Contents

Project Summary Table

Section	Parameter	Details
1. Project Identification	Name of Project / M/S	M/S Crystolite Pharmaceuticals
	Project Location	Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan
	Geographical Coordinates	Latitude: 33.5196"N Longitude: 73.2396"E
2. Proponent Information	Proponent Name	Mr. Ali Raza
	CNIC	33104-2121634-1
	Proponent Address	House# 326 ST# 34-E, Sector I-9/4 Islamabad
3. Project Overview	Total Project Cost	PKR 50 million
	Project type	Proposed Construction
	Process Description	The subject project is the proposed construction of a pharmaceutical unit under the name of M/S Crystolite Pharmaceuticals. Located Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan. Total area of the Project site is 3781 square yards and Estimated cost of the project is 50 million PKR.
	Production Capacity	The total production capacity of the proposed pharmaceutical unit is estimated at 600,000 to 800,000 Products per month, covering a range of dosage forms. This includes approximately 200,000 to 250,000 capsules, 150,000 to 200,000 sachets, 100,000 to 150,000 syrup bottles, and 150,000 to 200,000 soft gelatin capsules per month. The

		production capacity may vary slightly based on demand and operational planning.
	Land Area and Ownership	Over an area of 3781 square yards.
	Allied Facilities	Admin Block, Utilities, Generators, WWTP, chiller, Compressor Room
4. Waste Management	Types of Waste	During the construction phase, waste generated will include excavated soil, construction debris, concrete waste, steel and wood scraps, packaging materials, minor hazardous waste (like used oil and paint), and domestic waste from workers
	Estimated Waste Generation	Total Estimated Solid Waste is ~200-300 kg/month
	Waste Handling Measures	Source segregation, appropriate interim storage, and final disposal
	Final Disposal Plan	The waste management strategy emphasizes source segregation, appropriate interim storage, and final disposal or recycling through authorized and certified vendors.
5. Wastewater Management (Proposed)	Coordinates of WWTP	Latitude: 33.5174 Longitude: 73.2382
	Proposed Treatment Method	Sewerage waste water treatment will be done on site. As their will be only domestic waste water. No process related waste water will be generated.
	NOC from Authority	Wastewater bill is paid to RCCI industrial Estate, Rawat, Rawalpindi, Pakistan

6. Rainwater Harvesting	Harvesting Infrastructure	Pits & Storage Tanks
	Collection Source	Rooftop and Surface Runoff
	Implementation Status	Planned
7. Plantation & Green Development	Proposed Green Area	10% of the total project Area
	Tree Types and Numbers	Azadirachta indica (Neem) – Medicinal, shade-providing, pest-repellent, Dalbergia sissoo (Sheesham) – Fast-growing, strong timber, excellent for shade, Morus alba (Mulberry / Shahtoot) – Fruit-bearing, supports biodiversity, Acacia nilotica (Kikar / Babul) – Hardy, nitrogen-fixing, good windbreak, and Ficus religiosa (Peepal) – Sacred, oxygen-producing, long-living
8. CSR & Community Welfare	CSR Budget	3-5% of total Budget
	Activities	Health & Safety Water, Sanitation & Hygiene (WASH) Livelihood & Skill Development

Executive Summary

1. Title and Location of the Project

1. Project Title: Proposed Construction of Pharmaceutical Unit under the name of M/S Crystolite Pharmaceuticals

Location: Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan.

Land Coordinates:

Latitude: 33.5196"N

Longitude: 73.2396"E

2. Name of the Proponent

M/S Crystolite Pharmaceuticals

Proponent: Mr. Ali Raza

Address: House# 326 ST# 34-E, Sector I-9/4 Islamabad

3. Name of the Organization Preparing the Report

Pak Green Enviro-Engineering (Pvt.) Ltd.

Address: 46-M, Gulberg III, Lahore

Contact: 042-35441444, 0303-4442335

4. Brief Outline of the Proposal

1. Project Overview

M/S Crystolite Pharmaceuticals proposes the construction of a pharmaceutical manufacturing facility located at **Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan**. The total project area is **3781 square yards**. The proposed unit will manufacture pharmaceutical products in compliance with GMP standards to support the domestic market and export potential.

The site lies within a dedicated industrial estate managed by RCCI, providing infrastructure such as road access, utilities, and waste disposal systems, making it ideal for industrial operations.

2. Objectives of the Project

The primary objectives of the project are:

- To establish a modern pharmaceutical manufacturing unit
- To contribute to the national supply chain of essential medicines
- To create employment opportunities for local communities
- To support industrial development and promote pharmaceutical exports

3. Scope and Need for EIA

As per the Pakistan Environmental Protection Act, 1997 and Punjab Environmental Protection Rules, 2012, an Environmental Impact Assessment (EIA) is mandatory for projects involving pharmaceutical manufacturing due to potential impacts on air, water, and waste systems.

This EIA evaluates baseline environmental conditions, identifies likely impacts during all phases of the project, and prescribes mitigation measures to ensure compliance with environmental regulations and sustainable development principles.

4. Key Environmental Aspects Considered

The study addresses the following environmental components:

- Physical Environment: Ambient air quality, water resources, noise levels, and soil characteristics
- Ecological Environment: Local vegetation, fauna, and biodiversity within the industrial estate and surroundings
- Socioeconomic Environment: Community structure, employment, infrastructure, and land use

5. Environmental Management and Mitigation

The project's environmental impacts are mostly manageable and include temporary construction-phase impacts (e.g., noise, dust, solid waste) and operational impacts (e.g., wastewater, air emissions, hazardous waste). These will be mitigated through an Environmental Management Plan (EMP) that includes:

- Installation of a wastewater treatment facility
- Adoption of air emission control systems
- Proper hazardous waste storage and disposal
- Rainwater harvesting for water conservation

6. Proposed Environmental Monitoring Program

To ensure effective implementation of mitigation measures, a comprehensive Environmental Monitoring Program will be put in place. Monitoring will cover:

Parameter	Phase	Frequency	Responsibility
Ambient Air Quality	**Construction/Operation**	**Quarterly**	**Environmental Consultant**
Wastewater Quality	**Operation**	**Monthly**	**Laboratory + Site Staff**
Noise Levels	**Construction/Operation**	**Bi-annually**	**Site Engineer**
Waste Management	**Construction/Operation**	**Ongoing**	**Environmental Officer**

Monitoring reports will be submitted to the Punjab EPA for compliance verification.

5. Conclusion

The EIA has concluded that the proposed pharmaceutical unit is both environmentally and socially viable. The project location within an established industrial zone, combined with the integration of environmental safeguards, ensures that potential impacts are minimal and manageable. The project will support public health infrastructure, boost industrial growth, and generate employment. Approval is recommended, subject to implementation of the Environmental Management and Monitoring Plan

Chapter 01

Introduction

1.1 Purpose of the Report

The purpose of this Environmental Impact Assessment (EIA) report is to evaluate and document the potential environmental and social impacts associated with the proposed construction and future operation of a pharmaceutical manufacturing unit by M/S Crystolite Pharmaceuticals, located at Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan. This report has been prepared in accordance with the Pakistan Environmental Protection Act, 1997, and the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000. The objective is to ensure that the proposed project complies with national environmental legislation and incorporates environmental considerations into its planning, design, and implementation phases.

This report provides a comprehensive analysis of the existing baseline environmental conditions of the project area and assesses the potential impacts of the project on air quality, water resources, soil, noise levels, ecology, and socio-economic parameters. It also presents appropriate mitigation and management measures to minimize adverse impacts and enhance positive outcomes during both construction and operational phases. By conducting this EIA, the project proponents aim to demonstrate environmental responsibility, secure the approval of the relevant environmental authorities, and facilitate sustainable development through responsible industrial growth.

Furthermore, this report serves as a guiding document for decision-makers, regulatory authorities, stakeholders, and the general public by ensuring transparency and accountability in the project's environmental performance. It reflects the proponent's commitment to adhering to environmental standards and to implementing effective Environmental Management and Monitoring Plans throughout the project lifecycle. Ultimately, the EIA aims to protect human health and the environment while supporting the economic and social benefits envisioned through the establishment of a modern pharmaceutical manufacturing facility in a designated industrial zone.

1.2 Identification of Project and Proponent

Project Title:

Proposed Construction of Pharmaceutical Unit by M/S Crystolite Pharmaceuticals

Project Location:

Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan, Pakistan

Project Area:

3781 square yards

Proponent Details:

Name: M/S Crystolite Pharmaceuticals

Address: Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan, Pakistan

Contact Person: Mr. Ali Raza

Proponent CNIC: 33104-2121634-1

The proponent intends to establish a modern pharmaceutical manufacturing facility that will produce quality medicines in accordance with the applicable health, safety, and environmental standards.

1.3 Details of Consultant

The EIA report has been prepared by Pak Green Enviro Engineering Pvt. Ltd, a registered environmental consultancy firm, in accordance with the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000.

Consultant Details:

Consultant Firm:

Pak Green Enviro-Engineering (Pvt.) Ltd.

Environmental Consultants & Engineers

Office Address: 46-M, Gulberg III, Lahore

Contact: 042-35441444, 0303-4442335

Scope of Services: Independent environmental consultancy for the preparation of EIA including baseline assessment, stakeholder consultations, impact analysis, mitigation planning, and formulation of the Environmental Management Plan (EMP).

Pak Green Enviro-Engineering (Pvt.) Ltd. is a registered and experienced firm specializing in environmental assessments for industrial, infrastructural, and development projects across Pakistan. The firm has multidisciplinary expertise in environmental sciences, engineering, pollution control, and regulatory compliance.

1.4 Brief Description of Nature, Size, and Location of the Project

The proposed project involves the construction of a pharmaceutical manufacturing facility by M/S Crystolite Pharmaceuticals at Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan, Pakistan. The project is industrial in nature and falls within the scope of pharmaceutical formulation and manufacturing. It is intended to contribute to the growing demand for locally produced, high-quality medicines in Pakistan. The facility will be designed to meet national and international regulatory standards, including those set by the Drug Regulatory Authority of Pakistan (DRAP) and Good Manufacturing Practices (GMP), ensuring that the pharmaceutical products manufactured are safe, effective, and compliant with quality requirements.

The project will be constructed on a land area of approximately 3781 square yards. The plot lies within the boundaries of the Rawat Industrial Estate developed by the Rawalpindi Chamber of Commerce and Industry (RCCI), which is a designated industrial zone equipped with essential infrastructure such as roads, electricity, water supply, and waste disposal systems. The selection of this site is based on its strategic industrial location, logistical advantages, and availability of utilities and support services necessary for pharmaceutical manufacturing.

The facility will consist of multiple operational zones including production blocks, quality control laboratories, raw material and finished goods warehouses, administrative offices, and utility infrastructure such as HVAC systems, boilers, and power generation units. It will also incorporate an Effluent Treatment Plant (ETP) for the treatment of process wastewater, along with systems for the safe storage and handling of chemicals and hazardous substances. The project also includes internal road networks, parking areas, and green belts to ensure compliance with environmental and safety standards.

The spatial characteristics of the project site are summarized below:

Parameter	Details
Project Name	M/S Crystolite Pharmaceuticals
Project Type	Pharmaceutical Formulation and Manufacturing Facility
Location	Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan
Total Area	3781 square yards

Coordinates (Approx.)	Latitude: 33.5196"N Longitude: 73.2396"E
Land Ownership	Privately owned
Project Status	Proposed Construction
Zoning Category	Industrial
Nearest Settlements	Scattered residential areas lie beyond the industrial estate
Accessibility	Connected via GT Road and Islamabad Expressway

The construction phase is expected to span a period of approximately 12 to 18 months, depending on weather conditions, resource availability, and regulatory clearances. Upon completion, the facility will employ a workforce comprising skilled and unskilled labor, technical staff, and management personnel. The operations will include manufacturing of tablets, capsules, syrups, and other formulations, with possible future expansion into injectables and specialty products, depending on regulatory approvals and market demand.

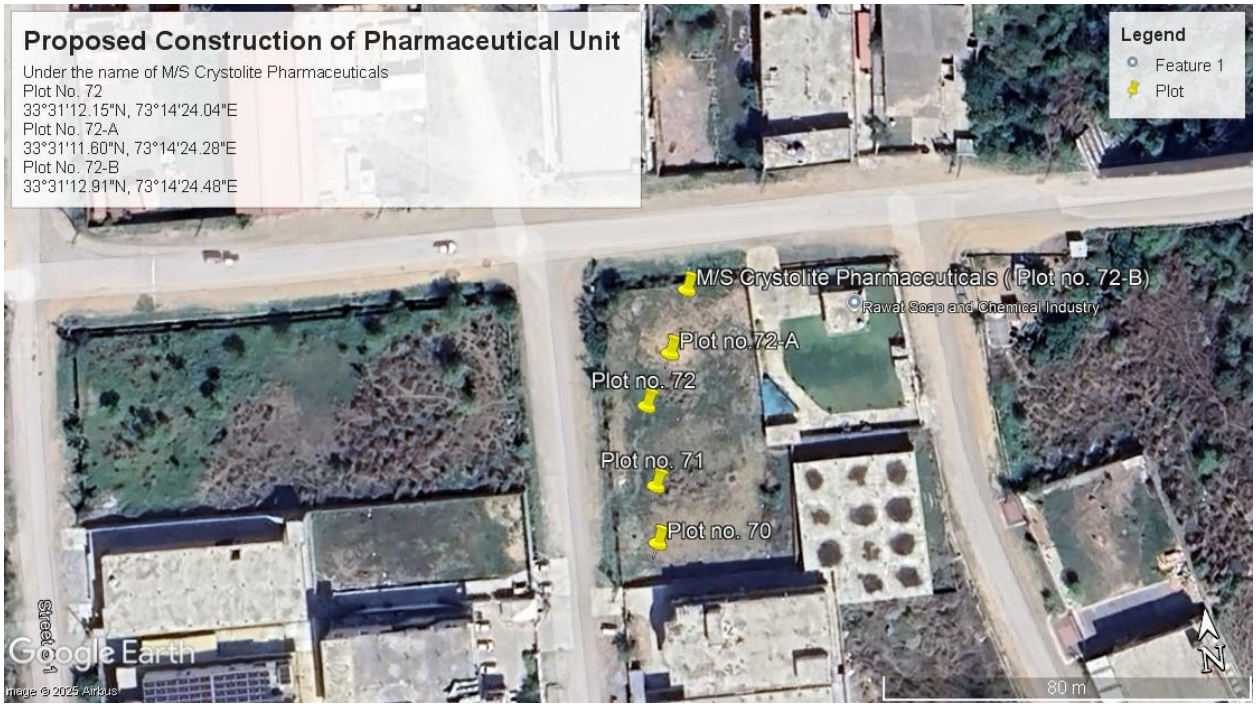
- **Geographic Coordinates:**

Latitude: 33.5196"N

Longitude: 73.2396"E

This location is part of a well-established industrial corridor and is well connected to urban infrastructure, utilities, and logistics networks. It is conducive for industrial development and minimizes environmental conflicts due to its existing industrial land use.

Map 1.1: Location of the Project Site



Given the nature of pharmaceutical production and the handling of raw materials, solvents, and chemicals, the project incorporates strict environmental controls and safety protocols. The design will integrate pollution control systems, energy-efficient equipment, occupational safety standards, and environmental management procedures to ensure that the project aligns with the principles of sustainable industrial development.

Screening

The screening process is a critical step in the Environmental Impact Assessment (EIA) framework, intended to determine the level of environmental review a proposed project must undergo. It involves a preliminary examination of the nature, size, and location of a project, as well as the potential extent of its impacts on the surrounding environment. Screening is necessary to classify the project under the relevant regulatory schedule and to identify whether it requires a full EIA, an Initial Environmental Examination (IEE), or no formal environmental review.

1.5.1 Regulatory Basis for Screening

The screening process for this project has been conducted in accordance with the legal provisions outlined in the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000, which were framed under the Pakistan Environmental Protection Act (PEPA), 1997. These regulations divide development projects into two categories: Schedule I projects that require an IEE and Schedule II projects that require a comprehensive EIA. The

proposed construction of a pharmaceutical unit by M/S Crystolite Pharmaceuticals falls under Schedule II, Catergory B (Manufacturing and processing) Clause 2, which includes industrial projects involving chemical processing or manufacturing due to their potential to cause significant environmental impacts if not managed properly.

1.5.2 Screening Determination for the Proposed Project

The pharmaceutical manufacturing facility to be developed by M/S Crystolite Pharmaceuticals is intended to produce a range of medicinal formulations that may involve the use of solvents, chemical reagents, and other sensitive raw materials. The operations will generate air emissions, process wastewater, and solid as well as hazardous waste. Additionally, the project involves significant civil construction, utility infrastructure, and material handling, all of which carry environmental implications. Although the project is located within RCCI Industrial Estate—a designated zone for industrial development—it does not exempt it from environmental scrutiny. Given the operational scale, resource utilization, and waste generation profile of the project, it has been determined that the project falls squarely within the scope of Schedule II and therefore requires a full EIA under the aforementioned regulations.

1.5.3 Justification for EIA Requirement

The requirement for a full EIA for the proposed M/S Crystolite Pharmaceuticals is justified on both regulatory and environmental grounds. Firstly, pharmaceutical production typically involves processes that can potentially release pollutants into the air, water, and soil if not properly controlled. Secondly, the facility will handle chemicals and solvents that, if mishandled or released into the environment, could pose significant risks to human health and ecological systems. Furthermore, the use of energy-intensive equipment, boilers, HVAC systems, and effluent treatment plants necessitates a thorough assessment of energy efficiency, emissions control, and waste treatment strategies. In light of these factors, a comprehensive EIA is not only a legal requirement but also a prudent environmental planning tool to ensure that potential risks are anticipated and addressed prior to project implementation.

1.5.4 Regulatory Consultation and Confirmation

To validate the need for an EIA and to ensure compliance with regulatory procedures, preliminary consultations were held with officials from the Punjab Environmental Protection Agency (Punjab EPA). During the consultations, the nature and scale of the project were reviewed in relation to the regulatory framework. Based on the information provided regarding the production processes, land area, and type of emissions and discharges expected from the

project, the Punjab EPA confirmed that an EIA report must be submitted for review and approval before any construction or operational activities commence. The agency emphasized that the EIA must include detailed assessments of the physical, ecological, and socioeconomic impacts and must propose adequate mitigation and monitoring mechanisms.

1.5.5 Summary of Screening Outcome

The screening process has established the necessity of conducting a full EIA for the proposed pharmaceutical unit. A detailed summary of key screening attributes is provided in the following table for clarity and reference:

Screening Attribute	Details
Project Name	Construction of Pharmaceutical Unit by M/S Crystolite Pharmaceuticals
Project Type	Industrial – Pharmaceutical Manufacturing
Project Location	Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan
Land Area	3781 square yards
Potential Environmental Impacts	Air emissions, process wastewater, chemical handling, solid/hazardous waste
Regulatory Basis	Pakistan Environmental Protection Act, 1997; EIA Regulations, 2000
Applicable Category under EIA Regulations	Schedule II, Clause B (Manufacturing and Processing)
Screening Determination	Full Environmental Impact Assessment (EIA) Required
Confirmation by Regulatory Authority	Screening outcome confirmed by Punjab Environmental Protection Agency

In conclusion, the project is classified as environmentally sensitive due to the nature of its operations and the potential impacts on surrounding resources. This justifies the need for a full EIA to ensure that all environmental risks are identified, assessed, and effectively mitigated through sound planning and engineering practices.

Scoping

Scoping is a critical stage in the Environmental Impact Assessment (EIA) process that serves to define the extent and focus of the study. It identifies the key environmental and social issues that may arise from the proposed project and determines the spatial and temporal boundaries within which those issues will be assessed. The primary goal of scoping is to ensure that the EIA remains relevant, concise, and responsive to actual concerns—both regulatory and public—while avoiding unnecessary analysis of insignificant issues. This section describes the outcome of the scoping exercise undertaken for the proposed construction of a pharmaceutical unit by M/S Crystolite Pharmaceuticals in RCCI Industrial Estate, Rawat.

1.6.1 Spatial and Temporal Boundaries of Environmental Assessment

The spatial boundaries for the environmental assessment have been defined to include the project site and its immediate surroundings within a 1-kilometer radius, which covers adjacent plots within the industrial estate and any nearby infrastructure or residential settlements that could potentially be impacted by the project. Broader regional considerations, such as water resource availability and air quality, are included where potential cumulative effects may arise.

The temporal boundaries of this assessment extend from the pre-construction and construction phases through to the operational and post-operational stages of the facility. The assessment considers both short-term impacts, such as noise and dust during construction, and long-term operational impacts, including emissions, effluent discharges, and solid waste management.

1.6.2 Important Issues and Concerns Raised During Consultation

Preliminary consultations were held with various stakeholders including local community representatives, estate management, and technical experts to identify key concerns. The primary issues raised included potential air and water pollution, management of hazardous materials, noise during construction, and traffic congestion resulting from transportation of materials and finished goods. Community members also emphasized the importance of ensuring safe waste disposal, access to clean groundwater, and compliance with safety regulations to avoid any risk to neighboring plots and workers.

Within the internal technical consultations, particular emphasis was placed on the need for an effective Effluent Treatment Plant (ETP), energy-efficient operations, chemical storage safety protocols, and occupational health measures for employees.

1.6.3 Significant Impacts and Factors to be Determined

Based on the initial screening and stakeholder input, the following impacts were identified as significant and requiring detailed assessment: air emissions from production and utility equipment, wastewater discharge and its treatment, solid and hazardous waste management, chemical handling risks, occupational health and safety concerns, and the project's contribution to local traffic and noise levels. These impacts will be evaluated in detail through baseline data collection, impact prediction modeling, and comparative analysis with national standards and guidelines.

Additionally, potential cumulative impacts due to other industrial units in RCCI Industrial Estate will be explored, particularly in relation to air and water resources. The risk of accidental spills, fire, or chemical exposure is also considered a significant factor, warranting the inclusion of emergency response protocols and safety training in the Environmental Management Plan.

1.6.4 Summary of Scoping Outcome

The scoping exercise concluded that the EIA should concentrate on the following key thematic areas: air quality, water quality, noise, solid and hazardous waste, occupational health and safety, chemical risk management, and socioeconomic interactions. The scope ensures the EIA will provide the basis for informed decision-making by addressing all relevant and potentially significant environmental and health-related issues associated with the project.

A summary of the scoping outcome is provided in the table below:

Scoping Parameter	Details
Spatial Boundary	Project site and 1 km surrounding industrial area
Temporal Boundary	Pre-construction, construction, operation, and decommissioning phases
Key Environmental Issues	Air emissions, wastewater, hazardous waste, chemical safety, noise, traffic

Stakeholder Concerns	Pollution control, occupational safety, groundwater safety, waste disposal
Significant Impacts for Assessment	Air/water quality, chemical risks, waste, energy use, cumulative impacts
EIA Focus Areas	Environmental health, regulatory compliance, emergency preparedness

The scope defined through this process will guide the remaining sections of the EIA report, including baseline data collection, impact assessment, and formulation of the Environmental Management Plan (EMP).

1.7 Consideration of Alternatives

The consideration of alternatives is a core principle of environmental impact assessment. It ensures that the selected project design and location represent the most environmentally and socially responsible option. This section evaluates possible alternatives in terms of site selection, design and technology, environmental mitigation, and economic feasibility. The aim is to minimize adverse environmental impacts while achieving the project's operational and commercial objectives.

1.7.1 Site Alternatives: Selection and Rejection Criteria

Several sites were initially considered for the establishment of the pharmaceutical manufacturing unit, including locations in the outskirts of Rawalpindi and nearby areas in Islamabad. However, most of the evaluated options presented challenges such as lack of infrastructure, difficulties in securing necessary utilities (power, water, and gas), and proximity to residential zones, which raised environmental and social concerns. The chosen site within the RCCI Industrial Estate in Rawat was ultimately selected due to its availability of essential industrial infrastructure, proximity to Rawalpindi's urban center, ease of logistics, and compatibility with existing land-use policies. The site is part of a legally notified industrial estate, which minimizes land-use conflict and offers access to roads, utilities, and waste disposal services.

Site Option	Merits	Drawbacks	Decision
Rawat RCCI Industrial Estate	Industrial infrastructure, utilities, legal compliance	Limited space expansion, minor traffic congestion	Selected

Islamabad Outskirts	Less congestion, room for expansion	Outside industrial zone, utility challenges, NOC complexities	Rejected
Rural Rawalpindi (Murree Road)	Low land cost	Close to residential areas, lack of wastewater facilities	Rejected

1.7.2 Design and Technology Alternatives: Selection and Rejection Criteria

In terms of design, multiple layouts and process flow arrangements were assessed to ensure efficient spatial planning, ease of workflow, and effective pollution control. The selected design includes separate zones for raw material storage, formulation, packaging, and quality control, all planned to minimize cross-contamination and improve safety.

Technology options for production, HVAC systems, emissions control, and effluent treatment were also evaluated. Conventional technologies, while cost-effective, were found to be less energy-efficient and environmentally burdensome. The adopted solution involves semi-automated equipment with modern control systems and energy-saving devices to reduce emissions, optimize water and energy usage, and ensure better process reliability.

Technology/Design Option	Advantages	Disadvantages	Decision
Conventional manual-based process	Low cost, simple to operate	High labor demand, increased emissions	Rejected
Fully automated system	Highly efficient, low environmental footprint	High capital cost	Partially adopted
Semi-automated with controls	Balanced cost, improved safety and efficiency	Requires moderate training for staff	Selected

1.7.3 Environmental Alternatives: Selection and Rejection Criteria

To reduce the environmental footprint of the project, several environmental management alternatives were considered. For emissions control, the use of high-efficiency particulate air (HEPA) filters and activated carbon scrubbers was preferred over conventional exhaust systems. For wastewater management, a modular Effluent Treatment Plant (ETP) has been selected to ensure that wastewater meets National Environmental Quality Standards (NEQS) before discharge or reuse. Options for waste minimization, chemical substitution, and energy recovery were also explored and incorporated where feasible.

In addition, landscaping with native plant species around the facility perimeter has been proposed to enhance site aesthetics and improve air quality.

1.7.4 Economic Alternatives: Selection and Rejection Criteria

From an economic perspective, the project team evaluated scenarios involving different scales of investment, product types, and production capacities. A small-scale facility, while cheaper to build, would not be commercially viable due to high per-unit production costs and limited scalability. Conversely, an overly large facility would have imposed unnecessary financial burdens and regulatory delays.

The selected model is a medium-sized, scalable facility that meets initial market demand and allows for future expansion as business growth permits. This approach ensures a balanced return on investment and keeps operational costs manageable while maintaining environmental compliance.

Scale Option	CAPEX	OPEX	Environmental Risk	Decision
Small-scale unit	Low	High per unit	Low	Rejected
Large-scale unit	Very High	Moderate	High initial footprint	Rejected
Medium-scale with expansion	Moderate	Balanced	Manageable	Selected

1.7.5 No-Project Alternative

The “No-Project” scenario refers to the possibility of not establishing the pharmaceutical facility at all. While this option would avoid any environmental impact, it would also forgo significant socioeconomic benefits such as employment generation, industrial growth, and enhanced access to locally produced pharmaceutical products. The absence of the project would also mean continued dependence on imported drugs and missed opportunities for technology transfer and public health improvement. From a broader policy perspective, the No-Project scenario is not aligned with the national and provincial goals of industrial self-reliance and economic diversification.

In conclusion, the selected project configuration and site have been chosen after comprehensive evaluation of alternatives, ensuring environmental responsibility, technical feasibility, and economic sustainability. These alternatives will be further validated through detailed impact assessment and mitigation planning in subsequent chapters of the EIA.

Chapter 02

Description of the Project

2.1 Objectives of the Project

The proposed project aims to establish a modern pharmaceutical manufacturing facility under the name *M/S Crystolite Pharmaceuticals* within the RCCI Industrial Estate, Rawat, Rawalpindi. The primary objective of the project is to contribute to the strengthening of Pakistan's pharmaceutical industry by producing high-quality, cost-effective medicines that meet national and international regulatory standards.

The pharmaceutical sector in Pakistan is facing increasing pressure to enhance production capabilities, improve drug quality, and reduce dependency on imported medications. The M/S Crystolite Pharmaceuticals seeks to address these gaps by setting up a facility equipped with modern technology, automated production lines, cleanroom environments, and a robust quality assurance framework. The project will adhere to current Good Manufacturing Practices (cGMP) as outlined by the Drug Regulatory Authority of Pakistan (DRAP), and other applicable global standards.

In addition to improving drug availability, the project has several other strategic objectives:

- **Enhancement of Healthcare Access**: By producing a reliable supply of essential medicines such as tablets, capsules, and other formulations, the project will help improve healthcare outcomes and medicine accessibility, particularly in underserved regions of Pakistan.
- **Economic Uplift and Employment Generation**: The project is expected to create direct and indirect employment opportunities for skilled and semi-skilled workers, technicians, pharmacists, and administrative personnel. This will contribute to the socio-economic uplift of the surrounding region, particularly Rawat and Rawalpindi District.
- **Promotion of Local Industrial Development**: Located in an established industrial estate, the project aligns with national goals of industrial development, import substitution, and private sector-led economic growth. It supports the government's vision to boost indigenous pharmaceutical production and encourage investments in value-added sectors.

- **Export-Oriented Growth**: With appropriate certifications and regulatory compliance, the facility aims to export pharmaceutical products to regional and international markets. This will contribute to Pakistan's foreign exchange earnings and help position the country as a competitive pharmaceutical manufacturing hub.
- **Environmental Responsibility**: Through integration of sustainable practices such as rainwater harvesting, energy-efficient operations, effluent treatment systems, and green landscaping, the project intends to minimize its environmental footprint while maintaining operational efficiency.

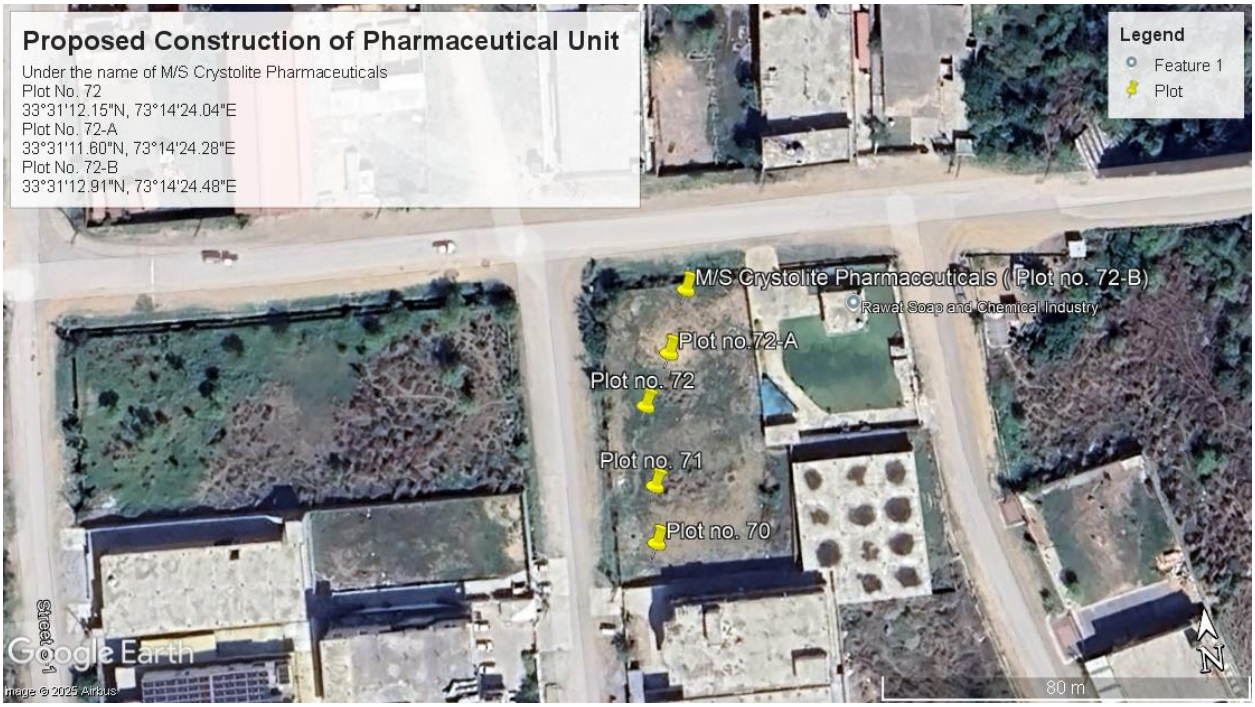
Overall, the establishment of the M/S Crystolite Pharmaceuticals represents a forward-looking initiative that combines healthcare improvement, industrial modernization, economic development, and environmental stewardship. It is expected to serve as a model for future pharmaceutical ventures within Pakistan's regulated industrial zones.

2.2 Location and Site Layout of the Project

The proposed pharmaceutical unit by *M/S Crystolite Pharmaceuticals* is strategically located at **Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan, Pakistan**. The RCCI Industrial Estate is a well-planned, government-approved industrial zone developed to facilitate organized industrial growth in the Rawalpindi region. It provides a controlled environment, robust infrastructure, and essential utilities for industrial activities. This makes it an ideal location for the establishment of a pharmaceutical manufacturing facility.

2.2.1 Geographical Coordinates:

- Latitude: 33.5196"N
- Longitude: 73.2396"E

- 

The total land area for the project is **3781 square yards**. The site is rectangular in shape and leveled, with well-defined plot boundaries demarcated by boundary walls on all sides.

The location offers several advantages that support the sustainability and operational efficiency of the pharmaceutical unit:

- **Proximity to Major Roads:** The site lies in close proximity to the Grand Trunk (G.T.) Road (N-5), one of Pakistan's most important national highways. This ensures convenient transportation of raw materials and finished goods.
- **Utility Accessibility:** The RCCI Industrial Estate is equipped with essential infrastructure, including uninterrupted electricity supply, gas connections, and a piped water system. Telecom and fiber-optic connectivity are also available.
- **Zoning Compliance:** The project falls within a zone designated for industrial use, thus eliminating the risk of zoning conflicts or residential encroachment.

2.2.2 Site Layout Plan

The layout of the site has been designed with efficient space utilization and functional separation of different operational zones. The design follows international GMP requirements by separating clean and non-clean areas and ensuring unidirectional flow of materials and personnel.

Site Components	Approximate Area Allocation	Description
Production Blocks (Sterile/Non-Sterile)	30%	Dedicated facilities for manufacturing tablets, capsules, and injectables
Quality Control Laboratory	5%	Facility for analytical, microbiological, and stability testing
Warehousing (Raw, Packaging, Finished)	15%	Segregated storage areas to prevent cross-contamination
Administration and Support Offices	10%	Management, HR, IT, and compliance departments
Utility Area (Boilers, HVAC, ETP)	10%	Includes backup generators, effluent treatment plant, water tanks, etc.
Internal Roads and Circulation	15%	For movement of materials, staff, and emergency access
Landscaping and Green Belts	15%	Plantation zones for environmental mitigation and aesthetic enhancement

The internal layout is designed to maintain a **clean manufacturing environment** with defined entry/exit points, controlled access areas, proper drainage, and emergency evacuation routes. Fire-fighting equipment, security checkpoints, and CCTV systems will be installed at strategic locations to ensure safety and regulatory compliance.

Future Expansion Provision:

The layout also accommodates potential future expansions. A portion of the site will remain unconstructed during the initial phase to allow scaling up production in response to market demand or regulatory requirements.

In summary, the chosen site and its proposed layout are in full alignment with the functional, environmental, and regulatory needs of a modern pharmaceutical manufacturing unit. The design ensures operational efficiency, regulatory compliance, and environmental responsibility.

2.3 Land Use on the Site

The project site, comprising a total area of **3781 square yards**, is located within the **RCCI Industrial Estate, Rawat, Rawalpindi**, which is an officially designated industrial zone developed to promote structured industrialization in the region. The land was acquired

specifically for industrial purposes and is in conformity with land use regulations and policies of the concerned authorities, including the Rawalpindi Development Authority (RDA) and Punjab Industrial Estates Development & Management Company (PIEDMC).

The current land use is categorized as industrial, with no prior development or construction activity having been undertaken on the site. The land is presently a flat, vacant plot with naturally compacted soil and limited vegetation in the form of sparse wild grass. There are no trees, water bodies, cultural or archaeological features, or ecologically sensitive areas present on the plot. The site has been cleared and prepared for development without the need for extensive earthworks or major modification to its natural form.

The surrounding area of the RCCI Industrial Estate comprises industrial units of various scales and vacant industrial plots, which ensures compatibility in terms of future operations, emissions, waste management, and utility use. The site is bounded by other industrial plots on its sides, with paved internal estate roads ensuring accessibility. There are no residential colonies or agricultural activities in the immediate vicinity, minimizing the likelihood of land use conflicts.

The table below summarizes the existing and proposed land use within the project boundary:

Component	Current Land Use	Proposed Land Use
Core Project Area	Undeveloped industrial plot	Construction of production facility, warehouse, utilities
Vegetation and Open Areas	Sparse natural grass	Planned green belts and landscape buffer zones
Built Structures	None	Industrial buildings including QC labs, offices, and utilities
Internal Circulation	None	Internal roads, access points, and paved paths
Wastewater/Drainage Facilities	Not available	Effluent Treatment Plant (ETP), stormwater drains

The proposed land use ensures efficient spatial planning with functional segregation between production, storage, utilities, administration, and green spaces. This segregation supports Good

Manufacturing Practices (GMP) and enables compliance with national and international regulatory standards.

Moreover, the project design includes reserved spaces for future expansion within the same land parcel, avoiding the need for external land acquisition and maintaining land use compatibility with the estate's overall industrial zoning strategy.

2.4 Road Access

The proposed M/S Crystolite Pharmaceuticals is located at Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan, which is well-connected through a developed network of internal estate roads and external national highways. The site is directly accessible via a wide, paved industrial estate road that connects to the main entrance of the RCCI Industrial Estate. These internal roads are designed to support heavy vehicular movement including container trucks and supply vehicles essential for industrial operations.

One of the key advantages of the site is its **proximity to the National Highway N-5 (also known as Grand Trunk Road)**, which is approximately 1.5 kilometers from the project location. N-5 is Pakistan's longest and most significant highway, facilitating regional trade and movement of goods from the north to the south of the country. This provides easy and efficient logistical access for the transport of raw materials, packaging materials, and finished pharmaceutical products.

Additionally, the project site is approximately 4 kilometers from the **Rawat Interchange of the Islamabad–Lahore Motorway (M-2)**, offering further connectivity to major urban centers such as Islamabad, Lahore, and Peshawar. The dual access via both the national highway and the motorway ensures redundancy in transport options, reducing the risk of supply chain disruptions and ensuring timely delivery of products to market.

The **road infrastructure within RCCI Industrial Estate** is regularly maintained by the estate authority and features standard widths, turning radii for large vehicles, proper drainage channels, and street lighting, all of which support safe and uninterrupted movement of industrial traffic.

The table below provides a summary of the site's road connectivity:

Access Route	Distance from Site	Type of Road	Purpose Served

RCCI Internal Industrial Road	0 km (on-site)	Paved estate road	Direct access to plot and internal movement
National Highway (N-5 / G.T. Road)	~1.5 km	Four-lane dual carriageway	Material inflow/outflow and staff commute
Rawat Interchange (Islamabad-Lahore M-2)	~4 km	Access-controlled motorway	Intercity connectivity and long-distance haul

The proposed facility will have **two dedicated entry and exit gates** for vehicular movement—one for raw material and product transport, and the other for employee and administrative access—to prevent congestion and ensure a smooth traffic flow. These gates will be equipped with security checkpoints and vehicle scanning systems as part of the standard pharmaceutical facility design.

In conclusion, the road access to the project site is highly suitable for industrial operations. The connectivity ensures efficient logistics and supply chain management, which are critical for the pharmaceutical industry where timely delivery and transportation reliability are essential for maintaining product quality and regulatory compliance.

2.5 Vegetation Features of the Site

The project site, encompassing 3781 square yards within the RCCI Industrial Estate in Rawat, Rawalpindi, is currently characterized by minimal natural vegetation. The land is largely barren, with sparse patches of wild grasses and small shrubs that have naturally colonized the area. These plants are typical of the semi-arid climate zone of the region, which experiences hot summers and mild winters with relatively low and erratic rainfall.

There are no significant trees, forested areas, or ecologically sensitive vegetation within the site boundaries. The absence of mature trees or dense vegetation means the site has limited biodiversity value in its current state. Additionally, no rare, endangered, or protected plant species have been recorded or are known to exist in this particular area of the industrial estate.

Vegetation in the surrounding areas of RCCI Industrial Estate consists mainly of similar dry grasses, some small patches of shrubs, and landscaped green belts along the estate roads and plot boundaries. These planted green areas are maintained by the estate management and provide partial aesthetic and environmental benefits such as dust control and microclimate regulation.

The project design includes a comprehensive landscaping plan that aims to enhance the green cover within the site through the planting of trees, shrubs, and grass lawns. These green areas will serve several purposes:

- **Environmental Mitigation:** Vegetation buffers will help reduce dust and noise pollution, improve air quality, and contribute to carbon sequestration.
- **Aesthetic Enhancement:** Landscaped green belts and gardens will improve the visual appeal of the industrial facility and create a healthier working environment.
- **Microclimate Regulation:** Green spaces contribute to lowering ambient temperatures and provide shade, which is particularly beneficial in the hot climate of Rawalpindi.
- **Soil Erosion Control:** Properly planted vegetation will stabilize the soil, preventing erosion during the rainy season and maintaining land integrity.

The landscaping will predominantly consist of indigenous and drought-resistant species suitable for the local climate, ensuring minimal water demand and ease of maintenance. Native species such as *Prosopis juliflora* (Mesquite), *Acacia nilotica*, and *Ziziphus mauritiana* are examples of trees that could be incorporated, along with grass species adapted to semi-arid conditions.

In summary, while the existing natural vegetation at the project site is sparse and of low ecological value, the proposed pharmaceutical unit will incorporate a well-planned green infrastructure component. This will improve the environmental quality of the site and contribute positively to the overall sustainability and aesthetics of the RCCI Industrial Estate.

2.6 Cost and Magnitude of Operation

The proposed construction and operation of the M/S Crystolite Pharmaceuticals represent a significant investment aimed at establishing a modern facility for the manufacturing of pharmaceutical products. The total estimated project cost is projected at approximately **PKR 50 million,** covering all aspects from land development, construction, equipment procurement, installation, and commissioning to initial working capital.

This capital expenditure reflects the installation of state-of-the-art manufacturing technology, including sterile and non-sterile production lines, quality control laboratories, clean rooms, utilities such as boilers and HVAC systems, and an effluent treatment plant (ETP) designed to comply with environmental regulations.

The operational magnitude of the facility is planned to be robust and scalable. The unit will be capable of producing a variety of pharmaceutical dosage forms such as tablets, capsules, syrups, and possibly sterile injectables. The designed production capacity targets an annual output sufficient to meet domestic market demands and facilitate export opportunities.

Parameter	Details
Total Project Cost	PKR 50 million
Project Area	3781 square yards
Production Capacity	The total production capacity of the proposed pharmaceutical unit is estimated at 600,000 to 800,000 units per month, covering a range of dosage forms. This includes approximately 200,000 to 250,000 capsules, 150,000 to 200,000 sachets, 100,000 to 150,000 syrup bottles, and 150,000 to 200,000 soft gelatin capsules per month. The production capacity may vary slightly based on demand and operational planning.
Number of Employees	150 (skilled, semi-skilled, and support staff)
Operational Hours	8-12 hours/day, 6 days/week
Utilities Required	Electricity (~500 kW), Water (approx. 100 m^3/day), Natural Gas
Effluent Generation	Estimated 30-40 m^3/day wastewater
Expected Product Range	Tablets, capsules, syrups, ointments, injectables (subject to regulatory approvals)

The magnitude of operations includes a mix of fully automated and semi-automated production processes to optimize efficiency while maintaining strict quality control. The quality assurance and quality control laboratories will operate continuously to ensure compliance with Good Manufacturing Practices (GMP).

Employment generated by the project will include direct jobs in production, quality control, administration, maintenance, and logistics. Indirect employment is also expected through suppliers, contractors, and ancillary services supporting the pharmaceutical unit.

Financial projections indicate that the project will achieve operational breakeven within the first 3-4 years, after which it will contribute positively to local economic development through taxes, salaries, and industrial growth.

In summary, the project represents a high-value industrial investment with significant production capabilities, employment potential, and economic impact on the Rawalpindi region and beyond.

2.7 Schedule of Implementation

The implementation schedule for the construction and commissioning of the *M/S Crystolite Pharmaceuticals* has been carefully planned to ensure timely completion while maintaining compliance with all regulatory and environmental requirements. The overall project timeline is estimated to span approximately **18 to 24 months**, divided into distinct phases ranging from pre-construction to operational start-up.

The first phase involves detailed design, procurement of equipment, and obtaining all necessary environmental and construction permits, including the Environmental Protection Agency's (EPA) No Objection Certificate (NOC). These activities are scheduled to take around **4 to 6 months**. During this period, final architectural and engineering designs will be completed, and tenders for construction and equipment supply will be finalized.

The second phase, encompassing site preparation and civil construction, is expected to last approximately **8 to 10 months**. This includes earthworks, foundation laying, structural work, roofing, and installation of utilities such as electricity, water, and gas connections. The construction phase will be closely monitored to ensure adherence to environmental safeguards, safety standards, and quality specifications.

Parallel to construction, procurement and installation of specialized pharmaceutical manufacturing equipment, HVAC systems, clean room facilities, and quality control laboratories will occur. Equipment testing, calibration, and validation will take place during the **third phase**, spanning approximately **4 to 6 months**.

The final phase focuses on commissioning, trial production runs, staff training, and regulatory inspections prior to the commencement of full-scale commercial operations. This phase is

crucial to ensure that all operational processes meet Good Manufacturing Practices (GMP) and environmental compliance standards.

The table below summarizes the key milestones and estimated timelines:

Implementation Stage	Duration (Months)	Description
Design and Permitting	4 - 6	Detailed design, environmental approvals, tendering
Site Preparation and Construction	8 - 10	Civil works, utilities installation, structural build
Equipment Installation & Testing	4 - 6	Machinery installation, calibration, and validation
Commissioning and Start-up	2 - 3	Trial runs, staff training, regulatory inspection

The schedule allows some flexibility for unforeseen delays such as adverse weather conditions, supply chain interruptions, or changes in regulatory requirements. Project management will employ risk mitigation strategies to minimize delays and ensure that the project proceeds as planned.

In conclusion, the phased implementation schedule balances efficiency with thoroughness, aiming to bring the *M/S Crystolite Pharmaceuticals* into operation within two years from the start of the project, while upholding all environmental and quality standards.

2.8 Description of the Project

The proposed project involves the construction and operation of a state-of-the-art pharmaceutical manufacturing facility under the name *M/S Crystolite Pharmaceuticals*, located at Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan. The total land area allocated for this project is 3781 square yards.

This pharmaceutical unit aims to manufacture a broad range of pharmaceutical products, including tablets, capsules, syrups, ointments, and sterile injectables, catering primarily to the domestic market with potential for exports. The facility will adhere to international Good Manufacturing Practices (GMP) and meet all regulatory requirements laid down by the Drug Regulatory Authority of Pakistan (DRAP) and relevant environmental authorities.

2.8.1 Project Components

The project will consist of multiple integrated components designed to ensure efficient and compliant production operations:

- **Production Blocks:** These include dedicated zones for formulation, processing, packaging, and labeling of pharmaceutical products. The production area will be segregated into sterile and non-sterile manufacturing sections to maintain product safety and quality.
- **Quality Control (QC) Laboratories:** Fully equipped laboratories will perform routine and advanced analytical testing of raw materials, in-process samples, and finished products to ensure compliance with pharmacopeial standards.
- **Utility Facilities:** The project will include essential utilities such as water purification plants (for potable and pharmaceutical-grade water), boilers, compressors, HVAC (Heating, Ventilation, and Air Conditioning) systems, and power backup units. These utilities are critical to maintaining controlled environmental conditions essential for pharmaceutical manufacturing.
- **Effluent Treatment Plant (ETP):** To manage liquid waste generated from production and cleaning processes, a modern effluent treatment system and septic tanks will be installed to treat wastewater to acceptable discharge standards, thereby minimizing environmental impact.
- **Warehousing and Storage:** Dedicated storage areas will be allocated for raw materials, packaging materials, and finished goods, equipped with climate control features to preserve product integrity.
- **Administrative and Support Facilities:** Offices, conference rooms, staff welfare areas, and security installations will be constructed to support smooth administrative functioning and employee well-being.

2.8.2 Production Process

The manufacturing process will follow a streamlined workflow beginning with raw material receipt and storage, formulation and processing, quality control testing, packaging, and finished goods dispatch. Each stage will incorporate rigorous quality assurance protocols to prevent contamination, ensure product uniformity, and meet safety standards.

Sterile product manufacturing will take place in controlled clean rooms with high-efficiency particulate air (HEPA) filtration systems to maintain aseptic conditions. Non-sterile products will be processed in controlled environments that comply with GMP guidelines.

2.8.3 Utilities and Infrastructure

The project's infrastructure will include:

- A reliable electricity supply with an estimated demand of approximately 500 kW, sourced from the national grid with backup diesel generators for emergency power.
- Water supply sourced from the RCCI Industrial Estate's water network, supplemented with on-site water treatment units to produce pharmaceutical-grade purified water.
- Natural gas connection for boiler and heating requirements.
- Adequate waste management systems for solid, liquid, and hazardous waste streams.

2.8.4 Environmental and Safety Considerations

Environmental safeguards will be integrated throughout the project lifecycle. These include measures for air emission control, effluent treatment, solid waste disposal, noise mitigation, and occupational health and safety programs to protect workers and the surrounding community.

2.8.5 Project Capacity and Scalability

The initial production capacity is designed to manufacture up to 50 million pharmaceutical units annually, with provisions for future capacity expansion within the existing site boundaries. The modular design allows for the addition of new production lines or product types without major reconstruction.

2.9 Restoration and Rehabilitation Plans

As part of the project's commitment to sustainable development and environmental stewardship, comprehensive restoration and rehabilitation plans have been formulated to address any environmental disturbances arising during the construction and operational phases of the *M/S Crystolite Pharmaceuticals*. These plans aim to minimize adverse impacts on the site and surrounding environment while promoting ecological balance and social well-being.

2.9.1 Restoration During Construction

Construction activities inevitably lead to temporary disturbances such as soil excavation, vegetation clearance, dust generation, and noise emissions. To mitigate these impacts, the following restoration measures will be implemented:

- **Site Stabilization:** Immediately after construction activities in a specific area are completed, the disturbed land will be stabilized using soil compaction and, where appropriate, covering with topsoil to prevent erosion and dust emissions.
- **Revegetation:** Native and drought-resistant vegetation will be replanted on disturbed soil surfaces to restore the site's natural appearance and ecological function. This will include planting grasses, shrubs, and trees as per the landscaping plan designed to enhance biodiversity and prevent soil degradation.
- **Dust Control:** During construction, dust suppression techniques such as water sprinkling, use of dust screens, and limiting vehicle speeds on unpaved roads will be enforced to protect air quality.
- **Waste Management:** Construction waste will be segregated, and non-recyclable debris will be disposed of in authorized landfills. Efforts will be made to recycle or reuse materials wherever feasible to reduce environmental footprint.

2.9.2 Rehabilitation During Operations

Once the pharmaceutical unit is operational, the focus will shift to maintaining environmental integrity and managing any ongoing impacts associated with manufacturing processes.

- **Effluent Treatment and Disposal:** The project will operate a state-of-the-art Effluent Treatment Plant (ETP) to treat all wastewater generated onsite. Treated effluent will meet regulatory standards before discharge or reuse for non-potable purposes, thus preventing water pollution.
- **Solid Waste Management:** Pharmaceutical solid waste, including packaging materials, expired products, and hazardous waste such as contaminated solvents, will be handled following strict protocols. Hazardous waste will be collected separately and disposed of through authorized contractors in compliance with environmental laws.

- **Green Belt Development:** Continuous maintenance of the landscaped green belts and planting additional trees will be undertaken to enhance carbon sequestration, reduce noise pollution, and create a buffer zone around the facility.
- **Soil Quality Monitoring and Remediation:** Regular monitoring of soil quality around the site will be conducted to detect any contamination. In the unlikely event of soil pollution, remediation techniques such as soil excavation, bioremediation, or chemical stabilization will be applied.
- **Community Engagement and Social Rehabilitation:** The project will engage with local communities to address any concerns related to environmental or social impacts. Support initiatives, such as community health programs or employment opportunities, will form part of the rehabilitation framework to ensure inclusive growth.

2.9.3 Emergency Response and Contingency Planning

To handle accidental spills or environmental incidents, a comprehensive emergency response plan will be developed. This plan will include immediate containment measures, notification procedures, and remediation steps to minimize environmental damage and ensure worker and public safety.

In conclusion, the restoration and rehabilitation plan for the *M/S Crystolite Pharmaceuticals* are designed to proactively address environmental impacts at every stage, ensuring the project remains sustainable and compliant with national environmental regulations and international best practices.

Rainwater Harvesting System Design and Integration

1. Introduction

Rainwater harvesting is a key component of the *M/S Crystolite Pharmaceuticals*'s sustainable water management approach. Located in Rawalpindi, which experiences a semi-arid climate, the project seeks to reduce reliance on municipal water resources by capturing and utilizing rainwater effectively. The system will collect runoff from building rooftops and paved surfaces, storing it for non-potable uses within the facility, such as irrigation, cooling systems, cleaning, and sanitary purposes. This initiative supports both environmental conservation and operational cost reduction.

2. System Components and Technical Design

The system's design focuses on maximizing rainwater capture while ensuring water quality and ease of maintenance. Rooftops of production, utility, and administrative buildings will serve as the primary catchment areas. These surfaces are constructed with materials suitable for collecting clean runoff. Rainwater from these catchment areas will be directed through a network of gutters and downpipes designed to channel water efficiently and prevent blockages.

To protect the stored water quality, first flush diverters are incorporated in the system. These devices remove the initial portion of runoff, which typically contains debris, dust, and other contaminants, before the cleaner water enters the storage tanks. The tanks themselves will be constructed from durable, corrosion-resistant materials such as reinforced concrete or high-density polyethylene. Their capacity is determined based on the average rainfall patterns, catchment surface area, and expected demand for rainwater within the facility.

Before distribution, the collected rainwater undergoes filtration through mesh screens and sand filters to remove suspended solids. Where necessary, further treatment methods like chlorination or ultraviolet sterilization will be applied to ensure that the water is safe for its intended non-potable uses. The treated water will be supplied through a dedicated distribution network that is separate from the potable water system to avoid cross-contamination.

3. Usage and Environmental Benefits

The harvested rainwater will primarily support non-potable applications across the facility. It will irrigate green spaces and landscaping, supply cooling towers and HVAC systems, assist in cleaning operations, and provide water for toilets and other sanitary facilities. This reduces the demand for treated municipal water, lowers operational costs, and promotes water conservation. Additionally, by capturing rainwater runoff, the system aids in reducing stormwater flow from the site, mitigating risks of local flooding and soil erosion.

4. Maintenance and Monitoring

Proper maintenance is essential to the longevity and effectiveness of the rainwater harvesting system. Routine cleaning of gutters, downpipes, storage tanks, and filtration units will be conducted, especially before and after the rainy season, to prevent blockages and contamination. Periodic monitoring of water quality will ensure that the system complies with health and safety standards, guaranteeing the suitability of water for its designated uses.

5. Compliance and Best Practice Alignment

The design, installation, and operation of the rainwater harvesting system comply fully with national environmental guidelines and reflect international best practices in industrial water management. This initiative aligns with Pakistan’s broader water conservation policies and enhances the overall environmental management plan of the pharmaceutical project.

Chapter 03

Description of Environment

This chapter provides a comprehensive overview of the existing environmental conditions at and around the project site. Understanding the baseline environment is essential to assess the potential impacts of the proposed pharmaceutical unit and to design appropriate mitigation measures. The baseline environment is divided into three main components: physical, ecological, and socioeconomic. In addition, laboratory analyses of environmental samples collected from the site and its surroundings are summarized. Finally, the suitability of the site for the proposed development is discussed.

3.1 Baseline Physical Environment

The baseline physical environment encompasses all natural and man-made physical factors present at the project site prior to any construction or operational activities. Understanding these elements is essential for assessing how the proposed pharmaceutical unit might interact with and impact its surroundings. This section describes the existing climate, topography, geology, soils, air quality, noise environment, and water resources in and around the RCCI Industrial Estate, Rawat, Rawalpindi.

3.1.1 Climate

The project site lies within the climatic zone of Rawalpindi, which experiences a semi-arid to subtropical climate. Seasonal variations include hot summers, a defined monsoon season, and cool winters. Temperatures during summer months often reach highs of 40°C or above, while winter temperatures can drop to near freezing. The monsoon season, spanning roughly from July to September, brings the majority of the annual precipitation, averaging approximately 800 millimeters per year. This seasonal rainfall significantly influences water availability and environmental conditions in the area.

Wind patterns generally follow a southwest to northeast direction during most of the year, with occasional variability during seasonal shifts. These winds can influence the dispersion of airborne emissions or odors that might arise from industrial activities.

3.1.2 Topography

The terrain at the project site and surrounding RCCI Industrial Estate is predominantly flat to gently undulating, which is typical of the Pothohar Plateau region. This flatness is

advantageous for construction and infrastructure development, reducing the need for extensive earthworks or grading.

Elevation at the site ranges approximately from 480 to 500 meters above sea level. The absence of steep slopes minimizes soil erosion risks but requires adequate drainage planning to prevent waterlogging during heavy rains.

3.1.3 Geology and Soil Characteristics

The geological setting of Rawalpindi comprises sedimentary rock formations overlain by alluvial deposits. The site itself sits on Quaternary alluvial soils composed mainly of sand, silt, and clay mixtures. Soil investigations conducted at the project area indicate a predominantly loamy texture with moderate permeability and good load-bearing capacity, making it suitable for the foundations of industrial buildings and infrastructure.

Soil pH measurements indicate a neutral to slightly alkaline condition, typical of the region, and organic matter content is relatively low due to the industrial nature of the area. The soil is generally free of contamination, as confirmed by preliminary chemical analyses, but ongoing monitoring will be maintained during construction to ensure no adverse effects occur.

3.1.4 Air Quality

Baseline ambient air quality data were collected around the project site to establish current levels of common air pollutants. Parameters measured included particulate matter (PM10 and PM2.5), nitrogen oxides (NOx), sulfur dioxide (SO2), carbon monoxide (CO), and volatile organic compounds (VOCs). The results indicate that existing air quality falls within Pakistan Environmental Protection Agency (Pak-EPA) standards for industrial areas, with occasional minor exceedances during dust storms or peak traffic hours.

The site is located away from major highways and densely populated residential zones, which helps maintain relatively good air quality. Nonetheless, air quality will be monitored throughout the project lifecycle to ensure emissions remain within regulatory limits.

3.1.5 Noise Environment

Noise levels at the project site and adjacent areas were measured during different periods of the day to characterize the ambient sound environment. The readings indicate typical industrial estate noise ranges, with average decibel (dB) levels between 50 and 65 dB during working hours and reduced levels at night.

Major noise sources include vehicle movement within the industrial estate and ongoing industrial activities from neighboring facilities. The proposed pharmaceutical unit will implement noise control measures, such as sound insulation and operational timing restrictions, to minimize noise impact on surrounding areas.

3.1.6 Water Resources

Water resources in the vicinity include surface water bodies and groundwater aquifers. The closest significant surface water source is the Swaan River, situated approximately 5 kilometers from the project site. Surface water availability is seasonal and limited in quantity, primarily during the monsoon period.

Groundwater is the principal source of water supply for industrial, agricultural, and domestic purposes in Rawalpindi. Aquifers lie at depths ranging from 20 to 40 meters. Preliminary water quality assessments indicate that groundwater in the area is generally suitable for industrial use but may require treatment for portable applications. The pharmaceutical unit plans to utilize treated municipal water along with harvested rainwater for sustainable water management.

3.2 Baseline Ecological Environment

The baseline ecological environment describes the existing biological conditions including vegetation, wildlife, habitats, and ecological sensitivities in and around the project site. This assessment helps to identify any potential impacts on biodiversity from the construction and operation of the pharmaceutical unit and informs mitigation measures.

3.2.1 Vegetation and Flora

The project site is located within the RCCI Industrial Estate, where natural vegetation is limited due to urban and industrial development. The site features landscaped green belts consisting of planted trees and shrubs suited to the semi-arid climate. Surrounding agricultural lands support seasonal crops and patches of native scrub vegetation.

Table 3.1: Common Vegetation Types at and Around the Project Site

Vegetation Type	Description	Location	Ecological Role
Acacia spp.	Drought-resistant tree species	Planted green belts	Soil stabilization, shade
Eucalyptus spp.	Fast-growing trees used for greenery	Along roads and boundaries	Air quality improvement

Neem (Azadirachta indica)	Hardy native tree with medicinal properties	Landscaping areas	Supports biodiversity, pest control
Agricultural Crops	Wheat, maize, vegetables	Surrounding agricultural lands	Supports local fauna, soil cover
Native Scrub Vegetation	Drought-tolerant shrubs and grasses	Adjacent non-cultivated areas	Wildlife habitat, erosion control

3.2.2 Fauna and Wildlife

Due to the heavily industrialized nature of the site, wildlife diversity is limited. Common species observed include small mammals, reptiles, and birds adapted to urban and agricultural environments.

Table 3.2: Common Fauna Species Observed Near the Project Site

Species Group	Common Species	Habitat	Conservation Status
Birds	Pigeon, Sparrow, Crow, Myna	Urban green belts, agricultural fields	Least Concern
Mammals	Rodents (rats, mice)	Urban environment	Least Concern
Reptiles	Lizards, Non-venomous snakes	Scrub vegetation, built-up areas	Least Concern
Migratory Birds	Seasonal visitors (e.g., flycatchers)	Agricultural and green areas	Varies by species

No endangered or protected species were identified within or near the project area, and no critical habitats or ecological corridors were found during field surveys.

3.2.3 Ecological Sensitivity and Conservation Status

The site lies outside designated ecological sensitive zones or protected areas. The nearest protected forest or wildlife sanctuary is located several kilometers away, reducing the likelihood of direct impacts on critical ecosystems.

Table 3.3: Proximity of Ecologically Sensitive Areas to Project Site

Protected Area	Distance from Project Site (km)	Description
Murree National Park	~25 km	Protected forest area, diverse flora and fauna
Ayubia National Park	~50 km	Protected wildlife sanctuary
Local Agricultural Lands	Adjacent	Support for local biodiversity

3.2.4 Potential Ecological Impacts and Mitigation

While the site's ecological sensitivity is low, potential impacts may arise from construction activities such as habitat disturbance, dust emissions, and contamination risks. The following mitigation measures are proposed to minimize these impacts:

- Strict control of construction waste and effluents to prevent soil and water contamination.
- Dust suppression during earthworks to protect nearby vegetation.
- Retention and enhancement of existing green belts with native species planting.
- Implementation of stormwater management to avoid runoff pollution.

3.3 Baseline Socioeconomic Environment

The baseline socioeconomic environment encompasses the demographic, economic, social, and cultural characteristics of the population living in and around the project area. Understanding these factors is essential to evaluate how the proposed pharmaceutical unit may influence local communities, employment opportunities, infrastructure, and social welfare.

3.3.1 Demographics

The project site is situated within Rawalpindi district, a populous and economically active region of Punjab, Pakistan. The local population comprises diverse ethnic groups and a range of socioeconomic classes. According to the latest census data, the district has a population density of approximately 1,000 persons per square kilometer. The population in areas adjacent to the RCCI Industrial Estate is a mix of urban and peri-urban settlements.

Table 3.4: Demographic Profile of Rawalpindi District

Parameter	Value
Total Population	Approx. 5.4 million
Population Density	~1,000 persons/km²
Average Household Size	5–7 members
Literacy Rate	~73%
Urban vs Rural Population	60% Urban / 40% Rural
Major Languages Spoken	Punjabi, Urdu, Pashto

3.3.2 Economic Activities

The local economy is driven by a combination of industrial, agricultural, and service sectors. The RCCI Industrial Estate is a hub for various manufacturing activities, including pharmaceuticals, textiles, chemicals, and food processing. The presence of such industries has created employment opportunities for thousands of workers, contributing to the economic upliftment of the area.

Table 3.5: Employment Structure in the Project Vicinity

Sector	Approximate % of Workforce	Description
Industrial	40%	Manufacturing, pharmaceutical, textiles
Agriculture	30%	Small-scale farming, livestock
Services	20%	Retail, transportation, education, health
Informal Sector	10%	Street vendors, casual labor

The development of the pharmaceutical unit is expected to further enhance local employment prospects by creating skilled and unskilled jobs during construction and operation phases.

3.3.3 Infrastructure and Public Services

The area surrounding the project site benefits from reasonably developed infrastructure. Roads connecting the industrial estate to Rawalpindi city and nearby towns are well-maintained, facilitating the movement of goods and people. Public utilities such as electricity, water supply, and telecommunications are available and reliable, supporting both residential and industrial needs.

Table 3.6: Infrastructure Facilities Near Project Site

Infrastructure Type	Availability	Description
Road Network	Good	Paved roads connecting to major highways
Electricity Supply	Reliable	Grid connection with backup options
Water Supply	Municipal + Groundwater	Available through local authority and wells
Healthcare Facilities	Accessible	Clinics, hospitals within 5-10 km radius
Educational Institutions	Accessible	Schools and colleges within 5-15 km radius
Telecommunications	Good	Mobile and internet coverage

3.3.4 Social and Cultural Aspects

The population in the Rawat and Rawalpindi region follows diverse cultural traditions, languages, and social norms. The majority of residents are Punjabi-speaking with a mix of other ethnicities, including Pashtuns and Kashmiris. Religious diversity is also present, with Islam being the predominant faith alongside minority communities.

Table 3.7: Social and Cultural Overview

Aspect	Details
Major Ethnic Groups	Punjabi, Pashtun, Kashmiri
Languages Spoken	Punjabi, Urdu, Pashto
Religious Composition	Predominantly Muslim; minorities include Christians and others
Social Structures	Family/clan-based communities, mosques, schools
Cultural Events	Religious festivals (Eid, Ramadan), local fairs and markets

3.3.5 Potential Socioeconomic Impacts

The proposed pharmaceutical unit has the potential to positively impact the socioeconomic environment by generating employment, stimulating local businesses, and improving infrastructure. Conversely, construction and operational activities could lead to increased traffic, pressure on utilities, and potential displacement of informal activities or small businesses if not managed carefully.

Mitigation measures will focus on community engagement, fair labor practices, infrastructure enhancement, and ongoing communication to address concerns and maximize positive outcomes.

3.5 Suitability of the Site

The suitability of the project site at Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan, has been carefully evaluated based on multiple environmental, technical, and socioeconomic factors to ensure that the location is appropriate for the construction and operation of the pharmaceutical unit. The site's characteristics align with the project requirements, regulatory standards, and sustainability goals.

3.5.1 Environmental Suitability

The site is located within a designated industrial estate, which is specifically zoned for manufacturing and industrial activities. This zoning minimizes potential land-use conflicts with residential or ecologically sensitive areas. The surrounding environment is predominantly industrial with limited natural vegetation and no critical habitats or protected ecological zones nearby, thus reducing risks of significant ecological disturbance.

The physical environment, including soil type, topography, and drainage patterns, supports stable construction without major earthworks or extensive land modification. The absence of flood-prone areas or waterlogged soils enhances the site's suitability, minimizing risks related to water damage or contamination during operation.

3.5.2 Technical and Infrastructure Suitability

The RCCI Industrial Estate offers ready access to essential utilities including reliable electricity supply, potable water, wastewater treatment facilities, and telecommunications. The site is connected by a well-maintained road network that facilitates the smooth transportation of raw materials and finished products.

Proximity to the Rawalpindi urban center and major highways supports logistics and workforce accessibility. Availability of skilled and semi-skilled labor in the vicinity further supports project feasibility and long-term operations.

3.5.3 Socioeconomic Suitability

The location within an industrial estate aligns with local economic development plans and provides opportunities for job creation and community upliftment. The project is expected to contribute positively to the local economy without causing significant social disruption. The

community's readiness to engage with industrial development and existing infrastructure supports smooth project implementation.

3.5.4 Risk and Hazard Assessment

Preliminary assessments indicate that the site does not lie within seismic fault zones, flood plains, or other natural hazard-prone areas. Potential industrial hazards such as chemical spills or emissions will be managed through design controls and adherence to environmental regulations, reducing risks to workers and neighboring communities.

Summary of Site Suitability

Suitability Factor	Assessment Summary	Conclusion
Land Use Compatibility	Located within RCCI Industrial Estate zoning	Suitable
Environmental Sensitivity	No protected areas or sensitive habitats nearby	Suitable
Physical Conditions	Stable soil, good drainage, no flooding risk	Suitable
Infrastructure Access	Reliable utilities and road network	Suitable
Socioeconomic Context	Supports local employment, aligns with development plans	Suitable
Risk Factors	Low natural hazard risk, manageable industrial risks	Suitable

Overall, the project site is well-suited for the pharmaceutical unit, balancing environmental protection, technical feasibility, and socioeconomic benefits.

Chapter 4

Impact Assessment

This chapter presents a comprehensive evaluation of the potential environmental, social, and economic impacts associated with the proposed construction and operation of the pharmaceutical unit at Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan. The aim is to systematically identify, characterize, and assess these impacts to support informed decision-making and ensure appropriate mitigation measures.

4.1 Methodologies for Impact Identification

The identification of potential impacts associated with the proposed pharmaceutical unit project is a vital component of the Environmental Impact Assessment process. This section outlines the comprehensive approach taken to identify, analyze, and categorize potential environmental, social, and economic impacts arising from all phases of the project.

4.1.1 Desk Study and Literature Review

The process began with a detailed desk study of existing environmental regulations, industry standards, and previously conducted EIAs for similar pharmaceutical and industrial projects. This helped in understanding the typical environmental issues encountered in pharmaceutical manufacturing, including chemical handling risks, waste management concerns, and potential emissions. The literature review provided a baseline framework to anticipate impact types and scopes.

4.1.2 Baseline Data Collection and Field Investigations

To supplement secondary information, extensive field surveys were conducted to collect primary data on air and water quality, soil conditions, noise levels, flora and fauna, and socio-economic conditions within and around the project site. Standard sampling protocols and analytical methods ensured the accuracy and representativeness of the data. These site-specific details formed the basis for predicting impacts with high confidence.

4.1.3 Stakeholder Engagement and Public Consultation

Engaging local communities, regulatory bodies, and other stakeholders was critical in understanding their concerns and identifying sensitive receptors. This participatory approach ensured the inclusion of social dimensions such as community health, employment, and access to resources in the impact identification process.

4.1.4 Impact Identification Matrix

A core analytical tool used in this assessment is the Impact Identification Matrix. This matrix cross-links project activities against key environmental and social components to systematically identify potential impacts. The matrix helps visualize the nature and extent of interactions and assists in prioritizing areas for detailed analysis.

Table 4.1: Sample Impact Identification Matrix

Project Activity	Air Quality	Water Resources	Soil Quality	Noise Levels	Biodiversity	Socioeconomic	Traffic	Waste Generation
Site Clearing and Preparation	Moderate	Low	Moderate	High	Moderate	Low	Moderate	Low
Construction and Building Works	Moderate	Moderate	Moderate	High	Low	Moderate	High	Moderate
Chemical Handling and Storage	High	High	High	Low	Moderate	Low	Low	High
Wastewater Discharge	Low	High	Low	Low	Moderate	Low	Low	High
Operational Emissions	Moderate	Low	Low	Moderate	Low	Moderate	Moderate	Moderate

This matrix helps identify which environmental and social aspects are potentially impacted by each project activity, indicating the need for detailed assessment in subsequent sections.

4.1.5 Geographic Information System (GIS) Analysis

GIS tools were utilized to map the project site in relation to environmental receptors such as nearby water bodies, residential areas, sensitive habitats, and transportation networks. Spatial analysis provided insights into the proximity and vulnerability of these receptors, aiding in the identification of potential impact pathways such as pollutant dispersion or habitat fragmentation.

4.1.6 Expert Judgment and Multidisciplinary Review

The multidisciplinary team applied professional judgment to interpret data and anticipate complex impacts such as cumulative and indirect effects that might not be immediately evident. This expert input was critical in refining the impact identification process and ensuring that all significant impacts were considered.

4.1.7 Classification and Ranking of Impacts

Following identification, impacts were classified according to characteristics like magnitude, duration, extent, reversibility, and likelihood (explained in Section 4.2). This classification provided a structured basis for impact prioritization and guided the formulation of appropriate mitigation and management strategies.

This multi-method approach, combining empirical data, stakeholder input, spatial analysis, and expert evaluation, ensures that the impact identification process is comprehensive, transparent, and aligned with best environmental management practices.

4.2 Characteristics of Impacts

Understanding the nature and significance of potential impacts identified in the previous section requires a detailed characterization. This involves evaluating various attributes of each impact to determine its overall importance and to guide mitigation and monitoring strategies. The main characteristics used to assess impacts include magnitude, extent, duration, reversibility, likelihood, and significance. Each of these is described in detail below.

4.2.1 Magnitude

Magnitude refers to the scale or intensity of the impact on the affected environmental or social component. It measures how severe the change is compared to the baseline condition. For example, a high magnitude air quality impact would indicate a substantial increase in pollutants exceeding regulatory limits, whereas a low magnitude impact might cause minor, localized changes that are within permissible levels. Magnitude helps prioritize impacts based on their potential harm or benefit.

4.2.2 Extent

Extent defines the geographical area over which the impact is experienced. It differentiates between site-specific effects confined within the project boundary, local impacts affecting nearby communities or ecosystems, and regional or even transboundary impacts that influence

larger areas beyond the immediate vicinity. Understanding the spatial scale of impacts is essential for evaluating cumulative effects and identifying vulnerable receptors.

4.2.3 Duration

Duration relates to the time period over which an impact occurs. Impacts may be short-term (occurring only during construction activities), medium-term (lasting throughout the operational phase), or long-term/permanent (persisting beyond the project lifespan). For example, noise and dust emissions are often short-term during construction, while groundwater contamination could have long-lasting or permanent effects. Duration affects both management priorities and the design of monitoring programs.

4.2.4 Reversibility

Reversibility assesses whether the impact can be undone or the environment restored to its original state after the cessation of project activities. Some impacts, such as temporary disturbance of soil or vegetation, are generally reversible through rehabilitation and restoration efforts. Others, such as loss of certain sensitive species or contamination of groundwater, may be irreversible or require long-term remediation. Reversibility influences the urgency and type of mitigation measures.

4.2.5 Likelihood

Likelihood indicates the probability that the identified impact will actually occur, considering existing control measures and project design. Impacts with a high likelihood require stringent preventative measures, while impacts with low likelihood may be monitored but require less intensive intervention. This characteristic helps focus resources on managing the most probable risks.

4.2.6 Significance

Significance is an integrated measure that combines the previous characteristics (magnitude, extent, duration, reversibility, and likelihood) along with regulatory standards, stakeholder concerns, and cumulative effects to determine the overall importance of an impact. Significance determines the priority level for mitigation and monitoring. It is often categorized qualitatively as negligible, minor, moderate, or major.

Table 4.2: Summary of Impact Characteristics

Characteristic	Description	Example

Magnitude	The intensity or severity of the impact compared to baseline conditions	High pollutant concentrations
Extent	Spatial area affected by the impact	Site-specific, local, regional
Duration	Time period over which the impact occurs	Short-term (construction), long-term
Reversibility	Whether the environment or receptor can return to pre-impact condition	Reversible soil disturbance vs. permanent contamination
Likelihood	Probability of the impact occurring considering existing controls	High likelihood of dust emissions during construction
Significance	Overall importance combining all factors and regulatory thresholds	Major impact requiring mitigation

4.2.7 Application to the Pharmaceutical Unit Project

In the context of the proposed pharmaceutical unit at RCCI Industrial Estate, Rawat, each identified impact will be analyzed against these characteristics. For example, emissions of volatile organic compounds (VOCs) during chemical processing may have a high magnitude and likelihood, a local extent, medium to long-term duration, and limited reversibility, resulting in a significant impact classification. Conversely, temporary noise increase during site preparation might have a moderate magnitude, short-term duration, and be fully reversible, thus classified as minor or moderate.

This detailed characterization enables focused mitigation strategies, efficient allocation of monitoring resources, and effective communication with stakeholders and regulatory bodies.

Chapter 5

Screening of Potential Environmental Impacts and Mitigation Measures

5.1 Project Location

The proposed project site lies within Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan. This location is designated for industrial use, which reduces potential conflicts with residential or ecologically sensitive areas. However, possible impacts include local soil disturbance, runoff, and increased traffic loads.

Table 5.1: Potential Environmental Impacts at Project Location and Mitigation Measures

Environmental Aspect	Potential Impact	Mitigation Measure
Soil	Soil compaction and contamination risk	Implement erosion controls and safe chemical storage
Water Resources	Runoff carrying pollutants to water bodies	Construct sedimentation ponds and treat stormwater
Traffic	Increased local traffic and congestion	Develop traffic management plan
Air Quality	Dust emissions during site preparation	Regular watering of exposed surfaces
Biodiversity	Loss of minor vegetation cover	Landscaping with native plants post-construction

5.2 Design Phase

The design phase emphasized environmental protection through layout planning, pollution control integration, and energy efficiency.

Table 5.2: Design Phase Potential Impacts and Mitigation

Aspect	Potential Impact	Mitigation Approach
Process Design	Inefficient resource use leading to waste	Incorporate clean technologies and resource efficiency
Site Layout	Encroachment on buffer zones	Maintain regulatory buffer distances
Waste Management	Inadequate waste handling	Design proper waste segregation and treatment systems
Energy Consumption	High energy demand	Implement energy-saving technologies

5.3 Construction Phase

Construction activities may cause temporary impacts such as noise, dust, and soil erosion.

Table 5.3: Construction Phase Environmental Impacts and Mitigation

Activity	Environmental Impact	Mitigation Measures
Excavation and Site Preparation	Soil erosion and sedimentation	Install silt fences and sediment traps
Material Handling	Dust generation	Regular watering and dust suppression techniques
Construction Equipment	Noise pollution	Restrict work to daytime hours, use noise barriers
Waste Generation	Construction debris	Segregate and dispose of waste properly
Traffic Increase	Road congestion and emissions	Schedule material deliveries to off-peak hours

5.4 Operational Phase

During operations, continuous monitoring and control are vital to reduce impacts from emissions, waste, and energy use.

Table 5.4: Operational Phase Potential Impacts and Mitigation

Aspect	Potential Impact	Mitigation Measure
Air Emissions	Release of VOCs and particulate matter	Install scrubbers and filters on emission sources
Wastewater	Contamination of water bodies	Operate on-site wastewater treatment plant
Solid Waste	Generation of hazardous and non-hazardous waste	Implement waste segregation and disposal protocols
Noise	Continuous equipment noise	Use sound insulation and maintain equipment
Energy Use	High electricity consumption	Employ energy-efficient equipment and explore renewables

5.5 Potential Environmental Enhancement Measures

The project includes proactive measures that not only mitigate harm but enhance the local environment and community welfare.

Table 5.5: Environmental Enhancement Measures

Enhancement Area	Description	Expected Benefit
Green Buffer Zones	Landscaping with native trees and shrubs	Improved air quality, noise buffering, aesthetic improvement
Rainwater Harvesting	Collection and reuse of rainwater	Reduced freshwater demand and groundwater recharge
Waste Minimization	Recycling and reuse initiatives	Reduced waste sent to landfill, resource conservation
Community Engagement	Local employment and training programs	Socio-economic upliftment, skills development
Energy Efficiency	Adoption of renewable energy sources	Reduced carbon footprint and operational costs

This comprehensive approach to screening potential impacts and mitigation ensures environmental and social risks are addressed throughout the project lifecycle, supporting sustainable development goals.

Chapter 6

Environmental Management and Monitoring Program

6.1 Description of Proposed Mitigation Actions

Effective mitigation is fundamental to minimizing the environmental impacts associated with the proposed pharmaceutical unit at RCCI Industrial Estate, Rawat. The mitigation strategies have been developed in accordance with best practices, regulatory requirements, and site-specific conditions. These actions are structured according to the project phases—design, construction, and operation—to ensure environmental protection throughout the project lifecycle.

6.1.1 Mitigation during Design Phase

During the design phase, mitigation measures focus on integrating environmentally friendly technologies and ensuring compliance with environmental standards. Key actions include designing efficient wastewater treatment facilities to prevent water pollution, implementing air pollution control systems such as scrubbers and filters, and planning for waste minimization and segregation facilities. The site layout is optimized to maintain buffer zones from sensitive receptors and to facilitate effective stormwater management. Energy efficiency considerations are embedded in equipment selection and process design to reduce the overall carbon footprint.

6.1.2 Mitigation during Construction Phase

The construction phase presents various temporary environmental risks which are addressed through a suite of mitigation measures. Erosion and sediment control structures such as silt fences and sediment traps will be installed to prevent soil runoff into adjacent areas. Dust control will be achieved through regular watering of exposed surfaces and limiting vehicle speeds on-site. Noise mitigation will involve scheduling noisy activities during daytime hours and using noise barriers where necessary. Waste management protocols will ensure segregation and proper disposal of construction debris and hazardous materials. A traffic management plan will be implemented to minimize congestion and reduce emissions from construction vehicles.

6.2 Schedule for Implementation and Environmental Budget

An effective environmental management program requires timely implementation of mitigation measures supported by adequate financial resources. The schedule for implementation aligns mitigation activities with project milestones across design, construction, and operational phases to ensure proactive environmental control.

Table 6.1: Implementation Schedule of Key Mitigation Measures

Phase	Mitigation Measure	Timing/Duration
Design	Incorporate wastewater treatment design	During detailed engineering
Design	Selection of air pollution control systems	Prior to equipment procurement
Construction	Installation of erosion control structures	Start of site preparation
Construction	Dust and noise control measures	Throughout construction phase
Operation	Operation of wastewater treatment plant	Continuous during operation
Operation	Routine air quality and noise monitoring	Continuous during operation

6.2.1 Environmental Budget Estimate

The environmental budget covers costs related to installation of pollution control equipment, monitoring, training, and contingency measures. This budget ensures that sufficient financial resources are available to maintain compliance and environmental performance.

Table 6.2: Estimated Environmental Budget

Item	Estimated Cost (PKR)
Wastewater treatment system	10,000,000
Air pollution control devices	5,000,000
Erosion and sediment control	1,200,000
Environmental monitoring	800,000 per year
Training and capacity building	500,000 per year
Contingency	1,000,000
Total Estimated Budget	**18,500,000 (initial)**

6.3 Environmental Management Team and Their Roles & Responsibilities

The success of the Environmental Management Plan (EMP) relies heavily on the establishment of a competent and well-structured Environmental Management Team (EMT). This team will ensure that mitigation measures are implemented effectively, environmental monitoring is

conducted regularly, and compliance with environmental regulations is maintained throughout the project lifecycle.

The Environmental Manager will serve as the key coordinator and overall supervisor of the EMP. This individual will be responsible for planning, organizing, and overseeing all environmental activities related to the project. Their role includes ensuring that all project phases adhere to environmental guidelines, coordinating with regulatory authorities, preparing environmental reports, and acting as the primary point of contact for environmental matters.

Supporting the Environmental Manager will be Environmental Officers, who will be stationed on-site or in the vicinity of construction and operational areas. Their main responsibilities include daily supervision of environmental mitigation measures, conducting routine environmental inspections, identifying potential environmental issues, and facilitating immediate corrective actions. They will also assist in training and awareness sessions for staff and contractors.

The Health and Safety Officers will collaborate closely with the environmental team to ensure worker safety measures align with environmental protection goals. This includes monitoring occupational health risks related to hazardous materials and enforcing safe work practices.

The project's Operations Supervisor will integrate environmental management into the routine operational procedures, ensuring long-term sustainability of mitigation efforts post-construction.

In addition, the EMT will coordinate with contractors, vendors, and external consultants to ensure all subcontracted activities meet the EMP requirements. Roles and responsibilities will be clearly defined in contracts and service agreements to guarantee accountability.

Regular team meetings and coordination sessions will be scheduled to review progress, address challenges, and update mitigation or monitoring plans as necessary. This dynamic and proactive approach ensures environmental risks are managed effectively and helps foster a culture of environmental responsibility across the project workforce.

6.4 Proposed Monitoring Program to Assess EMP Performance

Monitoring is critical to assess the effectiveness of mitigation measures and ensure environmental compliance. The proposed monitoring program includes regular measurement of air quality parameters (e.g., particulate matter, VOCs), wastewater discharge quality, noise levels, and soil conditions.

Sampling locations are strategically selected within the project boundary and at sensitive receptor points, such as nearby residential areas and water bodies. Frequency of monitoring varies from weekly during construction to monthly and quarterly during operation, depending on the parameter.

The monitoring data will be analyzed to identify trends and any deviations from permissible limits, enabling timely corrective actions.

Table 6.3: Summary of Monitoring Parameters and Frequency

Environmental Parameter	Monitoring Frequency	Monitoring Location
Air Quality (PM10, VOCs)	Weekly (construction), Monthly (operation)	Site boundary, residential areas
Noise Levels	Weekly (construction), Monthly (operation)	Near sensitive receptors
Wastewater Quality	Monthly	Effluent discharge points
Soil Quality	Quarterly	Site and nearby agricultural land

6.5 Proposed EMP Reporting and Reviewing Procedures

A robust reporting and review mechanism is essential for tracking the implementation and effectiveness of the EMP. The Environmental Manager will be responsible for compiling comprehensive monthly environmental monitoring reports that document key performance indicators, compliance status, observed non-conformities, incidents, and corrective actions taken.

These reports will include data from air, water, soil, and noise monitoring, as well as waste management audits and observations from site inspections. The information will be analyzed to detect trends, identify emerging risks, and evaluate the success of mitigation measures.

Reports will be submitted to relevant regulatory agencies as required by environmental permits and standards. Additionally, internal dissemination of reports will ensure that all project stakeholders remain informed and engaged in environmental management.

An annual environmental performance review will be conducted to provide a holistic evaluation of the EMP. This review will incorporate monitoring results, audit findings, feedback from regulatory bodies, and community or stakeholder input. It will assess whether environmental objectives are being met, and where necessary, recommend adjustments to mitigation strategies or operational procedures.

The review process is critical for continuous improvement. It will help refine environmental management practices and ensure evolving regulatory and community expectations are met. Recommendations from the annual review will be integrated into updated EMP documentation, creating a living document that adapts to project developments and environmental challenges.

6.6 Training Needs to Ensure Implementation of EMP and Monitoring Plans

Effective training is essential for equipping all project personnel with the knowledge and skills required to successfully implement the Environmental Management Plan (EMP) and monitoring programs. Training efforts will be tailored according to the roles, responsibilities, and phases of the project, ensuring relevant content is delivered to the appropriate audience.

Training Needs Assessment

The identification of training needs is based on the nature of work, environmental risks involved, and regulatory requirements. Table 6.4 outlines the categories of personnel, the specific training topics relevant to each group, and the frequency of training sessions.

Table 6.4: Training Needs by Personnel Category

Personnel Category	Training Topics	Frequency
Environmental Management Team	EMP implementation, environmental monitoring, reporting, incident management	Initial & refresher annually
Construction Supervisors	Environmental mitigation measures, pollution control, waste management, health & safety integration	Initial & refresher semi-annually
Construction Workers	Basic environmental awareness, waste segregation, spill prevention, dust and noise control	Initial & refresher quarterly
Operations Staff	Sustainable operational practices, wastewater treatment operation, emergency response	Initial & refresher annually

Contractors & Vendors	Environmental compliance requirements, safe handling of materials, site-specific EMP procedures	Prior to work commencement

Training Program Components

The training program will consist of induction sessions for new hires, periodic refresher courses, and specialized workshops tailored to complex environmental management activities. The program delivery will combine classroom instruction, practical demonstrations, and hands-on exercises to maximize retention and application.

Table 6.5: Training Program Structure

Training Type	Description	Duration	Delivery Method
Induction Training	Overview of EMP, project environmental policies, site-specific concerns	1 day	In-person / Online
Specialized Training	Monitoring techniques, data analysis, emergency preparedness	2-3 days	Workshops / Seminars
Awareness Sessions	Practical environmental protection measures for labor force	Half-day	On-site demonstrations
Refresher Courses	Updates on regulations, new mitigation technologies	1 day	Interactive sessions

Training Record Keeping and Evaluation

To ensure the effectiveness and accountability of the training program, a comprehensive record-keeping system will be maintained. This will document attendance, training content, trainer qualifications, and evaluation results. Regular assessments will help gauge knowledge retention and identify areas requiring further emphasis.

Table 6.6: Training Records and Evaluation

Record Type	Description	Responsible Party
Attendance Registers	Lists of participants for each training session	Environmental Officer
Training Materials	Copies of presentations, handouts, manuals used	Training Coordinator

Evaluation Results	Feedback forms, quizzes, and practical test outcomes	Training Coordinator
Training Certificates	Issued to participants upon successful completion	Human Resources

By implementing this structured and continuous training program, the project will build environmental awareness and competence among all stakeholders, ensuring the EMP and monitoring plans are effectively and consistently applied throughout the project lifecycle

ENVIRONMENTAL MANAGEMENT PLAN OF M/S CRYSTOLITE PHARMACEUTICALS

		Impact & Mitigations to be taken			
Sr. #	**Aspects**	**Impacts**	**Mitigation measures Construction/Operation**	**Responsibility**	**Monitoring**
			AMBIENT AIR QUALITY		
1	Air Quality	Production machinery Flue gas emissions from machinery and generators	Air emissions-controlled devices must be installed to control the air pollution. For generators, small scrubbers should be installed. Air quality monitoring is recommended on regular base Open disposal and burning of solid waste in the premises of building should be strictly banned. Pollution abatement technologies regarding air pollution will be adopted. Emissions inspection and monitoring should be done on regular basis	HSE Department	Environmental Consultant/EPA PUNJAB
			NOISE & VIBRATION		

2	Noise	The major sources of the noise are production related machinery. Noise from generators (if any)	Personal Protective Equipment PPEs including Ear muffs, Ear plugs and other noise abating equipment will be provided to the workers and other staff. Sound proof room should be built for generator (if any) to control the noise.	HSE department	Environmental Consultant/ EPA PUNJAB

HEALTH AND SAFETY

3	Health and safety	Health & safety issues of workers and nearby community	Trainings of the workers is recommended for health & safety, first aid and firefighting. Proponent must provide First aid facilities to workers in case of any injury or accident. Safe drinking water must be provided to workers, staff, and poor people of the area. Water consumption records should be maintained. Provision of Proper PPEs must be ensured at workplace. Assembly point and exit points must be available at workplace. Electric wires, D.Bs must be kept covered & closed to avoid any electric hazards. Smoking or any drugs should be prohibited during working hours or performing work.	HSE Department	Environmental Consultant/ EPA

			Safety signs & boards will be placed at the time of construction activity. Security guards will be appointed at the construction site.		

WASTE WATER

4	Waste water	Domestic waste water. Minor wastewater from production activities. Spread of diseases, underground water contamination.	Domestic waste water is being drained out in industrial estate drain after treated in septic tanks An appropriately designed septic tank is being used to treat sewage/waste water to achieve PEQS. Periodic cleaning of septic tank is recommended.	HSE department	Environmental Consultant

SOLID WASTE GENERATION

5	Solid Waste Generation	Aesthetic degradation, foul smell etc. Solid waste generation from the machinery installation and production activities, domestic and process sources	A solid waste management plan should be formulated to deal with the proper disposal of solid waste, supervised by HSE Manager. Waste segregation is recommended at the source. Industrial ecology practices will be adopted wherever possible. 7 R's of sustainability is recommended Hazardous waste should be disposed in separate bins and handed over to EPA approved contractors.	HSE Department	Environmental Consultant/ EPA PUNJAB

			Waste produced from building alteration/renovation should be sold to local market.		
			ODOR		
6	Odor	Odor may produce from raw material and during product manufacturing	Raw material should be covered to reduce odor Face masks must be provided to the workers and employees on production floor	HSE Department	Environmental Consultant/ EPA PUNJAB
			ENERGY REQUIREMENT		
7	Energy requirement	Resource depletion	Do not waste the energy/electricity when there is no need of it. Use energy efficient and ecofriendly equipment Use energy saving appliances Conduct and maintain records for energy audits Do not leave the appliances in running when there is no need It is recommended to save and conserve the energy and adopt energy efficient technologies in the factory.	HSE Department	Environmental Consultant/ EPA PUNJAB
			SOCIO ECONOMIC IMPACTS		

8	Language	Change in cultural language	Maximum employment of Local people is recommended to preserve the local cultural language. It will help in communication with the local people to resolve any emerging issue near the project area	Proponent	NA
9	Education	Change in social behavior and economic gains	School and colleges exist in the area. The project proponent will initiate an educational awareness program with the coordination of the local people.	Proponent	NGO survey
10	Health	Social performance of the individuals in the area	The project proponent will assist the local impacted community for the improvement of health services Health clinic must be established for the project workers.	Proponent	Proponent
11	Culture and norms of the area	Change in culture by the influx of nomadic people	Maximum local employment should be ensured to preserve the culture of the area	Proponent	NGO survey/Environmental Consultant
12	Sewage and waste disposal	Diseases caused by improper sanitation	Subject project will uplift the economic status of the nearest human settlements. Awareness program will be initiated regarding the disposal of waste.	Proponent/ local NGO	NGO survey/ Environmental Consultant

Chapter 7

Stakeholders Consultation

7.1 Introduction

Stakeholder consultation is a critical part of the Environmental Impact Assessment (EIA) process for any project. For the proposed project by M/S Crystolite Pharmaceuticals, a series of consultations were held with various stakeholders from the local community, government agencies, and other relevant groups to gather their feedback on the project's potential social, economic, and environmental impacts. The consultations aimed to provide a platform for stakeholders to voice their concerns, suggestions, and expectations regarding the project.

7.2 Methodology of Consultation M/S Crystolite Pharmaceuticals

The EIA team conducted public consultations through group meetings and individual discussions. A Comprehensive questionnaire was developed in order to conduct the survey. The primary focus was to engage local communities and gather their perspectives on the proposed construction of the facility, its potential benefits, and any concerns related to environmental impacts. The consultations targeted stakeholders including local residents, government officials, and business owners from the surrounding area. Public discussions were held at various locations near the project site, and stakeholders from local communities, educational and health institutions, shops, and other facilities were consulted. The team also made initial visits to the project site and held reconnaissance meetings to understand the local context better.

7.3 Stakeholder Identification

A three-tier approach was adopted for stakeholder identification, which considered the various levels at which stakeholders could be impacted by the project. The stakeholders were classified at the provincial level (e.g., Environmental Protection Agency (EPA), Agriculture Department, Wildlife Department), district level (e.g., local government bodies), and village level (e.g., local residents, shopkeepers, school representatives, etc.). The consultations continued throughout the project lifecycle, ensuring that feedback was integrated into the environmental management plan.

Regular engagement with these stakeholders is crucial to maintain transparency and responsiveness to their concerns.

7.4 Proponent's Environmental Management Team

M/S Crystolite Pharmaceuticals management assured that all necessary mitigation measures would be implemented to minimize any potential environmental impacts during the construction and operation phases of the project. The proponent's Environmental Management Team will oversee the adoption of these measures, including maintaining the aesthetics of the area and addressing concerns related to environmental degradation.

7.5 Responsible Authority

The responsibility for overseeing the implementation of the proposed mitigation measures lies with the management of M/S Crystolite Pharmaceuticals. The company is committed to adhering to all environmental regulations and ensuring that the project's impact on the surrounding community and the environment is minimized.

7.6 Other Departments and Agencies

For the impact analysis, detailed meetings were held with local community leaders, educational institutions, health facilities, and NGOs. These discussions helped identify key issues related to the project and its potential effects. All relevant concerns were incorporated into the Environmental Management Plan to ensure a holistic approach to mitigating the project's impacts.

7.7 Environmental Practitioners and Experts

The team of environmental consultants conducted site visits and consultations with stakeholders from nearby villages. They gathered information on the socio-economic impacts of the project and incorporated feedback from different professionals, including local business owners, farmers, teachers, and health professionals. The consultations with women were also conducted, although some hesitated to provide personal information due to social constraints.

7.8 Affected and Wider Community

No specific community was found to be directly affected by the project within the study area. The consultations with the local population revealed a general positive response toward the project. Stakeholders emphasized that the project could bring tangible benefits, such as job creation and

local development, while ensuring that mitigation measures were taken to preserve the environment.

7.9 Consultation Findings

The results from the consultation meetings with stakeholders indicate a strong overall support for the project. The local community members expressed positive feedback regarding the project's potential to bring socio-economic benefits to the area, particularly in terms of employment opportunities and business growth. Many respondents felt that the construction of the project would improve the local infrastructure, contribute to social mobility, and increase the importance of the area.

However, there were also concerns raised regarding the potential environmental impacts, especially in relation to the potential effects on the area's aesthetic value and the environment. Some participants were worried about the impact on the scenic beauty of the area, but the project proponents assured that mitigation measures, such as land reclamation and maintaining the aesthetics of the area, would be implemented to address these concerns.

7.10 Stakeholder Feedback

The responses from stakeholders, summarized below, provide a more detailed picture of their views:

7.10.1 Sample Size

20 sample size was selected by the Team of consultants for conducting the socioeconomic survey. Women were also consulted for the said survey; some of their names are mentioned in the above list of respondents while most of them were not willing to give personal information.

7.10.2 Statistical Analysis

Two Different statistical software excel and SPSS have been used for the statistical analysis of the data collected during the visit of study site villages through questionnaires.

7.10.3 Results and Discussion

Gender

The consultations involved 20 respondents, including both 11 male and 9 female participants.

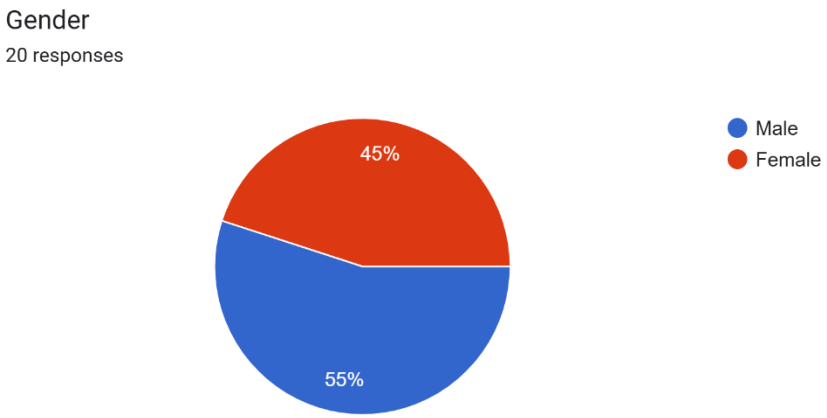


Figure 1: Gender of the Respondents

Project Support and Importance

The majority of the respondents (11), both male and female, expressed strong support for the proposed project. Most (9) agreed that the construction of the facility would increase the importance of the area, contributing to its overall growth and development. Participants were optimistic about the project's potential to raise the profile of the local community and enhance its standing within the region. The support for the project reflected a shared belief that it would bring significant benefits to the community.

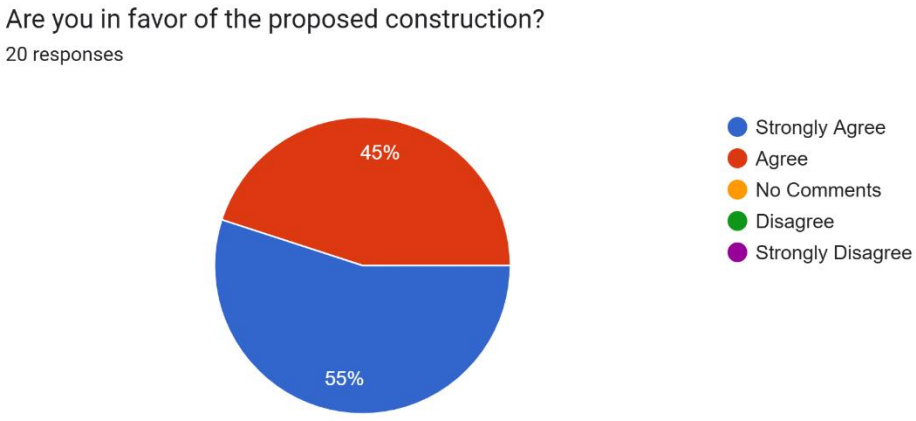


Figure 2: Respondents in favor of the Project

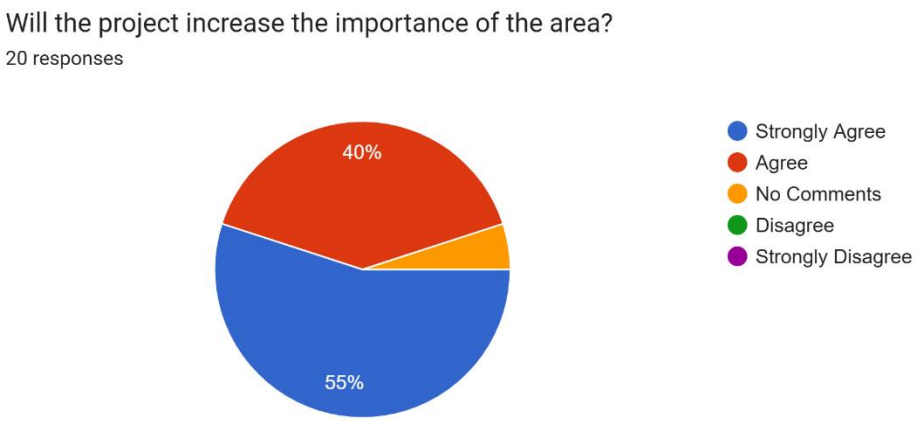


Figure 3: Respondents' Views on the Impact of the Project on the Importance of the Area

Improvement of Living Standards

While many respondents believed that the project would improve the living standards of the area, a few raised concerns. Approximately, 17 respondents strongly agreed or agreed that the project would result in better infrastructure, more employment opportunities, and improved services, which could enhance the overall quality of life. However, 3 individuals disagreed, possibly due to concerns over potential negative environmental impacts or uncertainties about the project's long-term benefits. Despite these reservations, the majority of the community seemed confident that the project would lead to better economic prospects.

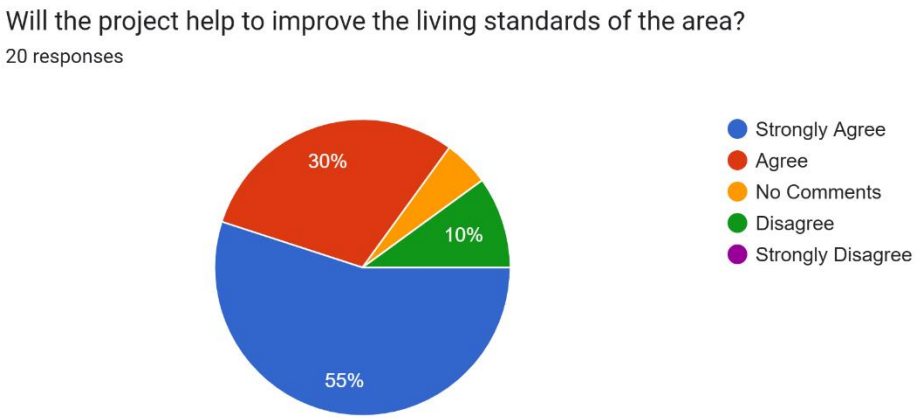


Figure 4: Respondents' Views on the Impact of the Project on the living standards of Area

Environmental Impact Concerns

When asked about the environmental impact of the project, responses were varied. 14 respondents strongly disagreed and 3 disagreed that the project would have any negative effect on the environment, 1 showed concern regarding its potential to disrupt area's aesthetic value. 2 responders were neutral and given no comments.

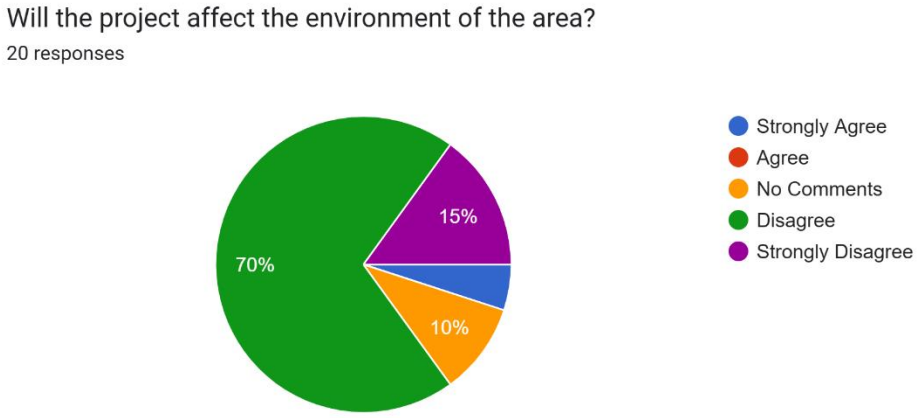


Figure 5: Respondents' Views on the Impact of the Project on the Environment of Area

Satisfaction with the Project

In terms of satisfaction, a substantial number of participants expressed their contentment with the project and its potential benefits. 18 respondents indicated their approval, citing the job creation and economic growth the project would bring. Their positive outlook on the project reflected their anticipation of tangible improvements in their community. However, 2 individuals, were neutral regarding the project satisfaction.

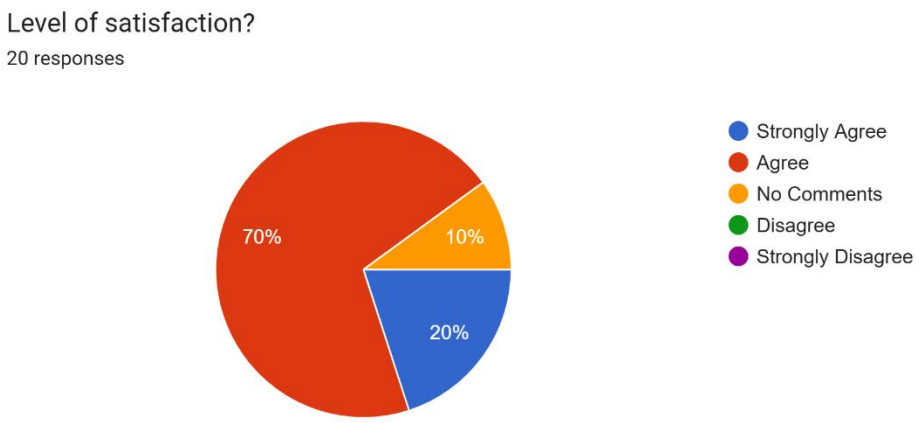


Figure 6: Respondents' Level of Satisfaction Regarding the Proposed Project

Conclusion

The stakeholder consultation process for the M/S Crystolite Pharmaceuticals project demonstrated strong support for the initiative from the local community, with a clear recognition of its potential to boost the area's economic development. While environmental concerns were noted, the project proponents have committed to implementing mitigation measures to address these issues and maintain local aesthetic and environmental values. Continuous engagement with stakeholders throughout the project's lifecycle is crucial to ensure that any emerging concerns are promptly addressed.

Chapter 8

Conclusion and Recommendations

8.1 Conclusion

The Environmental Impact Assessment conducted for the proposed construction of the pharmaceutical unit at Plot 72, 72A & 72B, Street S-2, national industrial zone, Rawat Islamabad, Pakistan, has provided a comprehensive evaluation of the potential environmental, ecological, and socioeconomic impacts associated with the project. The study has assessed baseline conditions, identified key environmental sensitivities, and analyzed the probable impacts during design, construction, and operational phases.

Overall, the findings indicate that while the project has the potential to cause environmental impacts such as air emissions, wastewater generation, noise pollution, and waste production, these impacts can be effectively mitigated through the implementation of a robust Environmental Management Plan (EMP). The project site's location within an established industrial estate minimizes risks to sensitive ecological and residential areas, and existing infrastructure supports the development with manageable environmental pressures.

The project is expected to bring significant economic benefits, including job creation, technological advancement in pharmaceutical manufacturing, and contribution to local and national healthcare sectors. The socioeconomic environment will benefit from improved employment opportunities and community development initiatives integrated as part of the corporate social responsibility efforts.

The baseline environmental data collected confirms that the site is suitable for the proposed pharmaceutical unit, provided that strict adherence to recommended mitigation measures and monitoring protocols is maintained. The designed rainwater harvesting system and waste management facilities will further enhance environmental sustainability by reducing resource consumption and minimizing pollution.

In conclusion, with the proposed mitigation and management strategies, the project can proceed without causing significant adverse environmental effects, ensuring sustainable development and regulatory compliance.

8.2 Recommendations

To ensure the continued protection of the environment and maximize the positive outcomes of the project, the following recommendations are proposed:

1. Strict Implementation of the EMP: All mitigation measures outlined in the EMP must be enforced rigorously throughout the design, construction, and operational phases. Regular training, supervision, and audits should be conducted to ensure compliance and effectiveness.

2. Continuous Environmental Monitoring: Establish a comprehensive environmental monitoring program as detailed in the report, with regular reporting to relevant regulatory authorities. Early detection of any environmental deviations should prompt timely corrective actions.

3. Stakeholder Engagement: Maintain open communication channels with local communities, regulatory agencies, and other stakeholders. Address any concerns proactively and incorporate feedback into project management to foster goodwill and social license to operate.

4. Waste Management Optimization: Prioritize waste minimization, segregation, and recycling practices. Hazardous waste generated from pharmaceutical processes should be handled by licensed contractors in accordance with environmental regulations to prevent contamination.

5. Water Resource Conservation: Maximize the use of the rainwater harvesting system and implement water-saving technologies to reduce freshwater consumption and minimize wastewater discharge.

6. Emergency Preparedness: Develop and maintain an environmental emergency response plan to address accidental spills, leaks, or other unforeseen environmental incidents promptly and effectively.

7. Periodic EMP Review and Updates: Conduct annual reviews of the EMP to evaluate its performance and integrate new technological advancements or regulatory changes, ensuring continual improvement of environmental management practices.

8. Capacity Building: Invest in ongoing training and capacity-building programs for staff and contractors to maintain high levels of environmental awareness and competence.

By adopting these recommendations, M/S Crystolite Pharmaceuticals will not only comply with environmental legislation but also demonstrate commitment to sustainable industrial development and corporate environmental responsibility.