumps, diffusers and other ancillary equipment's.

Periodic monitoring of wastewater to ensure compliance with SEQS.

Provision of sedimentation tank or holding tank, so that the effluent is primary treated and then disposed off to the main sewer line.

The cleaning agents used will be non-hazardous.

6.6.3 Water Consumption

Water requirement during the operation phase of Project will be about 367,000 gallons per day for which the Proponent has obtained permission & assurance from the DHA.

Mitigation Measures

Adherence to the following measures will ensure efficient use of water during the subsequent stage of operation:

A complete record of water consumption during the operation phase will be maintained.

Water conservation practices will be adopted to prevent wastage of water.

The water supply lines will be checked and repaired for leaks, if any, in order to reduce wastage of water.

Use of water efficient sanitary fittings such as low flush toilets, water efficient shower heads, and aerators on faucets will be ensured throughout the Project cycle.

Other Recommended water management strategies for domestic water usage at the facility include:

All water usage (lit/unit) at facility should be recorded.

All the main water inlets will be provided with water flow meters to record consumption of water.

Drinking water and service water sources should be clearly labeled.

The facility should put initiatives in place to reduce water usage.

Use signs and educational initiatives to reduce water wastage and consumption among workers.

Regulate water pressure.

Check for leaks.

Install appropriate technological solutions to reduce water consumption. Some conservation measures that can be taken in apartments are to install low-flow shower

heads and toilets, reduced water capacity washing machines at laundry and dishwashers at kitchen etc.

Reuse and recycle water as much as possible for example by using gray water for flushing toilet. Gray water is the term use for the used water that goes down our sinks and shower drains. Black water is another term for the water ‘and stuff’ that goes down from our toilets. The gray water from bathrooms sink can be reused it to flush the toilets as shown in figure—thereby turning gray into black. By using this recycling system can reduce water usage in a two-person accommodation by approx. 5,000 gallons a year. It is also not very expensive, and, of course, it will eventually pay for itself in water bill savings.

Collect rain water where feasible.

Sanitary wastewater includes that water generated from apartments including restrooms, kitchen, mess, showers, toilets and others. This sanitary wastewater can also be divided into sewage/black (toilet) and gray water. The gray water comes from sinks and showers and this can be collected separately and treated on site if required and can be reused for gardening, floor washing and other purposes. Sewage (toilet water) is collected in the sewerage treatment plant and treated at site.

Management is planning to install sewerage treatment plant for the disposal of wastewater from the facility. This system effectively eliminates contaminants from the effluent and then releases the effluent water for non-potable uses such as watering grass.

6.6.4 Energy Consumption

During operation, the family units will use a lot of electrical energy mainly for domestic purposes including lightning, cooking, running of air-conditioning equipment, running of refrigerating systems, pumping water into reservoirs.

During operation phase, power supply from Karachi Electric (K.E) will be made available. A back up diesel operated generator will also be installed in case of emergency or suspension of power supply from the mains. The power produced will be significant in terms of costs both environmental and economic. Since energy produced from non-renewable resource results in CO₂, SO₂, and NO_x emissions, it is important to ensure that energy is used prudently and best management practices are adopted in building design. Energy saving techniques such as Energy efficient mechanical systems and Passive ventilation/cooling will be employed to conserve energy.

Since electricity generation involves utilization of natural resources, excessive electricity consumption will strain the resources and negatively impact on their sustainability.

Mitigation Measures

The energy-efficient lighting system installed for the project will contribute immensely to energy saving during the operational phase of the project.

The occupants of the apartments will be sensitized to ensure energy efficiency in their domestic operations.

The energy usage during the operational phase will be monitored and targets would be set for efficient use of energy.

6.6.5 Air Emissions

During the operational phase, air emissions will mainly come from generators. If vented at lower heights, the exhaust gases are likely to disperse locally and cause localized pollution to the working staff. Other emissions coming from this project will be from the exhausts of additional traffic movement related to proposed project activity.

Mitigation Measures

Impacts of Emissions may be reduced to prescribed level by attempting the following measures:

Monitor all exhausts at regular frequency.

Regularly carry out ambient air quality monitoring at various points on the access road and immediately outside the proposed project premises.

Carbon monoxide detectors are to be provided in car parking which would be interlocked with the ventilation system.

Carry out regular maintenance of generators.

6.6.6 Traffic Flow and Congestion

Traffic will be generated in the operational phase of the project due to the commercialization of the project site. With this project coming on stream, it is expected that the traffic flow is going to increase. It is expected to have only localized attraction from the surrounding areas, which may not contribute substantially to the parking and the travel demand requirement i.e. Trip attraction/generation. Traffic congestion is going to further increase during peak hours.

Also, as per the prevailing Building Regulations, the builders and developers of residential and commercial projects are mandated to reserve sufficient car parking space for the residents and there visitors within the project building.

Appropriate building spaces have been allocated to cater for parking requirements of the vehicles. Moreover, induction of traffic management plan will result in the smooth flow of traffic during the rush hours.

Mitigation Measures

Following measures will be adopted by to minimize the impacts of traffic flow.

Designated parking areas will be provided for the type of project vehicles within and around the project site.

Traffic management plan will be introduced to manage smooth flow of vehicular traffic and to avoid traffic jam and long queues.

Traffic management plan will be implemented and monitored.

Vehicles will be parked at designated parking areas during operational phase.

Parking of vehicles alongside the road would be prohibited at all times.

Engineering design to examine vehicles exit and entry strategy so that it aligns with the traffic flow to cause minimum hindrance.

Ramp slopes and passage areas to cater for worst case scenarios traffic flow on the main and service roads.

6.6.7 Illumination

There will be extensive internal and external lightning in and around the apartments, office areas and parking area. Purpose of external lightning is to provide safe movement of pedestrians and vehicles over frequented routes. However, at the same time external lightning has a potential to cause nuisance to the neighbouring communities.

Mitigation Measures

The issue highlighted above may be avoided by adopting the following points:

Evaluation of minimum illumination requirement will be carried out in MEP Services Concept Report, for individual areas.

It is suggested to keep the levels at minimum for all external lightning.

6.6.8 Fire

Fire is one major hazard in high rise buildings. Fires can cause loss of life and property. However, at the same time fires have the potential to severely harm the people in the vicinity and affect the environment.

Mitigation Measures:

Risks involved with fire hazard can be reduced by adopting following measures:

For all engineering designs, NFPA (National Fire Protection Association) codes needs to be followed.

Standard fire and smoke detection and protection devices such as alarms, fire hoses and hydrants to be provided in all critical areas.

The facility will possess a detailed emergency and evacuation plan that will be regularly drilled to make sure that the responsible staff remains trained at all times.

Firefighting equipment such as fire extinguishers and hydrant systems will be maintained at strategic locations within the premises.

Regular inspection and servicing of the extinguishers will be undertaken by a reputable service provider and record of such inspections should be maintained.

Signs such as “NO SMOKING” will be prominently displayed within the premises, especially in parts where inflammable material are handled.

6.6.9 Land Use and Aesthetics

Construction of multi-storey buildings is in line with the objectives of sustainable development that aims at improvement of quality of life with optimum utilization of resources, in this case densification of an area by construction of multi-storied buildings that are self- contained in having their own power generation, water supply and sewage disposal system in addition to provision of parking space. The proponent of “The Arkadians” will accordingly be mandated by the EPA to ensure sustainability by the procedure just suggested.

Accordingly the development and launching of the Project will add the skilfully and sustainably designed multi-storied “The Arkadians” as a landmark to the skyline of Karachi and produce positive impact on the aesthetics of the urban environment.

With 24-hour security system all over the building the designers have ensured that the concerns on invasion of privacy are alleviated and eased. The Project would thus achieve its objective of providing a secure and safe residential cum commercial building at an attractive location. This being a positive impact would be an indicator of achievement of the objectives of the Project. No mitigation measures will be required.

6.6.10 Socioeconomic Impacts

A. Privacy of the Community

During the operational phase of the project, the privacy of the community resided in Creek Vista Apartments would be disturbed.

Mitigation Measures

Adopting the following measures, the privacy of the community dwelling near the project area can be kept intact:

Shading to be provided to overcome this problem.

Plantation will be done to restrict the gazing of the residents of the project.

B. Employment Opportunities

The labor force whether skilled or unskilled is the inhabitants of Karachi will be deployed at the project. This will not only provide them with the employment opportunities but they will now be having easy excess to the basic necessities of life by earning their both ends meet through the learning of skills. Some people will be employed by the project as management agents, caretakers, cleaners, security personnel and technicians.

C. Provision of Market for the Supply of Building Materials

The project will require the supply of large quantities of building materials which will be sourced locally. This provides ready market for building material suppliers such as quarrying companies, hardware shops and individuals with such materials.

D. Increased Business Opportunities

The large number of project staff required will provide ready market for various goods and services, leading to several business opportunities for small scale traders such as food vendors around the construction site.

E. Revenue to National and Local Government

Through payment of relevant taxes, rates and fees of the government and the local authority, the proposed project will contribute towards the national and local revenue earning.

F. Improved Security

Security will be ensured around the apartment through presence of 24-hour security guards. This will lead to improvement in the general security of the surrounding area.

Table 6.2: Potential Environmental Impact during Different Stages of the Project

Actions Affecting Environmental Resources & Values	Damage to Environment	Recommended Mitigation Measures	Significance of Impact			
			Non e	Sma ll	Medi um	Maj or
Environmental Problems during Construction Phase						
Soil Erosion	Loss of fertile soil	Careful planning of land excavation.		X		
Contaminated Land	Soil and water pollution	Careful planning to minimize the problem.		X		
Construction Waste	Soil contamination, water and air pollution	Adequate monitoring during construction			X	
Change in Ambient Air Quality	Nuisance due to dust esp. by PM ₁₀ ,spoil property and cause visibility issues.	Careful planning to minimize air emissions.		X		
Wastewater Generation & Disposal	Deterioration of surface and ground water quality, disturbance to flora and fauna as well as contamination of soil surface	Careful monitoring of effluent discharge			X	
Solid Waste Generation & Disposal	Effect the health of the workers, cause soil and water pollution	Careful planning to minimize the problem.			X	
Noise & Vibration	Nuisance problem	Careful planning and management of noise producing activities			X	
Vehicular Traffic	Environmental degradation	Careful planning and management		X		
Occupational Health & Safety	Over exertion, slips and falls as well as site hazards	Implementation of appropriate procedures		X		
Environmental Hazards during Operation Phase						
Inadequate management and monitoring of operation	Environmental degradation, waste of resources and time	Properly programmed operations and their monitoring		X		
Wastewater Generation & Disposal	Deterioration of surface and ground water quality, disturbance to flora and fauna as well as contamination of soil surface	Careful monitoring of effluent discharge		X		
Solid Waste Generation & Disposal	Effect the health of the workers, cause soil and water pollution	Careful monitoring to minimize the problem.		X		

Table 6.2: Potential Environmental Impact during Different Stages of the Project

Actions Affecting Environmental Resources & Values	Damage to Environment	Recommended Mitigation Measures	Significance of Impact			
Energy Consumption	Utilization of natural resources	Careful monitoring to save the natural resources.		X		
Illumination	Cause of light pollution for the neighbourhood	Careful planning to solve the problem.		X		
Explosion; fire hazard associated with fuel storage	Occupational hazard, possible environmental degradation	Storage of fuel at safe place in special purpose containers		X		
Changes in land uses	Possible loss in land use	Careful planning	X			
Environmental Aesthetics	Loss of environmental aesthetics	Careful planning	X			

7.0 PRELIMINARY CUMULATIVE IMPACTS ASSESSMENT

7.1 Assessment Scenario (I): Cumulative Impacts from Creek View and Terraces - The Arkadians in Construction with (i) Creek Vistas (ii) DHA Golf Club (iii) DHA School and (iv) Moin Khan Sports Academy (in Operation) (v) Creek Marinas (under construction) (vi) DHA Shopping Mall and Hospital (Design Phase)

The purpose of this section is to identify the cumulative impacts on the existing environment that may arise during the construction and operation of the proposed projects. This includes impacts on the physical, biophysical and socio-economic environments.

The assessment has been undertaken on the basis of information available at the time of writing this report and is based on the IEE Report of DHA Water Front Development Project.



Figure 7.1: Prominent Location near the Project Site

7.1.1 Impacts from Air Emissions

Air quality of the ambient environment may be degraded due to the construction phase of the project. The construction phase would contribute air contaminants of temporary nature which include but are not limited to;

Dust

Exhaust Emission from machinery and vehicles

Dust may be generated during the construction phase due to site preparation and clearing activities, excavations, dumping of material for reclamation, off-loading of construction materials, and movement of heavy machinery and vehicles. Dust may also be generated during the construction phase due to loss of vegetation cover, wind erosion from the disturbed areas, and blowing of the construction materials stock piles. These impacts may result from the works being carried out at the site or from those required for the establishment of engineering head-works, such as connecting road infrastructure and for service to the redeveloped site. It is anticipated that resultant dust impacts during the construction phase would be localized in nature and predominantly affect only the on-site land users. Through adoption of best practicable dust suppression measures, it is likely that ambient particulate levels would be able to be maintained at a level so as to have a negligible impact on human health in the zone of impact.

Exhaust Emissions may be generated during construction phase by manoeuvring of vehicles and other construction machinery. These emissions would include pollutants like CO, CO₂, SO_x, NO_x and particulate matter. The power generators would be other significant source of air emissions during the construction of these Projects.

Also the cumulative effect of these emissions coupled with those from the construction of Creek Marina and from operation of Creek Vistas, DHA Golf Club, Moin Khan Academy and DHA School needs to be considered. Air quality impacts from the construction of Creek Marina is expected to come from fugitive dust emissions from excavation and fill operations, and emissions from construction equipment/ vehicles, portable generators. Of these, emissions from vehicles and generators would likely contribute emissions similar to those from the construction of Creek View and Terraces and are considered in the cumulative impacts. However, these emissions would be limited to the construction period and in the vicinity of the construction works areas.

Airborne dust from construction sites of Creek View and Terraces – The Arkadians and Creek Marina is a problem for residents of Creek Vista and visitors of DHA Golf Club, Moin Khan Academy and children of DHA School for a number of reasons.

It can create health problems, particularly for those with respiratory problems. It can cause environmental degradation, including air and water pollution. It can create problems with visibility. It can damage or dirty property and belongings and create unsafe working conditions. It can increase costs associated with the loss of materials or additional work involved.

It is also anticipated that the resultant exhaust emission impacts during construction would be localized in nature and will predominantly affect ambient air quality.

A. Controls Adopted

The potential for off-site dust emissions to occur during the construction phase will be minimized through the development and implementation of the construction EMP. The construction EMP will include the use of dust suppression measures such as:

Ensuring exposed surfaces and stockpiles are watered or sprayed where required during dry windy conditions;

Where possible, undertaking progressive clearing in stages to minimize the areas of exposed surface at any one time and the likelihood of dust generation from bare surfaces;

Using speed limits to minimize dust generated by vehicle movements;

Scheduling works that have potential to cause dust emissions under favorable meteorological conditions only, with the aim of curtailing major works when winds have the potential to carry airborne dust directly towards the nearby residential areas;

Using minimum drop heights when loading and unloading soils and other excavated material; and

Provide training to employees and contractors to ensure that they are aware of the importance of minimizing dust generation both for on-site occupational health and off-site impacts.

Avoid working during School Hours

Providing Residents with advance warning of Construction activities.

Regular checks will be made of dust levels being generated by the works and appropriate remedial action will be taken whenever visible off-site emissions occur.

B. Significance of Impacts

Significance of impacts is expected to be Moderate because of time limited activity and emissions from construction of Creek View and Terraces are expected to have limited overlapping with those emitted from the construction of the Creek Marina but pose significant impact on residents of Creek Vista, children of DHA School and visitors of DHA Golf Club and Moin Khan Academy for limited time. An evaluation of impacts is summarized in Table below.

Table 7.1 : Impacts from Air emissions in the project areas					
Impact	Emissions from construction of Creek View and Terraces in combination of Creek Marina and operation of Creek Vistas, DHA Golf Club, Moin Khan Academy and DHA School.				
Impact Magnitude	Emissions from construction of The Arkadians site would be small and localized to the vicinity of the construction work areas.				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	The project locations are near from already developed Creek Vista Apartments, Moin Khan Sports Academy, DHA School and DHA Golf Club.				
Impact Nature	Negative	Positive	Neutral		
	Impacts to air quality are considered to be negative impacts				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will only last for the duration of construction of the projects, expected to 60 months respectively				
Impact Extent	Local	Regional	Global		
	Impacts would be limited to the area immediately around the project sites.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Medium due to the potential for disturbance to population living in vicinity and also children of School.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a Medium Receptor Sensitivity and Medium Impact Severity results in an overall Moderate significance.				

C. Additional Mitigation Measures, Management and Monitoring

It is recommended that further controls, such as those listed in the IFC EHS General Guidelines for air emissions and ambient air quality, be implemented during construction of this project to reduce and maintain levels of emissions within applicable standards.

D. Significance of Residual Impacts

With the implementation of the proposed further controls and if all emissions are controlled to within applicable standards, residual impacts on air quality would be considered of negligible significance.

7.1.1 Impacts from Noise Emissions

The main sources of noise generated from construction of The Arkadians with construction of the Creek Marina, include the following:

Table 7.2 Typical Noise Levels of Construction equipment at 15m			
Clearing		Structure Construction	
Equipment	Noise Level dB(A)	Equipment	Noise Level dB(A)
Bulldozer	80	Crane	75-77
Front end loader	72-84	Welding generator	71-82

Jack hammer	81-98	Concrete mixer	74-88
Crane with ball	75-87	Concrete pump	81-84
		Concrete vibrator	76
<i>Excavation and Earth Moving</i>		Air compressor	74-87
Bulldozer	80	Pneumatic tools	81-98
Backhoe	72-93	Bulldozer	80
Front end loader	72-84	Cement and dump trucks	83-94
Dump truck	83-94	Front end loader	72-84
Jack hammer	81-98	Dump truck	83-94
Scraper	80-93	Paver	86-88
<i>Grading and Compaction</i>		<i>Landscaping and clean-up</i>	
Grader	80-93	Bulldozer	80
Roller	73-75	Backhoe	72-93
		Truck	83-94
<i>Paving</i>		Front and end loader	72-84
Paver	86-88	Dump truck	83-94
Truck	83-94	Paver	86-88
Tamper	74-77	Dump truck	83-94

Ref: U.S. Environmental Protection Agency, Noise from Construction Equipment and Operations. Building Equipment and Home Appliance.NJID. December 31, 1971

Noise will also be generated during construction works such as pile boring, excavation, drilling, earthworks, etc. Acoustic effects in the barren land are expected to echo the noise, especially during activities with sharp bursts of noise such as those emitted during piling.

SEQS stipulate noise levels should not exceed 55dBA at day time for residential sites, 45 dBA for night, or result in background levels of 3dB at the nearest receptor location off-site. Monitoring of Noise is conducted in the vicinity of project areas at various locations during EIA study. The Noise limits were higher than SEQs limit for traffic noise and on-going construction activities in the area.

There are developed residential and recreational sites close to the Projects including Creek Vista, DHA Golf Club, Moin Khan Academy and DHA School. Therefore construction noise has the potential to disturb the population of this area and also the wildlife which may be roosting, foraging or breeding in the area. The operations involving raw material unloading, cement loading and handling in storage facilities are medium impact activities to the receptors for the time being.

As such, noise impacts are expected to be associated more with construction rather than operation of the sites.

A. Controls Adopted

During construction of the Creek View and Terraces – The Arkadians, periodic monitoring of noise at the nearest receptors such as at Creek Vista, DHA School, DHA Golf Club and Moin Khan Academy will be carried out. If noise levels exceed guidelines, the equipment suppliers will be required to reduce noise at the source in order to meet ambient noise targets. Additionally, noise-producing equipment will be placed inside acoustic enclosures to reduce noise at the source. Other measures include:

Selection of up to date and well maintained equipment/machinery with reduced noise levels.

Providing residents with advance warning of construction activities.

Avoid working during School Hours.

Use noise-abating devices wherever needed and practicable.

Where possible, confining noisy work to normal working hours in the day.

B. Significance of Impacts

Significance of impacts is expected to be Moderate because of time limited activity. An evaluation of impacts is summarized in Table 7.3 below.

Table 7.3 Impact of Noise from Construction of the Project					
Impact	Noise from construction of Creek View and Terraces in combination of Creek Marina and operation of Creek Vistas, DHA Golf Club, Moin Khan Academy and DHA School.				
Impact Magnitude	The magnitude of noise emissions is higher for construction than for operation. However, only the immediate residential vicinity, school and recreational sites will be affected.				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	The project locations are near from already developed Creek Vista Apartments, Moin Khan Sports Academy, DHA School and DHA Golf Club.				
Impact Nature	Negative	Positive	Neutral		
	Impacts from noise emissions are considered to be negative impacts				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will only last for the duration of construction of Creek View and Terraces –The Arkadians and Creek Marina, expected to 5 years respectively.				
Impact Extent	Local	Regional	Global		
	Impacts would be limited around all project sites that are considered.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Medium due to the potential for disturbance to local residents of Creek Vista and children of DHA School				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a Medium Receptor Sensitivity and Medium Impact Severity results in an overall Moderate significance.				

C. Additional Mitigation Measures, Management and Monitoring

Although the EIAs state that controls adopted are expected to maintain noise levels within acceptable limits, quantitative noise impact assessments for the construction phase of the projects to identify the extent of the potential cumulative noise impacts to sensitive receivers are recommended to confirmation compliance of relevant SEQs and World Bank Guidelines at sensitive receivers.

D. Significance of Residual Impacts

Quantitative noise impact assessments will provide basic knowledge and measure to implement and after that residual noise impacts will become minor.

7.1.2 Impacts from Wastewater

A. Wastes and Pollutants

The construction of Creek View and Terraces –The Arkadians and Creek Marina expected to generate sewage from construction camps, wastewater, etc., which may

result in contamination and affect water quality upon discharge. Construction activities also have the potential to release contaminating substances from spillage of construction materials, wastes, fuels and oils. Although each spill contributes little on an individual basis, many spills over the long term can cause chronic concentrations of contaminants and degradation of water quality. As mentioned earlier, the sewage will be treated in a closed system and the sludge will be transported to the nearest municipal facility. The grey water will be sprinkled on unpaved section with the construction corridor.

Also the cumulative effect of the wastewater coupled with those from the construction of Creek Marina and from operation of Creek Vistas, DHA Golf Club, Moin Khan Academy and DHA School needs to be considered. Water quality impacts from the construction of Creek Marina are expected to come from construction camps, spillage of construction materials, wastes, fuels and oils. Of this wastewater from construction activity would likely contribute similar to those from the construction of Creek View and Terraces and are considered in the cumulative impacts. This wastewater would also be contributed with the domestic wastewater already generated from the residential apartments of Creek Vista, DHA Golf Club, DHA School and Moin Khan Academy and pose significant impact and increase pollution load to the municipal water system.

B. Controls Adopted

These projects will implement several mitigation measures for management of liquid effluent streams:

Provide proper drainage arrangements at the cut slopes to collect water coming from higher slopes and to drain it away without flowing over to cut faces.

Provision of chutes ensuring safe disposal of surface runoff from upper slopes.

Taking precautionary measures to avoid accidental spills of oil & lubricants.

Provision of sedimentation basins / weirs to trap silt before entry to the surface water bodies.

Toilet wastewater will be treated in on-site in a closed system. The discharge rate and chemical quality of the wastewater effluent will be monitored to comply with SEQS.

Pollution prevention and cleanup measures are generally included in project Environmental Management Plans (EMPs).

C. Significance of Impacts

Significance of impacts is expected to be minor. An evaluation of impacts is summarized in Table 7.4 below.

Table 7.4 Impacts of water quality in the Project Areas	
Impact	Impacts to water quality due to construction of Creek View and Terraces in combination with construction of Creek Marina and operation of Creek Vistas, DHA Golf Club, Moin Khan Academy and DHA School.

Impact Magnitude	The magnitude of water quality impacts includes the immediate project areas as well as increase pollution load to the municipal water system.				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	Inputs of effluent and sediment may not significantly change water quality characteristics.				
Impact Nature	Negative	Positive	Neutral		
	Impacts to water quality are considered to be negative impacts.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will only last for the duration of construction of the project expected to 60 months respectively.				
Impact Extent	Local	Regional	Global		
	Impacts would be limited to the area around the project sites				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Low due to small adverse effects on water quality of streams				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a Low-Medium Receptor Sensitivity and Low Impact Severity results in an overall Minor significance.				

D. Additional Mitigation Measures, Management and Monitoring

Project EMP should provide procedures for contractors to ensure minimization of untreated operational discharge, and spills and release and a monitoring program that maintains compliance with applicable standards.

E. Significance of Residual Impacts

Upon compliance with applicable standards presented in EMP, if effluents are controlled to within applicable standards through the use of best practices and feedback monitoring, residual impacts may be reduced to Negligible.

7.1.3 Impacts on Soil and its quality

Construction activities for development of Creek View and Terraces – The Arkadians in combination with the construction of Creek Marina including laying of infrastructure pipelines, excavation for high rise buildings, laying of roads and movement of vehicles have the potential to extensive soil erosion during Monsoon. A significant impact will be interpreted if oil and grease is present in the run-off and result in soil contamination.

Construction of these projects has limited impacts on soil and its quality and is mostly site specific. Impacts are mostly related to soil contamination, temporary construction camp etc.

A. Controls Adopted

These projects will implement several mitigation measures for management of soil removal and contamination:

Seeding or plantation of erodible surfaces.

The construction activities must be planned to minimize disturbances to soil.

Proper drainage will be provided to construction camps, construction sites, especially near excavations and around proposed facility

Fuels, lubricants, and chemicals will be stored in covered bonded areas, underlain with impervious lining;

Maintenance of vehicles and equipment will not be carried out at the project site.

No washing of vehicles will take place at the site and prohibition will be imposed to wash the vehicles at the site;

Pollution prevention and cleanup measures are generally included in project Environmental Management Plans (EMPs).

B. Significance of Impacts

Significance of impacts is expected to be moderate. An evaluation of impacts is summarized in below table.

Table 7.5 Impacts on soil quality and its loss due to construction of these projects					
Impact	Impacts to soil quality and its loss due to construction of Creek View and Terraces in combination with construction of Creek Marina and operation of Creek Vistas, DHA Golf Club, Moin Khan Academy and DHA School.				
Impact Magnitude	The magnitude of soil quality and loss impacts includes project areas of Creek View and Terraces and Creek Marina.				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	Changes the landscape and disturbance f flora & fauna which may use the area for roosting, foraging or breeding within the project site will occur.				
Impact Nature	Negative	Positive	Neutral		
	Impacts on soil quality and its loss are considered to be negative impacts.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will only last for the duration of construction of these sites, expected to 60 months respectively.				
Impact Extent	Local	Regional	Global		
	Impacts would be limited to the area within the project sites.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Medium due to adverse effects on landscape, flora and wildlife which may use the area for roosting, foraging or breeding.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a Medium Receptor Sensitivity and Medium Impact Severity results in an overall Moderate significance.				

C. Additional Mitigation Measures, Management and Monitoring

An additional study should be conducted for soil reclamation and reuse. In this study, affected areas will be considered and give prime importance. Contaminated soil with oil and lubricants may be removed and sent to nearest factories for burning as fuel.

Project EMP should provide procedures for contractors to ensure minimization of soil extraction due to excavation and spills and release and a monitoring program that maintains compliance with applicable standards.

D. Significance of Residual Impacts

After soil reclamation and reuse study, results of the study will be incorporated and upon compliance with applicable standards presented in EMP, if loss of soil and contamination through the use of best practices and feedback monitoring will be controlled, residual impacts may be reduced to Minor.

7.1.4 Impacts on Community Health, Safety & Security

A. Exposure to Environmental Contaminants

Residents, particularly from Creek Vista and Visitors in Moin Khan Cricket Academy, DHA Golf Club and Beaches and children of DHA School that come within closer distance to the project activities, are at risk for exposure to project emissions and discharges to the air and water during construction.

Considering above the cumulative air quality impacts from emissions from the two under construction projects (e.g., exhaust emissions and dust) is anticipated to be moderate, the potential for health effects associated with exposure to air contaminants is anticipated to be low-medium. It is important to note the most sensitive receptors are residents of Creek Vista with existing respiratory illness conditions (TB and asthma) where their conditions can be exacerbated from exposure to air contaminants.

Population influx can lead to potential water and sanitation related diseases (e.g. diarrhea) associated with increased pressures on community sewage and wastewater systems.

An assessment on the potential for population influx (i.e., newcomers moving into the communities seeking to gain jobs or provide good and services to the two projects) is needed to assess the cumulative impacts from influx-related health issues (e.g., spread of infectious diseases, psycho-social well-being and effects on public health infrastructure).

B. Controls Adopted

Environmental pollution controls will be in placed to limit harmful air emissions and water quality impacts (see discussion for Air Quality and Water Quality above). In addition, the Project will implement a Materials Management Plan, which includes procedures for proper storage, transport and safe disposal of domestic wastes and hazardous wastes. Local contractors will be given preference for hiring equipment and machinery during construction operations. A complaint register will be maintained on sites during construction to record complaints of the nearby residents.

C. Significance of Impacts

Significance of impacts is expected to be Moderate. An evaluation of impacts is summarized in Table 7.6 below:

Table 7.6 Impacts to community health, safety and security from Construction of these projects

Impact	Impacts to community health, safety and security due to construction of Creek View and Terraces in combination with construction of Creek Marina and operation of Creek Vistas, DHA Golf Club, Moin Khan Academy and DHA School.				
Impact Magnitude	The magnitude of the impact encompasses all local people (residents, visitors).				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	The sensitivity of the local people to health impacts is considered Medium because of school located near the project site				
Impact Nature	Negative	Positive	Neutral		
	Impacts to community health are considered to be negative impacts.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	The cumulative impacts will be low during the construction of the projects. The impact is anticipated to be short-term during construction period.				
Impact Extent	Local	Regional	Global		
	Impacts would be limited to the area around all project sites.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Medium due to adverse effects on local residents and visitors especially school going children.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a Medium Receptor Sensitivity and Medium Impact Severity results in an overall Moderate significance.				

D. Additional Mitigation Measures, Management and Monitoring

As Moderate impacts are deemed to be “Significant”, additional mitigation is considered necessary.

E. Population Influx Assessment and Management

An assessment for the potential for population influx into the communities within the Project is recommended. If identified as a significant cumulative impact, consider preparing an influx management plan to address potential related health issues (e.g., infectious disease transmission, psycho-social wellbeing and effects on public health infrastructure).

F. Significance of Residual Impacts

Depending on the outcome of the additional study, and with the implementation of the recommended additional mitigation, management and monitoring measures, residual impacts on Community Health, Safety & Security may be considered minor-to-moderate.

7.1.5 Impacts on Ecology

The flora on these two under construction sites including Creek View and Terraces – The Arkadians and Creek Marina are not highly disturbed. There is a low level of threatened plant species on the site. Clearing of land for construction may result in the removal of these species and invasion by weeds. However, this impact can be reduced to low significance if care is taken in ensuring the identified indigenous species are kept intact. The noise caused by construction may also disturb local wildlife present in an area.

A Terrestrial and Ecological Baseline survey was conducted in June 2014 to evaluate the impact of the coastal Arkadians project on the ecological aspects. The Arkadians project consists of 13 tallest premium residential towers, six office enclaves and utility spaces. That project area is an L- Shaped plot spans 43 acres in D.H.A phase VIII, Opposite to D.H.A. Golf Club Phase VIII.

The terrestrial topography is flat and leveled; with sparse xerophytes vegetation. The sediments are composed of fine sand and compacted clay. The project area is in closed proximity to the sea overlooking Korangi Creek. The elevation of the project land is approximately 6.0 ft. above mean sea level (M.S.L. 1.6 m). The sediment type is mostly fine sand to silt to clayey.

The arid area vegetative grasses of *Poaceae* family, *Calotropis* plants were distributed as aggregated. While all other (Grasses, *Prosopis* and *Atriplex* were found to be randomly distributed in the project area. Reptiles such as lizards, insects, and rats are reported from the area, The Marine Flora and fauna observed at the project site of Creek View and Terraces – The Arkadian project site and Creek Marina are not threatened and are not listed in the IUCN Red book of threatened species 2012.

A. Controls Adopted

Plantation of vegetation (trees) should be undertaken to absorb the sound generated due to construction activity. Tree plantation would help improve the microenvironment of the project area. As project of the Creek View and Terraces – The Arkadians site office and Creek Marina in DHA phase VIII, Tree plantation would facilitate habitats for birds and other animal life forms such as squirrels etc. Dust suppressors such as spraying of water on soil should be done to reduce the dust emissions in the atmosphere.

B. Significance of Impacts

Significance of impacts is expected to be minor. An evaluation of impacts is summarized in Table 7.7.

Table 7.7 Impacts on ecology from Construction of these projects					
Impact	Impacts to local ecology from Construction of Creek View and Terraces – The Arkadians in Construction with Creek Marina & operation of DHA Golf Club, Moin Khan Academy, DHA School and Creek Vista.				
Impact Magnitude	The magnitude of the impact encompasses the local terrestrial areas that will be cleared, and species that depend on the area				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
Impact Nature	There is a low level of threatened plant species on the site.				
	Negative	Positive	Neutral		
Impact Type	Impacts to ecology are considered to be negative impacts.				
	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Cumulative impacts from concurrent projects are considered.				
	Temporary	Short-term	Long-term	Permanent	
	Some impacts, such as noise and turbidity and other disturbance generated during construction, will be temporary. However, the clearing of trees and plants is permanent as facilities will be constructed over the areas.				
Impact Extent	Local	Regional	Global		
	Most impacts would be considered local extent.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Low. Trees cutting will be mitigated through off-site plantation.				

Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a Low-Medium Receptor Sensitivity and Low Impact Severity results in an overall minor significance.				

C. Significance of Residual Impacts

Depending on the outcome of the additional study, residual impacts to ecology may be reduced negligible if ecological assemblages of high sensitivity or large areas of habitats are not significantly affected.

7.2 Assessment Scenario (II): Operations

Cumulative Impacts from Creek View and Terraces - The Arkadians in Conjunction with (i) Creek Vista (ii) Creek Marina (iii) DHA Golf Club (iv) DHA Shopping Mall and Hospital (v) DHA School (vi) Moin Khan Academy

7.2.1 Impacts from Air Emissions

Impacts on Air quality during operation period from these projects are limited to vehicle exhausts used by residents and visitors, backup Generator sets of the Creek View and Terraces – The Arkadians, Creek Vista, and Creek Marina projects, DHA Golf Club, Moin Khan Academy and DHA Shopping Mall and Hospital and from the generators use as a stand-by power generation source for these projects.

The exhaust emissions will include particulate matter (PM), hydrocarbons, NO_x, SO_x, CO and CO₂.

The fuel use in car that is CNG is the preferred option for residents (as it is an indigenous source of natural gas) and the drawbacks of CNG use such as higher fleet cost and higher maintenance cost could be offset by a net decrease in emissions affecting the populations near the roads.

A. Controls Adopted

Inspection should be done for black smoke generating vehicles;

Promotion of use of cleaner fuel should be done

Reducing the speed of a vehicle to 20 kph can reduce emissions by a large extent. Speed bumps are commonly used to ensure speed reduction.

The power generators will be designed for high-efficiency with advanced combustion controls to minimize fuel consumption and pollutant emissions.

Utilization of vegetation belts on the corridor and the enforcement of relevant standard and regulation on vehicular emission are the appropriate mitigation measures as the most important influence on the spread of the pollution after its release is the strength of the wind.

B. Significance of Impacts

Extensive traffic volume due to the operation of these projects mainly from 120" wide 16th Street, 60" wide Khayaban –e- Shujaat, 80" wide Zulfiqar Street, and also from 120" wide Beach Avenue, 100" wide Saba Avenue and 100" wide Khayaban-e- Ittehad will be expected. Assuming emissions from power generators will be maintained within applicable standards for the duration of operation of each of the projects. Impacts from emissions are expected to be moderate. An evaluation of impacts is summarized in Table 7.8.

Table 7.8 Impact of Emissions from operation of projects (vehicular emissions and power generator emissions - NO _x , SO _x , CO, CO ₂ , PM)					
Impact Magnitude	The magnitude of emissions from operation of Creek View and Terraces – The Arkadians in combination with Creek Vista, Creek Marina, DHA Golf Club, DHA School and Moin Khan Academy is localized.				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	The project locations are near from already developed Creek Vista Apartments, Moin Khan Sports Academy, DHA School and DHA Golf Club.				
Impact Nature	Negative	Positive	Neutral		
	Impacts to air quality are considered to be negative impacts				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts from concurrent projects are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will last as long as these facilities remain in operation at the same time.				
Impact Extent	Local	Regional	Global		
	Impacts would be limited to the area immediately around the project sites.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Medium due to the potential for disturbance to other residents and visitors.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a Medium Receptor Sensitivity and Medium Impact Severity results in an overall Moderate significance.				

C. Additional Mitigation Measures, Management and Monitoring

As Moderate impacts are deemed to be "Significant", additional mitigation is considered necessary.

Operation-phase quantitative air dispersion modelling is recommended to confirm whether potential air quality impacts would be acceptable as per SEQS. If operation-phase modelling confirms this, it is recommended that further controls, such as those listed in the IFC EHS General Guidelines for air emissions and ambient air quality, be implemented to reduce and maintain levels of emissions within SEQS.

D. Significance of Residual Impacts

With the implementation of the proposed further controls and if all emissions are controlled to within applicable standards, residual impacts of air emissions would be considered of Minor significance.

7.2.2 Impacts from Noise Emissions

Noise emitted during operation of the facilities is expected to be lower than noise generated during construction. Noise will be generated during operation stage from running of vehicles and blowing of pressure horns. Noise levels immediately outside the facilities, once in operation, are expected to be controlled within acceptable limits through the in-place controls described below.

A. Controls Adopted

Noisy equipment, such as power generators, will be housed in sound dampening structures. Sounds levels will be monitored for compliance.

The sources of noise during operation of the project include vehicular movements, intermittent sounding of horns etc. The noise emitting from these sources will not be significantly higher than the background noise level.

B. Significance of Impacts

Extensive traffic volume due to the operation of these projects mainly from 120" wide 16th Street, 60" wide Khayaban –e- Shujaat, 80" wide Zulfiqar Street, will be expected. Assuming noise from power generators will be maintained within applicable standards for the duration of operation of each of the projects. It is not considered likely that there will be significant increases (>3dBA) in ambient noise levels at sensitive receivers. As such, sensitive receivers (residents, wildlife) are not expected to be significantly affected. Significance of the impact is considered **minor**. An evaluation of impacts is summarized in below table.

Table 7.9 Impact of Noise from Operations of the Projects					
Impact Magnitude	The magnitude of noise emissions is substantially lower for operation than for construction. Impacts will be limited to the immediate vicinity of the sites.				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	The project locations are near from already developed Creek Vista Apartments, Moin Khan Sports Academy, DHA School and DHA Golf Club.				
Impact Nature	Negative	Positive	Neutral		
	Impacts from noise emissions are considered to be negative impacts.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts from concurrent projects are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will last as long as these facilities remain in operation.				
Impact Extent	Local	Regional	Global		
	Impacts would be limited to the immediate vicinity of the project sites.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Low due to low noise generation during operation.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a Medium Receptor Sensitivity and Low Impact Severity results in an overall Minor significance.				

C. Additional Mitigation Measures, Management and Monitoring

Quantitative noise impact assessments for the operation phase of the projects to identify the extent of the potential cumulative noise impacts to sensitive receivers are

recommended to confirmation compliance of relevant SEQs and World Bank Guidelines at sensitive receivers.

D. Significance of Residual Impacts

Residual noise impacts will remain negligible.

7.2.3 Impacts from Wastewater

The wastewater generally comprises of the liquid waste discharged by residential areas (Creek Vista, Creek Marina, Creek view and Terraces – The Arkadians) and commercial properties (Offices of Creek View and Terraces – The Arkadians, DHA Shopping Mall and Hospital, DHA Golf Club, Moin Khan Academy and DHA School) and can encompass a wide range of potential contaminants and concentrations. The composition of wastewater varies widely depending on the source of its generation. The wastewater expected to generate from the projects would have typical properties of a mix of domestic and commercial effluents. A partial list of the ingredients contained in a typical wastewater is given below:

Water (> 95%) which is often added during flushing to carry the waste down a drain.

Pathogens such as bacteria, viruses, and parasitic worms.

Non-pathogenic bacteria (> 100,000/ml for sewage)

Organic particles such as faeces, hairs, food, vomit, paper fibres, plant material, humus, etc.

Soluble organic material such as urea, fruit sugars,

Soluble proteins, drugs, pharmaceuticals, etc.

Inorganic particles such as sand, grit, metal particles, ceramics, etc.

Soluble inorganic material such as ammonia, road-salt, sea-salt, cyanide, hydrogen sulphide, thiocyanates, thiosulphates, etc.

Animals such as protozoa, insects, arthropods, small fish, etc.

Macro-solids such as sanitary towels, nappies/diapers, condoms, needles, children's toys, dead pets, body parts, etc.

Gases such as hydrogen sulphide, carbon dioxide, methane, etc.

It is a fact that these projects would generate lot of wastewater of typical domestic nature. All the wastewater from Creek View and Terraces – The Arkadians will be passed through the sewage treatment plant to be provided at the basement of the Creek View and Terraces – The Arkadians. Kitchen waste shall also be discharged into the grease interceptor prior to disposal to municipal wastewater system.

A. Controls Adopted

The grey water will be treated which will be recycled to be re-used again in toilets and kitchens.

Black water will be discharged into a nearby out fall sewer via a trunk sewer or it may be used in landscaping / in golf course;

Waste segregation measures would be employed to minimize entry of solid waste into the wastewater stream

Water conservation strategies will be employed to avoid wastage of water

Periodic monitoring of water quality will be undertaken at each site to ensure compliance with applicable water quality standards.

B. Significance of Impacts

Significance of the impacts is considered **moderate**. An evaluation of impacts is summarized in Table 7.10 below:

Table 7.10 Impacts to Water Quality from Operations of the Projects					
Impact Magnitude	The magnitude of impact from wastewater increases the pollution load of municipal wastewater system as well as affected Arabian Sea.				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	Inputs of domestic effluent and sediment may not significantly change water quality characteristics				
Impact Nature	Negative	Positive	Neutral		
	Impacts to water quality are considered to be negative impacts				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts from eight concurrent projects are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will last as long as these projects remain in operation				
Impact Extent	Local	Regional	Global		
	Impacts would limited to be of local concern because of like any other populated and industrialized coastal regions in the world, water quality in the coastal waters of Karachi are severely affected by pollutants (domestic and industrial effluents) discharged from the city into the marine environment. This is very significantly threatening to the marine life (mangrove forest and marine food chain, etc.) and water quality along Karachi coast. Pollution in the vicinity of Karachi such as Clifton and DHA beaches, Gizri creek and Korangi creek is constantly increasing due to untreated discharges.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Low due to the treatment of wastewater in these projects. Discharge effluents from project sites must meet SEQS to fulfill the legal requirement of EIAs.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a Low-Medium Receptor Sensitivity and Low Impact Severity results in an overall Minor significance.				

C. Additional Mitigation Measures, Management and Monitoring

The Project EMP should provide procedures for project management to ensure minimization of untreated operational discharge, and spills and release and a monitoring program that maintains compliance with SEQS.

D. Significance of Residual Impacts

Upon confirmation of compliance with applicable standards, and if effluents are controlled to within applicable standards through the successful running of treatment plants and feedback monitoring, residual impacts to water quality may be reduced to negligible.

7.2.4 Impacts on Community Health, Safety & Security

Impacts to community health, safety and security during operation of all projects would be similar to those described in above section. The risk of accidents and injuries is associated with increase in traffic from the operation of residential and commercial projects. Also the long-term operation of the projects may attract newcomers seeking jobs and/or opportunities to provide goods and services. An assessment on the potential for population influx is needed to better understand the potential for impacts on disease transmission, psycho-social well-being, and public health infrastructure (including drinking water and sanitation services, health care services, etc.).

A. Existing/In-Place Controls

Existing controls and mitigation measures for impacts to community health are described above sections of 7.2.1, 7.2.2 and 7.2.3. For Safety and Security of residents and visitors, all projects have their own security arrangements and emergency and disaster management plans.

B. Significance of Impacts

Significance of impacts is expected to be **Low**. An evaluation of impacts is summarized in Table 7.11 below.

Table 7.11 Impacts to Community Health, Safety & Security from Operations of the Projects					
Impact Magnitude	The magnitude of the impact encompasses all local people (residents and visitors)				
Receptor Sensitivity	Low	Low Medium	Medium	Medium High	High
	The sensitivity of the local people to health, safety and security impacts is considered low due to availability of all resources in an area.				
Impact Nature	Negative Imp	Positive	Neutral		
	Impacts to community health are considered to be positive impacts because of establishing hospital name as DHA Hospital.				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts from concurrent projects are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts, particularly the provision of social services will last as long as the facilities remain in operation.				
Impact Extent	Local	Regional	Global		
	Impacts would be limited to the area around the project sites.				
	No Change	Slight	Low	Medium	High

Impact Severity	Severity is ranked as low due to availability of resources in an area to tackle health, safety and security concerns.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of a Low Receptor Sensitivity and Low Impact Severity results in an overall Minor significance				

C. Additional Mitigation Measures, Management and Monitoring

Due to positive impacts, additional measures are not required.

7.2.5 Impacts from Solid Waste

From operation of these projects, Waste generated by users, i.e, domestic wastes includes food leftovers, vegetable peels, plastic, house sweepings, clothes, and ash. Commercial waste generally comprises paper, cardboard and plastic wastes like batteries, bulbs, tube lights should also be generated.

A. Controls Adopted

Adequate provision should be made for storage of solid waste and for easy access to the dustbins. Three colors of bins: - dark grey for inert waste, green for wood and ply waste and blue for hazardous waste can be used. Local Authority will be responsible to transfer waste from secondary to tertiary / landfill site. Adequate provision should be made for storage of solid waste.

B. Significance of Impacts

Significance of impacts is expected to be moderate. An evaluation of impacts is summarized in Table 7.12 below.

Table 7.12 Impact from Solid Waste from Operation of the Projects					
Impact Magnitude	The magnitude of the impact encompasses the local landfill site.				
Receptor Sensitivity	Low	Low Medium	Moderate	Medium High	High
	Natural soil and wastewater streams				
Impact Nature	Negative	Positive	Neutral		
	Impacts from solid waste are considered to be negative impacts				
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
	Cumulative impacts from concurrent projects are considered.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Cumulative impacts will last as long as these facilities remain in operation.				
Impact Extent	Local	Regional	Global		
	Impacts would be considered local.				
Impact Severity	No Change	Slight	Low	Medium	High
	Severity is ranked as Medium. Large quantities of solid wastes will be generated due to the operation of residential and commercial areas.				
Significance	Negligible	Minor	Moderate	Major	Critical
	The combination of Medium Receptor Sensitivity and Medium Impact Severity results in an overall Moderate significance.				

C. Additional Mitigation Measures, Management and Monitoring

Additional study will be required for the recycling and reuse of waste prior to disposal as Landfill sites to reduce the quantity as the landfill sites are currently dumping grounds and is not environmentally sustainable.

D. Significance of Residual Impacts

Depending on the outcome of the additional study, and with the implementation of the recommended additional mitigation, management, residual impacts of solid waste may be considered negligible.

7.3 RECOMMENDED FURTHER STUDIES & MITIGATION MEASURES

The impact assessment described in this Report identified and assessed the significance of potential cumulative environmental and social impacts from the concurrent construction and operation of residential and commercial projects as well as operation of other types of facilities. The significance of the impacts taking into account in-place controls is summarized in the respective sub-sections in above sections.

Table 7.13 Further Mitigation Measures Recommended	
Subject of Mitigation	Recommended Further Study/ Mitigation Measures
Air Quality	- Operation-phase quantitative air dispersion modeling is recommended to confirm whether potential air quality impacts of these sites would be acceptable as per the Applicable Standards. - If modeling confirms the need, further controls, such as those listed in the IFC EHS General Guidelines for air emissions and ambient air quality should be implemented during operation of these sites to reduce and maintain levels of emissions within applicable standards.
Noise	Quantitative noise impact assessments for the construction and operation phase of the projects to identify the extent of the potential cumulative noise impacts to the sensitive receivers are recommended to confirm compliance of relevant SEQs and World Bank Guidelines at sensitive receivers. For the construction phase assessment, relevant scenario to be considered as a worst case, if applicable, is the simultaneous construction of two projects. Noise contour maps would be produced based on the results of the modeling.
Wastewater	The Project EMP should provide procedures for contractors and project management staff to ensure minimization of untreated construction and operational discharge, and spills and release and a monitoring program that maintains compliance with applicable standards.
Community Health, Safety and Security	An assessment is recommended for the potential for population influx into the communities within the Project. If identified as a significant impact, consider preparing an influx management plan to address potential related health issues (e.g., infectious disease transmission)
Solid Waste	Additional study will be required in operation phase for the recycling and reuse of waste prior to disposal as Landfill sites to reduce the quantity and also as the landfill sites are currently dumping grounds and are not environmentally sustainable.

Further detailed studies and mitigation measures have been recommended to confirm compliance with applicable standards as committed by these concurrent projects, provide further information for a more detailed evaluation of potentially significant cumulative impacts, and to provide a means to reduce/ identify further mitigation measures to reduce potential impacts to a level that is as low as reasonably practicable. These recommendations are summarized in Table 7.13 above.

7.4 CONCLUSIONS

This preliminary cumulative impact assessment for the Arkadians Karachi, Pakistan was conducted to provide a desktop, high-level, qualitative assessment of the potential cumulative environmental and social impacts associated with the concurrent construction and operation of Creek Vista, Creek Marina, DHA Golf Club, Moin Khan Academy, DHA Shopping Mall and Hospital and DHA School.

Key operational activities of these projects were described. Applicable Pakistan and international regulatory frameworks and the requirements were summarized. The environmental and social setting was assessed to identify sensitive and important environmental and social receptors which could be affected by the Project.

The preliminary assessment suggested that potentially significant cumulative environmental and social impacts may arise from the concurrent construction and operation of the projects listed above. Further detailed studies were recommended to provide information for a more detailed evaluation. Where applicable, mitigation measures were recommended to reduce potential cumulative impacts.

8.0 ENVIRONMENTAL MANAGEMENT PLAN

This section of the EIA report describes the Environmental Management Plan (EMP) to assist the proponent i.e. Creek Developers (Pvt.) Limited, to ensure sound environmental and health safety management during various planned phases of the project such as development / designing, construction and operation. The EMP is developed in recognition of the fact that it is seldom possible to eliminate the adverse environmental impacts altogether, but it is often feasible to reduce its intensity by adopting and regularly practicing mitigation measures as framed in the Environmental Management Plan.

8.1 Purpose and Objectives of EMP

This EMP provides the delivery mechanism to address the adverse environmental and health safety impacts of the proposed project during its execution, to enhance project benefits, and to introduce standards of good practice to be adopted for all project phases.

The EMP will:

Define the responsibilities of the project proponent, contractors, and environmental monitors (Independent Monitoring Consultants), and provide a means of effectively communicating environmental and social issues among them,

Define the implementation mechanism for the mitigation measures identified during the present study.

Identify environmental as well as social (if applicable) training requirements at various levels

Provide the mechanism for taking timely action in the face of unanticipated environmental situations,

Define the monitoring mechanism and identify monitoring parameters in order to:

- Ensure the complete implementation of all mitigation measures, and
- Ensure the effectiveness of the mitigation measures.
- Identify environmental as well as social training requirements at various levels.

8.2 EMP Process

The EMP comprises of the following area and defining the methods and procedures of implementation.

Legislation and Guidelines.

Organizational structure as well as roles and responsibilities of project personnel.

Specific requirements for the Implementation of the EMP.

Mitigation or impact management matrix.

Monitoring plan with the emphasis on specific parameters to monitor.

Change management plan.

Training program

The preparation of this plan has involved an extensive and detailed programme of investigation to the processes involve and with consultation of CDPL management and the issues concerned. Therefore, this network will provide a structure to assist in the implementation of the management plan accordingly.

During the construction project, the CDPL management will assign an HSE officer whose role will be to implement all environmental related issues as per the mitigation matrix in the EIA. During normal operations of the project, the proponent will delegate all specific environmental related actions to respective departments who will be fulfilling their responsibilities as per the mitigation and monitoring matrices.

8.3 Review of Existing Condition

The current situation of the project has been given in the EIA report. CDPL is the responsible authority for reviewing the EIA, implementing the project and managing all environmental risks arising out of it.

8.4 Legislation and Guidelines

The EIA has discussed in detail all the legislation and guidelines in Section-3 which are relevant to the project. M/s Creek Developers (Pvt.) Limited herein referred as proponent, will ensure that the construction and operation of the project is conducted in conformance to relevant legislations and guidelines, guidance is sought as and when required. The proponent will also ensure that the key project management staff is aware of these legislations and guidelines. SEQS for municipal and industrial effluents, ambient air and motor vehicles exhaust as well as noise are provided in Section-3 of EIA report. Standards for disposal of solid waste have not yet been promulgated.

8.5 Health, Safety & Environmental Management System

Health, Safety and Environment Management System is essential and integral component of the environmental management system for the safe and secure working environment assuring sustained development, dependent on health associated performance of human resources. HSE issues and aspects are outlined in EMP with mitigation measures based on principles of best management practices. HSE management system undertakes carrying out a complete assessment, evaluating,

monitoring, identifying and control measures (mitigation) of all potential hazards and risks arising during the construction, operation and decommissioning phases of the proposed project. It needs to ensure that the Health and Safety Plan (HSP) along with the Health and Safety Rules is established, documented and enforced. The plan also outlines roles, responsibilities and expected outcomes of proper implementation with respect to the environment, health and safety management of various phases of the project. These measures should be implemented to ensure that no significant adverse, health and safety impacts occur due to proposed activities associated with the project.

Protection of the public in general and workforce health and safety in particular during both construction and operations is of paramount importance to the project. Utilizing expert personnel and adopting tailor made Environment, Health and Safety Management System (EHSMS) that is specifically designed for the project, the potential health and safety hazards and risks associated with the project as identified and assessed, would then be mitigated by adopting standard procedures for various operations at facilities in the project.

8.6 Roles and Responsibilities

Environmental management will be the integral part of policy of CDPL. Therefore, committing to reduce the environmental impacts will reflect the management approach and believe that good performance in this area is synonymous with running a well-managed efficient proposed project operations. During the construction phase, main responsibility of environmental performance will reside with the construction manager, who in turn will be assisted in daily activity monitoring by site EHS officer.

In case of normal operational phase, main responsibility for environmental performance will be supervised by Site Manager of The Arkadians while the daily management will be performed under the Site Supervisor. Under their surveillance, environmental management during operations will be performed as per the mitigation and monitoring plans outlined in this EIA. A brief structure of role and responsibilities is given below:

8.6.1 Top Management of Project

Environmental management plan (EMP) will be regulated by the Project top management; therefore will play an important role. Some of the key role & responsibilities are given below.

To cooperate and consult with relevant environmental agency in order to perform in better way.

To evaluate the progress of development and implementation of this management plan.

To approve any change in decision making with the consultation of respective managers, if appropriate

8.6.2 Construction Manager

The role of Construction Manager is very important. The success of an EMP will mainly depend upon effective management of the EMP by this person. Following are some of the roles and responsibilities given to the Construction Manager.

To ensure that the points of views of staff, contractors and EHS officers are considered and placed in the EMP accordingly.

To identify issues and where possible propose solutions for inclusion in the management plan review process.

To improve coordination and exchange of information between top management, employees, contractors, etc.

To contribute towards the actions to deliver the management plan and ensure its continued development.

To monitor the progress of development and implementation of this management plan.

8.6.3 EHS Officer

The role of EHS officer will be vital during the construction phase. He will be the key advisor on environmental issues to the construction manager of The Arkadians project.

To integrate, as far as possible, the aims and objectives of different users within an agreed plan.

To maintain a balanced, holistic approach to the solution of concerned issues in accordance with the compliance to the legislative requirements.

To provide professional guidance on questions relating to the environmental management and issues raised by contractors/relevant personals.

To progress the EMP process through development towards implementation.

8.6.4 Contractor

On behalf of contractor, the main responsibilities for all matters pertaining to environment will be that of the chief executive officer of the assigned contractor. The role and responsibilities of the contractor will consist of the following basic points:

To carry out construction activities in environmentally sound manner.

To coordinate with the EHS officer to resolve issues arise during construction phase.

To manage and implement environmental management practices as per the impact assessment report as well as EHS polices belong to both contractor and The Arkadians.

To manage construction crew and reduce the environmental impacts.

To appoint a dedicated environment officer that will understand and tackle environmental issues more easily.

8.6.5 Security/Administration/ Fire Safety Managers

The role of these managers will be crucial during the operation phase as all of the key environmental aspects listed fall into their respective domains. Following are some of the common roles and responsibilities given to these positions.

To ensure that the points of views of staff, are considered and placed in the EMP accordingly.

To regularly meet and resolve the upcoming and on-going environmental issues.

To identify issues and where possible propose solutions for inclusion in the management plan review process.

To make sure that relevant staff is adequately trained to carry out their respective duties in order to improve environmental performance of the proposed Arkadians Project.

To contribute towards the actions to deliver the management plan and ensure its continued development.

8.7 Regulatory Requirements

Approvals, Authorizations and Permits

The list of potential approvals, authorizations and permits required for the Project from various agencies including, federal, provincial, municipal are given below:

Sindh Environment Protection Agency (SEPA).

Sanction of utilities from concerned department such as Karachi Water and Sewage Board (KW&SB), K-Electric and Pakistan Telecommunication Company Limited (PTCL).

Approval from DHA under the Building Control and Town Planning Regulations 2011, Pakistan Defence Officers Housing Society.

8.7.1 Environmental Quality Objectives

This section outlines the criteria for management's quality objectives and generation of solid waste and wastewater quality, air and noise quality. The management of M/s. Creek Developers (Pvt.) Limited will review Environmental Objectives once a year and try to complete them in the stipulated time frame. This will also include any applicable

treatment criteria meeting the Sindh Environmental Quality Standards (SEQS) as per Pakistan Environment Protection Act 1997.

8.7.2 Compliance Monitoring

The management of M/s. Creek Developers (Pvt.) Ltd. shall comply with the Environmental Monitoring Plan outlined in the subsequent section. The compliance for periodic reporting is also required for the monitoring results in form of report submitted to the Environmental Protection Agency. During the construction phase, it will be on monthly basis and during the operation phase it will be done on quarterly basis.

It is also understood that monitoring will be done by an independent consultant /organization.

8.8 Implementation Stages of the EMP

CDPL will undertake overall responsibility for compliance with the EMP. It will ensure that all activities it executes with contractors comply with positive environmental sensitivities as well as it will cooperate with the concerned regulatory agencies such as the SEPA.

On the other hand, contractors will carry out field activities as part of the proposed project that includes relevant and subsidiary construction work. The contractors will be subjected to certain liabilities under the environmental laws of the country which will be mentioned in the contract with CDPL.

Some of the approaches to be followed during the environmental management practices are given below.

Complying with the relevant legislation and regulations.

Regularly reviewing of the impacts on the environment.

Developing appropriate indicators in order to monitor core impacts.

Setting appropriate annual objective, targets and publicly reporting on progress.

Communicating openly with internal and external stakeholder on environmental issues.

8.8.1 Planning and Design of the Proposed Project

There are three main components to consider in an EMP prior the construction phase. Implementation of EMP at this stage may tackle the environmental issues before they arise. Those components are given below:

8.8.2 Design of the Proposed The Arkadians Project

It describes the location of proposed project, its adjoining conditions in the area, facilities to be installed in particular locations as well as their mechanics and other

related operations. If any design parameter changes at time of approval, CDPL will assess the environmental impacts that may arise from such changes. If the impacts are found to be different and in excess of those mentioned in the report, CDPL will develop further mitigation measures with respect to the changes to minimise these impacts and seek approval for the required change from SEPA as well as other regulatory authorities, if comes under.

A. Approvals

Obtaining NOC from SEPA does not relieve CDPL of other obligations and hence CDPL and contractor will obtain all relevant clearances and necessary approvals required by the government prior to commencing the proposed operation. In addition, issuance of NOC will beabided by CDPL to conduct continuous monitoring.

B. Contractual Provisions

The requirements of environmental impact assessment in terms of environmental mitigation shall be incorporated into the operations plans and procedures of the contract. Therefore, signing of contract will strictly bind contractor to follow those procedures and must comply the environmental regulations.

8.8.3 Construction and Operation Phase

In order to implement EMP successfully during construction and operation phase, it is required to follow mitigation measures, monitoring plan and emergency procedures strictly. Training will be required at each step and phase, also if necessary to change management processes, will be documented and available to the employees.

A. Mitigation Plan

It defines all the impacts and their remedial with highlighting the responsible personals to work on those mitigations. A mitigation plan is basically a mitigation matrix which is given as Table 8.1 and table 8.2 for construction & operational phase respectively. All these impacts and mitigations have already been given in previous section of this report. The proponent and construction contractor will be required to adhere to these mitigation measures throughout the project.

B. Training

This is another major step for the implementation of EMP. All the employees will require to be trained appropriately to work on EMP effectively. Employees training can provide workers to minimize waste generation, conserve resources such as water and natural gas etc. The HSE Officer will determine the training requirements in consultation with contractor among the staff of both construction contractor and developer's staff with the advice of Site Manager.

C. Monitoring and Review

Monitoring of all the activities will be required to analyse the impacts of construction and operation on the environment and detailed Monitoring plan is given in table 8.3.

Project Manager will coordinate with Site Manager and contractor site representative to monitor environmental parameters during the construction phase.

During operations, the Project Manager will follow the monitoring plan as mentioned in the IEE. He will keep record of all environmental non-compliances and report them along with the corrective actions in meetings with the Management Committee members.

D. Meetings

Meetings are an important source of information exchange will be held periodically during the project to discuss any hang-up in the project. Environmental monitoring and performance will also be taken up in such meetings to evaluate the extent the EMP requirements are being met. The following meetings will take place during the project in addition to other meetings:

Project initiation meetings (once for each of the contractors).

Fortnightly meetings

The purpose of the project progress meetings will be to discuss the EMP, and ensure full understanding and commitment from concerned parties for its implementation. Meetings will be held periodically during the construction phase. The purpose of the meetings will be to discuss the progress of construction, any non-compliance observed, and any EHS / social issues identified at the project site. The remedial measures will also be discussed and agreed during these meetings. The meetings will be recorded in the form of a report prepared by the EHS Officer.

8.8.4 Traffic Management Plan

In view of the anticipated traffic volume which will be generated from the Arkadians, the proponent has merged enough parking capacity within the building design to accommodate the vehicles. The space for parking will also be managing the vehicles of visitors.

The proponent has conducted a traffic survey and has developed a comprehensive Traffic Load Management plan for the Residential Towers, Office Towers and Retail Mall. The vehicles exit and entry strategy will be aligned with the traffic flow to cause minimum hindrance. Garbage collection routes and emergency vehicle route have been defined

In case of an accident, the building management shall:

Contact the appropriate emergency response agencies immediately.

Remove the vehicle in order to overcome the problem of traffic congestion on the main road.

Record details of the incident and the appropriate mitigation measures taken at the time of incident.

Identify the cause of accident and report it to senior management.

8.9 Management Approach

Management will undertake overall responsibility for compliance with the EMP. It will ensure that all the activities that the management executes comply with positive environmental sensitivities as well as it will cooperate with the concerned regulatory agencies such as Sindh Environmental Protection Agency.

On the other hand, contractor will carry out field activities as part of the proposed project that includes relevant and subsidiary construction work. The contractor will be subjected to certain liabilities under the environmental laws of the country, which will be mentioned in the contract with the project site. The dynamic approaches that are followed towards successful implementation of the environmental management plan listed below:

Compliance with the relevant legislative and regulatory requirements of the project.

Developing appropriate monitoring indicators in order to assess the performance as well as magnitude of impact on the ecosystem (core impacts).

Regular review of the project activities and assessing their impacts on the environment.

Communicating broadly with internal and external stakeholders on issue of environmental concerns.

8.10 Environmental Monitoring Plan

The EIA predicts the impacts of the proposed project on the basis of information available at the time of conducting the assessment and the natural processes that link various environmental parameters. Based on this prediction, mitigation measures are proposed such that the predicted residual effects do not exceed acceptable levels. However, there is always an element of uncertainty in such predictions due to an insufficient grasp of the processes, limitations in prediction techniques, or inadequate data on the environment/social aspects. Consequently, it is possible that even if the mitigation measures are implemented fully, the negative impacts of the project might exceed acceptable limits.

In order to address the above concerns, environmental health and safety monitoring will be undertaken during the project activities, with the overall objective of proper management of environmental and social risks and uncertainties. Broadly, monitoring will be undertaken with the following objectives:

To verify that the impacts of the proposed project are within acceptable limits, thus establishing credibility (public assurance).

To immediately warn the project proponents (and the regulatory agencies, if required) of unanticipated adverse impact or sudden changes in impact trends so that corrective actions can be undertaken, which may include modifications in the proposed activities, or the inclusion of modified or additional mitigation measures.

To provide information to plan and control the timing, location, and level of certain project activities so that the effects are minimized.

The following environmental parameters will be monitored at locations identified during the construction phase:

Ambient Air Quality (NO_x, SO_x, CO, O₃, Lead, SPM, PM₁₀, and PM_{2.5})

Ambient Noise levels

A detailed environmental monitoring programme/plan is provided in this section to assist the proponent in evaluating and monitoring the project performance against the EIA requirements.

8.10.1 Independent Monitoring Consultant (IMC)

The role of Independent Monitoring Consultant (IMC) is very important to the overall performance of the facility in terms of environment, health and safety. The IMC can provide professional testing and consulting services to enhance the environment, health and safety performance of the facility in the areas of water, air quality, waste management and other aspects. The proponent can chose to hire an IMC for periodic monitoring of its facility in Korangi to evaluate compliance to EPA's requirements.

8.10.2 Compliance Monitoring

The compliance monitoring of the project activities is principally a tool to ensure that the environmental control measures identified in the EIA are strictly adhered to during the project activities. Compliance monitoring will be the responsibility of all organizations involved in the field activities, i.e., CDPL and the contractors. It will be carried out by the following:

EHS Officer

EHS Monitor or Independent Monitoring Consultant (IMC)

The compliance monitoring will be done at agreed intervals:

Systematically observe the activities undertaken by the contractors (and subcontractors) or any other person associated with the project.

Verify that the activities are undertaken in compliance with the EIA and EMP.

Document and communicate the observations to the concerned person(s) of the contractors and CDPL EHS Officer, so that any corrective measures, if required, can be taken in a timely manner.

Maintain a record of all incidents of environmental and social significance, related actions and corrective measures.

Maintain contact with the stakeholders, solicit their views and concerns, and discuss them during the regular meetings.

Prepare periodic reports of the environmental, health and safety performance of project.

The mitigation plan discussed in Table 8.2 will be used as a management and monitoring tool for compliance monitoring. Inspection will be done using checklists prepared by the respective contractors, on the basis of Table 8.2, during the construction phase.

8.11 Audits

In particular, there will be:

Annual audit reports.

A triennial review and improvement of the EMP.

Management recognizes that periodic external compliance audits and inspections will be made to monitor, assess and validate the level of performance and compliance pursuant to the commitments made in the accepted Environmental Management Plan. Management also proposes to conduct the following in-house audits:

8.11.1 Site Internal Environmental Audit

It is required in order to enable site management to assess the day-to-day environmental management of activities at the site. Environmental activities include all aspects of operations that result in emissions, effluent or wastes, etc.

8.11.2 Environmental Management Systems Audit

It is required to assess the implementation and operational success of the EMS at the site. This is achieved by assessing the objectives, organizational structure, responsibilities, procedures, processes and resources available at the site. The EMS Audit is a systems assessment, rather than an audit of environmental compliance, which is assessed through the Site Internal Environmental Audit.

8.12 Change Management

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

No modification will be made to the Project without authorization from CDPL top management or. Any modification will be carried out in accordance with the procedures approved by CDPL.

Proposed modifications must be evaluated for safety, health and environmental impact and a signed document should be available before the change can be implemented. The document should be signed for a second time before the change is made.

8.13 OHS Plan

Occupational Health and Safety Management System is essential for the care of OHS issues which should outline mitigation measures and best management practices. This management system recommends carrying out a complete assessment, evaluation, monitoring, identifying and control all potential hazards and risks that arise during the construction and operation phases of the proposed project. OHS Plan is attached as **Annex IV**.

8.14 Emergency Response Plan (ERP)

Emergency Response Plan (ERP) for the Arkadians Project has been developed and procedures prepared to include all events which have the tendency to create an emergency situation at the Arkadians. ERP is attached as **Annex IV**.

8.15 Water Management Plan

The purpose of the Plan is to ensure that CDPL drinking water and waste water discharges meet all the requirements of the SEQS for drinking water and Effluents. Water management Plan is attached as **Annex IV**.

8.16 Waste Management Plan

The waste management plan has been prepared for the proposed Arkadians Project in order to assist the CDPL management to collect, handle and dispose of the waste generated from routine operations. Waste management Plan is attached as **Annex IV**.

8.17 Maintenance of the EMP

EMP needs to be revised on periodic basis to maintain up-to-date environmental management requirements with the changing physical and regulatory constraints.

Therefore outlining and defining the responsibilities of personnel and activities under the project's operation execution, implementation, operation & monitoring and decommissioning phase are integral part of maintenance of the EMP. Dissemination of reviewed and revised EMP need to be notified to all stakeholders particularly, relevant government and municipal agencies so that their modified role is also redefined and re-established in the overall environmental management process.

Table 8.1: Roles and Responsibilities

Organization	Designation	Responsibilities
CDPL	Site In Charge / Head of Projects	- Fulfill responsibilities as assigned. - Ensure that the construction is carried out within the agreed timeframe according to satisfactory EHS and building standards - Review environmental reports, and ensure implementation of corrective measures, if any. - Coordinate with other stakeholders and EPA.
	EHS Supervisor/Officer	- Ensure that the entire project is conducted in an environmental friendly and socially sound manner. - Ensure compliance with all relevant environmental laws. - Facilitate full implementation of EMP and EIA requirements during the project. - Assist the Site In-charge in fulfilling the environmental and social responsibilities, and keep them updated on environmental and social matters relating to the construction.
Contractors	Construction Contractor/construction Supervisor	- Manage construction activities, manage construction crew, camp crew and other site personnel, in an environmentally and socially responsible manner; - Liaise with Arkadians Site In-charge. - Manage implementation of entire EMP, including the mitigation plan; - Report regularly to Site Manager/supervisor; - Liaise with Arkadians EHS Supervisor; - Provide instruction to workers on good construction practices

Table 8.2 Mitigation Matrix for Design and Construction Phase			
S. No	Affected Areas	Possible Mitigation Measures	Responsibility
1	Structural Stability	During the construction of basement it will be important to maintain the stability of excavated walls.	Site Management
		During monsoons or in the case of ingress of ground water (due to inadequate dewatering) it will be essential to protect the excavation walls with shoring/bracing.	Site Management/ Construction Contractor
2	Liquefaction Hazard	Avoid construction on liquefied susceptible soil.	Construction Manager
		If it is necessary to construct on liquefaction susceptible soil because of space restrictions, lack of favorable location, or other reasons, it may be possible to make the structure liquefaction resistant by designing the foundation elements to restrict the effects of liquefaction.	Site Management
		By improving the strength, density, and/or drainage characteristics of the soil.	Site Management
3	Soil Erosion	The project will be scheduled to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical.	Site Management
		After constructional activities, the site which is cleared temporarily will be re-vegetated promptly.	Construction Contractor
		Off-site sediment transport will be reduced or prevented by the use of settlement ponds, silt fences, water treatment, as well as modifying or suspending activities during extreme rainfall and high winds to the extent practical.	Site Management
		The environmental impact of soil erosion can best be mitigated by removing vegetative cover only from the specific site on which construction is to take place and by disturbing the vegetation in adjacent areas as little as possible.	Site Management
		Disturbing the existing vegetation and natural contour of the land as little as possible can mitigate surface runoff.	Site Management
		Construction activities that result in the soil being laid bare could be scheduled in such a way that some type of vegetative cover appropriate to the site could be established prior to the onset of intense rain or windstorms.	Site Management
		If grass is to be seeded, mulch of straw will help to protect the soil from less extreme erosive forces until vegetative and root development begins.	Site Management
		Exposed surface was regularly wetted to effectively keep airborne dust levels to minimum.	Construction Contractor
		During the windy weather situation, the stockpiles of fine materials will be covered with tarpaulin.	Construction Contractor
4	Contaminated Land	Site workers are mandated to wear dust masks especially during dry and windy weather conditions.	Construction Contractor
		Fuel oils, lubricants, and chemicals will be stored in covered dyked areas, underlain with impervious lining.	Site Management
		Maintenance of vehicles and equipment will be carried out in designated areas.	Construction Contractor
		Washing of vehicles will be carried out in the designated areas.	Construction

Table 8.2 Mitigation Matrix for Design and Construction Phase			
S. No	Affected Areas	Possible Mitigation Measures	Responsibility
			Contractor
		Construction vehicles and machinery will be examined on a regular basis for leakage prevention.	Construction Contractor
		Removal of oil and contaminated soil around the fuel and oil storage areas will be made possible by the availability of appropriate implements i.e. shovels, plastic bags and absorbent materials.	Construction Contractor
		Contaminated media will be managed with the objective of protecting the safety and health of laborer at the site, the surrounding residents, and the environment.	Site Management
		Plans and procedures will be prepared, to respond to the discovery of contaminated media to minimize or reduce the risk to health, safety, and the environment consistent with the approach for Contaminated Land.	Site Management
		The historical use of the land will be understood with regard to the potential presence of hazardous materials or oil prior to initiation of construction activities.	Site Management
5	Construction Waste	A comprehensive waste disposal plan to be developed to effectively manage these waste in large quantities.	Site Management
		The construction waste which will be sent for recycling like damaged pipes, left over steel, wooden and plastic pieces. While, the rest of the left over waste will then be taken away to the dumping sites for disposal.	Site Management
		The construction material will be kept in a covered place, especially during the precipitation season.	Contractor
		The excavated soil will be re-used by adopting different methods, which will be used as a filling material for the construction of the project.	Contractor
		Various waste containers for different types of waste will be deployed, in order to treat the waste in accordance with its nature.	Contractor
		The waste bins will be properly marked for each type of waste produced during the constructional activities.	Contractor
		The project area will contain the sewage and litter facility to overcome the problem of unchecked dumping of waste.	Site Management
		Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste.	Site Management
		Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time.	Site Management
6	Ambient Air Quality	Minimizing dust from open area sources by using control measures such as installing enclosures and covers, and increasing the moisture content.	Contractor
		Dust suppression techniques will be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements.	Site Management
		PPE, such as dusk masks, will be used where dust levels are excessive.	Contractor
		Sprinkling of water and fine spray from nozzles to suppress the dust.	Site Management
		On-Road- Inspection will be done for black smoke generating machinery	Site Management

Table 8.2 Mitigation Matrix for Design and Construction Phase			
S. No	Affected Areas	Possible Mitigation Measures	Responsibility
		Only those vehicles having certificate with respect to exhaust emission quality and noise will be allowed to supply the construction material to the project site	Site Management
		Sand and other materials transported by trucks shall be kept covered to prevent dust dispersion.	Contractor
		Speed bumps are commonly used to ensure speed reduction. In cases where speed reduction cannot effectively reduce fugitive dust, it may be necessary to divert traffic to nearby paved areas.	Site Management
		Fabrics and plastics for covering piles of soils and debris is an effective means to reduce fugitive dust.	Contractor
		Care will be taken to keep all the material storages adequately covered and contained so that they are not exposed to situations where winds on the site could lead to dust / particulate emissions.	Site Management
		Ensure that the vent of generator exhaust is at adequate height so it will not be a cause of localized dispersion	Site Management
7	Water Consumption	A complete record of water consumption during the construction phase will be maintained.	Site Management
		Construction workers will be trained to use water efficiently in way to reduce the wastage of water during different activities occurring in the construction phase.	Site Management / Contractor
8	Wastewater Generation and Disposal	Maintenance of vehicles and equipment used in the construction phase of the proposed project, in order to overcome the generation of wastewater at large scale.	Contractor
		Washing of vehicles and construction machinery will be restricted to a designated area.	Contractor
		Wastewater will not be disposed off directly into the water bodies, but first be treated and then the effluent will be disposed off in a proper manner.	Site Management
		Development of wastewater treatment facility i.e. septic tank, at the site of the proposed project area The wastewater treatment facility of the project will be leak proof.	Site Management
		Regular monitoring of the wastewater generation will be taken into consideration.	Site Management
		Wastewater generation will be minimized by controlling the pollutants at the source.	Contractor
		The oily waste will be contained before disposing the wastewater into the sewer.	Site Management/ Contractor
		Adequate portable or permanent sanitation facilities serving all workers will be provided at all construction sites.	Site Management
9	Solid Waste Generation and Disposal	Sewage will not be mixed with any other waste.	Site Management
		Separate bins will be placed for different type of wastes - plastic, paper, metal, glass, wood, and cotton.	Site Management
		Recyclable material will be separated at source. The recyclable waste will be sold to waste contractors for recycling.	Site Management
		Non-hazardous non-recyclable wastes such as construction camp kitchen wastes will be disposed of in landfill site through municipal administration or approved waste manager/contractor.	Contractor
		No wastes will be dumped at any location outside the site boundary.	Contractor
		All hazardous waste will be separated from other wastes. Hazardous wastes will be stored in designated areas with restricted access and proper marking.	Contractor

Table 8.2 Mitigation Matrix for Design and Construction Phase			
S. No	Affected Areas	Possible Mitigation Measures	Responsibility
		Hazardous wastes will be disposed of through approved waste manager/contractor.	Site Management
		Surplus construction materials including partially filled chemical and paint containers will be returned to suppliers. Inert construction wastes will be disposed of onsite as fill material or sold as scrap to contractors.	Contractor
		Records of all waste generated during the construction period will be maintained. Quantities of waste disposed, recycled, or reused will be logged on a Waste Tracking Register.	Contractor
		Training will be provided to personnel for identification, segregation, and management of waste.	Site Management/ Contractor
10	Noise and Vibration	Transport associated with the construction of the project will be avoided or minimized through already existing residential areas.	Contractor
		Noise control devices will be used such as temporary noise barriers and deflectors for constructional activities.	Contractor
		The residential area will be separated from traffic noise zones and the protection of schools and hospitals by green belts.	Site Management
		The activities associated with greatest potential to generate noise will be planned during the day period that will result in least disturbance to the nearby residents at night.	Site Management
		Truck drivers will be instructed to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as mosques, schools and hospitals.	Contractor
		Noise and vibration will be minimized in the projects site and surrounding areas through sensitization of the truck drivers to switch off vehicle engines while offloading material.	Site Management
		Construction machinery will be kept in good condition to reduce noise generation.	Site management/ Contractor
		All generators and heavy duty equipment will be installed and placed in enclosures to minimize ambient noise levels.	Contractor
11	Vehicular Traffic	The proponent will put in place measures to address such concerns by ensuring that construction vehicles preferably deliver materials during off-peak hours when traffic volume is low.	Site management
		There will also be provision for caution signs on the access road to alert users on construction activities in progress in order to prevent occurrence of accidents.	Site Management
		Heavy traffic during construction phase will come to the project site during late night hours.	Site Management
		Speed of vehicles will be regulated during construction phase.	Site Management/ Contractor
		Impacts from the traffic flow will be minimized through proper planning of the transportation of materials to ensure that vehicle fills are increased, in order, to reduce the number of trips done or the number of vehicles on the road.	Site management

Table 8.2 Mitigation Matrix for Design and Construction Phase			
S. No	Affected Areas	Possible Mitigation Measures	Responsibility
		Truck drivers will be sensitized to avoid unnecessary racing of vehicle engines at loading/offloading areas and to switch off or keep vehicle engines at construction site.	Contractor
12	Materials Selection	The structures and materials will, in the subsequent construction stage, conform to recommended standards and follow standard practice of civil works.	Site Management
		Materials including paving stones, crush, gravel and sand will be brought from commercial quarries located in Sindh province. Environmentally sound materials and goods will be selected, with priority being accorded to products meeting national and international standards.	Site Management
		Traditionally well-ried materials and components will be selected and selection of construction materials would be based on sustainable source.	Site Management
		Construction site will be adequately isolated to prevent entry of public and general safety measures will be evocatively imposed throughout the construction period.	Site Management
		The production, use and disposal of building materials during the construction stage of The Arkadians will utilize considerable amount of energy and resources; all attempts will be made towards efficient consumption and minimization of wastage of water, energy and materials.	Site Management
		Best practice of energy efficiency will be adopted in the building design. The Project building would be constructed with high level of thermal insulation.	Site Management
		The environmental impacts arising from selection of building materials and components would take account of the environmental issues during the materials selection process, and introduce Recycling strategies such as Reuse and Reduction of wastewater.	Site Management
13	Occupational Health and Safety	Workers will be trained with lifting and materials handling techniques before the construction of the project, including the placement of weight limits above which mechanical assists or two-person lifts are necessary. Work site layout will be planned to minimize the need for manual transfer of heavy loads	Site Management
		Tools will be selected and work stations would be designed to reduce force requirements and holding times, which promote improved postures, including, where applicable, user adjustable work stations.	Site Management
		Administrative controls, such as job rotations and rest or stretch breaks will be implemented into the work processes.	Site Management
		Good house-keeping practices, such as the sorting and placing loose construction materials in established areas away from foot paths, will be implemented.	Site Management
		Excessive waste debris and liquid spills will be cleaned up regularly.	Site Management
		Electrical cords and ropes will be located in common areas and marked corridors.	
		Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones, as well as securing, marking, and labeling covers for openings in floors, roofs, or walking surfaces.	Site Management
		Training and use of temporary fall prevention devices, such as rails or other barriers able to support a weight of 200 pounds, when working at heights equal or greater than two meters or at any height if the risk includes	Site Management

Table 8.2 Mitigation Matrix for Design and Construction Phase			
S. No	Affected Areas	Possible Mitigation Measures	Responsibility
		falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface.	
		Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards as well as fall rescue procedures to deal with workers whose fall has been successfully arrested.	Site Management
		The location of vehicle traffic, machine operation, walking areas, and controlling vehicle traffic will be planned and segregated through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic	Site Management
		Appropriate PPE such as safety glasses with side shields, face shields, hard hats, and safety shoes, would be wore.	Site Management
		The visibility of personnel would be ensured through the use of high visibility vests when working in or walking through heavy equipment operating areas as well as training of workers to verify eye contact with equipment operators before approaching the operating vehicle	Site Management
		Inspected and well-maintained lifting devices will be used that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.	Site Management
		Access to the site will be restricted through a combination of engineering and administrative controls.	Site Management
14	Community Health and Safety	Removing hazardous conditions on construction sites that cannot be controlled effectively with site access restrictions, such as covering openings to small confined spaces, ensuring means of escape for larger openings such as trenches or excavations, or locked storage of hazardous materials.	Site Management
		The mobility of the community living in the area would be restricted from the project site in order to prevent from catching any type of communicable diseases.	Site Management
		Any laborer found to catch any type of disease will leave the site immediately; and would be given proper medical facilities.	Site Management
		The incidence of road accidents involving project vehicles during construction would be minimized through a combination of education and awareness-raising, and the adoption of procedures.	Site Management

Table 8.3: Mitigation Matrix during Operation Phase of the Project			
S. No.	Affected Areas	Possible Mitigation Measures	Responsibility
1	Solid Waste	Storage facilities will be created and established by taking into account quantities of waste generation in the apartment complex and the population densities.	Project Manager
		All solid waste will be segregated into organic and recyclable waste at source and then collected, stored and transported for ultimate safe disposal.	Project Manager
		Handling and disposal of such waste will be managed by a dedicated waste managing contractor.	Project Manager
		Adequate provision will be made for storage of solid waste.	Project Manager
		Flats and multi-storeyed commercial buildings will have bulk dustbin type container.	Project Manager
		The solid waste management plan will be developed and facilities for collection, storage and transportation will be established and organized.	Project Manager
		A storage facility will be so placed that it is accessible to resident, employees and visitors of the project.	Project Manager
		A storage area will be allocated for storage and pre- treatment of the waste. This storage area will be covered and the pollutants from the waste would not affect the surrounding.	Project Manager
		Local authorities will provide different colored bins for different categories of waste.	BMC
2	Wastewater Generation & Disposal	Grease interceptor and/ or oil skimmer to be installed on kitchen effluent to maintain oil levels within SEQS limits.	Project Manager
		Water conservation strategies will be employed to avoid wastage of water.	Project Manager
		Waste segregation measures would be employed to minimize entry of solid waste into the wastewater stream.	Project Manager
		Periodic preventive maintenance of pumps, diffusers and other ancillary equipment's.	Project Manager
		Periodic monitoring of wastewater to ensure compliance with SEQS.	Project Manager
		Provision of proposed package wastewater treatment plant so that the effluent is primary treated and then disposed off to the main sewer line.	Project Manager
		Periodic monitoring of wastewater to ensure compliance with SEQS.	Project Manager
3	Water Consumption	The cleaning agents used will be non-hazardous.	Project Manager
		A complete record of water consumption during the operation phase will be maintained.	Project Manager
		Water conservation practices will be adopted to prevent wastage of water.	Project Manager
		The water supply lines will be checked and repaired for leaks, if any, in order to reduce wastage of water.	Project Manager
		Use of water efficient sanitary fittings such as low flush toilets, water efficient shower heads, and aerators on faucets will be ensured throughout the Project cycle.	Project Manager
4	Energy Consumption	The energy usage during the operational phase will be monitored and targets would be set for efficient use of energy.	Project Manager
		The occupants of the apartments and employees of the offices will be sensitized to ensure energy efficiency in their domestic operations.	BMC
		The energy-efficient lighting system installed for the project will contribute immensely to energy saving during the operational phase of the project.	Project Manager

Table 8.3: Mitigation Matrix during Operation Phase of the Project			
S. No.	Affected Areas	Possible Mitigation Measures	Responsibility
5	Air Emission	Regularly carry out ambient air quality monitoring at various points on the access road and immediately outside the proposed project premises.	Project Manager
		Carbon monoxide detectors are to be provided in car parking which would be interlocked with the ventilation system.	Project Manager
		Monitor all exhausts at regular frequency.	Project Manager
		Carry out regular maintenance of generators.	Project Manager
6	Traffic Flow & Congestion	Designated parking areas will be provided for the type of project vehicles within and around the project site.	Project Manager
		Traffic management plan will be introduced to manage smooth flow of vehicular traffic and to avoid traffic jam and long queues.	Project Manager
		Engineering design to examine vehicles exit and entry strategy so that it aligns with the traffic flow to cause minimum hindrance.	Project Manager
		Traffic management plan will be implemented and monitored.	Project Manager
		Vehicles will be parked at designated parking areas during operational phase.	Project Manager
		Parking of vehicles alongside the road would be prohibited at all times.	Project Manager
		Ramp slopes and passage areas to cater for worst case scenarios traffic flow on the main and service roads.	Project Manager
7	Illumination	Evaluation of minimum illumination requirement would be carried out in MEP Services Concept Report, for individual areas.	Project Manager
8	Fire	Standard fire and smoke detection and protection devices such as alarms, fire hoses and hydrants to be provided in all critical.	Project Manager
		The facility would possess a detailed emergency and evacuation plan that must be regularly drilled to make sure that the responsible staff remains trained at all times.	Project Manager
		Firefighting equipment such as fire extinguishers and hydrant systems would be maintained at strategic locations within the premises.	Project Manager
		Regular inspection and servicing of the extinguishers will be undertaken by a reputable service provider and record of such inspections should be maintained.	Project Manager
		Signs such as “NO SMOKING” will be prominently displayed within the premises, especially in parts where inflammable material are handled.	Project Manager
9	Socioeconomic Impacts	Shading to be provided to overcome to solve the problem of gazing.	BMC
		Plantation would be done to restrict the gazing of the residents and employees of the project.	BMC

Table 8.4 : Environmental Monitoring Plan for The Arkadians (Construction and Operation Phase)

Monitoring Areas	Location of monitoring	Parameters and Techniques to Monitor	Monitoring Frequency Parameter	Reason to Monitor	Responsibility
Air quality	- Generator area - Any potential site of air emissions (particularly dust emissions during site preparation, excavation)	- Parameters to monitor include: VOC, Hydrocarbons, Particulate Matters, SO₂, NO_x and CO. - Monitor adequacy of dust suppression measures undertaken:	Daily during construction and then regular during monitoring	Legal obligations, Occupational and local safety	- Third party lab/ Consultant - Contractor
	Storage and transportation of construction materials, excavated soil and silt;	Monitor adequacy of measures undertaken to prevent fugitive dust; monitor disposal of excavated soil and silt to see they are disposed of at approved site	Daily during construction		
Flooding/ Water Logging	Drainage Points	Monitor construction activities to ensure that they do not result in blockage of drainage and cause flooding or water logging at the project site	Weekly during construction	Legal obligations and maintenance of sanitary conditions	Third party lab/ consultant
Surface and Groundwater quality	- Surface runoff management; - At likely contamination points	- Monitor surface runoff management measures; - Monitor measures taken to prevent contamination of ground/ and or surface water from waste and sewage generated from construction activities.	Weekly during construction	Protection of water resources	Third party lab/ Consultant
Discharge of Effluents(Discharge of sewage into the sewer)	At discharge points	Monitor sewage quality at discharge points after treatment.	Monthly during construction	Protection of water resources	Third party lab/Consultant
Solid Waste	Collection, handling, storage areas and disposal	- Excavated soil and other construction waste - Solid waste generated from households and commercial units	All time activity Monthly during operation phase	Requirement of environmental Management	Construction Contractor during construction and Building Management during regular Operation

Table 8.4 : Environmental Monitoring Plan for The Arkadians (Construction and Operation Phase)					
Monitoring Areas	Location of monitoring	Parameters and Techniques to Monitor	Monitoring Frequency Parameter	Reason to Monitor	Responsibility
Occupational Risks	Construction machinery/equipment and construction activities	Monitor adherence to all occupational health safety requirements	Weekly during construction	Occupational safety and legal obligations	Contractor
Traffic management	The access roads to the project area	Monitor movement of construction vehicles across site Monitor and check for any hindrance caused by construction vehicles	regular during construction phase	To avoid inconvenience to the general public and to facilitate smooth flow of traffic	Construction Contractor
Noise	- Construction machinery - Generators	Noise intensity measurement;	- At the time of construction - Once at the time of noise source change	Occupational safety	Third party lab/consultant

9.0 CONCLUSION

The EIA of the “The Arkadians” Project has been conducted with respect to environmental and social aspects using the environmental assessment guidelines and incorporating all due information and data required evaluating the possible impacts of the proposed project through comparative evaluation and assessment technique. The impacts that are likely to arise during the construction phase of the project are short termed and restricted to the project area which have been controlled and reduced through suggested mitigation measures proposed in the Environmental Management Plan (EMP). The operational phase impacts are of lesser significance and hence may be addressed through continued environmental management and sustained monitoring of the project area. The assessment was carried out keeping in view the Pakistani legislation and SEPA, 2014.

Baseline environmental and socioeconomic information was collected from a variety of sources, including reports of previous studies, published literature, and field surveys. The information collected was used to compose profiles of the natural, socioeconomic, and cultural environments likely to be affected by the project.

The proposed project activities were reviewed, and an assessment made of the potential impact of these activities on the area’s natural, socioeconomic, and cultural environments is also described in this report. Where appropriate, mitigation measures were recommended to keep the adverse environmental impact within acceptable limits.

It is therefore concluded that if the field activities, including the implementation of all mitigation measures, are carried out as described in this report, the anticipated impact of the project on the area’s natural and socioeconomic environment will be well within acceptable limits. The project will also comply with all the statutory requirements and standards listed in this report.

The project proponent shall comply with the findings, conclusions and based on the approval of the environmental assessment of the study, the proposed mitigations as suggested in the form of Environmental Management Plan for ensuring sustainable development in the project area.

The study therefore recommends that the EIA report should be approved with the provision that the suggested mitigation measures will be adopted and the Environmental Management Plan will be followed in letter and spirit.

ANNEXURES

Annex – I
Sindh Environmental Protection Act, 2014 (SEPA)



The Sindh Government Gazette

Published by Authority

KARACHI THURSDAY MARCH 20, 2014

PART-IV

**PROVINCIAL ASSEMBLY OF SINDH
NOTIFICATION
KARACHI, THE 20TH MARCH, 2014.**

NO.PAS/Legis-B-06/2014- The Sindh Environmental Protection Bill, 2014 having been passed by the Provincial Assembly of Sindh on 24th February, 2014 and assented to by the Governor of Sindh on 19th March, 2014 is hereby published as an Act of the Legislature of Sindh.

THE SINDH ENVIRONMENTAL PROTECTION ACT, 2014.

• SINDH ACT NO. VIII OF 2014.

AN ACT

to provide for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution, and promotion of sustainable development.

WHEREAS it is expedient to provide for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution, promotion of sustainable development, and for matters connected therewith and incidental thereto;

Preamble.

PART-I

It is hereby enacted as follows:-

1. (1) This Act may be called the Sindh Environmental Protection Act, 2014

**Short title and
commencement.**

- (2) It extends to the whole of the Province of Sindh.
- (3) It shall come into force at once.

Definitions.

2. In this Act, unless there is anything repugnant in the subject or context—

- (i) "adverse environmental effect" means impairment of, or damage to, the environment and includes—
 - (a) impairment of, or damage to, human health and safety or to biodiversity or property;
 - (b) pollution; and
 - (c) any adverse environmental effect as may be specified in the rules or regulations made under this Act;
- (ii) "Agency" means the Sindh Environmental Protection Agency established under section 5 of this Act;
- (iii) "agricultural waste" means waste from farm and agricultural activities including poultry, cattle farming, animal husbandry residues from the use of fertilizers, pesticides and other farm chemicals and agricultural runoff;
- (iv) "air pollutant" means any substance that causes pollution of air and includes soot, smoke, dust particles, odor, light, electro-magnetic radiation, heat, fumes, combustion exhaust, exhaust gases, noxious gases, hazardous substances and radioactive substances;
- (v) "biodiversity" or "biological diversity" means the variability among living organisms from all sources, including inter-alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems;
- (vi) "biosafety" means the mechanism developing through policy and procedure to ensure human health and the environmentally safe application of biotechnology;
- (vii) "Council" means the Sindh Environmental Protection Council established under section 3 of this Act;
- (viii) "discharge" means spilling, leaking, pumping, depositing, seeping, releasing, flowing-out, pouring, emitting, emptying or dumping into the land, water or atmosphere;
- (ix) "ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit;

- (x) "effluent" means any material in solid, liquid or gaseous form or combination thereof being discharged from industrial activity or any other source and includes a slurry, suspension or vapour;
- (xi) "emission standards" means the permissible standards established by the Agency for emission of air pollutants and noise and for discharge of effluent and waste;
- (xii) "environment" means-
 - (a) air, water, land and natural resources;
 - (b) all layers of the atmosphere;
 - (c) all organic and inorganic matters and living organisms;
 - (d) ecosystems and ecological relationships;
 - (e) buildings, structures, roads, facilities and works;
 - (f) all social and economic conditions affecting community life; and
 - (g) the inter-relationship between any of the factors in sub-clause (a) to (f) made under this Act;
- (xiii) "environmental aspect" means an organization's activities or services that can interact with the environment;
- (xiv) "environment audit" means a systemic scrutiny of environmental performance of an organization, factory, company or manufacturing and production unit regarding to its operations;
- (xv) "environmental impact assessment" means an environmental study comprising collection of data, prediction of qualitative and quantitative impacts, comparison of alternatives, evaluation of preventive, mitigation and compensatory measures, formulation of environmental management and training plans and monitoring arrangements, and framing of recommendations and such other components as may be prescribed;
- (xvi) "Environmental Management Plan" means a site specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment and comply with the environmental legislation;
- (xvii) "Environmental Protection Order" means an order passed under Section 21 made under this Act.
- (xviii) "Environmental Protection Tribunal" means the Environmental Protection Tribunal constituted under section 25 of this Act ;

- (xxix) "Environmental Review" means a quantitative and qualitative assessment of documents submitted by proponent, comments from public and Government agencies or organizations;
- (xx) "factory" means any premises in which industrial activity is being undertaken;
- (xxi) "genetically modified organism" means any organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology and which does not occur naturally through mating and or recombination and includes both living and non-living modified organisms;
- (xxii) "Government" means the Government of Sindh;
- (xxiii) "Government Agency" includes:-
- (a) A department, attached department or any other office of Government; and
 - (b) A development authority, local authority, company body corporate established or control by Government;
- (xxiv) "Court" means the Court of the Judicial Magistrate First Class;
- (xxv) "hazardous substance" means-
- (a) a substance or mixture of substances, other than a pesticide as defined in the Agricultural Pesticides Ordinance, 1971 (II of 1971), which, by reason of its chemical activity or toxic, explosive, flammable, corrosive, radioactive or other characteristics, causes, or is likely to cause, directly or in combination with other matters an adverse environmental effect; and
 - (b) any substance which may be prescribed as a hazardous substance;
- (xxvi) "hazardous waste" means waste which is or which contains a hazardous substance or which may be prescribed as hazardous waste, hospital waste, nuclear waste, obsolete pesticides and persistent organic pollutants;
- (xxvii) "hospital waste" means waste medical supplies and materials of all kinds, and waste blood, tissue, organs and other parts of the human and animal bodies, from hospitals, clinics, laboratories and veterinary facilities;

- (xxviii) "industrial activity" means any operation or process for manufacturing, making, formulating, synthesising, altering, repairing, ornamenting, finishing, packing or otherwise treating any article or substance with a view to its use, sale, transport, delivery or disposal, or for mining, for oil and gas exploration and development, or for pumping water or sewage, or for generating, transforming or transmitting power or for any other industrial or commercial purposes;
- (xxix) "industrial waste" means waste resulting from an industrial activity;
- (xxx) "initial environmental examination" means a preliminary environmental review of the reasonably foreseeable qualitative and quantitative impacts on the environment of a proposed project to determine whether it is likely to cause an adverse environmental effect for requiring preparation of an environmental impact assessment;
- (xxxi) "local authority" means any agency set up or designated by Government, by notification in the official Gazette, to be a local authority for the purposes of this Act;
- (xxxii) "local council" means a local council constituted or established under a law relating to local government;
- (xxxiii) "motor vehicle" means any mechanically propelled vehicle adapted for use upon land whether its power of propulsion is transmitted thereto from an external or internal source, and includes a chassis to which a body has not been attached, and a trailer, but does not include a vehicle running upon fixed rails;
- (xxxiv) "municipal waste" includes sewage, refuse, garbage, waste from abattoirs, sludge and human excreta and the like;
- (xxxv) "noise" means the intensity, duration and character of sounds from all sources, and includes vibration;
- (xxvi) "non degradable plastic products" means a plastic product which are made from the non-biodegradable substances;
- (xxxvii) "nuclear waste" means waste from any nuclear reactor or nuclear plant or other nuclear energy system, whether or not such waste is radioactive;

(xxviii) "Oxo-biodegradable Plastic Products" means a plastic product made of a polymer by adding a pro-degrading additive containing a transition metal salt, except cobalt, which cause the plastic to degrade and bio-grade from oxidative and cell mediated phenomena either simultaneously or successfully;

(xxxix) "person" means any natural person or legal entity and includes an individual, firm, association, partnership, society, group, company, corporation, co-operative society, Government Agency, non-governmental organization, community-based organization, village organization, local council or local authority and, in the case of a vessel, the master or other person having for the time being the charge or control of the vessel;

(xl) "pollution" means the contamination of air, land or water by the discharge or emission of effluent or wastes or air pollutants or noise or other matter which either directly or indirectly or in combination with other discharges or substances alters unfavorably the chemical, physical, biological, radiational, thermal or radiological or aesthetic

properties of the air, land or water or which may, or is likely to make the air, land or water unclean, noxious or impure or injurious, disagreeable or detrimental to the health, safety, welfare or property of persons or harmful to biodiversity.

(xii) "prescribed" means prescribed by rules made under this Act;

(xlii) "project" means any activity, plan, scheme, proposal or undertaking involving any change in the environment and includes-

(a) construction or use of buildings or other works;

(b) construction or use of roads or other transport systems;

(c) construction or operation of factories or other installations;

(d) mineral prospecting, mining, quarrying, stone-crushing, drilling and the like;

(e) any change of land use or water use; and

(f) alteration, expansion, repair, decommissioning or abandonment of existing buildings or other works, roads or other transport systems, factories or other installations;

- (xlili) "proponent" means the person who proposes or intends to undertake a project;
- (xliv) "regulations" means regulations made under this Act;
- (xlv) "rules" means rules made under this Act;
- (xlvi) "sewage" means liquid or semi-solid wastes and sludge from sanitary conveniences, kitchens, laundries, washing and similar activities and from any sewerage system or sewage disposal works;
- (xlvii) "Schedule Plastic Products" means all types of flexible plastic packaging and disposable plastic products made of Polythene, Polypropylene, Polystyrene and Poly-ethylene Terephthalate (PET), used for food and non-food items, like shopping bags, garbage bags, snacks packs, water and milk packaging, shrink wraps, bubble pellet wraps, films, liners, woven or non-woven bags, mulch films;
- (xlviii) "Sindh Environmental Quality Standards" means standards established by the Agency under clause (e) of sub-section(1) of section 6 and approved by the Council under clause (c) of sub-section(1) of section 4 made under this Act;
- (xlix) "standards" means qualitative and quantitative standards for discharge of effluent and wastes and for emission of air pollutants and noise either for general applicability or for a particular area, or from a particular production process, or for a particular product, and includes the Sindh Environmental Quality Standards, emission standards and other standards established under this Act and the rules and regulations;
- (l) "strategic environmental assessment" mean an analysis of a proposed policy, legislation, plan or programme to determine whether the principles of sustainable development have been integrated therein and to identify its likely environmental effects and such components as require an initial environmental examination or environmental impact assessment;
- (li) "sustainable development" means development that meets the needs of the present generation without compromising the ability of future generations to meet their needs;

- (lii) "trans-boundary environmental impacts" means environmental impact arising from beyond the boundaries or limits of Sindh province and causing any adverse environmental impact or pollution in the air, land, water and coaster water of Sindh province;
- (liii) "waste" means any substance or object which has been, is being or is intended to be, discarded or disposed-of, and includes liquid waste, solid waste, waste gases, suspended waste, industrial waste, agricultural waste, nuclear waste, municipal waste, hospital waste, used polyethylene bags and residues from the incineration of all types of waste.
- (liv) "waters (coastal waters, internal waters, territorial waters and historical waters)" means such limits of the waters adjacent to the land territory as may be specified in the Territorial Waters and Maritime Zones Act, 1976 (LXXXII of 1976).

PART-II

THE SINDH ENVIRONMENTAL PROTECTION COUNCIL.

Establishment of the Sindh Environmental Protection Council.

3. (1) The Government of Sindh shall, by notification in the official Gazette, establish a Council to be known as the Sindh Environmental Protection Council consisting of-

- (i) Chief Minister or such other **Chairperson** person as the Chief Minister may nominate in this behalf.
- (ii) Minister-in-charge of the **Vice Chairperson** Environment Protection Department.
- (iii) Additional Chief Secretary, **Ex-officio Member** Planning and Development Department, Government of Sindh.
- (iv) Secretaries of the **Ex-officio Members** Environment, Finance, Public Health Engineering, Irrigation, Health, Agriculture, Local Government, Industries, Live Stock and Fisheries, Forest and Wildlife, Energy, Education, Departments of Government of Sindh and the divisional commissioners of Sindh.

- (v) Such other persons not exceeding twenty-five as Government may appoint from representatives of the Chambers of Commerce and Industry and industrial associations, representatives of the Chambers of Agriculture, the medical and legal professions, trade unions, non-governmental organizations concerned with the environment and sustainable development, and scientists, technical experts and educationists. **Non-official Members**
- (vi) Director General, Sindh Environment Protection Agency **Member / Secretary**
- (vii) **Two Members of the Provincial Assembly of Sindh amongst the eleven Members of the Standing Committee on Environment nominated by the Speaker**

2) The Members of the Council, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.

(3) A non-official member, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-appointment but shall not hold office for more than two terms.

(4) The Council shall frame its own Rules of Procedure.

(5) The Council shall hold meetings, as and when necessary, but not less than two meetings, shall be held in a year.

(6) The Council may constitute committees of its members and entrust them with such functions as it may deem fit, and the recommendations of the committees shall be submitted to the Council for approval.

(7) The Council, or any of its committees, may invite any technical expert or representative of any Government Agency or non-governmental organization or other person possessing specialized knowledge of any subject for assistance in performance of its functions.

**Functions and
Powers of the
Council.**

4. (1) The Council shall-

- (a) co-ordinate and supervise the enforcement of the provisions of this Act and other laws relating to the environment in the Province;
- (b) approve comprehensive provincial environmental and sustainable development policies and ensure their implementation within the framework of a conservation strategy and sustainable development plan as may be approved by Government from time to time;
- (c) approve the Sindh Environmental Quality Standards;
- (d) provide guidelines for the protection and conservation of species, habitats, and biodiversity in general, and for the conservation of renewable and non-renewable resources;
- (e) coordinate integration of the principles and concerns of sustainable development into socio-economic and development policies, plans and programmes at the provincial, district and local levels;
- (f) consider the annual Sindh Environment report and give appropriate directions thereon and cause it to be laid before the Provincial Assembly;
- (g) deal with inter-provincial and federal-provincial issues, and liaise and coordinate with other Provinces through appropriate inter-provincial forums regarding formulation and implementation of standards and policies relating to environmental matters with an inter-provincial impact;
- (h) provide guidelines for biosafety and for the use of genetically modified organisms; and
- (i) assist the Federal Government or Federal Agency in implementation and or administration of various provision of United Nation Convention on Laws on Seas, 1980 (UNCLOS) in coastal waters of the province.

(2). The Council may, either itself or on the request of any person or organization, direct the Agency or any Government Agency to prepare, submit, promote or implement projects for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, and the sustainable development of resources or to undertake research in any specified aspect of environment.

PART-III

THE SINDH ENVIRONMENTAL PROTECTION AGENCY

5. (1) Government shall, by notification in the Official Gazette, establish the Sindh Environmental Protection Agency, to exercise the powers and perform the functions assigned to it under the provisions of this Act and the rules and regulations made thereunder.

**Establishment
of the Sindh
Environmental
Protection
Agency.**

(2) The Agency shall be headed by a Director General who shall be appointed by Government on such terms and conditions as it may determine.

(3) The Agency shall have such administrative, technical and legal staff as Government may specify, to be appointed in accordance with such procedure as may be prescribed.

(4) The powers and functions of the Agency shall be exercised and performed by the Director General.

(5) The Director General may, by general or special order, delegate any of these powers and functions to staff appointed under sub-section (3).

(6) For assisting the Agency in the discharge of its functions Government shall establish Advisory Committees for various sectors and appoint as members thereof eminent representatives of the relevant sector, educational institutions, research institutes and non-governmental organizations.

6. (1) The Agency shall –

**Functions of the
Agency.**

- (a) administer and implement the provisions of this Act and the rules and regulations;
- (b) prepare, in co-ordination with the appropriate Government Agency or local council and, in consultation with the concerned Advisory Committees where established, environmental policies for the approval of the Council;
- (c) take all necessary measures for the implementation of the environmental policies approved by the Council;
- (d) prepare and publish an annual Sindh Environment Report on the state of the environment in the province;
- (e) prepare or revise and establish the Sindh Environmental Quality Standards with approval of the Council;

Provided that before seeking approval of the Council, the Agency shall publish the proposed Sindh Environmental Quality Standards for public opinion in accordance with the prescribed procedure;

(f) ensure enforcement of the Sindh Environmental Quality Standards;

(g) where the quality of ambient air, water, land or noise so requires, the Agency may, by notification in the Official Gazette establish different standards for discharge or emission from different sources and for different areas and conditions as may be necessary;

Provided that where these standards are less stringent than the Sindh Environmental Quality Standards; prior approval of the Council shall be obtained;

(h) establish systems and procedures for surveys, surveillance, monitoring, measurement, examination, investigation, research, inspection and audit to prevent and control pollution, and to estimate the costs of cleaning up pollution and rehabilitating the environment in various sectors;

(i) take measures to promote research and the development of science and technology which may contribute to the prevention of pollution, protection of the environment, and sustainable development;

(j) issue licences, approval for the consignment, handling, transport, treatment, disposal of, storage, handling or otherwise dealing with hazardous substances;

(k) certify laboratories as approved laboratories for conducting tests and analysis and one or more research institutes as environmental research institutes for conducting research and investigation for the purposes of this Act;

(l) identify the needs for and initiate legislation in various sectors of the environment;

(m) provide assistance to relevant Federal and Provincial Government Agencies in the management of environment accidents and natural and environmental disasters, including conduct of inquiry thereto;

(n) render advice and assistance in environmental matters including such information and data available with it as may be required for carrying out the purposes of this Act;

Provided that the disclosure of such information shall be subject to the restrictions specified in Part XI (Access to Information);

- (o) assist Government Agencies, local councils, local authorities and other persons to implement schemes for the proper disposal of wastes so as to ensure compliance with the Sindh Environmental Quality Standards;
 - (p) provide information and guidance to the public on environmental matters;
 - (q) recommend environmental courses, topics, literature and books for incorporation in the curricula and syllabi of educational institutions;
 - (r) promote public education and awareness of environmental issues through mass media and other means including seminars and workshops;
 - (s) establish and maintain mechanisms, including its own website, to disseminate information, subject to the provisions of this Act, regarding policies, plans and decisions of the Government, the Council and the Agency, relating to the environment;
 - (t) specify safeguards for the prevention of accidents and disasters which may cause pollution, collaborate with the concerned persons in the preparation of contingency plans for control of such accidents and disasters, and co-ordinate implementation of such plans;
 - (u) review and approve mitigation plans and give guidance and directions, where necessary, relating to clean up operations ordered under this Act;
 - (v) encourage the formation and working of non-governmental organizations, community organizations and village organizations to prevent and control pollution and promote sustainable development;
 - (w) take or cause to be taken all necessary measures for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution and promotion of sustainable development; and
 - (x) perform any function that the Council may assign to it.
- (2) The Agency may -
- (a) undertake inquiries or investigation into environmental issues, either of its own accord or upon complaint from any person or organization;
 - (b) request any person to furnish any information or data relevant to its functions;

- (c) initiate, with the approval of Government, requests for foreign assistance in support of the purposes of this Act and enter into arrangements with foreign agencies or organizations for the exchange of material or information and participate in international seminars or meetings;
- (d) recommend to Government and the Council the adoption of financial and fiscal programmes, schemes or measures for achieving environmental objectives and goals and the purposes of this Act, including -
 - (i) taxes, duties, cesses and other levies; and
 - (ii) incentives, prizes, awards, rewards, subsidies, tax exemptions, rebates and depreciation allowances;
- (e) establish and maintain laboratories to help in the performance of its functions under this Act and to conduct research in various aspects of the environment and provide or arrange necessary assistance for the establishment of similar laboratories in the private sector;
- (f) arrange, in accordance with such procedure as may be prescribed, financial assistance for projects designed to facilitate in discharge of its functions; and
- (g) acquire assistance of concerned authorities of district administration and other relevant agencies, departments and police assistance for enforcement of this Act.

Powers of the Agency.

7. Subject to the provisions of this Act, the Agency may-

- (a) lease, purchase, acquire, own, hold, improve, use or otherwise deal in and with any property both moveable and immovable;
- (b) sell, convey, mortgage, pledge, exchange or otherwise dispose of its property and assets;
- (c) fix and realize fees, rates and charges for rendering any service or providing any facility, information or data under this Act or its rules and regulations;
- (d) enter into contracts, execute instruments, incur liabilities and do all acts or things necessary for proper management and conduct of its business;
- (e) appoint, with the approval of Government and in accordance with such procedures as may be prescribed, such advisers, experts and consultants as it considers necessary for the efficient performance of its functions on such terms and conditions as it may deem fit;
- (f) summon and enforce the attendance of any person and require him to supply any information or document needed for the conduct of any enquiry or investigation into any environmental issue;

- (g) Director General may authorize any officer or official to enter and inspect or under a search warrant issued by Environmental Protection Tribunal or a Court, search at any time, any land, building, premises, vehicle or vessel or other place where or in which there are reasonable grounds to believe that an offence under this Act has been, or is being, or likely to be committed;
- (h) take samples of any materials, products, articles or substances or of the effluent, wastes or air pollutants being discharged or emitted or of air, water or land in the vicinity of the discharge or emission;
- (i) arrange for the testing and analysis of samples at a certified laboratory;
- (j) confiscate any article used in the commission of the offence where the offender is not known or cannot be found within a reasonable time;

Provided that the powers under clauses (f), (g), (h) (i), and (j) shall be exercised in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898) or the rules and regulations and under the direction of the Environmental Protection Tribunal or a Court; and

- (k) establish the Sindh Environmental Co-ordination Committee comprising the Director-General as its Chairman and such other persons as Government shall appoint as its members to exercise such powers and perform such functions as shall be delegated or assigned to it by Government for carrying out the purposes of this Act and for ensuring coordination among Government Agencies in implementation of environmental policies.

PART-IV

SINDH SUSTAINABLE DEVELOPMENT FUND

**Establishment
of the Sindh
Sustainable
Development
Fund.**

8. (1) There shall be established a Sindh Sustainable Development Fund.

(2) The Sindh Sustainable Development Fund shall be derived from the following sources, namely—

- (a) allocations and grants made or loans advanced by the Government of Sindh or by the Federal Government;
- (b) aid and assistance, grants, advances, donations and other non-obligatory funds received from foreign governments, national or international agencies, and non-governmental organizations; and

- (c) voluntary contributions from private, corporate, multinational organizations and other persons.
- (d) Any fees generated under the provision of this act including the fines imposed against contraventions including penalties.
- (3) The Sindh Sustainable Development Fund shall be utilized, in accordance with such procedures as may be prescribed for -
 - (a) providing financial assistance to projects designed for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, the sustainable development of resources and for research in any specified aspect of the environment; and
 - (b) any other purposes which, in the opinion of the Board, will help achieve environment objectives and the purposes of this Act.

**Management of
the Sindh
Sustainable
Development
Fund.**

9. (1) The Sindh Sustainable Development Fund shall be managed by a Board known as the Provincial Sustainable Development Fund Board consisting of—

- (i) Additional Chief Secretary, **Chairperson**
Planning and Development
Department, Government of
Sindh,
- (ii) Such officers of Government, **Ex-officio Members**
not exceeding five (05), as
Government may appoint
including Secretaries of the
Environment, Finance,
Industries and Local
Government Departments,
Government of Sindh.
- (iii) Such non-official persons, not **Non-official Members**
exceeding five (05), as
Government may appoint,
including representatives of
the Chambers of Commerce
and Industry, non-
governmental organizations
and major donors.
- (iv) Director General, Sindh **Secretary/ Member**
Environmental Protection
Agency.

(2) The members of the Board, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.

(3) A non-official member of the Board, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-nomination, but shall not hold office for more than two terms.

(4) The Board shall frame its own rules of procedure with the approval of Government.

(5) In accordance with such procedures and such criteria as may be prescribed, the Board shall have the power to —

- (a) sanction financial assistance for eligible projects;
- (b) invest moneys held in the Sindh Sustainable Development Fund in such profit-bearing Government bonds, saving schemes and securities as it may deem suitable; and
- (c) take such measures and exercise such powers as may be necessary for utilization of the Sindh Sustainable Development Fund for the purposes specified in sub-section (3) of section 8.

(6) The Board shall constitute committees of its members to undertake regular monitoring of projects financed from the Sindh Sustainable Development Fund and to submit progress reports to the Board which shall publish an Annual Report incorporating its annual audited accounts and performance evaluation based on the progress reports.

10. (1) The Agency shall maintain proper accounts of the Sindh Sustainable Development Fund and other relevant records and prepare annual statement of accounts in such form as may be prescribed. **Accounts.**

(2) The accounts of the Sindh Sustainable Development Fund shall be audited annually by the Auditor General of Pakistan.

PART-V PROHIBITIONS AND ENFORCEMENT

11. (1) Subject to the provisions of this Act and the rules and regulations, no person shall discharge or emit or allow the discharge or emission of any effluent, waste, pollutant, noise or any other matter that may cause or likely to cause pollution or adverse environmental effects, as defined in section 2 of this Act, in an amount, concentration or level which is in excess to that specified in Sindh Environmental Quality Standards; or, where applicable, the standards established under Section 6(1)(g)(i); or direction issued under Section 17, 19, 20 and 21 of this Act; or any other direction issued, in general or particular, by the Agency. **Prohibition of certain discharges or emissions and compliance with standards.**

(2) All persons, in industrial or commercial or other operations, shall ensure compliance with the Environmental Quality Standards for ambient air, drinking water, noise or any other Standards established under section 6(1)(g)(i); shall maintain monitoring records for such compliances; shall make available these records to the authorized person for inspection; and shall report or communicate the record to the Agency as required under any directions issued, notified or required under any rules and regulations.

(3) Monitoring and analysis under sub-section (1) and (2), shall be acceptable only when carried out by the Environmental Laboratory certified by the Agency as prescribed in the rules.

**Prohibition of
import of
hazardous
waste.**

12. No person shall import hazardous waste into Sindh province or its coastal, internal, territorial or historical waters, except acquiring prior approval of the Agency.

**Handling of
hazardous
substances.**

13. Subject to the provisions of this Act, no person shall import, generate, collect, consign, transport, treat, dispose of, store, handle or otherwise use or deal with any hazardous substance except-

(a) under a licence issued by the Agency; or

(b) in accordance with the provisions of any other law, rule, regulation or notification for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Government is a party.

**Prohibition of
action adversely
affecting
Environment.**

14. (1) Subject to the provisions of this Act and the rules and regulations, no person shall cause any act, deed or any activity, including-

(a) recycling or reuse of hospital waste and infectious waste;

(b) disposal of solid and hazardous wastes at unauthorized places as prescribed;

(c) dumping of wastes or hazardous substances into coastal waters and inland water bodies;

(d) release of emissions or discharges from industrial or commercial operations as prescribed;

(e) recycling or reuse or recovery of hazardous wastes or industrial by-products in an unauthorized or non-prescribed manner or procedure; and

- (f) any activity which may cause adverse environmental affect due to trans boundary projects of Province of Sindh.

which lead to pollution or impairment of or damage to biodiversity, ecosystem, aesthetics or any damage to environment and natural resources as defined in section 2 (xxxvi) of this Act.

(2) No person shall generate, handle, transport, dispose of or handle the hospital waste and infections waste except in accordance with the Hospital Waste Management Rules and in such manner as may be prescribed.

(3) No person shall import, manufacture, stockpile, trade, supply, distribute or sell any scheduled plastic product which is non-degradable. The scheduled plastic products must be oxo-biodegradable and the pro-degradant used must be approved by the Agency or any other department or agency and in such manner as prescribed.

15. (1) Subject to the provisions of this Act, no person shall operate or manufacture a motor vehicle or class of vehicles from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the Sindh Environmental Quality Standards or, where applicable, the standards established under sub-clause (i) of clause (g) of sub-section (1) of section 6.

Regulation of motor vehicles.

(2) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any motor vehicle or class of vehicles shall install such pollution control devices or other equipment or use such fuels or undergo such maintenance or testing as prescribed.

(3) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any manufacturer of motor vehicle or class of vehicles shall use such manufacturing standard or design or pollution control devices or other equipment or undergo such testing as may be prescribed.

(4) Where a direction has been issued by the Agency under sub-section (2) and (3) in respect of any motor vehicles or class of motor vehicles, no person shall operate or manufacture any such vehicle till such direction has been complied with.

16. (1) The monitoring, testing and analysis carried out in compliance or for the enforcement of any provisions of this Act

Certified Environmental Laboratory.

(2) The laboratory or organization having any facility for environmental monitoring, testing and analysis and intend to perform under sub-section (1) shall register with the Agency in accordance with the Environmental Laboratory Certification Rules as prescribed.

**Initial
environmental
examination and
environmental
impact
assessment.**

**PART-VI
ENVIRONMENTAL EXAMINATIONS AND ASSESSMENTS**

17. (1) No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof.

(2) The Agency shall –

(a) review the initial environmental examination and accord its approval, subject to such terms and conditions as it may prescribe, or require submission of an environmental impact assessment by the proponent; or

(b) review the environmental impact assessment and accord its approval subject to such terms and conditions as it may deem fit to impose or require that the environmental impact assessment be re-submitted after such modifications as may be stipulated or decline approval of the environmental impact assessment as being contrary to environmental objectives.

(3) Every review of an environment impact assessment shall be carried out with public participation and, subject to the provisions of this Act, after full disclosure of the particulars of the project.

(4) The Agency shall communicate its approval or otherwise within a period of two months from the date that the initial environmental examination is filed, and within a period of four months from the date that the environmental impact assessment is filed complete in all respects in accordance with the regulations, failing which the initial environmental examination or, as the case may be, the environmental impact assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations:

(5) The provisions of sub-sections (1), (2), (3) and (4) shall apply to such categories of projects and in such manner as prescribed:

(6) The Agency shall maintain separate registers for initial environmental examination and environmental impact assessment projects, which shall contain brief particulars of each project and a summary of decisions taken thereon, and which shall be open for inspection to the public during office hours.

18. (1) All provincial government agencies, departments, authorities, local councils and local authorities responsible for formulating policies, legislation, plans and programmes to be implemented in Sindh province which may cause any environmental impact in the jurisdiction of the province shall, before submitting the same to the competent authority for approval, forward to the Sindh Environmental Protection Agency a strategic environment assessment containing —

Strategic
environmental
assessment.

- (a) description of the objectives and features of the proposed policy, legislation, plan or programme that are in consonance with the principles of sustainable development;
 - (b) assessment of the adverse environmental effects, if any, likely to be caused during implementation of the policy, legislation, plan or programme alongwith proposed preventive, mitigation and compensatory measures;
 - (c) analysis of possible alternatives; and
 - (d) identification of those components of the policy, legislation, plan or programme, if any, in respect of which specific environmental impact assessment need to be carried out in due course.
- (2) The Agency shall, in consultation with the concerned Government Agencies and Advisory Committees where established, review the strategic environment assessment, within sixty (60) days of its filing, and prepare a report containing its comments and recommendations in respect thereof which shall be forwarded to the initiating Government Agency, authority, local council or local authority and duly considered by it and the competent authority before approval or otherwise of the proposed policy, legislation, plan or programme.
- (3) The provisions of sub-sections (1), and (2) shall apply to such categories of policies, plans and programmes and in such manner as may be prescribed.

19. (1) The Agency shall carry out or arrange environmental monitoring of all projects in respect of which it has approved an initial environmental examination or environmental impact assessment to determine whether the actual environmental impact exceeds the level predicted in the assessment and whether the conditions of the approval are being complied with.

Environmental
monitoring.

(2) For purposes of sub-section (1), the Agency may require the person in charge of a project to furnish such information as it may specify pertaining to the environmental impact of the project, including quantitative and qualitative analysis of -

**Environmental
Audit and
Review.**

- (a) discharge of effluents, wastes, emissions of air pollutants, noise and any other matter or action that may be found offensive under section 14 from the project on daily, weekly, monthly or annual basis;
 - (b) ambient quality of the air, water, noise and soil before, during and after construction and during operation of the project.
- (3) On review of the data collected by it and information provided, the Agency may issue such directions to the person in charge as it may consider necessary to ensure compliance with the conditions of the approval.

20. (1) The Agency shall from time to time require the person in charge of a project to furnish, within such period as may be specified, an environmental audit or environmental review report or environmental management plan containing a comprehensive appraisal of the environmental aspects of the project.

(2) The report of a project prepared under sub-section (1) shall include -

- (a) analysis of the predicted qualitative and quantitative impact of the project as compared to the actual impact;
- (b) evaluation of the efficacy of the preventive, mitigation and compensatory measures taken with respect to the project; and
- (c) recommendations for further minimizing or mitigating the adverse environmental impact of the project.

(3) Based on its review of the environmental audit report, the Agency may, after giving the person in charge of the project an opportunity of being heard, direct that specified mitigation and compensatory measures be adopted within a specified time period and may also, where necessary, modify the approval granted by it under section 17.

**PART-VII
ENVIRONMENTAL PROTECTION ORDER**

**Environmental
Protection
Order.**

21. (1) Where the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of any provision of this Act, the rules or regulations or of the conditions of a licence, or is likely to cause, or is causing or has caused an adverse environmental effect, the Agency may, after giving the person responsible for such

discharge, emission, disposal, handling, act or omission an opportunity of being heard, by order direct such person to take such measures as the Agency may consider necessary within such period as may be specified in the order.

(2) In particular and without prejudice to the generality of the foregoing power, such measures may include —

- (a) immediate stoppage, preventing, lessening or controlling the discharge, emission, disposal, handling, act or omission, or to minimize or remedy the adverse environmental effect;
- (b) installation, replacement or alteration of any equipment or thing to eliminate, control or abate on a permanent or temporary basis, such discharge, emission, disposal, handling, act or omission;
- (c) action to remove or otherwise dispose of the effluent, waste, air pollutant, noise, or hazardous substances;
- (d) action to restore the environment to the condition existing prior to such discharge, disposal, handling, act or omission, or as close to such condition as may be reasonable in the circumstances, to the satisfaction of the Agency; and
- (e) impose a penalty as prescribed.

(3) Notwithstanding the provisions of sub-section (1), in an emergency situation where, for reasons to be recorded, the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of the provisions of this Act and that circumstances of the case warrant immediate action in the public interest, it may pass an ad-interim order of the nature described in sub-sections (1) and (2) by providing reasonable opportunity of hearing.

PART-VIII OFFENCES AND PENALTIES

22. (1) Whoever contravenes or fails to comply with the provisions of sections 11, 17, 18 and 21 or any order issued there under shall be punishable with a fine which may extend to five million rupees, to the damage caused to environment and in the case of a continuing contravention or failure, with an additional fine which may extend to one hundred thousand rupees for every day during which such contravention or failure continues:

Penalties.

Provided that if the contravention of the provisions of section 11 also constitutes a contravention of the provisions of section 15, such contravention shall be punishable under sub-section (2).

(2) Whoever contravenes or fails to comply with the provisions of sections 13, 14, 15 and 16 or any rule or regulation or conditions of any license, any order or direction, issued by the Agency, shall be punished with a fine, and in case of continuing contravention or failure with an additional fine which may extend to ten thousand rupees for every day during which such contravention continues.

(3) Where an accused has been convicted of an offence under sub-sections (1) and (2), the Environmental Protection Tribunal and Court shall, as the case may be, in passing sentence, take into account the extent and duration of the contravention or failure constituting the offence and the attendant circumstances.

(4) Where an accused has been convicted of an offence under sub-sections (1) or (2), the Environmental Protection Tribunal or Court, as the case may be, shall endorse a copy of the order of conviction to the concerned trade or industrial association, if any, or the concerned Provincial Chamber of Commerce and Industry or the Federation of Pakistan Chambers of Commerce and Industry.

(5) Where a person convicted under sub-sections (1) and (2) had been previously convicted for any contravention of this Act and its rules or regulations, the Environmental Protection Tribunal, as the case may be, may, in addition to the punishment awarded thereunder-

- (a) sentence him to imprisonment for a term that may extend up to three years;
- (b) order the closure of the factory;
- (c) order confiscation of the facility, machinery and equipment, vehicle or substance, record, document or other object used or involved in contravention of the provisions of this Act;
- (d) order such person to restore the environment at his own cost, to conditions existing prior to the contravention or as close to such conditions as may be reasonable in the circumstances to the satisfaction of the Agency; and
- (e) order that compensation be paid to any person or persons for any loss, or damage to their health or property suffered by such contravention.

(6) The Director General or an officer generally or specially authorised by him in this behalf may, on the application of the accused, compound an offence under this Act with the permission of the Environmental Protection Tribunal or Court in accordance with such procedure as prescribed.

(7) Where the Director General is of the opinion that a person had contravened any provision of this Act, he may, subject to the rules, by notice in writing to that person require him to pay to the Agency a penalty in the amount set out in the notice for each day the contravention continues.

23. Where any contravention of this Act has been committed by a body corporate, and it is proved that such offence has been committed with the consent or connivance of, or is attributed to any negligence on the part of, any director, partner, manager, secretary or other officer of the body corporate, such director, partner, manager, secretary or other officer of the body corporate, shall be deemed guilty of such contravention along with the body corporate and shall be punished accordingly:

**Offences by
body corporate.**

Provided that in the case of a company as defined under the Companies Ordinance, 1984 (XLVII of 1984), only the Chief Executive as defined in the said Ordinance shall be liable under this section.

Explanation.— For the purposes of this Section, "body corporate" includes a firm, association of persons and a society registered under the Societies Registration Act, 1860 (XXI of 1860), or under the Co-operative Societies Act, 1925 (VII of 1925).

24. Where any contravention of this Act has been committed by any Government Agency, local authority or local council, and it is proved that such contravention has been committed with the consent or connivance of, or is attributable to any negligence on the part of, the Head or any other officer of Government Agency, local authority or local council, such Head or other officer shall also be deemed guilty of such contravention along with the Government Agency, local authority or local council and shall be liable to be proceeded against and punished accordingly.

**Offences by
Government
Agencies, local
authorities or
local councils.**

PART-IX

ENVIRONMENTAL PROTECTION TRIBUNALS AND COURTS

25. (1) Government may, by Notification in the Official Gazette, establish as many Environmental Protection Tribunals as it considers necessary and, where it establishes more than one Environmental Protection Tribunal, it shall specify territorial limits within which, or the class of cases in respect of which, each one of them shall exercise jurisdiction under this Act.

**Environmental
Protection
Tribunals.**

(2) An Environmental Protection Tribunal shall consist of a Chairperson who is, or has been, or is qualified for appointment as a Judge of the High Court to be appointed after consultation with the Chief Justice of the High Court and two members to be appointed by Government, of which at least one shall be a technical member nominated from amongst the officers of the Agency with suitable professional qualifications and experience in the environmental field.

(3) For every sitting of the Environmental Protection Tribunal, the presence of the Chairperson and not less than one Member shall be necessary.

(4) A decision of an Environmental Protection Tribunal shall be expressed in terms of the opinion of the majority of its members, including the Chairperson, or if the case has been decided by the Chairperson and only one of the members and there is a difference of opinion between them, the decision of the Environmental Protection Tribunal shall be expressed in terms of the opinion of the Chairperson.

(5) An Environmental Protection Tribunal shall not, merely by reason of a change in its composition, or the absence of any member from any sitting, be bound to recall and rehear any witness who has given evidence, and may act on the evidence already recorded by, or produced, before it.

(6) An Environmental Protection Tribunal may hold its sittings at such places within its territorial jurisdiction as the Chairperson may decide.

(7) No act or proceeding of an Environmental Protection Tribunal shall be invalid by reason only of the existence of a vacancy in, or defect in the constitution, of, the Environmental Protection Tribunal.

(8) The terms and conditions of service of the Chairperson and members of the Environmental Protection Tribunal shall be such as may be prescribed.

**Jurisdiction and
powers of
Environmental
Protection
Tribunals.**

26. (1) An Environmental Protection Tribunal shall exercise such powers and perform such functions as are, or may be, conferred upon or assigned to it by or under this Act or the rules and regulations.

(2) All contraventions punishable under sub-section (1) of section 22 shall exclusively be triable by an Environmental Protection Tribunal.

(3) An Environmental Protection Tribunal shall not take cognizance of any offence triable under sub-section (2) except on a complaint in writing by—

(a) the Agency or any Government Agency or Local Council;
and

(b) any aggrieved person, who has given notice of not less than thirty days to the Agency, of the alleged contravention and of his intention to make a complaint to the Environmental Protection Tribunal.

(4) In exercise of its criminal jurisdiction, the Environmental Protection Tribunal shall have the same powers as are vested under the Code of Criminal Procedure, 1898 (Act V of 1898).

(5) In exercise of the appellate jurisdiction under section 27 the Environmental Protection Tribunal shall have the same powers and shall follow the same procedure as an appellate court in the Code of Civil Procedure, 1908 (Act V of 1908).

(6) In all matters with respect to which no procedure has been provided for in this Act, the Environmental Protection Tribunal shall follow the procedure laid down in the Code of Civil Procedure, 1908 (Act V of 1908).

(7) An Environmental Protection Tribunal may, on application filed by any officer duly authorised in this behalf by the Director General, issue bailable warrant for the arrest of any person against whom reasonable suspicion exists, of his having been involved in contravention punishable under sub-section (1) of section 22:

Provided that such warrant shall be applied for, issued and executed in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898):

Provided further that if the person arrested executes a bond with sufficient sureties in accordance with the endorsement on the warrant he shall be released from custody, failing which he shall be taken or sent without delay to the officer in-charge of the nearest jurisdiction police station.

(8) All proceedings before the Environmental Protection Tribunal shall be deemed to be judicial proceedings within the meaning of sections 193 and 228 of the Pakistan Penal Code (Act XLV of 1860), and the Environmental Protection Tribunal shall be deemed to be a court for the purpose of sections 480 and 482 of the Code of Criminal Procedure, 1898 (Act V of 1898).

(9) No court other than an Environmental Protection Tribunal shall have or exercise any jurisdiction with respect to any matter to which the jurisdiction of an Environmental Protection Tribunal extends under this Act and the rules and regulations.

(10) Where the Environmental Protection Tribunal is satisfied that a complaint made to it under sub-section (3) is false and vexatious to the knowledge of the complainant, it may, by an order, direct the complainant to pay to the person complained against such compensatory costs which may extend to one hundred thousand rupees.

**Appeals to the
Environmental
Protection
Tribunal.**

27. (1) Any person aggrieved by any order or direction of the Agency under any provision of this Act or the rules or regulations may prefer an appeal with the Environmental Protection Tribunal within thirty days of the date of communication of the impugned order or direction to such person.

(2) An appeal to the Environmental Protection Tribunal shall be in such form, contain such particulars and be accompanied by such fees as prescribed.

**Appeals from
orders of the
Environmental
Protection
Tribunal.**

28. (1) Any person aggrieved by any final order or by any sentence of the Environmental Protection Tribunal passed under this Act may, within thirty days of communication of such order or sentence, prefer an appeal to the High Court.

(2) An appeal under sub-section (1) shall lie before the High Court of Sindh.

**Jurisdiction of
Judicial
Magistrate.**

29. (1) Notwithstanding anything contained in the Code of Criminal Procedure, 1898 (Act V of 1898), or any other law for the time being in force, but subject to the provisions of this Act, all contraventions punishable under sub-section (2) of section 22 shall exclusively be triable by the Court of Judicial Magistrate of First Class having of First Class having jurisdiction.

(2) A Judicial Magistrate shall be competent to impose any punishment specified in sub-sections (2) and (4) of section 22.

(3) A Judicial Magistrate shall not take cognizance of an offence triable under sub-section (1) except on a complaint in writing by—

(a) the Agency; and

(b) any aggrieved person.

**Appeals from
orders of the
Judicial
Magistrate.**

30. Any person aggrieved by any final order or sentence passed by a Judicial Magistrate under section 28 may, within thirty days from the date of the communication of such order or sentence, appeal to the Court of the District and Sessions Judge defined as Green Court under this Act, whose decision thereon shall be final.

**PART-X
PUBLIC PARTICIPATION**

31.(1) The Agency shall cause relevant details of any proposed project regarding which an Environmental Impact Assessment has been received to be published, alongwith an invitation to the public to furnish their comments thereon within a specified period. **Public participation.**

(2) In accordance with such procedure as may be prescribed, the Agency shall hold public hearings to receive additional comments and hear oral submissions.

(3) All comments received under sub-sections (1) and (2) shall be duly considered by the Agency while reviewing the environmental impact assessment or strategic impact assessment, and decision or action taken thereon shall be communicated to the persons who have furnished the said comments.

**PART-XI
GENERAL**

32. The Agency may, by notification in the official Gazette, make and amend the schedule. **Power to make and amend schedule.**

33. No suit, prosecution or other legal proceedings shall lie against Government, the Council, the Agency, the Director General of the Agency, members, officers, employees, experts, advisors, committees or consultants of the Agency or Environmental Protection Tribunal or Court or any other person for anything which is done or intended to be done in good faith under this Act or rules or regulations. **Indemnity**

34. Any dues recoverable by the Agency under this Act and rules or regulations shall be recoverable as arrears of land revenue. **Dues recoverable as arrears of land revenue.**

35. The provisions of this Act shall have effect notwithstanding anything inconsistent therewith contained in any other law for the time being in force. **Act to override other laws.**

36. The Sindh Environment Protection Agency may, by notification in the Official Gazette, make rules for carrying out the purposes not in consistence of this Act with the approval of Government. **Power to make rules.**

37. (1) For carrying out the purposes of this Act, the Agency may, by Notification in the Official Gazette and with the approval of Government, make regulations not inconsistent with the provisions of this Act or the rules. **Power to make regulations.**

(2) In particular and without prejudice to the generality of the foregoing power, such regulations may provide for —

- (a) submission of periodical reports, data or information by any Government Agency, local authority or local council in respect of environmental matters;
- (b) preparation of emergency contingency plans for coping with environmental hazards and pollution caused by accidents, natural disasters and calamities;
- (c) appointment of officers, advisors, experts, consultants and employees **as per prescribed rules**;
- (d) levy of fees, rates and charges in respect of services rendered, actions taken and schemes implemented;
- (e) monitoring and measurement of discharges and emissions;
- (f) categorization of projects to which, and the manner in which sections 17, 18 and 20 applies;
- (g) laying down of guidelines for preparation of initial environmental examination, environmental impact assessment and strategic environmental assessment, and development of procedures of their filing, reviews and approval.
- (h) laying down standard operating procedures for environmental sampling, examination of water, waste water, gaseous emissions, solid waste and noise;
- (i) providing procedures for handling hazardous substances; and
- (j) installation of devices in, use of fuels by, and maintenance and testing of motor vehicles for control of air and noise pollution.

**BY ORDER OF THE SPEAKER
PROVINCIAL ASSEMBLY OF SINDH**

**G.M.UMAR FAROOQ
SECRETARY
PROVINCIAL ASSEMBLY OF SINDH**

**Karachi: Printed at the Sindh Government Press
20-3-2014**

Annex – II
Environmental Assessment Regulation 2021

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Separate Paging is given to this Part in order that it may be filed as a separate compilation.

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PART-I

NOTIFICATIONS BY THE GOVERNMENT OF SINDH

SERVICES, GENERAL ADMINISTRATION AND COORDINATION DEPARTMENT

NO.SOII(SGA&CD)2-2/33/2019

Karachi, dated the 24th August, 2019

NO.SOII(SGA&CD)2-2/33/2019: Mrs. Mariam Qureshi, Associate Professor (BS-19), Government College for Women Shahrah-e-Liaquat, Karachi is hereby granted thirty (30) days leave Ex-Pakistan to visit United Kingdom, w.e.f. 26.08.2021 or from the date of availing (i.e. within 15 days of Issuance of this Notification), with the condition that she is not required by any court of law during the leave period and that her name does not exist on Exit Control List (ECL).

SINDH ENVIRONMENTAL PROTECTION AGENCY

Karachi dated the 03rd September, 2021

NO.EPA/TECH/739/2021:- In exercise of the powers conferred by section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government, is pleased to make the following regulations, namely:-

1. Short title and commencement

- (1) These regulations may be called the Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021.
- (2) They shall come into force at once.

2. Definitions. -

- (1) In these regulations, unless there is anything repugnant in the subject or context
 - (a) "Act" means the Sindh Environmental Protection Act, 2014 (VIII of 2014);
 - (b) "Agency" means the Sindh Environmental Protection Agency as defined under section 2(ii);
 - (c) "Director General" means the Director General of the Agency;
 - (d) Environmental Checklist means rapid environmental assessment or environmental screening through a prescribed checklist in respect of projects having least/minimal impacts on the environment.
 - (e) "Firm" means the Environmental Consulting Firm registered by the Agency.
 - (f) "Environmentally sensitive area" means a location, large or small, that has significant environmental values that contribute to maintaining biological diversity and integrity, have intrinsic or attributed scientific, historical or cultural heritage value, or are important in providing amenity, harmony or sense of community, ecosystem as declared by Agency.
 - (g) "Protected area" means any area which safeguards the earth's precious bio-diversity, protected areas of natural beauty and conservation of cultural significance as declared by relevant authority;
 - (h) "Schedule" means the Schedules provided in these regulations;
 - (i) "Urban area" means an area within the limits of a town, municipality or city as determined by the Agency on the basis of population and environmental issues
- (2) All other words and expressions used but not defined in these regulations shall have the same meaning as are assigned to them in the Act.

3. Projects requiring Environmental Checklist (EC)

A proponent of a project falling in any category listed in Schedule-I shall file environmental checklist with the Agency and the provisions of section 17 shall apply to such projects.

4. Projects requiring an Initial Environmental Examination (IEE)

A proponent of a project falling in any category listed in Schedule-II shall file an IEE with the Agency, and the provisions of section 17 shall apply to such projects.

5. Projects requiring an Environmental Impact Assessment (EIA)

A proponent of a project falling in any category listed in Schedule-III shall file an EIA with the Agency, and the provisions of section 17 shall apply to such projects.

6. Projects not requiring an Environmental Assessment

- (1) A project not falling in any category listed in Schedules-I, II and III shall not be required to file an EC, IEE or EIA
- (2) Notwithstanding anything contained in sub-regulation (1), the Agency may direct the proponent of a project, whether or not listed in Schedule I or II or III, to file an EC or IEE or EIA, for reasons to be recorded in such direction:
Provided that no such direction shall be issued without the recommendations in writing of the Advisory Committee constituted under regulations 21.

7. Preparation of environmental assessment report

- (1) The Agency may issue guidelines for preparation of an EC or IEE or EIA reports including guidelines of general applicability, and sectoral guidelines indicating specific assessment requirements for planning, construction and operation of projects relating to particular sector.
- (2) The Agency may issue guidelines for preparation scope of an Environmental Management Plan(EMP) or Environmental Audit(EA).
- (3) Where guidelines have been issued under sub-regulation (1) & (2), an EC, IEE or EIA or EMP or EA shall be prepared, to the extent practicable, in accordance therewith and the proponent shall justify any departure therefrom.

8. Review Fees

The proponent shall pay, at the time of submission of an EC, IEE or EIA or EMP or BTS tower a non-refundable review fee to the Agency as prescribe in Schedule-IV.

9. Filing of report

- (1) Two hard copies and two electronic copies for an EC or IEE or EIA report shall be filed with the Agency by the proponent. The Agency may require the proponent to submit additional copies, as and when required during the review process.
- (2) Every EC, IEE and EIA shall be accompanied by -
 - (a) an application, in the form prescribed in Schedule-V;
 - (b) Copy of receipt showing payment of review fee, as prescribed in Schedule-IV

10. Preliminary Scrutiny

- (1) Any report filed by the proponent or applicant shall be returned, if found incomplete in terms of Regulation 9.
- (2) Notwithstanding anything contained in sub-regulation (1) of regulation 12, the Agency may require the proponent to submit an additional information at any stage during the review process.

11. Public participation

- (1) In the case in an EIA, the Agency shall issue a public notice to be published in widely circulated English or Urdu or Sindhi national newspaper and in a local newspaper of general circulation in the area affected by the project, mentioning the type of project, its exact location, the name and address of the proponent and the date, time and place of public hearing for inviting comments from primary stakeholders.
- (2) The date fixed under sub-regulation (1) shall not be earlier than ten days from the date of publication of the notice.
- (3) The Agency shall also ensure the circulation of the EIA, where necessary, to the concerned Government Agencies and solicit their comments thereon.
- (4) All comments received by the Agency from the public or any Government Agency shall be duly considered before issuance of decision.
- (5) The Agency may issue guidelines indicating the basic techniques and measures to be adopted to ensure effective public consultation, involvement and participation in EIA assessment.

12. Review process

- (1) Notwithstanding anything contained in sub section (4) of Section 17, the Agency shall make every effort to conclude its review process of the EA, EMP or environmental checklist within fifteen days, of the IEE within thirty days, and of the EIA within sixty days after receiving of complete case.
- (2) In reviewing an EIA, the Agency shall consult such Committee of Experts be constituted for the purpose by the Director General, and may also solicit views of concerned Advisory Committee, if any, constituted by the Agency.
- (3) The Director General may, where considers it necessary, constitute a committee to inspect the site of the project and submit its report on such matters as may be specified.
- (4) In reviewing the IEE, the Director General may constitute a committee of the officers from within the Agency, on case to case basis, in view of the jurisdiction and location of the project for the purpose to extend final recommendation about the approval or rejection of the IEE.

- (5) The review of the IEE or EIA by the Agency shall be based on quantitative and qualitative assessment of the documents and data furnished by the proponent, comments from the public and Government Agencies received under regulation 12, and views of the committees mentioned in sub-regulations (2) and (3) above.
- (6) EMP, EA, EC shall be reviewed as per guidelines issued by SEPA

13. Decision

- (1) The documentary evidence in the form of videos (soft copies) of public hearing shall be submitted by the proponent within three days after conclusion of public hearing to the Agency.
- (2) On completion of the review process, the decision of the Agency shall be communicated to the proponent in the form prescribed in Schedule-VI or in case of an IEE or EMP or environmental checklist or environmental audit in the form prescribed in Schedule-VII in case of an EIA.

14. Conditions of approval

- (1) Every approval of an EC or IEE or EIA or EMP or EA shall, in addition to such conditions as may be imposed by the Agency, be subject to the condition that the project shall be designed, constructed or operated and mitigatory and other measures adopted, strictly in accordance with the EC or IEE or EIA or EMP or EA, unless any variations thereto have been specified in the approval by the Agency.
- (2) Where the Agency accords its approval subject to certain conditions, the proponent shall submit an undertaking to the Agency, before commencing operation of the project, in the form prescribed in Schedule-VIII that the conditions of approval, and the requirements in the IEE or EIA relating to design and construction, adoption of mitigation and other measures have been duly complied with.

15. Validity period of Approval

- (1) The approval accorded by the Agency under section 17 read with sub-regulation (2) of regulation 15 shall be valid, for commencement of construction, for a period of three years from the date of issue.
- (2) If construction is commenced during the initial three years validity period, the validity of the approval shall stand extended for a further period of three year.
- (3) The proponent may apply to the Agency for extension in the validity periods mentioned in sub-regulations (1), (2), which may be granted by the Agency in its discretion for such period not exceeding three years at a time, if the conditions of the approval do not require significant change;
Provided that the Agency may require the proponent to submit a fresh IEE or EIA, if in its opinion changes in location, design, construction and operation of the project so warrant.

16. Entry and inspection

- (1) For the purpose of verification of any matter relating to the review or to the conditions of approval of an EC or IEE or EIA or EMP or EA list prior to, before or during and after commencement of construction or operation of a project, duly authorized staff of the Agency shall be entitled to enter and inspect the project site, factory building and plant and equipment installed therein.
- (2) The proponent shall ensure full cooperation of the project staff at site to facilitate the inspection, and shall provide such information as may be required by the Agency for this purpose and pursuant thereto.

17. Cancellation of approval

- (1) Notwithstanding anything contained in these regulations, if, at any time, on the basis of information or report received or inspection carried out, the Agency is of the opinion that the conditions of an approval have not been complied with, or that the information supplied by a proponent in the approved EC or IEE or EIA or EMP or EA list is incorrect, it shall issue notice to the proponent for show cause within two weeks of receipt thereof as to why the approval should not be cancelled.

- (2) In case no reply is received or if the reply is considered unsatisfactory, the Agency may, after giving the proponent an opportunity of being heard -
- (i) require the proponent to take such measures and to comply with such conditions within such period as it may specify, failing which the approval shall stand cancelled; or
 - (ii) cancel the approval.
- (3) On cancellation of the approval, the proponent shall cease construction or operation of the project forthwith.
- (4) Any action taken under this regulation shall be without prejudice to any other action that may be taken against the proponent under the Act or rules or regulations or any other law for the time being in force.

18. Registers of EC or IEE and EIA projects

Separate Registers to be maintained by the Agency for EC or IEE and EIA projects shall be in the form prescribed in Schedule-IX.

19. Environmentally sensitive areas

- (1) The Agency may designate an area to be an environmentally sensitive area.
- (2) Notwithstanding anything contained in regulations 3 and 5, the proponent of a project situated in an environmentally sensitive area shall be required to file an EIA with the Agency.

20. Environmental assessment guidelines

- (1) The Agency may from time to time issue guidelines to assist proponents and other persons involved in the preparation of environmental assessment.
- (2) Where guidelines have been issued under sub-regulation (1), the projects shall be planned and prepared, to the extent practicable, in accordance therewith and any departure therefrom justified in the IEE/EIA pertaining to the project.

21. Environmental Assessment Advisory Committee. -

The agency may constitute one or more Committees for the purpose of rendering advice on implementation and enforcement of Section 17, which may include experts of relevant field, civil society, academia, environmental experts, representative of Administrative Department, legal expert and experts from natural resources.

22. Repeal and Savings.

- (1) The Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2014, shall, on commencement of these regulations, stand repealed.
- (2) All orders made, notification issued, actions taken under the repealed Regulations shall remain in force until amended, altered or repealed by the provisions of these regulations.

**DIRECTOR GENERAL
SINDH ENVIRONMENTAL PROTECTION
AGENCY**

SCHEDULE-I

(See Regulation 3)

List of projects requiring Environmental Screening (through check list)

- a. Subject to the compliance with concerned zoning laws:
 - i. Construction of residential and commercial buildings having total covered area from 60,000 sq. feet to 100,000 sq. feet
 - ii. Housing Schemes covering an area from 05 acres to 15 acres.
 - iii. Ware Houses for Non-Hazardous substances having total area from 1000 sq. yards to 5,000 sq. yards
 - iv. Warehouse for Fertilizers
 - v. Marriage Halls/Banquet/Restaurants/Baking facilities having total area more than 500 sq. yards
 - vi. Motor vehicle workshops/Service Stations having total area of more than 500 sq. yards.
- b. Construction/Reconstruction/Rehabilitation of roads in urban area from 500 meters to 01 kilometres and in rural area from 500 meters to 05 kilometres.
- c. Construction of Flyover, underpasses and bridges of length from 100 meters to 500 meters
- d. On-farm dams and fish farms
- e. Pulses mills
- f. Flour Mills
- g. Lining of existing minor canals and /or water courses.
- h. Canal cleaning
- i. Forest harvesting operations
- j. Rain harvesting projects
- k. Health care units of less than 50 beds
- l. BTS Tower
- m. Lime Kilns
- n. Ice factories and cold storage.
- o. Cotton oil mill
- p. Construction of LPG, CNG, LNG filling station and petrol pumps
- q. Carpet manufacturing units
- r. Rain harvesting projects
- s. Industrial Effluent Treatment Plant
- t. Sanitary Landfill site up to 500 tons/day

Schedule-II

(See Regulation 4)

List of projects requiring an Initial Environmental Examination**A. Agriculture, Livestock and Fisheries**

1. Poultry, livestock and fish farms
2. Warehousing for pesticides and pharmaceuticals
3. Projects involving packaging, formulation, cold storage and warehouse of agricultural, livestock and fish products.
4. Construction & Operation of Slaughter houses

B. Energy

1. Hydroelectric power generation up to 25 MW
2. Thermal power generation up to 100 MW
3. Coal fired power plants with capacity up to 50 MW
4. Transmission lines up to 132 KV, and grid stations
5. Waste-to-energy generation projects including bio-mass up to 25 MW
6. Construction of Coal Handling and storage facilities
7. Handling, Transportation & Storage of Biofuel Facility
8. Handling and storage of edible grains and seeds
9. All Renewable energy Projects (excluding Protected/Sensitive area under any law)

C. Oil and Gas projects:

1. Oil and gas 2D/3D Seismic survey and drilling activities (on and off shore)
2. Oil and gas extraction projects including exploration and production located outside the environmentally sensitive/protected areas
3. Oil & Gas transmission gathering, storage, separation & transportation system
4. Construction of CNG, LPG Petroleum and LNG bulk storage facility
5. Oil blending and recycling units

D. Manufacturing and processing

1. Ceramics and glass units
2. Food processing units
3. Pharmaceutical units.
4. Rice mills; ghee/oil mills, Cotton ginning
5. Man-made fibers and resin projects
6. Tanning and leather finishing projects
7. Manufacturing of apparel, textile garments units, including weaving, spinning, dyeing, bleaching and printing
8. Woodwork units manufacturing products
9. Steel re-rolling mills
10. Waste recycling plants
11. Battery manufacturing plant
12. Brick Kilns
13. Marble processing units
14. Stone Crushing units

E. Mining and mineral processing

1. Commercial extraction of sand, gravel, limestone, clay, Sulphur and other minerals not included in Schedule I.
2. Crushing, grinding and separation processes
3. Metal Smelting plant production capacity up to 20 tons/day

F. Transport

1. Construction of flyovers, underpasses and bridges having length more than 500 meters to 1000 meters in urban areas and more than 5km in rural areas
2. Bus terminals/ railway station/ metro stops and construction & operation of transport related terminals
3. Rehabilitation or rebuilding or reconstruction of existing roads more than one kilometers in urban areas and more than 5 km from rural areas

G. Water management, dams, irrigation and flood protection

1. Dams and reservoirs with storage volume of less than 25 million cubic meters of surface area less than 4 square kilometers
2. Irrigation systems and drainage system with the area of less than 15,000 hectors
3. Flood protection bunds

H. Water supply and filtration

Water supply schemes and filtration plants

I. Waste disposal and wastewater treatment

1. Solid and Non-hazardous waste with annual capacity up to 10,000 tonnes (excluding municipal landfill sites and commercial facilities) including Garbage Transfer station/composting plant

2. Wastewater treatment for sewerage treatment facility less than 100 mgd
3. Hospital waste disposal facilities including incineration units owned by Hospitals for own use excluding commercial facility.

J. Urban development

1. Housing schemes more than 15 acres to 50 acres
2. Residential, Commercial multistory High rise construction projects having covered area more than 100,000 sq. feet to 500,000 sq. feet.
3. Laboratories
4. Hospitals, health care unit of more than 50 beds
5. Construction of Educational and Academic institutions.

K. Other projects

Any other project for which filing of an IEE is required by the Agency under sub-regulation (2) of Regulation 6.

SCHEDULE III

(See Regulation 5)

List of projects requiring an EIA**A. Energy**

1. Hydroelectric power generation more than 50 MW
2. Thermal power generation more than 100 MW
3. Coal power projects more than 50 MW
4. Transmission lines above 132 KVA and distribution projects.
5. Nuclear power plants
6. Wind, Solar or renewable energy projects if falls under any environmental sensitive and protected area.

B. Oil and Gas projects

1. Oil Petroleum refineries.
2. LPG and LNG Terminals Projects
3. Coal Handling Terminals Projects

C. Manufacturing and processing

1. Cement plants
2. Chemical manufacturing industries
3. Fertilizer plants
4. Steel Mills
5. Sugar Mills and Distilleries
6. Establishment of Industrial estates & Export processing zones
7. Petrochemicals complex
8. Synthetic resins, plastics and man-made fibers, paper and paperboard, paper pulping, plastic products, printing and publishing, paints and dyes.

D. Mining and mineral processing

1. Mining and processing of coal, gold, copper, sulphur and precious stones
2. Mining and processing of major non-ferrous metals, iron and steel rolling
3. Metal Smelting plant production capacity more than 20 tons/day

E. Transport

1. Airports
2. Construction of highway, motor ways, major roads (Intercity roads) more than one km and above
3. Ports and harbor development
4. Mass transit projects
5. Railway works
6. Construction of Flyover, underpass and bridges having total length more than one km.

- F. Water management, dams, irrigation and flood protection**
1. Dams and reservoirs with storage volume of 25 million cubic meters and above having surface area of 4 square kilometers and above
 2. Irrigation and drainage projects serving more than 15,000 hectares and above
- G. Water supply and filtration**
- Public water supply schemes and filtration plants.
- H. Waste Disposal and treatment**
1. Facilities for handling, storage or disposal of hazardous or toxic wastes or radioactive waste (including landfill sites, incineration units, etc.)
 2. Solid waste municipal landfill sites.
 3. Combine Effluent Treatment Plant
 4. Domestic wastewater treatment plant more than 100mgd
- I. Urban development and tourism**
1. Housing schemes above 50 acres
 2. Residential, Commercial High rise buildings subject to compliance of building bylaws of relevant organizations more than 500,000 sq. feet
 3. All Projects located in High Density Zones notified by Government and relevant land controlling organization, irrespective of their size.
 4. Commercialization of major corridors/roads in urban centers
 5. Large Scale public facilities
 6. Large-scale tourism development projects
- J. Environmentally Sensitive Areas**
- All projects situated in environmentally sensitive areas being identified by the Agency.
- K. Other projects**
1. Any other project for which filing of an EIA is required by the Agency under sub-regulation (2) of Regulation 5.
 2. Any other project likely to cause an adverse environmental effect.

Schedule-IV
(See Regulation 8)

Project Cost (in million)	Review Fee
Up to 20	Rs. 50,000
Above 20 up to 100	Rs. 100,000
Above 100 up to 200	Rs. 200,000
Above 200 up to 500	Rs. 400,000
Above 500	Rs. 600,000
Review fee for Environmental Checklist or EMP shall be Rs. 40,000/=	
Review fee for BTS Tower shall be 20,000/=	

Note:

The fee shall be payable into the "Sindh Sustainable Development Fund" account
Details are as under:

A/C Title: Sindh Sustainable Development Fund

Account Number: 03084572626100

Bank: Sindh Bank

Branch Code: 0308-Korangi Industrial Area

SCHEDULE V
[See Regulation 9(2)(a)]
Application Form

1.	Name and address of Proponent	Phone: Email:	
2.	CNIC No. of proponent		
3.	Brief description of project		
4.	Location of project		
5.	Cost of the Project		
6.	Objectives of project		
7.	IEE/EIA attached?	IEE/EIA:	Yes/No
8.	Have alternative sites/options been considered/ reported in IEE/EIA?	Yes/No	
9.	Title document of the project		
10.	Existing land use	Land requirement	
11.	Is basic site data available, or has it been measured?	(only tick yes if the data is reported in the IEE/EIA)	
		Available	Measured
		Yes/No	Yes/No
	Meteorology (including rainfall)	Yes/No	Yes/No
	Ambient air quality	Yes/No	Yes/No
12.	Have estimates of the following been reported, especially Quantitative Analysis?	Water balance	Estimated
		Solid waste disposal	Yes/No
		Liquid waste	Yes/No
13.	Source of power	Power requirement	
14.	Labour force (number)	Construction:	
		Operation:	
15.	Environmental Consulting Firm		

Verification. I do solemnly affirm and declare that the information given above and contained in the attached EC/IEE/EIA is true and correct to the best of my knowledge and belief.

Date

Signature, name
of proponent (with official
stamp/seal)

SCHEDULE VI
[See Regulation 13(2)]

Decision on IEE/Environmental Check List

1. Name and address of proponent _____
2. Description of project _____
3. Location of project _____
4. Date of filing of IEE _____
5. After careful review of the IEE, the Agency has decided –
 - (a) to accord its approval, subject to the following conditions:

 - or (b) that the proponent should submit an EIA of the project, for the following reasons –

Dated _____

Tracking no. _____

Director-General
Sindh Environmental Protection Agency
(with official stamp/seal)

SCHEDULE VII

[See Regulation 13(2)]

Decision on EIA

1. Name and address of proponent _____
2. Description of project _____
3. Location of project _____
4. Date of filing of EIA _____
5. After careful review of the EIA, and all comments thereon, the Federation Agency has decided –
 - (a) to accord its approval, subject to the following conditions:

 - or (b) that the proponent should submit an EIA with the following modifications-

 - or (c) to reject the project, being contrary to environmental objectives, for the following reasons:

Dated _____

Tracking no. _____

Director-General
Sindh Environmental Protection Agency
(with official stamp/seal)

SCHEDULE VIII
(See Regulation 14(2))

Undertaking

I, (full name and address) as proponent for (name, description and location of project) do hereby solemnly affirm and declare that the conditions of approval and the requirements in the IEE or EIA relating to design and construction, adoption of mitigation and other measures and other relevant matters have been duly complied with in the design and construction of the project.

Signature, name and

designation of proponent
(with official stamp/seal)

Witnesses (full names and addresses)

SCHEDULE IX
(See Regulation 18)

Form of Registers for EC, IEE and EIA projects

S. No.	Description	Relevant Provisions
1	2	3
1.	Tracking number	
2.	Category type (as per Schedules I or II)	
3.	Name of proponent	
4.	Name and designation of contact person	
5.	Name of consultant	
6.	Description of project	
7.	Location of project	
8.	Date of submission of IEE/EIA	
9.	Date of public hearing / technical presentation	
10.	Date of committee of experts for schedule-II projects	
11.	Approval granted (Yes/No)	
12.	Date of approval granted or refused	

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Annex – III
Sindh Environmental Quality Standards (SEQS)



The Sindh Government Gazette

Published by Authority

KARACHI THURSDAY JANUARY 28, 2016

PART-I

GOVERNMENT OF SINDH
SINDH ENVIRONMENT PROTECTION
AGENCY

NOTIFICATION

NO.EPA/TECH/739/2014:- In exercise of the powers conferred under clause (g) of sub-section (1) of section 6 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of the Sindh Environmental Protection Council, is pleased to establish the following standards:-

1. (1) These Standards may be called the Sindh Environmental Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Airs, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards, 2015.

(2) These Standards shall come into force at once.

2. In these Standards, unless there is anything repugnant in the subject or context -

(a) "Government" means the Government of Sindh;

(b) "Standards" means the Sindh Environmental Quality Standards.

SINDH ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND LIQUID INDUSTRIAL EFFLUENTS (mg/l, UNLESS OTHERWISE DEFINED)

S. No.	Parameter	Standards		
		Into Inland Waters 3	Into Sewage Treatment ⁽⁵⁾ 4	Into Sea ⁽¹⁾ 5
1.	Temperature 40°C or Temperature Increase *	≤3°C	≤3°C	≤3°C
2.	pH value (H ⁺)	6-9	6-9	6-9
3.	Biochemical Oxygen Demand (BOD) ₅ at 20°C ⁽¹⁾	80	250	80**
4.	Chemical Oxygen Demand(COD) ⁽¹⁾	150	400	400
5.	Total Suspended Solids (TSS) .. .	200	400	200
6.	Total Dissolved Solids (TDS)	3500	3500	3500
7.	Oil and Grease	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.3	0.3
9.	Chloride (as Cl ⁻)	1000	1000	SC***
10.	Fluoride (as F ⁻)	10	10	10
11.	Cyanide (as CN ⁻) total	1.0	1.0	1.0
12.	An-ionic detergents (as MBAS) ⁽²⁾	20	20	20
13.	Sulphate (SO ₄ ²⁻)	600	1000	SC***
14.	Sulphide (S ²⁻)	1.0	1.0	1.0
15.	Ammonia (NH ₃)	40	40	40
16.	Pesticides ⁽³⁾	0.15	0.15	0.15
17.	Cadmium ⁽⁴⁾ ..	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent) ⁽⁴⁾ ..	1.0	1.0	1.0
19.	Copper ⁽⁴⁾	1.0	1.0	1.0
20.	Lead ⁽⁴⁾	0.5	0.5	0.5
21.	Mercury ⁽⁴⁾	0.01	0.01	0.01
22.	Selenium ⁽⁴⁾	0.5	0.5	0.5
23.	Nickel ⁽⁴⁾ ..	1.0	1.0	1.0
24.	Silver ⁽⁴⁾	1.0	1.0	1.0
25.	Total toxic metals .. .	2.0	2.0	2.0
26.	Zinc .. .	5.0	5.0	5.0
27.	Arsenic ⁽⁴⁾	1.0	1.0	1.0
28.	Barium ⁽⁴⁾	1.5	1.5	1.5
29.	Iron .. .	8.0	8.0	8.0
30.	Manganese .. .	1.5	1.5	1.5
31.	Boron ⁽⁴⁾	6.0	6.0	6.0
32.	Chlorine .. .	1.0	1.0	1.0

Explanations:

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Sindh Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.
2. Methylene Blue Active Substances; assuming surfactant as biodegradable.
3. Pesticides include herbicides, fungicides, and insecticides.
4. Subject to total toxic metals discharge should not exceed level given at S. N. 25.
5. Applicable only when and where sewage treatment is operational and BOD₅=80mg/l is achieved by the sewage treatment system.
6. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.
 - *. The effluent should not result in temperature increase of more than 3⁰C at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the point of discharge.
 - ** The value for industry is 200 mg/l
 - *** Discharge concentration at or below sea concentration (SC).

- Note: 1. Dilution of liquid effluents to bring them to the STANDARDS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.
2. The concentration of pollutants in water being used will be subtracted from the effluent for calculating the STANDARDS limits".

"SINDH ENVIRONMENTAL QUALITY STANDARDS FOR INDUSTRIAL GASEOUS EMISSION (mg/Nm³, UNLESS OTHERWISE DEFINED)."

S. No.	Parameter	Source of Emission	Standards
1	2	3	4
1.	Smoke	Smoke opacity not to exceed	40% or 2 Ringleman Scale or equivalent smoke number
2.	Particulate matter	(a) Boilers and Furnaces	
	(1)	(i) Oil fired	300
		(ii) Coal fired	500
		(iii) Cement Kilns	300

		(b) Grinding, crushing, Clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas.	500
3.	Hydrogen Chloride	Any	400
4.	Chlorine	Any	150
5.	Hydrogen Fluoride	Any	150
6.	Hydrogen Sulphide	Any	10
7.	Sulphur Oxides ^{(2) (3)}	Sulfuric acid/ Sulphonic acid plants	
		Other Plants except power Plants operating on oil and coal	1700
8.	Carbon Monoxide	Any	800
9.	Lead	Any	50
10.	Mercury	Any	10
11.	Cadmium	Any	20
12.	Arsenic	Any	20
13.	Copper	Any	50
14.	Antimony	Any	20
15.	Zinc	Any	200
16.	Oxides of Nitrogen	Nitric acid Manufacturing unit.	3000
	(3)	Other plants except power plants operating on oil or coal:	
		Gas fired	400
		Oil fired	600
		Coal fired	1200

Explanations:-

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

A. Sulphur Dioxide

Sulphur Dioxide Background levels Micro-gram per cubic meter ($\mu\text{g}/\text{m}^3$) Standards.

Background Air Quality (SO ₂ Basis)	Annual Average	Max. 24-hours Interval	Criterion I Max. SO ₂ Emission (Tons per Day Per Plant)	Criterion II Max. ground level increment to ambient (One year Average)
Unpolluted	<50	<200	500	50
Moderately Polluted*				
Low	50	200	500	50
High	100	400	100	10
Very Polluted**	>100	>400	100	10

* For intermediate values between 50 and 100 $\mu\text{g}/\text{m}^3$ linear interpolations should be used.

** No projects with Sulphur dioxide emissions will be recommended.

B. Nitrogen Oxide

Ambient air concentrations of Nitrogen oxides, expressed as NO_x should not be exceed the following:-

Annual Arithmetic Mean $100\mu\text{g}/\text{m}^3$
(0.05 ppm)

Emission level for stationary source discharge before missing with the atmosphere should be maintained as follows:-

For fuel fired steam generators as Nanogram (10^0 -gram) per joule of heat input:

Liquid fossil fuel	..	..	..	130
Solid fossil fuel..	..	..	..	300
Lignite fossil fuel	..	..	..	260

Note:- Dilution of gaseous emissions to bring them to the STANDARDS limiting value is not permissible through excess air mixing blowing before emitting into the environment.

Sindh Environmental Quality Standards for Motor
Vehicle Exhaust and Noise

(i) For in-use Vehicles				
S. No.	Parameter	Standards (maximum permissible limit)	Measuring Method	Applicability
1	2	3	4	5
1.	Smoke	40% or on the Ringleman Scale during engine acceleration mode	To be compared with Ringleman Chart at a distance of 6 meters or more.	Immediate effect
2	Carbon Monoxide	6 %	Under idling conditions: Non- dispersive infrared detection through gas analyzer.	
3.	Noise	85 db (A)	Sound-meter at 7.5 meter from the source.	

For new Vehicles

EMISSION STANDARDS FOR DIESEL VEHICLES

(a) For passenger Cars and Light Commercial Vehicles (g/Km)

Type of Vehicle	Category/Class	Tiers	CO	HC+ NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8
Passenger Cars.	M 1: with reference mass (RW).	Pak-II, IDI	1.0	0.7	0.08		All imported and local manufactured
	up to 2500 kg. Cars with RW over 2500 kg. to meet NI Category standards	Pak-II DI	1.0	0.9	0.10	NEDC (ECE 15+ EUDCL)	Diesel vehicles with effect from 01-07-2012
Light Commercial Vehicles	NI-I (RW<1250 Kg)	Pak-II IDI	1.0	0.70	0.08		
		Pak-II DI	1.0	0.90	0.10		
	NI-II(1250kg< RW < 1700 Kg)	Pak-II IDI	1.25	1.0	0.12		
		Pak-II DI	1.25	1.3	0.14		
	NI-III(RW< 1700 Kg)	Pak-II IDI	1.50	1.2	0.17		
		Pak-II DI	1.50	1.6	0.20		

Parameter Standards (maximum permissible limit) Measuring method

Noise	85 db (A)	Sound-meter at 7.5 meters from the source
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(b) For Heavy Duty Diesel Engines and Large Goods Vehicles (g/Kwh)

Type of Vehicle	Category/ Class	Tiers	CO	HC	NOx	PM	Measuring Method	Applicability
1	2	3	4	5	6	7	8	9
Heavy Duty Diesel Engines	Turks and Buses	Pak-II	4.0	1.1	7.0	0.15	ECE-R-49	All Imported and local manufactured diesel vehicles with the effect 1-7-2012
Large goods Vehicles	N2(2000 and up	Pak-II	4.0	7.0	1.10	0.15	EDC	

Parameter Standards (maximum permissible limit) Measuring method

Noise	85 db (A)	Sound-meter at 7.5 meters from the Source
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Emission Standards for Petrol Vehicles (g/km)

Type of Vehicle	Category/ Class	Tier	Co	HC+ NOx	Measuring Method	Applicability
1	2	3	4	5	6	7
Passenger Cars.	M 1: with reference mass (RW): upto 2500 kg. Cars with RW over 2500 kg. to meet N1 Category standards	Pak-II	2.20	0.5	NEDC (ECE 15 + EUDCL)	All imported and new models * locally manufactured petrol vehicles with effect from 1 st July, 2009**

Light Commercial Vehicles	NI-I (RW<1250 kg) NI-II (1250kg> kg RW< 1700 Kg)	Pak-II	2.20	0.5	
		Pak-II	4.0	0.65	
		Pak-II	5.0	0.08	
	NI-III(RW> 1700 kg)				
Motor Rickshaws & Motor Cycles	2,4 strokes < 150 cc	Pak-II	5.5	1.5	ECER 40
	2,4 strokes > 150cc	Pak-II	5.5	1.3	

Parameter Standards (maximum permissible limit) Measuring method

Noise source	85 db (A)	Sound-meter at 7.5 meters from the
--------------	-----------	------------------------------------

Explanations:

- DI: Direct Injection.
- IDI: Indirect Injection.
- EUDCL: Extra Urban Driving Cycle.
- NEDC: New European Driving Cycle.
- ECE: Urban Driving Cycle.
- M: Vehicles designed and constructed for the carriage of passenger and comprising no more than eight seats in addition to the driver's seat.
- N: Motor vehicles with at least four wheels designed and constructed for the carriage of goods.
- * New model means both model and engine type change.
- ** The existing models of petrol driven vehicles locally manufactured will immediately switch over to Pak-II emission standards but no late than 30th June, 2012.

SINDH ENVIRONMENTAL QUALITY STANDARDS FOR AMBIENT AIR

Pollutants	Time-weight average	Concentration in Ambient Air	Method of measurement
Sulphur Dioxide(SO ₂)	Annual Average* 24 hours**	80 µg/m ³ 120 µg/m ³	Ultraviolet Fluorescence method
Oxides of Nitrogen as (NO)	Annual Average* 24 hours**	40 µg/m ³ 40 µg/m ³	Gas Phase Chemiluminescence
Oxides of Nitrogen as (NO ₂)	Annual Average* 24 hours**	40 µg/m ³ 80 µg/m ³	Gas Phase Chemiluminescence
O ₃	1 hour	130 µg/m ³	Non dispersive UV absorption method
Suspended Particulate Matters(SPM)	Annual Average* 24 hours**	360 µg/m ³ 500 µg/m ³	High Volume Sampling (Average flow rate not less than 1 l in 3/minutes)
Respirable Particulate Matter PM10	Annual Average* 24 hours**	120 µg/m ³ 150 µg/m ³	B Ray absorption method
Respirable Particulate Matter PM2.5	Annual Average* 24 hours**	40 µg/m ³ *** 75 µg/m ³	B Ray absorption method
Lead Pb	Annual Average* 24 hours**	1 µg/m ³ 1.5 µg/m ³	ASS Method after sampling using EPM 2000 or equivalent filter paper
Carbon Monoxide(CO)	8 hours** 1 hours**	5 mg/m ³ 10 mg/m ³	Non Dispersive Infra Red(NDIR) method

*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly and at uniform interval.

** 24 hourly/8 hourly values should be met 98% in a year, 2% of the time. It may exceed but not on two consecutive days.

*** Annual Average limit of $40\mu\text{m}^3$ or background annual average concentration plus allowable allowance of $9\mu\text{g}/\text{m}^3$, whichever is lower.

Sindh Standards for Drinking Water Quality

Properties / Parameters	Standard Values for Sindh	WHO Standards	Remarks
Bacterial			
All water intended for drinking (e.Coli or Thermo tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Most Asian countries also follow WHO standards
Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform bacteria)	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Must not be detectable in any 100 ml sample In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period	Most Asian countries also follow WHO standards
Physical			
Colour	≤ 15 TCU	≤ 15 TCU	
Taste	Non objectionable/Acceptable	Non objectionable/Acceptable	
Odour	Non	Non	

	objectionable/Acceptable	objectionable/Acceptable
Turbidity	< 5 NTU	< 5 NTU
Total hardness as CaCO ₃	< 500 mg/l	---
TDS	< 1000	< 1000
pH	6.5 – 8.5	6.5 – 8.5
Chemical		
<i>Essential Inorganic</i>	<i>mg/Litre</i>	<i>mg/Litre</i>
Aluminium (Al) mg/l	≤ 0.2	0.2

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Antimony (Sb)	≤ 0.005 (P)	0.02	
Arsenic (As)	≤ 0.05 (P)	0.01	Standard for Pakistan similar to most Asian developing countries
Barium (Ba)	0.7	0.7	
Boron (B)	0.3	0.3	
Cadmium (Cd)	0.01	0.003	Standard for Pakistan similar to most Asian developing countries
Chloride (Cl)	< 250	250	
Chromium (Cr)	≤ 0.05	0.05	
Copper (Cu)	2	2	
<i>Toxic Inorganic</i>	<i>mg/Liter</i>	<i>mg/Litre</i>	
Cyanide (CN)	≤ 0.05	0.07	Standard for Pakistan similar to Asian developing countries
Fluoride (F)*	≤ 1.5	1.5	
Lead (Pb)	≤ 0.05	0.01	Standard for Pakistan similar to most Asian developing countries
Manganese (Mn)	≤ 0.5	0.5	
Mercury (Hg)	≤ 0.001	0.001	
Nickel (Ni)	≤ 0.02	0.02	

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Nitrate (NO ₃)	≤ 0.50	50	
Nitrite (NO ₂)	≤ 3 (P)	3	
Selenium (SE)	0.01 (P)	0.01	
Residual chlorine	0.2-0.5 at consumer end 0.5-1.5 at source	---	
Zinc (Zn)	5.0	3	Standard for Pakistan similar to most Asian developing countries

Properties / Performance	Standard Values for Pakistan	Who Standards	Remarks
Organic			
Pesticides mg/L		PSQCA No. 4639-2004, Page No. 4 Table No. 3 Serial No. 20-58 may be consulted.***	Annex II
Phenolic compounds (as Phenols) mg/L		0.002	
Polynuclear aromatic hydrocarbons (as PAH g/L)		0.01 (By GC/MS method)	
Radioactive			
Alpha Emitters bq/L or pCi	0.1	0.1	
Beta emitters	1	1	

*** PSQCA: Pakistan Standards Quality Control Authority

Proviso:

The existing drinking water treatment infrastructure is not adequate to comply with WHO guidelines. The Arsenic concentrations in some parts of Sindh have been found high then Revised WHO guidelines. It will take some time to control arsenic through treatment process. Lead concentration in the proposed standards is higher than WHO Guidelines. As the piping system for supply of drinking water in urban centers are generally old and will take significant resources and time to get them replaced. In the recent past, Lead was completely phased out from petroleum

products to cut down Lead entering into environment. These steps will enable to achieve WHO guidelines for Arsenic, Lead, Cadmium and Zinc. However, for bottled water, WHO limits for Arsenic, Lead, Cadmium and Zinc will be applicable and PSQCA Standards for all the remaining parameters.

Sindh Environmental Quality Standards for Noise

S. No.	Category of Area / Zone	Effective from 1 st Jan, 2015		Effective from 1 st January, 2015	
		Limit in dB(A) Leq *			
		Day Time	Night Time	Day Time	Night Time
1.	Residential Area (A)	65	50	55	45
2.	Commercial Area (B)	70	60	65	55
3.	Industrial Area (C)	80	75	75	65
4.	Silence Zone (D)	55	45	50	45

- Note: 1. Day time hours: 6:00 a.m to 10:00 p.m
 2. Night time hours: 10:00 p.m to 6:00 a.m
 3. Silence zone; Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts
 4. Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.
 * dB(A) Leq: Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

3. Repeal and Savings.

- (1) The provisions of the Statutory Notification dated 10th August, 2000 and 18th October, 2010, issued by the Ministry of Environment, Government of Pakistan, to the extent of the Province of Sindh are hereby repealed.
- (2) All actions taken, proceedings initiated shall be deemed to have been taken and initiated validly under the the provisions of these Rules.

DIRECTOR GENERAL
SINDH ENVIRONMENTAL PROTECTION
AGENCY

Annex – IV
Environmental Monitoring Report

Ambient Air Quality Test Report

Project Name:	EIA Creek View & Terraces – The Arkadians,	Test Report No:	QTS/CVTA/24/9632
Address:	Zone G of DHA Waterfront Development Area, Phase VIII, DHA, Karachi.	Sample Duration:	24hr's
Sample Description:	Ambient Air Quality Test	Location:	24°46'39.9"N 67°05'41.3"E

SEQS-PARAMETERS								
Date	Time	NO (µg/m ³)	NO ₂ (µg/m ³)	SO ₂ (µg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SPM (µg/m ³)	Lead (µg/m ³)
04.07.2024	10:00	13.7	24.9	13.2	62	43	253	BDL
	11:00	13.4	24.9	13.4	63	45	256	BDL
	12:00	13.6	25.8	13.6	65	47	258	BDL
	13:00	15.5	25.5	15.5	66	50	261	BDL
	14:00	15.1	26.0	15.3	68	52	263	BDL
	15:00	15.0	26.3	15.2	70	56	265	BDL
	16:00	17.5	27.1	19.0	72	58	266	BDL
	17:00	17.9	27.5	19.9	75	60	269	BDL
	18:00	17.8	30.4	19.8	77	57	273	BDL
	19:00	19.4	30.3	21.7	80	55	275	BDL
	20:00	19.2	28.2	21.2	83	50	277	BDL
	21:00	20.1	28.0	21.6	85	47	280	BDL
	22:00	20.3	26.8	22.1	87	45	283	BDL
	23:00	21.6	28.9	22.5	90	42	284	BDL
05.07.2024	00:00	21.4	25.5	24.0	93	40	285	BDL
	01:00	17.0	25.6	24.6	95	44	288	BDL
	02:00	17.5	23.5	21.2	97	47	290	BDL
	03:00	17.9	23.	21.7	101	51	293	BDL
	04:00	15.7	22.1	17.8	102	52	296	BDL
	05:00	15.0	22.0	17.9	105	48	301	BDL
	06:00	15.9	21.8	18.5	106	45	302	BDL
	07:00	16.8	21.7	18.4	108	40	305	BDL
	08:00	16.4	24.5	16.2	112	37	308	BDL
	09:00	18.2	24.1	16.3	113	35	312	BDL
	10:00	18.5	24.6	16.8	115	33	316	BDL
MIN		13.4	21.7	13.2	62	33	253	BDL
MAX		21.6	30.4	24.6	115	60	316	BDL
AVG		17.2	25.5	18.7	87.6	47.1	282.5	BDL
SEQS		40	80	120	150	75	500	1.5
LDL-Limits		0.0	0.0	0.0	10	2.5	1.0	-

Ambient Air Quality Test Report

Project Name:	EIA Creek View & Terraces – The Arkadians,	Test Report No:	QTS/CVTA/24/9632
Address:	Zone G of DHA Waterfront Development Area, Phase VIII, DHA, Karachi.	Sample Duration:	24hr's
Sample Description:	Ambient Air Quality Test	Location:	24°46'39.9"N 67°05'41.3"E

Parameter	Unit	Monitoring Duration	Average Obtained Concentration	SEQS	LDL-Limits	Methodology
Carbon Monoxide (CO)	mg/m ³	08 Hours	0.94	5.0	0.0	Non Dispersive Intra Red (NDIR)
Nitrogen oxide (NO)	µg/m ³	24 Hours	17.2	40.0	0.0	Chemiluminescence
Nitrogen Dioxide (NO₂)	µg/m ³	24 Hours	25.5	80.0	0.0	
Sulphur Dioxide (SO₂)	µg/m ³	24 Hours	18.7	120.0	0.0	Ultraviolet Fluorescence Method
Ozone (O₃)	µg/m ³	01 Hour	16.8	130.0	0.0	Non Dispersive UV Absorption Method
Particulate Matter (PM₁₀)	µg/m ³	24 Hours	87.6	150.0	10.0	β Ray Absorption Method
Particular Matter (PM_{2.5})	µg/m ³	24 Hours	47.1	75.0	2.5	
Suspended Particulate Matter (SPM)	µg/m ³	24 Hours	282.5	500.0	1.0	
Lead (Pb)	µg/m ³	24 Hours	BDL	1.5	-	ASS Method

*SEQS= Sindh Environmental Quality Standards.
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m³= Micrograms per Cubic Meter
mg/m³= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

Remarks: The Tested Parameters are within SEQS Limits for Ambient Air Quality.

Sample Analyzed By: <u>Hassan Ali</u>	Signature of Laboratory Incharge: Name : <u>Haseeb Arshad</u>
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Lab Report Ref. No.: QTS/CVTA/24/9633

Reporting Date: 08/07/2024

Report to: **EIA Creek View & Terraces – The Arkadians,**

Address: **Zone G of DHA Waterfront Development Area, Phase VIII, DHA, Karachi.**

SAMPLE DESCRIPTION

Sample ID: Noise Level Test
Sample Description: Ambient Noise
Sample Collected/Submitted by: QTS representative
Sampling Date :04/07/2024
Sample Receipt at QTS - Date: 04/07/2024

EMISSION TEST REPORT

S.NO.	LOCATION/SOURCE	*SEQS Limits : 55*dB(A) Leq		
		Noise Level Readings		
		Minimum	Maximum	Average
1	Front Side Right Corner	52.5	53.4	52.9
2	Front Side Left Corner	52.9	53.8	53.3
3	Back Side Right Corner	51.0	52.3	51.6
4	Back Side Left Corner	53.7	54.2	53.9

*SEQS=Sindh Environmental Quality Standard for Residential Area- Category "A".

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

Terms & Conditions:

- This report is not valid for any negotiations
- Report is valid for current batch(sample)
- This report is intended only for your guidance & not for legal purpose or for advertisement.

Comments:

The Noise Level is Within Acceptable Limits as describe in SEQs.

Sample Analyzed by: Hassan Ali

Signature of Laboratory In charge:
Name : Haseeb Arshad

