Environmental Impact Assessment (EIA)

Revised & Extended Layout Plan of Gulberg Green Farm Housing Scheme, Zone IV, Islamabad

A Project
Intelligence Bureau
Employee's Cooperative Housing Society (IBECHS)

Submitted to:
Pakistan Environmental Protection Agency (Pak-EPA)

ENVIRONMENTAL IMPACT ASSESSMENT

REVISED & EXTENDED LAYOUT PLAN OF GULBERG GREEN, FARM HOUSING SCHEME, ZONE IV, ISLAMABAD

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ABBREVIATIONS

CDA	Capital Development Authority
EMMP	Environmental Management and Monitoring Plan
EMP	Environmental Monitoring Program
EPA	Environmental Protection Agency
EPC	Environmental Protection Council
IUCN	International Union for Conservation of Nature
LAA	Land Acquisition Act
NEQS	National Environmental Quality Standards
NGOs	Non-governmental Organizations
NO_2	Nitrogen Dioxide
PAPs	Project Affected Persons
MMM	Mitigation Management Matrix
SC	Supervisory Consultants
EO	Environmental Officer
MER	Monthly Environmental Report

EXECUTIVE SUMMARY

This Environmental Impact Assessment has been prepared for the Revised and Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad, proposed by the Intelligence Bureau Employees Cooperative Housing Society. The assessment has been undertaken to evaluate the environmental and social implications of the revised development, identify technically feasible mitigation measures and establish an Environmental Management and Monitoring Plan for implementation during the design, construction, operation and eventual decommissioning of project infrastructure. The EIA has been prepared in accordance with Section 12 of the Pakistan Environmental Protection Act, 1997, the Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000, the Pakistan Environmental Assessment Procedures and relevant Capital Development Authority planning and development requirements.

Gulberg Green has developed progressively through earlier environmental approvals. An Initial Environmental Examination was approved in 2011 for an area of 3,861 kanals, followed by environmental approval through an EIA in 2021 for an expanded scheme area of 18,660 kanals. he proposal was further expanded, and an application for environmental approval covering a total area of **2,241 kanals** was formally submitted.. The development is intended to provide planned, serviced and comparatively low-density residential accommodation supported by commercial, institutional, recreational and municipal infrastructure.

The project responds to increasing housing demand and rapid urban expansion in the Islamabad–Rawalpindi region. Planned development supported by adequate roads, water supply, sewerage, drainage, electricity, public facilities and environmental controls is expected to reduce pressure for unregulated settlement growth and contribute to improved housing and urban service provision. The project is also expected to generate direct and indirect employment, stimulate construction and service-sector activity and increase the availability of organized residential development within the Islamabad Capital Territory.

The project is located in Zone IV of Islamabad in and around the mouzas of Koral, Paigh, Chapar Mer Khanal, Gora Sardar, Bora Bangial and Darwala. The scheme is situated near the Islamabad Expressway and approximately half a kilometre from Airport Chowk. Agricultural land occurs toward the east and north, the Islamabad

Highway lies toward the west, and the Korang River and associated drainage catchment occur toward the south. These surroundings make groundwater protection, natural drainage preservation, traffic management and downstream water-quality protection important project considerations.

The revised development includes residential farmhouses and plots, apartment areas, commercial centres, public buildings, schools, healthcare facilities, mosques, community facilities, parks, playfields, landscaped areas, roads, parking, a graveyard and supporting utility infrastructure. The infrastructure components include internal and external roads, water abstraction and distribution arrangements, reservoirs and overhead tanks, electricity and gas networks, sewerage collection, a centralized Sewage Treatment Plant, stormwater drainage, solid-waste collection arrangements, landscaping and emergency facilities.

The report's population-density calculation refers to approximately 1,774 plots and a projected population of 10,644 persons, whereas the water-demand assessment separately uses 1,746 farmhouses and additional apartment population assumptions. The final project population and associated infrastructure calculations should therefore be reconciled against the approved layout before submission.

The revised report has been expanded to include dedicated assessments addressing project alternatives, hydrogeology and groundwater sustainability, treated-effluent reuse and sludge management, seasonal biodiversity, construction accident risk, cumulative impacts, climate resilience, carbon footprint, traffic impacts and vehicular emissions, post-approval compliance, independent environmental auditing and long-term environmental liabilities. The overall report structure now integrates these assessments into the project description, baseline, impact assessment and EMMP chapters.

The alternatives assessment considers the no-project option, alternative site-development approaches, layout and density options, infrastructure phasing, water-supply alternatives, wastewater management arrangements and stormwater-management options. The no-project alternative would avoid direct project impacts but would not meet the intended housing and infrastructure objectives and could contribute to continued unplanned urban growth elsewhere.

The preferred approach is the controlled development of the existing project footprint through a low-density layout, phased infrastructure provision and occupation linked to verified utility capacity. The preferred water-management option combines regulated

and sustainable groundwater abstraction with demand reduction, rainwater harvesting, treated-effluent reuse, metering, leakage control and alternative bulk supply where available. Centralized wastewater treatment and controlled reuse are preferred over individual septic systems or uncontrolled discharge. Natural drainage corridors, detention measures and climate-adjusted stormwater design are preferred over the rapid conveyance of runoff to downstream watercourses.

The project area represents a progressively urbanizing landscape containing existing development, agricultural land, vacant or disturbed plots, scattered vegetation, settlements, roads and seasonal watercourses. Geotechnical investigations indicate soil conditions ranging from clay and silty clay to gravel and deeper granular strata. The project lies in a seismically active regional setting, and structural and infrastructure design must therefore comply with applicable earthquake-resistant design requirements. The report identifies five seasonal watercourses within the project area and recognizes the importance of the Korang River catchment and groundwater resources.

The baseline programme covers ambient air quality, noise, groundwater, surface water, soil and ecology. Monitoring locations are to be representative of project development areas, access roads, nearby settlements, existing wells, natural drains and downstream receptors. Laboratory methods, sampling coordinates, monitoring dates, calibration records, chain-of-custody documentation and accredited laboratory reports are to be maintained as supporting evidence.

The ecological assessment recognizes that the project area is predominantly modified by agriculture, settlement and existing development. Nevertheless, natural drains, riparian vegetation, mature trees and open-land habitat may provide ecological connectivity and seasonal habitat value. Seasonal biodiversity surveys, habitat mapping, species-abundance information and ecological sensitivity classification are therefore required before concluding that no sensitive ecological receptor will be affected. The Biodiversity Management and Monitoring Plan requires avoidance of sensitive drainage and riparian areas, minimization of vegetation clearance, protection of active nests and wildlife, compensatory plantation and survival monitoring.

Water availability is one of the project's most material environmental constraints. The report estimates a total operational water demand of approximately 13.76 million gallons per day, including residential, apartment, commercial, public-service and firefighting requirements. The proposed system includes groundwater abstraction, bulk storage reservoirs, overhead tanks and a distribution network.

Groundwater occurrence identified through resistivity surveys does not by itself demonstrate sustainable supply. The revised EIA therefore requires a detailed hydrogeological investigation including borehole records, seasonal groundwater-level monitoring, step-drawdown and constant-rate pumping tests, aquifer characterization, recharge assessment, community-well inventory, cumulative abstraction assessment and groundwater modelling. The model is required to assess phased and full-development abstraction, interference between project wells, impacts on surrounding communities, drought conditions and reduced recharge under climate change.

Project development and occupation are to be linked to demonstrated sustainable water availability. Groundwater abstraction must remain within approved and environmentally sustainable limits and shall not commence without the required permits or NOCs. Long-term dependence on groundwater is to be reduced through low-flow fixtures, metering, leakage management, rainwater harvesting, drought-tolerant landscaping and reuse of treated wastewater. Community wells are to be monitored, and project-related impairment of existing water access will require immediate corrective action or provision of an alternative supply.

A centralized STP is proposed for the collection and treatment of wastewater generated by the development. The STP is intended to be developed in modular phases corresponding to actual occupation and wastewater loading. Each treatment module must be commissioned before the incoming flow exceeds the available treatment capacity.

Treated effluent is to be reused to the maximum technically feasible extent for parks, green belts, roadside plantation, public landscaping, road washing, sewer flushing, dust suppression and other approved non-potable purposes. A separate reuse network incorporating storage, dedicated pumps, colour-coded pipelines, flow measurement, backflow protection and warning signs is required. A seasonal reuse water balance must quantify effluent generation, reuse demand, storage requirements and any residual discharge.

Surplus treated effluent may only be discharged through an approved and engineered outfall after compliance with applicable NEQS and any project-specific conditions has been verified. Monitoring must include pH, BOD, COD, suspended solids, dissolved solids, oil and grease, ammonia, residual chlorine and microbiological indicators.

Receiving-water monitoring is required upstream and downstream of the discharge point to protect natural drains and the Korang River catchment.

Screenings, grit and sewage sludge are to be collected, stabilized, dewatered, tested and stored in covered, impermeable areas. Beneficial use may only occur after laboratory confirmation and regulatory acceptance; otherwise, sludge must be transported through an authorized contractor to an approved treatment or disposal facility. The STP contingency plan provides for emergency storage, standby power, duty and standby equipment, alarms, critical spares, emergency tankering and prohibition of untreated bypass to drains or open land.

The principal construction impacts include vegetation clearance, soil disturbance, erosion, dust, equipment and vehicle emissions, noise, vibration, construction waste, wastewater, traffic disruption and occupational and community safety risks. These effects are expected to be primarily localized and temporary, provided that mitigation measures are rigorously implemented. Required controls include phased site clearance, water spraying, covering of material stockpiles, maintenance of machinery, restriction of noisy activities to approved hours, safe storage of fuel and chemicals, sediment control, waste segregation, authorized disposal and protection of natural drainage paths.

The environmental risk assessment covers vehicle collisions, equipment overturning, excavation collapse, falls from height, dropped loads, electrocution, fire, fuel and chemical spills, concrete wash-water releases, utility damage, flooding of excavations and failure of temporary drainage. High-risk activities require approved method statements, permit-to-work systems, competent supervision, certified equipment and emergency preparedness. A Construction Emergency Preparedness and Response Plan shall define first aid, firefighting, spill containment, evacuation, communication and coordination with Rescue 1122, healthcare facilities and regulatory authorities. Work must be suspended where an imminent or uncontrolled environmental or safety risk is identified.

The most significant operational issues are water demand, groundwater abstraction, wastewater and sludge management, solid-waste generation, stormwater runoff, traffic growth, vehicular emissions, noise, energy consumption and pressure on municipal and natural resources.

Based on the report's population estimate of 10,644 persons and a generation rate of 0.8 kg per person per day, the project is expected to generate approximately 8.52 tonnes of municipal solid waste daily, equivalent to approximately 3,109 tonnes annually. The waste-management system requires segregation at source, covered storage, regular collection, recycling, authorized transportation, disposal at an approved facility and maintenance of waste manifests and disposal records.

The stormwater system must preserve natural drainage alignments, avoid development within floodways and incorporate sufficient culverts, channels, detention, infiltration, erosion control and safe exceedance routes. Roads, boundary walls and other structures must not obstruct natural flow. Critical infrastructure, including the STP, water facilities and electrical installations, must be protected against flooding.

The cumulative assessment extends beyond the project boundary to include adjacent housing schemes, commercial developments, existing settlements, agricultural land, major roads, utilities, natural drains and downstream receptors within the Korang River catchment. The principal cumulative concerns are groundwater depletion, combined wastewater loading, higher stormwater runoff, traffic congestion, air and noise deterioration, increased solid-waste generation, loss of open land and ecological connectivity, and pressure on public infrastructure.

Water demand is considered the most important cumulative issue because simultaneous abstraction by the project, existing Gulberg Green development, adjoining schemes, villages and agricultural users may exceed local recharge and sustainable aquifer yield. Cumulative wastewater discharges may similarly exceed the assimilative capacity of local drains, while conversion of open land to impervious surfaces may increase downstream peak runoff and erosion.

Cumulative impacts are to be managed through coordinated development phasing, infrastructure-capacity verification, integrated water management, strict STP operation, treated-effluent reuse, stormwater detention, traffic improvements, ecological buffers and coordination with CDA, utility providers, neighbouring developers and regulatory authorities. The cumulative assessment must be updated when major adjoining developments or material changes in project density are approved.

The climate assessment identifies extreme rainfall, flash and riverine flooding, erosion, heatwaves, urban heat-island effects, drought, water scarcity, high winds, power disruption and climate-related public-health risks as material concerns. The proximity

of natural drains and the Korang River catchment, substantial water demand and long design life of project infrastructure make climate resilience an essential condition of development.

Climate adaptation measures include climate-adjusted hydrological and hydraulic modelling, protection of natural drainage corridors, detention and infiltration systems, flood-proofing of critical infrastructure, reflective and insulated building materials, shaded pedestrian routes, native canopy-forming plantation, heat-stress controls for workers, sustainable groundwater allocation, rainwater harvesting, treated-effluent reuse, drought-response planning and standby power for essential services.

The project carbon footprint is to cover construction and operational emissions. Scope 1 sources include project-controlled fuel combustion, generators, vehicles, refrigerants and wastewater-treatment emissions. Scope 2 includes purchased electricity for street lighting, water pumping, STP operation and common facilities. Relevant Scope 3 sources include cement, steel, concrete, asphalt, bricks, material transport, construction waste, municipal waste and resident and visitor transport. No definitive carbon total should be reported until actual activity data and verified emission factors are available. Annual GHG inventories and carbon-intensity indicators are to be maintained, supported by energy efficiency, renewable energy, low-carbon construction, waste diversion, water conservation and sustainable transport measures.

The Traffic Impact Assessment covers the internal road network, access points, connection with the Islamabad Expressway and other road sections and intersections affected by project traffic. It requires classified traffic counts, trip generation and distribution, future background growth, cumulative development traffic, intersection capacity, Level of Service, queue length, parking demand, road safety and pedestrian and public-transport requirements. The project road system includes main access rights-of-way of 100, 80 and 70 feet with 50-foot internal roads, but its adequacy must be confirmed through quantitative assessment.

Vehicular emissions modelling will assess nitrogen oxides, carbon monoxide, particulate matter, hydrocarbons, carbon dioxide and resuspended road dust under existing, construction, initial occupation, full-development and cumulative scenarios. Dispersion modelling is to be undertaken where significant impacts are anticipated, with receptors including nearby houses, settlements, schools, healthcare facilities, mosques, commercial areas and public open spaces. Transport-related carbon emissions are also to be included in the project GHG inventory.

Traffic mitigation includes access management, intersection improvements, turning lanes, parking controls, low internal speeds, safe pedestrian crossings, public-transport connections, construction delivery scheduling, reduced vehicle idling, vehicle maintenance, dust control and gradual provision for electric or low-emission vehicles.

Consultations were undertaken with regulatory institutions, project representatives, local communities and other stakeholders. The principal concerns related to environmental management during construction, water and utility availability, wastewater disposal, traffic, protection of surrounding land and natural drainage, and effective implementation of mitigation measures.

The concerns have been integrated into project design and the EMMP through water sustainability requirements, STP controls, drainage protection, traffic management, environmental monitoring, grievance redress and post-approval compliance arrangements. Stakeholder engagement is to continue during construction and operation, and complaints must be recorded, investigated and resolved within defined timeframes.

The EMMP establishes the institutional, financial and procedural arrangements required to implement the EIA commitments. The proponent shall appoint a qualified Environmental Manager or Environmental Compliance Officer, while each contractor shall designate an environment, health and safety focal person. Environmental requirements are to be incorporated into contracts, method statements, bills of quantities and contractor performance evaluations.

Monitoring during construction will cover dust, air emissions, noise, wastewater, runoff, soil contamination, waste, hazardous materials, traffic, occupational safety, vegetation clearance and community disturbance. Operational monitoring will cover groundwater levels and quality, abstraction volumes, water consumption, STP performance, effluent reuse, sludge, surface water, stormwater drainage, solid waste, traffic, air quality, noise, biodiversity, landscaping, energy and climate-resilience indicators.

A consolidated Environmental Compliance Register shall track all Pak-EPA approval conditions, EIA commitments, permits, deadlines, responsibilities and evidence of implementation. Environmental compliance reports should be submitted at the frequency specified by Pak-EPA and, where no frequency is prescribed, at least quarterly during major construction and annually during operation.

An independent third-party environmental audit is proposed within six months of the start of major construction and annually during active construction and the initial operational period, or at other intervals specified by Pak-EPA. The audit will verify compliance with environmental approval conditions, the EIA, EMMP, applicable standards, water and wastewater requirements, ecological commitments, safety controls and previous corrective actions.

Although the housing scheme is intended for long-term operation, temporary facilities and utility components may require eventual closure or replacement. The decommissioning framework covers contractor camps, fuel areas, boreholes, water facilities, the STP, sludge areas, generators, transformers, waste facilities and contaminated land.

Closure plans must define dismantling, waste removal, decontamination, borehole sealing, STP cleaning, site restoration, post-closure monitoring and independent verification. The proponent remains responsible for pollution or environmental damage arising from project activities even where infrastructure is operated by contractors or transferred to another entity. Adequate financial provision is required for foreseeable closure, remediation, monitoring and auditing costs.

1. INTRODUCTION

1.1. GENERAL

This report presents the findings of the Environmental Impact Assessment (EIA) carried out for the proposed project titled "***Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad***".

This EIA report has been prepared to conform to the requirements of Section 12 of the Pakistan Environmental Protection Act 1997 (PEPA), the Pakistan Initial Environmental Examination and Environmental Impact Assessment Review Regulations, 2000 and the guidelines provided in the Pakistan Environmental Assessment Procedures, 1997.

1.2. THE PROJECT

Following the establishment of the Capital Development Authority (CDA) on June 14, 1960, it soon became apparent that the rapidly growing residential needs of Islamabad would be difficult to meet solely through public-sector development. Land acquisition challenges and frequent litigations further constrained CDA's ability to keep pace with the city's expansion plans.

To address this, CDA opted to encourage private sector participation in urban development. Acting under the powers granted through Section 51 of the CDA Ordinance 1960 (XXIII of 1960), read with Section 11, the Islamabad Capital Territory (ICT) Zoning Regulations, 1992 were introduced. These regulations divided Islamabad into five distinct zones and permitted private developers to acquire land and establish residential schemes within Zone II and Zone V. All such developments were required

- *2011: Environmental approval granted through an IEE for 3,861 kanals (NoC attached as Annexure-A);*
- *2021: Environmental approval granted through an EIA for 18,660 kanals. (NoC attached as Annexure-A);*
- *2025 Update: Proposal further expanded, and environmental approval for a total area of 2,214 kanals has been formally submitted.*

to adhere to prescribed planning standards, ensuring consistency with the sector layout and urban design principles of Zone IV.

1.3. NAME OF PROJECT

The name of the Project under this study is “Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad”.

1.4. AIMS & OBJECTIVES OF ENVIRONMENTAL IMPACT ASSESSMENT

This report serves two purposes. Firstly, it provides necessary information to the Pakistan Environmental Protection Agency to determine whether the project poses any environmental threat. Secondly, it shall serve as a ready-reckoner for the proponents to manage the project during construction and operation in an environment-friendly manner and abide especially by recommendations of the Environmental Management Plan and the Environmental Monitoring Programme.

The main **aims and objectives** of this Environmental study are to identify baseline environmental, physical and socio-economic conditions pertaining to the project, examine project alternatives, and discuss potential impact, along with formulation of suitable mitigation measures for environment-friendly implementation of the project. These are summarised as follows:

- ✓ Identification and assessment of all environmental impacts or social sensitivity, whether major or minor, caused during the operational stage in order to formulate an effective Environmental Management Plan;
- ✓ Suggest measures required to mitigate any possible adverse environmental impact through minimisation, elimination, reversal or compensation of such impact;
- ✓ Pinpoint and assess all possible impacts of project operation on the natural, physical, biological and socio-economic environment of the project area and evaluate these both qualitatively and quantitatively, wherever possible, and determine their significance in light of technical and regulatory concerns, as well as those relating to public perceptions, and
- ✓ Prepare an Environmental Impact Assessment report presenting recommendations for effective implementation of the project in a manner that it does not compromise the environment existing at the project site or pose any environmental threat in the immediate foreseeable future.

In order to ascertain possible environmental impacts posed by the project, the study has been divided into the following sub-tasks:

- ✓ Identification of various legal and statuary requirements as set forth by the Pakistan Environmental Protection Act, 1997, and guidelines for preparation and review of environmental studies;
- ✓ Collection and scrutiny of data related to physical, ecological and socio-economic aspects of the project site and surrounding areas;
- ✓ Identification and evaluation of salient environmental impacts;
- ✓ Identification of mitigation measures required to minimise negative externalities of the project, and
- ✓ Preparation of an Environmental Management Plan and an Environmental Monitoring Programme.

1.5. SCOPE OF EIA

Laws, rules, regulations and guidelines that were considered while formulating this report include:

- ✓ Pakistan Environmental Protection Act, 1997
- ✓ Guidelines for preparation and review of environmental reports;
- ✓ Guidelines for public participation;
- ✓ Guidelines for sensitive and critical areas;
- ✓ Sectoral guidelines for construction and urban development projects;

- ✓ Sectoral guidelines for housing estates and new town Development;
- ✓ Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Initial Environmental Examination Regulations, 2000;
- ✓ Policy and procedures for the filing, review and approval of environmental studies by the concerned Environmental Protection Agency of the federal or provincial governments, and
- ✓ Rules and regulations of the Capital Development Authority, Islamabad, relating to development of housing projects.

This study evaluates environmental, social, physical and other aspects of the project, both during construction and operation, and identifies measures necessary to mitigate any environmental impact on any segment of local and surrounding environment. It also provides information to assist the concerned government agency to reach a decision to issue the Environmental Approval applied for by the proponent. The study has specifically followed, to the extent possible "Guidelines for the Preparation and Review of Environmental Report" circulated in November 1997, and related instructions covering environmental reports.

1.6. EIA METHODOLOGY

Key steps followed while conducting the study were screening, scoping, data collection and compilation, environmental screening and impact assessment, documentation and consultation. Environmental samples were collected by laboratory technicians and analysed at a certified laboratory. Screening comprised compilation and review of information on the project. Most of this information was obtained from the proponents and added to data on relevant legislation, regulations, guidelines and standards. Scoping involved a review of collected information and identification of potential environmental issues. Data collection and compilation was necessary to develop an environmental baseline of the project area. Review of secondary sources as well as primary and field data was also carried out. Environmental screening and impact assessment process of this study determined potential impacts of the project through examination and testing of environmental, socio-economic, and project information.

Subsequently, potential impacts were characterised in order to analyse significance. Mitigation measures were identified where required to minimise environmental impacts. A management framework was also developed in the form of an Environmental Management Plan for implementation of identified mitigation measures.

Consultation with the proponents and other stakeholders, such as local residents and persons that might be affected by the project was carried out at the same time

essentially to establish public concerns about the project and pinpoint any aspect that may have been overlooked during preparatory work.

Documentation was the last step of the study, which comprised collation of data and preparation of the report along with requisite appendices in proof of the study and its findings. Accordingly, this report includes a brief description of the project, an overview of environmental legislation relevant to the project, a description of baseline environmental and socio-economic conditions in the project area, and potential project impacts and mitigation measures. Findings from visits to a number of housing estates of similar nature were examined to observe environmental concerns associated with operation of such projects in order to assess what adverse environmental impacts can be anticipated at Gulberg Greens and to evolve tested mitigation measures.

The environmental consultants also remain in touch with all government agencies involved in regulation of projects of such nature. These include authorities responsible for traffic regulation, civil defence, water and sanitation, forestry, environment, traffic engineering and planning, housing and drainage in the Islamabad Capital Territory administration and the Capital Development Authority.

1.7. PROJECT JUSTIFICATION

Pakistan's housing sector is under acute stress due to rapid population growth, accelerated urbanisation, and a widening gap between housing demand and supply, particularly in major urban centres such as Islamabad and Rawalpindi. With an annual housing shortfall of approximately 270,000 units and nearly half of the urban population residing in informal or substandard settlements, the absence of planned and affordable housing has led to environmental degradation, encroachment on state and private land, and excessive pressure on existing civic infrastructure. The situation is further aggravated by rising land prices, aging housing stock, limited access to affordable housing finance, and declining public-sector investment in housing development. In the Rawalpindi–Islamabad region, Islamabad's status as the national capital and its superior urban services have intensified in-migration, resulting in unregulated expansion, congestion, and increased strain on natural and municipal resources.

The proposed housing project is justified as a planned intervention to address these challenges through the provision of regulated, serviced, and environmentally compliant residential development. By ensuring access to essential infrastructure such as water supply, sewerage, drainage, energy, and road networks, the project will help reduce pressure on informal settlements, improve living standards, and promote sustainable

urban growth. The project is expected to generate significant economic benefits through employment creation, stimulation of allied industries, and increased public revenues from land sales and municipal services, while also enabling recovery of development costs and strengthening institutional capacity for urban management. Conducting an Environmental Impact Assessment is therefore essential to ensure that development proceeds in accordance with environmental regulations, integrates sustainable planning principles, mitigates adverse environmental impacts, and contributes positively to the long-term socio-economic and environmental sustainability of the Islamabad region.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1. GENERAL

This Chapter provides an overview of the policy framework and national legislation for environmental and social assessment guidelines that apply to the proposed project for controlling the environmental consequences. The Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad is expected to comply with all national legislation relating to the environment and obtain all the required regulatory clearances.

2.2. NATIONAL POLICY AND ADMINISTRATIVE FRAMEWORK

The Pakistan National Conservation Strategy (NCS), which was approved by the federal cabinet in March 1992, is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992).

The GoP promulgated PEPA in 1997. Two organizations, the Pakistan Environmental Protection Council (PEPC) and the Pakistan Environmental Protection Agency (Pak-EPA), are primarily responsible for administering the provisions of the Act. The PEPC oversees the functioning of the Pak-EPA. Its members include representatives of the government, industry, non-governmental organizations, and the private sector.

The Pak-EPA is required to ensure compliance with the National Environmental Quality Standards (NEQS) and establish monitoring and evaluation systems. As the primary implementing agency in the hierarchy, it is responsible for identifying the need for, as well as initiating legislation whenever necessary. The Pak-EPA is also authorized to delegate powers to its provincial counterparts, the provincial Environmental Protection Agencies/Department (EPAs or EPD). One of the functions delegated by the Pak-EPA to provincial EPAs/EPD is the review and approval of environmental assessment reports of projects undertaken in their respective jurisdictions.

2.3. POLICIES AND LEGISLATION RELATED TO ISLAMABAD

This section provides an overview of the policy framework, national legislation and other guidelines regarding environment. The study is organized in light of laws, regulations and guidelines most relevant to scope of the project so that it becomes

compliant with national legislation relating to the environment and CDA development laws.

2.3.1. ICT DEVELOPMENT LAWS AND REGULATIONS

The Capital Development Authority (CDA) has the responsibility for the overall planning, provision and supervision of public health services, covering adequate sanitation and garbage disposal within the territorial limits of the Islamabad Capital Territory (ICT). It also has the responsibility for the coordination of public health services with other relevant agencies. This includes collection, transportation and safe disposal of liquid and solid waste collected from residential areas, commercial areas, open spaces etc.

The CDA operations are governed generally by the provisions of the Islamabad Capital Territory Municipal Bye Laws, 1968 as amended from time to time; and specifically by the Islamabad Regulations 1979 (Upkeep of Cleanliness) as amended from time to time.

2.3.2. ISLAMABAD CAPITAL TERRITORY (ZONING) REGULATION, 2005

For administration and land use characterization, through this regulation the Islamabad Capital territory has been delineated into following five zones;

Zone-1

This zone constitutes sectors up to the existing alignment of the G.T. road from the point of intersection of G.T. road with Shah rah-e-Kashmir to the point of the Nicolson Monument inclusive of sector H-14, H-15, H-16, H-17, I-14, I-15, I-16, I- 17.

Zone -2

The zone consists of an area bounded by G.T. road in the north &north east, north of Shah rah-e-Kashmir and Capital limits in the west, comprising residential sectors G-15 (part), G-16, G-17, F-15 (part), F-16, F-17, E-15 (part), E-16, E-17, D-16, D-17, C-17, AND B-17.

Zone-3

Margalla Hills National Park as notified under section 21 of the Islamabad Wildlife (Protection, Preservation, Conservation& Management) Ordinance 1979, Other protected ranges, forest areas and un- acquired land falling between the Margallah Hills & north of Murree Road shall constitute this zone.

Zone-4

This zone comprises Islamabad Park and rural periphery wedged between Murree road towards north and Lehtrar road towards south and extending beyond Simly road up to the ICT limits in the north east. This zone excludes the part of Margalla Hills National Park and Rawal Lake.

Zone-5

This zone comprises areas falling south of Islamabad Park and extending up to outer limits of ICT towards south, south west and south east.

2.4. ENVIRONMENTAL LAWS AND REGULATIONS

The enactment of environmental legislation covering multiple areas of concern is a relatively newly initiated process in Pakistan. Whereas, a basic policy and legislative framework for the protection of the environment and biodiversity in the country is now in place, detailed rules, regulations and guidelines required for the implementation of the policies and enforcement of legislation are mostly formulated. The following sections present a brief overview of the existing national policies, legislation and guidelines as well as a few international conventions to which Pakistan is a signatory.

2.4.1. PAKISTAN ENVIRONMENTAL PROTECTION ACT 1997

The Pakistan Environmental Protection Act, 1997 (PEPA) is the fundamental legislation empowering the government to formulate regulations for protecting the environment. It is broadly applicable to air, water, soil, marine and noise pollution, as well as to the handling of hazardous waste. Penalties have been prescribed for those contravening the provisions of the Act. The powers of the federal and provincial Environmental Protection Agencies (EPAs) have also been considerably enhanced under this legislation. In addition, the EPAs have been empowered to conduct inquiries into possible breaches of environmental law either upon the registration of a complaint or on their own accord. Under section 12 of PEPA (1997), no project involving construction activities or any change in the physical environment can be undertaken unless an Environmental Impact Assessment (EIA) or EIA, as required, is conducted and a report submitted to the federal or provincial EPA.

2.4.2. NATIONAL ENVIRONMENTAL ACTION PLAN (NEAP-SP)

The Government of Pakistan (GoP) and United Nations Development Program (UNDP) have jointly initiated an umbrella support program called the National

Environmental Action Plan - Support Program (NEAP-SP) signed in October 2001 and implemented in 2002. The development objective supported by NEAP-SP is environmental sustainability and poverty reduction in the context of economic growth.

2.4.3. NATIONAL ENVIRONMENTAL POLICY, 2005

The National Environmental Policy (NEP) was approved by the Pakistan Environmental Protection Council (PEPC) in its 10th meeting on 27th December 2004 under the chairmanship of the Prime Minister of Pakistan. Thereafter, it was approved by the Federal Cabinet on 29th June 2005. NEP is the primary policy document of Government of Pakistan that addresses Pakistan's environmental issues. The broad goal of NEP is, "To protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development". The NEP also provides the sectoral and cross-sectoral guidelines, listed in following paragraphs, for various sectors to achieve its goal of sustainable development:

Sectoral Guidelines - are available in the following areas:

Water Supply and Management; Air Quality and Noise; Waste Management; Forestry, Biodiversity and Protected Areas; Climate Change and Ozone Depletion; Energy Efficiency and Renewable Energy Resources; Agriculture and Livestock; and Multilateral Environmental Agreements.

Cross- Sectoral Guidelines

All environment related policies, programs and projects would be gender sensitive, integrate Poverty, Population and Health. Incorporate effective environmental management in Trade, Local Governance and Natural Disaster Management.

In addition to these sectoral and cross-sectoral guidelines, the NEP 2005 also suggests the following policy instruments to overcome the environmental problems throughout the country;

- Integration of environment into development planning
- Legislation and regulatory framework
- Capacity building of various institutions
- Economic and market based instruments
- Public awareness and education

- Public-private-civil society partnership

While NEP 2005 is a policy document and does not regulate individual projects, however, adopting policy guidelines ensure that the project does not add to the environmental problems identified in NEP. Moreover, adopted mitigation measures will minimize or avoid any contribution to the already existing environmental problems in the project area.

2.4.4. ISLAMABAD ENVIRONMENTAL IMPROVEMENT ACT, 1995

Islamabad Environmental Improvement (Green Areas) Act, 1995 was proposed to (1) prevent the existing green area in the Islamabad Capital Territory from being used for purposes other than those for which they are reserved and (2) ensure that at least 20 % of the total area of any new scheme is reserved for the development of green areas. For the purpose of this Act, “green areas” means land in the Islamabad Master Plan, or other schemes, reserved exclusively for parks, playgrounds, forests, nurseries, vegetative cover, green belts and open spaces on which no construction is planned.

2.4.5. ISLAMABAD WILDLIFE ORDINANCE, 1979

The Islamabad Wildlife (Protection, Preservation, Conservation and Management) Ordinance 1979 provides the protection, preservation, conservation and management of wildlife in Islamabad Capital Territory. Main aim of this act is the preservation and conservation of wildlife, flora and fauna for sustainable development to comply with the concept of national parks internationally.

2.5. ASSOCIATED LAWS AND REGULATIONS

This section outlines the statutes apart from Pakistan Environmental Protection Act, 1997, which are relevant to the project.

2.5.1. LAND ACQUISITION AND RESETTLEMENT REGULATIONS

At present, the only legislation relating to land acquisition and compensation is the Land Acquisition Act (LAA) of 1894. The LAA is, however, limited to a cash compensation policy for the acquisition of land and built-up property, and damage to other assets, such as crops, trees, and infrastructure. The LAA does not consider the rehabilitation and resettlement of disrupted populations and the restoration of their livelihoods.

Experience with large-scale infrastructure development projects implementation has demonstrated the need for a cohesive national policy for resettlement due to reasons that the LAA does not consider the rehabilitation and resettlement of disrupted populations and the restoration of livelihoods and also does not provide any assistance to non-title holders and vulnerable groups. Following a national consultative process, a Draft National Resettlement Policy was prepared in 2002. Details of this policy are not under consideration as this policy is still in draft form. The Project may involve acquisition of private as well as government land. The land will be acquired under the LAA 1894.

2.5.2. FACTORIES ACT, 1934

The clauses of this Act relevant to the project are those that concern the health, safety and welfare of workers, disposal of solid waste and effluent, and damage to private and public property. The Factories Act also provides regulations for handling and disposing of toxic and hazardous materials. Given that construction activity is classified as 'industry' these regulations will be applicable to the project contractors.

2.5.3. PAKISTAN PENAL CODE (1860)

The Pakistan Penal Code (1860) addresses many offences that are liable to enforce levies, fines, imprisonment or both. The fouling of public springs or reservoirs that makes them less fit for ordinary use is also addressed as offensive. The current project is also to reduce violation of this code in case of surface water bodies.

2.5.4. THE BIODIVERSITY ACTION PLAN

Pakistan, being a signatory to the Convention on Biological Diversity (Rio, June 1992), is obligated to develop a national strategy for the conservation of biodiversity. The Government of Pakistan has constituted a Biodiversity Working Group under the auspices of the Ministry of Environment, Local Government and Rural Development to develop a Biodiversity Action Plan (BAP) for the country. The project to protect water resources of Islamabad is quite supportive to conserve biodiversity in the downstream areas.

2.6. NATIONAL ENVIRONMENTAL QUALITY STANDARDS (NEQS)

The NEQS promulgated under the PEPA 1997 specify standards for industrial and municipal effluents, gaseous emissions, vehicular emissions, and noise levels. The

PEPA 1997 empowers the Provincial EPAs to impose pollution charge in case of non-compliance to the NEQS.

2.7. REGULATIONS FOR ENVIRONMENTAL ASSESSMENT

Under Section 12 (and subsequent amendment) of the 1997 Act, a project falling under any category specified in Schedule II require the proponent to file an EIA with the federal agency. Within ten working days of the IEE or EIA having been deposited, the federal agency will confirm that the document submitted is complete for the purpose of review. During this time, should the federal agency require the proponent to submit any additional information, it will return the IEE or EIA to the proponent for revision, clearly listing those aspects that need further discussion. Subsequently, the federal agency shall make every effort to complete an IEE review within 45 days and an EIA review within 90 days of filing.

2.7.1. PREPARING & REVIEW OF ENVIRONMENTAL REPORTS

The Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997 specify:

- The nature of the information to be included in environmental reports
- The minimum qualifications of the EIA/IEE conductors appointed.
- The need to incorporate suitable mitigation measures at every stage of project implementation.
- The need to specify monitoring procedures.
- The terms of reference for the reports are to be prepared by the project proponents themselves. The report must contain baseline data on the project area, detailed assessment thereof, and mitigation measures.

2.8. RELATED INTERNATIONAL CONVENTIONS, TREATIES & GUIDELINES

This section outlines the international conventions, treaties and guidelines regarding Environmental Protection, which are relevant to the project. Pakistan, being a signatory to these international treaties and conventions on the conservation of the environment and wildlife protection, is obliged to adhere to the commitments specified in these treaties. The relevant international treaties and conventions and the provisions therein have been described in the following paragraphs.

2.9. IUCN RED LIST (2000)

The red list is published by International Union for Conservation of Nature (IUCN) and includes those species that are under potential threat of extinction. These species have been categorized as:

- **Endangered**: species that are considered to be facing a very high risk of extinction in the wild in near future, reduction of 50% or more either in the last 10 years or over last three generations, survive only in small numbers, or have very small populations.
- **Vulnerable in Decline**: species that are considered to be facing a risk of extinction in the wild, having an apparent reductions of 20% or more in the last 10 years or three generations.
- **Vulnerable**: species that are seen to be facing a high risk of extinction in the wild, but not necessarily experiencing recent reductions in population size.
- **Lower Risk**: species that are seen to be facing a risk of extinction that is lesser in extent than that for any of the above categories.
- **Data Deficient**: species that may be at risk of extinction in the wild but at present there is insufficient information available to make a firm decision about its status.

2.10. CONVENTION ON BIOLOGICAL DIVERSITY

The Convention on Biological Diversity was adopted during the Earth Summit of 1992 at Rio de Janeiro. The Convention requires parties to develop national plans for the conservation and sustainable use of biodiversity, and to integrate these plans into national development programs and policies. Parties are also required to identify components of biodiversity that are important for conservation, and to develop systems to monitor the use of such components with a view to promoting their sustainable use.

2.11. CONVENTION ON CONSERVATION OF MIGRATORY SPECIES

The Convention on the Conservation of Migratory Species of Wild Animals (CMS), 1979, requires countries to take action to avoid endangering migratory species. The term 'Migratory Species' refers to the species of wild animals, a significant

proportion of whose members, cyclically and predictably, cross one or more national jurisdictional boundaries. The parties are also required to promote or co-operate with other countries in matters of research on migratory species.

3. DESCRIPTION OF PROJECT

3.1. GENERAL

This Chapter provides an overview of the project including main components, infrastructure and other related developmental activities to be carried out in the project area.

The Master Planning, detailed designing of infrastructure and buildings in the Zone – IV have been designed in compliance. Master Planning in conformity with the "Modalities and Procedures framed under ICT (Zone) Regulations 1992" issued by Capital Development Authority (CDA). *See Annexure-B*

3.2. PROJECT DESCRIPTION

Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad is redefining the future of affordable stylish living. A lifestyle that exceeds imagination, where there's nothing short of harmony and inspiration. Living in Islamabad within a friendly ambiance and experiencing a comfortable lifestyle is a dream which Gulberg Greens is making a reality. With ready for construction plots already available at affordable rates, within the heart of Islamabad, Gulberg Greens is poised to become a monumental success.

- *2011: Environmental approval granted through an IEE for 3,861 kanals (NoC attached as Annexure-A);*
- *2021: Environmental approval granted through an EIA for 18,660 kanals. (NoC attached as Annexure-A);*
- *2025 Update: Proposal further expanded, and environmental approval for a total area of 2,241 kanals has been formally submitted.*

The population within the scheme area shall be served with the facilities of shopping areas, school, hospital, mosques, marriage hall, community club and parks / playlots.

The sewerage treatment plant has been planned at the lower level and after the treatment; the effluent shall be made to flow in the nearby nallah. The grave yard has also been planned and is also accessible by 40ft roads. In short effort has been made through circulation plan to achieve convenient and smooth flow of traffic with less risk of accidents. The roads shall be landscaped with ornaments type of trees and shrubs

for healthy cool environment and for good aesthetic view along the roads. Majority of plots have been given well climately suited orientation i.e. north-south direction.

3.3. PROJECT COMPONENTS AND ACTIVITES

Key components and activities of the project are shown in the matrix overleaf and described in detail in the ensuing paragraphs. These range from project conception to project operation.

Table 3-1: Project Components

Project Components:	Salient Feature(s):	Purpose(s):
Land acquisition	Land measuring 2,241 *kanals* is available with the proponents	To develop residential spaces for city residents at an affordable price
Surveying and site Investigations	Included topographical survey, soil investigations, environmental testing etc., which are non-intrusive in nature	To obtain necessary information for detailed design of the project
Designing various components of the project	Included preparation of plans, maps, layout, specification, engineering details and tender documents, and conduct of an environmental study	To provide design and engineering details of the project
Selection of Contractor	Includes transportation of equipment, setting up of site office, construction camp, and assembly of project implementation team	To carry out construction at the site
Site preparation	Includes removal of wild vegetation and land levelling	To facilitate construction activities
Laying of services	Includes water supply system, drainage, electricity, sewerage, storm water disposal etc.	To provide necessary services at the estate
Construction of the housing estate	Includes roads and streets and major buildings, plantations, and landscaping of open areas	To provide necessary services for future residents
Operation of the estate	Includes regular maintenance by the proponents	To provide quality living for residents

3.4. LOCATION OF THE SITE

Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad falls in Moza's Koral, Paigh, Chapar Mer Khanal, Gora Sardar, Bora Bangial and Darwala etc in Zone IV, Islamabad. The scheme has its spacious sprawl over a parcel of land measuring altogether about 18,660 kanal. The development work of scheme will start after necessary approvals from CDA. The scheme is located at distance of ½ Kilometer from Airport Chowk on Islamabad Expressway.

The scheme is surrounded on the eastern side by agricultural land of Moza Kirpa, on the southern side by Korang River, on the Western side by Islamabad Highway and on the Northern side by agricultural land of Moza Chapar Mer Khanal and Khadir Pur.

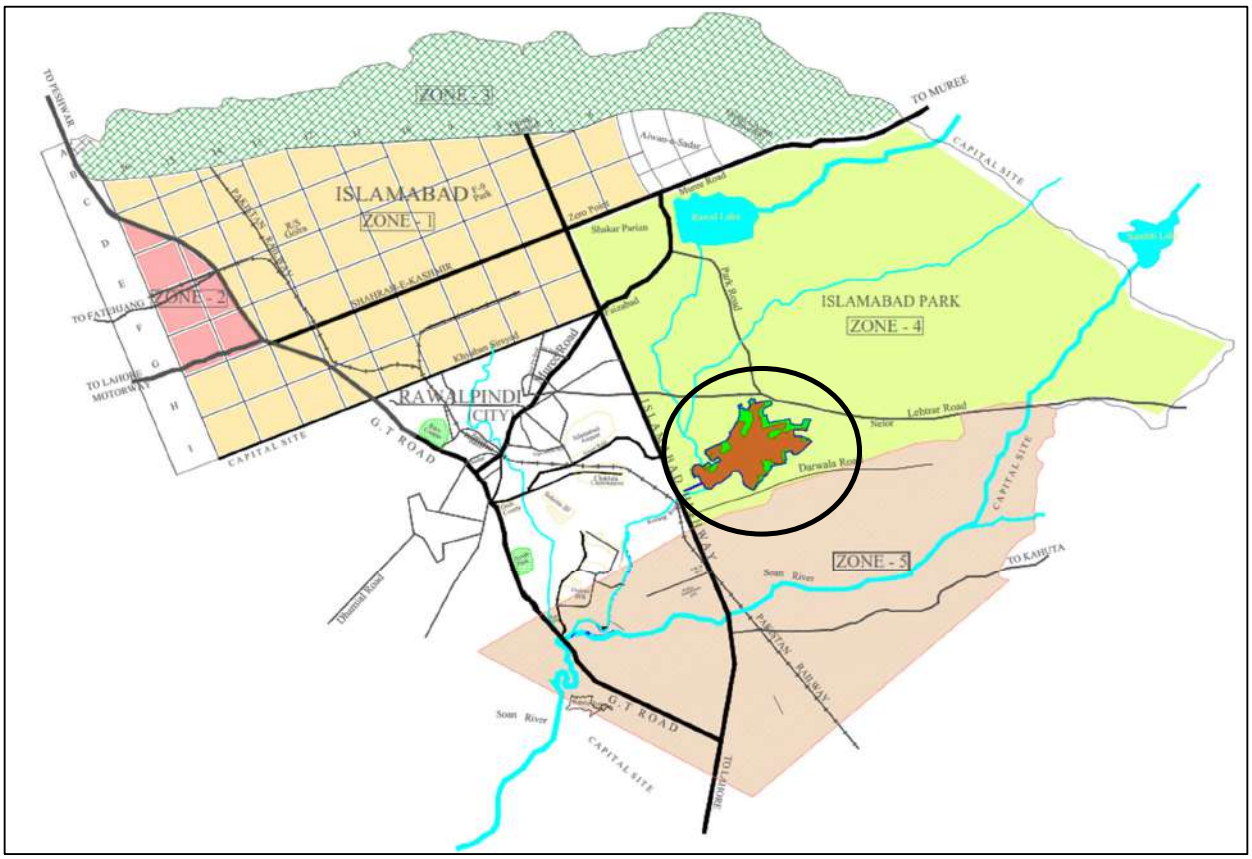

FIGURE 3-1: LOCATION OF GULBERG GREENS

FIGURE 3-2: GOOGLE IMAGERY OF LOCATION OF REVISED & EXTENDED LAYOUT PLAN OF GULBERG GREEN, FARM HOUSING SCHEME, ZONE IV, ISLAMABAD

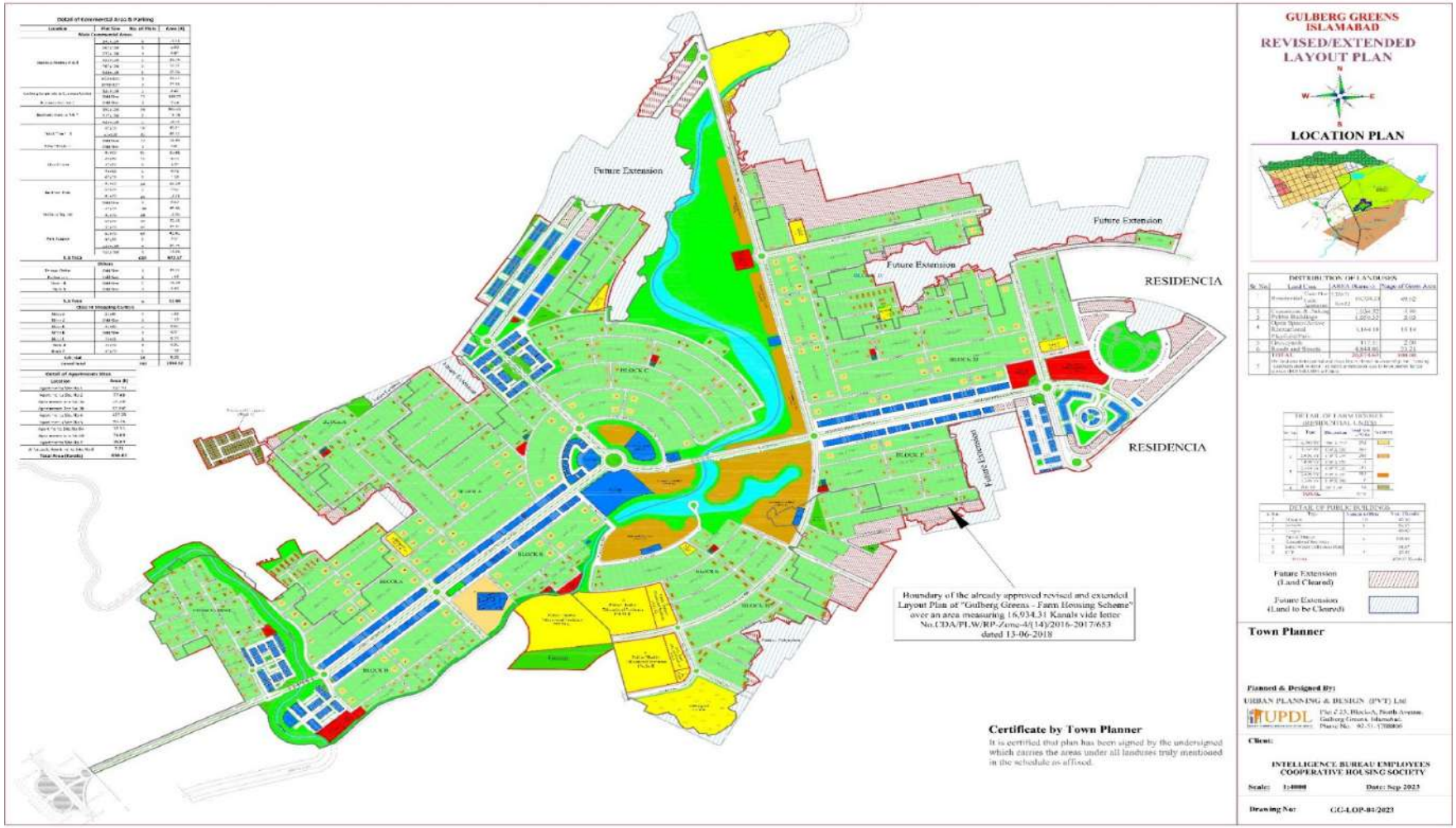

FIGURE 3-3: LAYOUT PLAN OF REVISED & EXTENDED LAYOUT PLAN OF GULBERG GREEN, FARM HOUSING SCHEME, ZONE IV, ISLAMABAD

3.4.1. LAND USE PLAN

The land use plan evolves the general functional arrangement in terms of types of activities linkages and densities. The activities are grouped to perform functions in relation to each other. The area is designed with various type of facilities and amenities. Proper linkages within the area and other units of scheme are also ensured so that whole scheme acts as one body rather than segregated units. Planning principles of health, beauty and conveyance are given priority in every step of planning and designing of scheme.

The physical plan ensures equal distribution of land uses for various activities in the area required for balance physical growth and embraces the land use standards set forth in the zoning regulation of CDA as detailed below:-

Table 3-2 land use standards set forth in the zoning regulation of CDA

S. NO	*DESCRIPTION*	*AREA IN KANAL*	*% AGE*
1	FARM HOUSE (RESIDENTIAL)	10,359.33	*49.62*
2	ROADS	4,844.86	*23.21*
3	COMMERCIAL & PARKING	1,034.52	*4.96*
4	PUBLIC BUILDING	1,050.33	*5.03*
5	ACTIVE RECREATIONAL PLAYFIELDS / PARK	3,168.18	*15.18*
6	GRAVEYARD	417.41	*2.00*
	TOTAL	*C*	*100*

3.5. SCHEDULE OF RESIDENTIAL PLOTS

3.5.1. RESIDENTIAL PLOTS

The **Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad** comprises a series of well-planned and superior neighborhoods designed to accommodate approximately 1,746 residential plots of varying sizes. The

residential layout has been planned to promote a high quality of living through close proximity to essential amenities, including schools, mosques, commercial areas, parks, and community centers, making the development particularly suitable for family-oriented living.

The scheme emphasizes low-density planning, preserved green spaces, and diverse recreational areas, complemented by an organized road network and supporting infrastructure. The availability of varied plot sizes allows flexibility in housing design while maintaining overall harmony and aesthetic coherence within the residential neighborhoods. These planning features collectively enhance livability, environmental quality, and long-term sustainability of the housing scheme.

The typology and quantitative distribution of residential plots within the project area are presented in **Table 3.3**, reflecting the range of plot categories and their respective dimensions, as detailed below:

Table 3-3: Plots Distribution

Sr. No	*Category*	*Dimension*	*Total Units*
1.	6000 SY	200’ X 270’	292
2.	3055 SY	110’ X 250’	465
3.	3006 SY	110’ X 246’	308
4.	3000 SY	100’ X 270’	8
5.	2444 SY	100’ X 220’	191
6.	2395 SY	110’ X 196’	6
7.	500 SY	50’ X 90’	93
		TOTAL	**1746**

3.6. RETAIL FACILITIES AND COMMERCIAL CENTERS

Since the project is in isolation and no properly planned retail facility exists in it suburbs therefore a commercial hub is inevitable for the long terms sustainability of the project along with the convenience of its residents. Keeping in view the retail psychology and needs of the residents bulk commercial sites are provided within the site.

When it comes to the form of commercial areas, topography of the project leads to linear form of commercial along with Main Boulevards. However, wherever commercial activity is provided it is supported with its independent circulation and parking leaving minimum impact on Main Boulevards. Every plot owner will have liberty to design the

internal spaces within prevailing bye laws; however the outer façade of the buildings will be strictly controlled in order to provide a harmony in the proposed development.

3.7. PUBLIC FACILITIES AND AMENITIES

The development is designed with good public amenities and facilities to ensure convenience for all residents. Mosque are disturbed throughout the site with sample space parking space. A school of international standard primary will cater the student population of the development. The sites for community centers and public amenities have been provided.

Table 3-4: Details of Public Building

Sr. No	*Type*	*Number of Plots*	*Area (Kanals)*
1.	Mosque	10	42.36
2.	School/College	5	89.57
3.	Public/Health/Educational Institutions	9	838.08
4.	SWCP	01	14.47
5.	STP	02	25.85
6.	Hospital/Dispensary	01	40.00
		Total	**1050.33**

3.8. EXTERNAL DEVELOPMENT WORK

The proposed project will involve a range of **external development works** aimed at providing essential infrastructure and ensuring orderly, sustainable development of the housing scheme. A comprehensive **sanitary sewerage network** will be developed to collect wastewater from residential, commercial, and public facilities and convey it efficiently to designated treatment facilities. The sewerage system will be designed in accordance with CDA standards to ensure safe and hygienic disposal of wastewater.

A **centralized Sewage Treatment Plant (STP)** will be constructed as part of the external development works to treat collected sewage to acceptable environmental standards prior to disposal or reuse. The treated effluent will comply with applicable National Environmental Quality Standards (NEQS), thereby minimizing potential impacts on surface and groundwater resources and contributing to improved environmental quality in the surrounding area.

To manage surface runoff and prevent localized flooding, a well-planned storm water drainage network will be established. The drainage system will be designed in harmony with the natural topography and existing drainage patterns to ensure efficient conveyance of rainwater and reduce risks of erosion and waterlogging, particularly during the monsoon season.

The project will also include soft and hard landscaping works, comprising the development of green belts, parks, roadside plantations, paved walkways, and other open spaces. These landscaping interventions will enhance the aesthetic appeal of the scheme, improve the micro-climate, reduce dust and noise levels, and contribute to overall environmental sustainability.

In addition, a boundary wall will be constructed around the project area to define the project limits, enhance security, and regulate controlled access to the housing scheme. The boundary wall will be designed to integrate with the surrounding landscape and comply with applicable planning regulations.

Provision of an electric transmission line will form an integral part of the external development works to ensure a reliable power supply to the scheme. The electrical infrastructure will be designed and installed in coordination with the relevant utility authorities and in compliance with safety and environmental standards to minimize visual and environmental impacts.

3.9. UTILITIES

The proposed Farm housing scheme will be supported by a comprehensive set of utility services designed to meet the needs of future residents in an efficient and environmentally responsible manner. A water supply network will be developed to ensure reliable provision of potable water for domestic, commercial, and public uses. The system will be designed in accordance with CDA standards and will incorporate appropriate storage, distribution, and pressure management arrangements.

External electrification for the project will be provided through an underground distribution system, which will enhance public safety, improve visual aesthetics, and reduce environmental and maintenance-related impacts associated with overhead power lines. The underground electrification system will be installed in coordination with the relevant power utility authorities and will comply with applicable technical and safety regulations.

The project will also be provided with natural gas supply through the Sui Northern Gas Pipelines Limited (SNGPL) network. The gas distribution system will be designed and

implemented by the concerned utility agency in accordance with its technical standards, ensuring safe, efficient, and uninterrupted gas supply to the residential and commercial units within the scheme.

3.9.1. ROADS AND CIRCULATION

The concept of road hierarchy is indicated in the physical plan.

3.9.1.1. MAIN ACCESS ROAD

The Major Roads having dual carriageway with ROW 100, 80 and 70 Ft. are traffic collectors and are linked with Secondary roads at convenient location. The dual carriage way of 100 ft wide road provides main linkage of scheme with Islamabad Expressway. To maintain free impeded flow of traffic maximum considerations for less number of junctions has been maintained during planning and designing.

3.9.1.2. INTERNAL ROADS & CUL DE SAC

The purpose of these roads is to provide access to the individual property/ premises. Thus to fulfill this purpose 50 feet wide access roads are provided with Cul-de-sacs at suitable locations. Cul-de-sacs not only stop through traffic but are also preferred from security point of view. The circulation plan evolves the general functional arrangements in terms of activities linkages and densities. Activities are grouped to perform functions in relation to each other. In the physical plan cross road junction are avoided to the utmost level. T type road junctions are flourished for convenient and smooth flow of traffic with less risk of accidents. Many road junctions are staggered to T-junction to minimize the road accidents during turning behavior of vehicles playing on street/ roads. During the planning and designing of circulation system in the layout plan turbine pattern are preferred to facilitate movement between different uses in line with land shape. The road shall be landscaped with ornament type of trees and shrubs for better environment and enhanced view along the roads.

Table 3-5 Description of Roads in Project Area

S. NO	*TYPE OF ROAD*	*R.O.W (FEET)*
1	**MAIN ACCESS ROADS**	*100'* *80'* *70'*
2	*INTERNAL ROADS*	*50'*

FIGURE 3-4: REVISED & EXTENDED LAYOUT PLAN OF GULBERG GREEN, FARM HOUSING SCHEME, ZONE IV, ISLAMABAD

3.10. POPULATION DENSITY

Density plays a vital role in allocation of various land uses and provision of different amenities and infrastructure. Using a figure of 6 persons per household and applying it to Gulberg Greens, the result yields that the proposed development will be a low density area. The detailed density calculation is as following.

Total Area of Project	3,940.32 Kanals
Total Plot	1774 units
House Hold Size	7 persons per H.H
Population	1,774 x 6 = 10,644 persons

3.11. EXTERNAL ELECTRIFICATION

The distribution system HT shall be 3 phase, 11 KV 50 Hz supply; whereas the secondary LT distribution system shall be 415 volt 3 phase 4 wire or 220 volts 1-phase 50 Hz supply including street light.

Electricity shall be installed by IESCO itself after approving electricity design on the payment by the society. The street lights and the house connection shall be done by the Society itself. The process of approval for the electricity connection is under process with IESCO. *See Annex- C*

3.12. GAS DISTRIBUTION NETWORK

Sui gas installation will be done by Sui Northern Gas pipeline ltd department on payment by M/s IBECHS. The gas network system shall be designed by the department itself on payment of demand note to the department for installation of gas supply network in the scheme area. The main Sui gas pipe line already passes to the eastern part of site. *See Annex- D*

3.13. GEO-TECHNICAL SURVEY REPORT

A comprehensive **geotechnical investigation program** was carried out across the Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad project area to assess subsurface conditions and determine soil characteristics relevant to structural design and infrastructure development. Multiple boreholes and test pits were strategically distributed across residential, commercial, public building, and future extension zones, as illustrated in the Geotechnical

Investigations Plan. The investigation covered key blocks and development sectors to ensure representative coverage of the entire scheme area. Soil testing was conducted to evaluate parameters such as soil stratification, bearing capacity, shear strength, and suitability for foundations and road infrastructure. The results indicate that the subsoil conditions across the project site are generally suitable for the proposed development, subject to adherence to recommended foundation design parameters and construction practices. The findings of the geotechnical investigations have been duly incorporated into the planning and engineering design of buildings, roads, and utilities to ensure structural stability, minimize settlement risks, and support long-term sustainability of the development.

3.14. WATER SUPPLY

The project site is located in the area where ground water potential is available. Resistively survey of the site has been conducted to establish water availability within the project site. According to the findings of the resistively survey, water is available where resistively survey has been conducted.

3.14.1. AVERAGE DAY WATER DEMAND

The total water demand for the proposed Gulberg Green (Revised & Extended) housing scheme has been estimated based on the projected population, land-use categories, and applicable planning standards. The residential component of the scheme, comprising 1,746 farmhouses and residential units, is expected to accommodate an estimated population of 20,952 persons. Based on per capita water consumption criteria, the domestic water demand for farmhouses and residential units has been calculated as approximately 1.26 million gallons per day (MGD).

In addition to residential demand, commercial activities within the scheme are projected to generate a significant water requirement. The total commercial water demand has been estimated at 6.20 MGD, accounting for commercial centers, retail facilities, and associated services planned within the development. These demands are considered independent of residential consumption and reflect peak operational requirements.

Provision has also been made for firefighting and emergency water requirements, calculated as 5 percent of the total operational water demand, amounting to 0.62 MGD. This allocation ensures adequate water availability for fire safety and emergency response in accordance with CDA and public safety standards.

Based on the cumulative assessment of residential, commercial, and fire demand, the total water requirement for the proposed development has been estimated at approximately 13.76 MGD. This demand will be met through a planned water supply system incorporating groundwater abstraction, storage reservoirs, overhead tanks, and distribution networks, supported by water conservation and efficient management measures to ensure sustainable utilization of available water resources.

Table 3-6 Average Water Demand in The Project Area

Category	Number of Units	Total Population	Water Demand (MGD)
Farmhouses	1746	20952	1.26
Apartments	12	82654	5
Commerical	-	-	6.2
Other Services	-	-	0.725
Fire Demand (5% OF WD)	-	-	0.62
Total Water Demand			**13.76 MGD**

3.15. WATER REQUIREMENT FOR GULBERG GREENS

The proposed water supply system for the Gulberg Green (Revised & Extended) housing scheme incorporates a comprehensive storage and bulk distribution infrastructure designed to ensure reliable water availability, adequate pressure, and operational resilience across the entire project area. The system includes a network of 15 bulk storage reservoirs, which will serve as primary storage facilities to balance supply and demand, provide reserve capacity, and enhance system reliability during peak consumption periods or supply interruptions.

To maintain adequate water pressure and ensure equitable distribution to residential, commercial, and public facilities, the scheme will be supported by 8 overhead tanks strategically located at hydraulically favorable points within the development. These overhead tanks will play a critical role in gravity-based distribution, minimizing energy requirements and ensuring consistent service levels throughout the network.

In addition, 27 underground storage tanks will be constructed to provide localized storage, support firefighting requirements, and supplement daily operational needs. The combined storage infrastructure will comprise a total of 50 storage units, forming an integrated system capable of meeting both routine and emergency water demands.

Bulk water conveyance within the scheme will be facilitated through an extensive network of rising mains with a total length of approximately 34.25 kilometers. These rising mains will transport water from source points and bulk reservoirs to overhead and underground storage facilities, ensuring efficient and controlled distribution throughout the housing scheme. The overall storage and distribution system has been planned in accordance with applicable design standards to support sustainable water management and uninterrupted service delivery.

Table 3-7: Storage & Bulk Distribution

SR. NO.	*DESCRIPTION*	*NUMBERS*
1	BULK STORAGE RESERVOIRS	15
2	OVERHEAD TANKS	8
3	UNDERGROUND TANKS	27
	TOTAL	**50**

FIGURE 3-5: WATER DEMAND FOR GULBERG GREENS

FIGURE 3-6: WATER SUPPLY DISTRIBUTION PLAN FOR GULBERG GREENS

3.16. WATER SUPPLY NETWORK

For the water supply network, the society shall use PVC pipe. These pipes are easy to lay, non-corrosive and long life when compared with G.I. and MS pipe. Sluice valve, double air valve & washout shall be installed at appropriate location in the network system. The loop system shall be designed in shape of network resembling a gridiron connected at interval to avoid dead ends. Water will be supplied from more than one direction for its circulation throughout the system.

3.17. WATER COMSERVATION STRATEGY

The project is currently in the detail design phase and possibilities of ensuring water conservation and rainwater harvesting through efficient design and water management system are being explored. here are a number of strategies that can be employed to reduce the amount of water consumed at a facility. In general terms, these methods include:

- System optimization (i.e., efficient water systems design, leak detection, and repair);
- Water conservation measures; and
- Water reuse/recycling systems.

More specifically, a wide range of technologies and measures can be employed within each of these strategies to save water and associated energy consumption. These include:

- Water-efficient plumbing fixtures (ultra-low-flow toilets and urinals, waterless urinals, low-flow and sensored sinks, low-flow showerheads, and water-efficient dishwashers and washing machines)
- Irrigation and landscaping measures (water-efficient irrigation systems, irrigation control systems, low-flow sprinkler heads, water-efficient scheduling practices, and Xeriscape)
- Water recycling or reuse measures (Gray water and process recycling systems), and
- Methods to reduce water use in HVAC systems.

While not a design specification or technology option, obtaining the participation of building inhabitants in the water conservation program is a key to achieving water use reduction goals, and is often one of the simplest and most cost-effective strategies to employ. One of the first steps in implementing a water conservation program is to train employees on the use of new water-efficient technologies, as well as maintenance staff on O&M procedures; technologies that are not properly used or maintained will not achieve their maximum savings potential. For example, double flushing of ultra-low

flush toilets may result in more water consumption than older, conventional devices. The following bullets summarize some of the activities that can be incorporated into a public information and education program:

- Establish hot line or other reporting mechanisms to report leaks and waste;
- Place signs on new equipment on how to use;
- Initiate a suggestion or incentive program;
- Distribute flyers and pamphlets to increase awareness of the facility's water management plan and educate inhabitants on wise water use practices; and
- Develop a display on water management highlighting the practices in use at the facility (i.e., Xeriscape, ULF toilets, water reuse, etc.) and its resultant savings and benefits and place in a highly visible area of the building.

The human factor is critical to obtaining the desired results from water conserving strategies, and development of an information and education campaign can help your facility in making the human factor work in favor of water conservation initiatives

3.18. HYDROGEOLOGICAL ASSESSMENT AND GROUNDWATER SUSTAINABILITY

The proposed development will generate substantial demand for potable and non-potable water during construction and operation. Groundwater has been identified as one of the potential sources for meeting this demand. Considering the scale of the development, the water-stressed conditions of the Islamabad region and the presence of other residential, agricultural and commercial users within Zone IV, groundwater availability cannot be assessed solely on the basis of borehole occurrence or geophysical resistivity results.

A comprehensive hydrogeological assessment is therefore required to determine:

- the nature and extent of the underlying aquifer system;
- groundwater depth and seasonal fluctuation;
- aquifer transmissivity and storage characteristics;
- groundwater recharge mechanisms and recharge rates;
- existing groundwater abstraction within the project influence area;
- sustainable yield available to the project;
- potential drawdown caused by the proposed abstraction;

- cumulative effects of surrounding developments;
- potential impacts on community wells and agricultural users;
- groundwater-quality constraints; and
- long-term groundwater sustainability under future climate and development conditions.

The hydrogeological assessment shall provide the technical basis for finalizing the number, location, depth, pumping capacity and operating regime of project tube wells.

3.19. EXISTING WATER DEMAND

The current project water-demand calculations indicate that water will be required for residential areas, apartments, commercial activities, public services, firefighting, landscaping and other operational requirements.

The EIA currently estimates the overall project demand at approximately 13.76 MGD. This demand includes residential, apartment, commercial, public-service and firefighting requirements.

Because this represents a substantial abstraction requirement, the stated demand shall be technically reviewed and reconciled before being used for groundwater design. In particular, the following shall be verified:

- total approved project population;
- number and type of residential plots;
- apartment population;
- commercial floor area and occupancy;
- public-building demand;
- landscaping demand;
- distribution losses;
- firefighting reserve;
- seasonal peak factors; and
- water demand after conservation and reuse.

Any inconsistency between the population, plot count and water-demand assumptions shall be corrected before the sustainable groundwater requirement is finalized.

3.20. HYDROGEOLOGICAL STUDY AREA

The hydrogeological study area shall extend beyond the legal project boundary and include the wider groundwater influence area within which drawdown or reduced well yield may occur.

The study area shall cover:

- the complete revised and extended project footprint;
- existing Gulberg Green developed areas;
- surrounding villages and settlements;
- nearby agricultural land;
- adjacent housing schemes;
- existing public and private wells;
- natural drainage channels;
- areas hydraulically connected with the Korang River catchment; and
- locations likely to contribute to groundwater recharge.

The final radius of influence shall be determined through pumping-test data and groundwater modelling rather than by administrative boundaries alone.

3.21. DESK REVIEW AND EXISTING INFORMATION

The hydrogeological assessment shall review all available information relevant to groundwater conditions, including:

- geological and hydrogeological maps;
- topographical maps;
- geotechnical investigation records;
- resistivity survey results;
- borehole completion records;
- existing tube-well logs;
- historical groundwater-level data;
- groundwater-quality records;
- rainfall and climate data;
- land-use and drainage information;
- water-supply studies for adjacent schemes;

- abstraction records from surrounding communities;
- previous environmental approvals; and
- any groundwater-related conditions imposed by CDA, Pak-EPA or another competent authority.

The existing resistivity survey may assist in identifying potential water-bearing zones, but it shall not be treated as a substitute for borehole logging, aquifer testing, recharge analysis or sustainability assessment.

3.22. FIELD HYDROGEOLOGICAL INVESTIGATION

A field investigation shall be undertaken by a qualified hydrogeologist. At minimum, it shall include:

- inventory of existing wells and tube wells;
- measurement of groundwater levels;
- borehole drilling and lithological logging, where required;
- geophysical logging, where appropriate;
- step-drawdown pumping tests;
- constant-rate pumping tests;
- recovery tests;
- groundwater-quality sampling;
- survey of community water-use patterns;
- identification of recharge and discharge areas; and
- establishment of groundwater-monitoring points.

3.23. PROPOSED HYDROGEOLOGICAL INVESTIGATION PROGRAMME

Investigation component	***Minimum requirement***	***Purpose***
Well inventory	All accessible wells within the defined study area	Establish existing abstraction and groundwater use
Static water-level survey	Dry and wet seasons	Determine groundwater elevation and seasonal variation
Borehole logging	All proposed production and monitoring wells	Define aquifer depth, thickness and lithology
Step-drawdown test	Each representative production well	Determine well efficiency and appropriate pumping rate

Constant-rate test	Minimum 24 to 72 hours, subject to aquifer response	Estimate transmissivity and storage properties
Recovery monitoring	Until adequate recovery is observed	Verify aquifer response after pumping
Groundwater-quality testing	Representative wells and community sources	Establish suitability and contamination risks
Community survey	Nearby settlements and agricultural users	Identify dependence on groundwater
Monitoring wells	Up-gradient, within-site and down-gradient locations	Monitor drawdown and groundwater quality

3.24. AQUIFER CHARACTERIZATION

The hydrogeological assessment shall define the aquifer system underlying the project area. The analysis shall include:

- aquifer type, whether confined, semi-confined or unconfined;
- depth to water;
- saturated thickness;
- lithological composition;
- hydraulic conductivity;
- transmissivity;
- storativity or specific yield;
- groundwater flow direction;
- hydraulic gradient;
- relationship between shallow and deeper aquifers;
- groundwater-surface water interaction;
- recharge sources; and
- vulnerability to contamination.

The aquifer characterization shall distinguish between groundwater presence and groundwater availability. A water-bearing formation may contain groundwater but may not be capable of sustaining long-term abstraction at the rate required by the project.

3.25. SEWAGE & SEWERAGE DISPOSAL.

There exists no sanitation sewerage system in the vicinity of the project area. An independent sewerage system shall be planned for this scheme. The volume of

sanitary from an area depends upon its population, the characteristics of the area, water usage and underground water conditions and material of joints etc. Per capita average daily sewage follow at 85% of water supply from residential area has been taken into account.

The scheme shall have its own sanitary sewerage system. The sewerage from houses shall be collected in house connection chambers for flow at adequate gradient in RCC pipes for its final collection at centralized location. The sewerage so collected shall be treated in the STP for disposal of effluent into the Nullah. The treatment of sewer shall be done in accordance with design criteria as per CDA zoning regulation. About 80% of total water supply quantum shall flow into the network system i.e. about 622766 gallons plus 10% infiltration 62277 gallon. The minimum pipe size shall be 9 inches in the system.

The hydraulic statement for determining the RCC pipe dia shall be worked out with the help of Manniny's formulas.

$$V= 1.486/N*R\ 2/3 * S\ 1/2$$

Where

V= Velocity in Ft/ Sec

N= 0.013

R= Area/Perimeter

S= Slope per 1000 ft

3.25.1. SEWAGE COLLECTION SYSTEM

Disposal of sewage from individual plots will be through house connections which be lead into main sewer lines through a series of lateral and sub-main sewer lines connected through manholes as detailed below

- ***House sewer connections***: Each individual plot will be provided with a separate house sewer connection .This will terminate into a manhole. Under no circumstances this sewer will have a smaller diameter than 6 inches. The house sewer connection will be located at the predestinated point near the gate of plot.
- ***Lateral Sewer*** will run across the streets connecting house sewer connection to the MAIN / sub-main sewers running on the other side of the road. They will start and terminate through manhole.
- ***Main/ sub Main Sewers***: these will run on the side of the road collecting sewage from houses connection as well as Laterals conveying sewage from other side of the road in

addition to this they will convey sewage from other sub mains converging onto it. All connections will be made through manholes.

- ***Sewerage Pipes***: All main / sub/ laterals /house connection pipes will be RCC pipes. These pipes will be bell and spigot types, which will be connected with "O" rings. Prior to the backfilling, each section will be plugged and tested fewer than 5ft head of water for minimum of 1 hour.

3.25.2. SEWERAGE NETWORK

The scheme shall have its own sanitary sewerage system. The sewerage from houses shall be collected in house connection chambers for flow at adequate gradient in RCC pipes for its final collection at centralized location. The sewerage so collected shall be treated in the STP for disposal of effluent into the Korang Nullah. The treatment of sewer shall be done in accordance with design criteria as per CDA zoning regulation. About 80% of total water supply quantum shall flow into the network system i.e. about 612,816 gallons plus 10% infiltration 61,282 gallons. The minimum pipe size shall be 9 inches in the system.

FIGURE 3-7: SEWERAGE SYSTEM OF GULBERG GREENS

3.25.3. SEWAGE COLLECTION

The sewage would be collected at one point, the lowest point – at Sewage Treatment Plant. The sewage from the housing project shall be collected at adequate gradient in RCC pipes and then concentrated at S.T plant for primary treatment then disposal to nallah passing nearby.

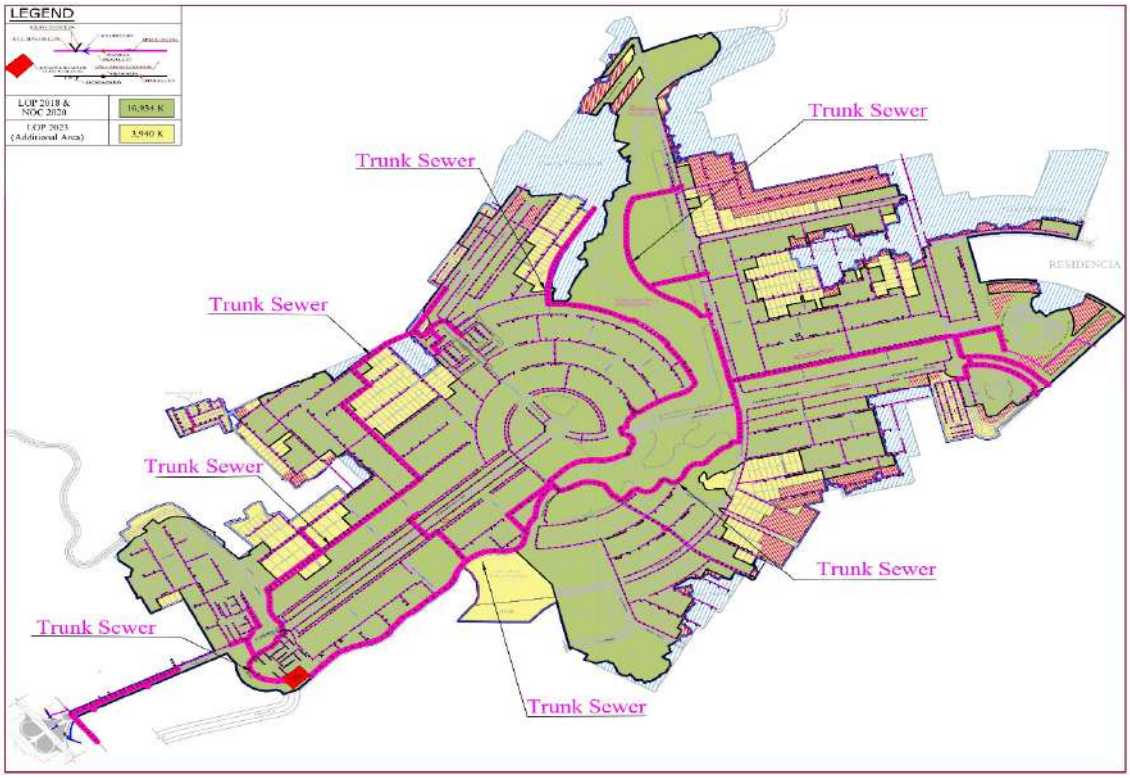

FIGURE 3-8: MAIN SEWER LINES

3.26. SEWAGE TREATMENT PLANT (STP) DESIGN

The proposed Sewage Treatment Plant (STP) for Gulberg Green, Islamabad has been conceptually designed to meet Pakistan Environmental Protection Agency (Pak-EPA) requirements for the safe treatment and disposal of wastewater into a natural drainage channel. The system integrates both anaerobic and aerobic treatment processes to ensure effective removal of organic and inorganic pollutants prior to final discharge or reuse.

The STP has been designed for an ultimate influent flow of approximately 13 cusecs, corresponding to full occupancy of the housing scheme. To accommodate phased development and gradual increase in wastewater generation, the treatment facility will be constructed in six modular units, each with a treatment capacity of 2.2 cusecs. This phased approach allows operational flexibility, cost efficiency, and scalability in line with population growth. Treated effluent from the plant will be partially reused for landscaping and irrigation, while surplus treated water will be discharged into the nearby natural stream in compliance with applicable environmental standards.

Wastewater entering the plant is conveyed through an intake channel equipped with dual bar screens to remove coarse debris and floating materials. The influent then passes into a grit chamber, designed to reduce flow velocity and allow settlement of heavy inorganic particles such as sand and grit, thereby protecting downstream treatment units from abrasion and mechanical wear.

FIGURE 3-9: LOCATION OF STP

Primary biological treatment is carried out in a cylindrical anaerobic chamber, where organic matter is degraded by anaerobic microorganisms under oxygen-free conditions, resulting in the production of biogas. Provision has been made for optional biogas collection and potential energy recovery. Effluent from the anaerobic chamber

is routed to sedimentation tanks, which provide adequate detention time for settling of suspended solids and sludge separation.

Flow regulation and load balancing are achieved through an equalization tank, which stabilizes hydraulic and organic fluctuations in the influent. The equalization tank also incorporates aeration through fountain systems, contributing to partial reduction of biochemical oxygen demand (BOD) and enhancement of dissolved oxygen levels prior to aerobic treatment.

Secondary and tertiary treatment is accomplished through biofilter (trickling filter) towers, where wastewater is evenly distributed over fixed media under aerobic conditions. Microorganisms attached to the media further degrade residual organic matter and nutrients that are not effectively removed during anaerobic treatment. The treated water then enters a clarifier tank, allowing final settling of biological solids and providing short-term treated water storage.

To ensure public health protection, the clarified effluent is passed through a chlorination tank for disinfection before final discharge. Treated wastewater is conveyed through a lined outlet channel to the designated nullah, while an overflow channel is provided to safely manage excess flows during peak or emergency conditions.

Operational control of the treatment facility will be managed through two dedicated control rooms, enabling monitoring, regulation, and maintenance of plant operations. Overall, the proposed STP design ensures effective wastewater treatment, environmental compliance, operational reliability, and long-term sustainability of sanitation infrastructure for the Gulberg Green housing scheme.

3.27. TREATED EFFLUENT REUSE, SLUDGE MANAGEMENT AND STP CONTINGENCY PLAN

A comprehensive wastewater management framework for the proposed Sewage Treatment Plant, covering treated effluent reuse, compliance with applicable discharge standards, sludge management, and contingency arrangements for plant failure. The STP will be developed in modular phases in accordance with actual occupancy and wastewater generation, and each treatment module will be commissioned before the incoming sewage load exceeds the available operational capacity. Treated effluent will be reused to the maximum technically feasible extent for irrigation of parks, green belts, roadside plantation, recreational spaces and public-building landscaping, as well

as for road washing, sewer flushing, dust suppression and other approved non-potable purposes. A detailed reuse water balance will be prepared to quantify daily effluent production, seasonal reuse demand, storage requirements, surplus discharge and the corresponding reduction in freshwater and groundwater demand. A separate non-potable distribution network, including dedicated storage tanks, pumps, colour-coded pipelines, flow meters, backflow prevention and warning signage, will be provided to prevent cross-connection with the potable water supply system. Any surplus treated effluent that cannot be reused will be discharged only through an approved and engineered outfall after confirmation of compliance with the applicable National Environmental Quality Standards and any additional conditions imposed by Pak-EPA, CDA or other competent authorities. Influent, final effluent and receiving-water quality will be monitored for key parameters, including pH, BOD, COD, total suspended solids, total dissolved solids, oil and grease, ammonia, residual chlorine and microbiological indicators. Monitoring will be undertaken at the STP inlet and outlet and at upstream and downstream locations along the receiving drain to ensure that the discharge does not adversely affect natural drains or the Korang River catchment. In the event of non-compliance, discharge and reuse will be suspended, the affected treatment unit will be isolated, corrective action will be initiated and confirmatory sampling will be completed before normal operations resume.

A complete sludge management system will also be incorporated into the STP design. Screenings, grit, primary sludge and biological sludge will be collected and managed separately. Sewage sludge will be thickened, stabilized and dewatered through lined drying beds, mechanical dewatering or another approved treatment system. Drainage from sludge treatment areas will be returned to the headworks of the STP and will not be discharged onto land or into stormwater drains. Dewatered sludge will be stored temporarily in a covered, paved and access-controlled area equipped with an impermeable floor, drainage collection, odour control and vector management arrangements. Before beneficial use or disposal, sludge will be tested for moisture content, organic matter, pathogens, nutrients, heavy metals and other relevant contaminants. Stabilized sludge may only be used for approved non-food landscaping, composting or soil conditioning where laboratory results demonstrate its suitability and written approval has been obtained. Where beneficial use is not technically or legally feasible, the sludge will be transported through an authorized contractor to an approved treatment or disposal facility. Sludge generation records, laboratory reports,

transport manifests and disposal receipts will be maintained as part of the environmental compliance documentation.

To prevent untreated sewage from reaching nearby natural drains and the Korang River catchment during operational disruptions, the STP will incorporate adequate emergency storage, standby power, equipment redundancy, alarm systems and critical spare parts. Potential failure scenarios, including power outage, pump or blower failure, hydraulic overloading, excessive organic loading, disinfection failure, blockage, flooding and mechanical breakdown, will be addressed through a formal STP Emergency Response and Contingency Plan. During a failure event, influent will be diverted to available operational modules or lined emergency storage, standby generators and equipment will be activated, and discharge or reuse will remain suspended until treatment performance is restored and verified through testing. Routine bypass of the treatment process will be prohibited. Where emergency storage capacity becomes insufficient, sewage will be transferred through sealed tankers to an authorized treatment facility rather than being released untreated into drains, open land or watercourses. The STP will be operated by trained personnel under the supervision of a qualified plant manager, and monthly performance reports will document influent and effluent flows, reuse volumes, surplus discharge, laboratory results, sludge generation and disposal, equipment downtime, incidents, complaints and corrective actions. These measures will ensure that the STP remains environmentally compliant, operationally resilient and protective of groundwater, natural drainage systems and the Korang River catchment.

3.28. STORM SEWERAGE SYSTEM

For the effective Surface drainage, the RCC storm water drains are provided at one side of road along the shoulder at the lower side of the road. Grit chambers converted to drain manholes are provided in storm water network.

For purpose of calculations maximum rainfall intensity has been taken as 3 inches /hour Run off has been calculated and details are under:

3.28.1. FLOW DIRECTION

Based on the Contour plan, the flow direction shall be specified.

3.28.2. DRAINAGE SYSTEM

The existing watershed drainage pattern of the scheme has been generated by HEC, GEO Software after detail hydrological study. The road side drainage system will be planned and designed accordingly to design parameters mentioned in the CDA's Modalities and Procedures 1993.

FIGURE 3-10: STORM WATER DRAINAGE SYSTEM

3.28.3. DISPOSAL OF SURFACE RUNOFF

The RCC storm water drains are provided at one side of the road along the shoulder at lower side of the road for effective surface drainage. Grit chambers connected to drain manhole are provided in the storm water network. Drain outfalls near the Nullah at appropriate locations are provided for storm water disposal. Manholes and drop manholes are constructed at appropriate distances and location to catch road water through grit chamber.

A number of methods are in use to estimate the runoff. Rational & Hydrographic methods are more common. All the main cross drainage structures on the main ravines will be based on 25 – 100 years return period discharge data whereas, the entire normal roadside drains will be based on CDA's Design Criteria. Rational

method is used for relatively small areas up to 3 km^2. SCS Curve No Technique will be used for larger drainage areas.

Capital Development Authority (CDA) recommends using 3 in/hour as maximum rainfall intensity for calculation of discharge. However, to ensure safety and sustainability of system, Gulberg Greens uses value of rainfall intensity as 4 in/hour. Intensity Duration Curves will be used where required.

The capacity of storm water drainage is calculated according to Rational Method which relates the flow to the rain fall intensity, the tributary area, and a coefficient which represents the combine effects of ponding, percolation, and evaporation.

The discharge shall be calculated from following formula

$$Q = CIA$$

Where,

I = Intensity of rainfall (inches/hr.)

A = Drainage area (Feet)

Q = Peak runoff (cusecs)

C = Runoff Coefficient

3.29. LANDSCAPING

A landscape Architect has been engaged by the Society to accord proper landscaping treatment to all the components like parks, play fields, Roads, Streets, Avenue, Medians of dual carriage way, Shopping center, Mosque etc. The landscaping plan and list of plants are following:

3.29.1. TREES

A tree is a perennial plant with an elongated stem, or trunk, supporting branches and leaves in most species. In some usages, the definition of a tree may be narrower, including only woody plants with secondary growth, plants that are usable as lumber or plants above a specified height. In wider definitions, the taller palms, tree ferns, bananas, and bamboos are also trees. Trees are not a taxonomic group but include a variety of plant species that have independently evolved a trunk and branches as a way to tower above other plants to compete for

sunlight. Trees tend to be long-lived, some reaching several thousand years old. Trees have been in existence for 370 million years. It is estimated that there are just over 3 trillion mature trees in the world.

Table 3-8: Plantation at Gulberg Greens

Sr No.	*Plant Name*	*Quantity*
1	Amaltas	7500
2	Arjun	4500
3	Bottle Bursh	5200
4	Bakain Draikh	12000
5	Cepium Tali	21000
6	Channar	4700
7	Gul e Nishter	3100
8	Gaab	2500
9	Jacuranda	4000
10	Kachnaar	4500
11	Papular	100000
12	Pilkan	45000
13	Pine	105000
14	Silver Oks	5500
15	Sheshum	42000
16	Sukhchain	8500
	Total	**375000**

Following are the fruit trees planted in Gulberg Greens.

Table 3-9: Fruit Trees at Gulberg Greens

Sr No.	*Plant Name*	*Quantity*
1	Apple	1000
2	Anjeer	3500
3	Lucat	3000
4	Pear	1500
5	Plum	2000
6	Peach	5000
	Total	**16000**

3.29.2. GROUND COVER

Groundcover or ground cover is any plant that grows over an area of ground. Groundcover provides protection of the topsoil from erosion and drought. In an ecosystem, the ground cover forms the layer of vegetation below the shrub layer known as the herbaceous layer. The most widespread ground covers are grasses of various types.

In ecology, groundcover is a difficult subject to address because it is known by several different names and is classified in several different ways. The term groundcover could also be referring to “the herbaceous layer,” “regenerative layer", “ground flora” or even "step over."

Table 3-10: Ground Cover Species

Sr No.	*Plant Name*	*Quantity*
1	Dranta	200000
2	Silvery	50000
3	Nenthra	160000
4	Aresinia	100000
	Total	**510000**

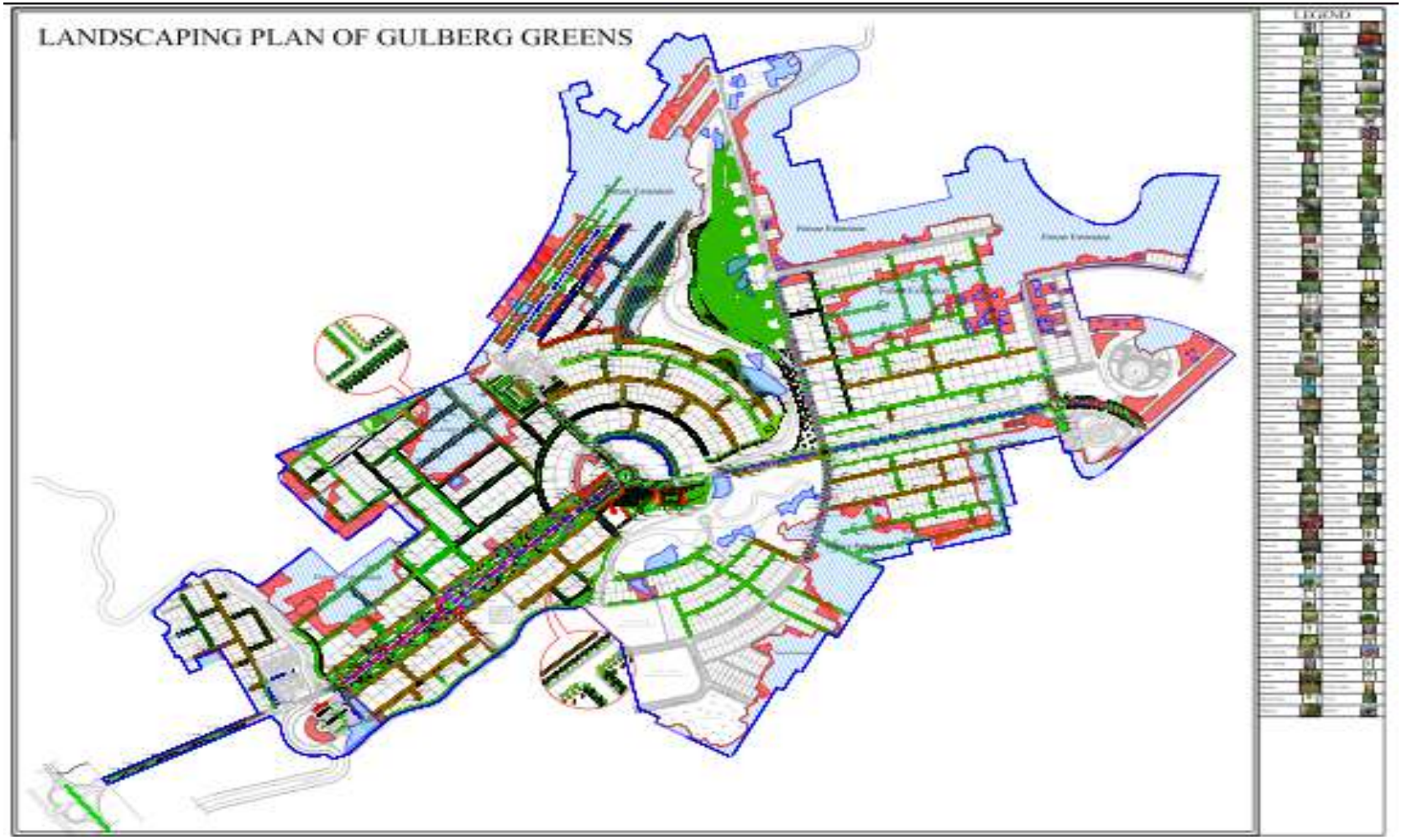

Figure 3-11: Landscaping Plan

3.30. ESTIMATED COST OF THE PROJECT

The project is estimated to cost Rs. 1680 million that include the cost of land and development.

3.31. TIME SCHEDULE

The development work of project will start after necessary approvals from CDA and environmental clearance from Pak EPA. The estimated time of development is three years.

3.32. CONSTRUCTION ASPECTS

Various construction phase activities are briefed in the following sections.

3.32.1. SITE PREPARATION

Site preparation for the housing scheme will be carried out in a planned and systematic manner to create a stable and suitable base for subsequent development works. This will involve clearing of surface vegetation within the development footprint, removal of roots, organic matter, and unsuitable material from areas designated for roads, buildings, and utility corridors. Any isolated rocks, debris, or obstructions encountered on site will be removed, and resulting voids will be filled and compacted with suitable material to achieve the required ground stability. Earthworks will be undertaken to level the site in accordance with the approved layout plan, ensuring proper grading and formation levels. Adequate drainage arrangements will be provided during site preparation to safely manage storm water runoff, prevent waterlogging and erosion, and protect adjacent areas. Where feasible, stripped topsoil will be stockpiled for later reuse in landscaping and green areas, thereby minimizing environmental disturbance and supporting sustainable site development.

3.32.2. CONTRACTOR'S ARRANGEMENTS

As the Project is being considered as a state of art, so it is expected that Contractor will be selected through international contract bidding (ICB) and having the experience of construction of such type of quality and sophisticated projects.

3.32.3. LIST OF EQUIPMENTS

Following equipment will be used during the project cpnstruction period.

Table 3-11: List Of Equipment

Equipment	*No.*	*Type*
Plain Roller	2	Mobile
Grader	2	Mobile
Excavator/Jackhammer	3	Mobile
Dumper	6	Mobile
Water Bowzer	2	Mobile
Tractor with Blade	2	Mobile
Tractor with Trolley	2	Mobile
Generator 30 KV	3	Stationary
Block Factory	1	Stationary
Pipe Factory	1	Stationary
Concrete Plant	1	Stationary
Loader	1	Mobile
Transit Mixer	2	Stationary
Mixer Machine	4	Stationary
Bolan/Pickup/ Car	6	Mobile
Air Compressor	2	Stationary
Diesel Tank with Unit	1	Stationary
Welding Plant	1	Stationary
Motorcycle	1	Mobile

Note: The contractor shall be bound under the contract to employ the above equipment in order to ensure that the target completion date is met. The type and numbers of equipment or machinery could change or increase/decrease, subject to need.

3.32.4. CONSTRUCTION CAMPS

Camp sites will be located keeping in view the availability of an adequate area for establishing camps, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from the sensitive areas in the vicinity. Final locations will be selected by the contractor with the approval of site Engineer's in-charge. While deciding the site for location of camp, all the measures will be kept in mind.

3.32.5. WORK FORCE

The Project involves many construction activities like excavation, construction of roads, general amenities, waste treatment plants, storm water drainage system, and

other miscellaneous infrastructure. It is expected that project will involve a large number of professional, technical, skilled, semi-skilled and unskilled manpower directly and indirectly.

The total number of crew, skilled and unskilled labor to be employed will depend on the Contractor's activity schedule at the time when the contract is awarded. The Contractor will be advised to hire the skilled and unskilled labor from the local communities.

3.32.6. CONSTRUCTION MATERIAL

Large quantities of construction materials will be required for the phased development of Gulberg Greens, as construction activities will be spread over an extended period. To support uninterrupted progress, a steady and reliable supply of construction materials will be ensured through locally available and established sources. The sourcing strategy has been planned to minimize transportation distances, reduce environmental disturbance, and utilize existing supply chains wherever possible.

Earth material will be required primarily for road embankments, leveling, and other filling works. Suitable earth fill material is available in the vicinity of the project area. As officially designated borrow areas are limited, contractors are expected to obtain earth material through short-term leasing of nearby private land. Prior to borrowing, the topsoil layer will be carefully stripped and stockpiled. Upon completion of borrowing activities, the stockpiled topsoil will be reapplied to restore the land for agricultural or original use, thereby minimizing long-term environmental impacts.

Fine and coarse aggregates will be required for concrete works across the project. These materials will be sourced from existing and approved quarry sites, including well-established quarries located in Sargodha, Chiniot, and the Margalla Hills near Taxila. Contractors will procure aggregates through licensed sub-contractors who hold leases for these quarry areas. As these quarry sites are already operational and accessible via existing road networks, no new haul roads will be required, thereby avoiding additional land disturbance.

Cement will be used extensively for building construction and structural works. Adequate supplies are readily available from cement manufacturing plants located in Rawalpindi and Attock, ensuring timely procurement without logistical constraints. Similarly, steel required for reinforcement and structural components will be sourced

from major suppliers and manufacturing units located in Islamabad, where availability is sufficient to meet project demands.

3.33. SITE RESTORATION

The estate is planned as a permanent residential housing complex and will be operated and maintained in accordance with high standards of health, sanitation, and municipal management to ensure comfort and safety for residents and visitors. Routine maintenance, timely repairs, and periodic upgrading of infrastructure such as roads, utility networks, and permanent structures will be carried out under a structured and well-defined maintenance schedule. As the development is a housing estate, large-scale land restoration or rehabilitation is not envisaged; however, selective removal or replacement of certain structures, such as roads or overhead water tanks, may be required over time to facilitate upgrading. Any dismantling activities will be undertaken strictly in line with municipal procedures, with full compliance to applicable rules and regulations, ensuring protection of surrounding infrastructure, private property, and public safety.

Demolition and decommissioning activities will be conducted using best practices to minimize environmental impacts and safety risks. All necessary precautions will be taken to prevent pollution, control dust through water sprinkling and wind shields, and safeguard workers and nearby communities. Debris generated from dismantling will be promptly removed and disposed of in an environmentally responsible manner, with recyclable or reusable materials recovered wherever feasible. Care will be taken to avoid damage to existing utilities such as sewerage systems, power and gas lines, and roads. Upon completion of the construction phase, all temporary facilities, including construction camps and waste pits, will be decommissioned and removed. Areas disturbed by temporary works will be restored and revegetated to reinstate ground cover and maintain the environmental integrity of the project area.

4. ANALYSIS OF PROJECT ALTERNATIVES

4.1. INTRODUCTION

An analysis of reasonable project alternatives has been undertaken to identify the development option that achieves the project objectives while avoiding or minimizing adverse environmental and social impacts. The assessment considers alternatives relating to:

- the no-project scenario;
- project location and site selection;
- layout configuration and development density;
- infrastructure development and phasing;
- water-supply arrangements;
- wastewater management;
- stormwater management; and
- environmental design measures.

The alternatives have been assessed against environmental, social, planning, engineering, regulatory and economic criteria. The purpose of the analysis is not merely to describe the available options, but to demonstrate how environmental considerations have influenced the selection of the proposed project configuration.

The project is a revised and extended component of the existing Gulberg Green Farm Housing Scheme rather than an entirely new greenfield development. The scheme has been developed progressively and has previously received environmental approvals. The current proposal relates to the revised and extended layout covering approximately 3,940.32 kanals within the broader scheme area. The proposed development is intended as a low-density residential scheme supported by roads, commercial areas, public buildings, recreational spaces and utility infrastructure.

4.2. METHODOLOGY FOR ALTERNATIVES ASSESSMENT

The alternatives were evaluated through a qualitative multi-criteria assessment. Each alternative was assessed against the following criteria:

Assessment criterion	***Description***
Environmental sensitivity	Potential effects on water resources, drainage, soil, vegetation, biodiversity, air quality and noise environment
Resource efficiency	Demand for land, water, energy and construction materials
Social acceptability	Effects on nearby communities, accessibility, public amenities, employment and housing provision
Planning compatibility	Consistency with the approved land-use framework, CDA planning requirements and the surrounding development pattern
Technical feasibility	Constructability, infrastructure availability, topography, drainage, utility connections and operational reliability
Regulatory feasibility	Ability to secure and maintain the required environmental, planning and utility approvals
Climate resilience	Capacity to manage flooding, heat, water scarcity and future climatic variability
Economic feasibility	Capital cost, operating cost, implementation timeframe and long-term maintenance requirements

For comparative purposes, the alternatives are ranked as follows:

- **Most favourable:** offers clear environmental, technical and planning advantages;
- **Moderately favourable:** feasible but requires additional mitigation or investment;
- **Least favourable:** associated with significant environmental, social, regulatory or technical constraints.

4.3. NO-PROJECT ALTERNATIVE

Under the no-project alternative, the revised and extended layout would not be implemented. The land would remain under its existing condition or would continue to be used for scattered agricultural, rural residential or undeveloped purposes.

4.3.1. POTENTIAL ADVANTAGES

The no-project alternative would avoid the direct environmental impacts associated with construction, including:

- vegetation clearance and land disturbance;
- construction-related dust, noise and traffic;
- generation of construction waste;

- additional water demand;
- wastewater and municipal solid waste generation;
- increased operational traffic;
- additional pressure on local infrastructure; and
- temporary occupational and community health and safety risks.

It would also avoid project-related capital expenditure and the need for long-term operation and maintenance of roads, water-supply systems, sewerage infrastructure, stormwater drains and public facilities.

4.3.2. POTENTIAL DISADVANTAGES

The no-project alternative would not meet the project objectives of providing planned residential development and associated infrastructure within the Islamabad Capital Territory. It would also forgo:

- planned housing and serviced residential plots;
- organized road, sewerage, drainage and utility networks;
- public buildings, commercial areas and community facilities;
- designated parks, recreational spaces and landscaping;
- employment during construction and operation;
- enhancement of land value and municipal revenue;
- planned management of wastewater and solid waste; and
- the opportunity to replace scattered or potentially unregulated development with a controlled land-use arrangement.

The report identifies significant pressure on the housing sector within the Islamabad and Rawalpindi region, including population growth, urbanization, informal expansion and increasing pressure on existing civic infrastructure. The project is intended to contribute to planned residential growth through the provision of serviced land and supporting infrastructure.

4.3.3. EVALUATION

Although the no-project alternative would avoid immediate project-specific impacts, it would not address the identified need for planned housing and infrastructure. It may also allow fragmented or unregulated development to occur over time without

an integrated sewerage, drainage, waste-management or environmental monitoring framework.

The no-project alternative is therefore considered **environmentally favourable in the short term but socially and strategically less favourable in the long term**. It has not been selected, subject to the condition that the proposed project implements all mitigation, resource-efficiency and monitoring measures specified in the EIA and EMMP.

4.4. SITE-SELECTION ALTERNATIVES

Alternative A: Development at an entirely different site

This alternative would involve abandoning the proposed extension area and acquiring a new site elsewhere in the Islamabad Capital Territory or the adjoining region.

Advantages

- Potential opportunity to select land with lower water-resource constraints.
- Potential avoidance of areas close to natural drainage channels.
- Possibility of identifying relatively flat land requiring less earthwork.
- Opportunity to avoid existing settlements or sensitive receptors.

Disadvantages

- Additional land acquisition and potential physical or economic displacement.
- New environmental disturbance in an otherwise undeveloped area.
- Requirement for entirely new road, electricity, gas, sewerage and water-supply connections.
- Greater construction footprint and higher infrastructure cost.
- Potential loss of agricultural land, vegetation or natural habitat at the alternative site.
- Requirement for new planning, environmental and utility approvals.
- Loss of integration with the existing Gulberg Green development and its supporting infrastructure.
- Longer project implementation period.

Alternative B: Development within the existing revised and extended Gulberg Green site

The selected site lies within and adjacent to an established and progressively developed housing scheme. It is connected to the broader Gulberg Green planning

framework and can utilize or integrate with the existing and planned road, utility, sewerage and drainage infrastructure.

The site is bounded by agricultural land on the eastern and northern sides, the Korang River toward the south and the Islamabad Highway toward the west.

Advantages

- Integration with an existing approved housing scheme.
- Reduced requirement for entirely new off-site infrastructure.
- Access to the existing regional road network.
- Compatibility with the planned residential character of the surrounding scheme.
- Availability of land with the project proponent.
- Ability to integrate environmental controls across the broader development.
- Lower likelihood of fragmented development.
- More efficient provision of community facilities and services.

Constraints

- Potential pressure on groundwater resources.
- Need to protect nearby natural drainage features and the Korang River catchment.
- Potential cumulative traffic and infrastructure impacts.
- Requirement for effective stormwater and wastewater management.
- Need for buffer zones and development controls around natural drains.
- Potential cumulative effects arising from adjoining housing and commercial development.

Site-selection conclusion

Development at an entirely new location would shift rather than eliminate environmental impacts and would require additional land acquisition, infrastructure development and regulatory approvals. The proposed site is preferred because it forms part of an existing planned scheme, is physically and functionally connected to existing development, and allows infrastructure to be planned as an integrated system.

The selected site is therefore considered **more favourable**, provided that groundwater abstraction, stormwater drainage, wastewater treatment, traffic, erosion and river-catchment protection measures are strictly implemented.

4.5. COMPARATIVE EVALUATION OF PRINCIPAL ALTERNATIVES

Alternative	*Environmental performance*	*Social and planning compatibility*	*Technical feasibility*	*Overall ranking*
No-project option	High short-term avoidance of impacts, but no integrated environmental improvement	Does not meet planned housing and infrastructure objectives	Technically simple	Moderately favourable
Entirely new project site	Uncertain and may shift impacts to another location	Requires new land acquisition and approvals	Lower due to new infrastructure requirements	Least favourable
Existing proposed site	Manageable subject to water, drainage and cumulative-impact controls	Compatible with the broader planned scheme	High due to infrastructure integration	Most favourable
High-density layout	Higher water, traffic, wastewater and runoff impacts	Greater housing yield but lower compatibility with farm-housing character	Technically possible but infrastructure intensive	Least favourable
Medium-density layout	Moderate to high environmental pressure	Provides housing diversity	Feasible with major infrastructure upgrades	Moderately favourable
Proposed low-density layout	Lower concentration of operational impacts and greater open space	Consistent with the intended project character	Feasible	Most favourable
Simultaneous full development	High peak construction disturbance	Shorter delivery time	Complex environmental control	Least favourable
Uncoordinated market-led phasing	Prolonged and fragmented impacts	Flexible but poorly controlled	Moderate	Least favourable
Controlled phased development	Limits active disturbance and links occupancy with infrastructure	Strong planning compatibility	High	Most favourable
Exclusive groundwater supply	High long-term resource risk	Potential conflict with surrounding users	Technically feasible but sustainability uncertain	Least favourable
Exclusive external bulk supply	Reduced local abstraction but uncertain availability	Dependent on external allocation	Moderate	Moderately favourable
Permanent tanker supply	High emissions, traffic and cost	Low reliability	Unsuitable for long-term operation	Least favourable
Integrated water-supply system	Diversified, efficient and resilient	Supports phased development	Feasible with monitoring and investment	Most favourable
Individual septic systems	Groundwater-contamination risk	Inconsistent with integrated development	Simple but difficult to regulate	Least favourable
Centralized STP	High environmental control and reuse potential	Strong compatibility	Feasible with skilled O&M	Most favourable
Conventional rapid storm drainage	Transfers runoff downstream	Moderate	Technically straightforward	Moderately favourable
Integrated stormwater management	Reduces peak flow, erosion and flood risk	Strong compatibility	Feasible subject to modelling	Most favourable

4.6. ENVIRONMENTAL COMMITMENTS ARISING FROM THE ALTERNATIVES ASSESSMENT

The proponent shall incorporate the following commitments into the project design and EMMP:

Aspect	Environmental commitment
Site	Development shall remain within the approved project boundary, and no additional land shall be included without regulatory review.
Density	The approved low-density character and designated open spaces shall be maintained.
Phasing	Each development phase shall be supported by operational water, sewerage, drainage and waste-management facilities before occupancy.
Water	Groundwater abstraction shall be limited to demonstrated sustainable yield, supported by metering and groundwater-level monitoring.
Water conservation	Water-efficient fixtures, leakage control, rainwater harvesting and treated-effluent reuse shall be implemented.
Wastewater	The centralized STP shall be operational before occupation, and its effluent shall comply with applicable standards.
Stormwater	Natural drainage paths shall be protected and supported by detention, infiltration and erosion-control measures.
Landscaping	Native and drought-tolerant species shall be prioritized to reduce irrigation demand.
Review	Any material change in layout, density, project area, water source or infrastructure capacity shall undergo environmental review and regulatory approval.

5. DESCRIPTION OF BASELINE ENVIRONMENT

5.1. GENERAL

This chapter describes the baseline conditions, which covers the existing physical, ecological and socio-economic environment of the Project Area as well as the Study Area. Information on these aspects has been derived from the desk study of available data, field visits to the Project/Study Area and information obtained through the visits to the Government departments and other agencies.

5.2. PHYSICAL ENVIRONMENT

Topography, geology, soil, water resources and climate have been included in physical environment as detailed below:

5.2.1. TOPOGRAPHY

The detailed topography study at 5ft intervals has been done. The site topography ranges from 1670' to 1820'. In general the overall topography can be generalized existing ground.

5.2.2. GEOLOGY

Islamabad is located at the southern foothills of Margalla hill range. Geologically, the rocks in the Islamabad, range in age from Jurassic to Paleocene and are of sedimentary origin and comprises of sandstone, limestone and shale.

In the project area minor rocks fall on the escarpment side take place due to erosion of underlying shale beds. This phenomenon is prominent along the central ridge where the overlying sandstone beds dip at shallow angles. Project area is underlain by sedimentary rocks comprising limestone, sandstone, conglomerate, siltstone and clay of sedimentary origin, ranging in age from Miocene to Recent. Bedrock belonging to Murree formation of Miocene age and is exposed partly in the project area. The remaining area is mostly covered with alluvial soils generally comprising silty / lean clay. The thickness of the alluvial soils near rock outcrop is between 1-2 meters, while the soil deposits near streams are expected to be up to 6 meters thick.

Sandstones represent deposits of levees, crevasse channels and splays, floodplain channels, and large sheet floods.

5.2.3. SOIL

The soil in project area mostly consist lean clay/sandy lean clay, silty clay, poorly graded sand with silt and silty sand. Top layer consist of cohesive soil present up to maximum depth of 7m. This layer is followed by granular soil in loose to very dense state up to maximum investigated depth of 35m.

Soil at the site has been tested and field investigations included drilling of five exploratory boreholes, in-situ testing and soil sampling.[1] The site is plain and levelled. Sub-soil stratum varies from lean to silty clay and gravel down to seventy to seventy-five feet below the existing ground level. Gravelly bedding was noticed further down. Soil found at the project site has been classified by the Soil Survey of Pakistan as a mix of the Chakwal Series and miscellaneous land type. Chakwal Series soil is silty clay loams to silty clays with moderate structure. Soil classification in Rawalpindi-Islamabad region is indicated at Appendix "X". Most of the land within the project area has been colonised, whereas the few vacant plots are mostly rough, broken and stony, with minor vegetation. Lithology of the project area is shown below.

Table 5-1: LITHOLOGY OF RAWALPINDI-ISLAMABAD

Name	*Type Locality*	*Lithology*	*Age*
Rawalpindi Group	Not Designated	Sandstone, shale of fresh water origin	Miocene
Leh-Conglomerate	Leh Nullah, west Islamabad	Siltstone, Eocene rocks	Pleistocene
Soan Formation	Areas around River Soan	Conglomerate, siltstone	Villafranchian Late Astian

Source: Soil Survey of Pakistan

5.2.4. SEISMICITY

Study of literature seismicity shows that active or likely to be active faults is located close to the area. History has recently witnessed a major epicenter of event magnitude 7.6 occurs in the area. Thickness of alluvium over bedrock at Margalla Hills is shallow and structure may be placed possibly on rock. Structure designs are recommended to be built should be earthquake resistance.

5.3. WATER RESOURCES

5.3.1. SURFACE WATER

The Five (5) small seasonal water courses which are present in the project area have no such nomenclature and the approximate run-off (seasonal) is 2,500 cusec.

In the project area, water sampling and analysis was carried out to establish the baseline conditions for the ground water quality. The surface water sample was collected **FROM** Malal Kas nullah and Korang nullah. These sample were analyzed by Green Cresent Islamabad.

The source of water for the proposed project and the existence of underground water reservoir is also an important consideration for a project. In this regard a geo-electric resistivity survey was conducted The following conclusions were drawn from the study:

- Siltstone/sandstone/conglomerates as bed rock have been interpreted in the area at different depths.
- Major lithological unit interpreted in the area are clay/shale, silty sandy clay, sand, gravel, Siltstone/sandstone/conglomerates.

5.3.2. GROUNDWATER

The second source which is as important is the groundwater. Hundreds of groundwater wells are operating in the area. The aquifers are again charged by the Soan River system. The developments in the basin has led to other environmental problems as well, such as, river diversion, fragmentation of aquatic habitats, impoundment, soil erosion, and water pollution due to deforestation and discharge of municipal garbage and industrial waste.

FIGURE 5-1 WELL IN BLOCK F (ZONE 5)

FIGURE 5-2 BOAR IN BLOCK C (ZONE 5)

In the project area the groundwater samples were collected from two different locations. These sample were analysed by Green Cresent Islamabad. *See Annexure-E* for detail laboratory results. The water sample tested for different parameters and the sample was safe for drinking.

Minimum proposed drilling depth was 450+10ft and expected charge would not be less than 5000 gallon per hour.

Moreover, hundreds of groundwater wells are operating in the area. The aquifers are again charged by the Soan River system. The developments in the area may lead to other environmental problems as well, such as fragmentation of aquatic habitats, impoundment, soil erosion, and water pollution due to deforestation and discharge of sewage and domestic solid waste.

5.4. CLIMATIC CONDITIONS

The climate of the region is characterized by four distinct seasons: the summer season from April to June; the monsoon season from July to mid-September; the post-monsoon season from mid-September to November; and the winter season from December to March. June is typically the hottest month, while January is the coldest.

Temperature:

Meteorological data from the Islamabad Airport climate station indicates that mean monthly temperatures in the project area range from approximately 14.1°C in January to 28.6°C in June. During the winter months, particularly in December and January, minimum temperatures occasionally fall below the freezing point.

Historically, the highest maximum temperature recorded in Islamabad is 46.1°C (June), while the lowest temperature recorded is –4°C (December–January).

Humidity and Rainfall:

The area experiences two major rainfall periods: the monsoon season (July to September) and the winter precipitation period (December to April). The majority of monsoon rainfall occurs in July and August, with long-term average values of 267 mm and 309 mm respectively. The highest monthly rainfall ever recorded in the region is 743 mm in July, while the maximum annual precipitation reported for Islamabad is 1,735 mm. Relative humidity levels remain fairly high throughout the year, particularly during the monsoon months.

Wind Direction and Speed:

Wind behavior across Islamabad shows no single prevailing direction during morning hours, with flow patterns distributed relatively evenly throughout the year. Westerly and north-westerly winds dominate during winter and spring, whereas southerly and south-easterly winds prevail in summer and monsoon months. Estate planning incorporates these wind patterns to promote optimum natural ventilation and fresh air circulation. Wind speeds are generally low during winter, gradually intensifying in spring and reaching their peak during the summer months. The maximum wind speed recorded in June is 90 knots. Seasonal variations show that May, June, and July tend to be the windiest months, while autumn and early winter experience calmer wind conditions.

5.5. EXISTING BASELINE ENVIRONMENTAL CONDITION

Baseline environmental quality monitoring for the Gulberg Greens Farm Housing Scheme, Zone-IV, Islamabad was undertaken to establish existing conditions prior to commencement of project activities. The environmental analysis was conducted during 04–05 December 2025, comprising groundwater sampling, 24-hour ambient air quality monitoring, and day- and night-time noise level measurements at representative locations within the project area. Laboratory analysis of groundwater samples was subsequently completed and reported on 09 December 2025. The monitoring and analytical work was carried out in accordance with recognized APHA methods and assessed against the National Environmental Quality Standards (NEQS) to provide a

reliable and compliant baseline for the Environmental Impact Assessment and Environmental Management Plan.

5.5.1. WATER QUALITY

Groundwater sampling and laboratory analysis were conducted at Gulberg Greens Farm Housing Scheme to establish baseline physicochemical and microbiological conditions prior to project activities. The analytical results indicate that the groundwater is clear, colorless, and palatable, with a measured pH of 7.22, which falls well within the acceptable NEQS range of 6.5–8.5. Total Dissolved Solids (TDS) were recorded at 341 mg/L, substantially below the permissible limit of 1,000 mg/L, indicating good overall mineral quality.

Key parameters such as hardness (184 mg/L), chlorides (22.14 mg/L), sulphates (34 mg/L), nitrates (<0.01 mg/L), cyanide (<0.01 mg/L), and fluoride (<0.01 mg/L) were all found within permissible limits. Heavy metals including arsenic, cadmium, chromium, lead, mercury, nickel, zinc, and selenium were either below detection limits or well within NEQS thresholds, indicating no contamination risk from toxic metals.

Microbiological analysis further confirmed that total coliforms and E. coli were absent, demonstrating that the groundwater is microbiologically safe and suitable for domestic use. Overall, the groundwater quality reflects unpolluted baseline conditions, with no evidence of anthropogenic contamination at the time of sampling

5.5.2. AMBIENT AIR QUALITY

Ambient air quality monitoring was carried out near the security office of Gulberg Greens over a continuous 24-hour period to assess baseline concentrations of key air pollutants. The average concentrations of PM_{10} (127.60 µg/m³) and $PM_{2.5}$ (81.51 µg/m³) were observed to be within NEQS limits of 150 µg/m³ and 35 µg/m³ respectively, though $PM_{2.5}$ levels indicate typical background particulate presence associated with urban and peri-urban settings.

Gaseous pollutants including carbon monoxide (1.87 mg/m³), sulphur dioxide (30.23 µg/m³), nitrogen dioxide (45.56 µg/m³), nitric oxide (26.10 µg/m³), and NOx (71.66 µg/m³) were all recorded below the applicable NEQS thresholds. Ozone concentrations were also within acceptable limits.

The findings suggest that ambient air quality in the project area is generally compliant with national standards, reflecting a stable baseline environment with no significant localized emission sources at present.

Figure 5-3: Recording of Environmental Baseline

5.5.3. NOISE LEVEL

Noise level monitoring was conducted during both daytime and nighttime periods at the same monitoring location. The average daytime noise level was recorded at 53.77 dB(A), which complies with the NEQS residential limit of 55 dB(A). Similarly, the average nighttime noise level was measured at 42.31 dB(A), remaining within the prescribed limit of 45 dB(A).

These results indicate that the project area currently experiences a low to moderate ambient noise environment, characteristic of controlled residential and semi-

developed zones. No excessive noise sources were identified during the monitoring period, establishing a compliant baseline acoustic environment.

5.6. ECOLOGICAL ENVIRONMENT

In this section, the baseline environmental conditions pertaining to biological environment have been described on the basis of primary and the secondary data. An initial reconnaissance of the project area was carried out followed by a detailed biological survey by ecological experts.

5.6.1. FLORA

The project area and its surroundings are devoid of any significant flora. The common vegetation includes kao (Wild olive), phulai (Acacia modesta), Sanatha (Dodonaea viscose), Shisham (Dalbergia sissoo), toot (Morus Alba) and paper mulberry.

FIGURE 5-4: ACCACIA NOLITICA

FIGURE 5-5: PARATHENIUM

Figure 5-6: Calotropis Procera

Figure 5-7: Cannabis Sativa

There are a number of species of shrubs and grasses are common in the area including Cenchrus Cilliris (Dhaman), Cannabis Sativa (Hemp), P. Julifora (Meskeet) and Parathenium.

5.6.2. FAUNA

Islamabad and the surrounding Margalla Hills support a rich diversity of wildlife due to their varied natural habitats, including dry subtropical forests, rocky slopes, grasslands, and seasonal streams. These ecosystems provide shelter for numerous mammals, birds, reptiles, and smaller fauna, making the region an important ecological corridor in the Potohar Plateau.

Mammals commonly found in the area include the Indian Pangolin (Manis crassicaudata), Golden Jackal (Canis aureus), Wild Boar (Sus scrofa), Porcupine (Hystrix indica), Fox (Vulpes vulpes), and different mongoose species. Rhesus Macaques (Macaca mulatta) are frequently seen around recreational sites, while the Common Leopard (Panthera pardus) is occasionally reported from deeper forested zones of the Margalla Hills.

FIGURE 5-8 DOMESTIC CAT

FIGURE 5-9: LOCAL DOG

Avifauna is one of the most prominent features of Islamabad's biodiversity. The area hosts a wide range of resident and migratory bird species such as Peafowl (Pavo cristatus), Bulbuls (Pycnonotus leucotis), kites, doves, and woodpeckers. Seasonal migrants traveling along the Indus Flyway significantly increase bird diversity during winter, particularly around Rawal Lake, nurseries, and riparian green belts.

FIGURE 5-10: HAWK

FIGURE 5-11: MOUNTAIN CROW

FIGURE 5-12: BULBUL

FIGURE 5-13: MYNA

FIGURE 5-14: HOUSE SPARROW

FIGURE 5-15: WHITE CHEEKED BULBUL

Reptiles such as lizards, geckos, cobras and vipers, as well as amphibians thriving in monsoon-fed water bodies, contribute to ecosystem balance by supporting pest control and maintaining the natural food chain. Freshwater turtles, native fish, and water birds inhabit the Nullahs and wetlands, benefiting from reed-covered stream banks and marshy zones.

However, habitat fragmentation, urban expansion, pollution, and increasing recreational pressure are posing threats to native fauna. Conservation efforts led by the Islamabad Wildlife Management Board and protected status of the Margalla Hills

National Park are vital for maintaining biodiversity and ensuring sustainable coexistence between wildlife and human communities in the capita.

5.7. SEASONAL BIODIVERSITY SURVEY, HABITAT MAPPING AND ECOLOGICAL SENSITIVITY ASSESSMENT

The earlier ecological description identified a limited number of commonly occurring plant, bird and domestic animal species through general observations and photographs, including *Calotropis procera*, *Cannabis sativa*, hawk, mountain crow, bulbul, myna, house sparrow and white-cheeked bulbul, but did not provide information on survey timing, sampling effort, habitat associations, relative abundance or seasonal variation. The revised assessment therefore requires field surveys during representative dry and wet seasons, with additional coverage of relevant bird migration and breeding periods, so that seasonal flora, resident and migratory birds, mammals, reptiles, amphibians and other fauna are adequately recorded. Standard survey methods shall include systematic walkover surveys, vegetation quadrats and transects, avifaunal point counts, direct sightings, calls, tracks, burrows, droppings and other indirect evidence, supported by GPS coordinates and geotagged photographs. The survey effort, dates, weather conditions, time of day, number and length of transects, observation duration and limitations shall be documented to ensure that the results are transparent and repeatable.

A habitat map shall be prepared using field verification and GIS-based interpretation of the project layout and surrounding land uses. The mapping shall distinguish existing built-up areas, agricultural land, fallow or disturbed ground, scrub vegetation, roadside plantation, mature tree stands, parks and landscaped areas, natural drainage channels, riparian vegetation and any relatively undisturbed habitat patches. Each habitat type shall be evaluated according to its area, condition, naturalness, vegetation cover, ecological connectivity, level of human disturbance, capacity to support wildlife and susceptibility to project-related change. Particular attention shall be given to natural drains and associated riparian vegetation because these features may function as wildlife movement corridors, seasonal aquatic habitats, groundwater recharge areas and ecological connections with the Korang River catchment. Habitat boundaries and sensitivity classes shall be superimposed on the revised project layout to identify areas requiring avoidance, buffers, restricted construction or restoration.

Species records shall be presented in a systematic inventory containing the scientific name, common or local name, taxonomic group, survey location, habitat association,

observation method, relative abundance, residency or migratory status and applicable conservation status. Relative abundance shall be classified using defined categories, such as dominant, common, occasional, uncommon or rare, supported where practicable by quantitative indicators including individuals per observation point, frequency of occurrence, encounter rate or percentage vegetation cover. Plant species shall also be categorized as native, introduced, cultivated or invasive. Species of conservation concern shall be screened against the current IUCN Red List, applicable national and ICT wildlife legislation, migratory species listings and relevant biodiversity conventions. The assessment shall not conclude that threatened species or sensitive habitats are absent solely because they were not recorded during a single rapid visit. Any survey limitation, including restricted seasonal coverage, inaccessible areas, low visibility or absence of surface-water flow, shall be disclosed and addressed through follow-up surveys or precautionary mitigation.

An ecological sensitivity assessment shall be undertaken by assigning each mapped habitat a sensitivity rating of low, moderate, high or critical. The rating shall consider the presence or potential presence of threatened or protected species, habitat rarity, naturalness, breeding or nesting use, riparian function, wildlife movement value, ecological connectivity, restoration potential and vulnerability to disturbance. Existing built-up and highly modified areas may generally be classified as low sensitivity, while agricultural and disturbed scrub areas may be low to moderate depending on their use by fauna. Mature native tree stands, natural drainage channels, riparian vegetation, nesting locations and any habitat supporting protected or conservation-significant species shall be treated as moderate to high sensitivity. Any critical habitat or confirmed location of a threatened species shall be subject to detailed specialist review and avoidance unless it can be demonstrated that no feasible alternative exists and appropriate regulatory approval has been obtained.

The ecological impact assessment shall use the verified seasonal and habitat-specific baseline to evaluate vegetation clearance, habitat loss, disturbance from noise and lighting, wildlife displacement, mortality risk, obstruction of movement corridors, increased human presence, invasive species spread and indirect effects on drains and riparian habitats. The mitigation hierarchy of avoidance, minimization, restoration and compensation shall be applied. The project layout shall avoid natural drainage channels, sensitive riparian vegetation, mature native trees, breeding sites and other high-sensitivity areas to the extent technically feasible. Pre-construction ecological inspections shall be conducted before vegetation clearance, and active nests, burrows

or protected fauna shall be safeguarded through temporary exclusion zones and appropriate work scheduling. Tree cutting shall be minimized and supported by a tree inventory, justification and applicable permissions. Plantation shall prioritize native and drought-tolerant species rather than relying solely on ornamental landscaping. Although the existing EMMP proposes extensive compensatory planting, including trees, shrubs and grass, plantation numbers alone cannot substitute for the loss of mature habitat or ecological connectivity and must therefore be linked to site-specific habitat restoration objectives and survival monitoring.

A Biodiversity Management and Monitoring Plan shall be incorporated into the EMMP to define responsibilities, locations, indicators, frequencies, thresholds and corrective actions. Monitoring shall include seasonal species observations, habitat condition, vegetation clearance, tree survival, invasive species, nesting activity, wildlife incidents, condition of drainage and riparian buffers, and restoration success. Ecological monitoring shall be undertaken by a qualified ecologist during construction and for an appropriate period after landscaping and habitat restoration. Corrective action shall be initiated where unauthorized habitat disturbance occurs, plantation survival falls below the approved target, invasive species expand, wildlife mortality is recorded or sensitive species are observed within active construction areas. The findings of the seasonal surveys, habitat maps, species abundance data and sensitivity analysis shall replace generalized conclusions regarding the absence of ecological constraints. The final conclusion on ecological significance shall be based on documented field evidence and shall recognize that, even where no notified protected area lies within the project footprint, natural drains, mature vegetation and habitat linkages may still require specific protection and management. The current report concludes that no significant ecological constraints affect the site, but this conclusion should only be retained after verification through the expanded seasonal assessment described above.

5.8. SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

This section describes the socio-economic and cultural environment of the project area. It presents information on the pertinent socio-economic parameters of the area and includes inter alia its location, major settlements, religious and cultural heritage sites, and economy and lifestyle of the people residing within and in the close proximity of the project sites. The baseline environmental conditions pertaining to socio-economic and cultural environment have been described using the secondary and the primary data. The secondary data were obtained either from published sources or from various departments while the primary data were obtained through surveys conducted

in the project area. The information was collected with the purpose of obtaining a clear and complete understanding of the socio-economic conditions of the local residents, assess the vulnerability of the local communities and identify the concerns of local residents regarding the proposed project activities. These baseline environmental conditions have subsequently been used to identify the potential impacts on socio-economic environment that are likely to arise from the project activities. In addition, the mitigation measures that need to be adopted to reduce or minimize these impacts have also been spelled out.

5.9. HISTORY AND BACKGROUND

Islamabad was developed during the 1960's as the new federal capital of the country in place of Karachi. The Site Selection Commission was formed in February 1959 and in June 1959 the Government accepted the recommendations of the commission. In September 1959, the Federal Capital commission was formed to produce a master plan. The master plan was prepared in October 1960 which demarcated the site for successive stages of development, in relation with the surrounding areas, and division into various sectors. On May 24, 1960 preliminary master programme and master plan designed by the consultant were presented to the Government. After a meeting of the federal cabinet on Shakar-parian Hills, formal approval of the plan was accorded. Capital Development Authority (CDA) came into being on June 14, 1960 under the CDA Ordinance 1960 and ground breaking finally took place in October, 1961.

Since its inception, Islamabad has undergone phenomenal development. During the early years, it was a small, quiet city with minimal commercial or business activity. However in the recent years, business activities have significantly increased and today Islamabad, apart from being the federal capital, is a city active economically, commercially as well as industrially.

5.9.1. POPULATION AND DEMOGRAPHICS

Islamabad has a rapidly growing and diverse population that includes government officials, business professionals, expatriates, diplomats, and internal migrants from all parts of Pakistan. As the seat of federal institutions, the city attracts a highly educated and skilled workforce. Literacy rates are significantly higher than national averages, and a large portion of the population is engaged in formal sector employment.

5.9.2. ECONOMY AND LIVELIHOODS

The city's economy is driven primarily by the public sector, with a large number of people employed in federal ministries, national organizations, development agencies, and foreign missions. Alongside government employment, private sector activities have expanded considerably, including banking, real estate development, information technology, education, hospitality, and retail businesses. Small-scale commercial enterprises and service-based professions contribute to local livelihoods, while nearby rural peripheries maintain segments of the workforce engaged in agriculture, livestock rearing, and small-scale trading.

Islamabad-Rawalpindi together form a major economic hub, where Islamabad provides the formal administrative structure and Rawalpindi complements it through trade, industrial production, defense services, and labor markets.Institutional Facilities

5.9.3. EDUCATION, HEALTH, AND SOCIAL SERVICES

Islamabad has a well-developed network of educational institutions, including top-tier universities, research centers, schools, and training academies. The city also hosts a range of advanced public and private healthcare facilities, placing it among the best serviced regions of Pakistan in terms of medical infrastructure.

Access to basic amenities clean drinking water, electricity, sanitation, transportation, and telecommunication is generally better relative to other parts of the country, although challenges persist in informal settlements and suburban areas.

5.9.4. CULTURAL AND SOCIAL CHARACTERISTICS

Culturally, Islamabad is a cosmopolitan city influenced by diverse ethnic groups residing here Punjabi, Pashtun, Kashmiri, Hazara, Sindhi, Baloch, and others. The city maintains a relatively peaceful social environment, characterized by law-abiding communities, strong administrative oversight, and a high priority on public safety due to its political significance.

Islamabad celebrates national cultural values through museums, art galleries, literary events, and theaters, while also reflecting contemporary and global lifestyles. Despite its modern character, traditional norms rooted in religion and local customs remain strong and influence community life, family structure, and social behavior.

5.9.5. HOUSING, URBAN DEVELOPMENT, AND LIFESTYLE

Urban development in Islamabad follows a sector-based planning model with organized residential, commercial, and green spaces. The city is known for its aesthetically designed avenues, parks, and recreational areas, such as Daman-e-Koh, Rawal Lake, Shakarparian, and the Margalla Trails, which contribute to a high quality of life.

However, rapid urbanization has also led to rising property prices, expansion of informal settlements, and increased social disparities between high-income residents and low-income communities, including migrant laborers and domestic workers.

5.9.6. HERITAGE AND TOURISM

Islamabad is a city with a lot of green and open spaces. Green belts and buffer zones are provided along the main arteries. The city is filled with parks, botanical and flower gardens. These factors make the city one the greenest cities of the world.

6. PUBLIC CONSULTATION

6.1. GENERAL

Public consultation is a systematic process which provides an opportunity for citizens, planners, managers and elected representatives to share their experience, knowledge and concerns and perceptions about the proposed Project. The objectives of the public consultation are as follows:

- Share information with stakeholders on proposed improvement works and expected impact on the socio-economic environment of the Project Area.
- Understand stakeholders concerns regarding various aspects of the Project, including the existing condition of the Project Area, upgrade requirements, and the likely impact of construction related activities and operation of the Project.

In order to meet the above mentioned objectives, at different locations, consultations including scoping sessions and focus group discussions were held. During consultations with the local community, main contents of the project were shared with community; they expressed their apprehensions about the Project in detail.

6.2. CONSULTATION WITH STAKEHOLDERS

The consultations were also held with Pak-EPA, Administration, ICT, Forest Department, Tourism Department, and Health Department, Contracts, Project designers/Developers (UPDL), Project Proponent (IBECHS) etc.

6.2.1. CAPITAL DEVELOPMENT AUTHORITY (CDA) OFFICIALS

Multiple consultation meetings were conducted with relevant officials of the Capital Development Authority (CDA) to discuss the proposed project design, associated construction activities, and the potential environmental and social impacts within the project area. These meetings provided a platform to present project information, gather technical input, and identify concerns that require integration into the Environmental Impact Assessment (EIA) and subsequent management plans.

During the discussions, CDA emphasized the need to ensure that environmental safeguards remain central to the project's implementation. A key concern highlighted was the effective management of solid and liquid waste, both during construction and operational phases. Current waste disposal practices in the area are placing

significant pressure on local land and water resources; therefore, the Authority stressed the importance of developing a comprehensive Waste Management Plan that includes proper segregation, collection, treatment and safe disposal mechanisms to prevent soil and water contamination.

Another major point raised was the requirement for a well-structured Plantation and Landscape Plan. CDA recommended that the project incorporate native tree and shrub species to enhance green cover, prevent soil erosion, and support local biodiversity. It was indicated that landscaping should not only align with Islamabad's environmental standards but also contribute positively to the aesthetic value and ecological resilience of the surrounding area.

CDA officials also advocated for gender-inclusive development practices. They recommended that local women from nearby communities be meaningfully engaged in employment and income-generating activities associated with the project including plantation works, horticultural maintenance, social mobilization, and community development initiatives. This approach would not only support local livelihoods but also contribute toward social empowerment and equitable benefit-sharing.

These insights from stakeholder consultations are being fully integrated into the project planning process, and appropriate mitigation and enhancement measures will be reflected in the Environmental Management Plan (EMP) to ensure environmentally responsible and socially inclusive project implementation

6.3. CONSULTATION WITH COMMUNITY

Community representatives from the neighboring villages were also discussed about the project to have an informed judgment about their possible response on this project. Salient findings of the group discussion and main concerns of the community are summarized below;

- Noise level will be highly irritating during the construction stage of the Project due to the operation of construction machinery and vehicular movements.
- General mobility of local residents will be disturbed during the construction phase of the Project.
- Insecurity and theft problems may generate during construction stage of the Project.
- Health of the nearby community may be suffered due to dust during the construction stage.
- Solid waste should be properly managed.

- Width of drains must be design keeping in view the climate change.
- Developer must utilize the concept of rainwater harvesting wherever possible.
- Trees must be planted at the embankments of drains to reduce soil erosions.

6.3.1. MAJOR FINDINGS OF PUBLIC CONSULTATIONS:

During stakeholder interactions, local residents shared a balanced set of concerns and expectations regarding the ongoing development activities. A primary issue repeatedly highlighted by the community was dust pollution arising from excavation, earth movement, and vehicle traffic. Residents mentioned that they had already communicated this concern to CDA authorities and urged the project team to implement effective dust-control measures to safeguard public health.

On the positive side, the community acknowledged that no significant loss of natural vegetation had occurred since the area was largely barren. This was perceived as a favorable environmental outcome, reducing concerns related to deforestation or habitat disturbance. Residents also expressed optimism regarding the employment opportunities generated during the construction phase. Large numbers of local people were hired for skilled, semi-skilled, and unskilled labor roles, and the community is hopeful that additional jobs will be available during future expansion and operational phases, including more stable long-term employment.

Some respondents also raised complaints regarding noise and vibration caused by heavy machinery and construction activities, which they felt caused inconvenience and disturbed routine life. Despite such issues, the community observed notable economic benefits, including an increase in property values in the surrounding settlements due to improved infrastructure and urban development. Local businesses have similarly benefited, as contractors purchase daily supplies and food items from nearby shops and vendors. Additionally, project personnel renting residences in adjacent areas has created supplemental household income for local property owners.

Social services planned within the project, such as parks, mosques, commercial facilities, hospitals, and especially a government school, were highly appreciated. The lack of a nearby government school has been a longstanding issue, and residents expressed satisfaction that their children will gain access to affordable and quality education within close proximity.

However, community members also stressed that local mobility may be disrupted during peak construction activities due to partial road closures and increased movement of construction vehicles. Additionally, they emphasized the need for an efficient solid waste management system to prevent littering, environmental contamination, and public health problems during both construction and operation stages.

Overall, the community response reflects a mix of practical concerns and strong support for the project's socioeconomic benefits. Their feedback has been incorporated into the Environmental Management Plan (EMP) to ensure that local wellbeing, safety, and environmental quality remain key priorities throughout the project lifecycle

7. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1. GENERAL

This chapter identifies the potential impacts due to the implementation of the proposed project on the physical, ecological and socio-cultural environment of the Project Area. The chapter also identifies measures that will help to mitigate the Project's adverse environmental effects and enhance the positive impacts.

7.2. APPROACH ADOPTED FOR IMPACT IDENTIFICATION

Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad is at the planning stage & detailed design for all the proposed amenities has to be carried out at later stages. To identify the potential impacts, checklists were developed for physical, ecological and socio-cultural environment by the experts keeping in view the type of proposed facilities and the existing setup of the Project Area.

7.3. IMPACTS DURING PROJECT DESIGN & PRE CONSTRUCTION PHASE

7.3.1. PHYSICAL ENVIRONMENT

Following is the description of the impacts envisaged during the design & pre-construction phase of the project:

7.3.1.1. TOPOGRAPHY

- Topography of the area will change, due to the construction of the Project related infrastructure, such as roads, sewerage network and infrastructure. Generally, slopes in the area are mild.
- The sites selected for the development of the Gulberg Green Farm Housing Scheme are mostly flat pieces of land available in the area. However, slight trimming of the land may be required during development and cut and fill procedure will be followed. Therefore, there will not be any significant adverse impact on the topography of the area.

Mitigation Measures

- To minimize adverse impacts on the natural terrain, the development should be designed to follow existing land contours wherever feasible. This can be achieved by adopting suitable layout planning, selecting appropriate road alignments, and limiting excessive excavation or filling. Where land modification becomes unavoidable, the extent of leveling and cutting should be reduced, and engineered slopes should be stabilized using retaining structures, turfing, and vegetation cover to prevent erosion and visual scarring of the landscape.
- Furthermore, maintaining the **natural drainage pattern** of the area is essential to avoid disruptions to surface runoff and groundwater recharge. The design of stormwater channels, culverts, and embankments should ensure that natural water flow paths are preserved or appropriately diverted without causing stagnation, flooding, or erosion. Silt traps and sedimentation ponds may be installed during construction to prevent soil from washing into streams or depressions. Regular monitoring during construction will help ensure that drainage systems remain functional and free from blockage.
- By applying these measures throughout the planning and implementation stages, the project will help safeguard landform integrity, reduce environmental risks, and maintain the aesthetic quality of the area's landscape.

7.3.2. ECOLOGICAL ENVIRONMENT

Project Area particularly along roads contains good vegetative cover. Provision of new facilities may require clearing of vegetative cover that are present in spares and this will cause an adverse environmental impact on the existing vegetation.

Mitigation Mesaures

To offset the loss of vegetation during site development, a comprehensive and well-planned tree plantation and landscaping program will be implemented alongside construction activities. Native and drought-resistant species should be prioritized to ensure better survival rates and support local biodiversity. Plantation will be carried out within designated green spaces such as proposed parks, along both existing and planned road corridors, and on the embankments of drainage channels (nullahs), where vegetation will also help stabilize soil and reduce erosion.

Prior to site clearing, vegetation surveys will be conducted to identify and retain mature or ecologically valuable trees wherever possible. Any unavoidable removal

of trees will be compensated through a defined replacement ratio, ensuring that the total green cover is enhanced rather than reduced. Plantation schedules should align with suitable climatic conditions preferably during the monsoon season to maximize healthy establishment. Post-plantation care, including watering, mulching, and protection from grazing, must be ensured through a structured maintenance plan.

Through these measures, the project will not only mitigate vegetation loss but also enhance aesthetic quality, micro-climate regulation, and environmental sustainability within the development area.

7.3.3. SOCIO-CULTURAL ENVIRONMENT

One of the key environmental and social considerations associated with the siting of the proposed project facilities, to be addressed at the design stage prior to commencement of construction activities, relates to land acquisition. For the revised and extended layout plan of the Gulberg Green Farm Housing Scheme, it is estimated that approximately 3,940.32 kanals of land will be acquired to facilitate the planned development. The land acquisition process will be undertaken in accordance with applicable legal, regulatory, and planning requirements to ensure orderly development and minimize potential social impacts.

Based on the assessment of the proposed project footprint and layout, it is anticipated that no existing physical infrastructure, including roads, utilities, or public service facilities, will be disrupted as a result of the proposed development activities. The revised layout has been designed to integrate with the surrounding built environment while avoiding interference with existing infrastructure networks.

Furthermore, the proposed project activities are not expected to affect any religious or culturally significant properties within or adjacent to the project area. No mosques, graveyards, shrines, or other sites of religious or cultural importance have been identified within the project footprint, and therefore, no adverse impacts on religious assets are anticipated during the design, construction, or operational phases of the project.

Mitigation Mesaures

Utmost efforts shall be made to minimize land acquisition through appropriate design optimization and efficient land-use planning. Where land acquisition is

unavoidable, fair and timely compensation shall be provided to the affected landowners at prevailing market rates, in accordance with applicable laws and regulatory requirements. For this purpose, a Land Acquisition Committee shall be constituted in consultation with potential Project Affected Persons (PAPs) to ensure transparency, stakeholder participation, and equitable decision-making throughout the acquisition and compensation process.

7.4. IMPACTS DURING CONSTRUCTION PHASE

7.4.1. CONTRACTING ARRANGEMENTS

The success of a construction project depends to a very large degree on selection of an experienced construction contractor who possesses the necessary expertise, has machinery and equipment, and has access to sufficient financial resources, in addition to a reliable, experienced workforce.

Mitigation Measures

- The contractor was selected by the proponent through a rigorous screening process, in accordance with relevant government procurement procedures.
- The selection criteria ensured the contractor has a strong track record, relevant technical experience, and the capacity to deliver the project within the required timeframe while adhering to environmental safeguards.
- Any additional contractors required for future phases of construction will be hired using the same transparent and compliant procedure.
- At peak construction activity, an estimated workforce of around 500 personnel will be engaged at the project site.
- Skilled and semi-skilled staff will include:
- Project Management & Supervisory Staff: Project Manager, Engineers, Quantity Surveyor, Surveyors
- Technical Staff: AutoCAD Operator, Lab Technician, Machinery Operators
- Administrative & Support Staff: Accountant, Storekeepers, Drivers, Security Guards, Cooks
- Construction Crew: Masons, Carpenters, Steel Fixers, General Labourers, Helpers
- The contractor has been instructed to hire maximum local labour to enhance livelihood opportunities for surrounding communities, while also providing them with on-the-job training and technical skills development.

- As the majority of workers are from nearby areas, no construction camp has been established at the project site to date, minimizing associated land-use and environmental impacts.

7.4.2. CONSTRUCTION MATERIALS

Procurement of construction materials and knowing beforehand about the sources and quantities required is another major factor vital for the success of a construction project.

Mitigation Measures

- Construction materials (cement, sand, aggregates/crush, bricks, steel bars, paints, asphalt, tar, glass, etc.) will be transported to the site only on a need-basis to reduce stockpiling, wastage, and dust.
- Preference will be given to environment-friendly and fire-resistant materials, in alignment with green building standards, where such products are available and cost-effective.
- Quarry materials that meet the required quality and technical specifications will be sourced from the nearest licensed quarry to minimize transportation costs and reduce vehicle emissions.
- Cement and other bulk materials will be procured directly from certified manufacturers or authorised agents to ensure authenticity and compliance with standards.
- All construction materials will be tested before use and will require prior approval from the Project Manager to maintain quality assurance.
- Noise-absorbent materials will be considered for use in relevant locations, subject to market availability and cost-effectiveness.
- Sourcing materials from the nearest vendors will help lower environmental footprint, reduce travel distances, and minimize disturbance to local communities.

7.4.3. OTHER SUPPLIES

Projects do not require construction materials alone and acquisition of other supplies well in time is as important as procuring sand and cement.

Mitigation Measures

- The primary resources required during construction include water, fuel, electricity, and standard construction consumables.
- Water demand will vary with the pace of construction activities; peak usage is estimated at approximately 5,000 gallons per hour.

- Recent hydrogeological studies show that Islamabad's groundwater resources are under increasing stress. According to a 2023 assessment by PCRWR, while aquifer recharge potential remains present, rising demand and drawdown have caused notable lowering of the water table over recent decades.
- Moreover, a 2025 water-quality study highlighted spatial variability in drinking-water quality and localized contamination risks, suggesting that groundwater availability and safety cannot be taken for granted across the board.
- Diesel and petroleum fuels for machinery and vehicles will be sourced from nearby fuel stations, with peak consumption expected at around 5000 liters per day.
- A temporary grid electricity connection has been secured from the local utility company and will be supplemented by diesel generators to ensure uninterrupted power supply.
- Construction management will ensure timely procurement and consistent availability of all required supplies to prevent work delays and avoid inconvenience to the workforce.

7.4.4. VEHICLES AND EQUIPMENT

Vehicles and equipment deployed at a project must be in good condition and not become detrimental to the local environment in terms of noise and emissions. These must also be of good quality to ensure there are no breakdowns that can disrupt the process of project implementation.

Mitigation Measures

The contractor has been directed by the proponents to take all possible measures to see that works do not impinge on the environment. Construction vehicles and equipment at the project site. The exact number of vehicles and equipment in use at the site at any given time will vary according to work schedules and work momentum, and shall be bound by traffic regimes within the city. The contractor shall be advised to use new vehicles, machinery and equipment to maintain emissions and noise at lowest possible levels. During early phase of construction, two or three truckloads of different types of construction material shall be delivered to project site per day, increasing to about five to eight at peak of construction activity. Arrival timing of such equipment and construction materials will not be concurrent and shall take place when there is minimal disturbance for local population. In any case, Islamabad Capital Territory's commercial traffic regime forbids entry of trucks during daylight hours on working days without a permit, more recently due to security concerns.

7.4.5. EMISSIONS AND DISCHARGES

Construction equipment and vehicles can discharge exhaust emissions containing CO_2, CO, NO_x, SO_2, and particulate matter and generate dust emissions from earthwork. The primary source of emissions to air during construction activities will be diesel engine-driven generator exhaust. Other emission sources include construction machinery and project vehicles. Dust from construction activities and movement of vehicles could be another main source of air emissions.

Mitigation Measures

Since vehicles and equipment in use shall be in good working condition and under due maintenance, as per instructions to construction contractor from the proponents, emissions shall be within acceptable limits, as is evident from environmental testing carried out at the project site at a time when work was in progress. The proponents shall monitor pollution levels regularly and instruct contractors to cover the perimeter with cordons to minimise dust pollution and sprinkle the grounds frequently to prevent dispersal of dust. Results of laboratory tests for ambient area whilst excavation was in progress indicate that the local area has not been impaired in terms of air quality due to dust dispersal.

7.4.6. NOISE

Unwanted noise can likewise be generated by machinery and equipment deployed during construction, causing annoyance and discomfort for users and neighbours.

Mitigation Measures

Noise levels were tested on 04–05 December 2025 while some works were being carried out and machinery was under deployment. Noise readings indicate that no excessive noise is being created from machinery, primarily because the equipment was new and under good maintenance. The construction crew assured that all machinery to be used during construction would be of high quality and thus prevent creation of excessive noise. Vehicles especially will be of recent vintage and fitted with silencers that reduces noise during operation.

7.4.7. WASTE STREAMS

Waste generated at site can be liquid as well as solid waste. Liquid waste consists of oils and oily water from maintenance of equipment and vehicles, accidental leakage or spillage from vehicles, equipment or storage, wastewater from construction activities and domestic sewerage from the project office and construction camp.

Mitigation Measures

No vehicles and equipment shall be repaired at the project site, thus eliminating spillage of oils or oily water that can damage sub-soil. The contractor has issued instructions to foremen and workers that any leaks from machines and equipment during use must be scooped up immediately and placed in dedicated bins. Alternatively, grey water will be sprinkled on unpaved sections within the construction site. Sieved substances, which will be dumped at municipal waste disposal sites, will not be of character injurious for the environment. Solid waste will consist of excavated earth, excess or used or rejected construction materials, scrap, warehouse waste, workshop waste and domestic solid waste from the project office and construction camp.

It will be ensured that liquid and solid waste is minimised and that all form of waste is carried away from the project site and disposed in a manner whereby it does not impinge on local environment. All solid waste will be collected at the site at designated spots from where it shall be removed to municipal skips on a regular basis by the waste management contractor. Excavated earth will be used for landscaping or sold for reuse. No excavated earth shall be dumped either on adjoining properties. Complaints from neighbours, if any, regarding inappropriate disposal of solid waste shall be attended to on top priority. Recycling or reuse of waste material shall be the preferred option but when not practical, solid waste will be treated and disposed of appropriately.

7.4.8. WASTE MANAGEMENT CONTRACTOR

Construction projects involving estate development create a great deal of liquid as well as solid waste that can impair local environment. Steps thus need to be taken to ensure appropriate collection and disposal of all forms of waste.

Mitigation Measures

A waste management contractor shall be prearranged to carry away all forms of waste from the project site for disposal in an environment-friendly manner at the nearest garbage disposal sites, identified by municipal authorities.

7.4.9. GENERATION OF EMPLOYMENT

A substantial number of site and off-site, direct and indirect jobs shall be created during implementation and operation of the project. A brief explanation of anticipated job creation is as follows:

- Eleven temporary jobs for skilled and semi-skilled workers have been created by the proponents to assemble a project implementation team;
- Twenty permanent jobs shall be created during operation of the project, including both skilled and unskilled workers;
- During full-fledged construction, project implementation will involve just over one hundred and fifty workers, with a minimum of twenty-five;
- The estate shall have seven hundred and eighty-one residential units. Abiding by resident profile, there are expected to be at least 1.5 domestic workers (driver/cook/maid/valet/ayah/chowkidar as the case may be) on full-time/part-time basis for each household, which translates into about 1,172 domestic workers skilled and semi-skilled workers;
- Thirty large retail units shall have at least two full-time employees, while the smaller five shall have at least one employee each;
- The number of jobs likely to be created at the school and the club has not been taken into account as yet since this is dependent on the ultimate profile of the two sub-projects, and
- The total number of jobs expected to be generated thus comes to approximately twelve hundred and fifty-seven.

In additional to these, operation of the project will also result in business and additional work opportunities for multiple upstream and downstream businesses and maintenance staff/technicians.

7.5. ENVIRONMENTAL RISK ASSESSMENT FOR CONSTRUCTION-PHASE ACCIDENTS

Construction activities may give rise to accidental events with the potential to affect workers, nearby communities, soil, groundwater, surface-water drains, air quality and project infrastructure. The environmental risk assessment shall therefore identify and evaluate foreseeable accident scenarios associated with excavation, earthworks, heavy machinery, material transport, lifting operations, fuel and chemical storage, electrical works, welding and cutting, confined spaces, temporary structures, worker camps and construction waste handling. Key accident scenarios may include vehicle collisions, overturning of heavy equipment, collapse of excavations or retaining structures, falls from height, dropped loads, electrocution, fire, explosion, fuel or lubricant spills, rupture of water or sewer lines, uncontrolled discharge of concrete wash water, failure of temporary drainage, flooding of excavations, dust or debris

release, and accidental damage to natural drains or surrounding properties. Each scenario shall be assessed in terms of likelihood, consequence, affected receptors and overall risk rating, with particular attention to incidents that could cause fatalities, serious injuries, contamination of soil or groundwater, obstruction of drainage channels, release of hazardous substances, or interruption of access for neighbouring communities and emergency services.

Risk control shall follow the hierarchy of elimination, substitution, engineering controls, administrative controls and personal protective equipment. High-risk works shall be subject to approved method statements, permit-to-work procedures, competent supervision and pre-task hazard assessments. Excavations shall be properly shored, barricaded and inspected; lifting equipment shall be certified and operated by trained personnel; machinery shall be fitted with alarms, guards and fire extinguishers; electrical systems shall be earthed and protected; and hazardous materials shall be stored in labelled containers within impermeable, bunded areas away from drains and water sources. Fuel transfer and equipment maintenance shall be undertaken only in designated areas equipped with spill kits and drainage controls. Emergency access routes shall remain unobstructed, and construction traffic shall be controlled through approved routes, speed limits, flag personnel and vehicle inspection. Contractors shall also maintain arrangements for first aid, firefighting, rescue from confined spaces, evacuation, spill containment, flood response and emergency shutdown.

A Construction Emergency Preparedness and Response Plan shall be prepared before mobilization and shall define responsibilities, communication procedures, emergency contacts, assembly points, evacuation routes, response equipment and coordination with Rescue 1122, firefighting services, nearby healthcare facilities and relevant authorities. All accidents, near misses, spills and environmental incidents shall be reported immediately, investigated to determine root causes and followed by corrective and preventive action. Serious incidents involving injury, fire, significant pollution, community impact or damage to natural drainage shall be notified to the competent authority in accordance with applicable requirements. Regular emergency drills, toolbox talks, equipment inspections and contractor audits shall be undertaken throughout construction. The Environmental Management and Monitoring Plan shall include measurable indicators such as number of accidents and near misses, spill volume, emergency-response time, percentage of workers trained, inspection compliance, corrective-action closure and recurrence of similar incidents. Construction shall be suspended where an imminent danger or uncontrolled environmental risk is

identified and shall only resume after the hazard has been removed and the responsible engineer and environmental officer have confirmed that adequate controls are in place.

7.6. ENVIRONMENTAL IMPACTS DURING PROJECT OPERATION PHASE

7.6.1. PHYSICAL ENVIRONMENT

- The Project operation will result into generation of substantial quantities of solid waste from the residential and commercial activities. This waste may have significant impact on soil if a proper arrangement for its disposal is not made. In addition it will enhance aesthetic pollution and unhygienic conditions. In order to assess the impacts and proper designing of disposal system, it is imperative to quantify the solid waste generation, to assess its characterization and preparation of waste management plan. Similarly, unmanaged disposal of liquid waste will also cause the contamination of land resources.
- On account of increased population (both local as well as visitors), there will be a significant increase in the sewage. It shall lead to further pollution of the available surface water resources.
- With the establishment of new neighborhood centers, new schools, colleges, hospitals and recreation centers, there will be an increased stress on the already scarce drinking water resources.
- Surface run-off from the impervious surface of the carriageway or hillside slopes can aggravate the flooding of embankment during the operation stage.
- If cross-drainage structures like culverts are not adequately maintained and cleaned, natural streams/nullahs tend to become choked with debris and eroded soil, adversely affecting the quality of surface water and pounding in the Project Area.
- Increased traffic load as a result of project operation will result in the emission of exhaust gases. This will in turn rise to some extent, the level of particulates and gaseous pollutants in the ambient air.
- The noise pollution will be lesser than the construction phase. However, it will definitely be more than pre-construction stage on account of increase in traffic on the newly constructed and widened roads there will be an increased noise. However, it is expected that resultant sound level will remain well within the NEQS limits.

Mitigation Measures

- To cater the existing and future solid waste management of the town, a separate solid waste management system needs to be developed and implemented.

- Proper monitoring of the soil erosion and landslide prone areas should be carried out during operation phase and soil conservation measures (if needed) will be carried out like provision of physical structures e.g. retaining walls, etc.
- Central wastewater treatment plant should be provided having the capacity for treatment of sewage of entire town and industrial estate.
- For air and noise quality, a monitoring system will be established by Gulberg Greens to ensure that ambient air and noise levels are within permissible limits.
- To reduce noise levels, if deemed necessary, provision of thick tree plantation, noise barriers and double glazed windows will be assessed as per site conditions.

7.6.2. ECOLOGICAL ENVIRONMENT

- There will be no further damage to the vegetation of the tract during operation stage.
- As the flora and fauna are interdependent, improvement of the flora through plantation shall be a source of attraction for the fauna, especially the avifauna or the birds. The birds, who were scared away during the construction stage, shall return to the Project Area during this stage.

Mitigation Measures

- In order to rectify the loss of habitat due to cutting/removal of trees, extensive planting shall be carried out along the both sides of existing and proposed roads, in the compounds of buildings, play grounds, parks and recreation centers, along nullahs and in all other available open spaces
- Fauna depends upon flora of a place. With the improvement of flora the fauna and especially the avi-fauna shall be attracted again to the site and negative impacts on fauna shall be mitigated to a great extent.

7.6.3. SOCIO-CULTURAL ENVIRONMENT

- Increased number of people will be a positive impact regarding the local business of the shopkeepers, hotels and food stalls. However, this increased number of visitors may become a threat to the available natural resources including water, fire wood, etc. This will also create uneasiness to the locals.
- There may be some cultural conflicts due to the visit of the Project Area by the outsiders particularly foreigners.

Mitigation Measures

- Provision of water supply and other resources should be made by assessing the potential visitors at operation stage.
- To protect the forest and other plantation of the Project Area, it is recommended that gas cylinders should be provided by the town management at subsidized rates.

7.7. CUMULATIVE IMPACT ASSESSMENT

The cumulative impact assessment has been undertaken to evaluate the combined environmental and social effects of the Revised and Extended Layout Plan of Gulberg Green together with existing, approved and reasonably foreseeable developments within Zone IV of Islamabad. The assessment recognizes that the environmental effects of a large housing scheme cannot be evaluated solely within its administrative boundary because groundwater resources, natural drainage systems, road networks, airsheds, municipal services and ecological corridors are shared with adjacent housing schemes, commercial areas, villages, agricultural land and infrastructure developments. The project is located within an area already undergoing progressive urbanization and is surrounded by agricultural land, existing settlements, the Islamabad Highway, natural drains and the Korang River catchment. The existing EIA also identifies substantial operational demands relating to water supply, wastewater generation, solid waste management, stormwater runoff and traffic, which may interact with similar pressures generated by surrounding developments.

For the purpose of this assessment, the cumulative study area extends beyond the project boundary and includes adjacent housing schemes, existing and proposed commercial developments, major and secondary roads, nearby villages, agricultural areas, public utilities, natural drainage channels and downstream receptors within the Korang River catchment. The assessment considers existing conditions, impacts associated with the proposed project, impacts from other developments and the combined future condition under progressive urban growth. Particular attention has been given to cumulative groundwater abstraction, wastewater generation, stormwater runoff, traffic congestion, vehicular emissions, noise, solid waste generation, loss of open land, ecological fragmentation and increased pressure on public infrastructure. The cumulative assessment also considers temporal interactions, including simultaneous construction activities, phased occupation of adjoining schemes and long-term operational growth.

The most significant cumulative concern relates to water availability. The project proposes substantial water demand and anticipates groundwater abstraction as part of the water-supply system. The existing report estimates total water demand at approximately 13.76 MGD, although this figure requires reconciliation with the approved population and land-use calculations. When combined with abstraction by existing Gulberg Green areas, adjoining housing schemes, commercial establishments, villages and agricultural users, the cumulative demand may exceed local aquifer recharge and sustainable yield. This may result in declining groundwater levels, reduced yields of community wells, higher pumping costs, deterioration of groundwater quality and conflict among users. Accordingly, project abstraction shall not be assessed in isolation. A cumulative groundwater balance and groundwater model shall be prepared using existing and projected abstraction data from the wider influence area. Development phasing and occupancy shall be linked to demonstrated sustainable water availability, and groundwater dependence shall be reduced through treated-effluent reuse, rainwater harvesting, water-efficient fixtures, leakage control and alternative bulk-water supply where available.

Cumulative wastewater impacts may arise where multiple housing schemes and commercial developments discharge treated, partially treated or untreated sewage into the same natural drainage system. Even where individual discharges comply with regulatory limits, the combined pollutant load may reduce the assimilative capacity of local drains and adversely affect the Korang River catchment. Potential cumulative effects include increased biochemical oxygen demand, nutrient enrichment, microbial contamination, odour, algal growth, deterioration of aquatic habitat and public-health risks. The project shall therefore maximize reuse of treated effluent and minimize residual discharge. Any surplus discharge shall be assessed in relation to the existing upstream water quality, downstream flow, other discharge points and the total pollutant load entering the receiving environment. Upstream and downstream monitoring shall be maintained to determine whether cumulative deterioration is occurring. Where receiving-water capacity is limited, stricter project-specific discharge targets, additional treatment or zero-discharge measures shall be considered.

Stormwater and flood risk may also increase cumulatively as open and agricultural land is converted into roads, roofs, parking areas and other impervious surfaces. Development within individual schemes may accelerate runoff and transfer flood risk downstream, particularly where natural drainage paths are constricted, filled or realigned. The combined effect of multiple developments may result in higher peak

flows, erosion of natural drains, sedimentation, localized flooding and increased hydraulic pressure on downstream infrastructure. The project shall therefore preserve natural drainage corridors, maintain appropriate buffers, provide detention and retention capacity, promote infiltration and incorporate climate-adjusted stormwater modelling. The drainage assessment shall consider runoff contributions from adjoining catchments and shall not assume that the project drainage network operates independently of surrounding development.

Traffic and transportation impacts are expected to accumulate as residential, commercial and institutional developments generate additional trips on the Islamabad Highway, access roads and internal road networks. The combined increase in traffic may cause congestion, reduced level of service, longer travel times, increased accident risk, obstruction of emergency access and elevated emissions of particulate matter, nitrogen oxides and carbon monoxide. Simultaneous construction activities in nearby developments may further increase heavy-vehicle movement, road dust and noise. A cumulative Traffic Impact Assessment shall therefore include existing traffic, committed development traffic, future background growth and project-generated traffic. Mitigation shall include phased access development, intersection improvements, traffic signalization where required, construction vehicle scheduling, pedestrian facilities, public-transport linkages, parking management and coordination with CDA and traffic authorities.

Cumulative air-quality and noise impacts may arise from traffic growth, construction machinery, diesel generators, commercial activities, road dust and concurrent construction within nearby schemes. Although individual sources may appear minor, their combined contribution may cause persistent deterioration at residential receptors, schools, healthcare facilities and roadside communities. The project shall undertake receptor-based air and noise monitoring, coordinate construction schedules where feasible, enforce equipment and vehicle emission controls, restrict high-noise activities to approved hours, stabilize exposed surfaces and maintain green buffers along roads and sensitive boundaries. Where monitoring indicates progressive deterioration from baseline conditions, additional controls shall be implemented.

The combined development of housing schemes and commercial areas will also increase municipal solid waste generation. Cumulative impacts may include overloading of collection systems, unauthorized dumping, open burning, littering of drains and reduced capacity at disposal facilities. The project shall establish a formal agreement with an authorized waste-management service and shall implement

segregation, recycling, covered storage, scheduled collection, transportation manifests and disposal at an approved facility. Waste-management planning shall consider not only project-generated waste but also the capacity and reliability of the wider municipal system serving Zone IV.

Urban expansion may progressively reduce agricultural land, open space, vegetation cover and ecological connectivity. Natural drains and riparian areas may become isolated between roads and built-up areas, reducing their capacity to support wildlife movement, groundwater recharge and flood conveyance. The cumulative ecological impact is therefore greater than the loss caused by any single development. The project shall protect designated green spaces, natural drainage corridors, mature trees and riparian vegetation, and shall use native species in landscaping. Ecological buffers shall be maintained between development and sensitive drainage features, and compensatory plantation shall be implemented where vegetation removal is unavoidable.

Cumulative pressure may also arise on electricity supply, water distribution, sewerage systems, emergency services, healthcare, schools and road infrastructure. Occupation of new development phases shall not proceed unless the required service capacity has been confirmed. The proponent shall coordinate with CDA, utility providers and relevant public agencies to ensure that project demand does not result in unacceptable deterioration of service levels for existing communities. Infrastructure capacity shall be reviewed before each major development phase and upgraded where required.

Based on the assessment, cumulative impacts are considered potentially significant for groundwater, wastewater, drainage, traffic, air quality, solid waste, ecological connectivity and public infrastructure. These impacts can be reduced through coordinated regional planning, phased development, infrastructure-capacity verification, integrated water management, strict STP performance, stormwater detention, traffic improvements, environmental monitoring and cooperation with adjoining developments and regulatory agencies. A cumulative impact monitoring programme shall therefore be incorporated into the Environmental Management and Monitoring Plan. The programme shall establish indicators, thresholds, responsibilities and corrective actions for groundwater decline, traffic congestion, receiving-water deterioration, drainage capacity, air quality, noise, waste accumulation and ecological loss. The cumulative assessment shall be updated whenever a major adjoining development, infrastructure project or material change in project density is approved, because cumulative conditions within Zone IV are expected to evolve over time.

8. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The goal of the Environmental Management and Monitoring Plan (EMMP) is to ensure that all the necessary corrective actions are carried out to counter any adverse environmental impacts and that enhancement measures are used where feasible and practical. One of the aims of the monitoring program is to actually observe and analyze these impacts, thereby providing the information to help in the modification of mitigation measures to reduce the risks, hazards and associated with this development Projects.

8.1. GENERAL

For the effective implementation and management of the proposed mitigation measures, it is necessary to develop an EMMP which basically provides a delivery mechanism to address the potential impacts of the Project activities and to develop a monitoring program in order to minimize the potential impacts during the construction and operational stages of the Project. The EMP has been prepared with an objective of:

- Outlining the mitigation measures required for avoiding or minimizing the potential impacts assessed by EIA.
- Developing a monitoring mechanisms and identifying the requisite monitoring parameters to confirm effectiveness of the mitigation measures recommended in the EIA.
- Defining roles and responsibilities of the Project proponent for the implementation of EMP and identifying areas where these roles and responsibilities can be shared with other parties involved in the execution and monitoring of the Project.
- Defining the requirements necessary for documenting compliance with the EMP and communicating it to all the concerned regulatory agencies.
- Prescribing the mechanisms with which consultation with stakeholders during the Project will be maintained.

8.2. STRUCTURE OF EMMP

The Environmental Management and Monitoring Plan (EMMP) is designed to ensure that all environmental safeguards are properly implemented throughout the planning, construction, and operational phases of the project. The EMMP comprises several key components. It begins with a review of the applicable environmental legislation, regulatory guidelines, and national standards to ensure full compliance with all statutory requirements. An organizational structure is then defined, clearly outlining the roles and responsibilities of the project proponent, contractor, supervising consultants, and relevant authorities for effective environmental oversight.

A Mitigation Management Matrix (MMM) is developed to identify all potential environmental impacts along with corresponding mitigation measures, responsible parties, performance criteria, and timelines. This matrix serves as the core tool for managing environmental risks during project execution. In parallel, an environmental monitoring program establishes parameters to be monitored, methods of measurement, monitoring frequency, reporting formats, and corrective action procedures, ensuring that environmental performance remains within acceptable limits.

Effective communication and documentation protocols are included to maintain transparent information flow, proper record-keeping, and timely reporting to regulatory bodies. A change management plan is incorporated to address any unforeseen modifications in project scope or environmental conditions, enabling responsive and adaptive environmental control. Additionally, a training program is integrated into the EMMP to build the capacity of personnel involved in the project, ensuring they are fully aware of environmental obligations and are capable of carrying out all required mitigation and monitoring measures.

8.3. LEGISLATION, GUIDELINES AND ENVIRONMENTAL STANDARDS

The project will be implemented in full compliance with the environmental regulatory framework of Pakistan. Key legal instruments applicable to the project include the Pakistan Environmental Protection Act (PEPA), 1997, the Land Acquisition Act (LAA), 1894, the Forest Regulations, 1930, and the Wildlife Protection, Preservation, Conservation and Management Act, 1975. These laws collectively provide the basis for environmental protection, land use regulation, biodiversity conservation, and

responsible project development. All project activities will adhere to the requirements stipulated by federal and local authorities to ensure that the environment and surrounding communities remain protected throughout the project life cycle.

To verify compliance with legal and environmental obligations, relevant standards and guidelines from the National Environmental Quality Standards (NEQS) of Pakistan and international best practices (where applicable) will be applied across various environmental components. The following standards will be particularly adopted during the construction and operational phases.

8.3.1. EFFLUENTS

The NEQS of Pakistan will be used for effluents. The NEQS for municipal effluents define the maximum allowable concentration of pollutants in effluents released into different types of receiving bodies. This standard will apply to all effluents from Project facilities. *Annexure-F for NEQS*

8.3.2. AMBIENT AIR QUALITY

Project operations must ensure that ambient air quality remains within the limits prescribed under the NEQS. These standards regulate levels of particulate matter, nitrogen oxides, sulfur oxides, carbon monoxide, and other pollutants to protect public health and environmental quality. Standards are attached at*Annexure-F for NEQS*

8.3.3. NOISE

Vehicle movement, construction machinery and equipment may generate noise. NEQS-prescribed limits for ambient noise and vehicle-generated noise will be applied. Necessary mitigation such as silencers, scheduling noisy activities during daytime and equipment maintenance will be implemented. Reference values are provided in *Annexure-F for NEQS*

8.3.4. DRINKING WATER

Water supplied for labor camps and workers' consumption must meet safety criteria. The World Health Organization (WHO) drinking water guidelines will be adopted as reference standards to ensure safe water quality. Relevant parameters are listed in *Annexure-F*

8.4. ROLES AND RESPONSIBILITIES

The following organizations would be involved in the implementation of the proposed Project: District Heads of various departments, such as CDA, Highways, Buildings, Public Health Engineering, who will be the executors of the EMMP, through the Project Contractors.

- Supervisory Consultants at Execution Stage as the monitor of the EMMP.
- Contractor (s) responsible for implementation of the EMMP.

8.4.1. IBECHS

The Project Proponent will hold primary responsibility for ensuring effective implementation of the Environmental Management and Monitoring Plan (EMMP) throughout the planning, design, and construction phases of the project. During construction, all contractors engaged under different work packages will be obligated to execute their activities in full compliance with the EMMP requirements and relevant national environmental regulations. It is recommended that a dedicated Environmental Officer (EO), be deployed on-site by the Project Proponent to oversee adherence to the approved environmental measures during both design and implementation.

In the operational stage, the respective operational departments will be accountable for applying all mitigation measures assigned to them, while the regulatory oversight including monitoring of operation and maintenance (O&M) activities will be carried out through the Environmental Officer to ensure continued compliance with the EMMP. The detailed allocation of responsibilities for each stage of the project is outlined in the following sections.

8.4.1.1. PLANNING AND DESIGN STAGE

- Setting up systems for environmental management.
- Ensuring that the terms of reference for each Project contractor adequately cover environmental and social issues and participate in short listing where appropriate.
- Ensuring that the Contractors develop and carry out environmental implementation plans that are consistent with the EMMP.
- Supervising environmental assessments, and providing substantial inputs and guidance.

8.4.1.2. PRE-CONSTRUCTION PHASE

- Identifying any problems due to restricted access during construction and verifying whether ramps/diversions have been provided where required.
- Establishing a grievance readdressal committee to ensure fairness and transparency during the resettlement process.
- Ensuring that the Contractor has prepared video of constructions sites as well as areas selected for establishing construction camp and other facilities like asphalt plant, etc. and copies of the same duly received.

8.4.1.3. CONSTRUCTION PHASE

- Liaising between Project staff of different departments including Capital Development Authority, Highway Department, Public Health Department, etc. and the Supervision Consultant's staff to monitor environmental compliance during construction.
- Supervising and providing technical support to Project and operations staff to help ensure compliance with the EMP.

8.4.1.4. OPERATION STAGE

- Coordinating with the operations staff working under the different departments including Heath, Education, Forest and other relevant departments to monitor environmental compliance during operation of Project facilities.
- Reporting on the progress of environmental compliance to the Environmental Officer, EPA.
- Assessing the long-term environmental impact of operation of the Project facilities.

8.4.2. SUPERVISORY CONSULTANTS

Supervisory Consultant (SC) will be responsible for following activities:

- Supervising the Project's Contractors and ensuring that all contractual obligations related to design and construction, as well as environmental and social compliance are met.
- Ensuring that day-to-day construction activities are carried out in an environmentally sound and sustainable manner.
- Assisting the Project management for coordinating with officials, community groups, government departments, etc. on environmental issues and obtaining the necessary

clearances from the regulatory authorities.

- Monitoring of the environmental aspects of Projects during construction to ensure that the environmental requirements of the contract and the mitigation measures proposed in the EMP are implemented.
- Supervising contractors and preparing environmental input to the quarterly progress report.
- Developing guidelines and a code of good practice descriAg low-cost environmental measures that can be implemented in the construction and maintenance programs.
- Developing and conducting environmental training activities for contractors and the supervision consultant staff.
- Ensure that asphalt plants, construction camps and other facilities are properly sited and installed in accordance with the contract.
- Determine the timing and exact locations of both baseline and routine air, noise and vibration, and water quality monitoring in accordance with the contract provisions (if any).
- Undertake critically important routine visual monitoring of construction, waste disposal and overall environmental management practices by the Contractors. Effective environmental management during construction will require frequent site visits and observation skills.
- Devise solutions to environmental issues as they arise. Developmental Projects inevitably give rise to problems of excessive dust, noise levels and other impacts that are in some instances unavoidable. Good construction supervision requires that every effort be made to minimize these impacts. A team approach is essential. Environmental issues are entwined with those of safety, traffic management and community relations. Circumstances will arise that will require creative solutions based on circumstances as they are encountered.
- Check that the Contractor backfills, compacts, and leaves the ground in the original condition after excavation of pits for subsurface investigations/borrow pits.
- Keep checks and controls so that the pollution of land and water resources due to the spills of lubricants, fuel, chemicals, and other wastes does not take place.
- To see that the Contractor keeps the damages to the minimum while making tracks for accessibility and that the damage is rectified properly.
- Monitor that the Contractor uses such working methodology so as not to cause disturbance to the communities by fugitive dust, noise, fumes, etc.

- Monitor that the Contractor adjusts his working hours during the construction activities in such a manner that it causes least inconvenience to the local population.
- To keep the working site/camps tidy so as to avoid unhealthy impacts on the work force.

8.4.3. CONTRACTOR

As referred earlier, implementation of the EMP will be the sole responsibility of the Contractor. All the environmental measures related with construction activities will be implemented by the contractors.

8.5. ENVIRONMENTAL MITIGATION MANAGEMENT MATRIX

The environmental protection and enhancement are achieved in various ways. These approaches should begin right at the embryonic stage, i.e. i) Project location, ii) Design, specifications, iii) Construction activities and iv) Post completion activities i.e. operation and maintenance stage. Appropriate environmental management measures are required to be exercised in a cascade order by the Project proponent at each stage of the Project.

In this way, it is envisaged that the Project will achieve maximum ongoing cost-effectiveness, environmental sustainability and social soundness, far beyond the end of implementation of the Project. All the stages of the Project have to be managed by adopting the proposed environmental mitigation measures, where, besides engineering aspects, due importance is to be accorded to mitigation measures which make a perfect blending with the surrounding ecosystem.

The key environmental and social issues, which have already been discussed, are as under:

- Contamination of air, water and soil during the construction and operation stages
- Soil erosion and soil contamination at construction and operation stages.
- Impact of noise generated by vehicles, machinery and equipment during the construction activities
- Impact on community and work force safety as a result of accident hazards during the construction and operation of the project
- Gender Issues.

MMM is provided below, which establishes the linkages between the environmental and social impacts, mitigation strategy and the agencies responsible for execution. The MMM identify:

- The required mitigation measures recommended in EIA.
- The person/organization directly responsible for adhering to or executing the required mitigation measures.
- The person/organization responsible for ensuring and monitoring adherence to the mitigation measures.
- The parameters which will be monitored to ensure compliance with the mitigation measures.
- The timing at which the mitigation or monitoring has to be carried out.

Table 8-1: Site-Specific EMMP Indicators, Trigger Thresholds and Corrective Actions

Environmental issue	*Monitoring indicator*	*Normal condition*	*Alert trigger*	*Non-compliance or emergency trigger*	*Required corrective action*	*Action timeline*	*Responsibility*
Groundwater abstraction	Groundwater abstraction from each operational bore, recorded in m³/day	Abstraction remains within the approved water balance, bore capacity, and authorization conditions	Monthly abstraction exceeds the approved allocation by more than 10%, or abstraction shows an increasing trend for two consecutive months	Abstraction exceeds the approved allocation by more than 20%, an unauthorized bore is operated, or pumping continues despite a significant decline in groundwater level	Reduce pumping; inspect leakage and distribution losses; implement water conservation measures; increase treated wastewater reuse; suspend unauthorized bore operation; review water balance	Alert action within 7 days; serious exceedance within 24 hours	IBECHS Estate Management, Water Supply Operator and Environmental Officer
Groundwater level	Static and pumping water levels in designated monitoring wells	Seasonal fluctuation remains within the hydrogeological baseline range	Decline of more than 1.0 m from the corresponding seasonal baseline, or continuous decline over three monitoring rounds	Decline of more than 2.0 m from the seasonal baseline, rapid drawdown, failure of nearby community wells, or verified complaint regarding loss of water availability	Verify monitoring results; inspect pumping rates; reduce abstraction; conduct hydrogeological review; provide an alternative water supply where project abstraction affects nearby users	Verification within 48 hours; pumping reduction within 24 hours after confirmation; hydrogeological review within 15 days	IBECHS, Environmental Officer and Qualified Hydrogeologist
Groundwater quality	pH, TDS, turbidity, nitrate,	Parameters comply with applicable drinking-water	Any parameter reaches 80% of its applicable	Any parameter exceeds the applicable	Repeat sampling; identify source; isolate	Repeat sampling within 48 hours; immediate isolation	Environmental Officer, Water Supply Operator and

	chloride, sulphate, hardness, total coliforms, E. coli and relevant heavy metals	standards and baseline trends	permissible limit, or deteriorates materially compared with the established baseline	standard, E. coli is detected, or contamination associated with sewage, waste, fuel, or chemical handling is identified	contaminated bore where necessary; repair leaking sewer or storage facility; provide an alternative safe water supply; undertake remediation	for microbiological contamination; corrective action plan within 7 days	Accredited Laboratory
STP hydraulic loading	Daily sewage inflow compared with STP design capacity	Average daily inflow remains at or below 80% of design capacity	Average daily inflow exceeds 80% of capacity for seven consecutive days, or peak flow exceeds 90%	Inflow exceeds design capacity, untreated bypass occurs, sewage backs up into the collection system, or overflow reaches a drain, watercourse, road, or property	Optimize plant operation; repair pumps and screens; arrange standby pumping or temporary storage; restrict new connections where necessary; upgrade capacity	Alert response within 7 days; overflow containment immediately and within 2 hours	STP Operator and IBECHS Estate Management
Treated effluent quality	pH, BOD_5, COD, TSS, oil and grease, faecal coliforms and other applicable NEQS parameters	Effluent complies with applicable NEQS and approved reuse requirements	A parameter reaches 80% of the applicable limit or shows repeated deterioration during two monitoring events	Any applicable limit is exceeded, untreated sewage is discharged, or treated effluent is released through an unauthorized outlet	Stop or control discharge where practicable; recirculate or temporarily store wastewater; inspect aeration, dosing and sludge systems; undertake repeat testing; implement process correction	Initial action within 2 hours; repeat testing within 24 to 48 hours; corrective action report within 3 days	STP Operator, Environmental Officer and Accredited Laboratory

Sewage overflow and sewer blockage	Number, duration and location of sewer overflow incidents	No sewage overflow or persistent blockage	Repeated choking, surcharging, odor complaint, or one overflow contained within the sewer corridor	Overflow continues for more than 30 minutes, enters a public area or drain, affects a residence, or creates a public-health risk	Barricade and contain area; deploy suction tanker; clear blockage; disinfect affected area; repair damaged sewer; notify affected community	Mobilization within 30 minutes; containment within 2 hours; permanent repair within 24 hours where feasible	Sewerage Maintenance Team and Estate Manager
STP operational reliability	Availability of pumps, blowers, power supply, alarms, standby units and disinfection system	Critical equipment operational and standby system available	One standby unit unavailable for more than 24 hours or repeated alarm activation	Failure of a critical process unit with no functional standby, power failure causing untreated discharge, or failure lasting more than 2 hours	Activate standby system; arrange generator or temporary pumping; repair or replace equipment; suspend influent connections if necessary	Immediate response; standby activation within 15 minutes; repair initiated within 2 hours	STP Operator and Electrical/Mechanical Maintenance Team
Traffic volume and congestion	Peak-hour traffic volume, queue length, travel time and intersection performance	Traffic remains within the level assessed in the approved Traffic Impact Assessment and no persistent congestion occurs	Peak-hour volume exceeds forecast by more than 10%, queues obstruct internal intersections, or travel time increases by more than 15%	Peak-hour volume exceeds forecast by more than 20%, queue spills onto an external road, emergency access is obstructed, or repeated community complaints are received	Adjust access control; stagger construction deliveries; deploy traffic marshals; modify signal or junction management; prohibit roadside parking; update traffic management arrangements	Traffic marshals immediately; operational correction within 7 days; engineering modification plan within 30 days	IBECHS, Contractor and Traffic Management Team

Construction traffic emissions	Visible exhaust, vehicle condition, maintenance records, PM_{10}, $PM_{2.5}$, NO_2 and CO at access routes and sensitive receptors	Vehicles are maintained, no persistent visible smoke is observed, and ambient air remains within applicable standards	Persistent visible smoke, repeated idling, missing maintenance record, or pollutant concentration reaches 80% of the applicable limit	Applicable ambient air standard is exceeded or a visibly polluting vehicle continues operation after warning	Remove vehicle or machinery from service; undertake maintenance; enforce no-idling; cover trucks; improve route and delivery scheduling; increase dust suppression	Polluting vehicle removed immediately; maintenance before re-entry; corrective measures within 24 hours	Contractor and Environmental Officer
Operational traffic emissions	PM_{10}, $PM_{2.5}$, NO_2 and CO at main access road, commercial areas, schools and other sensitive receptors	Concentrations remain within applicable ambient air standards	Concentration reaches 80% of the standard or shows an increasing trend over two consecutive quarters	Applicable standard is exceeded or complaints indicate persistent exposure at sensitive receptors	Review traffic circulation; restrict heavy vehicles during peak hours; improve road surface and roadside plantation; prohibit prolonged idling; coordinate traffic-control measures with relevant authorities	Investigation within 48 hours; corrective plan within 15 days	IBECHS and Environmental Officer
Traffic safety	Number of accidents, near misses, pedestrian conflicts, speeding incidents and blocked	No serious accident and emergency access remains unobstructed	Repeated near misses, speeding complaint, inadequate signs or one minor accident	Fatal or serious accident, recurring accident at the same location, or blocked fire and emergency access	Secure scene; notify emergency services; investigate root cause; install speed controls, markings, barriers, lighting or pedestrian facilities;	Emergency response immediately; investigation within 24 hours; permanent corrective action within 15 days	IBECHS, Contractor and Security/Traffic Team

	emergency routes				revise traffic management plan		
Environmental complaints	Number and type of substantiated complaints concerning water, sewage, odor, dust, noise and traffic	Complaint acknowledged and resolved within the defined grievance timeline	More than three similar substantiated complaints in one month or repeated complaint from the same location	Serious public-health complaint, unresolved complaint beyond the allowed period, or evidence of recurring environmental harm	Conduct site inspection; communicate with complainant; identify root cause; implement corrective action; verify closure and record satisfaction status	Acknowledgement within 24 hours; inspection within 48 hours; closure normally within 7 days	Environmental Officer and Grievance Redress Committee

8.6. ENVIRONMENTAL MONITORING PROGRAM

For the Gulberg Greens, Zone-IV, Islamabad, the Environmental Management Plan (EMP) serves as a vital strategic tool to ensure that all development activities are executed in an environmentally responsible and sustainable manner. It provides a framework for continuously evaluating the effectiveness of proposed mitigation measures and enables timely corrective actions wherever required. This adaptive approach is essential to maintaining environmental integrity throughout the advancement of the project.

To support this, a well-structured environmental monitoring program has been included, through which the performance of mitigation measures will be regularly assessed against prescribed environmental standards. Effective monitoring is crucial to confirm that environmental quality is maintained and that no unacceptable impacts arise due to construction or operation of project facilities. Without such monitoring, the effectiveness of environmental safeguards cannot be validated.

Therefore, the EMP for Gulberg Greens must be integrated into every phase of the project planning, detailed design, construction, and operation. Its continued application will ensure regulatory compliance, protect natural and community resources, and help achieve long-term sustainability objectives envisioned for this development..

8.6.1. OBJECTIVES

The objective of environmental monitoring during the operation will be as follows:

- To check compliance with the requirements of the EMP by monitoring activities of the Project Contractors on a daily basis. This will be called Activity Monitoring.
- To monitor actual impacts of the Project Activities on physical, biological and socio-economic receptors of the Project Area so that any impacts not anticipated in the EIA or impacts which exceed the levels anticipated in the EIA can be identified and appropriate mitigation measures can be adopted in time. This objective will be achieved through effects monitoring.
- To ascertain residual impacts of the operation. This will be achieved by post-Project monitoring.

To achieve these objectives the following monitoring program will be implemented.

8.6.2. ACTIVITY MONITORING

Responsibility for activity monitoring will be shared among all institutions involved in project implementation and oversight, including the regulatory authority, supervising consultants, and construction contractors. Monitoring will be performed at three levels:

- **Level 1: Monitoring by Pak-EPA:** Pak-EPA will conduct regular field inspections during the construction phase through its designated Environmental Officer(s). These visits will ensure that the project meets regulatory requirements and approved environmental conditions..
- **Level 2: Monitoring by the Supervising Consultant (SC)** Full-time environmental supervision will be maintained. Any non-conformities identified by the SC will be recorded using standardized non-compliance forms and addressed in scheduled environmental review meetings.
- **Level 3: Monitoring by the Contractor** Contractor's environmental officers will conduct routine inspections and ensure implementation of mitigation measures as prescribed in the Mitigation Management Matrix (MMM). Compliance records will be submitted to the Supervising Consultant and the regulatory authority for verification.

The detailed compliance monitoring protocol for physical environmental parameters is provided in **Table 7.1**. This multi-tiered monitoring approach ensures continuous tracking, timely reporting, and corrective action for all environmental issues encountered during project execution.

8.7. MONITORING LOCATIONS AND FREQUENCIES

The existing EMMP provides general monitoring for water, ambient air, noise and other environmental receptors. The following site-specific monitoring requirements shall supplement those provisions.

Table 8-2: Site-Specific Monitoring Schedule

Environmental parameter	*Monitoring locations*	*Construction phase frequency*	*Operation phase frequency*	*Reporting requirement*
Groundwater abstraction	Every production bore and bulk water-supply point	Monthly where construction water is abstracted	Continuous metering with monthly consolidation	Monthly water-use statement

Static groundwater level	Representative monitoring wells, including up-gradient, within-project and down-gradient locations	Monthly	Monthly for the first two years, thereafter quarterly subject to stable results	Monthly/quarterly groundwater trend graph
Groundwater quality	Representative drinking-water and monitoring wells	Quarterly and following any spill or sewage incident	Six-monthly, and immediately following suspected contamination	Laboratory report and comparison with baseline
STP inflow and treated flow	STP inlet and outlet	Not applicable until commissioning	Continuous flow metering with daily log	Monthly STP operating report
Treated effluent quality	Final STP outlet and reuse/discharge point	During commissioning and trial operation	Monthly, or at a greater frequency required by Pak-EPA	Laboratory results included in quarterly environmental report
Sewer overflow and blockage	Sewer network, pumping stations, low points and complaint locations	Weekly inspection where systems are commissioned	Routine daily observation and monthly preventive inspection	Incident report for every overflow
Ambient air quality	Main access road, commercial areas and sensitive receptors including schools and healthcare facilities	Monthly during intensive construction	Quarterly	Monitoring report with trend analysis
Traffic volume and queue conditions	Main entrance, Islamabad Expressway connection, major internal intersections and commercial areas	Quarterly and during peak construction deliveries	Six-monthly for the first two years and after major occupancy increase	Traffic monitoring statement

Traffic safety	Main entrance, school zones, commercial areas, sharp bends and emergency routes	Weekly inspection	Monthly inspection	Accident and near-miss register
Environmental complaints	Project office and affected community locations	Continuous registration and monthly review	Continuous registration and monthly review	Complaint register appended to environmental report

8.8. COMPLIANCE TIMELINES AND ESCALATION PROCEDURE

The following escalation process shall apply to all environmental non-compliances:

- Observation and recording: The Environmental Officer or monitoring team shall immediately record the non-compliance in the Environmental Non-Compliance Register.
- Immediate containment: Where the event involves sewage overflow, contaminated discharge, serious air pollution, blocked emergency access, groundwater contamination, spill, or risk to public health, the responsible activity shall be stopped or controlled immediately.
- Corrective Action Request: The Supervising Consultant or Environmental Officer shall issue a written Corrective Action Request identifying the violation, required action, responsible party, and closure deadline.
- Verification: Closure shall only be accepted after physical inspection, documentary evidence, photographs, monitoring results, or laboratory analysis confirms that the corrective measure has been completed.
- Escalation: Failure to complete the corrective action within the assigned period shall result in escalation to the Project Director, IBECHS management, and, where legally required, Pak-EPA or the concerned authority.

Table 8-3: Non-Compliance Classification and Enforcement Actions

Category	***Description***	***Corrective action deadline***	***Enforcement and escalation***
Minor non-compliance	Administrative omission or isolated failure that has not caused	Within 3 working days	Written observation; corrective action recorded and verified

	environmental harm, such as incomplete record, missing sign, delayed inspection or minor housekeeping issue		
Moderate non-compliance	Repeated minor violation, failure of a mitigation measure, monitoring result approaching a limit, recurring complaint, excessive idling, leakage or poorly controlled waste	Within 24 to 72 hours	Formal Corrective Action Request; warning notice; enhanced monitoring at the responsible party's cost
Major non-compliance	Exceedance of an applicable environmental standard, unauthorized discharge, serious sewage overflow, operation of unauthorized bore, repeated failure to comply, or obstruction of emergency access	Immediate containment and corrective action initiated within 2 hours	Suspension of the relevant activity; recovery of corrective and monitoring costs; notification to senior management and relevant authority
Critical environmental incident	Incident causing or threatening serious harm to public health, groundwater, surface water, community safety or the environment	Immediate emergency response	Stop-work order for affected activity; emergency notification; independent investigation; remediation at responsible party's cost; regulatory action as applicable

8.8.1. POST-PROJECT MONITORING

After completion of the construction, Post-Project monitoring will be carried out. The objective of this monitoring will be to determine the level of residual impacts of the Project on physical, biological and socio-economic receptors of the Project Area. The monitoring may be carried out within one month after the end of all activities in the Project Area. The Post-Project survey report will be submitted within two weeks after completion of the survey.

As part of the Post-Project monitoring field monitors will also check restoration of sites restored at that time according to the requirements of the EIA.

TABLE 8-4 RECOMMENDED COMPLIANCE MONITORING PROTOCOL FOR PHYSICAL, BIOLOGICAL AND SOCIAL ENVIRONMENT

Receptor	*Location*	*Monitoring Mechanism*	*Monitoring and Reporting Frequency*
Water Quality	Points where control of effluents can be easily implemented Surface drainage channels Concrete preparation plants Workers camp sewage treatment facility Disposal areas of earth fill or solid waste Fuel (Petrol. Oil and Grease) products storages Vehicle and machine repairing and servicing yards Discharge points from commercial establishment, hotels and restaurants. Discharge points from residential areas.	Discrete grab sampling and laboratory testing of water samples.	*Sampling and laboratory testing should be done on 6 month basis during the construction and monthly during operational time.* *Discharges from construction sites should be tested for temperature, pH, electrical conductivity, dissolved oxygen.* *Treated effluent discharges from workers camp to be tested for faecal coliforms, total coliforms, Ammonia, Biochemical Oxygen Demand (BOD5).* *Concrete production effluents to be tested for pH and temperature.* *Outlet and drains from mechanical repair units. include testing for pH, turbidity, lead, hydrocarbons, and oils.*
Dust Emissions	Tracks along the earth roads. At communities close to the access roads.	Visual checks	*Weekly during routine monitoring by activity monitors and reported on a monthly basis during the construction period*
Noise Levels	Camp sites, Selected locations along the access tracks Construction sites of health, education and commercial buildings. Sensitive receptors like schools, hospitals and community centers along roads and commercial buildings during operation stage	Noise meter	*Once prior to the start of construction and then on a monthly basis throughout the construction period.* *Quarterly Once during the operational stage.*
Fumes and gases	Ambient air (w.r.t. proposed land use plan of Master Plan), Silencers of heavy machinery, trucks and other vehicles.	LANCOM-III emissions monitoring system. Monitoring of ambient air quality in ppb.	*Monthly monitoring of air pollution parameters including the NOX, SOX, COX, Lead, Hydrocarbons during construction period and quarterly during operation stage.*
			Biological Environment
Hunting of animals and birds	In all Project Area generally and at construction sites particularly.	Periodic visits of Project Area and in consultation with community to get feed back on hunting by	*Monthly during routine monitoring and reported monthly basis during the construction period and*

		Contractor as well as outsiders	*quarterly monitoring and reporting during operation period.*
			Socio-cultural Environment
Relocation of private and public infrastructure	In all Project Area generally and roads at particularly before construction activities started	Consultations with PAPs	*Monthly during relocation of infrastructure and reporting on monthly basis.*
Inconvenience to community	*All around the Project Area at near by communities*	*Consultations with community to get feed back for incontinence due to construction activities to perform their daily routine matters*	*Monthly during construction period and monthly reporting only during construction period*

TABLE 8-5 RECOMMENDED EFFECTS MONITORING PROTOCOL

Receptor	***Location***	***Monitoring Mechanism***	***Monitoring and Reporting Frequency***
Water Quality	Sampling from points located at a greater distance from the construction sites to ensure they show the influence on wider range of receiving body.	Sampling and laboratory testing of water samples from the receiving body.	*Sampling and laboratory testing should be done on quarterly basis. Parameters to be monitored should be as per standards.*
Air Quality	Hotels premises, residential colonies, schools, hospitals, etc. along roadsides	Ambient air quality monitoring in ppb.	*Quarterly air quality monitoring for NOX, SOX, COX and Hydrocarbons.*
Tree Cutting	Construction sites and near camp site at construction stage and plantation sites during operation stage	Visual checking and consultations with locals Generation rate of new plantation	*Monthly during construction and quarterly during operation stage.*
Compensation, resettlement and dispute resolution	*Construction sites and restoration of borrow areas*	*Consultation with affected persons and owners of the land*	*Monthly during construction*

8.9. POST-APPROVAL ENVIRONMENTAL COMPLIANCE AND THIRD-PARTY AUDIT MECHANISM

Following approval of the EIA, the project proponent shall establish a formal post-approval environmental compliance system to ensure that all conditions imposed by Pak-EPA, commitments contained in the EIA, mitigation measures included in the Environmental Management and Monitoring Plan, and requirements of other relevant authorities are implemented throughout construction and operation. Environmental approval shall not be treated as a one-time procedural requirement; rather, compliance shall be maintained through continuous monitoring, documented implementation,

periodic reporting, corrective action and independent verification. Before commencement of construction, the proponent shall prepare a consolidated Environmental Compliance Register listing every approval condition, EIA commitment, monitoring requirement, permit, NOC, responsible person, implementation deadline, evidence required and compliance status. The register shall be maintained as a live document and updated throughout the project lifecycle. No activity shall proceed where the applicable environmental approval, permit, method statement or mitigation arrangement has not been secured or implemented.

The proponent shall appoint a qualified Environmental Manager or Environmental Compliance Officer with sufficient authority, resources and access to project management to oversee implementation of the approved EMMP. The Environmental Manager shall coordinate with contractors, consultants, estate management, STP operators, waste contractors, laboratories and regulatory authorities and shall maintain all compliance documentation. Each construction contractor shall designate an environment, health and safety focal person responsible for daily implementation at the work site. Environmental obligations shall be incorporated into tender documents, contracts, bills of quantities, method statements and contractor performance evaluations. Non-compliance with environmental requirements shall constitute a contractual breach and may result in corrective instructions, suspension of work, withholding of payment, penalties or termination, depending on the seriousness and recurrence of the violation.

A structured monitoring programme shall be implemented during construction and operation. Construction-phase monitoring shall cover dust, emissions, noise, wastewater, stormwater runoff, soil contamination, waste storage, hazardous materials, traffic, occupational safety, vegetation clearance, community disturbance and protection of natural drains. Operational monitoring shall cover groundwater abstraction and quality, water consumption, STP performance, treated-effluent reuse, sludge management, surface-water quality, stormwater drainage, solid waste, traffic, air quality, noise, landscaping, biodiversity, energy use and climate-resilience indicators. Monitoring shall be undertaken at the locations and frequencies specified in the approved EMMP and shall use calibrated equipment, qualified personnel and accredited laboratories where laboratory analysis is required. The results shall be compared with applicable environmental standards, baseline values, approval conditions and internal trigger thresholds.

The proponent shall submit periodic Environmental Compliance Reports to Pak-EPA at the frequency specified in the environmental approval. Where no reporting frequency is specified, reports should be prepared at least quarterly during major construction and annually during operation, or more frequently where significant environmental risks are present. Each report shall include the status of approval conditions, implementation of mitigation measures, monitoring results, photographs, laboratory reports, waste and sludge disposal records, water abstraction and reuse data, incidents, complaints, non-compliances, corrective actions and outstanding commitments. The report shall clearly distinguish between compliant, partially compliant, non-compliant and not-yet-applicable conditions. Unsupported statements of compliance shall be avoided; each compliance claim shall be supported by verifiable evidence such as inspection records, monitoring results, receipts, permits, photographs, training records or contractor documentation.

In addition to routine internal monitoring, an independent third-party environmental audit shall be undertaken to verify the accuracy of compliance reporting and the effectiveness of environmental controls. The auditor shall be an appropriately qualified and independent environmental consultant or firm with no direct responsibility for the project's EIA preparation, detailed design, construction supervision or routine environmental management, unless the regulatory authority explicitly accepts such an arrangement. The auditor shall have access to the project site, records, personnel, monitoring data, contracts, permits, complaints and incident reports. The scope of the audit shall include compliance with Pak-EPA approval conditions, the EIA and EMMP, applicable environmental standards, water and wastewater requirements, waste and sludge management, groundwater protection, ecological commitments, traffic controls, occupational and community safety, emergency preparedness and implementation of previous corrective actions.

The first third-party audit shall preferably be undertaken within six months of the start of major construction or at another milestone specified by Pak-EPA. Subsequent audits should be conducted annually during active construction and during the initial years of operation, with additional audits triggered by major incidents, repeated non-compliance, substantial changes in project design, significant expansion, failure of pollution-control systems or direction from the regulatory authority. During transition from construction to operation, a pre-commissioning or pre-occupancy environmental audit shall verify that essential infrastructure, including the STP, sewerage network,

stormwater system, water supply, waste-management facilities, emergency systems and monitoring arrangements, is operational before occupancy of the relevant phase.

The third-party audit shall include document review, site inspection, interviews, photographic evidence, verification of monitoring locations, review of laboratory results, checking of permits and manifests, and independent sampling where necessary. Audit findings shall be classified according to significance. A major non-conformity shall include any violation that creates an immediate or substantial risk to human health, groundwater, surface water, natural drains, ecological receptors or surrounding communities, or any failure to comply with a material approval condition. A minor non-conformity shall include a localized or procedural deficiency that does not create an immediate significant impact but requires correction. Observations and opportunities for improvement may also be recorded where existing controls are compliant but could be strengthened.

For every non-conformity, the audit report shall identify the relevant requirement, evidence, root cause, environmental consequence, responsible party, corrective action and completion deadline. Major non-conformities shall require immediate containment and time-bound corrective action and may require suspension of the affected activity. Minor non-conformities shall be corrected within an agreed period. The Environmental Manager shall maintain a Corrective and Preventive Action Register and shall provide documentary evidence of closure. The third-party auditor shall verify closure of significant findings through follow-up review or site inspection. A finding shall not be considered closed solely on the basis of a written assurance from the contractor or proponent.

An environmental incident and non-compliance notification procedure shall also be maintained. Significant spills, uncontrolled wastewater discharge, STP failure, fire, major accident, unauthorized vegetation clearance, damage to natural drains, exceedance of environmental standards or verified community impact shall be reported immediately to project management and to the competent authority within the period specified in the environmental approval or applicable requirements. The initial notification shall be followed by an investigation report describing the incident, affected receptors, immediate response, cause, environmental consequences and corrective measures. Monitoring shall continue until the affected environment has been restored or the authority accepts the remedial action.

A grievance redress mechanism shall operate alongside the compliance and audit system to enable residents, workers and neighbouring communities to report dust,

noise, traffic, water, wastewater, waste, odour, drainage, safety or ecological concerns. Complaints shall be logged, acknowledged, investigated and resolved within defined timeframes. Complaint trends shall be reviewed as part of internal compliance inspections and third-party audits. Repeated complaints concerning the same issue shall be treated as an indicator of ineffective mitigation and shall trigger additional investigation and corrective action.

The project shall maintain an organized environmental recordkeeping system for the full duration of construction and operation. Records shall include the environmental approval, NOCs, permits, compliance register, monitoring data, laboratory certificates, calibration records, inspection checklists, waste manifests, sludge disposal receipts, water abstraction records, STP logs, training records, emergency drills, complaints, incidents, audit reports, corrective-action records and correspondence with authorities. Records shall be retained for the period required by Pak-EPA and shall be made available for regulatory inspection. Electronic records shall be backed up and linked to the relevant approval condition or EMMP requirement to ensure traceability.

Environmental performance shall be reviewed by senior project management at least quarterly during construction and annually during operation. The review shall evaluate monitoring trends, recurring non-compliance, audit findings, complaints, incidents, regulatory directions, adequacy of resources and effectiveness of corrective actions. The EMMP shall be updated where monitoring or audit results demonstrate that existing mitigation measures are ineffective, where environmental conditions change, or where new project activities create risks not adequately covered in the approved documentation. Any material change in project design, land use, density, infrastructure, water source, STP capacity, discharge arrangement or project boundary shall be referred to Pak-EPA to determine whether additional environmental assessment or approval is required.

The results of third-party audits and compliance reporting shall be submitted to Pak-EPA and retained at the project office. A summary of key environmental performance information may also be disclosed to residents and affected communities through the project website, notice board or estate-management office. The disclosure should include monitoring status, major incidents, complaint resolution, STP performance, water-use indicators, waste-management performance and corrective actions, while protecting confidential personal or commercial information.

Through this mechanism, post-approval compliance will be based on measurable performance, documentary evidence, independent verification and timely corrective

action. The proponent shall remain fully responsible for environmental performance and cannot transfer regulatory liability to contractors, consultants, laboratories or third-party auditors. Independent auditing shall supplement, rather than replace, routine environmental management, self-monitoring and regulatory oversight.

8.10. COMMUNICATION AND DOCUMENTATION PLAN

Effective communication, transparent reporting, and proper documentation are essential to ensure that environmental requirements of the Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad are fully complied with during construction and operation. This plan outlines how environmental information will be shared between the Supervising Consultant (SC), the Contractor, and Pak-EPA

8.10.1. KICK-OFF MEETING

One kick off meeting will take place at the main camp of the respective Contractor before the start of construction. The purpose of the kick off meeting will be to demonstrate to the regulator and monitors that all requirements prior to the start of the individual Project activities have been met and the Capital Development Authority, Islamabad EO and concerned department, SC, and contractors are ready to start the Project as per the requirements of the EIA/EMP.

8.10.2. MEETINGS AND REPORTS

Monthly environmental review meetings will be convened at the construction site throughout the construction period. These meetings will provide a forum to:

- Review progress of construction activities
- Discuss environmental performance and any non-compliances identified by SC
- Plan corrective or preventive measures

The SC will prepare Monthly Environmental Reports (MERs) documenting key discussion points and environmental performance during the preceding month.Minimum MER contents:

- Summary of construction progress
- Record of SC and Contractor environmental personnel on site
- Summary of monitoring undertaken

- List of non-compliances and corrective actions

Meetings will be chaired by the SC's Environmental Officer and attended by the Contractor's representatives.

8.10.3. MONTHLY ENVIRONMENTAL REPORT

A MER will be prepared by SC summarizing the Project activities and results of activity and effects monitoring. The MER as a minimum will include the following:

- Summary of Project Activities
- Schedule of SC activity monitoring and effects monitoring team
- Summary of activity and effects monitoring activities
- Statistical record of non-compliances observed during the month
- Summary of the results of Effects Monitoring
- Record of mitigation measures taken or pending
- Record of social complaints
- Record of change managements
- Record of water consumption
- Record of fuel consumption
- MERs will be submitted to concerned departments and will feed into **Quarterly Environmental Reports** submitted to Pak-EPA. Hard copies will be kept on file at the Project Management Office.

8.10.4. SOCIAL COMPLAINTS REGISTER

To ensure that local community concerns are addressed promptly, SC will maintain a **grievance register** recording:

- Nature of complaints
- Location and date
- Actions taken to resolve concerns

Status of complaints will be reviewed during monthly meetings and included in quarterly submissions to Pak-EPA.

8.10.5. CHANGE RECORD REGISTER

Any changes in project design or environmental commitments will be documented in a **Change Management Register**, in accordance with the EMP Change Management Plan. Approval from relevant authorities will be sought, where required.

8.10.6. NON-COMPLIANCE RECORD REGISTER

SC will maintain a **Non-Compliance Register** to document all instances where environmental requirements are not met. Each observation will include:

- Description of non-compliance
- Root cause analysis
- Corrective and preventive actions
- Closure status

A copy of this register will be appended to every MER.

8.10.7. FINAL MONITORING REPORT

Upon completion of construction works, SC will prepare a Final Environmental Monitoring Report, covering:

- Overview of environmental monitoring program
- Natural resource usage (water, fuel, materials)
- Summary and analysis of non-compliances
- Documented environmental effects on communities, wildlife, and physical resources
- Lessons learned and recommendations for future development phases

This report will be submitted to Pak-EPA as a record of environmental performance..

8.10.8. PHOTOGRAPHIC RECORD

SC will maintain a comprehensive photographic record of all environmentally significant locations, including:

- Pre-construction conditions
- Relocation/compensation areas
- Camp sites and access roads
- Monitoring activities and mitigation installations
- Progressive rehabilitation works

These images will serve as visual evidence for compliance assessment and reporting.

8.11. CHANGE MANAGEMENT PLAN

The EIA for the Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad recognizes that certain modifications may become necessary during project implementation and operation. These changes may arise from new site-specific information, monitoring results, regulatory requirements, or evolving environmental conditions. To ensure that any such adjustments are handled in a controlled and responsible manner, a formal Change Management Plan has been established. The plan addresses both:

(i) additions to the EMP, and

(ii) modifications to project activities or operational practices that may trigger updates to the EMP.

8.11.1. ADDITIONS TO THE EMP

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

- A meeting will be held between Capital Development Authority, Islamabad, SC and the concerned Contractor. During the meeting the proposed addition to the EMP will be discussed and agreed upon by all parties.
- Based on the discussion during the meeting, a change report will be produced collectively, which will include the additional EMP clause and the reasons for the addition.
- The report will be signed by all parties and will be final at the site office. A copy of the report will be sent to Capital Development Authority, Islamabad, Contractor and SC head offices. Prior to start of activities as per changes made in EMP, approval will have to be taken from Punjab-EPA.

- All relevant Project personnel will be given information of the addition. These additions will be reported in the MER by SC.

8.11.2. CHANGES TO THE OPERATION

ensures that such modifications are screened, evaluated, documented, and approved at the appropriate level before implementation, so that environmental compliance is maintained at all times.

The Change Management Plan classifies modifications into three categories depending on their potential to alter environmental impacts:

8.11.2.1. FIRST ORDER

First Order Changes refer to any modification that causes a significant deviation from the project description or environmental impacts originally assessed in the EIA. These changes may result in new or increased environmental risks and therefore require formal reassessment and approval by Pak-EPA prior to implementation.

- Under these circumstances, the SC, along with Pak-EPA's designated Environmental Officer, will reassess the potential environmental impacts of the proposed change and submit an updated impact assessment to Pak-EPA for review and approval.

Examples include:

- Any modification in waste handling or disposal that could lead to soil or water contamination, particularly in sensitive environmental zones.
- Failure to meet minimum requirements for Effects Monitoring as stipulated in the EMP.
- Significant alteration to the reporting or stakeholder communication process that compromises the ability to demonstrate environmental compliance

8.11.2.2. SECOND ORDER

Second Order Changes are those that do not substantially alter the original project scope or create significant impacts beyond those assessed in the EIA. These changes may require additional mitigation or precautionary measures but do not necessitate a revised environmental approval.

In such cases, the SC's Environmental Officer will review the proposed modification, assess its potential environmental effects, recommend mitigation (if required), and provide a notification to the concerned department and Pak-EPA as part of routine documentation.

Examples include:

- Adjustment of location for facilities such as parks, schools, or commercial areas without altering the scale of development or environmental assessment outcomes.
- A moderate increase in resource consumption (e.g., water use) that does not negatively affect community supply or environmental flows.
- Minor extension of camp sites or access tracks that does not worsen impacts on vegetation, wildlife, or communities.
- Changes in waste handling procedures that remain within permissible limits and do not risk contamination.

8.11.2.3. THIRD ORDER

Third Order Changes involve minor on-site adjustments made purely to reduce environmental impacts and remain fully within the EIA-assessed limits. These adjustments do not create any additional environmental effect, and no further approval is required.

The only requirement is that such changes are properly logged in the Change Record Register for traceability.

Examples include:

- Small realignment of a road segment to avoid trees or sensitive vegetation.
- Relocation of temporary construction facilities to minimize land clearing or disturbance..

8.12. TRAINING PROGRAM

Environmental training will form part of the environmental management system. The training will be directed towards all personnel for general environmental awareness.

8.12.1. OBJECTIVES

The key objective of training program is to ensure that the requirements of the EMP are clearly understood and followed throughout the Project. The trainings to the staff will help in communicating environmental related restrictions specified in the EIA and EMP.

8.12.2. ROLES AND RESPONSIBILITIES

EO will primarily be responsible for arranging environmental training to all Project personnel on potential environmental issues of the Project. Contractors will be responsible to arrange trainings and ensure the presence of targeted staff. EO will prepare a Project specific training manual for this purpose. Contractors on their part will be required to provide induction training/briefing to all their staff before the start of any activity in the Project Area. This will be followed by trainings arranged by EO to all the targeted staff.

8.12.3. TRAINING LOG

A training log will be maintained by EO. The training log will include;

- Topic
- Date, time and location
- Trainer/Resource person
- Participants

8.12.4. TRAINING NEEDS ASSESSMENT

In addition to the training specified in the training log special/ additional trainings will be provided during the Project activity. The criteria to assess the need of training will be based on the following:

- When a specified percentage of staff is newly inducted in the Project.
- When any non-compliance is repeatedly reported refresher training will be provided regarding that issue.
- When any incident/accident of minor or major nature occurs.
- Arrival of new contractor/sub-contractor
- Start of any new process/activity

8.12.5. TRAINING MATERIAL

EO will develop and prepare training material regarding environmental awareness, sensitivity of the area, EIA, EMP and restrictions to be followed during the Project. Separate training material will be prepared for each targeted staff.

TABLE 8-6 TRAINING PROGRAM

Staff	*Contents*	*Timing*
Selected management staff of CDA concerned departments, SC staff and the construction Contractor staff	Environmental sensitivity of the Project area Wildlife, vegetation issues and related mitigation EMP communication, documentation and monitoring requirements Air and noise pollution control Waste disposal	*Prior to the start of any major Project activity*
Construction supervisors and survey crew	Environmental sensitivity of the Project Area Wildlife, vegetation & community issues and related mitigation EMP communication, documentation and monitoring requirements. Good construction practices Preservation of flora and fauna Community relations Air and noise pollution control	*Before the start of construction activities, daily during tool box meeting*
Drilling supervisors	Drilling waste disposal Landfill site operation Air and noise pollution control during the drilling operation	*Prior to start of drilling operation*
Drivers	Road safety Road restrictions Vehicle restrictions Waste disposal Defensive driving	*Prior to start of drilling operation*
Mechanics and Vehicle Repair Personnel	Environmental control of vehicles and equipment Waste disposal	*Prior to start of the operation*
Camp Staff	Camp operation Waste disposal Water consumption House keeping	*Prior to start of the operation*
Restoration and Clean-up team	*Restoration requirements*	*Prior start of restoration activity*

8.13. ENVIRONMENTAL MANAGEMENT AND MONITORING COST

8.13.1. ENVIRONMENTAL MANAGEMENT COST

Environmental management cost related with the mitigation measures of environmental parameters related to the location of camp site facilities, construction

activities, borrow material, etc. will be the sole responsibility of the Contractor and he will take care of cost implications as it will be the part of his contract agreement.

The Project's environmental management cost related with the construction of environmental mitigation infrastructure like waste water treatment plant, solid waste management, storm water drainage, etc. are being carried out separately will be the part of Project estimate.

8.13.2. ENVIRONMENTAL MONITORING COST

The environmental monitoring at pre-construction stage and other in-house monitoring to be carried out by the Contractor(s) will be a part of his contract agreement. Similarly, the environmental monitoring to be carried out during the construction stage by the SC will be the part of their contract agreement. The environmental monitoring cost for the complete project will be PKR 1.9 million.

8.13.3. TRAINING COST

The Project training will be imparted at different stages and different staff levels. A lump sum amount of Rs. 1,920,000 may be allocated for this purpose.

Table 8-7: Estimated Budget cost for the implementation of EMMP of the Project

Investment and Recurrent Cost	Units/ No. of Samples	Unit Cost specification	Cost (Rs)
A – Institutional Setup Cost			
Environment Officer @ 30,000 pm	12months	Monthly investment and operation cost	360,000
Equipment for field inspection	Lump sum	1 Digital Camera, 1 laptop and accessories	200,000
Recurrent cost	Lump sum	O&M for vehicle, telephone and printing	150,000
Sub Total A			**710,000**
B - Environmental Monitoring Activities (Base Line Sampling)			
Ambient Air Quality Monitoring	-	Lump sum	100,000
Ambient Water Quality Monitoring	-	Lump sum	100,000
Noise Levels	-	Lump sum	10,000
Sub Total B			**210,000**
C. External Monitoring	2	@ 150,000	300,000
D. Environmental Training	2	@ 50,000	100,000
E. Tree Plantation Cost	3,000	@ 150 per Plant	450,000
Sub Total (B-E)			**1,000,000**
Grand Total (A-E) Rs.			**1,920,000**

8.14. DECOMMISSIONING, SITE CLOSURE AND LONG-TERM ENVIRONMENTAL LIABILITY FRAMEWORK

Although the proposed housing scheme is intended for long-term occupation and operation, several temporary and permanent project components may eventually require closure, replacement, relocation or decommissioning. These may include construction camps, workshops, batching areas, fuel-storage locations, temporary access roads, tube wells, pumping stations, generators, transformers, substations, sewage-treatment units, sludge-handling areas, waste-storage facilities and other utility infrastructure. A formal decommissioning and environmental liability framework is therefore required to ensure that closure of any project component does not leave behind unsafe structures, contaminated soil or groundwater, abandoned waste, open boreholes, obstructed drainage, unstable land or continuing risks to workers, residents, surrounding communities and environmental receptors.

The framework shall apply during construction demobilization, phased development, infrastructure replacement, temporary suspension, partial closure, major rehabilitation and any permanent discontinuation of project facilities. It shall also apply where responsibility for a facility is transferred to an estate-management body, service provider, contractor or another operator.

8.15. DECOMMISSIONING PLANNING REQUIREMENTS

Before any project component is closed or dismantled, the proponent shall prepare a component-specific Closure and Decommissioning Plan proportionate to the nature and environmental risk of the facility. The plan shall describe the infrastructure to be removed, retained, reused or transferred and shall identify any hazardous materials, residual chemicals, fuels, oils, sewage, sludge, electrical equipment, underground structures, contaminated surfaces or potentially affected environmental receptors.

The plan shall define the sequence of closure activities, required permits and approvals, responsible personnel, occupational and community safety measures, waste-handling arrangements, monitoring requirements, restoration objectives, estimated costs and post-closure obligations. It shall also identify the applicable environmental standards and the criteria that must be achieved before closure can be considered complete. Decommissioning shall not commence until the plan has been reviewed by the project environmental manager and submitted to Pak-EPA or another competent authority where regulatory approval is required.

8.16. CLOSURE OF TEMPORARY CONSTRUCTION FACILITIES

Temporary construction facilities shall be removed as soon as they are no longer required. Contractor camps, workshops, material-storage areas, equipment yards, batching locations, fuel-storage facilities, temporary waste areas and access tracks shall be cleared of machinery, structures, construction materials, chemicals, fuel containers and general waste.

Impervious concrete slabs shall only be retained where they have an approved future use. Otherwise, they shall be broken and removed, and the underlying soil shall be inspected for staining, odour or other evidence of contamination. Areas used for fuel transfer, equipment maintenance, chemical storage, concrete washing or waste handling shall be sampled where contamination is suspected. Contaminated soil shall be excavated, treated or transferred to an approved disposal facility, followed by placement of clean material and restoration of the affected area.

Temporary drainage channels and diversions shall not be removed until permanent drainage infrastructure is functional. The natural or approved drainage pattern shall be restored to prevent ponding, erosion or uncontrolled runoff.

8.17. DECOMMISSIONING OF SEWAGE TREATMENT AND SEWERAGE INFRASTRUCTURE

Closure of the STP and associated sewerage infrastructure shall be managed under strict environmental controls because of the potential presence of untreated sewage, stabilized or unstabilized sludge, pathogens, odour, treatment chemicals and contaminated wastewater.

Before shutdown, incoming sewage shall be diverted to another approved and operational treatment facility. Treatment tanks, pumping chambers, pipelines, sludge beds, chemical-storage systems and associated structures shall be emptied, cleaned, disinfected and made safe. Residual sewage, sludge, screenings and grit shall be characterized and transported to an approved treatment or disposal destination through an authorized contractor.

No untreated sewage, sludge or contaminated wash water shall be discharged onto land, into stormwater drains, natural nullahs or toward the Korang River catchment. Underground tanks and pipelines proposed for abandonment shall either be removed or cleaned, sealed and filled using an approved engineering method. Soil and groundwater testing shall be undertaken where leakage, seepage, overflow or long-term contamination is suspected.

8.18. DECOMMISSIONING OF BOREHOLES AND WATER-SUPPLY WELLS

Abandoned tube wells, boreholes and groundwater-monitoring wells shall be formally decommissioned to prevent vertical migration of contamination, entry of polluted surface runoff and physical safety hazards. The depth, construction, location, water level and condition of each well shall be recorded before closure.

Pumps, pipes and recoverable equipment shall be removed, and the well shall be disinfected and sealed from the bottom upward using suitable impermeable materials. The surface shall be capped and stabilized, and the closure shall be documented through coordinates, photographs and an abandonment certificate. Wells shall not be left open, filled with uncontrolled debris or concealed under future construction without formal records.

Where groundwater contamination, excessive drawdown or declining water quality has been identified, monitoring shall continue after abstraction has ceased until groundwater conditions have stabilized.

8.19. ELECTRICAL AND MECHANICAL EQUIPMENT

Generators, transformers, electrical panels, pumps, blowers and other mechanical equipment shall be isolated, de-energized, drained and dismantled by qualified personnel. Transformer oil, used lubricants, batteries, refrigerants, electronic components and other potentially hazardous materials shall be collected separately and transferred to authorized recyclers or disposal facilities.

Refrigerants shall be recovered by trained technicians and shall not be vented to the atmosphere. Any equipment containing regulated substances, including polychlorinated biphenyls where encountered, shall be handled under applicable hazardous-material requirements. Electrical and mechanical equipment shall not be buried, abandoned on site or disposed of with ordinary municipal waste.

8.20. DEMOLITION AND DECOMMISSIONING WASTE MANAGEMENT

All demolition and dismantling waste shall be managed according to the waste hierarchy of avoidance, reuse, recycling, recovery and final disposal. Reusable materials such as steel, pipes, cables, doors, windows, pumps, paving blocks and uncontaminated aggregates shall be recovered wherever technically feasible.

Recyclable metals, timber, glass, plastics and electrical components shall be segregated and transferred to authorized recyclers. Concrete and masonry may be crushed and reused as approved fill or road sub-base where their technical suitability and absence of contamination have been verified. Hazardous or contaminated

materials shall be separately packaged, labelled, transported and disposed of through authorized facilities.

Waste quantities, contractor details, transport manifests, recycling certificates and disposal receipts shall be retained as evidence of compliant closure.

8.21. CONTAMINATED LAND INVESTIGATION AND REMEDIATION

Where contamination is identified or suspected, the proponent shall undertake a detailed environmental site investigation. The investigation shall determine the type, concentration, depth and spatial extent of contamination and identify potential pathways to soil, groundwater, drains, surface water, workers and neighbouring receptors.

Based on the findings, a Remediation Action Plan shall be prepared defining clean-up objectives, treatment or removal methods, verification sampling, environmental monitoring and completion criteria. Remediation options may include excavation and off-site disposal, soil treatment, containment, bioremediation, groundwater treatment or installation of engineering barriers.

Where complete removal is not technically practicable, residual contamination shall be managed through formal controls such as land-use restrictions, containment, long-term monitoring and disclosure to future owners or operators. Remediation shall continue until applicable standards or regulator-approved risk-based closure criteria have been achieved.

8.22. SITE RESTORATION AND REHABILITATION

Following removal of infrastructure and waste, all disturbed areas shall be restored to a stable, safe and environmentally acceptable condition. The land shall be regraded to prevent erosion, ponding and uncontrolled runoff. Natural drainage routes shall be restored or properly connected to the approved permanent stormwater system.

Exposed soil shall be stabilized through compaction, replacement of topsoil, vegetation, erosion-control measures or other suitable methods. Areas not required for future infrastructure shall be landscaped using native or locally adapted species consistent with the project’s landscape and biodiversity plans.

Restoration shall also cover temporary access tracks, spoil-disposal areas, damaged vegetation, slopes, construction compounds and areas disturbed during equipment

removal. Plantation survival shall be monitored, and failed planting shall be replaced during the maintenance period.

8.23. LONG-TERM ENVIRONMENTAL LIABILITY

The proponent shall remain responsible for environmental damage resulting from project activities, even where a facility has been operated by a contractor, transferred to another operator, abandoned, replaced or demolished. Long-term environmental liabilities may include contaminated soil or groundwater, leaking sewerage infrastructure, failed STP components, unstable slopes, blocked drains, abandoned waste, unsafe wells, chemical residues, downstream pollution and incomplete restoration.

Transfer of ownership or operating responsibility shall not automatically remove liability for pollution or environmental damage caused before the transfer. Any allocation of responsibility shall be clearly defined through legally valid agreements and, where necessary, accepted by the competent regulatory authority.

Contracts with contractors, operators, waste companies and estate-management bodies shall specify environmental responsibilities, indemnities, insurance requirements, monitoring obligations, recordkeeping and liability for remediation.

8.24. FINANCIAL PROVISION FOR CLOSURE AND REMEDIATION

The proponent shall maintain adequate financial provision for foreseeable closure, decommissioning and restoration costs. The provision shall cover dismantling, waste removal, contaminated soil remediation, sludge disposal, borehole abandonment, STP cleaning, site restoration, post-closure monitoring and independent environmental auditing.

For facilities with significant environmental risk, the financial mechanism may take the form of a dedicated reserve, performance guarantee, environmental insurance, contractual retention or another approved instrument. The purpose of the provision is to ensure that closure costs are not transferred to residents, surrounding communities or government agencies if the responsible contractor or operator becomes unavailable.

The estimated closure cost shall be reviewed periodically and revised where project facilities, environmental risks, market costs or regulatory requirements change.

8.25. POST-CLOSURE ENVIRONMENTAL MONITORING

Post-closure monitoring shall be undertaken where residual environmental risks may continue after physical decommissioning. Depending on the facility and identified risks, monitoring may include groundwater levels and quality, soil contamination, surface-water quality, drainage performance, erosion, slope stability, vegetation survival, settlement of filled structures and integrity of containment measures.

The monitoring duration and frequency shall be based on the nature, scale and persistence of the residual risk. Site-specific trigger thresholds shall be established so that deterioration can be detected and corrective action initiated. Monitoring shall continue until an independent environmental review confirms that closure objectives have been achieved and no unacceptable environmental risk remains.

8.26. INDEPENDENT CLOSURE ENVIRONMENTAL AUDIT

Following completion of decommissioning and restoration, an independent Closure Environmental Audit shall be conducted by a qualified third-party environmental consultant. The audit shall verify that infrastructure has been safely removed or secured, hazardous materials and wastes have been accounted for, contaminated areas have been remediated, boreholes have been sealed, drainage and landforms are stable, restoration measures have been implemented and all required documentation is available.

Any outstanding deficiency shall be recorded as a non-conformity with an assigned corrective action, responsible party and completion date. Major deficiencies shall be corrected before closure is accepted. Final closure shall only be recognized after all significant findings have been closed and written confirmation has been obtained from the competent authority where required.

8.27. DOCUMENTATION AND RECORDKEEPING

All decommissioning and environmental liability records shall be retained as part of the permanent environmental record of the project. These records shall include closure plans, regulatory approvals, site investigation results, waste manifests, recycling and disposal certificates, borehole abandonment records, monitoring results, remediation reports, photographs, environmental audit reports, corrective-action evidence and correspondence with regulatory authorities.

The records shall also identify any residual land-use restrictions, monitoring obligations, containment measures or environmental risks that must be communicated to future owners, operators, estate-management bodies or public agencies.

8.28. INSTITUTIONAL RESPONSIBILITIES

The project proponent shall retain overall responsibility for implementation of the framework. The Environmental Manager shall coordinate closure planning, regulatory approvals, monitoring, contractor compliance and documentation. Contractors shall be responsible for safe dismantling, waste management, restoration and compliance with approved method statements. Qualified specialists shall be appointed for contaminated-land assessment, borehole abandonment, STP closure, hazardous-material handling and ecological restoration where required.

A third-party auditor shall independently verify completion, while Pak-EPA and other competent authorities shall retain regulatory oversight and may inspect the site, direct corrective action or require additional monitoring.

Table 8-8: Decommissioning and Long-Term Environmental Liability Framework

Framework component	*Required action*	*Responsibility*	*Implementation stage*	*Verification evidence*
Closure planning	Prepare component-specific Closure and Decommissioning Plan	Proponent and Environmental Manager	Before closure	Approved closure plan
Regulatory approval	Obtain required approval or NOC	Proponent	Before decommissioning	Approval correspondence
Temporary facilities	Remove camps, workshops, yards and storage areas	Contractor	Construction demobilization	Site inspection and photographs
Fuel and chemical areas	Inspect and test soil where contamination is suspected	Contractor and environmental specialist	During closure	Laboratory results

STP closure	Divert sewage, clean tanks, remove sludge and disinfect facilities	STP operator and specialist contractor	Before STP shutdown	Cleaning and disposal records
Sludge management	Characterize and dispose of sludge through approved facility	STP operator	During closure	Laboratory reports and manifests
Borehole abandonment	Remove equipment, disinfect, grout and cap wells	Qualified hydrogeologist/contractor	When well is abandoned	Abandonment certificate
Electrical equipment	De-energize, dismantle and recover hazardous materials	Electrical contractor	During decommissioning	Equipment disposal records
Refrigerants	Recover refrigerants using qualified technicians	Mechanical contractor	Before equipment disposal	Refrigerant recovery log
Demolition waste	Segregate, reuse, recycle and dispose of residual waste	Contractor	During dismantling	Waste inventory and receipts
Contaminated land	Investigate and remediate affected soil or groundwater	Environmental specialist	As required	Remediation report
Drainage restoration	Restore natural or approved drainage patterns	Civil contractor	After removal of facilities	Engineering inspection

Site rehabilitation	Regrade, stabilize and landscape disturbed areas	Contractor and landscape specialist	After decommissioning	Restoration photographs
Plantation monitoring	Monitor survival and replace failed planting	Estate management	Post-closure	Survival monitoring records
Financial provision	Maintain reserve or security for closure liabilities	Proponent	Throughout project life	Financial provision record
Post-closure monitoring	Monitor residual soil, groundwater, drainage and vegetation risks	Environmental Manager	Post-closure	Monitoring reports
Independent audit	Conduct third-party closure audit	Independent auditor	After restoration	Closure audit report
Corrective action	Close audit findings and outstanding liabilities	Proponent and contractor	Before final closure	Corrective-action register
Final closure	Obtain regulatory closure confirmation where applicable	Proponent	Completion stage	Regulatory closure letter
Record retention	Maintain permanent environmental closure records	Proponent/estate management	Long term	Environmental record archive

9. ENVIRONMENTAL PLANS

9.1. SOLID WASTE MANAGEMENT PLAN

Domestic and commercial solid wastes include all non-gaseous, non-liquid wastes resulting from the wide range of community and commercial activities. Effective solution to problems of solid waste collection, treatment, conversion, reuse and disposal, are basic necessities from the perspective of sound public health. Otherwise, indiscriminate dumping of solid waste within the limits of populated areas can cause severe health hazards and at the same time impact on aesthetics. The amounts of solid waste generated by a community depend upon its socio-economic characteristics. Generation of per capita solid waste is on the rise on account of social, economic and technological changes. Solid waste in Pakistan generally comprises plastic and rubber, metal, paper and cardboard, textile waste, food waste, animal waste, leaves, grass, straws and fodder, bones, wood, stones, excreta and fines to various extents.

Findings of a study conducted by the Pakistan Environmental Protection Agency in cooperation with the Japanese International Cooperation Agency in October 2004 state that about 55,000 tons of solid waste is generated each day in urban areas of Pakistan and only about sixty percent is collected by municipal authorities.[1] These figures would not have changed much since then because of absence of initiatives in Islamabad especially for garbage collection and disposal on commercial basis. Solid waste generated at the proposed estate shall be substantial, and both project development and operation will generate large quantities of waste. Besides being an eyesore, solid waste can also pose serious health hazards if disposal is either absent or is improper. The city has limited landfill facilities and garbage is invariably dumped in open spaces by the public and outside the city by municipal authorities in improvised garbage dumps where there are no arrangements for segregation of waste, compaction or run-off control.

Environmental impact of poor waste disposal not only at a s project in operation or within or outside an urban centre can be categorised into two groups, namely impact due to poor waste disposal practices, and stress on natural resources due to excessive waste generation. Impacts caused by poor waste disposal practices include:

- Exposure of waste collectors and municipal administration to potentially hazardous stockpiles if hazardous waste is mixed with municipal waste. Waste collectors and municipal employees handle hazardous waste without proper personal protection clothing or equipment;
- Pollution of water resources, contamination of soil, and generation of hazardous fumes from uncontrolled and inappropriate disposal of hazardous waste;
- Nuisances such as odours, flies, mosquitoes and rats and rodents;
- Health issues due to provision of breeding ground for disease vectors;
- Effects on aesthetic qualities of an area due to scattered, and airborne trash, and
- Blockage and consequent overflow of drains and sewers due to indiscriminate dumping of solid waste.

Excessive waste generation results in stress on natural resources. Any production process requires fuel, electricity, land, water, chemicals and other mineral or agricultural inputs. Pressures on these resources can be minimised if production of unnecessary goods is avoided, for instance by using substitutes that are environmentally sound. This can also be achieved by maximising recycling and reuse of materials, promoting products and practices involving less use of natural resources, especially non-renewable resources. Proper and environment-friendly disposal of solid waste requires development of scientifically-designed landfill sites with by-product features. Even though large parcels of land, which itself is a vital natural resource, are required for landfills, this land is later reclaimed and green-topped when the landfill is exhausted. However, minimisation of solid waste at the same creates less demand for such landfills. Impact of solid waste from the project will depend on the quantity of waste generated, nature of such waste, arrangements for disposal and receptors in surrounding areas. As it is desirable to prevent any significant impact, a waste management plan must be developed for all phases of a project. Such a plan, when developed and implemented in earnest, will be the main tool to avoid any significant adverse impact from solid waste. Potential source of waste from construction activities include but are not necessarily limited to:

- Vegetation (grass, brush, shrubs, trees etc.) removed to clear the land;
- Cardboard and paper (packaging, office waste, cement bags etc.);
- Wood (lumber, planer waste and scrap, scaffolding waste, packaging crates etc.);
- Masonry and ceramics;

- Excess construction materials (aggregate, bricks etc.);
- Metal (scrap, containers, tins, cans, bottles, workshop waste, galvanised iron wires, steel bars etc.);
- Plastics (containers, bottles, wiring, bags, sheeting etc.);
- Styrofoam (containers, roofing etc.);
- Glass (electric lights, bottles, packaging, window pane waste etc.);
- Insulation materials;
- Excess soil and sand;
- Organic waste (kitchen waste);
- Waste oil and grease;
- Chemicals and paints;
- Batteries (lead batteries, dry and rechargeable cells etc.);
- Cotton and textiles (oily rags, cleaning cloths, rags etc.);
- Contaminated soil;
- Electric cables, and
- Clinic and medical waste.

It is anticipated that this solid waste during operation would consist of mainly the following:

- Organic waste (kitchen waste, leftovers etc.);
- Newspapers, magazines, and paper;
- Cotton and textiles, rags;
- Floor sweepings;
- Cardboard and thick paper cartons;
- Wood packaging;
- Disposable paper plates and cups;
- Various other forms of packaging, and
- Obsolete appliances from residential units.

Based on the estimated total population of 10,644 persons and an average solid waste generation rate of 0.8 kg per capita per day, the proposed development is expected to generate approximately 8.52 tonnes of municipal solid waste per day, equivalent to about 3,109 tonnes per year. Of this total quantity, it is assumed that approximately 90 percent will be generated from residential sources, including households and associated domestic activities, amounting to around 7,663 kg per day (approximately 2,798 tonnes per year). The remaining 10 percent of the waste stream is attributed to commercial and public facilities, such as shops, offices, mosques, and community areas, generating an estimated 852 kg per day (approximately 311 tonnes per year). The solid waste is expected to be predominantly non-hazardous municipal waste, and these estimates will serve as the basis for designing appropriate waste storage, collection, transportation, and disposal systems during the operational phase of the project.

Table 9-1: SOLID WASTE GENERATION (0.8 kgs per day)

Category	*Basis / Assumption*	*DailyWaste (kg/day)*	*Annual Waste (kg/year)*	*Annual Waste (tonnes/year)*
Residential Waste	90% of total waste	7,663 kg/day	2,798,078 kg/year	≈ 2,798tonnes/year
Commercial & Public Facilities Waste	10% of total waste	852kg/day	310,898 kg/year	≈ 311 tonnes/year
Total Solid Waste	Population =10,644 @ 0.8 kg/person/day	8,515 kg/day	3,108,975 kg/year	≈ 3,109 tonnes/year

The following measures shall be adopted for minimisation of solid waste and appropriate disposal:

- During construction, the contractor shall engage a waste management contractor for disposal of solid waste;
- The appointed waste management contractors shall be bound contractually to dispose of solid waste carried from the premises in an environment-friendly manner, both during transit and at the time of final disposal;
- The proponents shall extend the existing solid waste collection service to the project as soon as it comes in top operation;

- Residents shall be encouraged to dump their garbage in dumps that shall be built around the estate;
- In procurement of supplies for the project, the size and nature of packaging shall also be taken into consideration;
- Wherever possible, packaging shall be returned to manufacturers for reuse;
- Solid waste collected in the rubbish depots shall be carried away from the site on a regular basis for disposal at the municipal landfill;
- All solid waste will be segregated appropriately for safe disposal;
- The proponents shall encourage residents to move towards a paperless environment and reuse paper to the extent possible;
- Signs shall be posted in washrooms of public buildings advising minimisation of solid waste, and

Special attention would be paid to solid waste that can be recycled. All recyclable solid waste shall be kept separate for disposal through special arrangement with recycling industries and contractors that collect such solid waste for onward sale to industries engaged in recycling and production of environment friendly products.

A solid waste sub-contractor will be engaged by the contractor for disposal of all forms of solid and liquid waste in an environment-friendly manner. Waste shall be properly sorted and disaggregated for recyclable materials and thereafter disposed at the nearest landfill/garbage disposal site of the municipality. Recyclable waste may be sold to licensed recycling industries.

9.2. HEALTH AND OCCUPATIONAL SAFETY

Inconvenience and discomfort for workers and accidents resulting from careless construction practices can result in disruption of project implementation, as also socio-economic issues. Although it is the responsibility of the construction contractor to ensure occupational safety for workers, the proponents have given explicit instructions for observance of occupational safety and to abide by labour and safety standards.

These work-related hazards are universally-accepted and although subject to review and updating, these have been catalogued by the International Labour Organisation. There are no health hazards at the site that can impact unfavourably on the workers or immediate neighbours. Nonetheless, the following measures shall be taken by the contractors, under the supervision and inspection of the proponents, to enforce compliance of health and safety standards:

- Workers will be briefed about health hazards and all precautions that must be taken during construction;
- Wages shall be disbursed on time;
- Wages shall not be below minimum wage;
- There shall be no bonded labour;
- There shall be no child labour;
- Women workers, if any, shall be paid standard market wages, at least equal to minimum wage;
- The contractor will maintain a register of wages, which shall be open for inspection by the proponents;
- No deductions shall be made from wages unless prior arrangement in writing has been made with workers regarding provision of services and benefits;
- All labour and occupational safety laws and regulations shall be fully observed;
- Working hours shall be according to the law of the land;
- In case labourers, masons and other employees are made to work beyond normal hours, they shall be paid overtime according to the law of the land;
- Workers shall be insured against accidents under the relevant labour laws;
- Hard hats shall be worn by all workers and foremen at all times at the project site;
- The contractors will prepare an emergency plan so as to be fully prepared for an emergency situation;
- All medicinal needs of the workers, if any, will be attended to on top priority;
- Adequate first-aid arrangements shall be made at the project site as immediate relief in case of an accident;
- No worker shall be exposed to dangerous work;
- A number of fire extinguishers and other fire-fighting equipment shall be present at the premises;
- If female workers are engaged and require camping facilities, there shall be segregation and adequate arrangements shall be made for female workers at a construction camp;
- In such case, there shall be a strict code of conduct regarding interaction with female workers;
- Masks will be available for workers to avoid dust inhalation;

- The construction contractor is contractually bound to show labour wages (returns of labour) accounts to the proponents, and
- There shall be no night, Sunday or holiday work without prior permission of the proponents and without payment of applicable wage rates.

9.3. EMERGENCY AND FIRE-FIGHTING PROTOCOLS

Gulberg Greens would be susceptible to a fire hazard and other emergencies. A fire could be caused through negligence or accident within the project area or igniting nearby trees and shrubs because of heat or accident, negligence or criminal intent. Since the size of the housing scheme is not such that a separate fire brigade service must be established at the site, other fire-fighting measures would be sufficient to manage a fire threat. Other emergencies could be an earthquake, flood, health epidemic and terrorist activity, or any other unforeseen calamity. Therefore, appropriate protocols would be employed to reduce the risk and manage an emergency situation in order to ensure safety of residents.

9.3.1. FIRE-FIGHTING REGIMES

Capital Development Authority's building and town planning regulations specify that every public facility must be provided with sufficient means to extinguish fire. Sufficient fire prevention and fire-fighting measures have been incorporated into the project design. The proposed project shall be equipped with adequate fire-fighting measures in the form of fire hydrants at appropriate places within the enclave, from where fire tenders can access water to counter a fire situation. The fire hydrants shall draw water from the overhead and underground water tanks. A central alarm shall signal fire alerts whenever there is a fire situation within the proposed housing scheme. The nearest fire brigade is located close to Zero Point in Islamabad, which can be called upon in the event of a fire emergency. Fire-proof clothing and fire-fighting equipment shall be placed at maintenance offices and guard rooms.

9.3.2. EVACUATION PLAN

With almost twenty-five hundred people residing in the housing scheme at full colonisation, arrangements would be needed to evacuate residents in the event of an emergency. Installation of cameras at strategic locations will greatly facilitate evacuation in the event of an emergency. Evacuation shall be supervised by the security guards, who will be provided appropriate training for emergency precautions

and protocols. In the event of fire, the security guards shall immediately wear the provided fire-resistant clothing and supervise evacuation procedures. At the time of an emergency, which shall sounded by klaxons, security guards shall take appropriate pre-determined measures to guarantee their own safety and guide residents out of the estate. At the same time, communication shall be made with hospitals, emergency services and police for urgent support.

9.3.3. OTHER EMERGENCIES

There could also be other emergencies, such as earthquakes, epidemic, pest attack or terrorist activity. The Management Office shall devise a list of all possible emergencies and prescribe reaction, response and evacuation procedures for all such contingencies. Security Guards shall also be trained to act in case of all possible emergency situations and shall follow protocols defined within the evacuation plan. The fire alarms can be activated to signal evacuation. At the same time, communication shall be made with hospitals, emergency services and police for urgent support.

10. CLIMATE RISK, RESILIENCE AND CARBON FOOTPRINT ASSESSMENT

10.1. INTRODUCTION

This chapter assesses the vulnerability of the Revised and Extended Layout Plan of Gulberg Green Farm Housing Scheme, Zone IV, Islamabad, to current and future climate-related hazards and establishes a framework for reducing the project's greenhouse gas emissions. The assessment covers both physical climate risks, which may affect the safety, operability and long-term performance of the scheme, and transition considerations associated with energy efficiency, resource conservation and low-carbon urban development.

The project comprises a large, low-density residential development supported by commercial facilities, public buildings, roads, utilities, recreational spaces, landscaping and associated infrastructure. Its location, scale, substantial water demand, extensive road network and dependence on long-term infrastructure make climate resilience a material environmental consideration. The project is bounded by agricultural land to the east and north, the Islamabad Highway to the west and the Korang River toward the south, making stormwater management, downstream flood risk and protection of natural drainage systems particularly important.

The existing EIA recognizes stormwater runoff, water demand, wastewater generation, traffic, solid waste and pressure on natural resources as major operational concerns. It also proposes a centralized STP, stormwater drainage aligned with natural flow patterns, landscaping, water conservation, potential rainwater harvesting and reuse of treated wastewater. These measures provide an initial basis for climate resilience but require further assessment, quantified design criteria, monitoring indicators and implementation commitments.

The objectives of this chapter are to:

- identify climate hazards relevant to the project;
- assess the exposure and sensitivity of project components and surrounding receptors;
- evaluate potential consequences during construction and operation;
- classify climate risks according to likelihood and severity;

- identify structural, operational and nature-based adaptation measures;
- establish a greenhouse gas inventory boundary;
- identify significant Scope 1, Scope 2 and relevant Scope 3 emission sources;
- define a methodology for quantifying the project carbon footprint;
- recommend low-carbon design and operational measures; and
- integrate climate-related indicators and trigger thresholds into the EMMP.

10.2. ASSESSMENT APPROACH

The climate assessment applies a risk-based approach in which climate risk is determined by the interaction of:

- **Hazard:** the potential occurrence of a climate-related event or long-term trend;
- **Exposure:** the presence of people, buildings, infrastructure, utilities and environmental receptors in locations that may be affected;
- **Sensitivity:** the degree to which the exposed component may be damaged or disrupted; and
- **Adaptive capacity:** the ability of the project to anticipate, withstand, respond to and recover from the hazard.

The assessment considers the complete project lifecycle, including:

- planning and design;
- site preparation and construction;
- phased occupation;
- routine operation and maintenance;
- emergency conditions; and
- long-term infrastructure replacement.

The principal climate hazards considered are:

- extreme rainfall;
- pluvial and riverine flooding;
- flash flooding in natural drains and ravines;
- erosion and sedimentation;
- heatwaves and rising temperatures;
- urban heat-island effects;

- water scarcity and groundwater depletion;
- drought;
- severe storms and high winds;
- interruption of electricity and utility services;
- climate-related public health risks; and
- increased energy demand for cooling and water pumping.

10.3. CLIMATE ASSESSMENT BOUNDARY

10.3.1. SPATIAL BOUNDARY

The climate-risk assessment extends beyond the legal project boundary because stormwater, groundwater, traffic, ecological systems and emergency services are connected to the wider Zone IV development context.

The assessment area includes:

- the complete revised and extended project footprint;
- existing developed portions of Gulberg Green;
- adjoining agricultural and residential areas;
- natural drains and ravines;
- the Korang River catchment;
- project access roads and connections to the Islamabad Highway;
- proposed water-supply and sewerage infrastructure;
- downstream communities and infrastructure; and
- surrounding housing and commercial developments that may contribute to cumulative climate risk.

10.3.2. TEMPORAL BOUNDARY

Climate risks have been considered for:

- the construction period;
- initial occupation;
- full project development;
- medium-term operation;
- long-term infrastructure life; and

- future climatic conditions over the expected design life of major roads, drainage systems, water infrastructure, buildings and utilities.

Critical infrastructure should be designed using climate-adjusted assumptions appropriate to its service life rather than relying only on historical average conditions.

10.4. EXISTING PROJECT FEATURES RELEVANT TO CLIMATE RESILIENCE

The project already includes several planning and environmental features that can contribute to resilience if properly designed and maintained. These include:

- a low-density residential layout;
- designated parks and green spaces;
- landscaped roads and medians;
- a centralized sewerage and sewage treatment system;
- stormwater drainage intended to follow natural topography;
- water-storage infrastructure;
- potential rainwater harvesting;
- treated-effluent reuse for landscaping;
- underground electricity distribution;
- planned road hierarchy and access infrastructure; and
- environmental monitoring arrangements.

The stormwater system is intended to manage runoff in accordance with the natural topography and existing drainage patterns. The current design documentation refers to drainage of ravines based on return-period flows and indicates use of a rainfall intensity greater than the minimum CDA design assumption. This approach should be strengthened by applying updated intensity-duration-frequency information, climate-change allowances and downstream hydraulic assessment.

The project also contains extensive landscaping provisions. The EIA identifies a major plantation programme and states that landscaping will be applied to parks, playfields, roads, streets, medians, shopping centres, mosques and other components. These areas can support heat reduction, runoff control and carbon sequestration, provided that species selection, irrigation demand, canopy targets and survival monitoring are addressed.

10.5. CLIMATE HAZARD IDENTIFICATION

10.5.1. EXTREME RAINFALL

Extreme rainfall can generate runoff volumes and peak flows greater than those accommodated by conventional drainage systems. Urban development increases impervious surfaces through roads, roofs, paved areas and parking, reducing infiltration and accelerating runoff.

Potential consequences include:

- surcharge and overflow of roadside drains;
- flooding of low-lying plots and roads;
- erosion of embankments and unprotected slopes;
- sediment deposition in drains;
- damage to sewerage and water infrastructure;
- flooding of the STP;
- contamination of surface water through sewage overflow;
- interruption of traffic and emergency access;
- damage to electrical infrastructure;
- ponding and mosquito breeding; and
- increased downstream flood peaks.

The climate risk is increased where natural drainage paths are constricted, filled, encroached upon or disconnected from their catchments.

10.5.2. FLASH FLOODING AND NATURAL DRAINAGE RISK

The project area contains or is connected to natural drainage systems that convey monsoon runoff toward downstream receptors and the Korang River catchment. Short-duration, high-intensity rainfall may cause rapid water-level rise within ravines, nullahs and drainage corridors.

Potential high-risk locations include:

- road crossings over natural drains;
- low-lying residential plots;

- areas near culverts;
- STP and pumping installations;
- utility crossings;
- boundary walls intersecting natural flow paths;
- temporary construction camps;
- excavations and material-storage areas; and
- downstream communities.

Development shall not obstruct natural drains or rely on boundary walls, roads or embankments as unverified flood-control structures.

10.5.3. RIVERINE AND DOWNSTREAM CATCHMENT FLOOD RISK

Because the Korang River lies toward the southern side of the scheme, project drainage must be assessed in relation to the wider catchment rather than only within internal drainage boundaries.

Potential cumulative effects include:

- increased discharge from multiple housing schemes;
- higher downstream peak flow;
- erosion of receiving channels;
- sediment and pollutant loading;
- backwater effects at outfalls;
- reduced floodplain storage; and
- downstream infrastructure damage.

A hydrological and hydraulic assessment should verify that project runoff will not materially increase flood risk outside the project boundary.

10.5.4. HEATWAVES AND RISING TEMPERATURE

Higher temperatures and more frequent heatwaves may affect residents, workers, buildings, roads, water systems and vegetation.

Potential impacts include:

- heat stress among construction workers;
- increased risk to children, elderly persons and people with existing health conditions;

- increased electricity demand for air conditioning;
- overheating of buildings and public spaces;
- increased water demand;
- reduced outdoor comfort;
- thermal deterioration of road surfaces;
- overheating of electrical equipment;
- reduced efficiency of transformers and generators;
- heat damage to landscaping;
- higher irrigation requirements;
- deterioration of stored water quality; and
- increased ground-level ozone and air pollution risk.

Low-density development alone does not guarantee low heat risk. Large paved plots, wide roads, exposed roofs and limited mature canopy may still produce significant localized heat accumulation.

10.5.5. URBAN HEAT-ISLAND EFFECT

Conversion of agricultural and open land to buildings and paved infrastructure can increase surface and near-ground air temperatures. Dark roofing, asphalt roads, paved parking and reduced soil moisture absorb and retain solar heat.

The heat-island effect may be most pronounced in:

- commercial and parking areas;
- wide road corridors;
- densely constructed public-building areas;
- unshaded pedestrian zones;
- exposed residential plots;
- transformer and generator areas; and
- areas where landscaping has not yet matured.

Urban heat may also increase cooling demand and therefore increase indirect GHG emissions from electricity consumption.

10.5.6. LONG-TERM WATER SCARCITY

Water scarcity is one of the most significant long-term climate risks for the project. The current EIA estimates substantial operational water demand and proposes groundwater abstraction as part of the supply system. Water demand must therefore be reconciled with sustainable aquifer yield, recharge, existing users and future climate variability.

Potential impacts include:

- groundwater-level decline;
- reduced yield of project and community wells;
- higher energy demand for pumping;
- increased dependence on tankers;
- water-quality deterioration;
- conflict with surrounding communities;
- reduced landscaping viability;
- interruption of domestic and commercial water supply;
- constraints on future occupation; and
- increased operating costs.

The report itself recognizes the need for conservation, rainwater harvesting, treated-effluent reuse and groundwater monitoring to avoid over-abstraction.

10.5.7. DROUGHT

Extended periods of below-normal rainfall may reduce groundwater recharge while simultaneously increasing domestic and irrigation demand. Drought may also cause:

- vegetation stress and tree mortality;
- increased dust generation;
- reduction in surface-water flows;
- concentration of pollutants in drains;
- increased fire risk;
- pressure on public water supply;
- higher tanker demand; and
- restriction of non-essential water use.

The project should therefore maintain a drought-management plan with defined operational stages.

10.5.8. SEVERE STORMS AND HIGH WINDS

Strong winds and storms may damage:

- trees and landscaping;
- temporary construction facilities;
- scaffolding and hoardings;
- roof-mounted systems;
- solar panels;
- signage;
- power distribution equipment; and
- loose construction materials.

Fallen trees and debris may block roads and drains, affecting emergency access and drainage performance.

10.5.9. CLIMATE-RELATED PUBLIC HEALTH RISK

Climate change may increase:

- heat-related illness;
- mosquito breeding following waterlogging;
- waterborne disease following sewage overflow;
- respiratory illness from dust and smog;
- vector-related disease;
- dehydration among workers;
- food and water storage risks; and
- occupational accidents caused by extreme weather.

Public-health facilities, emergency response arrangements and community awareness should therefore form part of the climate adaptation plan.

Climate Risk Screening

Table 10-1: Preliminary Climate Risk Screening

Climate hazard	*Principal exposed components*	*Potential consequence*	*Initial risk level*
Extreme rainfall	Roads, plots, drains, STP, utilities	Flooding, erosion, service disruption	High
Flash flooding	Natural drains, road crossings, low-lying areas	Rapid inundation, damage and safety risk	High
Downstream catchment flooding	Outfalls, Korang River system, downstream communities	Increased peak flow and erosion	High
Heatwaves	Residents, workers, buildings, public spaces	Heat illness and cooling demand	High
Urban heat-island effect	Roads, roofs, parking and commercial areas	Elevated local temperatures	Moderate to high
Water scarcity	Groundwater supply, residents, landscaping	Supply failure and community impact	High
Drought	Water resources, vegetation, fire safety	Reduced recharge and increased demand	High
Severe storms and wind	Trees, roofs, utilities, temporary works	Physical damage and obstruction	Moderate
Climate-related disease	Residents, workers and vulnerable groups	Public-health impacts	Moderate to high
Power disruption	STP, pumps, lighting, buildings	Loss of essential services	High

The preliminary ratings shall be updated after completion of detailed flood modelling, hydrogeological assessment, climate projections and infrastructure vulnerability analysis.

10.6. EXTREME RAINFALL AND FLOOD RISK ASSESSMENT

10.6.1. HYDROLOGICAL ASSESSMENT REQUIREMENTS

A detailed hydrological assessment shall be undertaken to determine how rainfall is converted into surface runoff under existing and future development conditions. The assessment shall delineate the project catchments and sub-catchments, identify natural drainage paths, review topographic levels, and characterize existing land cover, soil infiltration capacity and surface permeability. It shall then quantify the changes expected from the proposed increase in roofs, roads, parking areas and other impervious surfaces. Rainfall intensity-duration-frequency data shall be used together with an appropriate climate-change allowance to account for the possibility of more intense future rainfall. The assessment shall also consider runoff entering the project from upstream areas, the hydraulic condition of downstream receiving channels and the contribution of surrounding developments. The analysis shall compare pre-development runoff, post-development runoff from the project alone, cumulative runoff from foreseeable development in Zone IV, and runoff under climate-adjusted extreme rainfall conditions. This comparison will establish whether the proposed development will increase peak discharge, runoff volume, flood duration or downstream erosion and will provide the basis for sizing drainage and stormwater-control infrastructure.

10.6.2. HYDRAULIC MODELLING

Hydraulic modelling shall be conducted to evaluate how stormwater will move through the project drainage system and surrounding natural channels during different rainfall events. The model shall include roadside drains, primary and secondary stormwater channels, natural ravines and nullahs, culverts, detention structures, road crossings, outfalls, STP drainage arrangements, low-lying plots and downstream receiving channels. It shall determine whether each component has sufficient hydraulic capacity and identify locations where water may surcharge, overtop or escape from the formal drainage system. The modelling outputs shall include predicted flood extent, water depth, flow velocity, duration of inundation, culvert and drain capacity, critical infrastructure exposure and safe overflow routes. Particular attention shall be given to the STP, electrical installations, water-supply facilities, emergency-access roads and residential areas located close to natural drainage features. The model shall also assess whether proposed outfalls could cause erosion, backwater effects or increased downstream flooding.

10.6.3. DESIGN STORMS

The stormwater system shall not be designed on the basis of a single rainfall event because different infrastructure components perform different functions and require different levels of protection. Routine and minor storms shall be used to design local drainage and prevent regular waterlogging, while major storms shall be used to assess the capacity of primary drains, culverts and detention systems. Extreme and climate-adjusted events shall be used to evaluate risks to critical infrastructure, residential properties and emergency routes. An exceedance event, representing rainfall greater than the formal design capacity, shall also be assessed so that safe overland flow paths can be identified. Critical infrastructure such as the STP, water pumping stations, electrical substations and emergency roads shall be protected against more severe rainfall events than ordinary roadside drainage. The design shall therefore provide both formal drainage capacity and a controlled system for managing flows that exceed that capacity.

10.6.4. FLOOD ADAPTATION MEASURES

Flood adaptation shall combine conventional drainage engineering with sustainable and nature-based stormwater measures. Natural drainage corridors shall be protected from encroachment, filling or obstruction, and construction shall be prohibited within defined floodways and required setbacks. Detention and retention basins shall be used to temporarily store runoff and reduce downstream peak flows, while vegetated swales, infiltration trenches, rain gardens and permeable paving shall promote infiltration and reduce the volume entering the drainage network. Sediment traps and erosion-control structures shall be installed to prevent siltation and channel damage. Culverts and road crossings shall be sized according to modelled flows, and outfalls shall incorporate energy dissipation and erosion protection. Critical electrical and mechanical equipment shall be placed above the relevant flood level or otherwise flood-proofed. Safe overland flow routes shall be maintained for events exceeding drainage capacity. Regular inspection, desilting and removal of waste from drains shall be treated as essential resilience measures because blocked drainage infrastructure can substantially increase flood risk even where the original design capacity is adequate.

10.7. HEAT STRESS AND URBAN HEAT ASSESSMENT

10.7.1. HEAT EXPOSURE

Heat exposure shall be assessed for all groups likely to spend significant time outdoors or in heat-sensitive locations. These include construction workers,

maintenance personnel, pedestrians, children using schools and play areas, elderly residents, utility operators and people using markets, parking areas, transport points and healthcare facilities. The assessment shall consider ambient temperature, relative humidity, direct solar radiation, surface temperature, availability of shade, air movement and duration of exposure. It shall also identify locations where dark roofs, asphalt roads, paved parking areas or limited vegetation may increase local temperatures. The purpose of the assessment is to identify groups and locations where heat stress, dehydration, heat exhaustion or heat-related illness may occur and to inform building design, landscaping, work practices and emergency arrangements.

10.7.2. HEAT-RESILIENT URBAN DESIGN

Heat-resilient urban design shall be incorporated into the layout, landscaping and building requirements of the scheme. Mature trees shall be preserved wherever feasible, and a continuous street-tree canopy shall be developed along major roads, pedestrian routes and public spaces. Playgrounds, seating areas, walkways and parking areas shall be shaded through trees, structures or solar canopies. Buildings should use reflective or cool roofs, insulated walls and roofs, energy-efficient glazing, external shading, natural ventilation and orientation that reduces direct solar gain. Light-coloured paving and permeable vegetated surfaces shall be preferred over extensive dark impermeable surfaces. Utility rooms, transformers and mechanical equipment shall be adequately ventilated and protected against overheating. Landscaping shall use drought-tolerant species capable of providing effective canopy without creating excessive irrigation demand. Public areas shall also include accessible drinking-water points where appropriate. These measures shall be translated into measurable targets for tree canopy, shaded pedestrian routes, roof performance and planting survival rather than remaining general landscaping commitments.

10.7.3. CONSTRUCTION WORKER HEAT MANAGEMENT

The contractor shall implement a formal Heat Stress Management Plan during the construction period. Daily weather conditions and heat-index values shall be monitored, and work-rest schedules shall be adjusted according to the level of heat risk. Shaded and ventilated rest areas shall be provided close to active work sites, together with adequate drinking water and electrolyte replacement. New workers shall be gradually acclimatized before undertaking prolonged heavy outdoor work.

Physically demanding activities shall be scheduled during cooler morning or evening periods when extreme heat is forecast. Supervisors and first-aid personnel shall be trained to recognize symptoms of heat exhaustion, heat stroke and dehydration. Workers with existing medical conditions or other vulnerability shall receive additional protection. All heat-related incidents and near misses shall be recorded and investigated so that work practices can be improved.

10.7.4. HEAT PERFORMANCE INDICATORS

Heat-resilience performance shall be monitored through measurable indicators. These may include the percentage of the development covered by tree canopy, the proportion of pedestrian routes and public spaces provided with effective shade, the survival rate of planted trees, the percentage of roofs using high-reflectance or insulated systems, and the availability of shaded emergency assembly areas. Operational indicators shall include public-space surface temperatures, peak electricity demand for cooling and the number of heat-related worker or resident incidents. The indicators shall be reviewed periodically to determine whether landscaping and building measures are achieving the intended reduction in heat exposure. Where performance falls below the adopted target, corrective measures such as replacement planting, additional shade structures, revised work practices or building upgrades shall be implemented.

10.8. WATER SCARCITY AND DROUGHT RESILIENCE

10.8.1. WATER SUSTAINABILITY PRINCIPLE

The project shall not rely on assumed groundwater availability or the presence of water-bearing formations as proof of a sustainable supply. Long-term water availability shall be demonstrated through hydrogeological investigations, pumping tests, aquifer characterization, recharge assessment, groundwater modelling and cumulative abstraction analysis. Existing and projected groundwater use by surrounding communities, agricultural users and adjoining developments shall be included. Monitoring of community wells shall be undertaken to identify any project-related decline in groundwater levels or yield. All required abstraction permits and approvals shall be obtained before groundwater production begins. The final sustainable allocation shall also be tested against climate-adjusted recharge conditions, including dry years and prolonged drought, so that project demand does not exceed the long-term capacity of the aquifer.

10.8.2. INTEGRATED WATER BALANCE

A comprehensive water balance shall be prepared for the project to identify all sources, demands, losses and reserves. The balance shall separately quantify potable and non-potable demand, average daily use, peak summer demand, firefighting reserve, irrigation demand and distribution losses. Available supply shall include approved groundwater abstraction, external bulk water, harvested rainwater, treated-effluent reuse and emergency supply. Storage requirements shall be defined for routine operation, peak demand and drought conditions. The water balance shall be prepared for the current development phase, intermediate occupation, full occupation, a representative dry year and an extended drought scenario. This phased approach will ensure that occupation and development do not proceed ahead of confirmed water availability and that additional conservation or supply measures are introduced before shortages occur.

10.8.3. DEMAND REDUCTION MEASURES

Water-demand reduction shall be incorporated into project design and operating requirements. Low-flow taps, showers and dual-flush toilets shall be used in residential, commercial and public buildings, while water-efficient appliances shall be encouraged through building guidelines. Individual and bulk meters shall be installed to identify high consumption and support billing and conservation. The distribution network shall include leak detection, pressure management and rapid isolation of damaged sections. Treated wastewater and harvested rainwater shall replace potable water for suitable non-potable uses. Landscaping shall use drought-tolerant species, drip irrigation and soil-moisture-based controls, and high-water-use ornamental planting shall be restricted. Resident awareness programmes shall promote responsible water use. Occupancy of additional phases shall remain conditional upon evidence that the confirmed supply and conservation measures can meet the projected demand.

10.8.4. RAINWATER HARVESTING

Rainwater harvesting shall be integrated into public buildings, schools, mosques, commercial premises, community facilities, maintenance buildings and suitable residential properties. Roof surfaces shall act as catchments, with first-flush diversion to remove initial contaminants before water enters the storage system. Filtration, covered tanks, overflow arrangements, mosquito protection and accessible maintenance points shall be provided. Rainwater systems shall be

separated from the potable supply and clearly identified as non-potable. Collected water may be used for landscaping, cleaning, road washing, construction support and other approved purposes. Storage capacity shall be calculated using roof area, rainfall characteristics, expected demand and seasonal variation. The volume collected and used should be monitored so that the contribution of rainwater harvesting to overall demand reduction can be demonstrated.

10.8.5. TREATED-EFFLUENT REUSE

The STP shall form a central part of the project's water-scarcity response by producing treated effluent suitable for approved non-potable uses. Reuse shall be prioritized for parks, green belts, roadside plantation, public landscaping, road washing, sewer flushing and dust suppression. A separate storage and distribution system shall be provided to prevent cross-connection with potable water. The volume of treated wastewater generated, stored, reused and discharged shall be measured and reported. Reuse targets shall be linked to landscaping and non-potable demand so that groundwater abstraction can be reduced. Effluent quality shall be monitored to ensure that reuse does not create public-health, soil or groundwater risks.

10.8.6. DROUGHT RESPONSE PLAN

The project shall maintain a staged drought response plan based on groundwater levels, recharge conditions, supply availability and consumption trends. Under normal conditions, routine metering, leakage control, groundwater monitoring, conservation awareness and treated-effluent reuse shall continue. An alert stage shall be triggered by declining groundwater levels, below-normal recharge or emerging supply constraints, leading to increased monitoring, restrictions on irrigation and non-essential washing, accelerated leak repair and public advisories. During severe shortage conditions, landscaping irrigation shall be reduced, potable and sanitation uses shall be prioritized, non-essential commercial consumption shall be restricted, emergency supplies shall be activated and further groundwater pumping controls shall be applied. Expansion of occupancy may also be paused. Under emergency conditions, controlled rationing, emergency potable-water distribution, suspension of non-essential development activity and coordination with competent authorities shall be implemented, with specific protection for vulnerable households, healthcare facilities and other essential services.

10.9. INFRASTRUCTURE AND UTILITY RESILIENCE

10.9.1. STP RESILIENCE

The STP shall be designed to remain functional during extreme weather and utility disruption. The site layout and platform levels shall protect treatment units, sludge areas, electrical panels and chemical storage from flood inundation. Intense rainfall and sewer inflow shall be considered in the hydraulic design to prevent overloading and uncontrolled bypass. Critical pumps, blowers and other equipment shall have duty and standby arrangements, while automatic generators shall maintain operation during power failure. Emergency storage shall be provided for temporary retention of incoming sewage during breakdown or maintenance. Alarm systems shall notify operators of high levels, power loss or equipment failure. Safe access to the plant shall remain available during heavy rainfall. Outfalls and drainage around the STP shall be protected against erosion, and stored sludge shall be secured against washout.

10.9.2. WATER-SUPPLY RESILIENCE

Water-supply infrastructure shall be designed to avoid dependence on a single source, pump or storage facility. Multiple approved sources shall be considered, supported by distributed reservoirs and sufficient reserve capacity. Pressure zoning shall allow different parts of the scheme to be supplied efficiently and prevent excessive losses. Isolation valves shall enable leaks or damaged sections to be repaired without shutting down the entire network. Critical pumping stations shall have backup pumps and standby power. Water quality shall be monitored at sources, storage facilities and distribution points. Emergency interconnections and alternative supply arrangements shall be provided where technically feasible. These measures will reduce the likelihood that drought, equipment failure, contamination or power interruption will result in prolonged loss of water supply.

10.9.3. ELECTRICITY AND ENERGY RESILIENCE

Electrical infrastructure shall be protected against flooding, extreme heat, wind damage and prolonged grid failure. Substations, transformers and control equipment shall be located above relevant flood levels or otherwise flood-proofed. Equipment shall be adequately ventilated and rated for expected future temperatures. Standby generation shall be provided for critical services, including water pumping, the STP, emergency lighting and communication systems. Solar photovoltaic systems and

battery-supported emergency power should be assessed for common facilities to reduce dependence on the grid and improve continuity of service. Energy-efficient lighting and equipment shall reduce peak demand and improve operating resilience. An emergency load-prioritization plan shall identify essential systems that must remain operational during supply constraints.

10.9.4. ROAD AND ACCESS RESILIENCE

Road and access infrastructure shall be designed to remain safe and functional during heavy rainfall, flooding and extreme heat. Road alignments and embankments shall not obstruct natural drainage paths, and adequate culverts and cross-drainage structures shall be provided. Erosion protection shall be incorporated at slopes, culvert outlets and road edges. At least one reliable emergency-access route shall remain available during severe rainfall events. Roads shall be designed to accommodate emergency and firefighting vehicles. Pedestrian routes shall provide shade and safe crossings, particularly near public buildings. Pavement materials and specifications shall account for high temperatures and potential softening, rutting or cracking. Regular drain maintenance and road inspections shall be undertaken before and during the monsoon season.

10.10. CLIMATE-SENSITIVE LANDSCAPING AND NATURE-BASED SOLUTIONS

Landscaping shall be designed as functional climate infrastructure rather than solely as an aesthetic feature. Trees, shrubs, grassed areas and natural drainage vegetation shall reduce surface temperature, provide shade, intercept rainfall, promote infiltration, stabilize slopes and control dust and erosion. Green corridors shall also support ecological connectivity and improve the visual quality of the scheme. Species selection shall favour native or locally adapted trees that are drought tolerant, capable of developing effective canopy, resilient to heat and wind, and compatible with roads, utilities and buildings. Invasive species and plants requiring excessive irrigation shall be avoided. The landscaping plan shall define canopy targets, planting density, irrigation sources, species diversity, soil preparation, maintenance requirements, survival targets and replacement obligations. Plantation success shall be monitored rather than assessed only by the number of trees initially planted. Treated wastewater and harvested rainwater should be used for irrigation where quality and supply permit.

10.11. CARBON FOOTPRINT CALCULATION METHODOLOGY

10.11.1. GENERAL EQUATION

Each emission source shall be calculated by multiplying the relevant activity data by an appropriate emission factor and applying any required unit conversion or global warming potential. Activity data may include litres of fuel, kilowatt-hours of electricity, tonnes of construction material, kilometres travelled, cubic metres of wastewater or tonnes of waste. The inventory shall document the source and unit of each activity value, the emission factor used, the source and year of that factor, the reporting period, assumptions, uncertainty and scope classification. Results shall be reported as carbon dioxide equivalent. Where measured data are unavailable and estimates are used, the estimation method and associated uncertainty shall be clearly stated.

10.11.2. CONSTRUCTION-PHASE EMISSIONS

Construction-phase emissions shall cover direct fuel and electricity use as well as embodied emissions associated with materials and transport. Diesel and petrol used by earthmoving equipment, generators, trucks and other machinery shall be recorded through fuel logs. Electricity consumption shall be obtained from meters or bills. Procurement and batching records shall be used to quantify cement, concrete, reinforcement steel, bricks, blocks, asphalt and aggregate. Material transport shall be assessed using the quantity transported and distance travelled. Excavation, vegetation clearance, worker transport, temporary facilities and construction waste shall also be included where material. Contractors shall be required to maintain the necessary records so that construction emissions can be calculated using actual activity data rather than broad assumptions.

10.11.3. OPERATIONAL EMISSIONS

Operational emissions shall include electricity for street lighting, common buildings, water pumping and STP operation, together with fuel used by generators, vehicles and maintenance equipment. Natural gas consumption, refrigerant leakage, wastewater-treatment emissions, sludge management and municipal solid waste shall also be quantified. Data shall be collected monthly where practical so that seasonal changes and abnormal consumption can be identified. Waste emissions shall be calculated using the actual quantity and composition of waste, the proportion recycled or composted and the final disposal method. Operational carbon reporting

shall begin when the first project phase becomes occupied and shall be expanded as additional facilities and development phases become operational.

10.11.4. CARBON INTENSITY INDICATORS

Absolute annual emissions shall be supported by intensity indicators that relate emissions to the scale and performance of the development. These shall include emissions per resident, per occupied plot, per square metre of controlled building area, per cubic metre of water supplied and per cubic metre of wastewater treated. Electricity use per resident, renewable-energy share, waste emissions per resident and embodied carbon per square metre of infrastructure or building shall also be tracked. Intensity indicators allow performance to be compared as occupancy increases and help determine whether efficiency is improving even where total emissions rise because the scheme is expanding.

10.11.5. MAIN ANTICIPATED GHG SOURCES

During construction, the largest emissions are expected to arise from the manufacture and use of cement, concrete, reinforcement steel, bricks, asphalt and other materials, together with diesel used by earthmoving machinery and transport vehicles. Road construction, material delivery, excavation, electricity use, vegetation clearance and disposal of construction waste will also contribute. During operation, major sources are likely to include grid electricity used by buildings and common infrastructure, energy for water pumping and wastewater treatment, backup generators, natural gas consumption, vehicle traffic, municipal solid waste, wastewater-treatment methane and nitrous oxide, and refrigerant leakage. The relative significance of each source shall be confirmed through the inventory. No final carbon footprint should be stated until actual or technically verified activity data and appropriate emission factors are available.

10.12. LOW-CARBON DESIGN AND CARBON MANAGEMENT PLAN

10.12.1. ENERGY EFFICIENCY

Energy demand shall be reduced through efficient design, equipment selection and operational controls. Street and public-area lighting shall use LEDs with timers, sensors or centralized controls. Water pumps and STP equipment shall be selected for high efficiency and fitted with variable-frequency drives where appropriate. Transformers and electrical systems shall minimize losses. Public and commercial buildings shall incorporate insulated walls and roofs, reflective surfaces, efficient

glazing, natural ventilation, daylighting and energy-efficient cooling. Energy-performance requirements should be included in building and procurement specifications. Consumption shall be metered by facility so that unusually high energy use can be identified and corrected.

10.12.2. RENEWABLE ENERGY

Renewable-energy opportunities shall be evaluated for common and critical infrastructure. Rooftop solar photovoltaic systems may be installed on public buildings, commercial facilities, schools, mosques and estate-management buildings. Solar street lighting and solar power for water-pumping or STP support systems should be assessed where technically feasible. Parking areas may accommodate solar canopies that provide both electricity and shade. Battery systems may support emergency controls and essential services during grid failure. Renewable-energy targets shall be established for common facilities and monitored through metered generation and consumption.

10.12.3. LOW-CARBON CONSTRUCTION

Contractors shall minimize construction emissions through efficient earthwork planning, material optimization and improved equipment management. Cut and fill shall be balanced where feasible to reduce the need for material import and disposal. Locally available materials shall be preferred when technically and environmentally suitable. Cement intensity shall be reduced through efficient structural design and the use of approved supplementary cementitious materials. Recycled steel and other recycled-content materials should be considered where quality requirements can be met. Excavated material shall be reused where suitable, and material wastage shall be controlled. Construction equipment shall be properly maintained, unnecessary idling prohibited and delivery routes optimized. Waste shall be segregated and recycled to reduce landfill disposal and embodied replacement demand.

10.12.4. WATER-ENERGY NEXUS

Water conservation shall also be treated as an energy-reduction measure because abstraction, pumping, treatment and distribution require electricity or fuel. Leakage reduction, low-flow fixtures and metering will reduce both water loss and pumping demand. Treated wastewater and harvested rainwater shall substitute for potable water in appropriate uses, reducing the energy required for groundwater abstraction. Gravity-based distribution should be used where topography permits, and pumps

shall be selected and operated efficiently. Water and energy data shall be reviewed together to identify excessive energy use per unit of water supplied or wastewater treated.

10.12.5. WASTE REDUCTION

Waste-related emissions shall be reduced through segregation, recycling, composting and controlled disposal. Recyclable paper, plastic, metal and glass shall be separated at source and transferred to authorized recyclers. Biodegradable waste should be composted or otherwise treated where feasible. Open burning shall be prohibited because it generates air pollution and greenhouse gases. Accurate measurement of waste quantities and composition shall be maintained so that diversion rates and emissions can be calculated. Contracts with waste service providers shall require authorized collection, transport and disposal and shall include reporting obligations.

10.12.6. TRANSPORT EMISSIONS

Transport emissions shall be reduced through a layout that supports walking, shorter trips and access to public transport. Internal roads shall include safe pedestrian routes, shaded walkways and appropriate crossings. Cycle facilities may be introduced where feasible. Public transport access and stops should be coordinated with relevant authorities. Electric vehicle charging infrastructure should be incorporated into public, commercial and common parking areas. Traffic flow and intersection design shall minimize congestion and vehicle idling. Construction traffic shall be scheduled and routed to reduce unnecessary travel, waiting and community disturbance.

10.12.7. CARBON SEQUESTRATION

Trees and vegetation may remove and store a limited quantity of atmospheric carbon, but sequestration shall be calculated separately from gross project emissions. Any reported removal shall be based on verified planting area, species, age, survival and biomass-growth methodology. The permanence of planted vegetation and the risk of future loss shall also be considered. Monitoring shall confirm that trees remain alive and continue to grow. Plantation shall complement direct emission reduction and shall not be used to justify avoidable fuel, electricity or material emissions.

10.13. RESIDUAL CLIMATE RISKS

Residual climate risks are those that remain after reasonable adaptation and mitigation measures have been implemented. These may include rainfall exceeding the drainage design, prolonged drought, regional groundwater decline, widespread power failure, flooding originating outside the project catchment, extreme heat beyond design assumptions, cumulative urban-development pressure and failure of residents or contractors to follow conservation measures. Such risks shall be managed through emergency plans, reserve water storage, standby power, insurance, early warning systems, evacuation routes and regular maintenance. Climate assumptions and design parameters shall be reviewed periodically and after major extreme-weather events. Where monitoring demonstrates that conditions are changing more rapidly than anticipated, the project shall adopt additional measures through an adaptive management process.

11. TRAFFIC IMPACT ASSESSMENT AND VEHICULAR EMISSIONS MODELLING

11.1. INTRODUCTION AND PURPOSE

A detailed Traffic Impact Assessment shall be undertaken to determine the effects of the Revised and Extended Layout Plan of Gulberg Green Farm Housing Scheme on the internal circulation system, project access points and the surrounding road network in Zone IV, Islamabad. The assessment shall evaluate existing traffic conditions, traffic generated by the proposed residential, commercial, institutional and recreational land uses, and cumulative traffic associated with adjoining housing schemes and foreseeable development within the wider influence area. The purpose of the assessment is to determine whether the proposed road network and external connections can safely and efficiently accommodate construction and operational traffic without causing unacceptable congestion, deterioration in road level of service, increased accident risk, obstruction of emergency access or significant deterioration in roadside air quality and noise conditions.

The existing project description provides a hierarchy of main access roads with rights-of-way of 100, 80 and 70 feet, supported by 50-foot-wide internal access roads and cul-de-sacs. It also states that the 100-foot-wide dual carriageway provides the principal connection with the Islamabad Expressway and that junctions have been minimized to facilitate traffic movement. These layout provisions provide the basis for the circulation system; however, their adequacy shall be verified through traffic counts, trip-generation analysis, capacity assessment, intersection modelling and emissions modelling rather than through road-width descriptions alone.

11.2. TRAFFIC STUDY AREA

The Traffic Impact Assessment shall cover the complete project road network and all external roads and intersections that may experience a material increase in traffic due to the proposed development. The study area shall include the main project entrances, connections with the Islamabad Expressway and other relevant approach roads, internal collector roads, commercial and public-building access points, school and

mosque approaches, parking areas, public transport locations and intersections serving surrounding communities. The final study area shall be defined on the basis of preliminary traffic surveys and shall extend to all junctions where project-generated traffic is expected to produce a measurable change in traffic volume, delay, queue length or road safety conditions.

The assessment shall also recognize that project traffic will interact with vehicles generated by existing Gulberg Green development, adjacent housing schemes, nearby villages, commercial establishments and ongoing or proposed infrastructure development in Zone IV. Traffic conditions shall therefore be assessed on a cumulative network basis rather than treating the housing scheme as an isolated traffic generator.

11.3. EXISTING TRAFFIC CONDITIONS

Existing traffic conditions shall be established through site-specific classified traffic counts at representative road sections and intersections. Counts shall cover normal weekdays and, where relevant, weekends, and shall include morning and evening peak periods as well as any locally significant commercial, school or prayer-time peaks. Vehicles shall be classified into motorcycles, cars, vans, minibuses, buses, light commercial vehicles, trucks, tractors and other heavy vehicles. Pedestrian and cyclist movements shall also be recorded at locations where they may interact with project traffic.

The baseline survey shall document traffic volume, directional distribution, turning movements, travel speed, queue length, delay, parking activity, public transport operations, pedestrian crossings, roadside encroachment, road condition and accident-prone locations. Existing congestion and safety constraints shall be identified before project-generated traffic is added. The baseline shall also record nearby sensitive receptors, including houses, schools, healthcare facilities, mosques and commercial areas that may be affected by increased traffic emissions, noise or road-safety risks.

11.4. TRIP GENERATION

Project-generated traffic shall be estimated separately for each land-use component, including residential plots, farmhouses, apartments, commercial areas, public buildings, schools, mosques, healthcare facilities, recreational areas and maintenance or service facilities. Trip generation shall account for the number of units, expected occupancy, vehicle ownership, employee numbers, visitors, deliveries, service vehicles and time-of-day variation.

Separate estimates shall be prepared for:

- construction-stage traffic;
- initial occupation;
- intermediate development phases;
- full project occupation;
- normal weekday conditions;
- weekend or recreational peaks; and
- special-event conditions at public or commercial facilities.

Trip-generation assumptions shall be clearly stated and supported by locally applicable rates, comparable housing developments or verified household and travel-behaviour surveys. The assessment shall avoid applying a single generalized trip rate to the entire scheme because different land uses generate different traffic patterns and peak times.

11.5. TRIP DISTRIBUTION AND ASSIGNMENT

Generated trips shall be distributed across the external and internal road network according to likely origins and destinations, access arrangements, employment centres, commercial activity, schools and regional road connections. The assessment shall identify the percentage of project traffic expected to enter or leave through each access point and the proportion assigned to each major approach road.

Traffic assignment shall consider the capacity and attractiveness of alternative routes, existing congestion and restrictions on heavy vehicles. The results shall show traffic added to each road section and intersection under each development scenario. Particular attention shall be given to the main connection with the Islamabad Expressway and any access routes shared with existing communities or adjoining schemes.

11.5.1. TRAFFIC GROWTH AND CUMULATIVE DEVELOPMENT

Future background traffic shall be estimated by applying an appropriate traffic growth rate to existing traffic volumes over the selected design horizon. In addition to general traffic growth, the assessment shall include traffic expected from approved, under-construction and reasonably foreseeable housing, commercial and infrastructure developments within the traffic influence area.

The cumulative scenarios shall include:

- existing traffic conditions;
- existing traffic with normal background growth;
- background traffic plus the proposed project at initial occupation;
- background traffic plus the proposed project at full development; and
- full project traffic combined with traffic from adjoining and foreseeable developments.

This approach shall determine whether congestion or capacity failure results from the project itself or from the combined urbanization of Zone IV. Where cumulative impacts are significant, mitigation shall be coordinated with CDA, traffic authorities and adjoining developers rather than assigned solely to individual internal roads.

11.5.2. ROAD AND INTERSECTION CAPACITY ASSESSMENT

Road sections and intersections shall be assessed for capacity, volume-to-capacity ratio, average delay, queue length and Level of Service. The analysis shall include signalized and unsignalized intersections, priority junctions, roundabouts, access gates and internal commercial intersections. The adequacy of turning lanes, acceleration and deceleration lanes, median openings, U-turn arrangements and pedestrian crossings shall also be evaluated.

Level of Service shall be reported for existing, construction, initial occupation and full-development scenarios. Where the analysis identifies unacceptable delay, excessive queueing or unstable traffic flow, specific improvements shall be recommended. These may include widening, additional turning lanes, signalization, roundabout improvement, junction channelization, access management, revised gate arrangements or redistribution of traffic between entrances.

The existing EMMP generally provides for wide entrances, orderly merging of estate traffic and adequate parking at public facilities. The Traffic Impact Assessment shall convert these general commitments into location-specific engineering requirements supported by capacity calculations.

11.5.3. INTERNAL CIRCULATION AND ACCESS MANAGEMENT

The internal circulation assessment shall verify whether the proposed road hierarchy can accommodate residential, commercial, institutional, service and emergency traffic. It shall review carriageway width, intersection spacing, turning radii, sight distance, gradients, pedestrian movement, roadside parking, loading and unloading, access to public facilities and the operation of cul-de-sacs.

Direct access from individual plots to major collector roads shall be controlled where it could interrupt traffic flow or create safety risks. Commercial and institutional areas shall have clearly defined entrances, exits, loading zones and parking arrangements. Schools, mosques, healthcare facilities and recreational areas shall be assessed for short-duration traffic surges, pedestrian concentration and roadside stopping. Internal roads shall provide continuous access for ambulances, firefighting vehicles, waste-collection vehicles, maintenance equipment and emergency evacuation.

11.5.4. PARKING ASSESSMENT

Parking demand shall be calculated separately for residential, commercial, public, institutional and recreational land uses. The assessment shall compare projected demand with the number and location of proposed parking spaces. It shall also consider visitor parking, staff parking, school pick-up and drop-off, mosque peak demand, commercial deliveries and parking for persons with disabilities.

Parking shall be provided within individual plots and designated parking areas so that vehicles do not obstruct carriageways, footpaths, drains or emergency routes. Commercial and public facilities shall include adequate off-street parking and managed loading areas. Where parking demand varies by time, shared parking may be evaluated, provided that the peak periods of the relevant land uses do not coincide. Unauthorized roadside parking shall be controlled through physical design, signage, enforcement and estate-management procedures.

11.5.5. PUBLIC TRANSPORT, WALKING AND CYCLING

The Traffic Impact Assessment shall evaluate opportunities to reduce private vehicle dependence through public transport, walking and cycling. Safe, continuous and shaded pedestrian routes shall connect residential areas with schools, mosques, parks, commercial centres, public buildings and transport stops. Pedestrian crossings shall be provided at locations with significant movement and shall include appropriate signs, markings, refuge islands or traffic-calming measures.

Public transport access shall be coordinated with relevant transport and planning authorities. Suitable locations for bus stops, shuttle services and passenger waiting areas shall be identified without obstructing through traffic. Where feasible, cycle routes and secure bicycle parking shall be provided. These measures will improve accessibility, reduce traffic growth and help control long-term transport-related emissions.

11.5.6. CONSTRUCTION TRAFFIC ASSESSMENT

Construction traffic shall be assessed separately because its characteristics differ from normal operational traffic. The assessment shall estimate the number and type of trucks, concrete mixers, earthmoving equipment, fuel vehicles, worker transport vehicles and material deliveries expected during each construction phase. It shall identify haul routes, access gates, delivery hours, vehicle holding areas and locations where heavy vehicles may interact with communities or normal traffic.

The current EIA anticipates approximately two to three daily construction-material truckloads during early construction, increasing to approximately five to eight truckloads during peak activity, with deliveries scheduled to minimize disturbance. These preliminary estimates shall be verified against actual construction quantities, earthwork volumes, material sources and the construction schedule.

A Construction Traffic Management Plan shall define approved routes, restricted hours, speed limits, signage, flag personnel, wheel-washing, covering of loose materials, road cleaning, vehicle inspection, parking and emergency procedures. Heavy vehicles shall not queue on public roads or block access to neighbouring properties. Any road damage caused by construction traffic shall be repaired by the proponent or contractor.

11.5.7. ROAD SAFETY ASSESSMENT

The assessment shall identify road-safety risks affecting residents, workers, pedestrians, children, motorcyclists, cyclists and surrounding communities. It shall review intersection geometry, sight distance, vehicle speed, pedestrian crossings, roadside activity, lighting, school access, commercial loading and emergency access.

A road-safety audit shall be conducted during detailed design and before operation. Recommended measures may include speed humps, raised crossings, rumble strips, warning signs, street lighting, guardrails, pedestrian refuges, school-zone controls, access restrictions and enforcement arrangements. The internal residential environment shall be designed for low vehicle speeds, while major collector roads shall provide controlled intersections and safe pedestrian crossing points.

11.5.8. VEHICULAR EMISSIONS MODELLING

Vehicular emissions modelling shall be undertaken to quantify the effect of project-generated traffic on local air quality and greenhouse gas emissions. The modelling shall cover pollutants associated with fuel combustion and traffic movement, including

nitrogen oxides, carbon monoxide, particulate matter, hydrocarbons and carbon dioxide. Where relevant, emissions from resuspended road dust shall also be assessed.

The emissions inventory shall be based on:

- traffic volume by vehicle class;
- average travel distance;
- road speed;
- congestion and idling time;
- fuel type;
- vehicle age or technology distribution;
- heavy vehicle proportion;
- road gradient;
- construction traffic;
- background traffic growth; and
- cumulative traffic from surrounding developments.

The existing EIA recognizes that construction vehicles and equipment may emit carbon dioxide, carbon monoxide, nitrogen oxides, sulphur dioxide and particulate matter, but it currently relies mainly on maintenance and dust-control measures rather than quantitative modelling. The revised assessment shall quantify emissions for existing, construction, initial occupation, full-development and cumulative scenarios.

11.6. AIR QUALITY DISPERSION ASSESSMENT

Where traffic emissions are potentially significant, dispersion modelling shall be conducted to estimate pollutant concentrations at nearby sensitive receptors. The model shall consider road alignment, traffic volume, vehicle speed, meteorological conditions, background air quality, receptor distance and surrounding terrain or built form.

Receptors shall include:

- residential settlements;
- houses near access roads;
- schools;

- healthcare facilities;
- mosques;
- commercial areas;
- pedestrian routes; and
- public open spaces.

Modelled traffic contributions shall be added to measured baseline concentrations and compared with applicable ambient air-quality standards. The assessment shall identify the road sections and receptors with the highest predicted exposure. Where pollutant concentrations approach or exceed the applicable criteria, additional measures such as traffic-flow improvement, access redistribution, green buffers, restrictions on heavy vehicles, public transport measures or development phasing shall be implemented.

11.6.1. TRANSPORT-RELATED GREENHOUSE GAS EMISSIONS

Carbon dioxide emissions from project-generated transport shall be included in the project carbon footprint. Construction vehicles under the control of the proponent or contractor shall be categorized as direct or contractor-related emissions, while operational emissions from residents, visitors, employees and service vehicles shall be reported as relevant indirect emissions.

The assessment shall estimate annual transport emissions using vehicle kilometres travelled, fuel type and appropriate emission factors. Indicators should include:

- total annual transport emissions in tCO_2e;
- emissions per resident;
- emissions per occupied plot;
- average vehicle kilometres per trip;
- percentage of trips by private vehicle;
- public transport share;
- walking and cycling share; and
- percentage of electric or low-emission vehicles.

Transport emissions shall be updated as actual occupancy and travel data become available.

11.6.2. TRAFFIC AND EMISSIONS MITIGATION MEASURES

Traffic mitigation shall prioritize avoidance and demand management before road widening. Project land uses shall be arranged to reduce unnecessary trips by providing accessible schools, mosques, parks, shops and public services. Public transport connections, pedestrian routes, cycling facilities and electric-vehicle charging shall be incorporated where feasible.

Operational traffic measures shall include coordinated access control, signal or junction improvements, adequate turning lanes, parking management, speed limits, road-safety controls, traffic signs, street lighting and enforcement against obstruction. Heavy commercial deliveries shall be scheduled outside peak traffic periods. Construction traffic shall follow approved routes and timing restrictions.

Emissions shall be reduced through smooth traffic flow, reduced idling, vehicle inspection and maintenance, restrictions on visibly smoking vehicles, paved and maintained roads, road dust control, public transport promotion and gradual adoption of electric or low-emission vehicles. Tree planting and green buffers may reduce dust exposure and improve the roadside environment but shall not be treated as a substitute for controlling emissions at source.

11.6.3. TRAFFIC MONITORING PROGRAMME

Traffic conditions shall be monitored during construction, initial occupation and full operation. Monitoring shall include traffic volume, queue length, intersection delay, Level of Service, travel speed, accident records, parking conditions, complaints, road damage and access obstruction. Roadside air quality and noise shall be monitored at representative sensitive receptors.

Monitoring frequency shall be highest during peak construction and major occupation phases. A follow-up traffic survey shall be undertaken when occupancy reaches defined thresholds, such as 25 percent, 50 percent, 75 percent and full occupation, or at other stages established in the approved Traffic Impact Assessment. Corrective action shall be initiated where traffic volumes exceed design assumptions, queues extend beyond available storage, Level of Service falls below the approved criterion, accident rates increase, emergency access is obstructed or roadside air-quality standards are exceeded.

12. CONCLUSIONS AND RECOMMENDATIONS

12.1. CONCLUSIONS

This Environmental Impact Assessment (EIA) has been conducted for the ***Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme, Zone IV, Islamabad*** in accordance with the requirements of Section 12 of the Pakistan Environmental Protection Act (PEPA), 1997, the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000, and relevant Capital Development Authority (CDA) zoning regulations. The assessment has comprehensively examined the project's design, location, scale, and activities, along with baseline environmental and socio-economic conditions of the project area and its surroundings.

The study concludes that the proposed housing scheme represents a **planned and regulated urban development** intended to address growing residential needs in Islamabad while conforming to applicable land-use planning standards. The project site is located in Zone IV, an area designated for controlled development under ICT Zoning Regulations, and no environmentally sensitive or protected areas such as notified wildlife sanctuaries, archaeological heritage sites, or critical habitats fall within the project footprint. Baseline environmental conditions indicate that the area is primarily rural-agricultural with scattered settlements and no significant ecological constraints that would preclude development, provided appropriate mitigation measures are implemented.

Potential environmental impacts associated with the project have been systematically identified for the **design, construction, and operational phases**. These impacts are largely localized, temporary, and manageable in nature. Key concerns relate to land acquisition, site preparation, soil disturbance, construction-related dust and noise, increased traffic movement, wastewater generation, solid waste management, and pressure on local water resources. Importantly, the assessment confirms that **no major infrastructure, religious properties, or cultural heritage assets will be disrupted** as a result of the proposed development. Impacts related to land acquisition are primarily social in nature and can be effectively managed through fair compensation mechanisms in line with market value and prevailing legal frameworks.

The project incorporates several positive planning and environmental features, including a comprehensive land-use plan, provision of adequate green and recreational spaces, a dedicated sewerage and sewage treatment system, storm water drainage aligned with natural flow patterns, landscaped road networks, and a low-density residential design. The inclusion of a centralized Sewage Treatment Plant (STP), water conservation strategies, and structured solid waste management systems significantly reduces the risk of adverse impacts on surface and groundwater quality, particularly with respect to Korang River and nearby natural drainage channels.

Public consultations carried out during the EIA process indicate general acceptance of the project, with stakeholders emphasizing the need for effective environmental management, controlled construction practices, and timely provision of municipal services. These concerns have been addressed through the formulation of a detailed **Environmental Management and Monitoring Plan (EMMP)**, which defines mitigation measures, monitoring protocols, institutional responsibilities, reporting mechanisms, and budgetary provisions to ensure environmental compliance throughout the project lifecycle.

In conclusion, the EIA determines that the **Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme** is **environmentally feasible** and **socially acceptable**, provided that all mitigation measures, environmental management actions, and monitoring requirements outlined in this report are strictly implemented. With adherence to national environmental regulations, CDA planning standards, and the proposed EMMP, the project is not expected to cause significant or irreversible adverse environmental impacts. Instead, it has the potential to contribute positively to planned urban growth, improved living standards, and sustainable development within the Islamabad Capital Territory

12.2. RECOMMENDATIONS

Based on the findings of the Environmental Impact Assessment, baseline environmental conditions, impact analysis, and stakeholder consultations, the following recommendations are proposed to ensure that the *Revised & Extended Layout Plan of Gulberg Green, Farm Housing Scheme* is implemented in an environmentally sustainable, socially responsible, and regulatory-compliant manner throughout its design, construction, and operational phases.

First, it is strongly recommended that **all provisions of the Environmental Management and Monitoring Plan (EMMP)** included in this EIA be treated as

mandatory and fully integrated into project execution. The proponent shall ensure that adequate financial, technical, and human resources are allocated for effective implementation, monitoring, documentation, and reporting of environmental performance during all phases of the project.

Land acquisition for the project should be **minimized to the extent practicable** through design optimization. Where land acquisition is unavoidable, compensation must be paid strictly in accordance with prevailing market rates and applicable land acquisition laws. A **Land Acquisition and Compensation Committee**, in consultation with potential Project Affected Persons (PAPs), should be established to ensure transparency, timely compensation, and grievance redressal.

During the **construction phase**, contractors must adopt environmentally sound construction practices to control dust emissions, noise levels, and waste generation. Construction activities should be restricted to designated working hours, and appropriate dust suppression measures such as water sprinkling should be applied on unpaved surfaces and material stockpiles. All construction machinery and vehicles should be properly maintained to minimize air and noise pollution and ensure compliance with National Environmental Quality Standards (NEQS).

It is recommended that **soil erosion and surface runoff** be carefully managed during site preparation and earthworks. Natural drainage patterns should not be obstructed, and temporary drainage channels, sediment traps, and slope stabilization measures should be provided to prevent soil erosion and off-site sedimentation, particularly during the monsoon season.

For **water resource management**, strict implementation of the proposed water conservation strategy is essential, given the water-scarce context of Islamabad. Rainwater harvesting, efficient plumbing fixtures, reuse of treated wastewater for landscaping, and public awareness programs for residents should be actively promoted. Groundwater abstraction should be regularly monitored to avoid over-extraction and long-term depletion.

The **sewerage and sewage treatment system** should be constructed and operated strictly in accordance with approved designs and CDA requirements. The Sewage Treatment Plant (STP) must be fully operational before occupancy of residential units, and treated effluent should consistently meet NEQS prior to discharge into nearby natural drainage channels. Regular monitoring of influent and effluent quality is essential to safeguard surface water resources.

A **comprehensive solid waste management system** should be implemented during both construction and operation phases. Waste segregation at source, safe storage, timely collection, and disposal through authorized waste management contractors should be ensured. Open dumping or burning of waste within the project area must be strictly prohibited.

To enhance **ecological sustainability**, the project proponent should prioritize landscaping with native and climate-appropriate tree and plant species. Green belts, parks, and open spaces should be developed as planned, and tree plantation along roads and drainage corridors should be used as a measure to reduce dust, noise, and soil erosion while improving the micro-climate of the area.

Occupational **health and safety measures** must be enforced at all construction sites. Workers should be provided with appropriate personal protective equipment (PPE), first-aid facilities, safe drinking water, sanitation facilities, and emergency response arrangements. Regular safety training and toolbox talks should be conducted to minimize occupational hazards.

It is further recommended that the proponent maintain **continuous coordination with relevant regulatory authorities**, including Pak-EPA, CDA, and local administration, throughout the project lifecycle. Periodic environmental monitoring reports should be submitted to the concerned authorities, and any non-compliance identified during inspections should be promptly rectified.

Finally, the proponent should establish an effective **grievance redress mechanism** for residents and surrounding communities to address environmental and social concerns during construction and operation. Maintaining transparent communication and responsiveness to stakeholder concerns will contribute to long-term social acceptance and sustainability of the project.

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14. ANNEXURES

ANNEXURE A

Previous NoC for Gulberg Greens

BY HAND

F. No. 3(1)/2018-EIA-GGFH-DD(EIA/Mont)/61
GOVERNMENT OF PAKISTAN
PAKISTAN ENVIRONMENTAL PROTECTION AGENCY (PAK-EPA)
MINISTRY OF CLIMATE CHANGE
PLOT # 42, STREET # 6, SECTOR H-8/2, ISLAMABAD
Ph # 051-9250716, Fax # 051-9250715

***

CLEANGREENPAKISTAN
صاف سبز پاکستان

Dated:- 22nd March, 2021

Subject: **ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT OF GULBERG GREENS FARMS HOUSING SCHEME (REVISED & EXTENDED) ZONE-4-B, ISLAMABAD.**

I am directed to convey the approval of Competent Authority on EIA Report submitted by Mr. Allah Rakha Nasir, Joint Secretary (IBECHS) M/s I.B. Employees Cooperative Housing Society Limited project (Gulberg Green Farm Housing Scheme at Zone-4-B), Islamabad for the above-mentioned project.

2. It may also be indicated that approval of EIA is subject to the conditions laid down in the Approval Document (Attached). It is further requested that as per Schedule-VII, IEE / EIA Regulations, 2000, the proponent of project has to submit undertaking regarding acceptance of the conditions laid down in the approval document, soon after the receipt of the decision on EIA.

3. Please also find enclosed herewith format Proforma for ease of compliance reporting.

Encl: As above.

(M. AHSAN RAFI KIANI)
Director (EIA/Mont)

Mr. Allah Rakha Nasir
Joint Secretary
Employees Cooperative Housing Society (IBECHS)
Head Office Street No. B-04
Business Park, Gulberg Greens
Islamabad.

F. No. 3(1)/2018-EIA-GGFH-DD(EIA/Mont)/61
GOVERNMENT OF PAKISTAN
PAKISTAN ENVIRONMENTAL PROTECTION AGENCY
PLOT NO. 42, STREET NO. 6, SECTOR H-8/2,
ISLAMABAD.
Tele: (92-51-9250713)
Fax No. (92-51-9250715)

E-mail: pakepa@environment.gov.pk

***

DECISION ON ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT
Under

Review of Initial Environmental Examination (IEE) and Environmental Impact Assessment Regulations, 2000.

1.	Name & Address of Proponent:	Mr. Allah Rakha Nasir Joint Secretary (IBECHS) Head Office, Street No. B-04, Business Park Gulberg Greens **Islamabad.**
2.	Description of Project:	Construction of Gulberg Greens Farms Housing Scheme (Revised & Extended).
3.	Location of Project:	At Zone-IV-B, Islamabad.
4.	Date of Admission of Application:	7th November, 2018. (Required Documents and information received on **27th November, 2020**.

5. After careful review of the Environmental Impact Assessment (EIA) Report of the project **"Construction of Gulberg Greens Farm Housing Scheme (Revised & Extended) Zone-IV-B, Islamabad"** submitted by Mr. Allah Rakha Nasir, Joint Secretary (IBECHS) Head Office, Street No. B-04, Business Park, Gulberg Greens, Islamabad and followed by queries, comments, clarifications / replies by the proponent /consultant. Pakistan Environmental Protection Agency (Pak-EPA), Government of Pakistan has decided to accord its approval on EIA Report subject to the following conditions:-

i. The proponent shall intimate Pak-EPA regarding the date of commencement of the project.

ii. The proponent shall engage services of a third party for compliance monitoring and reporting as per the EMP and condition of approval issued by Pak-EPA. Information regarding the same shall be provided to Pak-EPA before start of construction work at site. Daily Environmental Incident reporting shall also be ensured.

iii. The proponent shall prepare a comprehensive traffic management plan for material transportation during construction phase and for vehicular traffic during operational phase of the project in consultation with Islamabad Traffic Police (ITP) and details thereof be shared with Pak-EPA.

iv. Proponent will strictly adhere to implement all mitigation measures contained in the EIA Report and addendum in order to minimize any negative impact on soil, ground water, ambient air quality, noise, natural drainage and biological resources during and after construction of the project. This may be indicated in the report as **"Commitment"**. Institutional arrangements for implementation of environmental management plan will be finalized before the start of construction, so that proposed mechanism of environmental protection should work in time.

v. In case of hiring of contractor for different jobs. Clause of "Environmental Protection" should be made part of the agreement. Institutional arrangements for implementation of environmental management plan may be finalized well before the start of construction, so that the proposed mechanism of environmental protection should work at the time of mobilization of project activities as to ensure monitoring of the project activities.

vi. The proponent / contractor should ensure a proper plantation and land scaping plan duly approved by CDA. The plan should clearly identify plants / trees to be cut and the types of plants and species to be planted. The local species will be given preference.

vii. The proponent of project shall ensure to implement the Environmental Management Plan as part of EIA Report in true letter and spirit.

viii. The proponent will constitute Environmental Management Committee responsible for the management of solid / liquid / hazardous / hospital waste and other issues related to the environment and ensure compliance with all relevant NEQS.

ix. The Environmental Management Committee shall submit quarterly compliance monitoring report to this Agency for review and further guidance.

x. The proponent's Environmental Management Committee shall liaise with Pak-EPA for monitoring of EMP.

xi. The proponent will take appropriate measures to avoid contamination of soil from disposal of liquid and solid waste generated during and after the project activities to ensure that no adverse impact would be on environment.

xii. The proponent shall solely be responsible for all technical / engineering design parameters of the development project. If any breach / deficiency or failure of the project design that may / would appear at any stage (from execution to operation) that causes deterioration of environment and disturb socio economic conditions of the project surrounding area, the whole responsibility for remedial / mitigation measures and compensation of damage will be bone by the proponent of project.

xiii. As far as possible, employment should be provided to local people particularly for unskilled jobs. Employment record for all positions shall be provided to Pak-EPA. Compensation must be provided to inhabitants in case of loss of agriculture land, crop and property etc in accordance with the rates that are agreed upon. All conflicting issues regarding compensation etc to be settled before executing / commencing the project activities.

xiv. The proponent should ensure unhindered movement of surrounding communities and maintenance of community access roads to be used by proponent and its society inhabitants.

xv. Special safety precautions and noise controlling measures shall be taken while working close to any settlements, towns, schools and hospitals etc for safety of the people and livestock.

xvi. The proponent should identify exact locations of camp sites and areas for earth material site with the consultation of consultant.

xvii. The proponent shall ensure proper management of solid waste, which will be generated during construction and operation of the project. The proponent shall impose ban on use of Non-Biodegradable Plastic Bags.

xviii. The proponent of project will ensure to sign agreement with CDA for the management of solid waste / domestic waste.

xix. The proponent should ensure use of energy efficient devices in the project.

xx. The proponent should ensure to avoid dumping of debris into down slopes and stabilize other slopes by planting grasses / shrubs.

xxi. The proponent of project should ensure to arrange clean and safe drinking water for the inhabitants of the society.

xxii. The proponent should ensure maximum use of alternate energy in the project.

xxiii. The proponent of the project shall ensure to have rainwater-harvesting practices, inverted well, and reuse of grey water.

xxiv. The proponent of project will establish sewerage treatment plant of optimum capacity and Integrated Resource Recovery facility in its premises and comply with NEQS. A separate undertaking regarding the same with clear-cut indication of schedule of construction and operation shall be submitted by the proponent.

xxv. No natural drain / stream would be disturbed, which are flowing within or nearby / adjacent to the society.

xxvi. The proponent will also ensure to manage sewage sludge properly, and dump it at identified approved places.

xxvii. The proponent shall ensure incorporation of water conservation measures in the project and seek prior approval for extraction of groundwater from relevant authority.

xxviii. The proponent will ensure that the proposed project does not fall in any sensitive area and there is no pending court case against the proposed project.

xxix. The proponent of the project shall be responsible to ensure the compliance of CDA building codes and byelaws.

xxx. The proponent and management committee of the proposed housing scheme will solely be responsible to mitigate the environmental issues on priority basis. In case of any emergency i.e. flooding, fire or any other natural disaster, the proponent should be solely responsible to prepare emergency response, plans in advance so that the timely actions could be taken to protect the inhabitants and their property urgently.

xxxi. The proponent shall ensure to consider the presence of buffer zone for managing High Transmission Lines.

xxxiii. **This environmental clearance is for the development of infrastructure based on the plan submitted to this Agency as part of this EIA Report. However, the proponent will have to seek fresh environmental clearance from this Agency for any future extension / addition in the scheme (i.e. entire layout plan: existing + additional) by submitting EIA Report. In addition the proponent will have to seek fresh environmental clearance for multi structure projects in the existing scheme also.**

xxxiv. **The proponent will also have to seek separate approval for operational phase of the project.**

xxxv. After completion of the project, project area (campsite, workshops, and batching plant and stockpile sites) will be restored to its original condition. For this purpose documentation in the shape of video and photographs should be kept on record.

xxxvi. Pak-EPA reserves the right to proceed against the proponent of project in case of delay in submission of EIA study of the project (if any) as per law.

6. The proponent shall be liable for compliance of regulations 13, 14, 17 and 18 of IEE / EIA Regulations, 2000, which enunciate the conditions for approval, confirmation of compliance, entry, inspection and monitoring of the proposed project.

7. The proponent will restrict for development of land measuring **18,660 Kanals**.

8. This approval shall be treated as null and void if the conditions, mentioned herein, are not complied with.

9. This approval does not absolve the proponent of the duty to obtain any other approval including the provincial and local governments or clearance that may be required under any other law in force.

10. Hence therefore, exercising powers under section 12 of the Pakistan Environmental Protection Act, 1997, the undersigned hereby accords Environmental Approval on EIA Report of the proposed project **"Construction of Gulberg Greens Farm Housing Scheme (Revised & Extended) at Zone-IV-B, Islamabad"** with **the above-mentioned conditions.**

(Director General)
Pak-EPA

ANNEXURE B

Modalities and Procedures Framed Under ICT (Zone) Regulations 1992

REGISTERED No. M - 302
L.-7646

The Gazette of Pakistan

EXTRAORDINARY
PUBLISHED BY AUTHORITY

ISLAMABAD, WEDNESDAY, DECEMBER 10, 2014

PART II

Statutory Notifications (S. R. O.)

GOVERNMENT OF PAKISTAN

CAPITAL DEVELOPMENT AUTHORITY

(Regional Planning Directorate)

NOTIFICATION

Islamabad, the 8th December, 2014

Subject:—**AMENDMENTS IN ICT (ZONING) REGULATIONS, 1992 OF ZONE-4.**

S. R. O. 1105(I)/2014.—In exercise of powers conferred by Section 51 read with Section 11 of the Capital Development Authority Ordinance, 1960 (No.XXIII of 1960), the Capital Development Authority has been pleased to make the following amendments in the Islamabad Capital Territory (Zoning) Regulation, 1992, as being expedient, namely:—

PROPOSED LAND USE OF ZONE-4

	Subject	Existing land use	Proposed land use
a	Agro-farming	Not less than 20 kanals.	Minimum size of 4 kanals shall be permissible.
b	Housing	No private housing or housing scheme permissible.	Housing schemes in selected areas shall be permissible. Houses on private land in unutilized patches of built up area shall be allowed as per CDA byelaws.

[5273(2014)/Ex. Gaz.] *Price : Rs. 5.00*

	Subject	Existing land use	Proposed land use
c	Commercial	No commercial activity is permissible.	Commercial activity astride defined major roads shall be permissible on selected locations.
d	Sub-zones	No provision of sub-zones.	Area divided into sub-zones.

A. Sub Zone-A (12,188 Acres)

(1) **Delineation:** This sub zone is bounded in the north by Zone-3 limits and by southern boundary of sub –zone B-2, in the North-West by Murree Road, in the West by sub-zone B-1 (acquired area limit), in the South and East by sub-zone C and Lehtrar Road.

(2) **Pre-dominant existing uses:** Poultry and vegetable agro-farming scheme No.1, 2 and 4 and their extensions, Orchard Scheme, Educational and Research Institutions.

(3) **Proposed uses:** Besides the existing land use for Agro Farming/ Orchard Schemes, Institutions and CDA Model Villages; public sector housing schemes at defined locations shall be permissible.

(4) **Parameters:**

a. **Agro-farming scheme :**

i.	Min. area of scheme	50 acres
ii.	Min. size of Farm,	08 kanals
iii.	Max. covered area	1000 Sq. yds (Excluding basement)
iv.	Number of storeys	Ground + 1 + basement

b. **Housing Scheme:**

i.	Min. area	100 acres
ii.	Plot size	130-600 Sq.yd.
iii.	Number of storeys	Ground + 1 + basement

c. **Apartments & Office Buildings:**

i.	Number of storeys	Ground + 3 + basement

B. Sub Zone-B (12,941 Acres)

(1) **Delineation:** This sub zone comprises two parts namely; B-1 (6805 Acres) and B-2 ¹,6136 Acres). Delineation is as follows:

(a) **B-1:** This area is bounded in the West by Islamabad Expressway, in the South by inter-zone boundary of Zone-4 & Zone-5, in the East by sub-zones A & C and includes 500 meter area astride Lehtrar Road up to the PINSTECH limits.

(b) **B-2:** The area is bounded in the north by Murree Road, in the West by Zone-3 limits, in the south by sub-zones A, C & D and in the east by sub-zone D.

(2) **Pre-dominant existing uses:** Illegal Commercial & residential development, Rampant un-authorized expansion of existing villages/settlements.

(3) **Proposed uses:** Mixed Land Uses, Residential, Institutions, Housing Schemes, Regulated expansion of existing villages/ settlements.

(4) **Parameters:**

a. **Housing Scheme**

i.	Min. area	50 acres
ii.	Plot size	130 to 600 Sq.yd.
iii.	Number of storeys	Ground+1+ basement

b. **Apartments, Office & Commercial Buildings**

i.	Number of storeys	Ground+3+ basement

C. **Sub Zone-C (21,279 Acres)**

(1) **Delineation:** This sub-zone is bounded in the north by southern limits of sub-zones B2 and A, in the east by sub-zone 'D' in the south by inter zone boundary of Zone-4 & Zone-5 and in the west by sub-zone B-1.

(2) **Pre-dominant existing uses:** Illegal Commercial & residential development, brick kilns, PINSTECH.

(3) **Proposed uses:** Agro farming/Country Housing /Orchard Schemes Institutions, IT Parks, Villages Up-gradation, Regulated villages/ settlements expansion, public sector housing schemes.

(4) **Parameters:**

a. **Agro farmictg scheme**

i.	Min. area	100 acres.
ii.	Min. area farm	04 kanals.
iii.	Max. covered area	1000 Sq.yds. (excluding basement)
iv.	Number of storeys	Ground+1+ basement

b. **Housing Scheme**

i.	Min. area	100 acres
ii.	Plot size	130 to 600 Sq.yd.
iii.	Number of storeys	Ground+1+ basement

c. **Apartments and office buildings:**

i.	Number of storeys	Ground+3+ basement

D. **Sub Zone-D (23,618 Acres)**

(1) **Delineation:** This sub-zone is bounded in the north by the sub-zone B-2, in the east and south by ICT limits and in the west by sub-zone C.

(2) **Pre-dominant existing uses:** Forests, Agro Farms, Simly Dam, Villages.

(3) **Proposed uses:** Agro farming, Reserved Forests, Nature Conservation Projects, Sports and Recreation (hotels, cultural centers, Cineplex, theatres. playgrounds and parks), Entertainment Zones, Golf Courses. Polo Grounds, Country Club, Water Sports, Swimming Pools, Gliding & Jogging Tracks.

(4). **Parameters:**

a. **Agro farming/Orchard Scheme**

i.	Min. area of scheme	200 acres

ii.	Min. area of farm,	4 to 20 kanals at defined locations
iii.	Max. covered area	1000 Sq. yd (Excluding basement)
iv.	Number of storeys	Ground + 1 + basement

b. **Apartments and Office Buildings**

i. Number of storeys	Ground + 3 + basement

c. **Hotels**

i. Number of storeys	Ground + 6 + 2 basements

ZONING REGULATION FOR ZONE-4 (AMENDED) ISLAMABAD (1992) DELINEATION OF ZONE-4 AND ITS SUB ZONES

The Zone-4 comprises Islamabad Park and rural periphery wedged between Murree Road towards north and Lehtrar Road towards south and extending beyond Simly Road upto the ICT limits in the north-east. This zone excludes the part of Margalla Hills National Park around Rawal Lake. The total area of this zone is 70,026 acres. The Zone has been divided into four sub-zones as detailed below:

Sub Zone-A (12,188 Acres)

2. This sub zone is bounded in the north by Zone-3 limits and by southern boundary of sub-zone B-2, in the North-West by Murree Road, in the West by Sub-zone B-1 (acquired area limit) in the South and East by sub-zone C and Lehtrar Road.

Sub Zone-B (12,941 Acres)

3. This sub-zone comprises two parts namely; B-1 (6805 Acres) and B-2 (6136 Acres). Delineation is as follows:

(a) B-1: This area is bounded in the West by Islamabad Expressway, in the South by inter-zone boundary of Zone-4 & Zone-5, in the East by sub-zones A & C and includes 500 meter area astride Lehtrar Road upto the PINSTECH limits.

(b) B-2: The area is bounded in the north by Murree Road, in the West by Zone-3 limits, in the south by sub-zones A, C & D and in the east by sub-zone D.

Sub Zone-C (21,279 Acres)

4. This sub-zone is bounded in the north by southern limits of sub –zones B2 and A, in the east by sub-zone 'D' in the south by inter zone boundary of Zone-4 & Zone-5 and in the west by sub-zone B-1.

Sub Zone-D (23,618 Acres)

5. This sub-zone is bounded in the north by the sub-zone B-2, in the east and south by ICT limits and in the west by sub-zone C.

PERMISSIBLE LAND USES IN ZONE-4

6. No industry, livestock and poultry farming schemes shall be allowed in Zone-4. Sub-zones wise permissible land uses are given as under:

Sub Zone-A

7. The area of this sub zone shall be used for agro-farming/orchard schemes of 8 kanals, large scale institutions of national importance, sports & recreation, green belt projects, nurseries, model villages and public sector housing schemes. All the buildings to be constructed in this zone shall be subject to the Islamabad Building Regulations, 2005. The owners of the existing buildings and the sponsors of the proposed land uses shall get approval from CDA of their buildings after payment of scrutiny fee, regularization, development and commercialization charges as determined and levied by the Authority from time to time and without prejudice to the right of the Authority to acquire the land in public interest.

Sub Zone-B

8. The area of this sub zone shall be used for planning and development of small scale residential and commercial buildings. Existing residential and commercial developments shall be regularized by CDA. The owners of the existing developments/

schemes shall get approval from CDA of their residential and commercial buildings after payment of scrutiny fee, regularization, development and commercialization charges as determined and levied by the Authority from time to time. The unutilized patches of land within this sub zone shall be utilized for residential schemes. Minimum contiguous area for such a scheme shall be 50 acres. Other parameters of the schemes shall be governed by the Modalities and Procedures framed under ICT Zoning Regulation 1992 for housing schemes in Zone-2 & 5.

Sub Zone-C

9. The predominant use of this sub zone shall be agro-farms and agro-farming schemes. The minimum size of an agro-farm shall be 4 kanals. The minimum area for an agro-farming scheme shall be 100 acres. Public sector housing schemes inclusive of residential plots shall also be permissible in this area, minimum area of such a scheme shall be 100 Acres. The major existing villages/settlements shall be up-graded. The individual/owners of the structures shall get approval from CDA of their buildings after payment of scrutiny fee, regularization, development and commercialization charges as determined and levied by the Authority from time to time. All the developments / schemes in the sub zone shall be subject to prior approval of the Authority.

Sub Zone-D

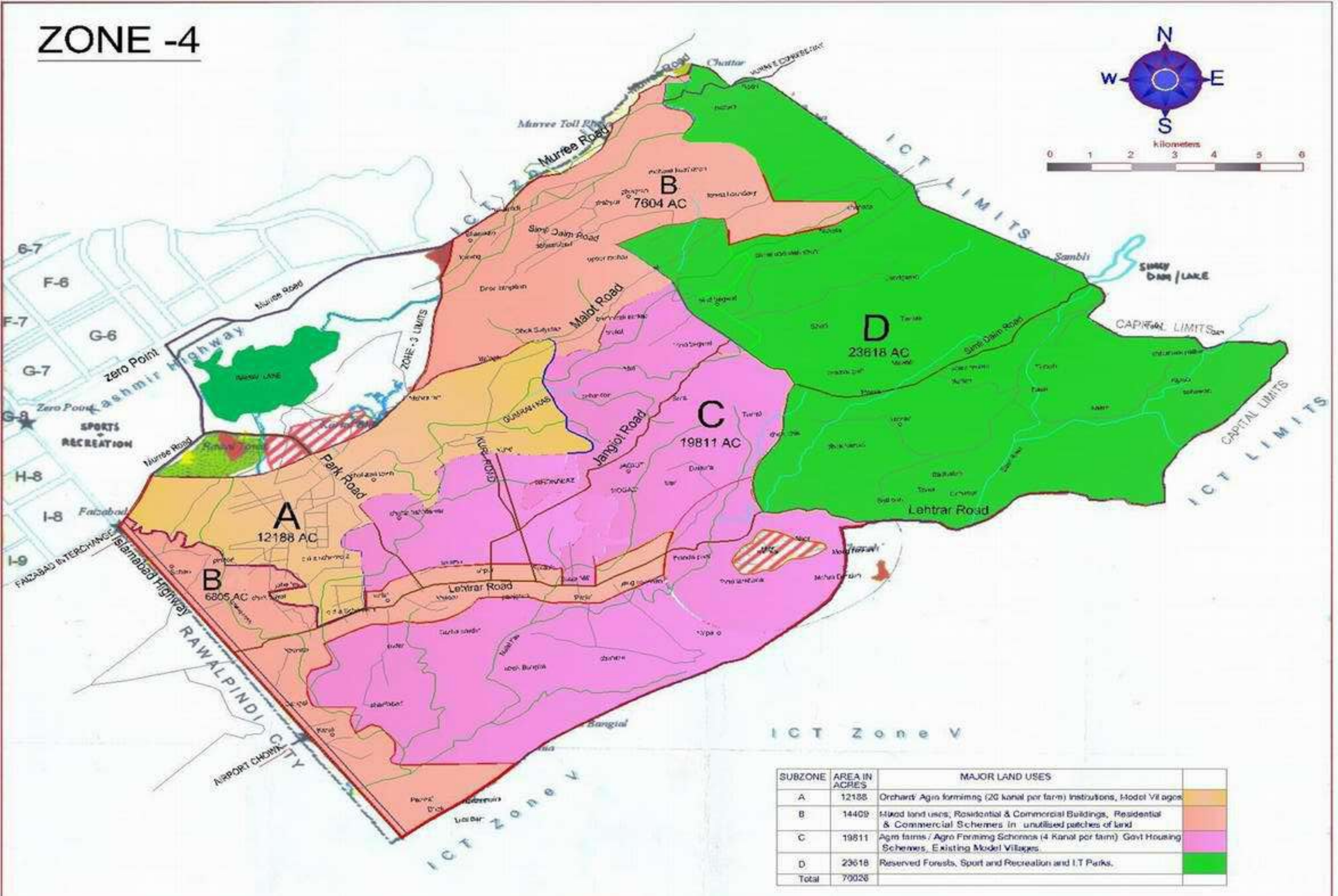
10. The existing reserved forests located in this sub-zone shall be maintained and intensive vegetation shall be done in these forests. The uses for the remaining area shall be agro-farming (farm area 4 kanals to 20 kanals. Minimum area of a farming scheme shall be 200 acres), recreation and entertainment zones, golf courses, polo ground, country club, water sports, swimming pools, gliding and jogging tracks, exhibition ground, drive-in-cinema, IT parks, research and development centers, caravan camping sites, scatting, wildlife sanctuary and aviaries. All the developments/ schemes in the sub-zone shall be subject to prior approval of the Authority.

11. This amendment will be applicable w.e.f. 29-04-2010

[F.No. CDA/PLW-I/PD-2(2)/14.]

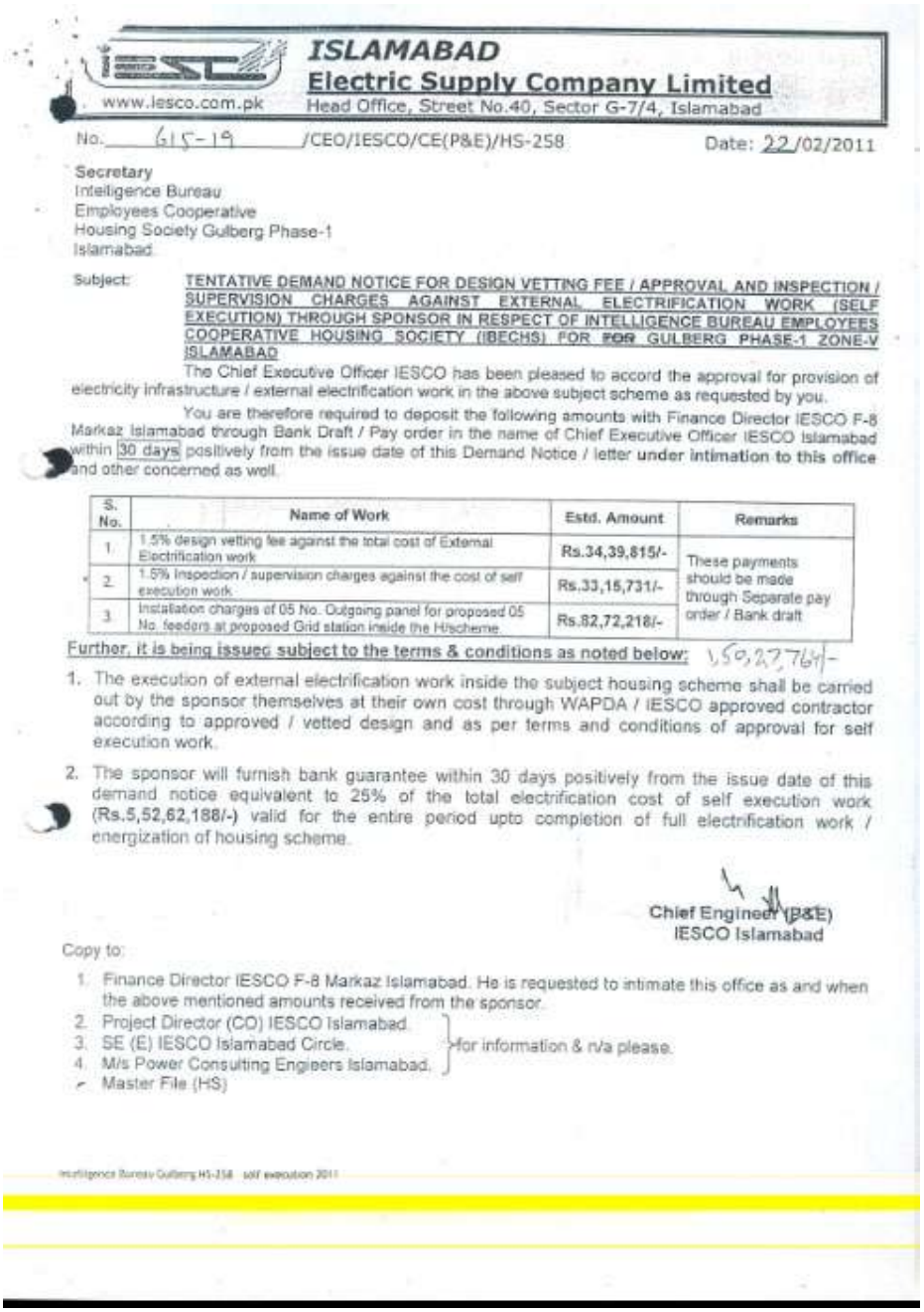
MUHAMMAD WISHAQ,
Secretary CDA Board.

ZONE -4



SUBZONE	AREA IN ACRES	MAJOR LAND USES	
A	12188	Orchard/ Agro farming (20 kanal per farm) Institutions, Model Villages	
B	14409	Mixed land uses; Residential & Commercial Buildings, Residential & Commercial Schemes in unutilised patches of land	
C	19811	Agro farms / Agro Farming Schemes (4 Kanal per farm) Govt Housing Schemes, Existing Model Villages	
D	23618	Reserved Forests, Sport and Recreation and I.T Parks.	
Total	70026		

ANNEXURE C
EXTERNAL ELECTRIFICATION/ IESCO APPROVAL



ISLAMABAD
Electric Supply Company Limited
www.iesco.com.pk Head Office, Street No.40, Sector G-7/4, Islamabad

No. 615-19 /CEO/IESCO/CE(P&E)/HS-258 Date: 22/02/2011

Secretary
Intelligence Bureau
Employees Cooperative
Housing Society Gulberg Phase-1
Islamabad

Subject: **TENTATIVE DEMAND NOTICE FOR DESIGN VETTING FEE / APPROVAL AND INSPECTION / SUPERVISION CHARGES AGAINST EXTERNAL ELECTRIFICATION WORK (SELF EXECUTION) THROUGH SPONSOR IN RESPECT OF INTELLIGENCE BUREAU EMPLOYEES COOPERATIVE HOUSING SOCIETY (IBECHS) FOR ~~FOR~~ GULBERG PHASE-1 ZONE-V ISLAMABAD**

The Chief Executive Officer IESCO has been pleased to accord the approval for provision of electricity infrastructure / external electrification work in the above subject scheme as requested by you.

You are therefore required to deposit the following amounts with Finance Director IESCO F-8 Markaz Islamabad through Bank Draft / Pay order in the name of Chief Executive Officer IESCO Islamabad within 30 days positively from the issue date of this Demand Notice / letter under intimation to this office and other concerned as well.

S. No.	Name of Work	Estd. Amount	Remarks
1.	1.5% design vetting fee against the total cost of External Electrification work	Rs.34,39,815/-	These payments should be made through Separate pay order / Bank draft
2.	1.5% Inspection / supervision charges against the cost of self execution work	Rs.33,15,731/-	
3.	Installation charges of 05 No. Outgoing panel for proposed 05 No. feeders at proposed Grid station inside the H/scheme	Rs.82,72,218/-	

Further, it is being issued subject to the terms & conditions as noted below: 150,27,764/-

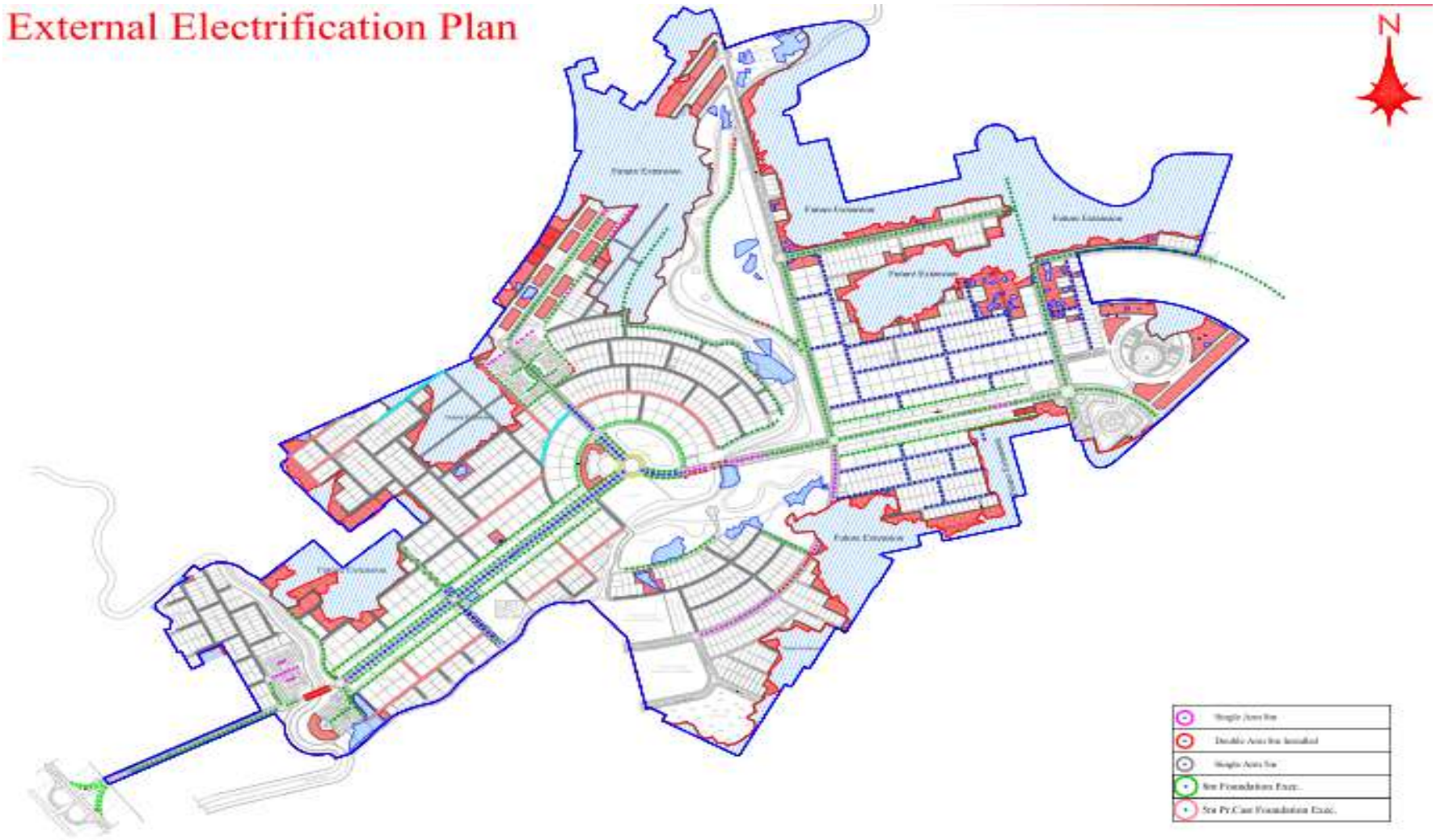
1. The execution of external electrification work inside the subject housing scheme shall be carried out by the sponsor themselves at their own cost through WAPDA / IESCO approved contractor according to approved / vetted design and as per terms and conditions of approval for self execution work.
2. The sponsor will furnish bank guarantee within 30 days positively from the issue date of this demand notice equivalent to 25% of the total electrification cost of self execution work **(Rs.5,52,62,188/-)** valid for the entire period upto completion of full electrification work / energization of housing scheme.

Chief Engineer (P&E)
IESCO Islamabad

Copy to:

1. Finance Director IESCO F-8 Markaz Islamabad. He is requested to intimate this office as and when the above mentioned amounts received from the sponsor.
2. Project Director (CO) IESCO Islamabad.
3. SE (E) IESCO Islamabad Circle. } for information & n/a please.
4. M/s Power Consulting Engineers Islamabad.
- Master File (HS)

Intelligence Bureau Gulberg HS-258 self execution 2011


External Electrification Plan
N

ANNEXURE D
SNGPL APPROVAL LETTER

87/c

Telephones : 092-51-9257710-19
Cable : "SUINORTH"
Fax No. : 092-51-9257770-

SUI NORTHERN GAS PIPELINES LIMITED
Plot No. 28-30, Industrial Area, I-9 Islamabad (Pakistan)

REF. NO. IS/L-42
DATE 20.05.2014

Mr. A. R Nasir
Joint Secretary
I.B Employees Co-operative Housing Society Limited
ISLAMABAD.

SUPPLY OF GAS TO
INTELLIGENCE BUREAU EMPLOYEES CO-OPERATIVE HOUSING SOCIEYT GULBERG ISLAMABAD.

We refer our letter # SGMD-(N)-14 dated 13.01.2014, regarding the subject and wish to advise you as follows:-

Our gas distribution network does not exist in the vicinity of above premises. In order to provide gas to the subject premises, the following network of gas mains are required to be laid at an estimated cost of **Rs. 60864515/- (Sixty Million Eight Lac Sixty Four Thousands Five Hundred and Fifteen Rupees Only)** (E. & O. E) subject to revision if prices of materials escalate).

PIPE DIA	METERAGE	UNIT RATE (Rs.)	COST (Rs.)
4" dia	7.9 KM	6401.71	50573509.00
TBS's (300mcf)	01 Nos	2352156.00	2352156.00
		Escalation Charges	7938849.75
		Total	60864514.75

Please be advised that after receipt of full amount, it normally takes us a minimum period of 18 to 24 months for the procurement of materials and allied fittings after receipt of which the execution of the job is taken in hand. All costs of Road Cross/Road Cuttings/boring will have to be borne by you. You will also be required to obtain prior permission for Road Cross/Cutting/boring from the competent authorities. The reinstatement of roads, pavements, sand filling inside the colonies and Nullah crossing would be carried out by your own arrangements.

Please also note that the security amount and service line cost sharing charges/cost of meter station will have to be deposited by you in addition to the above cost, and will be intimated to you after the successful laying/commissioning of the proposed gas main.

The proposed layng of the gas mains can be considered on 100% cost recovery basis. Proprietary rights of the Gas Network and its maintenance will rest with Sui Northern Gas Pipelines Limited and the Company will have the right to supply gas through the system to any other applicants. Therefore, should you agree to our above offer, you are requested to remit us the cost estimates along with the 'draft agreement' (specimen attached) duly filled in/signed on a **Rs.100/-** non-judicial stamp paper. This offer is valid up to **.20.06.2014.**

Assuring you of our best services at all times.

Sui Northern Gas Pipelines Limited

(Faiz Ahmed Chaudhary)
GENERAL MANAGER (ISLD)

Note: This refers to SGMD-(N)-14 dated 15.05.2014

ANNEXURE-E
ENVIRONMENTAL TESTING RESULTS

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 13720

Test Report

- Ground Water
- Ambient Air Monitoring

GULBERG GREENS FARM HOUSING SCHEME, ZONE –IV

09th Dec. 2025

Job Reference No.: GCEC-PK-ISL-109/2025

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
0320 4143519, 0320 4143318
042 35962884-85 0320 4143318
manager.operations@gcee.ae www.gcee.pk

Islamabad Office:
Flat # 4C, 4th Floor
Usmania Tower, E-11/3 Markaz
Islamabad.
Ph: 051 2375145

Client Detail:	
Name of Contact Person:	Miss. Humera Qasim Khan
Designation:	Environmental Manager
Contact Number:	+92-33-39219198
Address:	Gulberg Greens, Islamabad, Pakistan

GCEC Details:	
Director:	Mr. Mian Khurram Usman
Telephone:	+92 42 35962885
Fax:	+92 42 35962884
Email:	manager.operations@gcee.ae
Address	House No. 368-B Block B, Canal View, Lahore

Signatories:

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
0320 4143519, 0320 4143318
042 35962884-85 0320 4143318
manager.operations@gcee.ae www.gcee.pk

Islamabad Office:
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Islamabad.
Ph: 051 2375145

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 13748

CHEMICAL ANALYSIS TEST REPORT (GROUND WATER)

Sample Details			
Job Ref. No:	GCEC-PK-ISL-109/2025	Client Name:	Gulberg Greens Farm Housing Scheme, Zone –IV
Contact Number:	+92-33-39219198	Sample Matrix:	Ground Water Sample
Sample Date:	04-12-2025	Sampled By:	GCEC
Sample Receipt Date:	05-12-2025	Date of Completion of Analysis:	09-12-2025
Grab/Composite:	Grab Sampling	Address:	Gulberg Greens, Islamabad, Pakistan

Sample Identification	
01	Gulberg Greens

Parameters	Analysis Method	Unit	LOR	Results 01	NEQS
PYSICAL & CHEMICAL ANALYSIS					
pH	APHA-4500H+ B	-	0.01	7.22	6.5-8.5
Odor	In-house	-	-	Odorless	Non-Objectionable
Taste	In-house	-	-	Sweet	Non-Objectionable
Color	APHA-2120 B/C	Pt/Co	1.0	<1.0	≤15 TCU
Turbidity	APHA-2130 B	NTU	0.1	<0.1	<5 NTU
Total Hardness	APHA-2340 B&C	mg/l	0.1	184.0	< 500 mg/l
Total Dissolved Solid (TDS)	APHA-2540 C	mg/l	1.0	341.0	< 1000
Ammonia	APHA-4500-NH_3-B	mg/l	0.002	<0.002	-
Chloride	APHA-4500 B	mg/l	0.24	22.14	< 250
Cyanide (CN)	APHA-4500CN E	mg/l	0.01	<0.01	≤ 0.05
Fluoride (F)	APHA-4500F- D	mg/l	0.01	<0.01	≤ 1.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	≤ 3 (P)
Nitrate	APHA-4500NO3 C	mg/l	0.1	1.9	≤ 50
Phenolic Compound	APHA-5530 D	mg/l	0.01	<0.01	-
Residual Chlorine	APHA-4500Cl G	mg/l	0.1	<0.1	0.2-0.5
Aluminum (Al)	APHA-3111Al B	mg/l	0.028	<0.028	≤ 0.2
Cadmium	APHA-3111 B	mg/l	0.0028	<0.0028	0.01
Copper	APHA-3111 B	mg/l	0.0045	<0.0045	2
Chromium	APHA-3111 B	mg/l	0.0054	<0.0054	≤ 0.05 (P)
Antimony (Sb)	APHA-3111 B	mg/l	-	ND	≤ 0.005 (P)
Nickel	APHA-3111 C	mg/l	0.008	<0.008	≤ 0.02
Zinc	APHA-3111 B	mg/l	0.0033	<0.0033	5.0
Barium	APHA-3111Ba B	mg/l	0.031	<0.031	0.7
Manganese	APHA-3111 B	mg/l	0.0016	<0.0016	≤ 0.5
Iron	APHA-3111 B	mg/l	0.1	<0.1	-
Boron	APHA-4500-B (C)	mg/l	0.1	<0.1	0.3
Lead	APHA-3111 B	mg/l	0.013	<0.013	≤ 0.05
Mercury	APHA-3112Hg B	mg/l	0.0008	<0.0008	≤ 0.001
Arsenic	APHA-3111As B	mg/l	0.01	<0.01	≤ 50 (P)
Selenium	APHA-3111Se B	mg/l	-	ND	0.01 (P)
MICROBIOLOGICAL ANALYSIS					
Total Coliforms	APHA:9222 B	CFU/100ml		Absent	0/100ml
Faecal Coliforms (Ecoli)	APHA:9222 D	CFU/100ml		Absent	0/100ml

Abbreviations:
ND: Not Detected **LOR:** Limit of Reporting **NEQS:** National Environmental Quality Standards

Note:
** Uncertainty of all the parameters and laboratory conditions at the time of analysis will be provided as per the client's requirement. The lab environmental conditions are maintained at 25±5C° and humidity at 50±20%.*

Disclaimer: This Report is not valid for EPA or any court purposes.

Prepared By: **Reviewed By:** **Approved By:**

Green Crescent Environmental Consultants Pvt Ltd. ★ PAKISTAN ★

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
0320 4143519, 0320 4143318
042 35962884-85 0320 4143318
manager.operations@gcee.ae www.gcee.pk

Islamabad Office:
Flat # 4C, 4th Floor
Usmania Tower, E-11/3 Markaz
Islamabad.
Ph: 051 2375145

Ambient Air Monitoring Location

NEAR SECURITY OFFICE

(Gulberg Greens, Islamabad)

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
0320 4143519, 0320 4143318
042 35962884-85 0320 4143318
manager.operations@gcee.ae www.gcee.pk

Islamabad Office:
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Usmania Tower, E-11/3 Markaz
Islamabad.
Ph: 051 2375145

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-ISL-109/2025
Monitoring Point	Gulberg Greens (Near Security Office)
Date of Intervention	04-Dec-2025 to 05-Dec-2025
Coordinates	33°36'45.9"N 73°10'15.1"E

Sr. #	Time	CO (mg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)
1	10:45	2.03	79.04	135.76	27.72	48.46	76.19	30.50
2	11:45	1.87	82.16	129.52	26.66	47.96	74.62	31.11
3	12:45	1.38	83.20	137.84	25.80	49.06	74.86	32.10
4	13:45	2.12	84.24	130.56	28.84	49.26	78.10	30.36
5	14:45	1.68	81.12	128.48	28.65	45.39	74.04	32.08
6	15:45	1.72	85.28	125.36	29.46	45.89	75.35	30.68
7	16:45	2.10	83.20	129.52	27.83	47.28	75.11	29.13
8	17:45	1.98	86.32	123.28	27.11	45.45	72.56	28.05
9	18:45	2.01	83.20	119.12	27.24	45.07	72.31	27.63
10	19:45	1.93	84.24	127.44	26.13	45.30	71.43	26.01
11	20:45	2.03	83.20	120.16	27.19	44.69	71.88	28.44
12	21:45	1.99	81.12	118.92	25.42	45.23	70.64	27.60
13	22:45	1.76	85.28	114.44	23.80	43.77	67.58	30.61
14	23:45	1.68	81.12	112.15	24.66	43.36	68.01	30.68
15	00:45	1.85	80.08	121.20	25.50	45.07	70.57	29.13
16	01:45	1.88	78.00	117.04	22.20	45.17	67.37	29.53
17	02:45	1.90	75.92	125.36	20.89	46.05	66.94	32.13
18	03:45	1.89	73.84	127.44	23.45	44.55	68.00	33.27
19	04:45	1.83	81.12	130.56	24.96	44.90	69.87	32.37
20	05:45	2.01	78.00	136.80	25.57	46.20	71.77	29.85
21	06:45	1.99	82.16	139.92	25.22	43.24	68.46	29.33
22	07:45	1.85	81.12	129.52	26.26	42.55	68.80	30.35
23	08:45	1.73	82.16	139.92	27.81	44.50	72.31	31.88
24	09:45	1.68	81.12	142.00	28.00	45.10	73.10	32.61
Average Concentration		**1.87**	**81.51**	**127.60**	**26.10**	**45.56**	**71.66**	**30.23**

Deputy Analyst:

Reviewd By:

Approved By:

Green Crescent Environmental Consultants PVT. LTD. PAKISTAN

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
0320 4143519, 0320 4143318
042 35962884-85 0320 4143318
manager.operations@gcee.ae www.gcee.pk

Islamabad Office:
Flat # 4C, 4th Floor
Usmania Tower, E-11/3 Markaz
Islamabad.
Ph: 051 2375145

Ambient Air Quality Monitoring

Job Reference Number	GCEC-PK-ISL-109/2025
Monitoring Point	Gulberg Greens (Near Security Office)
Date of Intervention	04-Dec-2025 to 05-Dec-2025
Coordinates	33°36'45.9"N 73°10'15.1"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	NEQS
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	45.56	80.0
Nitrogen oxide (NO)	µg/m³	24 Hours	1.00	26.10	40.0
NO_X	µg/m³	24 Hours	1.00	71.66	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	30.23	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	1.87	5.0*
Ozone (O_3)	µg/m³	24 Hours	-	23.32	130.0**
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	127.60	150.0
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	81.51	35.0
Total Particulate Matter (TSP)	µg/m³	24 Hours	1.00	244.11	500.0

Abbreviations:
LDL= Lowest Detection Limit
NEQS= National Environmental Quality Standards
(*8 hours standard for CO
**1 hour standard for O_3)
µg/m³= Micrograms per Cubic Meter
mg/m³= Milligrams per Cubic Meter

Deputy Analyst:

Reviewd By:

Approved By:

Green Crescent Environmental Consultants Pvt. Ltd. ★ PAKISTAN ★

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
0320 4143519, 0320 4143318
042 35962884-85 0320 4143318
manager.operations@gcee.ae www.gcee.pk

Islamabad Office:
Flat # 4C, 4th Floor
Usmania Tower, E-11/3 Markaz
Islamabad.
Ph: 051 2375145

Noise Level Monitoring Report

Job Reference Number	GCEC-PK-ISL-109/2025
Monitoring Point	Gulberg Greens (Near Security Office)
Date of Intervention	04-Dec-2025 to 05-Dec-2025
Coordinates	33°36'45.9"N 73°10'15.1"E

Sr. #	Time	Method/Technique	Unit	Results LAavg	NEQS (Residential)
Night Time					
1.	23:45	Noise Meter	dB	41.2	
2.	00:45	Noise Meter	dB	38.7	
3.	01:45	Noise Meter	dB	44.7	
4.	02:45	Noise Meter	dB	44.4	
5.	03:45	Noise Meter	dB	45.6	45.0
6.	04:45	Noise Meter	dB	42.2	
7.	05:45	Noise Meter	dB	38.2	
8.	06:45	Noise Meter	dB	43.5	
Night Time Average			**dB**	**42.31**	**45.0**
Day Time					
9.	07:45	Noise Meter	dB	54.5	
10.	08:45	Noise Meter	dB	61.7	
11.	09:45	Noise Meter	dB	63.2	
12.	10:45	Noise Meter	dB	52.9	
13.	11:45	Noise Meter	dB	52.7	
14.	12:45	Noise Meter	dB	51.7	
15.	13:45	Noise Meter	dB	53.2	
16.	14:45	Noise Meter	dB	52.9	
17.	15:45	Noise Meter	dB	52.7	55.0
18.	16:45	Noise Meter	dB	51.7	
19.	17:45	Noise Meter	dB	53.2	
20.	18:45	Noise Meter	dB	52.9	
21.	19:45	Noise Meter	dB	51.7	
22.	20:45	Noise Meter	dB	50	
23.	21:45	Noise Meter	dB	54.4	
24.	22:45	Noise Meter	dB	50.9	
Day Time Average			**dB**	**53.77**	**55.0**

Deputy Analyst:

Reviewd By:

Approved By:

Green Crescent Environmental Consultants Pvt Ltd * PAKISTAN *

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
0320 4143519, 0320 4143318
042 35962884-85 0320 4143318
manager.operations@gcee.ae www.gcee.pk

Islamabad Office:
Flat # 4C, 4th Floor
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Ph: 051 2375145

Pictorial Evidence for Ground Water Sampling & Ambient Air Monitoring

Figure 1: Ground Water Sampling of Gulberg Greens

Figure 2: Ambient Air Monitoring of Gulberg Greens (Near Security Office)

End of Report

Pakistan Office: House No. 368-B , Block Canal View Housing Society, Lahore. Pakistan.
0320 4143519, 0320 4143318
042 35962884-85 0320 4143318
manager.operations@gcee.ae www.gcee.pk

Islamabad Office:
Flat # 4C, 4th Floor
Usmania Tower, E-11/3 Markaz
Islamabad.
Ph: 051 2375145

ANNEXURE-F

NATIONAL ENVIRONMENTAL QUALITY STANDARDS

REGISTERED No. M - 302
L.-7646

The Gazette of Pakistan

EXTRAORDINARY
PUBLISHED BY AUTHORITY

ISLAMABAD, FRIDAY, NOVEMBER 26, 2010

PART II

Statutory Notifications (S. R. O.)

GOVERNMENT OF PAKISTAN

MINISTRY OF ENVIRONMENT

NOTIFICATIONS

Islamabad, the 18th October, 2010

S. R. O. 1062(I)/2010.—In exercise of the powers conferred under clause (c) of sub-section (I) of section 6 of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency, with the prior approval of the Pakistan Environmental Protection Council, is pleased to establish the following National Environmental Quality Standards for Ambient Air.

National Environmental Quality Standards for Ambient Air

Pollutants	Time-weighted average	Concentration in Ambient Air: Effective from 1st July, 2010	Concentration in Ambient Air: Effective from 1st January 2013	Method of measurement
Sulphur Dioxide (SO_2)	Annual Average*	80 $\mu g/m^3$	80 $\mu g/m^3$	-Ultraviolet Fluorescence method
	24 hours**	120 $\mu g/m^3$	120 $\mu g/m^3$	
Oxides of Nitrogen as (NO)	Annual Average*	40 $\mu g/m^3$	40 $\mu g/m^3$	- Gas Phase Chemiluminescence
	24 hours**	40 $\mu g/m^3$	40 $\mu g/m^3$	

Pollutants	Time-weighted average	Concentration in Ambient Air: Effective from 1st July, 2010	Concentration in Ambient Air: Effective from 1st January 2013	Method of measurement
Oxides of Nitrogen as (NO_x)	Annual Average*	40 µg/m³	40 µg/m³	- Gas Phase Chemiluminescence
	24 hours**	80 µg/m³	80 µg/m³	
O_3	1 hour	180 µg/m³	130 µg/m³	-Non dispersive UV absorption method
Suspended Particulate Matter (SPM)	Annual Average*	400 µg/m³	360 µg/m³	- High Volume Sampling, (Average flow rate not less than 1.1 m3/minute).
	24 hours**	550 µg/m³	500 µg/m³	
Respirable Particulate Matter, PM_{10}	Annual Average*	200 µg/m³	120 µg/m³	-β Ray absorption method
	24 hours**	250 µg/m³	150 µg/m³	
Respirable Particulate Matter, $PM_{2.5}$	Annual Average*	25 µg/m³	15 µg/m³	-β Ray absorption method
	24 hours**	40 µg/m³	35 µg/m³	
	1 hour	25 µg/m³	15 µg/m³	
Lead Pb	Annual Average*	1.5 µg/m³	1 µg/m³	- ASS Method after sampling using EPM 2000 or equivalent Filter paper
	24 hours**	2 µg/m³	1.5 µg/m³	
Carbon Monoxide (CO)	8 hours**	5 mg/m³	5 mg/m³	- Non Dispersive Infra Red (NDIR) method
	1 hour	10 mg/m³	10 mg/m³	

*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.

S. R. O. 1063(I)/2010.— In exercise of the powers conferred under clause (c) of sub-section (1) of section 6 of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency, with the prior approval of the Pakistan Environmental Protection Council, is pleased to establish the following National Standards for Drinking Water Quality.

National Standards for Drinking Water Quality

Properties/Parameters	Standard Values for Pakistan	Who Standards	Remarks
Bacterial			
All water intended for drinking (e.Coli or Thermotolerant 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 objectionable/Acceptable	Non 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			
Essential Inorganic	***mg/Litre***	***mg/Litre***	
Aluminium (Al) mg/l	≤ 0.2	0.2	

Properties/Parameters	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	
Toxic Inorganic	***mg/Litre***	***mg/Litre***	
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	
Nitrate (NO_3)*	≤ 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

* indicates priority health related inorganic constituents which need regular monitoring.

Properties/Parameters	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 South Punjab and 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 centres 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.

S. R. O. 1064(I)/2010.—In exercise of the powers conferred under clause (c) of sub-section (1) of section 6 of the Pakistan Environmental Protection Act, 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency, with the prior approval of the Pakistan Environmental Protection Council, is pleased to establish the following National Environmental Quality Standards for Noise.

National Environmental Quality Standards for Noise

S. No.	Category of Area / Zone	Effective from 1st July, 2010		Effective from 1st July, 2012	
		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.

[No. F. I(12)/2010-11-General.]

MUHAMMAD KHALIL AWAN,
Section Officer (PEPC).

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