

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Bangladesh Ordnance Factories

Gazipur Cantonment, Gazipur-1703



Prepared By:



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Declaration

This Environmental Impact Assessment (EIA) report has been prepared for **Bangladesh Ordnance Factories (BOF)** by the consulting team of **Environest Engineering**. The report encompasses various environmental management plans specifically developed for the proposed arms and ammunition production facilities, identifying potential environmental impacts and outlining appropriate mitigation measures. It emphasizes strategies for minimizing waste, reducing resource consumption, promoting reuse and recovery wherever practicable, controlling pollution, and implementing the necessary actions to effectively manage environmental concerns throughout the project lifecycle.

Shamim Ur Rahman has served as the principal author of this EIA report, with comprehensive support and collaboration from the entire team at Environest Engineering. The successful completion of this report was made possible by the collective effort of our team.

We gratefully acknowledge the valuable data, technical information, and cooperation provided by the Board of Directors and management of Bangladesh Ordnance Factories (BOF), which have been essential for the preparation and completion of this EIA report.



Shamim Ur Rahman
Chief Executive Officer
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EMP	Environmental Management Plan
DOE	Department of Environment
EIA	Environmental Impact Assessment
DGHS	Directorate General of Health Services
ECR	Environment Conservation Rules
GOB	Government of Bangladesh
ETP	Effluent Treatment Plant
STP	Sewage Treatment Plant
OHSA	Occupational Health and Safety Administration
EPA	Environmental Protection Agency
WHO	World Health Organization
ECA	Environment Conservation Act
DG	Director General
ECC	Environmental Clearance Certificate
NOC	No Objection Certificate
ADB	Asian Development Bank
DPDC	Dhaka Power Development Corporation
DCC	Dhaka City Corporation
EQS	Environmental Quality Standard
IEE	Initial Environmental Examination
EIA	Environmental Impact Assessment
GPS	Global Positioning System
MOEF	Ministry of Environment and Forests
NGO	Non-Government Organization
SDG	Sustainable Development Goals
TOR	Terms of Reference
UNDP	United Nations Development Program
WASA	Water And Sewer Authority
BMD	Bangladesh Meteorological Department
CEA	Comprehensive Environmental Assessment
BOF	Bangladesh Ordnance Factories
EHS	Environment, Health and Safety
ERP	Emergency Response Plan
SDG	Sustainable Development Goals
WWTP	Wastewater Treatment Plant

Abbreviations



Physical Units

m	=	Meter
he	=	Hectares
km	=	Kilometers
sq.m	=	Square Meters
l	=	Liter
sq.ft	=	Square Feet
sq.km	=	Square Kilometer
435.6 sq.ft	=	1 Decimal
720 sq.ft	=	1 Katha
3 Bigha	=	1 Acre
20 Katha	=	1 Bigha
100 Decimal	=	1 Acres



Executive Summary

The proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory is located at Gazipur Cantonment, Gazipur and covers approximately 135.87 acres. The proposed development includes specialized manufacturing facilities for Assault Rifles, Small Arms Ammunition (SAA), Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortars/Bombs. The project will use a range of metallic, chemical and other raw materials, including alloy steel, copper and brass strips, lead, antimony sulphide, barium nitrate, lead styphnate, red lead powder, lead azide and other production chemicals.

The Environmental Impact Assessment (EIA) has been prepared to identify and evaluate the potential environmental and socio-economic impacts associated with the construction and operational phases of the proposed project and to recommend appropriate mitigation, management and monitoring measures. The assessment considers potential impacts on air quality, surface and groundwater, soil and land environment, noise and vibration, wastewater, solid and process waste, drainage, occupational health and safety, chemical handling, emergency risks and socio-economic conditions.

The project will require approximately 40 m³/day of water, which will be supplied from BOF's own deep tube-well. Approximately 36 m³/day of wastewater is expected to be generated. For treatment of wastewater, BOF proposes a 5 m³/hour (40 m³/day) Effluent Treatment Plant (ETP) based on chemical treatment. Treated effluent is proposed to be discharged through the City Corporation drain leading toward the Balu River; therefore, continuous operation of the ETP and regular monitoring of treated-effluent quality will be essential.

The available project information identifies cartons and boxes as solid waste. However, considering the nature of the proposed manufacturing activities, additional process-related, chemical-contaminated and ETP sludge waste streams may arise during operation and should be properly identified, characterized, segregated and managed according to their properties. Waste minimization, source segregation, recycling/recovery where practicable, secure temporary storage and environmentally appropriate final disposal will form integral parts of the waste-management system.

Electricity will be supplied from REB, with a stated requirement of approximately 6,500 kWh/month. BOF also proposes seven standby generators consisting of four 1,000 kVA units, two 1,500 kVA units and one 1,250 kVA unit. Generator operation, production machinery, material handling and vehicular movement may contribute to air emissions and noise; consequently, preventive maintenance, suitable exhaust arrangements, engineering controls and periodic environmental monitoring will be required.



Occupational health and safety represents a major consideration because the project involves specialized production equipment, metallic raw materials and various chemicals. BOF has approximately 2,125 permanent and temporary personnel, and the project will operate for approximately 8 hours per day and 6 days per week. Accordingly, the Environmental Management Plan (EMP) emphasizes hazard identification, job-specific risk assessment, PPE, machine safety, chemical management, workplace monitoring, medical surveillance, worker training and incident reporting.

Emergency response and fire management are also important because of the specialized nature of arms and ammunition manufacturing. Appropriate fire-detection and firefighting facilities, chemical spill-response arrangements, emergency exits, evacuation routes, assembly points, trained emergency-response personnel, first-aid facilities and periodic emergency drills should therefore be incorporated into project operation.

The assessment indicates that potential adverse environmental impacts are mainly associated with water consumption and wastewater discharge, air emissions, noise, solid/process waste, chemical handling, soil and water contamination, occupational exposure, traffic and accidental hazards. Most routine impacts are expected to be localized and manageable provided that the recommended mitigation measures, engineering controls and monitoring requirements are effectively implemented.

The project is also expected to generate positive socio-economic benefits through direct and indirect employment, development of specialized technical skills, associated economic activity and strengthening of domestic arms and ammunition production capability. The documented project workforce of approximately 2,125 personnel represents an important employment contribution.

The analysis of alternatives considered the Do Nothing Alternative, Alternative Land Use and Alternative Land Site. The Do Nothing Alternative would avoid project-related environmental impacts but would not achieve the intended production objectives. Alternative land use would provide different development opportunities but would not establish the proposed arms and ammunition production facilities. No alternative site has been identified in the supplied project information as demonstrably superior to the proposed Gazipur Cantonment site.

An Environmental Management Plan (EMP) has therefore been developed to ensure systematic implementation of mitigation, enhancement and monitoring measures. The EMP focuses on wastewater treatment, waste management, air and noise control, chemical and raw-material management, occupational health and safety, emergency response, resource conservation and environmental monitoring. Regular monitoring of relevant environmental parameters and timely corrective action will be required to maintain compliance and environmental performance.



The EIA concludes that the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory will involve environmental impacts that require careful and continuous management. With proper implementation of the proposed ETP, waste-management system, air and noise controls, chemical-management procedures, OHS measures, emergency-response arrangements and environmental monitoring program, the identified adverse impacts can be substantially minimized and managed. Subject to implementation of the recommended EMP and applicable environmental requirements, the proposed project can proceed in an environmentally responsible and sustainable manner while delivering its intended industrial, employment and technical benefits.



Chapter One: Introduction

1.1 General

The proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory at Gazipur Cantonment, Gazipur is a new industrial development intended to establish specialized manufacturing facilities for selected arms and ammunition products. The project covers approximately 135.87 acres and includes production facilities for Assault Rifles, Small Arms Ammunition (SAA), Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortars/Bombs. Due to the nature and scale of the proposed manufacturing activities, the project involves the use of metallic materials, specialized chemicals, production machinery, utility facilities, water supply, wastewater treatment and supporting infrastructure. Accordingly, this Environmental Impact Assessment (EIA) has been undertaken to identify and evaluate the potential environmental impacts associated with project development and to establish appropriate mitigation, management and monitoring measures for environmentally responsible implementation.

The key features relevant to the EIA are summarized below:

- **Project Nature and Scope:** BOF is proposed as an arms and ammunition manufacturing facility comprising multiple specialized production units. The environmental assessment therefore considers both construction-related impacts and impacts arising from future industrial operations.
- **Production Facilities:** The proposed facilities include manufacturing of Assault Rifles, SAA, Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortars/Bombs. Each production activity has specific material, utility, occupational-safety and environmental-management requirements.
- **Raw Materials and Chemicals:** Production will involve materials such as alloy steel, copper and brass strips, lead, antimony sulphide, barium nitrate, lead styphnate, red lead powder, lead azide and other production chemicals. Consequently, appropriate storage, handling, occupational protection, spill prevention and waste-management arrangements are important components of the project.
- **Water Requirement and Wastewater Generation:** The project information indicates a total water requirement of approximately 40 m³/day, to be supplied through BOF's own deep tube-well. Approximately 36 m³/day of wastewater is expected to be generated during operation.
- **Wastewater Treatment:** A 5 m³/hour (40 m³/day) chemical-treatment Effluent Treatment Plant (ETP) is proposed for wastewater management. Treated effluent is intended to be discharged through the City Corporation drainage system leading toward the Balu River; therefore, proper ETP operation and treated-effluent monitoring will be essential.



- **Power and Utility Facilities:** Electricity will be supplied from REB, with a stated requirement of approximately 6,500 kWh/month. The project information also identifies seven standby generators, comprising four 1,000 kVA units, two 1,500 kVA units and one 1,250 kVA unit.
- **Employment:** Approximately 2,125 permanent and temporary personnel are associated with the proposed project. Occupational health and safety, workplace environmental quality, training and emergency preparedness are therefore important considerations of the EIA.
- **Environmental Management Requirement:** Potential environmental issues include air emissions, wastewater, solid and process waste, noise, chemical handling, soil and water contamination, resource consumption, occupational health and safety, and accidental/emergency risks. These issues require appropriate mitigation measures and systematic management through the Environmental Management Plan (EMP).

The EIA therefore provides the environmental framework for planning, construction and operation of the proposed BOF facility. By systematically identifying potential impacts and establishing appropriate pollution-control, waste and wastewater management, occupational safety, emergency-response and environmental monitoring measures, the assessment aims to ensure that the project is implemented with adequate protection of environmental quality and human health while achieving its intended industrial objectives.

1.2 Environmental Impact Assessment (EIA) and Its Significance

An Environmental Impact Assessment (EIA) is a systematic process used to evaluate the potential environmental effects of a proposed project before its implementation. The primary objective of an EIA is to identify, assess, and mitigate any adverse environmental impacts associated with a project throughout its lifecycle, including design, construction, operation, and decommissioning (Glasson, Therivel, & Chadwick, 2013). This process ensures that potential environmental concerns are addressed early in the project planning stages, allowing for effective mitigation measures to be developed.

The EIA process consists of several key stages. Screening determines whether a full EIA is necessary based on the potential impacts of the project (Burdge, 2004). Scoping involves identifying the main environmental issues and concerns that need to be addressed (Wood, 2003). During the impact assessment phase, the potential environmental impacts are evaluated, including both positive and negative effects (Petts, 1999). Mitigation measures are then proposed to avoid, reduce, or offset adverse impacts (Morgan, 2012). The findings are documented in an Environmental Impact Statement (EIS), which is reviewed to make decisions regarding project approval and additional requirements (Glasson et al., 2013).

The significance of an EIA lies in its ability to provide a comprehensive understanding of the potential environmental consequences of a project. By integrating environmental considerations into the



decision-making process, an EIA supports informed decision-making that balances development needs with environmental protection. It enables early identification of potential impacts, allowing for the development of strategies to address issues before they become significant problems (Wood, 2003). Additionally, the EIA process often includes public consultation, which helps to address community concerns and enhance project transparency (Petts, 1999).

Conducting an EIA also ensures regulatory compliance by adhering to environmental regulations and standards, thereby reducing legal and financial risks (Morgan, 2012). Moreover, by considering environmental factors in project planning, an EIA supports the principles of sustainable development, contributing to the conservation of natural resources for future generations (Morrison-Saunders & Partidário, 2013). Overall, the EIA is a crucial tool for managing and mitigating environmental impacts, promoting sustainable development, and ensuring that projects are executed in an environmentally responsible manner.

1.3 Aims and Objectives of the EIA

The primary aim of the Environmental Impact Assessment (EIA) for Bangladesh Ordnance Factories (BOF) is to systematically identify, evaluate, and mitigate the potential environmental impacts associated with the establishment and operation of the proposed arms & ammo manufacturing facility. This EIA report is designed to ensure that the project is developed in an environmentally responsible manner, balancing the need for arms & ammunition production and industrial growth with the protection and preservation of the surrounding environment.

To achieve this aim, the EIA report has several key objectives and they are as follows,

- a. Assess Environmental Impacts:** To comprehensively assess the potential environmental impacts of the proposed arms & ammo manufacturing plant on the surrounding land, air, water, and ecosystems. This includes evaluating both direct and indirect effects related to the construction, operation, and decommissioning phases.
- b. Identify Key Environmental Issues:** To identify and analyze key environmental issues and concerns specific to the site located at Gazipur Cantonment, Gazipur. This involves assessing potential impacts on local communities, natural resources, and infrastructure.
- c. Develop Mitigation Measures:** To propose effective strategies and measures to mitigate adverse environmental impacts identified during the assessment. This includes developing plans to address waste management, pollution control, and resource conservation.
- d. Enhance Positive Benefits:** To enhance the positive environmental and social benefits of the arms & ammo manufacturing plant. This involves identifying opportunities for improving local environmental conditions and contributing to sustainable development goals.



- e. **Ensure Regulatory Compliance:** To ensure that the project complies with all relevant environmental regulations and standards. The EIA report will outline how BOF plans to meet legal requirements and obtain necessary permits and approvals.
- f. **Facilitate Public Engagement:** To provide a transparent and inclusive process by engaging with local communities and stakeholders. This includes incorporating feedback and addressing public concerns regarding the environmental impacts of the project.
- g. **Support Informed Decision-Making:** To provide decision-makers with comprehensive and accurate information to support informed decisions regarding the approval and implementation of the arms & ammo manufacturing plant. This includes evaluating the potential trade-offs between environmental protection and project benefits.
- h. **Document Findings and Recommendations:** To document the findings of the environmental assessment in a clear and structured report, including recommendations for managing environmental impacts and monitoring the effectiveness of mitigation measures.

1.4 Methodology

The methodology for the Environmental Impact Assessment (EIA) for Bangladesh Ordnance Factories (BOF) is systematically designed by Environest Engineering to meet the requirements of the Environment Conservation Rules (ECR), 2023. The process began with assembling a skilled EIA team comprised of professionals from environmental science, engineering, and social sciences. This team was tasked with overseeing the entire assessment process.

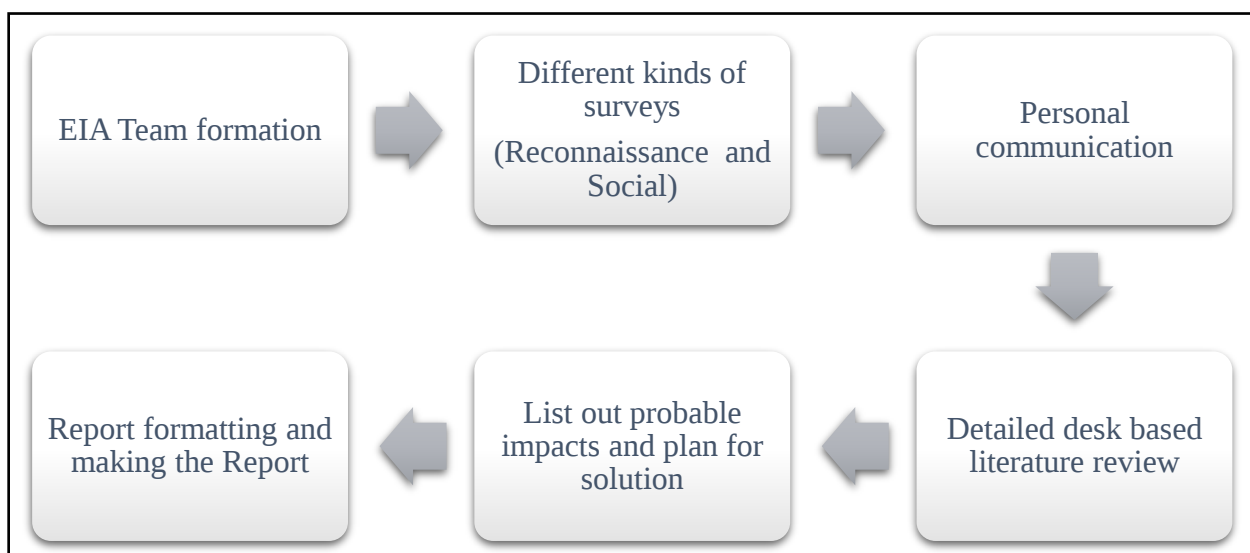


Figure 1 Schematic diagram of methodology

assessed to establish a baseline. This baseline is crucial for comparing potential environmental impacts resulting from the project's implementation. A reconnaissance survey was conducted to identify key environmental and social issues in the project area.



Data collection followed a structured approach. This included a detailed desk-based literature review to gather background information from existing studies and reports. Personal communications with stakeholders, including local community members and government officials, provided additional insights into the local context and concerns.

Social surveys helped to understand the socio-economic and cultural aspects of the community. These surveys were complemented by consultations with various government departments and agencies to ensure comprehensive data gathering.

The EIA assessed potential environmental impacts during both the construction and operational phases of the project. This involved evaluating direct and indirect effects on the environment and local communities. Based on this assessment, a comprehensive Environmental Management Plan (EMP) was developed.

The EMP includes measures to mitigate adverse impacts, enhance positive effects, and provide recommendations for monitoring throughout both construction and operational phases. Additionally, the EIA identified issues that may require further study to address any uncertainties or gaps in the assessment.

Finally, the EIA report was prepared following prescribed formats and guidelines set by the Department of Environment (DoE). This ensures that all potential environmental impacts are thoroughly assessed and managed, aligning with regulatory requirements and best practices.

In addition to the Environmental Impact Assessment (EIA) report, several specialized management plans are included to address specific project impacts. These plans encompass the Occupational Health & Safety Management Plan (OHSMP), which ensures worker safety; the Emergency Response and Fire Management Plan (EFMP), which outlines protocols for emergencies; the Solid Waste Management Plan (SWMP), which details procedures for waste handling and disposal; and the Noise Management Plan (NMP), which focuses on mitigating noise pollution. All these plans are integrated into the EIA report to ensure a comprehensive approach to managing the project's environmental and operational impacts.

1.5 Organizing of the Report

This report consists of a total of twelve chapters.

- **Chapter One** provides an introduction to the report and Bangladesh Ordnance Factories (BOF), outlining the purpose and scope of the Environmental Management Plan (EMP), and the methodologies used in the report.
- **Chapter Two** covers the relevant Acts, Policies, Rules, and Regulations that govern environmental management and compliance for arms & ammo manufacturing plant facilities.



- **Chapter Three** provides a detailed description of the project, including information on BOF's location, infrastructure, and operational characteristics.
- **Chapter Four** discusses the existing environment, including aspects such as flora and fauna, air quality, water resources, land use, and noise levels in the vicinity of BOF.
- **Chapter Five** identifies the potential environmental impacts associated with BOF's operations and outlines mitigation measures to address these impacts.
- **Chapter Six** presents the Environmental Management Plan (EMP), detailing the strategies and actions to be implemented to manage environmental impacts during the project's lifecycle.
- **Chapter Seven** outlines the Environmental Management Policy and Monitoring Plan, specifying how BOF will monitor and manage environmental performance and ensure compliance with environmental standards.
- **Chapter Eight** provides an analysis of alternatives, evaluating different scenarios and approaches to achieve the project's objectives while minimizing environmental impacts.
- **Chapter Nine** describes the Decommissioning Plan, including procedures and measures to be taken when ceasing operations to ensure environmental protection and site restoration.
- **Chapter Ten** details the public consultations conducted as part of the environmental assessment process, summarizing stakeholder inputs and concerns.
- **Chapter Eleven** concludes the report, summarizing the key findings, policies, and plans that have been adopted to ensure environmental sustainability and compliance with regulatory requirements.
- **Chapter Twelve** lists all the references used throughout the report.

1.6 Performance of the Assessment

This Phase of EIA consists of the following steps

- a. Site Visit:** The member of the EIA team has visited the site to determine the possible environmental impacts of the proposed project and recorded the prevailing conditions of the environment as they existed prior to the implementation of the project.
- b. Identification and Evaluation:** The adverse and beneficial effects of the proposed project on the environment have been evaluated.
- c. Discussion of Alternatives:** Various possible alternatives have been discussed.
- d. Preparation of Checklist:** A checklist has been prepared to ensure complete coverage of all the possible consequences of the proposed project so that it can be determined as to what administrative actions should be taken.
- e. Developed of Environmental Impact Due to The Project:** To identify the impact of the project on the environment, a checklist of environmental attributes has been developed that reflect the impact on the environment resulting from a particular action.



- f. Decommissioning Considerations:** The assessment includes planning for decommissioning the project, addressing potential environmental impacts, and ensuring proper management of waste and site restoration upon project completion.

1.7 Limitations of the Report

The Environmental Impact Assessment (EIA) report for this project relies predominantly on data provided by the client, insights gathered from discussions with industry personnel, and observations from various surveys and investigations conducted within the project area. Throughout this study, professional judgment and subjective interpretation have been utilized. It is crucial to acknowledge that any modifications to the project's location, design, or activities could result in variations in the identified impacts. Furthermore, technological advancements during the construction and operational phases may influence the extent and severity of these impacts. As with any environmental assessment report, certain limitations must be recognized:

- i. Predictive Uncertainty:** Anticipating which potential environmental and social issues will materialize as actual problems in the future is inherently challenging. Environmental regulations and enforcement priorities are subject to frequent changes, which can affect the relevance and applicability of the findings and recommendations outlined in this report (Glasson, Therivel, & Chadwick, 2013). Consequently, unforeseen regulatory changes could necessitate revisions to the impact assessment and the proposed mitigation measures.
- ii. Estimation of Liabilities:** Estimating the liabilities associated with mitigating identified environmental and social issues is often complex and imprecise. Legal and technological standards for addressing environmental concerns are continually evolving, and liability can be significantly influenced by negotiations with regulatory agencies, which are inherently unpredictable (Wood, 2003). This variability underscores the need for adaptive management approaches to address emerging issues as they arise.
- iii. Applicability of Data and Practices:** The policies, methods, and plans included in this report are based on data and practices derived from a range of sources, which may not always be directly applicable to this specific project. The report incorporates hypothetical scenarios and predictive modeling, acknowledging that not all proposed measures may be fully effective or relevant in every situation (Canter, 1996). As a result, there is a need for continuous monitoring and adjustment of the environmental management strategies to ensure their efficacy.



- iv. **Technological and Methodological Evolution:** Technological advancements and methodological innovations during the project's lifecycle may influence the environmental impacts and the effectiveness of mitigation strategies. It is essential to remain vigilant about emerging technologies and best practices that could enhance environmental performance and reduce potential impacts (Sadler, 1996).

These limitations highlight the inherent uncertainties present in environmental impact assessments. They emphasize the importance of ongoing review, monitoring, and adaptation as new information, regulations, and technologies become available. Proactive and flexible environmental management practices will be crucial in addressing these uncertainties and ensuring the project's long-term sustainability.

1.8 Scope of the Present EIA

The scope of the present Environmental Impact Assessment (EIA) for the proposed Bangladesh Ordnance Factories (BOF) arms & ammo Production Factory at Gazipur Cantonment, Gazipur, covers the environmental investigations and assessments necessary to identify, evaluate and manage the potential impacts associated with project development, construction and operation. The study addresses applicable environmental requirements, existing environmental conditions, project activities and their interactions with environmental receptors, alternatives, mitigation measures and environmental management and monitoring. This scope provides the basis for integrating environmental considerations into project planning and implementation.

The major scope of the EIA includes: Review of Environmental Legislation and Requirements: Relevant environmental legislation, regulatory requirements, policies and guidelines applicable to the BOF project will be reviewed to establish the environmental obligations and management requirements applicable to project implementation.

Description of Existing Environmental Conditions: The existing environmental conditions of the project site and surrounding area will be assessed to establish the baseline condition and identify environmental receptors that may potentially be affected by project activities.

Project Description and Activity Assessment: The EIA will consider the proposed BOF facilities and associated activities, including the production of Assault Rifles, SAA, Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortars/Bombs, together with supporting utilities and infrastructure.

Assessment of Potential Environmental Impacts: Potential impacts associated with the development, construction and operational phases will be identified and evaluated using appropriate assessment



methods and checklists. Particular consideration will be given to air quality, noise, water resources, wastewater, waste, soil, chemical handling, occupational health and safety, and accidental risks.

Analysis of Alternatives: Relevant alternatives, including the Do Nothing Alternative, Alternative Land Use and Alternative Land Site, will be assessed to examine their environmental implications and suitability in relation to the proposed project.

Development of Mitigation Measures: Appropriate measures will be developed to avoid, minimize and control identified adverse environmental impacts and enhance beneficial impacts wherever practicable.

Environmental Management Plan (EMP): An EMP will be formulated to translate the recommended mitigation measures into practical environmental-management actions. It will include monitoring requirements and management strategies for maintaining environmental performance during project implementation and operation.

Environmental Monitoring: Monitoring requirements will be established for relevant environmental parameters, including treated effluent, ambient air quality, noise, waste management and other significant environmental aspects, to evaluate the effectiveness of mitigation measures and identify the need for corrective action.

Occupational Health, Safety and Emergency Management: Considering BOF's specialized manufacturing activities and use of metallic and chemical raw materials, the EIA will address occupational health and safety, chemical handling, fire prevention, accidental incidents and emergency-response requirements.

Identification of Further Study Requirements: Where information gaps, uncertainties or emerging environmental issues are identified, the EIA will specify areas requiring further investigation, monitoring or assessment during subsequent stages of project implementation.

The scope of the present EIA is designed to provide a comprehensive assessment of the environmental implications of the proposed BOF project, from baseline conditions and impact identification through mitigation, environmental management and monitoring. The findings will support environmentally responsible project implementation and provide the framework for controlling significant impacts throughout the construction and operational phases.

1.9 EIA Team

The EIA report for Bangladesh Ordnance Factories (BOF) has been prepared by a highly qualified, knowledgeable, and dynamic team from Environest Engineering. This team comprises experts from diverse fields, including engineering, science, and sociology, ensuring a comprehensive approach to the



assessment. Throughout the preparation of the report, the team engaged in collaborative efforts, including round-table meetings, field visits, and discussions with both the client and local communities near the project site. The collective expertise and collaborative approach of the EIA team have been pivotal in developing a thorough and effective Environmental Impact Assessment. The members of the EIA team are listed as follows.



Table 1: EIA Team Member

SL No	Name	Qualification	Position	Field of Specialization	Year's of Experience	Signature
1	Shamim Ur Rahman	• M.Sc. in Environmental Sciences and Management, Jahangirnagar University (JU)	Team Leader	• Environmental Impact Assessment (EIA) • Environmental Management & Monitoring • Environmental Policy & Planning	8	
2	Dr. Md. Mostafizur Rahman	• PhD in Environmental Science from Graduate School of Environmental Science, Hokkaido University, Japan	Environmental Expert	• Environmental Specialist (EIA, ESIA, EMP, ETP, CETP, ATP, WTP & STP). • 340 Research articles published in national and international journals	16	
3	Dr. Mst. Mahmuda Parvin	• PhD in Life and Environment Sciences from Kumamoto University, Japan	Environmental Expert	• Environmental Specialist (EIA, ESIA, EMP). • 28 Research articles published in national and international journals	18	
4	Engr. Abdul Wadud	• FIEB, MBA • B.Sc. in Civil Engineering, Bangladesh University of Science & Technology (BUET)	Industrial Manufacturing & Operation Expert	• Feasibility Study & Project Planning • Industrial & Infrastructure Project Consultancy • Multidisciplinary Engineering Design and Project Supervision	29	
5	Sudipta Sarker	• B.Sc. in Civil Engineering, Ahsanullah University of Science & Technology (AUST)	Environmental Engineer	• Environmental Baseline Survey • Specialized in STP, ATP, ETP and WTP. • Specialized in IEE, EIA & EMP	4	



SL No	Name	Qualification	Position	Field of Specialization	Year's of Experience	Signature
6	Emtiaz Ibne Easin	• B.Sc. in Civil Engineering, Ahsanullah University of Science & Technology (AUST)	Environmental Engineer	• Environmental Survey • Environmental Data Analysis • STP, ETP & EIA Support	4	
7	Shahadat Hossain	• M.Sc. in Geological Science, Jahangirnagar University	Geologist	• Geological Investigation • Hydrogeological Assessment • Soil & Subsurface Analysis	3	
8	Ehsanul Haque	• M.Arch., Bangladesh University of Engineering and Technology (BUET)	Architectural Consultant	• Architectural Planning & Design • Building Design & Development	20	
9	Md. Aminul Islam	• B.Sc. in Environmental Sciences and Management, Jahangirnagar University (JU)	Environmental Monitoring Specialist	• Expert on Air Quality, Water Quality and Noise Quality Assessment, Sampling, Analysis & Reporting	8	
10	Fatema Islam Lucky	• Master of Business Administration (MBA), National University	Senior Executive (Green Economy)	• Green Economy Assessment • Socio-economic Analysis • Sustainability Evaluation	4	
11	Md. Hayder Hossain	• Diploma in Mechanical Engineering	Mechanical Engineer	• Mechanical Systems & Utilities • Equipment Assessment • Industrial Support Services	16	



Numerous individuals and agencies contributed valuable data, information, and support in preparing this EIA report for Bangladesh Ordnance Factories (BOF). Their cooperation and openness in discussing environmental issues were crucial to the thoroughness of the assessment. We extend our gratitude to the Department of Environment (DoE) personnel for their assistance and collaboration throughout the study.

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Chapter Two: Acts, Policies, Rules & Regulations

2.1.Introduction

Development projects are governed by some legal and institutional requirements. So, considerations of relevant legal provisions, policies, strategies, and institutional issues are very important for any project proponent or developer before they actually execute a program or plan, and obviously at the operational stages of projects, no project can deny these rules which set the boundary limits for each project. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary. The following sections review the relevant national legislation and policies along with some international laws.

2.2.Environmental Policy

Environment Conservation Act, 1995 (ECA '95) is currently one of the main legislative documents relating to environmental protection in Bangladesh. Under this act, no industrial unit or project shall be established or adopted without obtaining environmental clearance, in the manner prescribed by the rules, from the Director General. Compliance with the provision of this Act is the responsibility of the Department of Environment (DoE). A set of the relevant rules to implement the ECA'95 had been promulgated in August 1997. The rules mainly consist of:

- Categorized list (green, orange, and red) of the projects.
- Application format to take environmental clearance.
- Ambient standards about water pollution, air pollution, and noise, as well as permitted discharge/emission levels of water and air pollutants and noise by industries.

In accordance with section 20 of The Bangladesh Environment Conservation of Act No. 1 of 1995, the Government in March 2023 passed the Bangladesh Environment Conservation Rules, 2023. This Article discussed various important provisions of the Regulation:

- Categorized list (green, yellow, orange, and red) of the projects.
- Application format to take site clearance and environmental clearance.
- Ambient standards in relation to water pollution, air pollution, and noise, as well as permitted discharge/emission levels of water and air pollutants and noise by industries.
- Procedure for issuance of Environmental Clearance and Location Clearance Certificate.
- Services, fees, and mode of payment Services, fees, and mode of payment.

In light of the categorization made under the above ECR, '23, **Bangladesh Ordnance Factories (BOF)** (BOF) falls under the “Red” category.

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According to ECR'23, industries that fall under the Green and Yellow categories are not required to undertake an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) study. Orange projects are required to undertake an IEE, while Red category projects must undertake an EIA and or EMP.

Being committed to environmental protection, BOF has taken positive actions from the beginning to meet ECA, '95, ECR, '23, and other environmental protection rules and regulations.

2.3.Provisions Under the Environmental Legislation

2.3.1. National Water Management Plan (NWMP), 2001 (approved in 2004)

The National Water Resources Council approved on March 31, 2004, a 25-year National Water Management Plan. The plan provides a framework within which all concerned with the development, management, and use of water resources and water services in Bangladesh can plan and implement their activities in a coordinated and integrated manner. The planned activity programs have been presented in the eight sub-sectoral clusters: i) Institutional Development, ii) Enabling Environment, iii) Main River, iv) Towns and Rural Areas, v) Major Cities; vi) Disaster Management; vii) Agriculture and Water Management, and viii) Environment and Aquatic Resources. Each cluster comprises several individual programs. WARPO was assigned to monitor the NWMP.

2.3.2. Natural Water Bodies Protection Act 2000

- According to this Act, the character of water bodies, i.e., rivers, canals, tanks, or floodplains identified as water bodies, in the master plans or the master plans formulated under the laws establishing municipalities in division and district towns shall not be changed without approval of the concerned ministry.
- Anyone disobeying this act will be subjected to a maximum of 5 years of imprisonment or a maximum 50,000-taka penalty or both.

2.3.3. National Water Policy (1999)

The National Water Policy of 1999 was passed to ensure efficient and equitable management of water resources, proper harnessing, and development of surface and groundwater, availability of water to all concerned, and institutional capacity building for water resource management. It has also addressed issues like river basin management, water rights and allocation, public and private investment, water supply and sanitation, and water needs for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc.



2.3.4. National Agricultural Policy, 1999

The overall objective of the National Agriculture Policy is to make the nation self-sufficient in food through increasing production of all crops including cereals and ensure a dependable food security system for all. One of the specific objectives of the National Agricultural Policy is to take necessary steps to ensure environmental protection as well as environment-friendly sustainable agriculture. Through increased use of organic manure and strengthening of the integrated pest management program. The policy also suggests creating awareness so that the chemical fertilizers and pesticides used for increased crop production do not turn out to be responsible for environmental pollution. Water logging and salinity are identified as one of the serious problems in some parts of the country including the coastal areas for agricultural activities and environmental damage. The policy recommends for crop rotation and salt tolerant crop varieties.

2.4. Other Sectoral Policies/Legislation of Relevance

Any industry in the country is also required to comply with the industrial and export/import policy of the country. The industry is also required to comply with the Factories and Establishment Act and to undertake the license from concerned licensing authority.

In addition to the above National rules and regulations BTSM in its operational phase must comply with other national acts, policies, and rules, some of which are as follows:

2.4.1. Forest Policy (1994)

The National Forest Policy of 1994 is the amended and revised version of the National Forest Policy of 1977 in light of the National Forestry Master Plan. The major target of the policy is to conserve the existing forest areas and bring about 20% of the country's land area under the forestation Program and increase the reserve forest land by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

Amendments to the existing laws (acts, rules, and regulations) relating to the forestry sector and the creation of new laws for sectoral activities have been recognized as important conditions for achieving the policy goals and objectives. The Forestry Policy also recognizes the importance of fulfilling the responsibilities and commitments under International Conventions, Treaties, and Protocols (ICTPs).

2.4.2. National Fisheries Policy, 1999

The National Fisheries Policy, 1999 was formulated following the review and intent of the East-Bengal Protection and Conservation of Fish Act 1950, which was updated by the Protection and Conservation of Fish (Amendment) Ordinance 1982 and further refined by the Protection and Conservation of Fish



(Amendment) Act 1995. These Acts and ordinances provide provisions for the protection and conservation of fish in fresh water and brackish water bodies.

The Fisheries Policy highlights the need to conserve fish breeding grounds and habitats. It intends to promote fisheries development and conservation in all water bodies. The project should consider these policies to protect the habitats, migration, and connectivity of fish and fisheries resources around the project area. Measures to reduce any potential negative impacts on local fish populations will be incorporated into all stages of the Project.

2.4.3. National Land Use Policy, 2001

The National Land Use Policy was enacted in 2001 aims at managing land use effectively to support trends in accelerated urbanization, industrialization, and diversification of development activities. The policy urges that increasing the land area of the country may be not possible through artificial land reclamation process, which is cost-effective only in the long run. The major contents of this policy are the following:

- Stopping the high conversion rate of agricultural land to non-agricultural purposes;
- Utilizing agro-ecological zones to determine maximum land-use efficiency;
- Adopting measures to discourage the conversion of agricultural land for urban or development purposes;
- Improving the environmental sustainability of land-use practice

2.4.4. The Embankment and Drainage Act, 1952

The East Bangle Act No. 1, 1953 was amended in 1953 and was adapted by the People's Republic of Bangladesh, by the Bangladesh Order (adaptation of Existing Laws), 1972 (President's Order No. 48 of 1972). The Act consolidates the laws relating to embankments and drainage providing provision for the construction, maintenance, management, removal, and control of embankments and water courses for the better drainage of lands and their protection from floods, erosion, or other damage by water.

The specific Sections and Articles relevant to the project are mentioned below:

- **Section 4 (1)** of the Act states that the embankment, watercourse, tow-path, earth, pathways, gates, berms, and hedges of the embankments shall vest in the Government of the Authority (BWDB).
- **Section 56 (1)** states that the person will be subject to a penalty (500 takas or imprisonment... if he erects, or causes or willfully permits to be erected, any new embankment, or any existing embankment, or obstructs or diverts, or causes or willfully permits to be obstructed or diverted, any watercourse).



- **Section 15** allows for the engineer (engineer in charge of Divisional level BWDB) for constructing new embankment or enlarging, lengthening or repairing existing embankments.
- The other sections of the Act give powers and access to the Government or Authority or Engineers to commence necessary project activities, for land acquisition (through the DC), and site clearing activities including removal of trees or houses (if necessary).

2.4.5. Bangladesh Climate Change Strategy and Action Plan (BCCSAP), 2009

The GOB also prepared the BCCSAP in 2008 and revised it in 2009. This is a comprehensive strategy to address Climate Change (CC) challenges in Bangladesh. BCCSAP built on and expanded the NAPA. It is built around the following six themes:

- **Food security, social protection, and health** to ensure that the poorest and most vulnerable in society, including women and children, are protected from CC and that all programs focus on the needs of this group for food security, safe housing, employment, and access to basic services, including health.
- **Comprehensive disaster management** to further strengthen the country's already proven disaster management systems to deal with increasingly frequent and severe natural calamities.
- **Infrastructure** to ensure that existing assets (e.g., coastal and river embankments) are well maintained and fit for purpose and that urgently needed infrastructure (cyclone shelters and urban drainage) is put in place to deal with the likely impacts of climate change.
- **Research and Knowledge management** to predict the likely scale and timing of CC impacts on different sectors of the economy and socio-economic groups; to underpin future investment strategies; and to ensure that Bangladesh is networked into the latest global thinking on climate change.
- **Mitigation and low carbon development** to evolve low carbon development options and implement these as the country's economy grows over the coming decades.
- Capacity building and Institutional strengthening to enhance the capacity govt. ministries, civil society, and the private sector to meet the challenge of CC.

2.4.6. Sound Pollution Control Rules, 2006

Table 2: Bangladesh Standards for Noise

SL. No.	Area Category	Standard Values (All values in dB)	
		Day	Night
1.	Silent Area	50	40
2.	Residential area	55	45
3.	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50



SL. No.	Area Category	Standard Values (All values in dB)	
		Day	Night
4.	Commercial	70	60
5.	Industrial	75	70

Source: MOEF, 2006

- Note:**
- 1) The time from 6 a.m. to 9 p.m. is counted as daytime.
 - 2) The time from 9 p.m. to 6 a.m. is counted as night time

2.5. Compliance with DoE's EIA Guideline

2.5.1. The National Environmental Policy, 2018

The National Environmental Policy (2018) aims to systematically identify and control all forms of environmental pollution and degradation while promoting environmentally sound development across all sectors. It emphasizes the sustainable and long-term use of natural resources, the integration and strengthening of environmental policies within the broader development framework, and the enhancement of regional and international cooperation to support global environmental protection and sustainable development objectives.

2.5.2. The Environmental Conservation Act, 1995 and Amendment of 2010

The Bangladesh Environmental Conservation Act of 1995 and Amendment of 2010, is an umbrella legislation enacted to provide for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. The DOE was created under the Act. The provisions of the Act authorize the Director General (DG) of the Department of Environment to undertake any activity he deems fit and necessary to conserve and enhance the quality of the environment and to control, prevent, and mitigate pollution. The main provisions of the Act have been listed in table 2.2.

Table 3: Various Provisions of the Bangladesh Environmental Conservation Act, 1995 and Amendment of 2010

Sections	Provisions
Section 3	A Department of Environment, headed by a Director General (DG), should be established by the government for carrying out the purposes of this Act.
Section 4	The powers and functions of the DG will include taking necessary measures for conservation and protection of environment and issuing directions to concerned persons, to be carried out within a specified time limit, including that of closure after sending a written notice.
Section 4(A)	The DG or any other authorized person may seek assistance from law-enforcing agencies in case of non-compliance with directions of closure. In such cases, the electricity, gas, telephone and water services for the non-compliant party can be discontinued.



Sections	Provisions
Section 5	The government can declare an area ecologically critical, and issue a notice specifying the activities or processes that cannot be initiated or continued in it.
Section 6	This section specifies the restrictions regarding (a) vehicles emitting smoke injurious to environment and (b) manufacture, sale etc. of articles injurious to environment.
Section 7	The DG may seek compensation and/or corrective measures from the concerned person whose act/emission has caused direct/indirect injury to the ecosystem, failing which a civil suit and/or criminal case can be filed in a competent court.
Section 8	This section allows a person affected or likely to be affected by environmental pollution or degradation to apply to the DG for remedy.
Section 9	The person responsible and the person in charge of the place of occurrence of accidental pollution shall take measures to control or mitigate it, expenses for which are payable to the DG.
Section 10	Any person generally or specially authorized by the DG shall have the right to enter any building.
Section 11	A person authorized by the DG may, in the manner prescribed by rules, collect from any factory, premises or other place any sample of air, water, soil or other substance for analysis.
Section 12	An Environmental Clearance Certificate must be obtained from the DG for the establishment and undertaking of an industrial project.
Section 13	The government may formulate and publish environmental guidelines for conservation and improvement of environment and control and mitigation of pollution.
Section 14	This section allows a person aggrieved by a notice, order or direction issued under this Act to appeal to the appellate authority constituted by the government, within 30 days from its issuance.
Section 15	This section specifies the penalty to be paid for various offences.
Section 16	When a company violates any provision of this Act or fails to perform its duties in accordance with a notice issued under this Act or the Rules, it will amount to a violation.
Section 17	This section introduces the grounds for taking cognizance of an offence and claim for compensation by a court.
Section 18	An action taken by the government or the DG, which caused or is likely to cause injury to any person, cannot be legally contested, if taken in good faith.
Section 19	The government may delegate its powers to the DG, who may delegate his to any other officer of the department.
Section 20	The government is vested with the power to make various rules for carrying out the purposes of this Act.

Source: The Bangladesh Environmental Conservation Act, 1995

2.5.3. The Environmental Conservation Rules (ECR), 2023

The Environment Conservation Rules, 2023 are the first set of rules promulgated under the Environment Conservation Act, 2023. ECR, '23 provides additional guidance for specific components of the Act. The rules mainly consist of:



- Categorization of industries, development projects, and other activities on the basis of pollution activities of the existing or proposed industries/development projects/activities (Section-1);
- The National Environmental Quality Standards (EQS) for surface water, groundwater, drinking water, and industrial effluents (Section 2);
- Procedure for obtaining environmental clearance;
- Requirement for undertaking IEE and EIA as well as formulating EMP according to categories of industries/development projects/activities;
- Procedure for damage claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life;
- Guideline for preparing Environmental Impact Assessment (EIA) report (Section-11).

The Rules incorporate "inclusion lists" of projects requiring varying degrees of environmental investigation.

Green: Industries/development projects/activities are considered relatively pollution-free and therefore do not require an environmental clearance certificate from the DoE and no environmental study.

Yellow: Industries/development projects/activities fall in Yellow category are those which are causing medium pollution on the environment and human health. These projects/activities required to submit general information, an IEE report, application to DoE for obtaining environmental site clearance and environmental clearance.

Orange: Industries/development projects/activities fall in Orange category are moderately polluted required to submit general information, a process flow diagram and schematic diagrams of waste treatment facilities, an IEE and EMP along with their application to DOE for obtaining environmental site clearance and environmental clearance.

Red: Industries/development projects/activities which fall in RED category are those which may cause significant adverse environmental impacts and are therefore required to submit an EIA report. It should be noted that they might obtain an environmental site clearance on the basis of an IEE report, and subsequently submit an EIA report for obtaining environmental clearance along with other necessary papers.

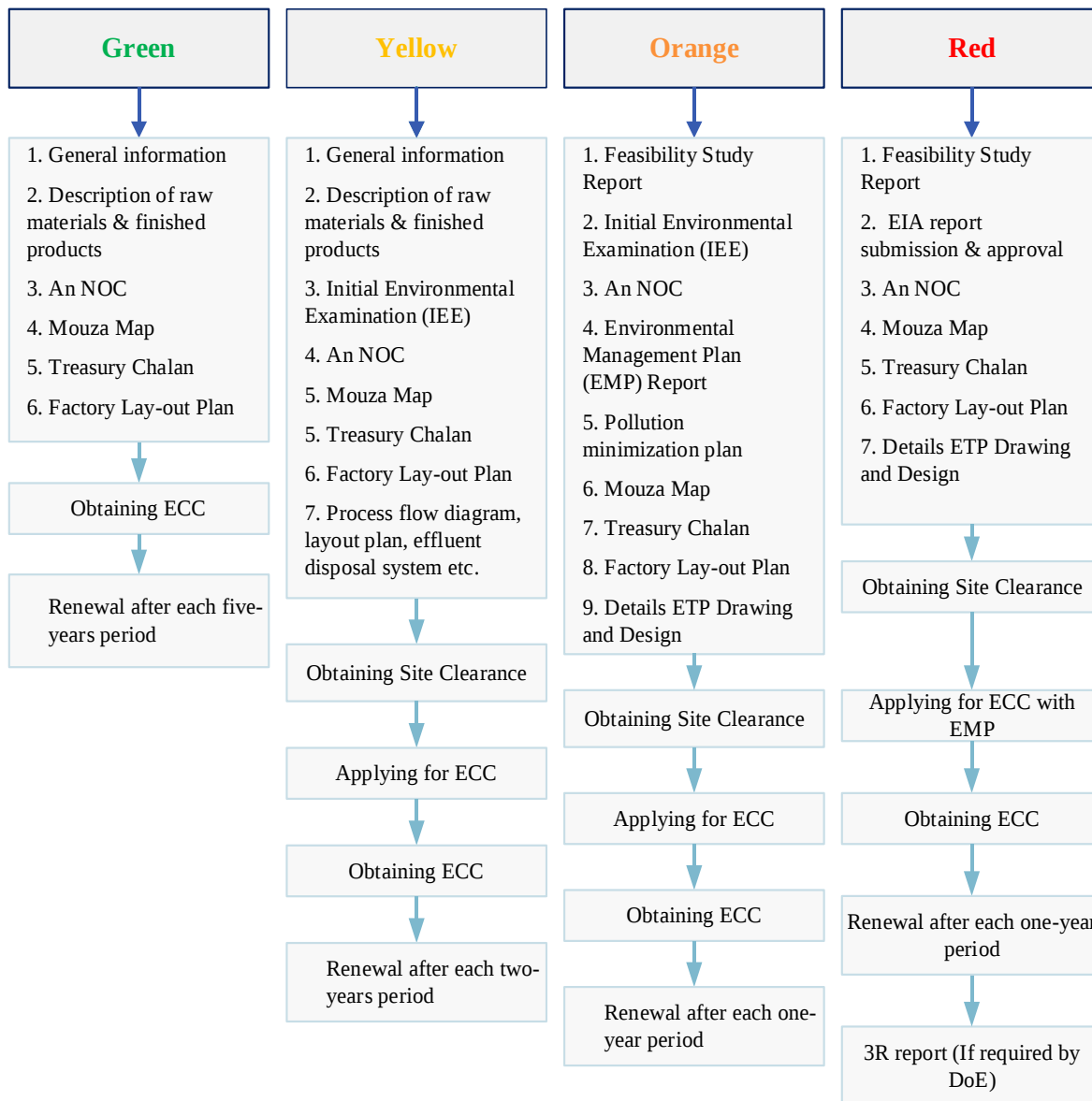
2.6.Compliance with Legal Requirements

Including ECA, 1995 and the ECR, 2023, depending on applicability, the entrepreneur has to adhere to and may require approvals of other previous and existing policies, ordinances, acts, and rules.



2.6.1. Obtaining Environmental Clearance

APPLICATION TO DOE FOR ENVIRONMENT CLEARANCE CERTIFICATE



N.B. If the industry/project locates inside EPZ, then IEE is not required

Figure 2.1: Process of Getting Environmental Clearance Certificates



2.6.2. Environmental Quality Standards

Bangladesh is one of the least developed countries with a low resource base, a burgeoning population with a very low land-man ratio, often threatened by both natural & anthropogenic stresses. Like all other nations of the world, Bangladesh also acted to the global call for the protection and conservation of the natural environment & ecology. Industrial development significantly contributes towards the economic growth of a country. It brings along with it a host of environmental problems too. It is increasingly being recognized in Bangladesh as in other part of the world that for development to be meaningful & sustainable over a longer period environmental concern must be integrated into all development policies. The Ministry of Environment and Forest is the nodal ministry that supervises the implementation of environmental and forestry programs in Bangladesh. The Department of Environment (DoE) carries out policy analysis, planning and evaluation, program coordination, and monitoring and evaluation of the environmental programs. The Forest Department in the ministry deals with forestry programs.

In Bangladesh, the environmental aspects of any project are mainly governed by: The Environmental Conservation Act, of 1995, the Environmental Conservation Rules, of 1997, the Environmental Conservation Rules, of 2023, and the Forest Act, of 1927 (if forestland has been converted).

The requirement for undertaking environmental studies has been specified under the ECA, 1995, the ECR, 1997, and the ECR, 2023. Section 12 of ECA, 1995 stipulates that "No industrial unit or project shall be established or undertaken without obtaining environmental clearance from the Director General, Department of Environment (DG, DoE) in the manner prescribed by the rules".

**2.6.2.1. Air Quality**

Table 4: Ambient Air Quality Standards

Air Pollutant	Unit	Standards	Average Time
Carbon Monoxide (CO)	mg/m ³	5	8 hrs.
		20	1 hr.
Lead (Pb)	micro gm/m ³	0.25	Annual
		0.5	24 hrs.
Nitrogen di oxide (NO ₂)	micro gm/m ³	40	Annual
		80	24 hrs.
Particulate Maters ₁₀ (PM ₁₀)	micro gm/m ³	50	Annual
		150	24 hrs.
Particulate Maters _{2.5} (PM _{2.5})	micro gm/m ³	35	Annual
		65	24 hrs.
Ozone (O ₃)	micro gm/m ³	180	1 hr.
		100	8 hrs.
Sulphur di oxide (SO ₂)	micro gm/m ³	250	1 hr.
		80	24 hrs.
Ammonia (NH ₃)	micro gm/m ³	100	Annual
		400	24 hrs.

Source: Air Emission Control Rules, MOEF, 2022

Note:

- In this schedule, air quality means ambient air quality.
- Average value shall not exceed more than once a year.
- The target will be achieved when the annual average is within the prescribed standard.



2.6.2.2. Water Quality

Table 5: Standards for Inland Surface Water

Parameters													
SL. No.	Best Practice Based Classification	pH	DO mg/L	BOD mg/L	NO ₃ -N mg/L	NH ₄ -N mg/L	PO ₄ -P mg/L	Total Cr mg/L	Pb mg/L	Hg mg/L	Total Coliform CFU/L	TDS mg/L	TDS mg/L
1	Source of drinking water for supply only after disinfecting	6.5-8.5	6 or above	2 or less	7.0	0.1	0.1	0.02	0.03	0.001	100 or less	1000	10
2	Water usable for recreational activity	6.5-8.5	5 or above	3 or less	7.0	0.3	0.5	0.2	0.05	0.001	50 or less	1000	10
3	Source of drinking water for supply after conventional treatment	6-9	5 or above	5 or less	7.0	0.3	0.5	0.02	0.03	0.001	5000 or less	1000	25
4	Water usable by fisheries	6-9	5 or above	6 or less	7.0	0.3	0.5	0.05	0.1	0.004	5000 or less	1000	50
5	Water usable by various process and cooling industries	6.5-8.5	1 or above	12	-	2.7	-	0.1	0.1	0.05	-	1000	100
6	Water usable for irrigation	6.5-8.5	-	12 or less	5.0	1.5	2.0	0.1	0.1	0.002	50,000 or less	1000	100

Source: Environmental Conservation Rules, 2023

Notes:

- Electrical conductivity for irrigation water – 2250 µmhos/cm (at a temperature of 25°C); Sodium less than 26%; Boron less than 0.2%

Table 6: Standards for Drinking Water

Sl. No.	Parameters	Unit	Standards
1.	Fecal Coliform	CFU/100ml	0
2.	Total Coliform	“	0
3.	Free Residual Chlorine	mg/L	0.20
4.	Nitrate (NO ₃ -)	“	45
5.	Arsenic (As)	“	0.05
6.	Turbidity	NTU	5
7.	Aluminum (Al)	“	0.20
8.	Ammonia (NH ₃)	“	1.50
9.	Barium (Ba)	“	0.70
10.	Benzene (C ₆ H ₆)	“	0.01
11.	Boron (B)	“	1.0
12.	Cadmium (Cd)	“	0.003
13.	Calcium (Ca)	“	75
14.	Chloride (Cl)	“	250*
15.	Carbon tetra chloride	“	0.005
16.	1,1 Dichloroethane	“	0.03
17.	1,2 Dichloroethane	“	0.03



Sl. No.	Parameters	Unit	Standards
18.	Tetrachloroethane	“	0.04
19.	Trichloroethane	“	0.02
20.	Pentachlorophenol	“	0.009
21.	2,4,6 Trichlorophenol	“	0.20
22.	Chloroform	“	0.09
23.	Total Chromium	“	0.05
24.	Color	Hazen	15
25.	Copper (Cu)	mg/L	1.5
26.	Cyanide (CN)	“	0.05
27.	Fluoride	“	1.0
28.	Hardness as CaCO ₃	“	500
29.	Ferrous (Fe)	“	0.3-1.0
30.	Total Kjeldahl Nitrogen	“	1.0
31.	Lead (Pb)	“	0.01
32.	Magnesium (Mg)	“	30-35
33.	Manganese (Mn)	“	0.4
34.	Mercury (Hg)	“	0.001
35.	Nicale (Ni)	“	0.05
36.	Nitrite (NO ₂ ⁻)	“	1.0
37.	Odor	-	Odorless
38.	Oil & Grease	mg/L	0.01
39.	pH	-	6.5-8.5
40.	Phenols	mg/L	0.002
41.	Potassium (K)	“	12
42.	Radioactive materials (gross alpha activity)	Bq/L	0.1
43.	Radioactive materials (gross beta activity)	“	1.0
44.	Selenium (Se)	mg/L	0.01
45.	Silver (Ag)	“	0.02
46.	Sodium (Na)	“	200
47.	Suspended Solid (SS)	“	10
48.	Sulfide as H ₂ S	“	0.05
49.	Sulfate (SO ₄ ²⁻)	“	250
50.	Total Dissolve Solids (TDS)	“	1000
51.	Temperature	0C	20-30
52.	Tin (Sn)	mg/L	2.0
53.	Zinc (Zn)	“	5.0
54.	Aldrin/Dieldrin	Micro-g/L	0.03
55.	Anionic detergents	mg/L	0.2

Source: Environmental Conservation Rules, 2023

Note: *1000 mg/L for Coastal Area



Table 7: Standards for Sewage Discharge

SL No.	Parameters	Unit	Standards
1	BOD ₅	mg/l	30
2	Nitrate	„	50
3	Phosphate	„	15
4	Suspended solids (SS)	„	100
5	Temperature	Degrees centigrade	30
6	Total Coliform	CFU/100 ml	1000
7	pH	mg/L	6-9
8	COD	„	150
9	Oil & Grease	„	10

Source: Schedule 3, Environmental Conservation Rules, 2023

Notes:

- This limit shall be applicable to discharges into surface and inland water bodies.
- Sewage shall be chlorinated before final discharge. Residual Chlorine cannot be more than 0.2 mg/L.



2.6.2.3. Noise

Table 8: Standards for Sound

SL. No.	Area Category	Standard Values (All values in dB)	
		Day	Night
1.	Silent Area	50	40
2.	Residential area	55	45
3.	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
4.	Commercial	70	60
5.	Industrial	75	70

Source: Noise Control Rules, MOEF, 2006

Note:

- The time from 6 a.m. to 9 p.m. is counted as daytime.
- The time from 9 p.m. to 6 a.m. is counted as night time.

2.6.3. The National Conservation Strategy

National Conservation Strategy (GoB/IUCN, 1992) was drafted in late 1991 and submitted to the Government in early 1992. For sustainable development in the industrial sector, the report offered various recommendations; some of which are as follows:

- Industries based on nonrenewable resources should be made to adopt technology that conserves raw materials, and existing industries should be given incentives to install technical fixes to reduce the wastage rate
- All industries, especially those based on imported raw materials, should be subjected to EIA and the adoption of pollution prevention/control technologies should be enforced.
- No hazardous or toxic materials/wastes should be imported for use as raw material.
- The import of appropriate and environmentally sound technology should be ensured.
- Complete dependence on imported technology & machinery for industrial development should gradually be reduced so that industrial development is sustainable with local skills and resources.

2.6.4. The National Environmental Management Plan (NEMAP), 1995

The National Environmental Management Plan (NEMAP) was developed as the framework of programs and interventions aimed at implementing NEP. Under this Plan, various program outlines were drawn up and activities incorporated. The main aims of the Plan were:

- Better management of scarce resources;
- Checking the rate of environmental degradation;



- Improving the natural and manmade environment;
- Conserving habitats and biodiversity;
- Promoting sustainable development; and
- Improving quality indicators of human life.

2.6.5. National Environmental Policy (NEP), 1992

In 1992 the National Environmental Policy (NEP) was drawn up with the aim of providing protection and sustainable management of the environment. The objectives of the Policy include:

- Maintaining ecological balance and overall development through protection and improvement of the environment;
- Identifying and regulating polluting and environmentally degrading activities;
- Ensuring environmentally sound development;
- Ensuring sustainable and environmentally sound use of all-natural resources;
- Active association with all international environmental initiatives.

2.6.6. The Environment Court Act, 2010

In 2010, a new law known as the Bangladesh Environment Court Act, 2010 was enacted, replacing the 2000 Act. The objective of the current Act is to establish Environment Courts in each district, presided over by a Joint District Judge. This Judge handles both regular cases and those falling under the jurisdiction of an Environment Court. Notably, the Act doesn't require the creation of entirely separate Environment Courts. Consequently, aside from the former three Courts and an Appellate Court, no additional Environment Courts have been set up. Similar to the prior Act, the 2010 Act also allows for the establishment of Special Magistrate Courts in each District, managed by first-class Magistrates or Metropolitan Magistrates. These courts handle cases with penalties of less than five years imprisonment or fines up to five lakh BDT. Furthermore, the Act involves Executive Magistrates who operate under the Mobile Court Act, of 2009. They can promptly address certain offenses and pass judgments based on the offender's admission of guilt. Environmental laws commonly incorporate provisions for the operation of Mobile Courts.

2.7. International Legal Obligations

2.7.1. The Convention on Biological Diversity (CBD), 1992

The Convention on Biological Diversity (CBD) is an international treaty that was adopted in 1992. The CBD has three main goals:

- Conservation of biological diversity
- Sustainable use of its components
- Fair and equitable sharing of benefits arising from genetic resources



The CBD applies to all types of biological diversity, including land-based ecosystems. Land development projects can have a significant impact on biological diversity, both positive and negative. The CBD provides a number of tools and mechanisms to help countries manage the impacts of land development projects on biological diversity. These tools include:

National Biodiversity Strategies and Action Plans (NBSAPs): NBSAPs are national plans that set out the goals and objectives for the conservation and sustainable use of biological diversity in a particular country.

The Prior Informed Consent (PIC) procedure: The PIC procedure requires countries to obtain the consent of the country providing genetic resources before using those resources in a land development project.

The Access and Benefit-sharing (ABS) regime: The ABS regime provides a framework for countries to share the benefits arising from the use of genetic resources.

The CBD is an important tool for protecting biological diversity and ensuring that land development projects are carried out in a sustainable manner. By following the CBD's guidelines and procedures, countries can minimize the negative impacts of land development projects on biological diversity and maximize the positive impacts.



Chapter Three: Project Description

3.1. Project Definition

The proposed Bangladesh Ordnance Factories (BOF) arms & ammo Production Factory is a new industrial development located at Gazipur Cantonment, Gazipur, covering approximately 135.87 acres of land. The project has been planned to establish specialized manufacturing facilities for different categories of arms and ammo together with the utilities, infrastructure and environmental-management facilities necessary for their operation.

The proposed project comprises dedicated production facilities for Assault Rifles, Small Arms Ammunition (SAA), Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortars/Bombs. These manufacturing operations involve different metallic and chemical raw materials, including alloy steel, copper and brass strips, lead, antimony sulphide, barium nitrate, lead styphnate, red lead powder, lead azide and other production chemicals. The nature of these materials and manufacturing activities makes appropriate material storage, process control, occupational safety, waste management and emergency preparedness important components of project planning.

The project will also include the supporting infrastructure and utility systems required for production. The documented water requirement is approximately 40 m³/day, which is proposed to be supplied from BOF's own deep tube-well. Approximately 36 m³/day of wastewater is expected to be generated, for which a 5 m³/hour (40 m³/day) chemical-treatment Effluent Treatment Plant (ETP) has been proposed. Treated effluent is intended to be discharged through the designated City Corporation drainage system leading toward the Balu River.

Electricity for the project will be supplied from REB, with the supplied project information indicating an electricity requirement of approximately 6,500 kWh/month. In addition, BOF has proposed seven standby generators, comprising four 1,000 kVA units, two 1,500 kVA units and one 1,250 kVA unit, to provide backup power where required. The project will also incorporate internal infrastructure, material storage and handling arrangements, drainage, waste-management facilities and other supporting services required for industrial operation.

The proposed facility is associated with approximately 2,125 permanent and temporary personnel and is planned to operate approximately 8 hours per day and 6 days per week. The project will therefore involve not only manufacturing activities but also substantial requirements for occupational health and safety, worker welfare, traffic and material movement, utility management and emergency-response arrangements.



From an environmental perspective, the BOF project is defined as an integrated industrial development in which the proposed production facilities and associated infrastructure may interact with land, water resources, air quality, the acoustic environment, waste-management systems and occupational health and safety conditions. Accordingly, the EIA addresses the potential impacts arising from both construction and operation and establishes appropriate mitigation, monitoring and Environmental Management Plan (EMP) measures to ensure environmentally responsible implementation of the proposed project.

3.2. Project Location and Details

Bangladesh Ordnance Factories (BOF) will be located at Gazipur Cantonment, Gazipur-1703, Dhaka, Bangladesh. The latitude and longitude of the facility are 24° 2'14.30"N and 90°25'19.10"E. Its distance from Hazrat Shahjalal International Airport is about 29.7 km. The location map, location direction from Google map and satellite image have been given in the following figure:

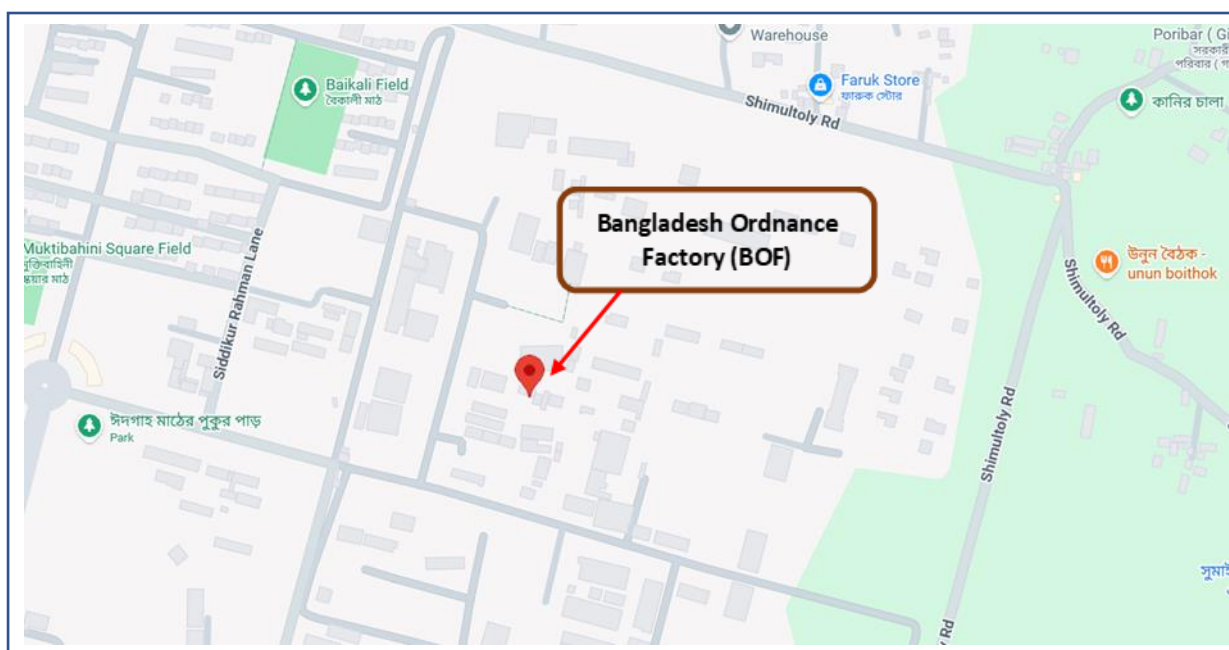


Figure 3: The location map of the project (Adopted from Google Maps)

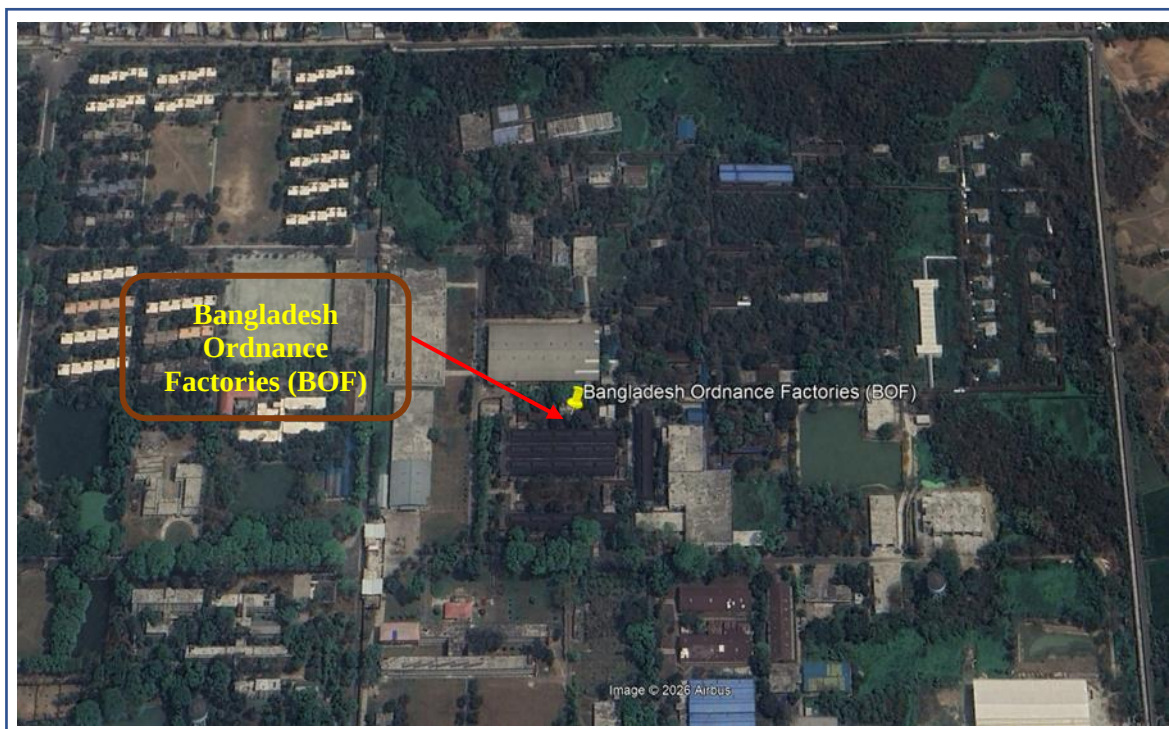


Figure 4: The location map of the project (Adopted from Google Maps)

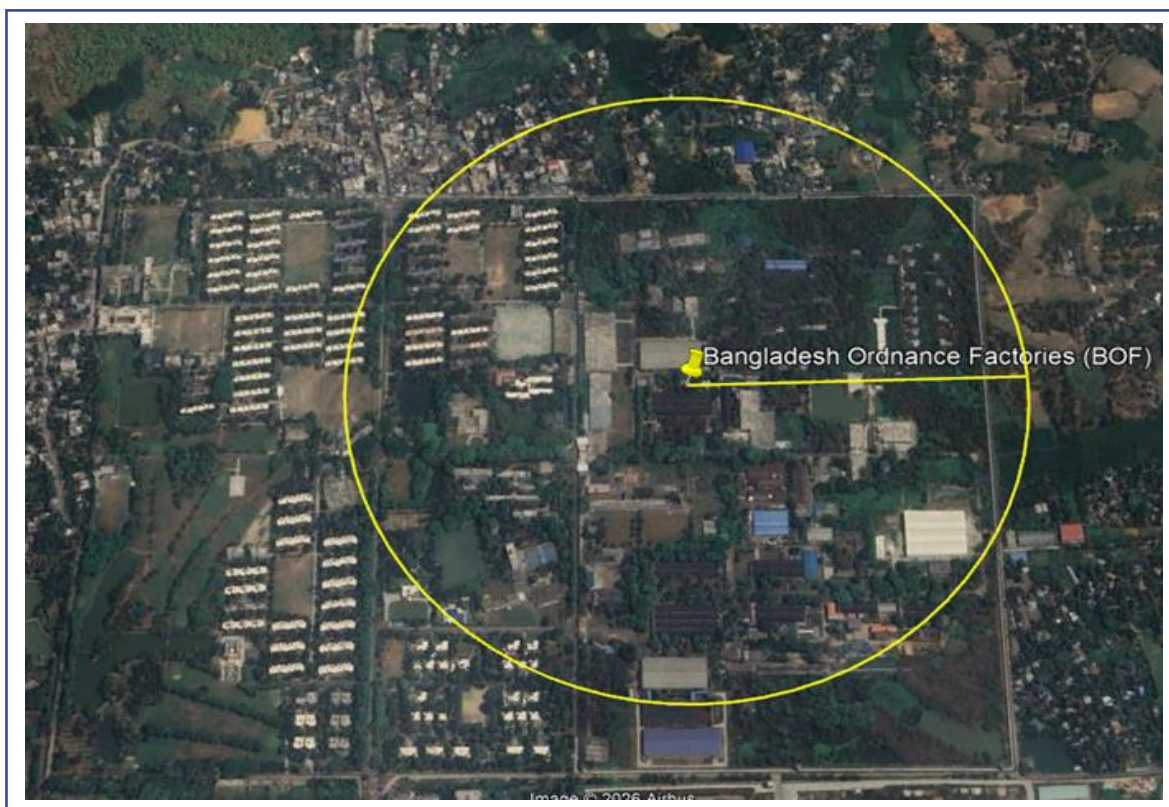


Figure 3.3

Figure 5: 500-meter surrounding area from project location (captured from Google Earth)



3.3. Basic Information of Project

The Environmental Impact Assessment (EIA) report of Bangladesh Ordnance Factories (BOF) presented herein primarily focuses on the potential environmental impacts arising from the construction and operational activities of the proposed Arms & Ammo manufacturing facility on the surrounding environment. The basic information of the project is presented in Table 3.1.

Table 9: Basic Information of Bangladesh Ordnance Factories (BOF)

Particulars	Details
Project Name	Bangladesh Ordnance Factories (BOF)
Project Location	Gazipur Cantonment, Gazipur-1703, Bangladesh
Project Type	Arms & Ammo Production Factory
Name of the Entrepreneur	Government of Bangladesh
Project Responsible person	Md. Eftakharul Alam Manager Bangladesh Ordnance Factories (BOF) Phone: 01769044094 Email: magbof1969@gmail.com
Project Area	135.87 acre (549,846.88 m ² or 5,918,497.20 ft ²)
Final Product	Arms & Ammunition
Project Valuation	2235 crore 64.68 lakh BDT (BDT 2235,64,68,000.00)
Raw materials	Assault Rifle SAA Line Primer and Detonator Production Line 12.7 and 14.5 mm Ammo
Production Capacity of the Project	Assault Rifle: 50 nos. SAA Line: 1,44,000 nos. Primer and Detonator Production Line: 2,500 nos. 12.7 and 14.5 mm Ammo: 20,000 nos. Mortars, Bomb: 150 nos.
Power Requirements	6,500 kwh/month from REB
Water Requirements	40 m ³ per day
Source of Raw Water	Own Deep Tube-well
Wastewater Generation	36 m ³ /day
ETP Capacity	5 m ³ /hour (40 m ³ /day)
ETP Type	Chemical Treatment Process
Solid Waste	Cartoon, Box, etc.
Manpower	Permanent Employee: 1,753 persons. Temporary Employee: 372 persons.
Factory Running time	8 hours, 6 days per week



Particulars	Details
Generator Capacity	7 nos (4 nos 1,000 KVA, 2 nos 1,500 KVA and 1 nos 1,250 KVA)
GPS Location	24° 2'14.30"N & 90°25'19.10"E
North, South, East, West	North: Vacant land, a local market, and local residential house South: Bangladesh Machine Tools Factory and 20 feet Shimultoli Road East: Agri field and vacant land West: Gazipur Cantonment
Water outlet (Khal, River, Drain)	Treated effluent will be discharged to the City Corporation drain leading to the Balu river.



Figure 6: Location map of Bangladesh Ordnance Factories (BOF).



3.4. Project Category

In the light of categorization made under the above ECR, '23, **Bangladesh Ordnance Factories (BOF)**, falls under “**Red**” categories. (*Schedule-1, Page No. 3057, ECR, '23*)

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According to ECR, '23, industries fall under the Green and Yellow categories are not required to undertake an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) study. Orange projects are required to undertake an IEE, while Red category projects must undertake an IEE and an EIA and or EMP.

According to ECR, '23, industries fall under the Green category do not require to undertake an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) study. Yellow and Orange projects are required to undertake an IEE, while Red category projects must undertake an EIA and EMP.

Being committed to environmental protection BOF from the beginning has taken positive actions to meet ECA, '95, ECR, '23, and other environment protection rules and regulations.

3.5. Employment Opportunities

The proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory is expected to provide significant employment opportunities through its specialized manufacturing and supporting activities. According to the supplied project information, approximately 2,125 permanent and temporary personnel will be associated with the project. Employment will be required across production, engineering, maintenance, utility operation, administration, safety, environmental management and other supporting functions.

The establishment of dedicated production facilities for Assault Rifles, Small Arms Ammunition (SAA), Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortars/Bombs will require personnel with different levels of technical competence. This will create opportunities for engineers, technicians, machine operators, skilled and semi-skilled workers, quality-control personnel, maintenance staff, administrative personnel and other support workers. Specialized production activities will also require appropriate technical and occupational-safety training, contributing to workforce skill development.



In addition to direct employment, the project is expected to create indirect employment opportunities through construction activities, transportation, equipment maintenance, material supply, logistics and other supporting services associated with project implementation and operation. Such activities may contribute to economic activity within the surrounding area and associated supply chains.

Employment generation is therefore considered an important positive socio-economic impact of the proposed BOF project. The approximately 2,125 permanent and temporary employment opportunities, together with associated indirect employment and technical skill development, are expected to contribute positively to the socio-economic benefits of the project throughout its implementation and operational phases.

3.6.Power

Bangladesh Ordnance Factories (BOF) will utilize electricity from the following sources to meet the power requirements of the proposed production and supporting facilities:

- a. The BREB will supply the main grid power. The industry's connecting load will be 6,500 kWh per month.
- b. To ensure uninterrupted operation, 7 standby generators will be installed with a total capacity of multiple units (4 nos 1000 KVA, 2 nos 1500, 200 and 1 no 1250 kVA). These generators will operate during power outages and will consume diesel as fuel on a periodic basis.

3.7.Safety Provision

Considering the nature of the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory, safety provisions will constitute an integral part of the project design and operation. The manufacturing activities involve specialized machinery, electrical installations, metallic raw materials and various chemicals used in ammunition, primer and detonator production. Therefore, adequate measures will be maintained to minimize occupational accidents, chemical exposure, fire hazards and other operational risks.

Appropriate Personal Protective Equipment (PPE) will be provided to workers according to the hazards associated with their respective activities. These may include safety helmets, protective gloves, safety footwear, goggles or face shields, hearing protection, respiratory protection and suitable protective clothing. Machinery will be operated by trained personnel, and appropriate machine guarding, safety devices and operating procedures will be maintained to reduce mechanical and electrical hazards.



Special attention will be given to the safe storage and handling of chemicals and process materials. Chemicals will be properly labelled and stored in designated areas, and relevant Safety Data Sheets (SDS) will be maintained for safe handling and emergency response. Suitable containment and spill-control arrangements will be provided where required to prevent accidental release and worker exposure.

Adequate fire prevention and emergency-response facilities will also be maintained within the project premises. Appropriate fire detection and alarm systems, firefighting equipment, clearly identified emergency exits, evacuation routes and assembly points will be provided according to the identified hazards. Regular inspection of fire-safety equipment and periodic fire and evacuation drills will be undertaken to maintain emergency preparedness.

Workers will receive appropriate occupational health and safety training covering safe working procedures, PPE use, machinery operation, chemical handling, fire safety, first aid and emergency response. First-aid facilities and trained personnel will be maintained at appropriate locations, while accidents, near misses and unsafe conditions will be recorded and investigated to facilitate corrective and preventive actions.

BOF will maintain an integrated safety-management approach incorporating engineering controls, PPE, chemical safety, machine safety, fire protection, emergency preparedness, worker training and routine inspection. These provisions will be implemented throughout project operation to protect employees, prevent accidents and maintain safe working conditions within the proposed facility.

3.8. Pollution Control and Waste Disposal

The proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory will incorporate appropriate pollution-control and waste-management measures to minimize adverse impacts arising from its production and supporting activities. The principal environmental aspects requiring control include industrial wastewater, solid and process waste, chemical-contaminated waste, air emissions, noise and accidental chemical releases. Pollution prevention, segregation at source, treatment and environmentally appropriate disposal will therefore form integral components of project operation.

Approximately 36 m³/day of wastewater is expected to be generated from the project. A chemical-treatment Effluent Treatment Plant (ETP) with a capacity of 5 m³/hour (40 m³/day) is proposed for treatment of the industrial wastewater. Wastewater requiring treatment will be



collected and directed to the ETP, and treated effluent will be discharged through the designated drainage system only after achieving the applicable discharge requirements. Routine monitoring of treated-effluent quality will be undertaken to verify ETP performance.

Solid waste identified in the supplied project information includes cartons and boxes, which will be segregated and reused or recycled wherever practicable. Other process-related wastes generated during actual production will be separately collected and managed according to their characteristics. Any waste contaminated with production chemicals will be kept separate from general waste and stored securely pending appropriate treatment or final disposal. ETP sludge will also be collected separately and characterized before determining the appropriate management and disposal method.

Potential air pollution may arise from production activities, material handling, standby diesel-generator operation and vehicular movement. These impacts will be controlled through preventive maintenance of machinery and generators, suitable exhaust arrangements, appropriate ventilation or local exhaust systems where required, good housekeeping and periodic air-quality monitoring. Similarly, noise from production machinery, generators and utility equipment will be controlled through equipment maintenance, acoustic measures and appropriate occupational protection.

Chemicals and process materials will be stored in designated areas using suitable containers, labelling and containment arrangements. Spill-control materials and appropriate emergency procedures will be maintained to prevent accidental releases from contaminating soil, drains or water resources. Waste-storage areas will also be properly managed to prevent leakage, uncontrolled runoff and mixing of incompatible waste streams.

Overall, BOF will adopt an integrated approach to pollution prevention, wastewater treatment, waste segregation, recycling, controlled disposal, emission and noise management, and chemical-spill prevention. Proper operation of the proposed ETP, systematic management of process wastes and continued environmental monitoring will be essential for maintaining acceptable environmental performance throughout the operational phase.



3.9. Effluent Treatment Plant (ETP)- Capacity: 5.0 m³/hour

Industrial wastewater treatment is used to treat contaminated water generated from industrial processes before discharge or reuse. Ammo & ammunition manufacturing industries produce significant wastewater, requiring an Effluent Treatment Plant (ETP).

Bangladesh Ordnance Factories (BOF) will operate an ETP to treat wastewater from operations, ensuring compliance with DoE standards and minimizing environmental pollution.

3.10.1 General Information

Name of Client	:	Bangladesh Ordnance Factories (BOF)
Location	:	Gazipur Cantonment, Gazipur-1703
Type of Effluent	:	Ammo & Ammunition Manufacturing Process Effluent
ETP Capacity	:	5.0 m ³ /hour (40.0 m ³ /Day)
Treatment Hours	:	8 Hrs/Day
Treatment Concept	:	Physico-Chemical followed by Biological Treatment Process.
Treated Water Re-Use	:	After treatment in the ETP, water may be reused for cleaning, gardening, and floor washing where applicable.

A 70 m² area (approx.) is constructed for a 40.0 m³/Day. ETP. Details, Drawing and Design Calculation is attached in **Annex-A**.

3.10. Sewage Treatment Plants (STP)

Bangladesh Ordnance Factories (BOF) is committed to minimizing environmental impacts through the installation of a Sewage Treatment Plant (STP). This facility, with a capacity of 4.0 m³/hr (80.0 m³/day), will treat domestic wastewater generated from approximately 1753 employees, ensuring compliance with environmental standards prior to discharge. The STP will play an important role in pollution control and sustainable environmental management of the project.



Table 3.4: Basic Details of Sewage Treatment Plant

Name of Client	:	Bangladesh Ordnance Factories (BOF)
Location	:	Gazipur Cantonment, Gazipur-1703
Type of Effluent	:	Sewage Wastewater
Treatment Hours	:	20 Hr./Day
STP Capacity	:	4.0 m ³ /hour (80 m ³ /day)
STP Treatment Concept	:	Biological MBBR Treatment Process.
Treated Water Re-Use	:	After treatment in the STP, the water will be reused for commode flushing, gardening and irrigation.

Constructing the STP systems will require a 3.5 m² area (approximately). STP details, drawings, and design calculations are attached in **Annexure A**.



Chapter Four: Existing Environment

4.1. General Aspects

Baseline data on the environment is crucial for understanding the physical, biological, cultural, economic, and social characteristics of the project study area. This information serves as the foundation for analyzing the potential impacts of project activities. The primary objectives of examining and defining the existing environment are:

- a. To identify environmental and socioeconomic components that may be affected by project activities.
- b. To recognize potential environmental impacts on these components.
- c. To establish a baseline against which future environmental conditions of the project can be measured.

For this Environmental Impact Assessment (EIA) study, the focus is on key environmental factors such as water, air, and noise quality within the study area. The assessment also considers both the immediate and ancillary areas that may be impacted.

4.2. Land Use

The proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory is located at Gazipur Cantonment, Gazipur, within a total project area of approximately 135.87 acres. Land use is an important baseline component because development of production buildings, utility facilities, internal roads, drainage systems, wastewater-treatment facilities and other supporting infrastructure will result in permanent utilization of portions of the project land. The existing and surrounding land-use characteristics provide the basis for assessing potential impacts related to land transformation, drainage, vegetation, nearby receptors and future industrial activities.

The major land-use considerations for the BOF project are as follows:

- **Project Land Area:** The proposed development covers approximately 135.87 acres. The land will accommodate the proposed arms and ammunition production facilities together with necessary utility, environmental-management and supporting infrastructure.
- **Industrial/Production Land Use:** The site will accommodate specialized production facilities for Assault Rifles, Small Arms Ammunition (SAA), Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortars/Bombs. The proposed land use is therefore predominantly industrial/manufacturing in character.



- **Supporting Infrastructure:** Portions of the project area will be required for internal roads, utility installations, water-supply arrangements, drainage, the proposed 5 m³/hour ETP, storage and other supporting facilities necessary for operation of the production units.
- **Open and Green Areas:** Available open spaces within the project premises should be maintained appropriately, and plantation/greenbelt development should be incorporated wherever practicable to improve environmental quality and compensate for vegetation disturbed during development.
- **Drainage and Surface Runoff:** Development of buildings, roads and other impervious surfaces may modify existing surface-runoff characteristics. Appropriate site grading and drainage facilities should therefore be incorporated to prevent waterlogging, erosion and uncontrolled runoff.
- **Surrounding Land Use:** The supplied BOF project information identifies the project location as Gazipur Cantonment, Gazipur; however, it does not provide a sufficiently detailed quantitative breakdown of surrounding land-use categories or their percentages. Therefore, specific percentages of residential, agricultural, industrial, waterbody or other surrounding land uses should not be stated without supporting baseline survey/GIS data.

4.3. Water Quality

Water resources can generally be classified into two main categories: surface water and groundwater. Surface water includes water present on the Earth's surface such as rivers, canals, ponds, and lakes. These sources are directly exposed to atmospheric conditions and are more susceptible to pollution and seasonal variations.

Groundwater refers to water stored beneath the Earth's surface within soil and rock formations. It is recharged through rainfall infiltration and is commonly accessed through tube wells or pumps. Groundwater is widely used for industrial, domestic, and drinking purposes and is comparatively less exposed to surface contamination.

The project area of Bangladesh Ordnance Factories (BOF) is surrounded by a combination of khal, nearby river systems, ponds, and agricultural land, indicating the presence of both surface and groundwater resources. The region receives moderate to high rainfall, contributing to groundwater recharge. The project will utilize groundwater from its own deep tube-well as the primary water source for industrial operations.

Baseline water conditions in the Gazipur region show increasing pressure on water quality due to industrialization and urban expansion. Nearby river systems and water bodies may experience contamination from untreated discharges and inadequate waste management practices. Therefore, proper wastewater management is essential to protect local water resources.

BOF will treat all industrial wastewater through a properly designed Effluent Treatment Plant (ETP) prior to discharge, ensuring compliance with Department of Environment (DoE) standards. Treated water may be reused within the facility where feasible, thereby reducing freshwater demand and minimizing environmental impact.

Monitoring of key water quality parameters such as pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), and total dissolved solids (TDS) will be conducted regularly. This will ensure that the project does not adversely affect surrounding water bodies and supports sustainable water resource management in the area.

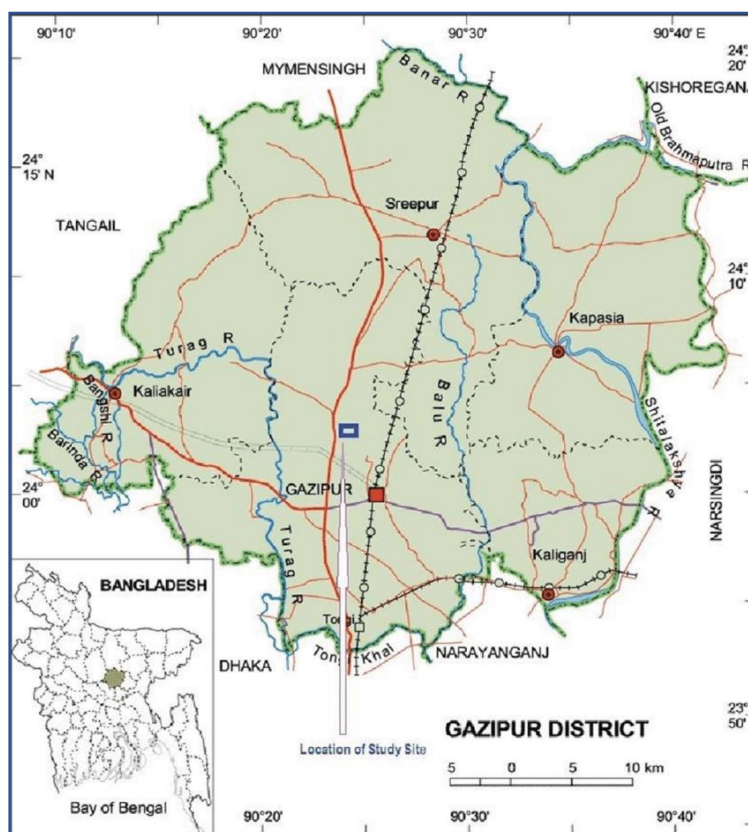


Figure 7: The River System in the Gazipur District

4.3.1 Surface Water Quality

The Gazipur region is influenced by several major river systems, including the Turag, Balu, Shitalakshya, Dhaleshwari, and Meghna rivers, which play an important role in the local hydrology. Among these, the Balu River is the closest surface water body to the project site of Bangladesh Ordnance Factories (BOF).

To assess the baseline surface water quality, water samples were collected from the nearest pond adjacent to the project area and analyzed in a laboratory. This analysis provides an understanding of existing water quality conditions and helps evaluate potential impacts from project activities.



Method of Analysis

Table 10: Method of Analysis of Surface Water Quality Parameters of Pond

SN.	Name of Parameters	Method of Analysis
01	pH	pH Meter
02	Total Dissolved Solid (TDS)	Gravimetric
03	Total Suspended Solids (TSS)	Gravimetric
04	EC	Multimeter
05	Dissolved Oxygen (DO)	Azide modification
06	Biological Oxygen Demand (BOD ₅ at 20 °C)	Dilution
07	Chemical Oxygen Demand (COD)	COD Reflection
08	Turbidity	Turbidity Meter
09	Salinity	Multimeter

a) Results of Surface Water Quality Analysis

Table 11: Analysis Result of Surface Water Quality Parameters of Pond

SN.	Name of Parameters	Concentration Present	Unit	Bangladesh Standard	Method of Analysis
01	pH	8.3	–	6.5–8.5	pH Meter
02	Total Dissolved Solid (TDS)	321	mg/l	2100	Gravimetric
03	Total Suspended Solids (TSS)	172	mg/l	150	Gravimetric
04	EC	453	μmohs/cm	1200	Multimeter
05	Dissolved Oxygen (DO)	5.3	mg/l	4.5–8.0	Azide modification
06	Biological Oxygen Demand (BOD ₅ at 20 °C)	2.14	mg/l	50	Dilution
07	Chemical Oxygen Demand (COD)	18.2	mg/l	200	COD Reflection
08	Turbidity	0.21	NTU	10	Turbidity Meter
09	Salinity	nil	g/L	0.6	Multimeter

Source: Bangladesh Ordnance Factories (BOF) adjacent pond

b) Comments:

Appropriate Analytical Methods (pH, Total Dissolved Solid (TDS), Total Suspended Solids (TSS), EC, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD₅ at 20 °C), Chemical Oxygen Demand (COD), Turbidity, Salinity) have been used for the determination of the above mentioned physico-chemical parameters of surface Water from Bangladesh Ordnance Factories (BOF). was collected from



nearby surface water. The physico-chemical parameters of the water were below standard level of surface water quality set by the DoE, Government of Bangladesh.

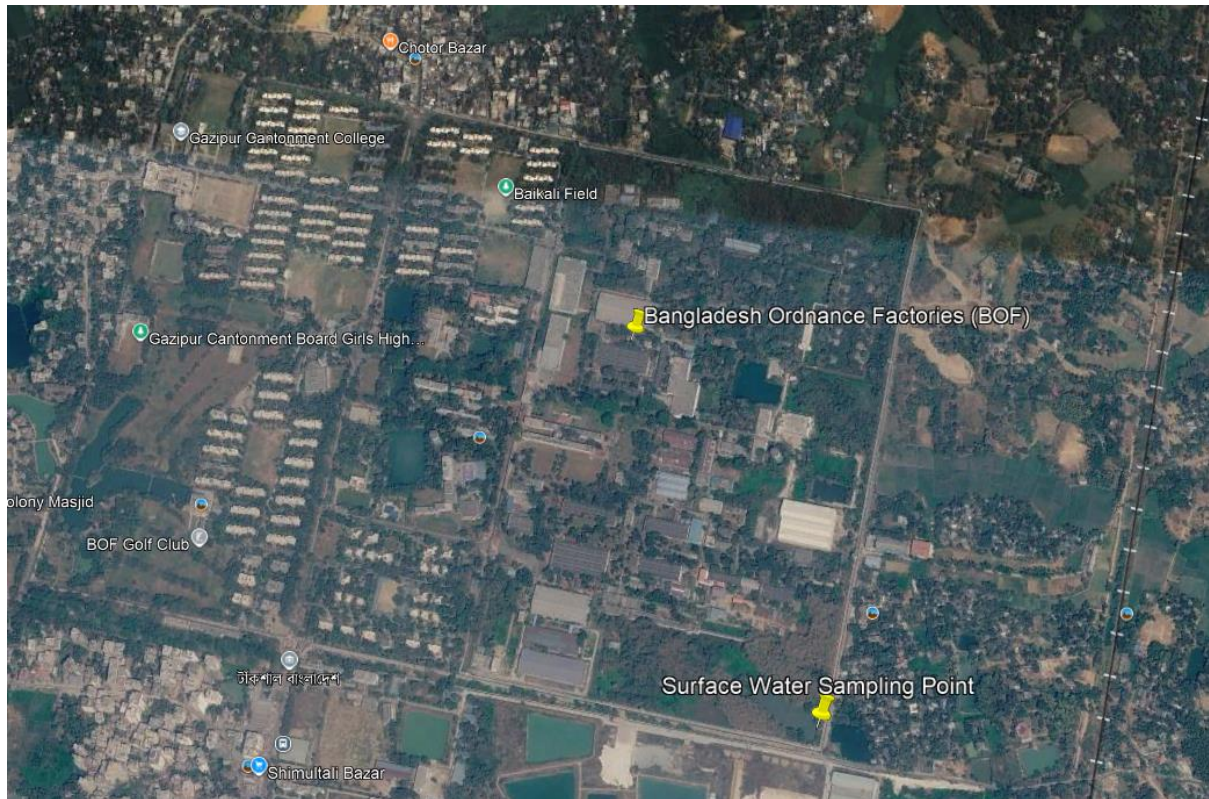


Figure 8: Surface Water Quality Monitoring within The Study Area

- Laboratory Report on Surface Water has been attached in Annex-B

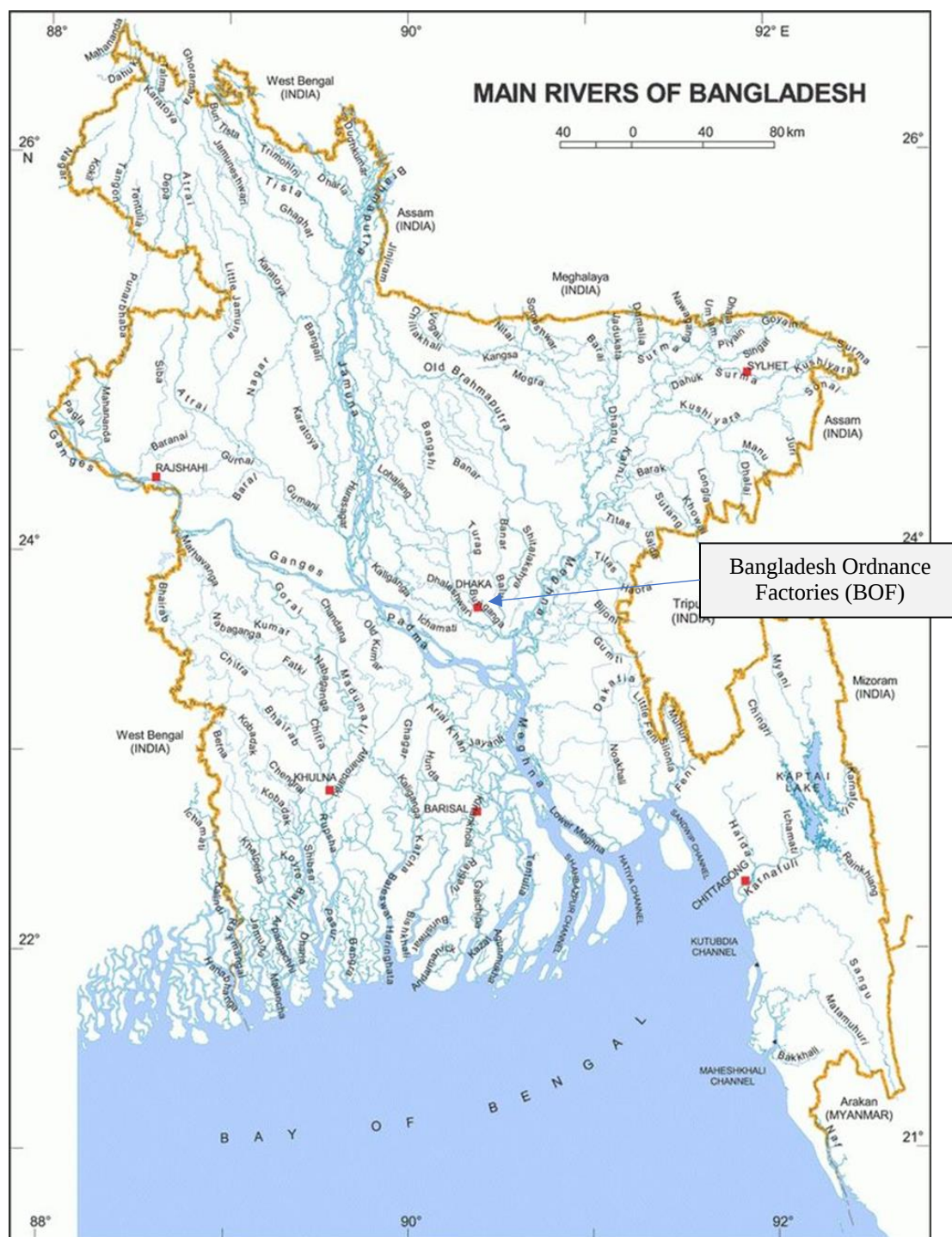


Figure 9: River Map of Bangladesh

Source: The Prime Minister's Office eLibrary, (13 July, 2021)

4.3.2 Groundwater Quality

Bangladesh Ordnance Factories (BOF) tested the deep tube-well water. The test report results are attached in the Annexure C.



Table 12: Method of Analysis of Ground Water Quality Parameters of Tube-well

SN.	Name of Parameters	Method of Analysis
01	pH	pH Meter
02	Total Dissolved Solids (TDS)	Multimeter
03	Iron	UV-visible spectrophotometer
04	Alkalinity	Titrimetric
05	Hardness	Complexo-metric titration by EDTA
06	Chloride	Titrimetric
07	Arsenic	UV-visible spectrophotometer

a) Results of Ground Water Quality Analysis

Table 13: Analysis Result of Ground Water Quality Parameters of Pond

SN.	Name of Parameters	Concentration Present	Unit	ECR' 2023 Standard	Method of Analysis
01	pH	7.2	—	6.5–8.5	pH Meter
02	Total Dissolved Solids (TDS)	176	mg/L	1000	Multimeter
03	Iron	0.13	mg/L	0.3–1	UV-visible spectrophotometer
04	Alkalinity	32	mg/L	NYS	Titrimetric
05	Hardness	45	mg/L	200–500	Complexo-metric titration by EDTA
06	Chloride	49	mg/L	250	Titrimetric
07	Arsenic	0.001	mg/L	0.05	UV-visible spectrophotometer

Laboratory analyses were conducted to determine the specified parameters, including ion concentration, chloride, TDS, hardness, and alkalinity. A buffered, calibrated pH meter was used to measure the pH value accurately. The groundwater quality at Bangladesh Ordnance Factories (BOF) was found to be satisfactory, with all parameter values falling within the water quality standards set by the Department of Environment (DoE) and EPA. This water is deemed suitable for drinking purposes.

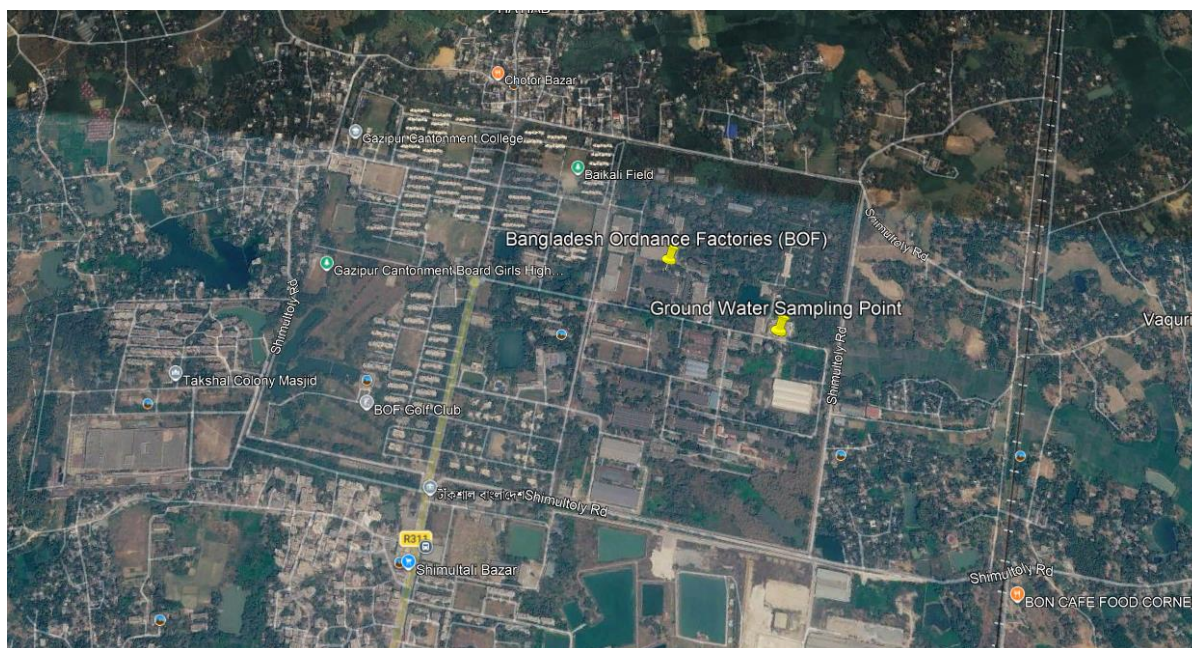


Figure 10: River Map of Bangladesh

4.4. Air Quality

Air quality is determined by the concentration of substances in the atmosphere that can cause adverse effects on human health, animal and plant life, and property. Key pollutants include gases such as sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), and carbon dioxide (CO₂), as well as suspended particulate matter (SPM) like smoke, dust, and fumes. Elevated levels of these pollutants can have detrimental impacts on the environment and public health.

Increased vehicular traffic is a primary contributor to elevated air pollution levels. However, recent regulatory measures implemented by the Bangladesh Government through the Department of Environment (DoE) have led to improvements in air quality.

The area in front of Bangladesh Ordnance Factories (BOF) is subject to some pollution due to ongoing development projects and vehicular traffic. Emissions from vehicles contribute various gases, including SO₂, NO_x, CO, CO₂, as well as smoke and dust particles. Additionally, construction activities in the vicinity generate dust.

To mitigate these effects, the industry building is designed to be fully enclosed, preventing the infiltration of contaminated air into the facility. The typical air quality of Gazipur city, including baseline measurements for the area, is depicted in the following figure.

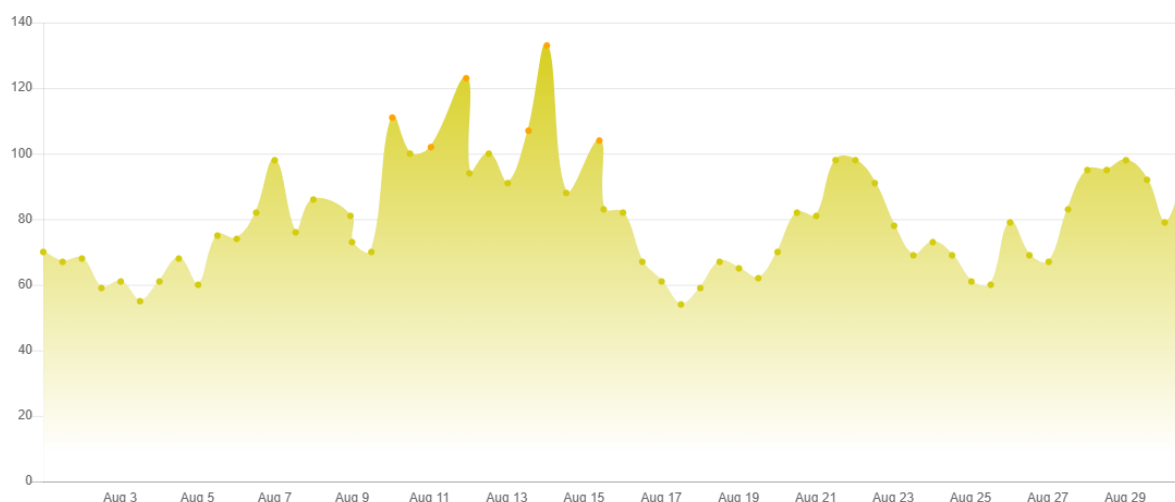


Figure 11: Air Quality Index of Gazipur During August 2025 (source: <https://www.aqi.in/dashboard/bangladesh/gazipur>)

According to the Air Quality Index (AQI) data for Gazipur, the maximum AQI recorded in August 2025 was 54 on August 17, indicating a moderate level of air quality. The lowest air quality during the same period was observed on August 14, with an AQI of 133, which falls into the category of unhealthy for sensitive groups.

Table 14: Air Quality Index (AQI) specifics

AQI	Category	Color	Health implications	What should people do
0-50	Good	Green	Air quality is considered satisfactory, and air pollution poses little or no risk.	It's a great day to be active outside.
51-100	Moderate	Yellow	Air quality is acceptable; however, for some pollutants, there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.	Unusually sensitive people: Consider reducing prolonged or heavy exertion. Watch for symptoms such as coughing or shortness of breath. These are signs to take it easier. Everyone else: It's a good day to be active outside.
101-150	Unhealthy for Sensitive Groups	Orange	Members of sensitive groups may experience health effects. The general public is not likely to be affected.	Sensitive groups: Reduce prolonged or heavy exertion. It's OK to be active outside, but take more breaks and do less intense activities. Watch for symptoms such as coughing or shortness of breath. People with asthma should follow their asthma action plans and keep quick relief medicine handy. If you have heart disease: Symptoms such as palpitations, shortness of breath, or unusual fatigue may indicate a serious problem. If you have any of these, contact your health care provider.
151-200	Unhealthy	Red	Everyone may begin to experience health effects; members of sensitive groups	Sensitive groups: Avoid prolonged or heavy exertion. Move activities indoors or reschedule to a time when the air quality is better.



AQI	Category	Color	Health implications	What should people do
		Red	may experience more serious health effects.	Everyone else: Reduce prolonged or heavy exertion. Take more breaks during all outdoor activities.
201-300	Very Unhealthy	Purple	Health alert: everyone may experience more serious health effects.	Sensitive groups: Avoid all physical activity outdoors. Move activities indoors or reschedule to a time when air quality is better. Everyone else: Avoid prolonged or heavy exertion. Consider moving activities indoors or rescheduling to a time when air quality is better.
301-500	Hazardous	Maroon	Health warnings of emergency conditions. The entire population is more likely to be affected.	Everyone: Avoid all physical activity outdoors. Sensitive groups: Remain indoors and keep activity levels low. Follow tips for keeping particle levels low indoors.

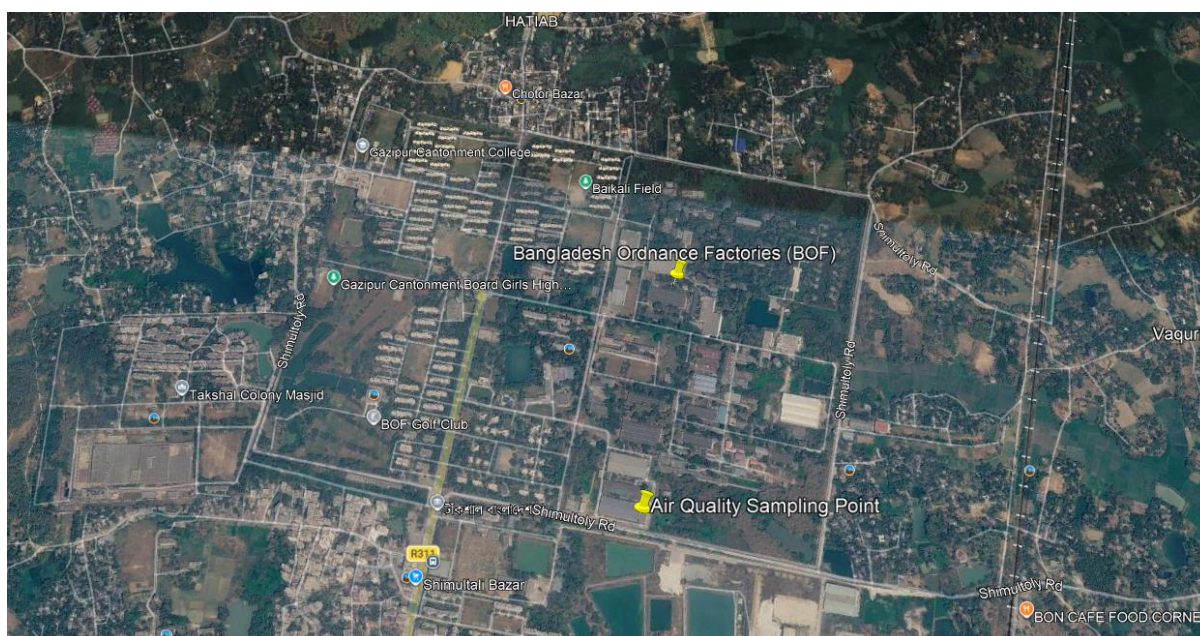


Figure 12: Air Quality Monitoring within The Study Area



a) Results of Air Quality Analysis

Table 15: Analysis Result of Air Quality Parameters

S.N	Sampling Location ID & Name / Details	PM _{2.5}	PM ₁₀	SPM	SO ₂	NO ₂	CO
01	AQ-01 Inside the project area	19	37	84	6.1	8.6	0.45
02	Unit	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	PPM
03	Duration	24	24	8	24	24	8
04	Method of Analysis	Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	Electro-Chemical Sensor
05	Bangladesh (DoE) Standard for Ambient Air	65	150	200	80	80	5
06	Remarks	Good	Good	Good	Good	Good	Good



4.5. Ambient Noise Level

Bangladesh Ordnance Factories (BOF) tested the ambient noise level at the project site. The test report results are attached in Annexure C.

Table 16: Ambient Noise Level Assessment Test Report

Sample ID	Location Name	Day Time Leq	Day Time L _{max}	Day Time L _{min}	Night Time Leq	Night Time L _{max}	Night Time L _{min}	Category
NL - 01	East side of the project	44.16	51.2	37.4	35.21	50.4	31.6	Silent Area
NL - 02	West side of the project	42.82	49.1	33.2	34.35	42.7	31.5	Silent Area
NL - 03	North side of the project	42.10	50.6	36.4	33.58	37.7	31.2	Silent Area
NL - 04	South side of the project	43.27	50.3	35.8	34.62	44.2	31.2	Silent Area

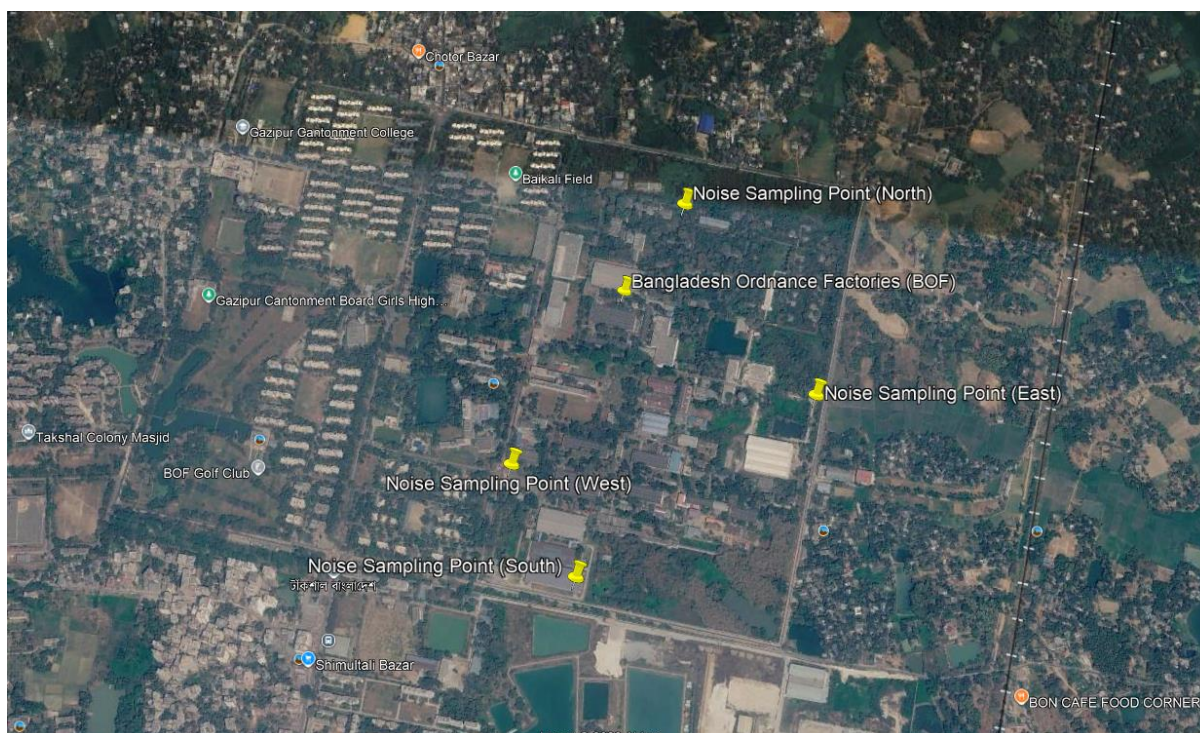


Figure 13: Ambient Noise Level Monitoring within The Study Area

The ambient noise level assessment for Bangladesh Ordnance Factories (BOF) presents measured noise levels at different locations around the project site, which have been compared with the standards set by the Department of Environment (DoE), Bangladesh. The measurements were conducted during the time interval of 2:00 pm to 7:00 pm using standard test methods.

The recorded daytime noise levels range from 42.10 dBA to 51.2 dBA, while nighttime levels range from 33.58 dBA to 50.4 dBA. These values are well within the permissible limits set by the DoE for



industrial areas, which allow up to 75 dBA during daytime and 70 dBA at night. Therefore, the observed noise levels indicate that the project site is currently within acceptable environmental limits.

Considering the surrounding land use, the measured noise levels also remain within acceptable ranges for commercial and mixed-use zones. The relatively lower nighttime noise levels further indicate minimal disturbance during non-operational hours.

4.6. Climate and Meteorological Condition of the Project Area

Bangladesh Ordnance Factories (BOF) is in a tropical savanna climate characterized by a hot, wet summer season from May to September and a cooler, dry winter. The monthly average temperature can reach up to 32°C during the pre-monsoon period. More than 85% of the total annual rainfall occurs during the wet season, with predominant wind patterns blowing from the south. However, ongoing research is needed to determine if these trends are indicative of broader climatic changes. Notably, the typical rainy monsoon period is experiencing delays, leading to shifts in agricultural patterns. This delay results in increased production costs and reduced crop yields, adversely affecting both the agriculture sector and the livelihoods of local communities.

In recent years, the region has experienced heat waves, attributed to indiscriminate deforestation and the specific geographical characteristics of the area. The highest recorded temperature in the metropolitan area is now 38°C, while the lowest is around 12°C. During the monsoon, the average temperature hovers around 25.0°C. Local observations suggest that temperatures have been gradually rising over the past five years, making daily life increasingly challenging. The primary cause of these heat waves is the rising humidity levels in the atmosphere, posing significant challenges to future development efforts.

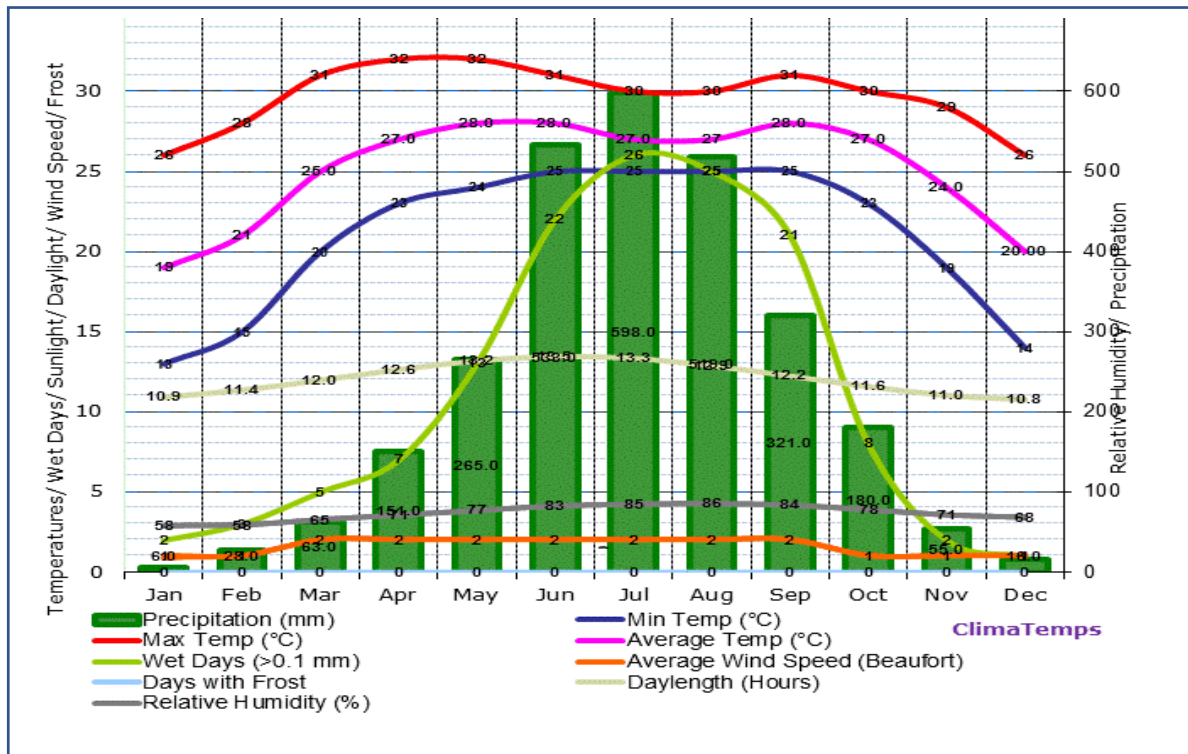


Figure 14: Climate graphs of Gazipur Division

To illustrate the variation in rainfall throughout the year, we present data accumulated over a sliding 31-day period centered on each day of the year. Gazipur experiences significant seasonal variation in monthly rainfall. The rainy season extends for approximately 9.5 months, from February 13 to November 30, during which the sliding 31-day rainfall consistently exceeds 0.5 inches. July is typically the wettest month, with an average rainfall of 9.7 inches.

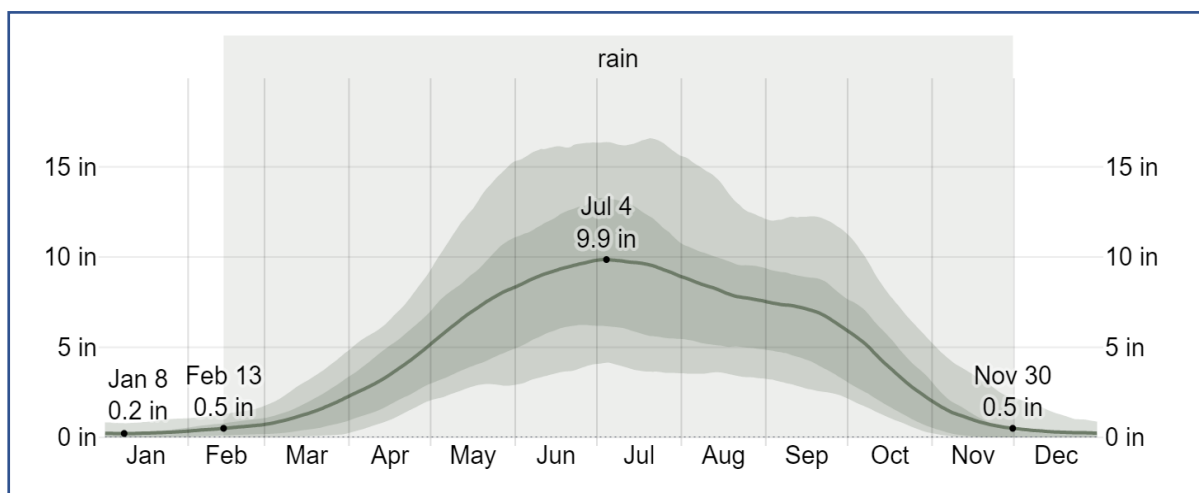


Figure 15: Average Rainfall over the Year in Gazipur

The rainless period in Gazipur lasts for approximately 2.5 months, from November 30 to February 13. January typically experiences the least rainfall, with an average of just 0.2 inches.



Humidity levels are based on the dew point, which indicates whether perspiration can evaporate from the skin to cool the body. Lower dew points feel drier, while higher dew points feel more humid. Unlike temperature, which can fluctuate significantly between day and night, dew points tend to change more gradually. Consequently, a humid day often leads to a humid night. Gazipur experiences significant seasonal variation in perceived humidity. The humid period spans about 8.8 months, from March 3 to November 28, during which conditions are muggy, oppressive, or uncomfortable at least 26% of the time. January has the fewest muggy days, with only 0.8 days falling into this category.

Statistics indicate that average humidity rises to nearly 80% between June and October, while it decreases during the remaining months. The annual average humidity levels are illustrated below:

This section examines the wide-area hourly average wind vector, encompassing both speed and

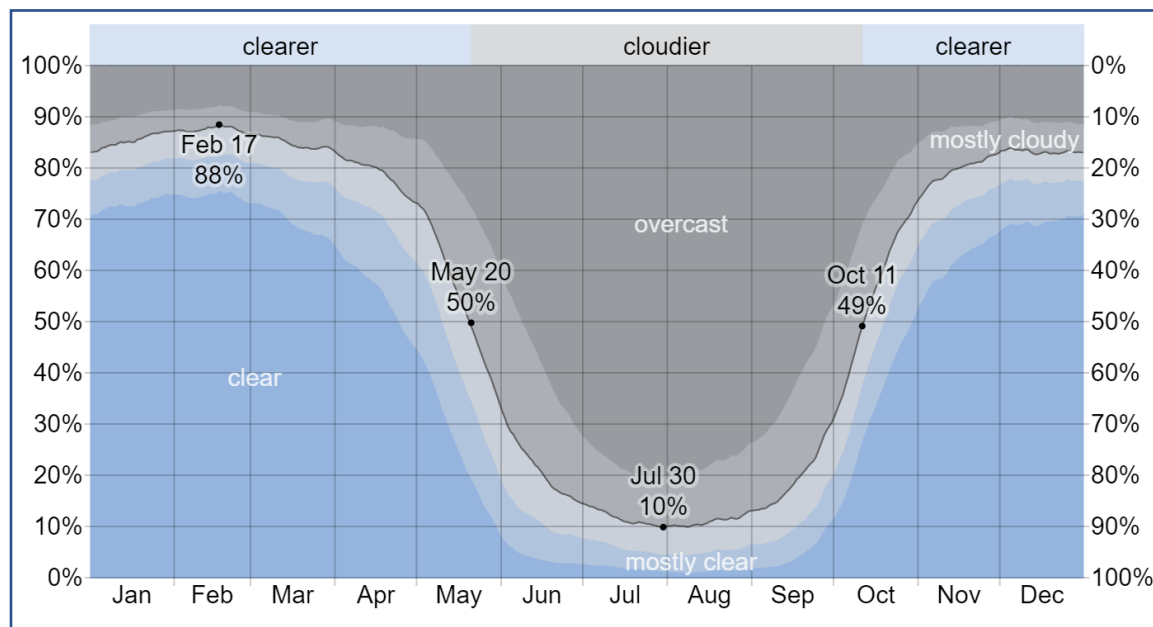


Figure 16: Average humidity over the year in Gazipur

direction, measured at 10 meters above ground level. Wind conditions at any specific location can vary significantly due to local topography and other factors, resulting in more variability in instantaneous wind speed and direction than in hourly averages.

Gazipur experiences notable seasonal variation in average hourly wind speed throughout the year. The windier period extends for approximately 5.3 months, from March 29 to September 6, during which the average wind speed exceeds 7.4 miles per hour. July is typically the windiest month, with an average hourly wind speed of 9.8 miles per hour. Conversely, the calmer period spans about 6.7 months, from September 6 to March 29, with November being the calmest month, characterized by an average hourly wind speed of 4.6 miles per hour.



Wind direction also varies with the seasons. During the pre-monsoon and monsoon seasons, winds predominantly blow from the southwest and southeast. In contrast, during the post-monsoon and dry seasons, the winds shift to blow from the northwest and northeast. Periods of high wind velocity are typically observed between mid-April and early June, as well as between mid-September and mid-December. The average wind speed throughout the year for the project site is detailed below:

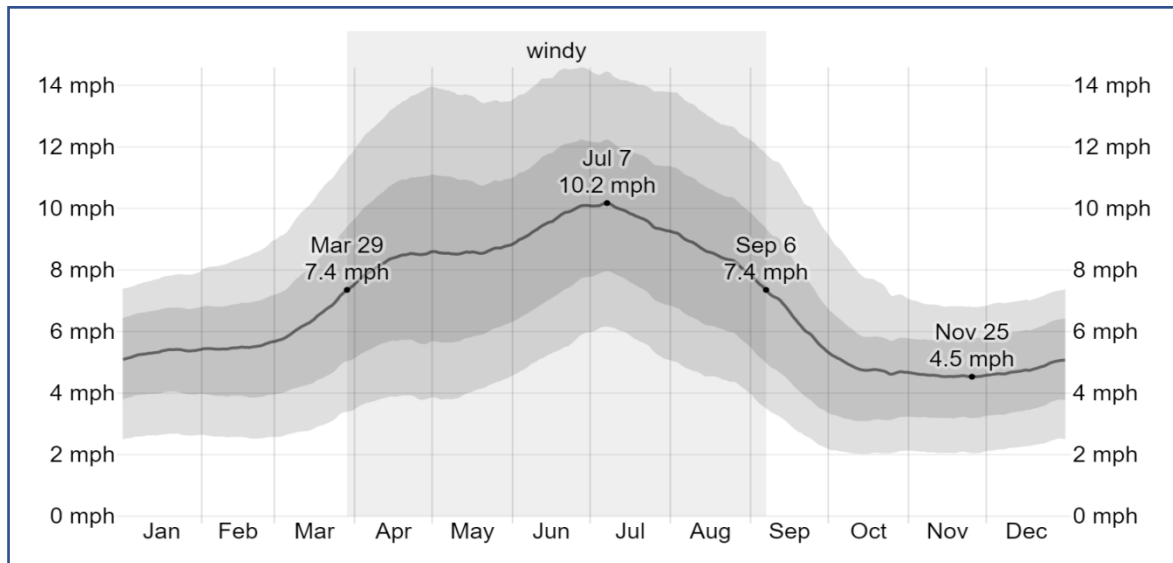


Figure 17: Average wind speed over the year in Gazipur

The hot season in Gazipur spans approximately 3.5 months, from March 13 to June 27, with average daily high temperatures exceeding 89°F. May is typically the hottest month of the year, featuring an average high of 92°F and a low of 78°F.

Conversely, the cool season lasts around 1.5 months, from December 14 to January 31, during which the average daily high temperature remains below 78°F. January is the coldest month, with average low temperatures of 57°F and high temperatures of 76°F.

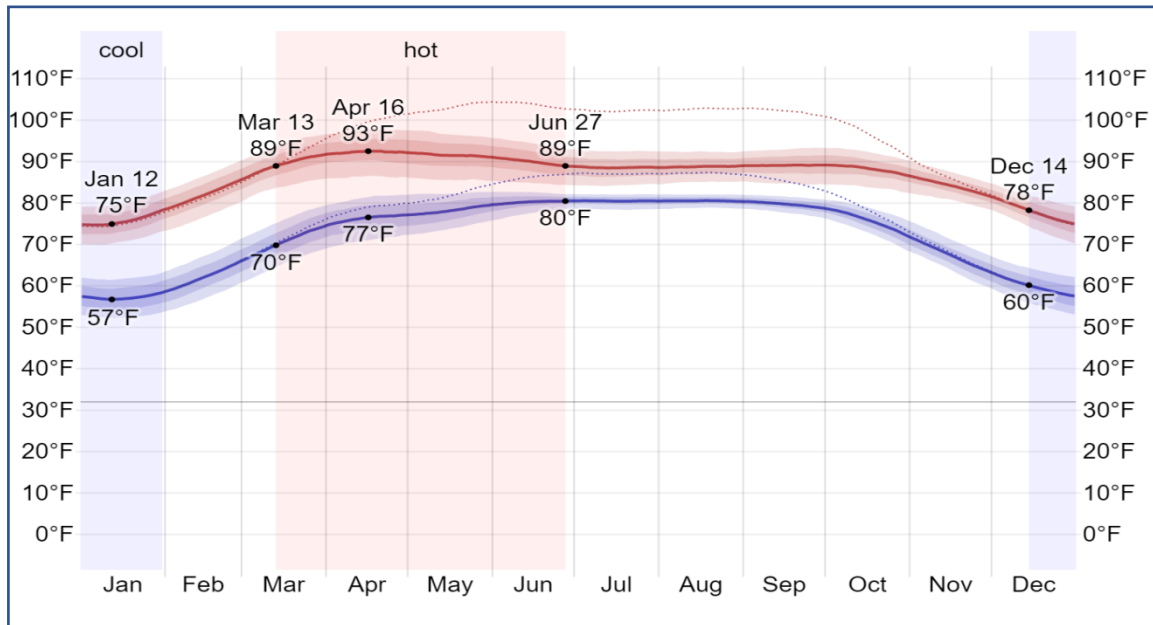


Figure 18: Average High and Low Temperature in Gazipur

In Gazipur, the average cloud cover shows significant seasonal variation throughout the year. The clearer period begins around October 11 and extends for approximately 7.3 months, concluding around May 20. February is typically the clearest month, with the sky being clear, mostly clear, or partly cloudy approximately 87% of the time. In contrast, the cloudier period starts around May 20 and continues for about 4.7 months, ending around October 11. August is the cloudiest month, with the sky being overcast or mostly cloudy approximately 89% of the time.

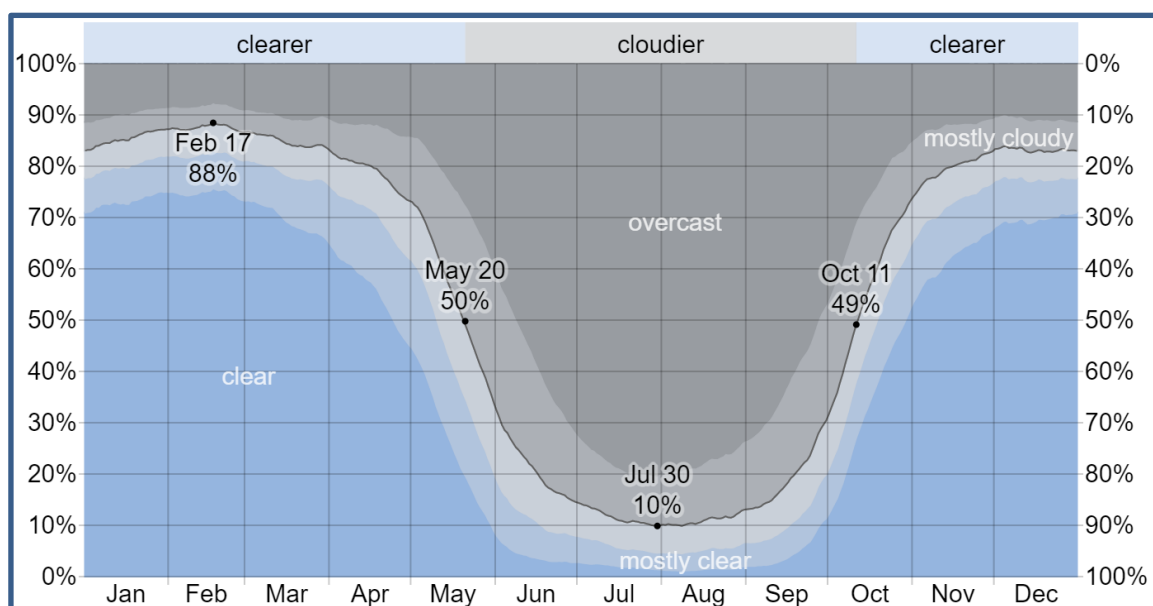


Figure 19: Average cloud cover in Gazipur



4.7. Archeological Heritage

There are no historical sites or structures of archaeological, paleontological, or architectural significance near the project or industry areas.

4.8. Life Pattern

The life pattern in the vicinity of the project site and industry area is generally positive, as the region is experiencing gradual development and increased job opportunities for the local population.

4.9. Settlement and Housing

Currently, there are limited settlements and housing in the project area. As the project progresses, the influx of workers from various sectors will necessitate additional housing, leading to rapid development of settlements around the project site. This will also result in increased socio-economic activities due to the influx of capital and the economic contributions of the newly settled workforce. Consequently, the demand for infrastructure and services, such as water supply, garbage collection, sanitation, electricity, roads, and drainage, will rise. To meet these needs, the relevant local authorities, in collaboration with the project proponents, will work to enhance and expand service facilities in the area. Therefore, the project does not require the evacuation of existing settlements or housing in the project vicinity.

4.10. Traffic and Transport

The project is strategically located adjacent to a well-maintained road network and is directly connected to Gazipur & Mawna Road. Existing traffic and transport facilities are adequate to support the project's operations. However, the establishment of this industry is expected to increase traffic and transport activities in the area, which will likely lead to a rise in socio-economic activities around the project site.

4.11. Terrestrial and Aquatic Flora and Fauna

Gazipur's climate and location are favorable for the growth and development of various tree species. Despite being a bustling city, Gazipur district still retains significant vegetation and diverse ecosystems, intersected by several rivers. The area boasts a rich array of flora and fauna, contributing to both terrestrial and aquatic ecosystems. Key ecological features include the four major rivers, natural and social forestry initiatives, gardens, and institutions, all contributing to the ecological balance.



However, increasing industrialization and urban development pose significant threats to these ecosystems. Ecosystems provide essential goods and services crucial for human well-being and need to be managed with care (Graham, 2004). In the past, many areas in Gazipur served as sanctuaries for avifauna, wildlife, and fisheries, contributing to rich faunal biodiversity and a well-functioning ecosystem. Currently, however, extensive land, including low-lying areas and wetlands, is being encroached upon for residential and industrial development. This trend is driven by Gazipur's attractive living conditions and excellent connectivity to the rest of the city (Hossain et al., 2008).

4.11.1 Flora

The dominant flora in the area includes a variety of species such as Kochuripana (Water Hyacinth), Chechra (*Schenoplectus articulatus*), and Kolmi (*Ipomoea* sp.), alongside larger trees like Tamarind (*Tamarindus indica*), Jackfruit (*Artocarpus heterophyllus*), and Mango (*Mangifera indica*). Fruit-bearing trees commonly found in the area include jackfruit, mango, litchi, banana, coconut, and blackberry. The region also features a variety of timber trees such as mahogany, neem, rain tree, and koroi. The area is characterized by a considerable number of trees and bushes, with a diverse composition of plant species including low-growing grasses, herbs, shrubs, and trees (Source: EIA, MGSP). A detailed list of common tree species in the area is provided below.

Table 17: Common Trees in the Project Area

Name of Trees	Scientific Name	Name of Trees	Scientific Name
Mango	Mangifera indica	Guava	Psidium guajava
Kodbel	Feronia limonia	Dumor	Ficushispida
Sajina	Moringa oleifera	Akashmoni	Acacia auriculiformis
Atafal	Annona reticulate	Rain Tree	Samanea saman
Sobeda	Manilkara sapota	Shimul	Bombax ceiba
Date Palm	Phoenix	Supari	Areca catechu
Lichi	Lichi chinensis	Papaya	Carica Papaya
Bel	Aegle marmelos	Banana Musa	Sapientum
Shishu	Dalbergia sisoo	Bakul	Mimosas eleng
Jackfruit	Artocarpus heterophyllus	Jaw	Casuarina littorea
Mahogany	Swietenia macrophylla	Boroi	Zizyphusm auritiana
Neem	Azadirachta indica	Jambura	Citrus grandis
Babla	A. nilotica	Kamranga	Averrhoa carambola
Jarul	Lagerstroemia speciosa	Eucalyptus	Eucalyptus teritocornis
Tetul	Tamarindus indica		

4.11.2 Fauna

A study conducted by Md. Eftekhair Hossain, Mohammad Mamun Chowdhury, and Kazi Farhed Iqbal in the Kaliakair Upazila of Gazipur District documented a diverse range of species, including 30 species of birds, 24 species of winter birds, 7 species of reptiles, 3 species of amphibians, 15 species of



mammals, and 32 species of fish. The relative abundance of these species was assessed, revealing that the House Sparrow (*Passer domesticus*) was the most abundant among the bird species, while Blyth's Kingfisher (*Alcedo hercules*), Rock Eagle Owl (*Bubo bengalensis*), Hooded Pitta (*Pitta sordida*), Black-headed Oriole (*Oriolus xanthornus*), White-winged Duck (*Cairina seoululala*), and the Bar-headed Goose (*Anser indicus*) were classified as rare. The relative abundance of winter birds could not be determined due to their migratory nature.

Among the reptiles, the Striped Keelback (*Amphiesma stolata*) and Common Smooth Water Snake (*Enhydryis enhydryis*) were observed to be common, whereas the Black Pond Turtle (*Geoclyms hamiltonii*) and Pond Tortoise (*Melanochelys trijuga*) were recorded as endangered. For amphibians, the Common Toad (*Bufo melanostictus*) was found to be abundant, while the Bullfrog (*Rana tigrina*) was rare. In the mammalian category, the Asiatic Wild Dog (*Cuon alpinus*) and House Mouse (*Mus musculus*) were abundant, while the Common Otter, Large Indian Civet, Irrawaddy River Dolphin, and Indian Hare were noted as rare.

Regarding fish species, Carp, Silver Carp, Tilapia, and Nile Tilapia (*Oreochromis niloticus*) were found to be abundant. In contrast, species such as Freshwater Garfish, One-striped Spiny Eel, and Grey Featherback were rare. The study identified several major threats to the faunal diversity of the Kaliakair area, including landfilling, deforestation, poaching, industrial effluents, and the use of current nets (jal).

4.12. Socio-Economic Status

The area surrounding the proposed industry site hosts limited socio-economic activities, with residents engaged in a wide range of occupations across industrial, commercial, transportation, and various other sectors. This industrial region is characterized by a diverse population from different cultural and religious backgrounds who live, work, and worship harmoniously. The establishment of the industry has not led to the displacement or negative impact on local residents. Instead, it will have stimulated multi-disciplinary activities and businesses, providing numerous employment opportunities. A significant number of people have become involved in the industry's operations, supporting their livelihoods.

During both the construction and operational phases, the project is expected to employ a large workforce, including both skilled and unskilled labor. The industry's presence has already benefited many local residents, either directly through employment opportunities or indirectly through the provision of Ammo & ammunition products.

The primary sources of income in the area are agriculture (47.89%), non-agricultural labor (2.89%), business (14.85%), transport and communication (3.85%), employment (13.28%), rent and remittance (4.57%), and other activities (12.67%). The industry's establishment offers the local population access



to improved diagnostic services, reducing the need for long commutes, which are often hindered by traffic congestion in Gazipur.

Bangladesh Ordnance Factories (BOF) will employ approximately 1500 individuals, both skilled and unskilled, in its operational phase. This will provide significant socio-economic benefits to the community, including increased employment opportunities and the growth of ancillary businesses related to the ammunition manufacturing plant sector. Consequently, the industry's presence enhances local service accessibility and overall quality of life for nearby residents.

The project site is not marshy, and no aquatic life has been observed on the land throughout the year. Therefore, the industry's establishment has not resulted in the loss of any wetland areas. The industry has successfully integrated into the local environment, contributing positively to the socio-economic development of the area without compromising ecological integrity.



Chapter Five: Identification and Mitigation of Potential Impacts

5.1. General Consideration

The identification and assessment of potential environmental impacts constitute a fundamental component of the Environmental Impact Assessment (EIA) for the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory at Gazipur Cantonment, Gazipur. The assessment will systematically identify the potential beneficial and adverse impacts associated with the pre-construction, construction, and operational phases of the project and evaluate their significance considering the nature, magnitude, duration, extent, reversibility, and sensitivity of the affected environmental receptors. Particular consideration will be given to potential impacts on ambient air quality, noise and vibration, surface and groundwater, soil and land environment, ecology, waste generation, wastewater, occupational health and safety, community safety, traffic, and the surrounding socio-economic environment. The assessment will also consider project-specific activities associated with the production of arms and ammunition, including the use and handling of metals, chemicals and other raw materials identified for the Assault Rifle, SAA, Primer and Detonator, and ammunition production lines. Appropriate avoidance, minimization, control, and mitigation measures will subsequently be formulated for the identified adverse impacts, taking into consideration BOF's proposed utility and environmental management facilities, including its 40 m³/day water requirement, 36 m³/day wastewater generation and 5 m³/hour chemical ETP. The overall objective is to ensure that potential environmental impacts are identified at an early stage and managed effectively so that the proposed BOF project can be implemented and operated in an environmentally responsible and sustainable manner.

5.2. Impacts Identification and Mitigation Measures

Identification of potential impacts due to the project location, construction and operation of Bangladesh Ordnance Factories (BOF) has been carried out using a checklist approach. Checklists are comprehensive lists of environmental effects and impact indicators designed to stimulate the analysis to think broadly about possible consequences of contemplated actions (Munn, 1979). In order to prepare the checklist and further analyze the associated environmental impacts of the proposed project, the relevant project activities and significant environmental components likely to be affected have been considered. Particular attention has been given to BOF's proposed Arms & Ammunition manufacturing activities, including the Assault Rifle, SAA, Primer and Detonator, 12.7 and 14.5 mm ammunition, and Mortar and Bomb production facilities. The project involves various metallic, chemical and other raw materials, including alloy steel, copper and brass strips, lead, antimony sulphide, barium nitrate, lead styphnate, red lead powder, lead azide and other production chemicals. These activities and materials have been considered to identify the significant environmental components and potential interactions



associated with the project. Based on the project characteristics, air and noise quality, surface and groundwater quality, soil and land environment, wastewater management, solid and hazardous waste management, chemical handling and storage, occupational health and safety, community safety, drainage and overall environmental management are considered among the major environmental issues requiring assessment.

As the BOF project information describes the assessment in relation to the construction and operational activities of the proposed Arms & Ammo manufacturing facility, environmental impacts associated with both phases have been considered in developing the EIA. Particular emphasis is placed on the operational phase because of the nature of arms and ammunition manufacturing, raw-material and chemical handling, wastewater generation and associated environmental management requirements. BOF requires approximately 40 m³/day of water, generates approximately 36 m³/day of wastewater, and proposes a 5 m³/hour (40 m³/day) chemical-treatment ETP, with treated effluent discharged to the City Corporation drain leading to the Balu River. Table 5.1 presents the checklist developed for Bangladesh Ordnance Factories (BOF). In this checklist, the major project activities that may create Significant Environmental Impacts (SEIs) are identified. The terms none, minor, moderate and major, together with short-term and long-term, are used in the checklist to classify the magnitude and duration of the probable SEIs.

5.2.1. Environmental Aspects Process Model

The Environmental Aspects Process Model provides a systematic framework for identifying the interaction between the proposed activities of Bangladesh Ordnance Factories (BOF) and the surrounding environmental components. For the BOF Arms & Ammunition Production Factory, environmental aspects have been considered with respect to project activities, associated inputs and outputs, potential environmental receptors, resulting impacts, and necessary control or mitigation measures.

- **Identification of Project Activities:** The first step involves identifying activities capable of interacting with environmental components. For BOF, these include site development and construction activities as well as the operation of the different arms and ammunition production lines, utility systems, generators, material handling, wastewater treatment and waste-management activities.
- **Identification of Inputs and Resource Consumption:** The environmental assessment will consider the principal inputs required for project activities, particularly raw materials, chemicals, water and electricity. BOF will use materials including alloy steel, wood, plastics, composites, copper and brass strips, lead and different production chemicals. The documented



utility requirements include approximately 40 m³/day of water and 6,500 kWh/month of electricity from REB.

- **Identification of Environmental Aspects:** Environmental aspects are identified based on the manner in which individual BOF activities may interact with the environment. Relevant aspects include water consumption, wastewater generation, air emissions, noise and vibration, solid and potentially hazardous waste generation, raw-material and chemical handling, energy consumption and operation of utility facilities.
- **Identification of Potential Environmental Impacts:** Each identified environmental aspect will be linked with its possible environmental consequence. Potential impacts requiring assessment include deterioration of air, water and soil quality; increased ambient noise; resource consumption; waste-related pollution; occupational exposure; and potential effects on nearby environmental and human receptors. The significance of such impacts will depend on their magnitude, duration, extent and sensitivity of the affected receptor.
- **Wastewater Generation and Treatment:** BOF is reported to generate approximately 36 m³/day of wastewater against a total water requirement of 40 m³/day. A 5 m³/hour (40 m³/day) ETP based on a chemical treatment process is proposed for wastewater management. Treated effluent is intended to be discharged into the City Corporation drain leading to the Balu River. Therefore, wastewater generation, treatment efficiency and treated-effluent quality constitute important environmental aspects of the project.
- **Waste Generation and Management:** The available project information identifies cartons and boxes as solid wastes. Other waste streams should be incorporated into the assessment only where supported by detailed production-process and waste-inventory information. Appropriate segregation, collection, storage and disposal practices will form part of the environmental management system.
- **Air Emission and Noise Aspects:** Potential air emissions and noise will be assessed in relation to construction activities, production operations and utility equipment. BOF has seven generators comprising four 1,000 kVA units, two 1,500 kVA units and one 1,250 kVA unit, which represent relevant sources for assessment during their operation. Appropriate emission and noise-control measures will be determined according to the identified significance of impacts.
- **Chemical and Raw-Material Handling:** Particular consideration will be given to storage and handling associated with the identified raw materials for the ammunition and primer/detonator production lines, including lead-containing materials and various production chemicals. The assessment will consider potential environmental interactions associated with handling, storage,



accidental release and worker exposure, with suitable preventive and control measures incorporated into the EMP.

- **Evaluation of Significance and Mitigation:** Identified aspects and impacts will be evaluated to determine their environmental significance and priority for management. The assessment will support the selection of measures following the hierarchy of avoidance, minimization, control and mitigation, followed by monitoring of relevant environmental parameters to verify the effectiveness of the proposed measures.



Table 18: Checklist for identification of probable Environmental Impact of Bangladesh Ordnance Factories (BOF) (Project Location).

Project Phase	Action Affecting Environmental Resources and Values		SEIs without Mitigation Measures				Impact Type				Duration	
			None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
Industry Location	a	Loss of and displacement from homestead land	√									
	b	Overland Drainage and Impact on Surface Water		√			√			√		√
	c	Change in Landscape		√			√			√		√
	d	Loss of and displacement from agricultural land and house	√									
	e	Disruption of Earth's Surface		√			√			√		√
	f	Inadequacy of Buffer Zone		√			√		√			√



Table 19: Checklist for identification of probable Environmental Impact of Bangladesh Ordnance Factories (BOF) (Project Location).

Project Phase	Action Affecting Environmental Resources and Values		SEIs without Mitigation Measures				Impact Type				Duration	
			None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
Construction	a	Air pollution		√			√			√	√	
	b	Noise Pollution and Vibration affect.		√			√			√	√	
	c	Spreading diseases		√			√			√		√
	d	Accidents		√			√			√		√

Table 20 Checklist for identification of probable Environmental Impact of Bangladesh Ordnance Factories (BOF) (Operation of the Industry).

Project Phase	Action Affecting Environmental Resources and Values		Effect on Environment and Economy	SEIs without Mitigation Measures				Impact Type				Duration	
				None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
Industry Operation	Operation of Bangladesh Ordnance Factories (BOF)												
	a	Noise Pollution	Noise Generated from Electromechanical machinery and transports			√		√		√			√



Project Phase	Action Affecting Environmental Resources and Values		Effect on Environment and Economy	SEIs without Mitigation Measures				Impact Type				Duration	
				None	Minor	Moderate	Major	Adverse	Beneficial	Reversible	Irreversible	Short Term	Long Term
	b	Water Pollution	Untreated liquid wastewater and sewage discharge can pollute the environment.				√	√			√		√
	c	Air pollution from the generators			√			√			√	√	
	d	Solid Wastes from daily activities as well as from routine maintenance work				√		√			√		√
	e	Accidental and Natural Hazard				√		√			√		√
	f	Employment- Recruitment of new staffs and operators					√		√				√

The checklist identifies the Impacts likely to occur in the different phases of the project. The following sections evaluate these impacts, mentioning their origin and characteristics, actual site condition implemented mitigation measures, and possible enhancement of mitigation/enhancing measures. At the end of each sub-section, the status of residual impact will also be mentioned.



5.3.Evaluation of Predicated Adverse Impacts and Mitigation

Unplanned or inadequately controlled construction and operation of the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory may adversely affect the surrounding environmental quality. Following the approach adopted in the EIA, potential adverse impacts have been evaluated considering pollution of air and water, noise, waste generation, accidental spillage/runoff, effects on land and ecological resources, and human health and safety. For BOF, particular consideration is required because the manufacturing processes involve metallic and chemical raw materials such as alloy steel, copper and brass strips, lead, antimony sulphide, barium nitrate, lead styphnate, red lead powder, lead azide, tracing/incendiary components and other chemicals. The principal adverse impacts and corresponding mitigation considerations are summarized below.

Table 21 Evaluation of Predicted Adverse Impacts and Mitigation

Potential Adverse Impact	BOF Context	Proposed Mitigation Approach
Air Quality Deterioration	Dust and emissions may arise from construction activities, material handling, manufacturing operations and operation of standby generators.	Control construction dust, maintain machinery and generators properly, provide adequate ventilation/extraction where required, and periodically monitor ambient air quality and relevant emission sources.
Water Consumption & Wastewater Discharge	BOF requires approximately 40 m ³ /day of water from its own deep tube-well and is expected to generate approximately 36 m ³ /day of wastewater.	Minimize unnecessary water consumption and ensure wastewater requiring treatment is adequately treated in the proposed 5 m ³ /hour (40 m ³ /day) chemical ETP before discharge through the designated drainage system.
Solid and Process Waste	The project information identifies cartons and boxes as solid waste; manufacturing activities may require assessment of additional process-specific waste streams as detailed process information becomes available.	Segregate wastes at source, provide designated storage areas and ensure appropriate reuse, recycling, treatment or disposal according to the characteristics of each identified waste stream.
Noise and Vibration	Production machinery, construction equipment, vehicle movement and the seven generators may contribute to increased noise levels.	Maintain equipment regularly, provide appropriate acoustic/noise-control arrangements, restrict unnecessary noise-generating activities and provide suitable hearing protection to exposed workers.
Soil and Land Contamination	Accidental leakage or spillage during storage and handling of chemicals and other materials may contaminate soil or enter surface runoff.	Provide controlled storage and handling areas, suitable containment, spill-response arrangements and immediate collection and management of accidental releases.



Potential Adverse Impact	BOF Context	Proposed Mitigation Approach
Occupational Health & Safety	Arms and ammunition manufacturing involves machinery, metallic materials and chemicals, making worker health and safety an important project consideration.	Implement appropriate operating procedures, PPE requirements, worker training, controlled access, machine safety, chemical-handling procedures and emergency preparedness measures.
Natural and Accidental Hazards	Fire, chemical spills and other accidental events may result in environmental and safety consequences if inadequately controlled.	Maintain emergency response procedures, fire protection arrangements, safe storage and handling practices, trained response personnel and periodic emergency drills.
Surface Runoff and Drainage	Contaminated runoff or poorly managed drainage could affect surrounding land and receiving drainage systems. Treated effluent is proposed to enter the City Corporation drain leading to the Balu River.	Maintain separate and effective drainage arrangements where appropriate, prevent chemicals/wastes from entering stormwater, and ensure only suitably managed effluent is directed to the designated outlet.
Ecological and Surrounding Environmental Impact	Uncontrolled emissions, wastewater, waste or runoff could indirectly affect vegetation, agricultural land and other environmental receptors surrounding the project area.	Apply pollution-prevention measures, maintain proper waste and wastewater management, undertake environmental monitoring and maintain appropriate landscaping/green areas within the project premises.

5.4. Impact due to Operation of the Proposed Project

Several environmental issues have been identified for evaluation during the operational phase of the Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory. Following the approach of the EIA, these issues require systematic monitoring and management to prevent deterioration of the surrounding environmental quality. The report evaluates operational impacts in terms of topography, water consumption and wastewater discharge, solid waste, noise, and natural and accidental hazards. For BOF, these considerations are particularly relevant because the proposed facilities involve production of Assault Rifles, SAA, Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortars/Bombs using various metallic and chemical raw materials. The major operational environmental issues identified for BOF are:

- **Topographical and Land-Related Impacts:** Operation of the project is not expected to cause major alteration of the existing topography. However, development and maintenance of production buildings, internal infrastructure, drainage and other facilities within the 135.87-acre project area may influence local land characteristics and surface runoff if not properly managed.
- **Water Consumption and Wastewater Discharge:** BOF requires approximately 40 m³/day of water, supplied from its own deep tube-well, and is expected to generate approximately 36 m³/day of wastewater. A 5 m³/hour (40 m³/day) chemical-treatment ETP is proposed for



wastewater treatment. Proper ETP operation and treated-effluent monitoring will therefore be important for minimizing impacts on the receiving environment.

- **Solid and Process Waste Generation:** The supplied BOF information specifically identifies cartons and boxes as solid waste. Considering the different manufacturing activities, any additional process-specific wastes identified during detailed operation should be properly characterized, segregated, stored and managed through an appropriate waste-management system.
- **Air Quality Impact:** Operational air-quality impacts may be associated with production activities and utility equipment. BOF has seven generators—four 1,000 kVA, two 1,500 kVA and one 1,250 kVA units—which constitute relevant emission sources when operated. Proper equipment maintenance and environmental monitoring will be required to control potential impacts.
- **Noise Pollution:** Manufacturing machinery, material handling, vehicle movement and generator operation may increase occupational and ambient noise levels. Regular equipment maintenance, appropriate noise-control measures and suitable personal protective equipment (PPE) for exposed workers should therefore be maintained.
- **Chemical and Raw-Material Handling Risk:** The BOF production lines involve materials including lead, antimony sulphide, barium nitrate, lead styphnate, red lead powder, lead azide and other chemicals. Proper storage, controlled handling, spill prevention and response procedures are consequently important operational management requirements.
- **Natural and Accidental Hazard Risks:** Considering the nature of arms and ammunition production and the identified chemical raw materials, accidental incidents require particular attention. The available project information, however, does not provide a quantitative risk assessment; therefore, the magnitude of specific accidental scenarios cannot be precisely established from the supplied data. Appropriate fire protection, emergency preparedness, safe operating procedures and occupational safety management should be maintained.

Overall, water consumption and wastewater discharge, waste generation, air and noise emissions, chemical/raw-material handling, and natural or accidental hazards constitute the principal environmental considerations during BOF operation. Effective implementation of pollution-control measures, safe operating procedures, the proposed ETP, waste-management practices and regular environmental monitoring will be necessary to minimize these impacts and ensure environmentally sound operation of the project.

5.5.Impacts on Topography

Development of the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory within the 135.87-acre project area may result in localized modification of existing ground



conditions and landscape, particularly during site preparation, earthwork, construction of production buildings, internal roads, drainage facilities and other infrastructure. Such impacts are expected to be primarily associated with the construction stage and can be minimized through controlled earthwork, proper drainage planning and restoration/landscaping of disturbed areas. The potential topographical impacts are discussed below.

5.5.1. Disruption of Earth Surface

5.5.1.1. Impact Origin

Site development activities may require localized land filling, excavation, grading and cutting to establish suitable formation levels for buildings, roads, utility facilities and drainage infrastructure. If these activities are undertaken without appropriate control, alteration of the existing ground surface may affect natural runoff patterns, cause localized erosion and sediment movement, and potentially create drainage congestion or waterlogging. Therefore, earthwork should be limited to areas required for project development and coordinated with the proposed site drainage system.

5.5.1.2. Mitigation Measure

The following measures should be adopted to minimize disruption of the earth surface:

- **Controlled Earthwork:** Filling, cutting, excavation and grading should be restricted to designated construction areas. Unnecessary disturbance of adjoining land should be avoided.
- **Proper Site Grading:** The finished ground level should maintain suitable slopes so that stormwater can drain effectively without creating stagnant-water or waterlogging conditions.
- **Cross-Drainage Provision:** Appropriate cross-drainage structures should be provided wherever roads, buildings or other project infrastructure may interfere with existing surface-water movement.
- **Erosion and Sediment Control:** Exposed soil, excavated materials and temporary stockpiles should be appropriately managed to minimize erosion and transport of sediment through stormwater runoff.
- **Reuse and Management of Excavated Soil:** Suitable excavated soil should, where practicable, be reused for site development and landscaping. Any excess material should be transported and disposed of at an appropriate location without obstructing natural drainage.

5.5.1.3. Residual Impact

Provided that controlled earthwork, appropriate grading, erosion-control measures and adequate drainage facilities are properly implemented, disruption of the earth surface is expected to remain minor and localized, with insignificant residual impact on the overall topography of the BOF project area.



5.5.2. Change in Landscape

Development of BOF will introduce production buildings, utility structures, internal roads and associated infrastructure into the project area and will therefore alter the existing landscape to some extent. Although landscape impact is largely qualitative, inappropriate development may create visual intrusion and reduce existing green coverage. The project layout and landscaping should therefore be integrated with the overall site-development plan.

5.5.2.1. Impact Origin

The principal landscape impact will originate from construction of industrial structures and associated infrastructure and from alteration of existing ground surfaces and vegetation within the development footprint. The visual character of the site may consequently change from its present condition to a more developed industrial setting. Removal of vegetation, where necessary for construction, may also temporarily reduce the visual and ecological quality of affected portions of the project area.

5.5.2.2. Mitigation Measure

- **Landscape-Sensitive Design:** Project structures and infrastructure should be arranged considering appropriate landscape criteria such as coherence, readability, hierarchy and stability.
- **Preservation of Existing Vegetation:** Existing trees and vegetation outside essential construction footprints should be retained as far as practicable.
- **Greenbelt and Plantation:** Suitable indigenous trees and vegetation should be planted along appropriate project boundaries, roads and available open spaces to compensate for disturbed green areas and improve visual quality.
- **Restoration of Disturbed Areas:** Temporary construction areas, exposed ground and other disturbed surfaces should be restored and landscaped after completion of construction activities.

5.5.2.3. Residual Impact

Provided the mitigation measures above are fully implemented, the residual impact will be very insignificant.

5.6. Impact on Climate

The construction and operation of the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory may contribute to climate-related impacts primarily through energy consumption, fuel combustion, transportation, water use, waste generation and land-use changes associated with project development. Following the approach of the EIA, climate impacts are considered in relation to greenhouse gas (GHG) emissions and resource consumption. For BOF, electricity will primarily be supplied by REB, while seven generators are identified in the project



information as backup/utility power sources. Accordingly, appropriate energy, resource and waste-management practices should be incorporated into project operation.

5.6.1. Impact Origin

The potential climate impacts associated with BOF may originate from the following sources:

- **Greenhouse Gas Emissions:** Direct and indirect GHG emissions may arise from electricity consumption, generator operation, transportation and other energy-consuming project activities. These emissions will contribute to the overall carbon footprint of the facility.
- **Combustion of Fuel:** Operation of BOF's seven generators—four 1,000 kVA, two 1,500 kVA and one 1,250 kVA units—may generate carbon dioxide and other combustion-related emissions when they are operated. Therefore, unnecessary generator operation should be avoided and equipment should be maintained efficiently.
- **Energy Consumption:** BOF's production machinery, lighting, ventilation, utility systems and other electrical equipment will consume energy during operation. The project information indicates an estimated electricity requirement of approximately 6,500 kWh/month from REB. Efficient use of electricity can reduce the indirect GHG emissions associated with power consumption.
- **Water Use and Wastewater Treatment:** BOF requires approximately 40 m³/day of water and is expected to generate about 36 m³/day of wastewater. Water abstraction, pumping and operation of the proposed ETP require energy and therefore indirectly contribute to the project's energy and carbon footprint.
- **Waste Generation:** Improper handling or disposal of solid and process wastes may indirectly contribute to GHG emissions and unnecessary resource consumption. Waste minimization, segregation, recycling and appropriate disposal are therefore important climate-related management considerations.
- **Transportation and Logistics:** Transportation of raw materials, products, personnel and wastes by fuel-powered vehicles will contribute to fuel consumption and associated GHG emissions.
- **Loss of Vegetation:** Clearing of vegetation during site development, where unavoidable, may reduce local carbon sequestration capacity. Existing vegetation should therefore be retained wherever practicable and compensated through plantation and landscaping.

5.6.2. Mitigation Measure

The following measures should be implemented to minimize climate-related impacts of BOF:



- **Energy Efficiency:** Energy-efficient production equipment, motors, lighting and utility systems should be used where technically feasible. Regular maintenance and energy audits should be undertaken to identify opportunities for reducing unnecessary energy consumption.
- **Efficient Generator Operation:** Generators should be operated only when required and maintained according to the manufacturer's recommendations to ensure efficient fuel combustion and minimize emissions.
- **Renewable Energy Consideration:** The feasibility of incorporating solar power or other suitable renewable-energy systems may be considered for appropriate auxiliary loads in the future, consistent with the mitigation approach adopted in the EIA.
- **Water Conservation:** Water use should be optimized throughout production and utility operations. Opportunities for suitable water reuse, recycling and rainwater harvesting may be evaluated where technically feasible to reduce abstraction and associated energy requirements.
- **Waste Minimization and Recycling:** Waste should be minimized at source and segregated according to type. Reusable and recyclable materials should be recovered wherever feasible, while remaining wastes should be managed through appropriate treatment and disposal practices.
- **Efficient Transportation and Logistics:** Transportation schedules should be optimized, vehicles should be properly maintained, and unnecessary vehicle movement should be minimized to reduce fuel consumption and associated emissions.
- **Greenbelt and Plantation:** Existing vegetation should be preserved as far as practicable, and suitable indigenous trees should be planted along appropriate boundaries, roads and open spaces within the project area to enhance green coverage and carbon sequestration.

5.6.3. Residual Impacts

Following implementation of the above mitigation measures, the principal residual climate impacts are expected to include:

- **Reduced Carbon Footprint:** Energy conservation, efficient generator operation and optimized transportation will reduce avoidable GHG emissions.
- **Lower Energy Consumption:** Energy-efficient equipment and operational practices will reduce overall electricity and fuel demand.
- **Reduced Water-Related Energy Demand:** Efficient water use will reduce energy requirements associated with abstraction, pumping and wastewater treatment.
- **Reduced Waste-Related Impact:** Waste minimization, segregation and recycling will decrease the quantity of waste requiring final disposal and conserve resources.



- **Improved Carbon Sequestration:** Plantation and preservation of vegetation will partially compensate for vegetation disturbance associated with project development.

5.7. Impact on Water Use & Wastewater Discharge on Environment

Water use and wastewater discharge are important environmental considerations for the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory. BOF is expected to require approximately 40 m³/day of water, supplied from its own deep tube-well, while approximately 36 m³/day of wastewater will be generated. A 5 m³/hour (40 m³/day) Effluent Treatment Plant (ETP) based on chemical treatment has been proposed for wastewater management. The treated effluent is intended to be discharged through the City Corporation drain leading toward the Balu River. Therefore, efficient water use, proper wastewater treatment and regular monitoring of treated effluent will be essential to prevent adverse impacts on surface water, groundwater and soil.

5.7.1. Impact Origin

Potential impacts associated with water consumption and wastewater discharge from BOF include:

- **Groundwater Abstraction:** The project will obtain approximately 40 m³/day of water from its own deep tube-well. Continuous abstraction represents a demand on the local groundwater resource and should therefore be managed through efficient water-use practices.
- **Wastewater Generation:** Approximately 36 m³/day of wastewater is expected from BOF activities. The supplied project information specifies the quantity and proposed treatment system but does not provide the detailed wastewater characteristics or pollutant concentrations; therefore, these should be established through appropriate wastewater characterization and monitoring.
- **Surface Water Pollution:** Discharge of untreated or inadequately treated wastewater may introduce pollutants into the drainage network and ultimately affect the receiving water environment. Industrial wastewater requires adequate treatment before environmental discharge, as untreated effluent can adversely affect receiving water quality.
- **Soil and Groundwater Contamination:** Leakage, uncontrolled wastewater discharge or infiltration of contaminated water may deteriorate soil quality and potentially affect groundwater. Percolation of untreated industrial wastewater is specifically recognized as a potential pathway for groundwater contamination.
- **Chemical Contamination:** BOF's production activities involve various chemical raw materials. Accidental spills, wash water or contaminated runoff entering the wastewater or stormwater system could increase the pollution risk if not properly controlled.



5.7.2. Mitigating Measure

The following measures should be implemented to minimize impacts associated with water use and wastewater discharge:

- **Operation of ETP:** Wastewater requiring treatment should be directed to the proposed 5 m³/hour (40 m³/day) chemical-treatment ETP and adequately treated before discharge.
- **Compliance of Treated Effluent:** Treated wastewater should comply with the applicable national discharge standards before being released to the designated drainage system. Periodic testing should be undertaken to verify treatment performance.
- **Water Conservation:** Unnecessary water consumption should be minimized through controlled use, regular inspection of pipelines and fittings, prompt repair of leakage and good housekeeping practices.
- **Wastewater Segregation:** Process wastewater, domestic wastewater and stormwater should be appropriately managed according to their characteristics. Uncontaminated stormwater should not unnecessarily enter the industrial wastewater treatment system.
- **Chemical Spill Prevention:** Chemicals should be stored and handled in controlled areas with suitable containment. Accidental spills should be collected promptly and should not be allowed to enter open drains, soil or surface-water pathways.
- **Drainage Management:** The drainage network should be properly maintained to prevent waterlogging and uncontrolled discharge. Where runoff has a potential for contamination, appropriate interception or containment measures should be provided before discharge.
- **Monitoring and Record Keeping:** Influent and treated-effluent quality, ETP operation and relevant water-consumption records should be routinely maintained. Monitoring is necessary to determine whether the required treatment level and receiving-water protection objectives are being achieved.

5.7.3. Residual Impact

Even after treatment, a certain level of residual impact may remain; therefore, effective ETP operation and monitoring are essential for maintaining acceptable discharge quality. The principal residual considerations for BOF are:

- **Treated Effluent Discharge:** Minor residual pollutant loads may remain in treated wastewater. Maintaining treatment efficiency and compliance with applicable discharge standards will minimize the associated environmental impact.
- **Groundwater Consumption:** Groundwater abstraction will continue during operation; therefore, water-conservation measures should remain an integral part of BOF's environmental management practices.



- **Accidental Release Risk:** A residual risk of leakage or accidental chemical/wastewater release will remain and should be controlled through preventive maintenance, containment and emergency response procedures.

Overall, the impact of BOF's water use and wastewater generation can be effectively controlled through water conservation, proper segregation and collection of wastewater, reliable operation of the 5 m³/hour ETP, prevention of chemical contamination and regular treated-effluent monitoring. With these measures properly implemented, the residual impact on water resources and the receiving environment is expected to be minor and manageable.

5.8. Impact Due to Solid Waste Generation

The operation of the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory will generate solid wastes from production, packaging, material handling, maintenance and general activities. The supplied BOF project information specifically identifies cartons and boxes as solid waste. However, considering the different manufacturing facilities and raw materials involved, additional process-specific waste streams may arise during operation and should be identified and characterized before determining their final management route. Proper segregation, storage, recycling and disposal are therefore necessary to prevent contamination of soil, water and the workplace environment.

5.8.1. Impact Origin

The major sources and potential impacts of solid waste generation at BOF are identified as follows:

- **Process-Related Waste:** Arms and ammunition manufacturing may generate rejected or off-specification materials and production residues. The available BOF information does not quantify or characterize these waste streams; therefore, their types, quantities and characteristics should be established through a detailed operational waste inventory.
- **Packaging Waste:** The project information identifies cartons and boxes as solid waste. Such materials will mainly originate from packaging and handling of raw materials, equipment and other supplies. Recyclable packaging should be separated from other wastes and stored appropriately.
- **Chemical-Contaminated Waste:** BOF uses materials such as lead, antimony sulphide, barium nitrate, lead styphnate, red lead powder, lead azide and other chemicals in different production lines. Waste contaminated with these substances, if generated, will require separate identification and controlled management rather than disposal with general solid waste.
- **ETP Sludge:** BOF proposes a 5 m³/hour chemical-treatment ETP for approximately 36 m³/day of wastewater. Sludge generation can be expected from chemical wastewater treatment;



however, its quantity and composition are not provided in the available project information. The sludge should therefore be characterized before selecting an appropriate treatment or disposal method.

- **Maintenance and Utility Waste:** Routine maintenance of production machinery, generators and utility systems may generate worn components, filters, containers and other maintenance-related wastes. These wastes should be segregated according to their characteristics and contamination potential.
- **General/Domestic Solid Waste:** General waste will also arise from routine activities of the project's workforce. BOF has approximately 2,125 permanent and temporary employees, making organized collection, storage and disposal of general waste an important operational requirement.

5.8.2. Mitigation Measures

To effectively manage solid waste generated from BOF and minimize associated environmental impacts, the following measures should be implemented:

- **Segregation of Waste:** Waste should be segregated at the point of generation into appropriate categories, particularly general, recyclable, process-related and potentially hazardous/chemical-contaminated waste. Clearly identified collection containers should be provided at designated locations.
- **Reduction, Reuse and Recycling:** Waste generation should be minimized wherever practicable. Clean cartons, boxes and other recyclable materials should be reused or transferred through an appropriate recycling route rather than mixed with general waste.
- **Controlled Management of Chemical-Contaminated Waste:** Any waste contaminated with chemicals or potentially hazardous substances should be separately collected, clearly identified and stored in a secure designated area pending appropriate treatment or disposal.
- **ETP Sludge Management:** ETP sludge should be collected separately and characterized to determine its appropriate management method. Dewatering may be applied where suitable to reduce sludge volume, followed by disposal or other management according to its determined characteristics.
- **Safe Temporary Storage:** Waste-storage areas should have adequate containment and protection against rainfall, runoff and accidental release, particularly for wastes that could contaminate soil or water.
- **Record Keeping and Waste Inventory:** BOF will maintain records of significant waste streams, including their source, quantity, characteristics and final management route. This will support environmental monitoring and continuous improvement of waste-management practices.



- **Training and Good Housekeeping:** Relevant personnel should receive training on waste segregation, handling and emergency procedures. Production and storage areas should be maintained in a clean condition to prevent accumulation and uncontrolled disposal of waste.

5.8.3. Residual Impact

Implementation of the above measures will substantially reduce environmental impacts associated with BOF's solid waste generation. The principal residual considerations are:

- **Minor Remaining Waste:** Certain non-recyclable wastes will continue to require final disposal even after waste minimization and recycling.
- **ETP Sludge:** Residual sludge will remain following wastewater treatment and will require continued controlled management based on its characteristics.
- **Chemical-Contaminated Waste Risk:** A residual contamination risk may remain where chemical-contaminated wastes are generated; therefore, segregation, secure storage and appropriate final management must be maintained throughout operation.

Overall, if BOF implements effective waste minimization, source segregation, recycling, controlled storage, ETP sludge management and appropriate disposal practices, impacts associated with solid waste generation can be effectively controlled. With these measures properly implemented, the residual impact is expected to be minor to insignificant.

5.9. Impact on Air Quality

The construction and operation of the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory may affect ambient and workplace air quality through fuel combustion, production activities, raw-material handling, vehicle movement and construction-related dust. Particular attention is required for BOF because the project includes several arms and ammunition production lines and uses various metallic and chemical raw materials. The project information also identifies seven standby generators, comprising four 1,000 kVA, two 1,500 kVA and one 1,250 kVA units, which may act as combustion-emission sources during operation. Appropriate source controls, equipment maintenance and regular air-quality monitoring will therefore be necessary to minimize impacts.

5.9.1. Impact Origin

The potential impacts on air quality may originate from the following activities:

- **Generator Emissions:** Operation of standby generators may release combustion-related pollutants, including nitrogen oxides (NO_x), sulfur oxides (SO_x), carbon monoxide (CO) and



particulate matter (PM), depending on the fuel characteristics and operating condition of the equipment. Combustion equipment is recognized as a potential source of these pollutants.

- **Production and Material-Handling Activities:** Handling and processing of metallic and chemical raw materials may generate localized dust, fumes or other airborne contaminants depending on the specific manufacturing operation. BOF uses alloy steel, copper and brass strips, lead and several chemical materials in its different production lines; therefore, workplace emission sources should be identified and controlled at the point of generation.
- **Chemical Handling:** Improper handling, transfer or storage of chemicals may result in localized airborne exposure or accidental release. Adequate ventilation, closed containers and safe material-handling procedures should therefore be maintained.
- **Vehicle Exhaust:** Transportation of personnel, raw materials, products and wastes will generate exhaust emissions within and around the project premises. Poorly maintained vehicles may increase emissions of CO, NO_x and particulate matter.
- **Construction Dust and Equipment Emissions:** During construction, site preparation, excavation, material handling, vehicle movement and operation of construction machinery may temporarily increase suspended dust and exhaust emissions. Construction activities and machinery are recognized as potential contributors to deterioration of local air quality.

5.9.2. Mitigation Measure

The following measures should be implemented to control potential air-quality impacts:

- **Proper Maintenance of Generators:** All seven generators should be periodically inspected and maintained to ensure efficient combustion and minimize exhaust emissions. Unnecessary operation should be avoided.
- **Adequate Exhaust Arrangement:** Generator exhaust should be released through appropriately designed exhaust/stack arrangements so that pollutants are adequately dispersed and localized exposure is minimized.
- **Local Exhaust Ventilation:** Where production activities generate dust, fumes or airborne contaminants, suitable local exhaust ventilation (LEV) or other appropriate engineering controls should be provided close to the emission source.
- **Safe Chemical Handling:** Chemicals should be stored in properly closed and designated containers/areas. Handling procedures should minimize spills, evaporation, dust formation and unnecessary worker exposure.
- **Dust Control During Construction:** Water spraying should be undertaken on exposed surfaces and dusty roads where necessary. Construction materials should be properly stored or covered, and vehicles transporting loose materials should be appropriately covered.



- **Vehicle and Equipment Maintenance:** Project vehicles, construction machinery and other combustion equipment should undergo regular preventive maintenance to minimize incomplete combustion and excessive exhaust emissions.
- **Greenbelt Development:** Appropriate plantation and greenbelt development should be maintained around suitable portions of the project area to improve the site's environmental condition and provide a supplementary buffer against dust.
- **Air Quality Monitoring:** Ambient/workplace air quality should be periodically monitored at appropriate locations, particularly near significant emission sources and sensitive work areas. Monitoring results should be reviewed to determine whether additional control measures are required.

5.9.3. Residual Impact

Following implementation of the proposed mitigation measures, the residual air-quality impacts are expected to include:

- **Reduced Combustion Emissions:** Proper generator operation and maintenance will reduce avoidable emissions of NO_x , SO_x , CO and particulate matter.
- **Controlled Workplace Emissions:** Appropriate ventilation and source-control systems will minimize worker exposure to dust, fumes and other airborne contaminants generated by relevant production activities.
- **Reduced Fugitive Dust:** Water spraying, covered material handling, good housekeeping and controlled vehicle movement will substantially reduce construction-related and fugitive dust.
- **Lower Vehicle-Related Emissions:** Preventive maintenance and efficient transportation management will minimize unnecessary exhaust emissions from project vehicles.

Overall, potential impacts on air quality can be effectively minimized through source-specific emission control, proper generator and vehicle maintenance, local exhaust ventilation, safe chemical handling, construction dust suppression, greenbelt development and periodic air-quality monitoring. With effective implementation of these measures, the residual impact on ambient air quality is expected to be minor and manageable.

5.10. Impacts on Acoustic Environment

The construction and operation of the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory may influence the acoustic environment through operation of production machinery, utility equipment, standby generators, material handling, vehicular movement and construction activities. Continuous or intermittent exposure to elevated noise may affect workers and, depending on propagation and distance, the surrounding environment. Industrial equipment,



HVAC/utility systems, construction machinery and transportation activities are recognized as important sources of operational and temporary noise. Therefore, appropriate engineering controls, maintenance, occupational protection and periodic noise monitoring should be incorporated into BOF's environmental management practices.

5.10.1. Impacts and Origin

Potential noise and vibration impacts associated with BOF may originate from the following sources:

- **Production Machinery and Equipment:** Machinery used within the Assault Rifle, SAA, Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortar/Bomb production facilities may generate continuous or intermittent operational noise. Workers operating close to such equipment may be the principal receptors.
- **Standby Generators:** BOF has seven generators consisting of four 1,000 kVA units, two 1,500 kVA units and one 1,250 kVA unit. Their operation may create localized noise and vibration, particularly near the generator installations.
- **Utility and Ventilation Equipment:** Ventilation systems, pumps, motors and other utility equipment associated with production and environmental-control facilities may contribute to the overall workplace and ambient noise level.
- **Material Handling and Transportation:** Movement of raw materials and finished products, loading/unloading activities and operation of project vehicles may generate intermittent noise within the project premises and along access routes.
- **Construction Activities:** Site preparation, excavation, building construction and operation of construction machinery may temporarily increase noise and vibration levels. Construction machinery, drilling and transportation of construction materials are typical sources of temporary acoustic disturbance.
- **Waste Handling Activities:** Collection, movement and loading of solid wastes may generate intermittent noise, particularly where mechanical equipment or vehicles are used. Waste collection and disposal activities can contribute to the acoustic environment.

5.10.2. Mitigation Measures

The following measures should be implemented to minimize noise and vibration impacts:

- **Equipment Selection and Maintenance:** Machinery and utility equipment should be properly installed and periodically maintained. Worn, loose or defective components should be repaired promptly to prevent unnecessary noise and vibration.
- **Acoustic Control of Generators:** Standby generators should be provided with suitable acoustic enclosures or other noise-control arrangements, where required, and maintained in good operating condition.



- **Isolation of Noise Sources:** High-noise equipment should, where practicable, be located within enclosed or designated areas and isolated from routinely occupied workspaces.
- **Vibration Control:** Appropriate foundations, vibration isolators, damping pads or similar engineering measures should be used for equipment capable of producing significant vibration.
- **Occupational Hearing Protection:** Workers exposed to high workplace noise should be provided with suitable earplugs/earmuffs and instructed in their proper use. Appropriate warning signs should be provided in designated high-noise areas.
- **Control of Construction Noise:** Construction equipment should be properly maintained, unnecessary idling should be avoided, and high-noise construction activities should be managed to minimize disturbance to nearby receptors.
- **Traffic and Material-Handling Management:** Unnecessary horn use, excessive vehicle idling and avoidable movement of heavy vehicles should be minimized. Loading and unloading activities should be undertaken in an organized manner.
- **Noise Monitoring:** Workplace and boundary noise levels should be periodically monitored at appropriate locations. Monitoring results should be compared with applicable standards to determine whether additional noise-control measures are necessary.

5.10.3. Residual Impact

After implementation of the recommended mitigation measures, the following residual impacts are anticipated:

- **Reduced Equipment Noise:** Preventive maintenance, acoustic control and isolation of noisy machinery will substantially reduce unnecessary operational noise.
- **Reduced Worker Exposure:** Engineering controls combined with appropriate hearing protection will minimize occupational exposure to elevated noise levels.
- **Reduced Vibration:** Proper equipment foundations and vibration-isolation arrangements will reduce transmission of vibration to surrounding structures and work areas.
- **Localized Intermittent Noise:** Some noise from generators, vehicles, material handling and production equipment will remain during operation, but it should be localized and manageable with continued control and monitoring.

Overall, potential impacts on the acoustic environment can be effectively minimized through equipment maintenance, acoustic enclosures, source isolation, vibration control, occupational hearing protection, traffic management and periodic noise monitoring. With proper implementation of these measures, the residual acoustic impact of BOF is expected to be minor and manageable.



5.11. Impact on Health and Safety, Natural and Accidental Incidents

The construction and operation of the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory require particular attention to occupational health, safety and emergency preparedness because the project involves production machinery, metallic raw materials and chemicals used in different arms and ammunition production lines. Potential incidents may include occupational injuries, chemical exposure, fire, spills and natural hazards. Emergency preparedness is therefore an important component of the project because fires, chemical spills and natural disasters can create significant health and safety consequences if adequate response arrangements are not maintained.

5.11.1. Health and Safety

5.11.1.1. Impact Origin

Potential health and safety impacts at BOF may originate from the following activities:

- **Chemical Handling and Exposure:** BOF uses materials including lead, antimony sulphide, barium nitrate, lead styphnate, red lead powder, lead azide and other chemicals. Improper storage, transfer, handling or accidental release may create occupational exposure and contamination risks.
- **Production Machinery:** Operation and maintenance of manufacturing machinery may expose workers to mechanical hazards, moving components, electrical hazards, noise and other workplace risks if adequate safeguards are not maintained.
- **Waste and Wastewater Handling:** Improper collection, storage or disposal of process waste, chemical-contaminated waste and ETP sludge may expose workers to potentially harmful substances. Safe waste management is therefore an important occupational-health consideration.
- **Noise Exposure:** Production machinery, utility equipment and the seven standby generators may create elevated workplace noise, potentially affecting employees working close to these sources.
- **Construction and Maintenance Activities:** Construction, equipment installation and maintenance may involve heavy machinery, electrical work, working at height, lifting and material handling, creating risks of injuries and accidents.
- **Emergency Situations:** Fire, chemical spills, equipment malfunction and other emergencies may pose significant health and safety risks if adequate preparedness and response arrangements are not maintained.



5.11.1.2. Mitigation Measures

The following measures should be adopted to minimize occupational health and safety impacts:

- **Personal Protective Equipment (PPE):** Appropriate PPE such as safety helmets, gloves, protective footwear, eye/face protection, hearing protection and suitable protective clothing should be provided according to job-specific hazards.
- **Chemical Safety:** Chemicals should be properly labelled and stored in designated areas with appropriate containment and ventilation. Relevant Safety Data Sheets (SDS) should be readily available, and workers should be trained in safe handling procedures.
- **Machine Safety:** Production machinery should be fitted with appropriate guards and safety devices. Preventive maintenance and safe operating procedures should be implemented, with maintenance undertaken only by trained personnel.
- **Waste-Handling Safety:** Process waste, ETP sludge and any chemical-contaminated waste should be segregated and handled using appropriate PPE and designated storage arrangements.
- **Occupational Health and Safety Training:** Workers should receive induction and periodic refresher training covering workplace hazards, PPE, chemical safety, machine operation, emergency response and safe working practices.
- **Spill and Emergency Response:** Suitable spill-control materials and emergency equipment should be maintained at relevant locations. Personnel handling chemicals should be trained in spill containment and emergency procedures.
- **Inspection and Monitoring:** Workplace conditions, safety equipment and work practices should be periodically inspected to identify unsafe conditions and ensure timely corrective action.

5.11.1.3. Residual Impact

Following implementation of the above mitigation measures:

- **Reduced Chemical Exposure:** Proper storage, handling, PPE and spill-response arrangements will substantially reduce worker exposure to chemicals.
- **Reduced Occupational Injury:** Machine guarding, safe operating procedures and worker training will minimize mechanical and workplace accidents.
- **Reduced Noise Exposure:** Engineering controls and hearing protection will reduce occupational impacts from high-noise areas.
- **Improved Emergency Preparedness:** Training, emergency procedures and readily available response equipment will improve preparedness for abnormal events.



- **Controlled Workplace Risks:** Regular inspection and preventive maintenance will allow potential hazards to be identified and corrected before they develop into significant incidents.

These measures are expected to substantially reduce occupational health and safety risks, although continued supervision, training and monitoring will remain necessary throughout operation.

5.11.2. Natural and Accidental Incidents

5.11.2.1. Impact Origin

The potential impacts of natural and accidental incidents at Bangladesh Ordnance Factories (BOF) can originate from the following sources:

- **Natural Disasters:**
 - **Flooding:** Heavy rains or natural flooding events could affect industry operations, disrupt services, and damage infrastructure.
 - **Earthquakes:** Seismic activity could compromise the structural integrity of the industry building, leading to safety risks and potential damage to equipment and facilities.
 - **Cyclones and Storms:** High winds and severe weather conditions could cause physical damage to the industry structure and impact the availability of essential services.
- **Accidental Incidents:**
 - **Fire:** Potential sources include electrical faults, flammable materials, and chemical storage, which could lead to fire hazards affecting employee safety and industry operations.
 - **Chemical Spills:** Accidental spills of hazardous substances used in operational processes could threaten health, safety, and the environment.
 - **Equipment Failure:** Malfunctions or breakdowns in critical industry equipment could disrupt manufacturing system and impact overall process.
 - **Human Error:** Mistakes or lapses in following safety protocols by staff could lead to accidents, affecting personnel and employees.
- **Construction Phase Accidents:**
 - **Site Safety Hazards:** During the construction phase, risks such as falls from heights, accidents involving heavy machinery, and exposure to hazardous materials can pose serious safety threats to construction workers and nearby residents.
 - **Structural Failures:** Inadequate construction practices or failure to adhere to safety standards could result in structural collapses or accidents, impacting ongoing construction activities and future industry operations.



- **Traffic and Equipment Accidents:** Increased vehicle traffic and construction equipment operation could lead to accidents, posing risks to workers and the general public in and around the construction site.
- **Material Handling:** Improper handling and storage of construction materials could lead to accidents or injuries, affecting the safety of construction workers and nearby individuals.

5.11.2.2. Mitigation Measures

To manage impacts from natural and accidental incidents, including those during construction, the following measures will be implemented:

Natural Disasters

- **Flooding:** Utilize flood-resistant design and effective drainage systems and update flood management plans.
- **Earthquakes:** Follow seismic design standards and conduct regular structural inspections.
- **Cyclones and Storms:** Design for weather resilience and develop cyclone response plans.

Accidental Incidents

- **Fire:** Install fire safety systems, conduct regular drills, and ensure proper storage of flammable materials.
- **Chemical Spills:** Implement safe handling protocols and spill response plans and maintain containment equipment.
- **Equipment Failure:** Maintain and inspect critical equipment regularly and use backup systems.
- **Human Error:** Provide safety training and foster a strong safety culture.

Construction Phase Accidents

- **Site Safety Hazards:** Ensure safety training, PPE usage, and regular site inspections.
- **Structural Failures:** Enforce quality control and structural monitoring practices.
- **Traffic and Equipment Accidents:** Implement traffic management plans and ensure operator training.
- **Material Handling:** Establish safe handling procedures and conduct regular audits.

5.12. Socio-Economic Impacts

The proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory is expected to generate both positive and potential adverse socio-economic impacts during construction and operation. The project will support employment, procurement of goods and services, development of technical skills and associated economic activities. BOF project information indicates a total workforce of approximately 2,125 permanent and temporary personnel, demonstrating its significance in terms of employment generation. At the same time, workforce movement, transportation of raw



materials and products, and increased project-related activities may create pressure on traffic and surrounding services. The major socio-economic impacts and corresponding mitigation measures are discussed below.

5.12.1. Positive Impacts

- **Employment Opportunities:** BOF will provide direct employment for technical, skilled, semi-skilled, administrative and support personnel. The documented workforce of approximately 2,125 permanent and temporary employees represents a significant positive socio-economic contribution.
- **Indirect Employment Opportunities:** Project activities may create additional employment through transportation, maintenance, supply, construction and other supporting services associated with the facility.
- **Economic Activities:** Procurement of materials, equipment and services and expenditure associated with the project workforce may generate business opportunities for suppliers, contractors and service providers. Industrial operation can consequently contribute to wider economic activity.
- **Development of Technical Skills:** Operation of specialized arms and ammunition manufacturing facilities will require trained technical personnel. Training and operational experience can contribute to development of specialized manufacturing, engineering, maintenance, safety and quality-control skills.
- **Contribution to Domestic Industrial Capability:** Production of Assault Rifles, SAA, Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortars/Bombs will strengthen domestic production capability in these specified product categories and support associated technical capacity.
- **Supporting Infrastructure and Services:** Development and operation of the project may support improvement and maintenance of internal access, utilities and other project-related infrastructure and services. Infrastructure development is generally identified as a positive socio-economic effect of industrial projects.

5.12.2. Potential Negative Impacts

- **Increased Traffic Movement:** Transportation of employees, raw materials, finished products and other supplies may increase vehicular movement along project access routes, potentially contributing to localized traffic congestion and road-safety risks. Increased operational traffic is recognized as a potential socio-economic impact.
- **Pressure on Local Services:** Increased project-related activities and workforce movement may create additional demand for transportation and supporting commercial services in the surrounding area.



- **Community Disturbance:** Noise, traffic, construction activities and other project-related movements may cause temporary or localized disturbance if not adequately controlled.
- **Health and Safety Concerns:** Inadequately managed traffic, emissions, noise, waste, wastewater or accidental events could indirectly affect people within or around the project area. Appropriate environmental and safety controls will therefore be required.
- **Changes in Local Socio-Economic Activity:** Increased employment and supporting commercial activities may influence existing patterns of economic activity around the project area. The magnitude of such changes cannot be quantified from the available project information and should therefore be monitored where relevant.

5.12.3. Mitigation Measures

- **Stakeholder and Community Communication:** Appropriate communication should be maintained with relevant stakeholders regarding project activities that could cause disturbance or affect surrounding areas. Effective engagement helps identify and address concerns associated with project implementation.
- **Traffic Management:** A systematic traffic-management approach should be followed for movement of personnel, raw materials and products. Vehicle scheduling, designated routes, speed control and appropriate traffic-safety measures should be implemented to minimize congestion and accident risks.
- **Employment and Skill Development:** Suitable training and skill-development programs should be maintained for project personnel to strengthen occupational competence and maximize the project's employment benefits.
- **Control of Environmental Nuisance:** Air emissions, noise, wastewater, solid waste and construction-related disturbance should be managed through the mitigation measures identified in the respective sections of the EIA.
- **Occupational and Community Safety:** Appropriate safety procedures, emergency preparedness, access control and traffic-safety measures should be implemented to minimize risks to employees and surrounding receptors.
- **Grievance and Complaint Management:** A suitable mechanism should be maintained for receiving, documenting and addressing relevant environmental or social complaints associated with project activities in a timely manner.

Overall, the proposed BOF project is expected to generate positive socio-economic benefits through direct and indirect employment, economic activity, technical skill development and strengthening of domestic production capability. Potential adverse impacts are mainly associated with increased traffic, localized disturbance, pressure on supporting services and environmental or safety concerns. With appropriate traffic management, stakeholder communication, environmental controls, occupational



safety and grievance-management measures, the adverse socio-economic impacts are expected to remain minor and manageable, while the positive benefits will continue throughout project operation.

5.13. Overland Drainage and Impact on Surface Water

5.13.1. Impact Origin

- **Altered Drainage Patterns:** Construction and operation of the industry can change natural drainage patterns, potentially leading to increased runoff and localized flooding.
- **Surface Water Pollution:** Increased runoff from the site, including pollutants such as oils, chemicals, and sediments, can contaminate nearby surface water bodies.
- **Erosion:** Construction activities and disturbed land can lead to soil erosion and sedimentation in local water sources.
- **Reduced Natural Absorption:** Impervious surfaces, such as pavements and building foundations, reduce natural water infiltration, increasing the volume and velocity of surface runoff.

5.13.2. Proposed Mitigation Measures

- **Stormwater Management Plan:** Implement a comprehensive stormwater management plan that includes the design of detention basins, retention ponds, and permeable surfaces to manage runoff and reduce peak flow rates.
- **Erosion Control:** Use erosion control measures, such as silt fences, sediment basins, and vegetation cover, to minimize soil erosion and sedimentation during and after construction.
- **Pollutant Management:** Implement best management practices (BMPs) to control and treat pollutants in runoff, including oil-water separators and regular maintenance of drainage systems.
- **Regular Monitoring:** Monitor surface water quality regularly to ensure that runoff and discharges comply with environmental regulations and do not adversely impact nearby water bodies.

5.13.3. Residual Impact

- **Managed Runoff:** Proper stormwater management and erosion control measures will minimize the residual impact on surface water quality and flooding.
- **Reduced Pollution:** Effective BMPs will reduce the potential for surface water contamination and maintain compliance with environmental standards.
- **Minimal Erosion:** Continued use of erosion control practices will limit soil erosion and sedimentation, preserving the health of local water bodies



5.14. Increase in Vehicular Traffic in The Area

5.14.1. Impact Origin

- **Increased Traffic Volume:** The establishment and operation of the industry will likely result in a significant increase in vehicular traffic due to staff commuting, and supply deliveries.
- **Congestion:** The influx of vehicles may lead to traffic congestion, particularly during peak hours, affecting local roadways and transportation efficiency.
- **Increased Emissions:** Higher traffic volumes can contribute to elevated levels of air pollutants, including particulate matter and greenhouse gases.
- **Parking Demand:** The increased number of vehicles will raise the demand for parking spaces, potentially leading to inadequate parking facilities and increased roadside parking.

5.14.2. Mitigation Measures

- **Traffic Management Plan:** Develop and implement a traffic management plan that includes strategies for managing peak traffic times, optimizing traffic flow, and reducing congestion around the industry.
- **Public Transport Options:** Encourage the use of public transportation and provide information on available transit options to reduce the number of private vehicles.
- **Parking Solutions:** Design and provide sufficient on-site parking facilities to accommodate the needs of employees, staff, and visitors, minimizing the need for roadside parking.
- **Emission Controls:** Promote the use of low-emission vehicles and consider implementing vehicle emission control measures to reduce the impact on air quality.

5.14.3. Residual Impact

- **Managed Traffic Flow:** With effective traffic management and parking solutions, congestion and traffic-related issues can be minimized.
- **Reduced Emissions:** Emission controls and promotion of public transport will help mitigate the impact on air quality.
- **Improved Accessibility:** Adequate parking and efficient traffic management will enhance accessibility to the industry while reducing potential negative effects on the local transportation network.

5.15. Impacts During Construction

5.15.1. Disruption of Earth Surface-Site Preparation and Clearing and Earthworks

5.15.1.1. Impact Origin

- **Land Disturbance:** Site preparation and clearing activities involve removing vegetation, topsoil, and altering the land surface, which can lead to soil erosion and sedimentation.



- **Soil Compaction:** Heavy machinery used for earthworks can compact the soil, affecting its permeability and potentially impacting groundwater recharge and soil fertility.
- **Erosion and Sedimentation:** Disturbance of the earth's surface increases the risk of erosion and sediment runoff into nearby water bodies, which can degrade water quality and harm aquatic habitats.
- **Habitat Destruction:** Clearing land for construction may destroy natural habitats and affect local flora and fauna, leading to potential biodiversity loss.

5.15.1.2. Mitigation Measures

- **Erosion Control Measures:** Implement erosion control practices such as silt fences, sediment basins, and vegetation cover to prevent soil erosion and manage sediment runoff.
- **Minimize Land Disturbance:** Limit the area of land disturbed at any one time and avoid unnecessary clearing of vegetation to reduce environmental impact.
- **Soil Management:** Use soil management techniques to reduce compaction, such as employing lighter machinery and maintaining soil quality through proper handling and storage practices.
- **Habitat Preservation:** Conduct pre-construction environmental assessments to identify and protect sensitive habitats and species. Implement measures to minimize habitat destruction and ensure the preservation of biodiversity.

5.15.1.3. Residual Impact

- **Controlled Erosion:** Erosion control measures will significantly reduce soil erosion and sedimentation, maintaining water quality and protecting aquatic ecosystems.
- **Managed Soil Quality:** Soil management practices will mitigate compaction effects, supporting groundwater recharge and maintaining soil health.
- **Minimized Habitat Impact:** By preserving critical habitats and minimizing land disturbance, the impacts on local flora and fauna will be reduced, supporting biodiversity conservation.

5.15.2. Impacts on Air Environment

5.15.2.1. Impact Origin

- **Dust Generation:** Construction activities such as excavation, grading, and demolition produce dust, which can lead to increased particulate matter in the air. This can impact air quality and cause respiratory issues for nearby residents.
- **Vehicle Emissions:** Construction vehicles and machinery, including trucks, bulldozers, and cranes, emit exhaust gases like nitrogen oxides (NOx), carbon monoxide (CO), and particulate matter (PM). These emissions contribute to air pollution and can degrade air quality in the surrounding area.
- **Machinery Emissions:** The operation of construction equipment, such as generators and compressors, releases pollutants and particulate matter, further impacting air quality.



- **Material Handling:** The transportation and handling of construction materials, such as sand, gravel, and cement, generate dust and particulate matter, contributing to airborne pollution.
- **Site Preparation:** Activities such as land clearing and soil disturbance can release dust and particulate matter into the atmosphere, affecting local air quality.

5.15.2.2. Mitigation measures

To address the impacts on the air environment during construction, the following mitigation measures should be implemented:

- **Dust Suppression:** Regularly apply water or dust suppressants to construction sites and unpaved roads to minimize airborne dust. Use soil stabilizers where appropriate to reduce dust emissions.
- **Road Maintenance:** Maintain construction and access roads in good condition by filling potholes and smoothing surfaces to prevent dust and reduce vehicle emissions.
- **Vehicle Management:** Enforce speed limits on construction and access roads to reduce dust generation. Ensure that construction vehicles are well-maintained and equipped with proper emission control devices.
- **Erosion Control:** Implement erosion control measures, such as silt fences and sediment barriers, to prevent soil erosion and reduce dust and particulate matter release.
- **Air Quality Monitoring:** Conduct regular air quality monitoring to assess dust and emission levels. Adjust mitigation strategies as necessary based on monitoring results.
- **Public Communication:** Keep local communities informed about construction activities, dust control measures, and any potential impacts on air quality to manage expectations and address concerns.

5.15.2.3. Residual Impact

Even with the implementation of mitigation measures, some residual impacts on the air environment may remain. These include:

- **Minor Dust Emissions:** Despite dust suppression efforts, there may still be occasional dust emissions from construction activities and unpaved surfaces.
- **Increased Vehicle Emissions:** Construction vehicles and machinery may continue to contribute to localized air pollution, though maintained and well-regulated vehicles will minimize this effect.
- **Temporary Air Quality Degradation:** Short-term increases in particulate matter and other pollutants may occur, particularly during peak construction periods or adverse weather conditions.



Overall, while mitigation measures will significantly reduce air quality impacts, occasional residual effects are expected. Regular monitoring and prompt adjustments to mitigation strategies will help manage and minimize these residual impacts

5.15.3. Gains to The Economy

5.15.3.1. During Operation Phase

i. Impact Origin

The operation phase of the Bangladesh Ordnance Factories (BOF) industry will bring several economic benefits, including:

- **Job Creation:** The industry will provide employment opportunities for a range of professionals, including staff, administrative personnel, maintenance workers, and support staff. This will reduce local unemployment and contribute to household incomes.
- **Boost to Local Economy:** Increased employment and industry operations will stimulate local businesses, including suppliers, vendors, and service providers. This can lead to the growth of ancillary businesses such as pharmacies, food outlets, and transport services, boosting the overall economic activity in the area.
- **Training and Development:** The industry will offer opportunities for training and skill development for professionals and other staff, enhancing the local workforce's expertise and increasing their employability.
- **Increased Property Values:** The establishment of BOF manufacturing plant can lead to an increase in property values in the surrounding area, as improved services and job opportunities make the area more attractive to residents and businesses

ii. Benefit Enhancement Measure

To amplify economic gains during the operation phase of the Bangladesh Ordnance Factories (BOF) industry, the following benefit enhancement measures will be implemented:

- **Local Employment:** Prioritize hiring local residents to fill both skilled and unskilled positions. This will provide job opportunities for the community, reduce unemployment, and support local economic growth.
- **Local Procurement:** Source materials, supplies, and services locally whenever possible. This approach will support local businesses, stimulate the local economy, and reduce supply chain disruptions.
- **Staff Training and Development:** Invest in regular training and professional development for industry staff. Enhanced skills will lead to better service quality, job satisfaction, and retention, while also contributing to the overall professionalism of the ammo manufacturing sector in Bangladesh.



- **Community Engagement Programs:** Establish initiatives that involve the community, such as health education programs, wellness workshops, and preventive health check-ups. These initiatives will improve public health awareness and create goodwill within the community.
- **Collaborative Partnerships:** Form partnerships with local educational institutions to provide internships, training, and research opportunities. This will not only enhance educational outcomes but also create a pipeline of qualified professionals for the industry.
- **Infrastructure Support:** Contribute to the development of local infrastructure, such as roads, public transport access, and utility services, which will benefit both the industry and the local community, improving accessibility and quality of life.

5.15.3.2. During Construction

i. Impact Origin

During the construction phase of the Bangladesh Ordnance Factories (BOF) industry, several economic benefits are anticipated, which include:

- **Job Creation:** The construction activities will generate direct employment opportunities for local workers, including engineers, architects, construction laborers, and support staff. This influx of employment will provide a boost to the local job market.
- **Local Business Opportunities:** The demand for construction materials, equipment, and services will benefit local suppliers and vendors, stimulating business for local hardware stores, equipment rental companies, and other service providers.
- **Increased Demand for Services:** Construction workers will require food, accommodation, and other amenities, leading to increased business for local restaurants, grocery stores, hotels, and transport services.
- **Skill Development:** The construction project will provide training and experience for local laborers and contractors, enhancing their skills and employability for future projects.
- **Boost to Local Economy:** The overall increase in economic activity due to the construction process will contribute to higher spending and circulation of money within the local economy, supporting overall economic growth and stability.

ii. Benefit Enhancement Measure

To maximize the economic gains during the construction phase of the Bangladesh Ordnance Factories (BOF) industry, the following benefit enhancement measures should be implemented:

- **Prioritize Local Hiring:** Establish policies that prioritize the hiring of local workers and contractors. This approach ensures that employment opportunities directly benefit the local community, boosting the local economy and fostering community support.
- **Support Local Businesses:** Encourage procurement of construction materials, equipment, and services from local suppliers and vendors. This not only stimulates the local market but also



reduces transportation costs and the environmental footprint associated with sourcing materials from distant locations.

- **Provide Training Programs:** Implement training programs for local workers to improve their skills in construction and related fields. This initiative will enhance the employability of the workforce, ensuring they gain valuable skills and experience that can be applied to future projects.
- **Engage with Community Stakeholders:** Maintain open communication with community leaders and stakeholders to understand their needs and concerns. By involving the community in the planning process, the project can be better aligned with local economic development goals, and any issues can be promptly addressed.
- **Encourage Local Entrepreneurship:** Support initiatives that promote local entrepreneurship, such as small business grants or partnerships with local startups, to provide services and products needed during construction. This can help build a more diverse and resilient local economy.
- **Monitor Economic Impact:** Regularly monitor and assess the economic impacts of the construction project to ensure that the benefits are being realized and to make adjustments as needed. This may involve conducting surveys or working with local economic development agencies to track economic indicators.

5.15.4. Job Opportunities

5.15.4.1. Impact Origin

The construction and operation phases of the Bangladesh Ordnance Factories (BOF) industry will create a significant number of job opportunities, contributing positively to local employment levels. During the construction phase, a wide range of positions will be available, including those for skilled labor, such as engineers, architects, and project managers, as well as unskilled labor for tasks such as site preparation, materials handling, and general construction work.

Once operational, the industry will provide employment opportunities for professionals, including technicians, as well as administrative, maintenance, and support staff.

5.15.4.2. Benefit Enhancement Measures

To maximize the job opportunities created by the project, the following measures should be implemented:

- **Local Employment Policies:** Develop and enforce policies that prioritize the hiring of local residents for both construction and operational roles. This approach will help ensure that the economic benefits of job creation remain within the local community.



- **Skills Training Programs:** Offer training and apprenticeship programs to equip local residents with the necessary skills for employment during both the construction and operational phases. This will enhance the employability of the local workforce and ensure a steady supply of qualified personnel.
- **Career Development Opportunities:** Provide ongoing career development and training opportunities for employees to advance within the organization. This can improve job satisfaction and retention rates while building a more skilled and capable workforce.
- **Fair Wage and Labor Practices:** Ensure that all employees, whether directly hired or contracted, receive fair wages and benefits. Adhering to ethical labor practices will foster a positive work environment and enhance the industry's reputation as an employer of choice.
- **Monitoring and Evaluation:** Regularly monitor employment levels and the effectiveness of training and development programs. Adjust strategies as needed to address gaps and optimize job creation and employee development.



Chapter Six: Environmental Management Plan (EMP)

6.1. General

The Environmental Management Plan (EMP) for the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory provides a systematic framework for managing the environmental impacts identified during the EIA and ensuring effective implementation of mitigation and monitoring measures throughout the construction and operational phases. The EMP is intended to minimize adverse impacts, enhance beneficial outcomes and ensure compliance with the applicable environmental requirements and Environmental Quality Standards (EQS) of Bangladesh. Considering BOF's arms and ammunition manufacturing activities, chemical and raw-material handling, wastewater generation, solid/process waste, air emissions, noise, occupational health and safety, and emergency risks, the EMP will particularly emphasize pollution prevention, resource efficiency, safe operation and continuous environmental monitoring.

1. **Mitigation Plan:** The mitigation plan will implement appropriate measures to avoid, minimize and control the adverse impacts identified for BOF. Particular attention will be given to wastewater treatment through the proposed 5 m³/hour ETP, waste management, air and noise control, chemical/material handling, occupational safety, drainage management and emergency preparedness.
2. **Enhancement Plan:** The enhancement plan will strengthen the beneficial environmental and socio-economic outcomes of the project. It will emphasize efficient use of water and energy, good housekeeping, greenbelt/plantation development, waste minimization and recycling, occupational skill development, employment benefits and continual improvement of environmental performance. The enhancement approach is intended to maximize positive project outcomes through green practices, employment and resource optimization.
3. **Monitoring Plan:** A systematic environmental monitoring program will be maintained to verify the effectiveness of mitigation measures and identify any deterioration in environmental performance. Monitoring will cover relevant parameters such as ambient air quality, noise, wastewater/treated-effluent quality, waste management, occupational health and safety, and performance of pollution-control facilities, with corrective measures undertaken where necessary.

The EMP will therefore serve as the principal environmental management mechanism for translating the findings and mitigation commitments of the EIA into practical actions during BOF's construction and operation. Effective implementation of the mitigation, enhancement and monitoring plans, supported by defined responsibilities, adequate resources, documentation and periodic review, will enable BOF to control significant environmental impacts and maintain environmentally responsible and



compliant project operation. The following specific management plans are integral to the overall EMP and are either already in place or will be activated during the project:

- **Occupational Health & Safety Management Plan (OHSMP):** Ensures the safety and well-being of all employees and stakeholders by adhering to best practices in occupational health and safety.
- **Emergency Response and Fire Management Plan (EFMP):** Prepares the industry to effectively manage emergencies, including fires, by establishing clear protocols and training programs.
- **Industry Waste Management Plan (HWMP):** Focuses on the proper disposal and treatment of wastewater and general waste generated by the industry to prevent environmental contamination.
- **Air Management Plan (AMP):** Aims to control and reduce air emissions from the industry, ensuring that air quality remains within acceptable limits.
- **Noise Management Plan (NMP):** Addresses noise pollution by implementing measures to minimize noise levels and their impact on the surrounding environment.

By implementing the EMP, the project will be able to reduce its environmental impact to levels that are acceptable under Bangladesh government regulations. Additionally, the EMP will enhance the project's positive effects, contributing to the overall well-being of the environment and the community. The proactive approach taken by Bangladesh Ordnance Factories (BOF) in developing and executing the EMP reflects its commitment to environmental responsibility and sustainability.

6.2. Occupational Health and Safety Management Plan

Occupational Health and Safety (OHS) is a major management priority for the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory because its activities involve production machinery, metallic materials, chemical handling, noise, electrical systems, material movement and specialized arms and ammunition manufacturing processes. BOF has approximately 2,125 permanent and temporary personnel; therefore, a structured OHS management system is required to prevent occupational injury and exposure, maintain safe working conditions and ensure preparedness for emergencies. The OHS plan will emphasize hazard identification, risk assessment, engineering controls, PPE, worker training, medical surveillance, emergency preparedness and continuous improvement.

6.2.1. Present Scenario and Future Implementation

As the available BOF project information does not provide detailed documentation of the existing OHS facilities, health records or current safety-management arrangements, these should be verified and



documented during project implementation. The OHS management system should incorporate the following measures:

- **Formation of Health and Safety Committee:** BOF should maintain a designated Health and Safety Committee/team responsible for planning, implementing, reviewing and improving workplace health and safety measures.
- **Pre-job Risk Assessment and Permit-to-Work:** Risk assessment should be undertaken before hazardous or non-routine work. Appropriate permit-to-work procedures should be applied for activities such as electrical maintenance, hot work, confined-space entry and other identified high-risk tasks.
- **Provision of Personal Protective Equipment (PPE):** Appropriate PPE—including safety helmets, gloves, goggles/face shields, protective clothing, safety footwear, respiratory protection and hearing protection—should be provided according to job-specific hazards. PPE provision and pre-job risk assessment are key elements of structured OHS implementation.
- **Chemical Safety Management:** Chemicals used in production should be properly labelled, stored and handled. Safety Data Sheets (SDS), appropriate containment and spill-control arrangements should be readily available, and relevant workers should receive chemical-safety training.
- **Machine and Electrical Safety:** Production machinery should have appropriate guards, interlocks and emergency-stop provisions where applicable. Electrical equipment should be periodically inspected and maintained by competent personnel.
- **Training and Awareness:** Workers should receive induction and periodic refresher training on workplace hazards, chemical handling, PPE, machinery safety, fire prevention, first aid and emergency-response procedures.
- **First Aid and Medical Support:** Adequately stocked first-aid facilities and trained first-aid personnel should be available at appropriate locations. Arrangements for prompt medical response and referral should also be established.
- **Inspection and Accident Reporting:** Routine workplace safety inspections should be conducted, while accidents, near misses and unsafe conditions should be documented, investigated and followed by corrective and preventive actions.

Implementation of these measures will provide a structured approach to reducing occupational risks and maintaining safe working conditions throughout BOF's operation.

6.2.2. Plan and Fund Allocation for Occupational Health & Safety (OHS)

BOF should maintain an OHS implementation plan supported by an adequate dedicated annual budget. The plan should prioritize higher-risk production and chemical-handling areas and provide sufficient



resources for PPE, safety equipment, training, medical surveillance, emergency preparedness, inspection and monitoring. A dedicated OHS budget is necessary to support continuous implementation rather than treating safety expenditure as an occasional activity.

Table 22: Indicative Fund Allocation for OHS

OHS Component	Major Provision	Fund Allocation
PPE and Worker Protection	Helmets, gloves, goggles/face shields, hearing protection, respiratory protection, protective clothing and safety footwear	8,00,000
OHS Training	Induction, chemical safety, machine safety, PPE, first aid and emergency-response training	3,50,000
Medical Surveillance	Pre-placement/periodic health examinations and occupational health monitoring	4,00,000
Safety & Emergency Equipment	First-aid equipment, spill-response materials, safety signs and other required protective facilities	2,50,000
Inspection and Monitoring	Workplace inspection, occupational exposure/noise monitoring, safety audits and corrective actions	2,00,000
Contingency Provision	Emergency response and incident-management requirements	2,00,000

6.2.3. Annual Report of Health Status of Workers (with Special Reference to OHS)

BOF will prepare and maintain an Annual Health Status Report for its workforce, with particular emphasis on occupational exposures and work-related health conditions. Such reporting provides a systematic basis for identifying occupational-health trends, evaluating the effectiveness of existing controls and implementing corrective measures.

- **Periodic Medical Examination:** Medical examinations should be conducted according to occupational risk, with particular attention to workers involved in chemical handling, production machinery, high-noise areas and other higher-risk operations.
- **Exposure-Oriented Health Monitoring:** Relevant health parameters should be selected according to actual workplace hazards. These may include hearing, respiratory condition, skin condition and general physical fitness, where applicable to the worker's exposure profile.
- **Occupational Incident Records:** The annual report should document workplace injuries, accidents, near misses, suspected occupational illnesses and health-related absenteeism, where applicable.
- **Evaluation of OHS Performance:** Health-surveillance findings should be reviewed together with workplace monitoring and incident records to determine whether existing control measures remain effective.



- **Corrective and Preventive Action:** Where occupational-health concerns are identified, BOF should investigate their causes and implement appropriate engineering, administrative, medical or PPE-related corrective measures.
- **Documentation and Confidentiality:** Occupational-health information should be systematically maintained while ensuring appropriate confidentiality of individual medical records. Required reports should be submitted to relevant authorities where applicable.

The Occupational Health and Safety Management Plan will be an integral component of BOF's EMP. Effective implementation of risk assessment, engineering controls, PPE, worker training, medical surveillance, emergency preparedness, dedicated financial resources and annual health-status evaluation will help minimize occupational risks and establish a systematic process for continuous improvement of workplace health and safety performance.

Table 23: Annual Health Monitoring Framework

Sl. No.	Health Parameter	Frequency	Responsible Authority	Remarks
1	General Health Check-up	Once per year	Company Doctor / Medical Team	Mandatory for all employees
2	Respiratory Health Test	Twice per year	Medical Specialist	For workers in chemical areas
3	Skin Examination	Twice per year	Medical Team	For chemical exposure monitoring
4	Hearing Test	Once per year	Authorized Lab	For workers in high-noise areas
5	Accident & Injury Record	Continuous	Safety Officer	Maintained and reviewed monthly
6	Occupational Disease Monitoring	Continuous	Medical Team	Immediate action if detected
7	Health Awareness Program	Quarterly	HR & Safety Department	Training and counseling

6.3. Emergency Response and Fire Management Plan (ERFMP)

An effective Emergency Response and Fire Management Plan (ERFMP) is essential for the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory because the facility will involve specialized production machinery, electrical installations, generators, metallic materials and chemicals used in ammunition, primer and detonator production. The plan will establish procedures for prevention, detection, communication, evacuation, firefighting and coordinated emergency



response. Considering the nature of BOF operations, fire and emergency preparedness should be maintained as a high-priority management function throughout construction and operation.

6.3.1. General

In the event of fire or other emergency at BOF, protection of personnel should receive the highest priority. The following general procedures should be followed:

- **Immediate Alarm and Notification:** Any person detecting a fire or emergency should immediately activate the alarm/communication system and inform the designated emergency-response personnel.
- **Initial Firefighting:** A small and controllable fire may be addressed using the appropriate portable extinguisher only by personnel who are trained and can do so safely. Untrained personnel should not attempt firefighting.
- **Immediate Evacuation:** If the fire cannot be safely controlled, smoke becomes hazardous, or there is potential for escalation, personnel should evacuate immediately through designated emergency routes.
- **Emergency Services:** Relevant internal and external emergency/fire-response services should be notified without delay. Evacuated personnel should proceed to designated assembly points and remain there until further instruction.
- **Personnel Accountability:** Responsible personnel should verify evacuation and account for workers at designated assembly points. No unauthorized person should re-enter the affected area until it has been declared safe.

These procedures are intended to protect personnel and ensure an organized and coordinated response during a fire or other emergency.

6.3.2. Types of Fire

There are five types of fire such as:

Fire Class	Typical Fire Source	BOF Relevance
Class A	Ordinary combustible materials such as wood, paper and plastics	Offices, packaging/storage and general-use areas
Class B	Flammable/combustible liquids	Areas where combustible liquids are stored or handled, if applicable
Class C	Energized electrical equipment, wiring and appliances	Production machinery, electrical panels, generators and utility installations
Class D	Combustible metals	Applicable only where combustible-metal hazards are identified in BOF processes/materials
Class E	Cooking oils and fats	Kitchen/canteen areas, where applicable



It is extremely important to choose the properly rated fire extinguisher for the class of fire that is burning.

		Ordinary Combustibles	Wood, Paper, Cloth, Etc.
		Flammable Liquids	Grease, Oil, Paint, Solvents
		Live Electrical Equipment	Electrical Panel, Motor, Wiring, Etc.
		Combustible Metal	Magnesium, Aluminum, Etc.
		Commercial Cooking Equipment	Cooking Oils, Animal Fats, Vegetable Oils

Figure 20: Pictorial view of different types of fire

6.3.3. Fire Safety Risk Assessment

A Fire Safety Risk Assessment should be undertaken systematically to identify potential fire hazards, persons at risk and appropriate preventive and protective measures. The assessment should be periodically reviewed and updated whenever significant changes are made to production processes, chemical storage, machinery, building layout or utility installations. The assessment process should include the following steps:

Table 24: Fire Safety Risk Assessment

FIRE RISK ASSESSMENT	
1	Identify fire hazards Identify: Sources of Ignition Sources of Fuel Sources of Oxygen
2	Identify People at Risk Identify: People in and around the premises People especially at Risk
3	Evaluate, Remove, Reduce, and Protect from Risk Evaluate the risk to people from fire Remove or Reduce the Risks to people Detection and warning Fire-fighting Escape routes



	Lighting Signs and notices Maintenance
4	Record, Plan, Inform, Instruct and Train Record significant findings and action taken Prepare an emergency plan Inform and instruct relevant people co-operate and co-ordinate with others Provide training
5	Review Keep assessment under review Revise where necessary

Source: Project Paper, IDM, KUET

Beyond the above measures, the project also has full provision for firefighting equipment in each area and first aid medical services. Though there might not be a serious threat of fire in the industry, the possibility still exists. Adequate precautionary measures should be taken to prevent that and also to combat a situation of fire need to be taken. The project is equipped with firefighting equipment such as a water sprayer, fire extinguisher, sand etc. Adequate first aid medical facilities should be provided in the project too.

6.3.4. Measures for Emergency Response and Fire Management

BOF should establish appropriate engineering, administrative and emergency-response measures based on the hazards identified through the fire-risk assessment.

- **Fire Detection and Alarm System:** Suitable fire detection, alarm and emergency communication systems should be installed at appropriate locations and maintained in functional condition.
- **Firefighting Facilities:** Adequate numbers and appropriate types of fire extinguishers, fire-water lines, hose arrangements and other required firefighting facilities should be provided according to the identified fire hazards. Comprehensive firefighting facilities and emergency training are important elements of fire management.
- **Emergency Evacuation Plan:** BOF should maintain a documented evacuation plan identifying emergency exits, escape routes, assembly points, responsible personnel and communication procedures.
- **Emergency Exits and Escape Routes:** Emergency exits and escape routes should be clearly marked, adequately illuminated and kept unobstructed at all times.
- **First-Aid Facilities:** Adequate first-aid facilities, trained first-aid personnel and arrangements for emergency medical response should be available within the project premises.
- **PPE and Emergency Equipment:** Suitable PPE and specialized emergency-response equipment should be provided to designated personnel according to the hazards associated with their duties.



- **Emergency Response Team:** Appropriately trained personnel should be designated for firefighting, evacuation, first aid, communication and other emergency-response responsibilities.
- **Chemical Emergency Management:** Appropriate containment and spill-response arrangements should be maintained in areas where chemicals are stored or handled. Chemical-specific emergency information should be readily accessible.
- **Inspection and Maintenance:** Fire extinguishers, alarms, electrical systems, emergency lighting, exits and other emergency facilities should be periodically inspected, tested and maintained.

6.3.5. Proposed Future Measures

To strengthen BOF's emergency preparedness and fire-management system, the following measures should be incorporated into future implementation:

- **Clearly Marked Evacuation Routes:** All emergency escape routes, stairways, exits and assembly points should be clearly identified with visible safety signs.
- **Unobstructed Emergency Access:** Emergency exits and evacuation routes should remain free from stored materials, equipment and other obstructions at all times.
- **Emergency Lighting:** Sufficient emergency lighting should be maintained along evacuation routes and exits to ensure visibility during power failure or smoke-related low-visibility conditions.
- **Regular Fire and Evacuation Drills:** Fire and evacuation drills should be conducted periodically so that workers understand alarm signals, escape routes, assembly points and their emergency responsibilities.
- **Routine Electrical Inspection:** Electrical wiring, cables, panels and connections should be periodically inspected and defective components corrected promptly to minimize electrical fire hazards.
- **Periodic Fire-Safety Audit:** Fire-protection systems, chemical/material storage, evacuation arrangements and emergency preparedness should be periodically audited and corrective actions documented.
- **Emergency Contact and Communication System:** Updated emergency contact information and communication procedures should be displayed at appropriate locations and made available to responsible personnel.
- **Review and Updating of ERFMP:** The ERFMP should be reviewed following significant process/layout changes, major incidents or emergency drills and updated where weaknesses or new hazards are identified.



The Emergency Response and Fire Management Plan will function as an integrated prevention, preparedness, response and recovery system for BOF. Considering the specialized nature of arms and ammunition manufacturing, the effectiveness of the plan will depend on process-specific fire-risk assessment, appropriate firefighting systems, trained emergency personnel, clear evacuation arrangements, routine inspection and maintenance, and regular emergency drills. These measures will substantially reduce the likelihood and consequences of fire and other emergency incidents during BOF operation.

6.4. Industry Waste Management Plan

The Industry Waste Management Plan for the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory is intended to ensure systematic management of solid waste, liquid waste and air emissions generated during project operation. The plan emphasizes waste minimization, segregation at source, appropriate collection and storage, treatment, recycling/recovery where feasible, environmentally sound disposal and pollution monitoring. This approach is intended to prevent secondary contamination and protect environmental quality. For BOF, particular attention is required for packaging waste, process-related waste, chemical-contaminated waste, ETP sludge and wastewater, as well as potential air emissions from production and utility operations.

6.4.1. Waste Treatment and Disposal Plan for Solid & Liquid Waste

BOF will implement a structured waste treatment and disposal system to ensure that wastes are managed according to their physical and chemical characteristics. The available project information specifically identifies cartons and boxes as solid waste and approximately 36 m³/day of wastewater, with a proposed 5 m³/hour (40 m³/day) chemical-treatment ETP. Other process-specific wastes should be identified and characterized during operation before determining their final management route.

The total management plan of industry waste is given in the following schematic diagram:

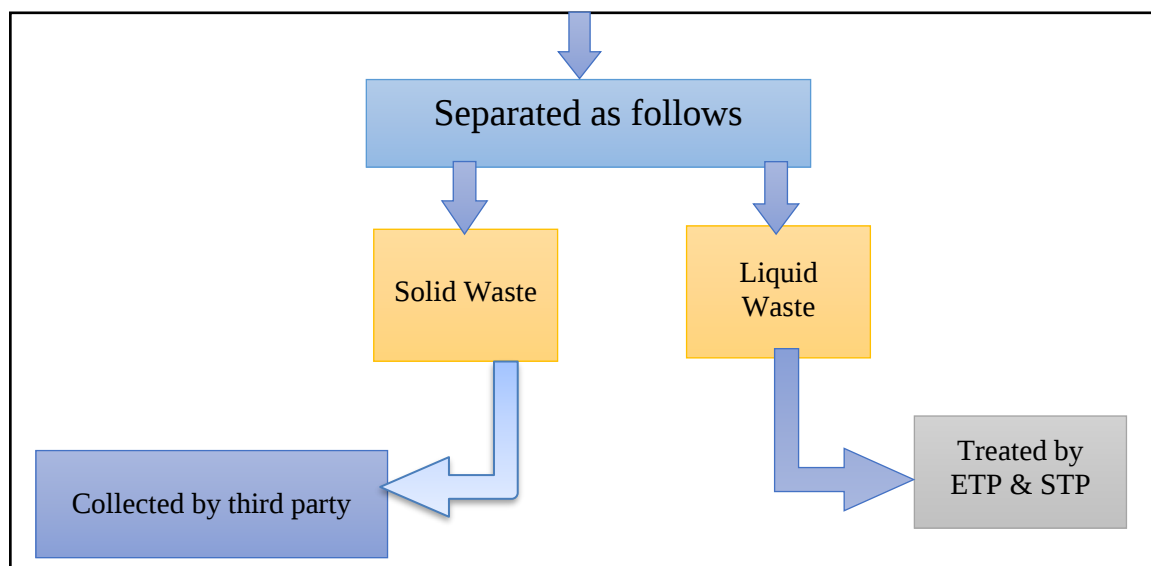


Figure 21: The proposed Waste Management plan of the Industry

The following table gives a summary of the total industry waste management system.

Table 25: Waste Management Plan of Bangladesh Ordnance Factories (BOF).

Sl. No.	Type of Waste	Management Plan
1	Process-related solid waste	Segregated at source and collected in designated containers; managed through controlled handling and disposed of via approved methods to prevent contamination.
2	Packaging waste (paper, plastic, cardboard)	Collected separately; recyclable materials sent to authorized recyclers, while non-recyclable residues are disposed of through approved waste handlers.
3	Maintenance and utility waste	Includes scrap materials, used filters, and containers; stored safely and disposed of following regulatory guidelines to avoid soil and water pollution.
4	ETP & STP sludge	Dewatered and dried within the ETP system; stored securely and disposed of in compliance with environmental regulations to prevent secondary pollution.
5	Domestic and office solid waste	Segregated into biodegradable and non-biodegradable fractions; collected daily and disposed of through municipal or licensed waste management services.
6	Process wastewater	Treated in the on-site Effluent Treatment Plant (ETP) using physico-chemical and biological processes; treated water reused for non-potable purposes.
7	Domestic sewage	Managed through Sewage Treatment Plant (STP); treated and discharged in accordance with applicable DoE standards.



Sl. No.	Type of Waste	Management Plan
8	Liquid chemical waste	Neutralized or diluted as per safety guidelines prior to disposal through approved drainage systems.
9	Used oil and lubricants	Collected in leak-proof containers and handed over to authorized recyclers or disposal agencies.
10	Hazardous waste	Stored in labeled containers and disposed of through licensed hazardous waste handlers following regulatory requirements.

6.4.2. Air Pollution Management Plan

Potential air emissions from BOF may arise from production and material-handling activities, standby generator operation, vehicular movement and associated utility activities. BOF has seven generators comprising four 1,000 kVA units, two 1,500 kVA units and one 1,250 kVA unit. Appropriate source controls and preventive maintenance will therefore be necessary to maintain acceptable ambient and workplace air quality. Bangladesh Ordnance Factories (BOF) implements the following measures:

- 1. Use of Low-Emission Gas Burners:** The canteen and kitchen will utilize gas burners, which are known for their low emissions compared to other types of fuel. Regular maintenance of these burners ensures efficient combustion and minimal emission of harmful gases.
- 2. Generator Emission Control:** Generators used for power backup will be fitted with proper exhaust systems to minimize smoke emissions. Regular maintenance and timely servicing of generators help to ensure they operate efficiently, thereby reducing their impact on air quality.
- 3. Regular Cleaning and Maintenance:**
 - Floors and common areas will regularly be washed and cleaned to reduce the spread of odors and minimize dust accumulation.
 - This practice will help to maintain a clean environment and reduce potential air quality issues caused by dust and debris.
- 4. Vehicle Management:** Efficient management of transportation facilities will be in place to minimize emissions from vehicles. This will include the regular maintenance of industry vehicles to ensure they comply with emission standards, thereby reducing their impact on air quality.
- 5. Greenery and Vegetation:** The industry premises will feature greenery and vegetation that help absorb dust particles and reduce the amount of airborne dust. This natural barrier will play a significant role in maintaining clean air within the facility.
- 6. Regular Water Sprinkling:** To further reduce dust levels, water sprinkling is conducted regularly around the premises. This practice helps to settle dust on surfaces and prevents it from becoming airborne, contributing to improved air quality.



7. **Odor Control Measures:** Proper waste management and ventilation systems will be in place to prevent the accumulation and spread of odors, particularly in areas like the canteen and kitchen.

By implementing these measures, Bangladesh Ordnance Factories (BOF) ensures compliance with air quality standards and minimizes the potential for air pollution, thereby safeguarding the health and well-being of its employees, staff, and visitors

6.5.Noise Management Plan

At Bangladesh Ordnance Factories (BOF), the noise levels will be monitored to ensure they comply with the Environmental Conservation Rules (ECR), 2023, and are currently around 60 dBA. The following Noise Management Plan outlines the strategies to manage and minimize noise pollution effectively.

Sources of Possible Noise Pollution:

1. **Generators:** Used for power backup and can emit significant noise.
2. **Kitchen and Canteen Areas:** Equipment such as exhaust fans, dishwashers, and cooking appliances generate noise.
3. **Transportation Facilities:** Vehicles and transportation equipment contribute to noise levels.
4. **General Industry Operations:** Includes manufacturing equipment, staff activities, and employee interactions.

Mitigation Measures:

1. **Generator Management**
 - **Enclosure:** The generator room will be fully enclosed to contain and reduce noise emissions.
 - **Protective Gear:** Staff working in the generator room will be provided with earplugs as necessary.
 - **Low-Noise Equipment:** Utilization of a modern generator designed to produce minimal noise.
2. **Kitchen and Canteen Areas**
 - **Regular Maintenance:** Ensure all kitchen equipment will be well-maintained to reduce noise.
 - **Noise Barriers:** Install noise-absorbing materials around high-noise equipment.
3. **Transportation Facilities**
 - **Vehicle Management:** Implement schedules and maintenance checks to ensure vehicles operate quietly.



- **Parking Area:** Designate areas for vehicle idling and loading/unloading to minimize noise impact on sensitive areas.

4. General Industry Operations

- **Noise Protection:** Use noise protection materials in areas prone to high noise levels.
- **Door and Window Management:** Keep doors and windows closed when not in use to prevent external noise from entering.

5. Additional Measures

- **Regular Monitoring:** Conduct periodic noise level assessments to ensure compliance with ECR standards.
- **Staff Training:** Educate staff about noise reduction practices and the importance of maintaining a quiet environment.

By implementing these measures, Bangladesh Ordnance Factories (BOF) aims to effectively manage and reduce noise pollution, thereby enhancing the comfort and well-being of both staff and employees.

6.6. Other Environmental Management Plan

6.6.1. Disaster Management Plan

To ensure comprehensive emergency preparedness and response, Bangladesh Ordnance Factories (BOF) has established a Disaster Management Program. This program encompasses training for staff and volunteers, installation and maintenance of emergency equipment, and the establishment of a command center. The following sections outline the strategies and measures in place to mitigate disaster risks.

6.6.1.1. Objectives

- **Enhance Preparedness:** Equip staff and volunteers with the skills and knowledge needed for effective emergency response.
- **Reduce Risk:** Implement measures to minimize risks associated with potential disasters.
- **Ensure Continuity:** Maintain industry operations and safety during and after emergencies.
- **Promote Awareness:** Foster a culture of safety and preparedness among staff and the community.

6.6.1.2. Current Measures to Reduce Disaster Risk

1. Building Design and Infrastructure

- **Structural Integrity:** The industry's well-designed building reduces the risk of collapse.



- **Land Improvement:** Measures have been taken to reduce water logging and flooding in the industry area.
- **Electrical Safety:** Good electrical wiring practices have minimized the risk of electrical incidents.
- **Engineering Expertise:** Recruitment of qualified engineers contributes to reducing disaster risks.
- **Firefighting Measures:** Installed firefighting equipment supports the mitigation of fire risks.

6.6.1.3. Future Measures to Further Reduce Disaster Risk

1. Fire Risk Assessment

- **Regular Assessments:** Conduct a comprehensive fire risk assessment annually, following the guidelines in Table 6.1.

2. Fire Drills and Training

- **Drills:** Execute at least two fire drills annually involving firefighters, security personnel, the compliance team, and support from the district fire service and civil defense.
- **Training:** Provide disaster risk reduction training for campus staff and students.

3. Disaster Management Team

- **Formation:** Establish a dedicated disaster management team responsible for overseeing preparedness and response efforts.

4. Seasonal Monitoring

- **Seasonal Vigilance:** Monitor weather conditions closely during the monsoon and cyclone seasons, and prepare for potential impacts.

5. Awareness and Education

- **Community Awareness:** Implement awareness programs for students and staff to increase understanding of disaster risks and preparedness strategies.
- **Training Programs:** Conduct disaster risk reduction training sessions for all campus members.

6.6.1.4. Implementation and Review

- **Training and Equipment:** Ensure ongoing training for all staff and volunteers, and regularly inspect and maintain emergency equipment.
- **Command Center:** Operate a command center to coordinate emergency response activities effectively.
- **Plan Review:** Regularly review and update the Disaster Management Plan based on new risks, lessons learned from drills, and feedback from staff.



Bangladesh Ordnance Factories (BOF) is committed to maintaining a robust Disaster Management Plan to safeguard the well-being of employees, staff, and visitors while ensuring the continuity of industry operations during emergencies.

6.7. Sequential Elements of Environmental Management Plan

The Environmental Management Plan (EMP) for Bangladesh Ordnance Factories (BOF) follows a structured approach to ensure effective management of environmental impacts throughout the project lifecycle. The EMP process comprises three sequential elements:

1. Identification of Impacts

- **Positive and Negative Impacts:** Identify all potential impacts, both positive and negative, on the natural and human environment resulting from the industry's operations and infrastructure. This includes impacts on air quality, water resources, noise levels, solid waste, and community health.

2. Evaluation and Assessment of Impacts

- **Quantification and Analysis:** Evaluate and quantify the identified impacts to understand their significance. This includes assessing impacts relative to baseline conditions and understanding how they affect various aspects of the environment and community. The assessment helps in understanding the extent of impacts and the need for mitigation.

3. Preparation and Implementation of Management Plans

- **Mitigation and Protection Measures:** Develop and implement management plans designed to reduce or offset the potentially significant negative impacts of the industry operations to acceptable levels. These plans may include modifications to project design, implementation of specific environmental protection measures, and adoption of project alternatives that minimize adverse effects.

Monitoring and Review

- **Monitoring Plan:** Include a monitoring plan to track the effectiveness of the mitigation measures. Regular monitoring ensures that the environmental protection measures are functioning as intended and allows for adjustments as needed based on observed performance and environmental changes.
- **Review Process:** Periodically review the EMP to address any new environmental concerns or changes in project operations. This ongoing review helps in maintaining compliance with environmental standards and adapting to evolving environmental conditions.

Bangladesh Ordnance Factories (BOF) is committed to integrating these sequential elements into its Environmental Management Plan to promote environmental sustainability, ensure regulatory



compliance, and enhance the overall impact of the industry's operations on the community and environment.



Table 26: Environmental Management Action Plan for Operation Phases

Environmental Impact	Mitigation Measures	Time Frame	Location	Responsibility
Air pollution	➤ Provide adequate ventilation and exhaust fan in the workplace; ➤ Maintain open air exhaust for generator and set catalytic converter and faulty engine would be repaired as soon as possible; ➤ Plant tree near the boundary line or in the green area; ➤ Monitoring Air every 06 Months;	Throughout Operation phase	Project site	Representative of project proponent
Water pollution	➤ Per day, 38 cubic meters of wastewater are generated during industry operations, and Waste water is treated by Effluent Treatment Plant. After treatment, the water is reused, and excess treated water is discharged through the drainage system.	Throughout Operation phase	Project site	Representative of project proponent
Solid waste	➤ Apply the 3R method for waste management of the project (per day waste produces around 4-5 KG); ➤ Trained employees on waste control and disposal procedures; ➤ Segregates wastes at source and stores in demarcated places and disposes of them.	Throughout Operation phase	Project site	Representative of project proponent
Noise and Vibration	➤ Air plugs will be provided to workers while near to noise generating equipment or working in noise areas; ➤ Procure and use low noise generating machinery; ➤ Conduct periodic maintenance of equipment, replace worn-out parts, lubricate rotating parts;	Throughout Operation phase	Project site	Representative of project proponent



Environmental Impact	Mitigation Measures	Time Frame	Location	Responsibility
	➤ Will procure noise monitoring device and monitor noise conditions in and outside the project premises; ➤ Monitoring noise condition every 06 months;			
Impact on soil or land	➤ Maintain Cleanliness of the Industry and store solid waste in waste collection bin; ➤ Green belt development for enhancing the natural aesthetic of the site;	Throughout Operation phase	Project site	Representative of project proponent
Impact on traffic volume	➤ Control vehicle movement in an organized way and follow local traffic instructions;	Throughout Operation phase	Project site	Representative of project proponent
Fire/Explosion	➤ Explosion does not apply to the said project; ➤ Establish own firefighting system and maintain collaboration with government firefighting and civil defense departments locally; ➤ Organize fire drills and training for construction staff;	Throughout Operation phase	Project site	Representative of project proponent
Occupational health and safety risk	➤ Conduct job safety analysis; ➤ Use of personal protective equipment such as hard helmet, musk, boot, general glass, etc.; ➤ Aware and train employees on using safety devices;	Throughout Operation phase	Project site	Representative of project proponent
Statutory requirements	➤ Meet all statutory requirements with DoE within the time frame;	Throughout Operation phase	Project site	Representative of project proponent



Table 27: Environmental Management Action Plan

Issue/Concern	Potential Negative Environmental Impacts	Mitigation Measures	Environmental Monitoring	Responsible Actors	Time Frame
Water Pollution	- Surface and groundwater pollution -Occupational illness	- Wastewater is treated by Effluent Treatment Plant. - Water recycling	-Monitoring of water quality	-Authority & workers - Health and safety officer	- monitoring half-yearly
Solid waste	- Air, water, and soil pollution -Poorly disposed waste may block drainage	- Proper solid waste management system - Solid waste collection, storage, and transportation system - Awareness and training campaign	- Regular monitoring of the solid waste management facilities	-Authority & workers - Health and safety officer - Prism Bangladesh Foundation	-Must be kept daily register for solid waste - Quarterly reporting



Issue/Concern	Potential Negative Environmental Impacts	Mitigation Measures	Environmental Monitoring	Responsible Actors	Time Frame
Air Pollution	- Deterioration of indoor air quality -Occupational illness/health impact	- Proper stack height for the generator -Regular maintenance of Generators -Use of PPE	-Negligible amount of gaseous from generator (250 kVA) -Monitoring of Air Quality	-Authority & workers - Health and safety officer	- monitoring half-yearly
Noise Pollution	- Hearing loss -Reduced productivity and efficiency -Fatigue, headache, nervousness, irritability, and high pretension resulting in accidents at the workplace	- Implementation of an effective noise control and hearing conservation program -Noise measurement -Providing suitable hearing protection to all workers -Training of workers	-Determine Noise levels from time to time -Negligible sound produced by generator	-Authority & workers - Health and safety officer - Neighbors and - The General Public	- Half yearly Noise level monitoring



Issue/Concern	Potential Negative Environmental Impacts	Mitigation Measures	Environmental Monitoring	Responsible Actors	Time Frame
Occupational hazards	- Injury to employees on site -Injury to visitors - Reduced productivity - Plant and equipment damage -Negative corporate image	- Good and sound housekeeping practices -Provision of appropriate working tools and equipment -Use of PPE -Timely repair and maintenance of equipment -Employee training -Use appropriate elevators and other machinery	-Accident and incident records -Record of employee training	-Authority & workers - Health and safety officer	- The mitigation measures proposed should be put in alongside project implementation and daily operations, continuously improved on and sustained throughout the operation life of the industry.



Chapter Seven: Environmental Management Policy & Monitoring Plan

7.1. Issues of Environmental Management Policy

7.1.1. Issues of Environmental Management Policy

Bangladesh Ordnance Factories (BOF) is committed to implementing a robust environmental policy for its facilities. This policy will be periodically reviewed and enhanced to ensure that all operations adhere to high standards of environmental responsibility and sustainable resource utilization. The policy will address the following key areas:

- **Compliance with Legislation:** Ensure all activities comply with relevant national environmental regulations and standards.
- **Continuous Improvement:** Promote ongoing environmental enhancement and superior performance through rigorous monitoring and evaluation of industry operations.
- **Resource Utilization:** Optimize the use of natural resources while implementing measures for conservation and preservation to ensure their availability for future generations.
- **Balanced Approach:** Achieve a harmonious balance between natural resource use, environmental conservation, and economic development.

To support these goals, the environmental stewardship program will entail both management responsibilities and individual employee obligations. To achieve the program's objectives, the following actions will be implemented:

- **EHSMS Maintenance:** Continuously maintain and improve the organization's Environment, Health, and Safety Management System (EHSMS).
- **Employee Training:** Provide appropriate training to all employees to fulfill their environmental responsibilities within the EHSMS framework.
- **Objectives and Targets:** Establish annual environmental objectives and targets and implement programs to meet them.
- **Legal Compliance:** Ensure compliance with relevant legal and other environmental requirements.
- **Resource Allocation:** Ensure Bangladesh Ordnance Factories (BOF) has the necessary resources and skills to meet its environmental commitments.
- **Performance Appraisal:** Incorporate environmental performance into the annual appraisal of employees and contractors and provide recognition accordingly.
- **Monitoring and Reporting:** Conduct formal monitoring, auditing, and review of environmental performance and EHSMS requirements, and report annually on progress against defined objectives.



7.1.2. Occupational Health and Safety Policy

Bangladesh Ordnance Factories (BOF) is dedicated to establishing a comprehensive Occupational Health and Safety (OHS) Policy as part of its broader environmental policy framework. This policy will be regularly reviewed and updated as necessary to ensure it addresses the health, safety, and welfare of all employees and meets the local community's health needs. The policy will encompass the following key areas:

- **Safety Measures:** Implement and maintain safety protocols for all machinery and equipment used within the facility.
- **Emergency Procedures:** Develop and enforce emergency procedures and actions to minimize risks and manage accidental damage to employees, the community, and the environment.
- **Training and Maintenance:** Ensure proper machinery maintenance and provide proficiency training for operators to address safety concerns effectively.
- **Personal Protective Equipment (PPE):** Ensure appropriate PPE is available and used for all staff members.

To promote best practices in health and safety management, the following actions will be undertaken:

- **EHSMS Improvement:** Continuously maintain and enhance the organization's Environment, Health, and Safety Management System (EHSMS).
- **Health and Safety Focus:** Balance efforts between managing health and well-being, personnel, and process safety.
- **Hazard Identification:** Actively identify hazards and manage risks as low as reasonably practicable.
- **Employee Engagement:** Encourage active participation and consultation with employees regarding their own and others' health, well-being, and safety.
- **Resource Allocation:** Provide the necessary resources to support a systematic approach to health, safety, and process management, ensuring continuous performance improvement.
- **Performance Measures:** Establish performance metrics, set improvement targets, and measure and report performance at all organizational levels.
- **Legal Compliance:** Ensure compliance with all relevant legal and regulatory requirements.
- **Safety Culture:** Foster a culture where employees remain vigilant about safety hazards and integrate health and safety performance into employee appraisals, recognizing and rewarding adherence to safety practices.



7.1.3. Local Community Policy

Bangladesh Ordnance Factories (BOF) is committed to fostering strong relationships with both its employees and the local community based on mutual respect and active partnership. The Local Community Policy will focus on:

- **Collaboration:** Working closely with local communities, government departments, and relevant agencies to support sustainable community development.
- **Communication:** Enhancing the flow of information between management, employees, and the community to ensure transparency and effective engagement.
- **Capacity Building:** Actively involving the local community in industry activities and decision-making processes to build community capacity and engagement.

7.1.4. Pollution Control Policy

Bangladesh Ordnance Factories (BOF)'s Pollution Control Policy is derived from the comprehensive Environmental Management Plan (EMP) and is designed to prevent and manage pollution effectively. The policy includes:

- **Pollution Prevention:** Ensuring that industry operations do not result in pollution of the premises or surrounding areas.
- **Waste Management:** Implementing proper measures for pollution control, including:
 - **Liquid Waste:** Treating liquid waste using a properly designed effluent treatment plant.
 - **Gaseous Effluents:** Managing incinerator emissions by passing them through water, with subsequent treatment of this water.
 - **Solid Waste:** Preventing open dumping and ensuring safe disposal.
 - **Sharp Waste:** Storing sharp waste in a reinforced concrete container (RCC tank).
- **Environmental Safety:** Taking all necessary steps to ensure a safe and clean environment in accordance with the policy.

7.2. Environmental Monitoring Plan

Monitoring is an essential part of EMP. Monitoring makes it easy to understand whether the recommended mitigation/enhancement measures are working well or not. Under this monitoring plan, different types of monitoring works, such as Water Pollution, Air Pollution, Noise pollution, etc., will be monitored periodically to measure the pollution level of specified locations within the project and the surrounding area.



7.2.1. Monitoring Parameters and Frequency

According to the monitoring data, improvements and further mitigation measures may be needed for more effective maintenance and control of pollution levels within the government-recommended level. The monitoring will be conducted as per the following table.

Table 28: Monitoring Parameters and Frequency

Issue	Location of Monitoring	Parameters	Monitoring Frequency	Duty Unit /Persons
Solid waste Generation	Every Floor /Premises etc.	-	Daily	Based on discussion and the Management department
Wastewater discharge	ETP inlet & outlet, Drain.	pH, BOD, COD, Temp., TSS, etc.	Every Three Months	
Stack Emissions & Ambient air quality	Air pollutant emission points like generator room, Incinerator, and Around the Industry site.	Not mandatory	Not mandatory	
Generation of Hazardous waste	Production area, chemical storeroom	Chemicals sample, igneous, Sharp metal, etc.	Daily	
Workplace Environment	Industry Premises	Light, Air, Sound, Temperature, Moisture content, etc.	Once in every three months	
Noise Level	Industry Premises	Noise at different locations day and night	Once in every three months	
Drinking water Quality	Drinking water outlet	pH, Total Alkalinity Total Hardness TDS, As, Fe, Chloride (Cl-), Fecal & Total Coliform	Once in six months	



Chapter Eight: Analysis of Alternatives

Analysis of alternatives is an important component of the EIA for the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory at Gazipur Cantonment, Gazipur. The assessment considers the implications of the Do Nothing Alternative, Alternative Land Use and Alternative Land Site in relation to project objectives, environmental impacts, land suitability, infrastructure requirements, economic considerations and operational requirements. The purpose is to determine whether proceeding with the proposed BOF development at the selected 135.87-acre project area represents an appropriate option while ensuring that identified environmental impacts are controlled through the proposed mitigation and management measures.

8.1. Do Nothing

The Do Nothing Alternative represents the scenario in which the proposed BOF Arms & Ammunition Production Factory is not developed. This alternative would avoid the environmental disturbances directly associated with construction and subsequent operation of the proposed facilities. The alternative-analysis framework considers both the avoided environmental impacts and the benefits that would be forgone if a proposed development were not implemented.

- **Avoidance of Construction Impacts:** No site preparation, excavation, building construction or associated construction activities would occur. Consequently, temporary impacts such as dust, construction noise, soil disturbance, construction waste and additional construction traffic would be avoided.
- **Avoidance of Operational Environmental Impacts:** The project-specific wastewater, solid/process waste, generator emissions, operational noise, resource consumption and other environmental impacts associated with the proposed production facilities would not arise.
- **Loss of Proposed Production Capacity:** The planned production facilities for Assault Rifles, SAA, Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortars/Bombs would not be established under this alternative.
- **Loss of Employment and Economic Benefits:** Employment and associated economic benefits attributable to the proposed facility would not materialize. The available BOF information indicates approximately 2,125 permanent and temporary personnel associated with the project.
- **Overall Consideration:** Although this option would avoid additional project-related environmental impacts, it would also prevent realization of the intended industrial and production objectives of the proposed development.

Therefore, the Do Nothing Alternative provides an environmental advantage by avoiding new impacts, but it does not fulfill the stated purpose of establishing the proposed BOF arms and ammunition production facilities.



8.2. Alternative Land Use

The Alternative Land Use option considers utilizing the designated BOF project area for purposes other than the proposed arms and ammunition production facilities. Alternative uses could potentially result in different environmental, infrastructure and socio-economic outcomes depending on the nature and intensity of development. The environmental consequences of alternative land use may therefore range from relatively low-impact development to other forms of development with their own pollution and resource requirements.

- **Alternative Development Opportunities:** The project land could theoretically be allocated to other institutional, infrastructure, open-space or compatible development purposes. The actual benefits would depend on the selected alternative use.
- **Environmental Implications:** A lower-intensity land use could potentially reduce wastewater generation, emissions, industrial noise and process-related waste. Conversely, another intensive development could introduce different environmental impacts requiring separate assessment.
- **Loss of BOF Production Objective:** Alternative utilization of the designated land would not provide the planned manufacturing facilities for the identified arms and ammunition products and would therefore not achieve the principal purpose of the proposed project.
- **Infrastructure Implications:** The utilities, buildings, internal infrastructure and environmental-management systems planned specifically for BOF production would need to be reconsidered or redesigned according to the alternative land use.
- **Economic and Operational Consideration:** Although an alternative land use might provide different benefits, those benefits would have to be weighed against the loss of the intended BOF production capacity and associated employment and technical-development opportunities.

Accordingly, alternative land use may offer different environmental or socio-economic benefits, but it would not satisfy the stated objectives of the proposed BOF project.

8.3. Alternative Land Site

The Alternative Land Site option considers relocation of the proposed project from the selected site at Gazipur Cantonment to another suitable location. Any alternative site would need to be assessed considering accessibility, land availability, environmental sensitivity, construction suitability, utilities, transportation, safety and other project-specific requirements. Relocation may potentially reduce particular site-specific impacts, but it may also introduce additional costs, delays and environmental impacts at the new location.



- **Environmental Suitability:** A new site could potentially provide environmental advantages if it has lower receptor sensitivity or more favorable physical conditions. However, these benefits cannot be assumed without conducting site-specific baseline and environmental assessment.
- **Land Requirement:** The proposed BOF project occupies approximately 135.87 acres. Any alternative location would therefore need to provide sufficient suitable land for production facilities, utilities, internal infrastructure, environmental-management systems and required supporting facilities.
- **Utility Availability:** The alternative site would need adequate water and electricity arrangements. BOF's documented requirements include approximately 40 m³/day of water and electricity supply from REB, together with standby generator facilities.
- **Wastewater and Drainage Considerations:** A new site would require appropriate wastewater treatment and environmentally acceptable drainage/discharge arrangements. The current proposal includes a 5 m³/hour (40 m³/day) chemical-treatment ETP for approximately 36 m³/day of wastewater.
- **Additional Cost and Delay:** Relocation could require new land development, site preparation, infrastructure planning, environmental investigations and regulatory procedures, potentially increasing project cost and implementation time. Such additional cost and delay are important considerations when assessing an alternative site.
- **Requirement for Separate Environmental Assessment:** Environmental advantages of an alternative site cannot be established from the currently supplied BOF information. Any proposed alternative location would require appropriate baseline investigation and environmental assessment before its suitability could be confirmed.

8.4. Conclusion

The three principal alternatives considered for BOF present different advantages and limitations:

Table 29: Analysis of Alternative

Alternative	Principal Advantage	Principal Limitation	Overall Consideration
Do Nothing	Avoids new construction and operational environmental impacts	Proposed production facilities and associated benefits would not be realized	Not preferred for achieving project objectives
Alternative Land Use	Could provide other environmental or socio-economic benefits depending on use	Does not fulfill the proposed arms and ammunition production objective	Not preferred for the stated project purpose



Alternative	Principal Advantage	Principal Limitation	Overall Consideration
Alternative Land Site	Could potentially offer site-specific advantages	Requires additional site assessment and may involve additional development, cost and delay	No superior alternative site established from available information
Proposed Project/Site	Allows implementation of the planned production facilities with proposed environmental-control systems	Generates environmental impacts requiring mitigation and monitoring	Preferred, subject to effective environmental management

Based on the available information, proceeding with the proposed BOF development at the selected Gazipur Cantonment site is considered the most appropriate of the alternatives assessed. The Do Nothing and Alternative Land Use options would not achieve the stated project objectives, while no alternative site has been identified in the supplied project information as demonstrably superior. The selected option should therefore proceed subject to effective implementation of the proposed ETP, waste-management measures, emission and noise controls, occupational health and safety provisions, emergency-response arrangements, and environmental monitoring program.



Chapter Nine: Decommissioning Plan

The decommissioning plan for Bangladesh Ordnance Factories (BOF) outlines a comprehensive strategy to safely dismantle the project site, minimize environmental impacts, and restore the area for future use. Each component of the plan is elaborated below:

9.1. Project Closure Notification

- **Notification Process:**
 - **Regulatory Bodies:** Notify relevant government agencies, including environmental authorities, about the decommissioning activities. This might include the Department of Environment and local municipal authorities.
 - **Stakeholders:** Inform key stakeholders such as employees, contractors, suppliers, and local community members about the project's closure and decommissioning plans. This helps to manage expectations and address any concerns.
 - **Public Communication:** Use local media and community meetings to keep the public informed about the decommissioning schedule and potential impacts. This transparency helps to build trust and facilitates smooth communication.
- **Documentation:**
 - **Decommissioning Plan Documentation:** Prepare comprehensive documentation outlining the decommissioning schedule, procedures, safety measures, and contact information for project managers.
 - **Regulatory Compliance Records:** Ensure that all regulatory compliance documents, including permits and approvals, are up-to-date and accessible.

9.2. Site Assessment

- **Pre-Demolition Assessment:**
 - **Site Survey:** Conduct a detailed survey of the site to assess current conditions, including structural integrity, environmental quality, and the presence of hazardous materials.
 - **Review Historical Data:** Analyze historical records and reports related to site operations, maintenance, and previous environmental assessments to identify potential issues.
- **Hazard Identification:**
 - **Hazardous Materials:** Identify and catalog hazardous materials such as asbestos, lead, or chemical residues. Use specialized services to assess the presence and concentration of these materials.



- **Risk Assessment:** Evaluate the risks associated with these hazards, including potential health impacts on workers and environmental contamination.

9.3. Dismantling and Removal

- **Dismantling Procedures:**
 - **Detailed Plan:** Develop a detailed dismantling plan that outlines the steps for safely decommissioning the industry's structures and systems. This plan should include methods for deconstructing buildings, removing equipment, and managing debris.
 - **Safety Measures:** Implement safety protocols to protect workers and the public, including barricades, signage, and emergency response plans.
- **Equipment Removal:**
 - **Decommissioning Equipment:** Safely decommission and remove operational equipment, ensuring that any hazardous components are handled appropriately.
 - **Special Handling:** For equipment containing hazardous materials (e.g., chemicals, electronic waste), follow specific disposal procedures.
- **Structural Demolition:**
 - **Demolition Methods:** Use appropriate demolition methods for different types of structures. This may include mechanical demolition, dismantling by hand, or using controlled explosives.
 - **Debris Management:** Manage demolition debris by sorting materials for recycling, disposal, or reuse. Ensure that debris is transported and disposed of according to regulations.

9.4. Waste Management

- **Waste Categorization:**
 - **Types of Waste:** Classify waste into categories such as hazardous, non-hazardous, recyclable, and general waste.
 - **Waste Tracking:** Implement a waste tracking system to monitor the types and quantities of waste generated and their disposal methods.
- **Disposal Procedures:**
 - **Licensed Contractors:** Work with licensed waste disposal contractors to handle and dispose of hazardous and non-hazardous waste.
 - **Compliance:** Ensure that all waste disposal activities comply with local, national, and international regulations.
- **Recycling and Reuse:**
 - **Recycling Programs:** Establish recycling programs for materials such as metals, wood, and concrete. Partner with recycling facilities to process these materials.



- **Reuse Opportunities:** Identify opportunities to repurpose or reuse materials in other projects or for charitable purposes.

9.5. Soil and Water Remediation

- **Soil Testing:**
 - **Sampling and Analysis:** Conduct soil sampling and laboratory analysis to detect contamination from hazardous materials or chemicals used during industry operations.
 - **Contamination Mapping:** Map areas of contamination to target remediation efforts effectively.
- **Remediation Measures:**
 - **Treatment Methods:** Apply appropriate soil remediation techniques such as excavation, soil washing, or bioremediation to clean contaminated soil.
 - **Regulatory Compliance:** Follow guidelines and regulations for soil remediation to ensure effectiveness and safety.
- **Water Quality Monitoring:**
 - **Testing:** Regularly test surface and groundwater for contaminants, especially if there were storage tanks or waste disposal areas on-site.
 - **Treatment:** Implement water treatment solutions if contamination is detected, ensuring that treated water meets regulatory standards before discharge or reuse.

9.6. Site Restoration

- **Restoration Plan:**
 - **Land Regrading:** Regrade and contour the land to restore it to its natural state or prepare it for new uses. This may involve filling in excavations or leveling uneven areas.
 - **Vegetation:** Plant vegetation and grasses to stabilize the soil, prevent erosion, and enhance the aesthetic appeal of the site.
- **Final Inspection:**
 - **Inspection Checklist:** Conduct a final inspection to verify that all decommissioning and restoration activities have been completed according to the plan.
 - **Regulatory Approval:** Obtain any necessary approvals from regulatory authorities to confirm that the site meets all required standards for restoration.



9.7. Monitoring and Reporting

- **Ongoing Monitoring:**
 - **Environmental Monitoring:** Implement a monitoring program to track environmental conditions, such as soil quality and water quality, after decommissioning. This helps to detect any residual contamination or impacts.
 - **Periodic Reviews:** Conduct periodic reviews to assess the effectiveness of remediation and restoration efforts.
- **Reporting:**
 - **Final Report:** Prepare a comprehensive final report detailing the decommissioning activities, waste management practices, remediation efforts, and site restoration outcomes.
 - **Stakeholder Communication:** Share the final report with stakeholders, including regulatory bodies, local communities, and internal management.

9.8. Health and Safety

- **Health and Safety Plan:**
 - **Risk Assessment:** Conduct a risk assessment to identify potential health and safety hazards associated with decommissioning activities.
 - **Safety Measures:** Develop and enforce safety measures, including the use of personal protective equipment (PPE), training for workers, and emergency response procedures.
- **Risk Management:**
 - **Accident Prevention:** Implement procedures to prevent accidents and injuries, including regular safety audits and inspections.
 - **Emergency Response:** Establish an emergency response plan to address potential incidents, such as chemical spills or equipment failures, during decommissioning.

By addressing each of these components, Bangladesh Ordnance Factories (BOF) ensures a thorough and responsible approach to decommissioning. This plan aims to protect the environment, safeguard public health, and prepare the site for future use in a sustainable manner.



Chapter Ten: Public Consultations

10.1. Introduction

Public consultation is an important component of the Environmental Impact Assessment (EIA) process for the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory at Gazipur Cantonment, Gazipur. The consultation process is intended to facilitate communication between the project authority and relevant stakeholders and to obtain their views regarding the project's potential environmental and socio-economic impacts, associated concerns, and proposed mitigation measures. Consultation activities should enable stakeholders to express their opinions, suggestions and expectations so that relevant issues can be appropriately considered during project planning, environmental management and implementation. This participatory approach helps ensure that stakeholder concerns are incorporated into the EIA process and supports environmentally responsible project development.

10.2. Objectives of Public Consultation and Disclosure Meeting

The objectives of the public consultation for the proposed ammunition manufacturing plant project by Bangladesh Ordnance Factories (BOF) at Gazipur Cantonment, Gazipur, are outlined below:

- **Engagement and Inclusion:** To actively engage the local community, stakeholders, and relevant authorities in the decision-making process, ensuring their opinions, concerns, and feedback are collected and considered.
- **Information Sharing:** To provide clear and comprehensive information about the project's objectives, scope, location, potential impacts, and proposed mitigation strategies, thereby fostering transparency and understanding among all participants.
- **Addressing Concerns:** To offer a platform for participants to express their concerns, ask questions, and share perspectives on potential environmental, socio-economic, and community impacts associated with the ammunition manufacturing plant.
- **Gathering Feedback and Suggestions:** To solicit valuable feedback and suggestions from participants on how to minimize negative impacts, enhance positive outcomes, and incorporate sustainable development practices throughout the project's lifecycle.
- **Promoting Collaboration:** To promote collaboration and partnership between project developers, local community members, stakeholders, and relevant authorities, aiming to achieve a shared understanding and alignment on the project's vision and objectives.
- **Influencing Decision-Making:** To ensure that the input gathered during the public consultation process significantly influences the decision-making process, project design, and the development of the Environmental Impact Assessment (EIA) report.



- **Building Trust:** To build trust and credibility between Bangladesh Ordnance Factories (BOF) and the local community by actively listening to concerns, responding to inquiries, and integrating meaningful feedback into the project's planning, implementation, and monitoring phases.

10.3. Approach and Methodology of Public Consultation and Disclosure Meeting

The approach and methodology for the public consultation and disclosure meeting for Bangladesh Ordnance Factories (BOF)'s proposed ammunition manufacturing plant project at Gazipur Cantonment, Gazipur, aim to ensure effective communication, meaningful engagement, and transparency. The following steps outline the suggested approach and methodology for the public consultation:

10.3.1. Preparing for the Consultation:

- **Identify Key Stakeholders:** Engage with relevant stakeholders, including local community members, government authorities, non-governmental organizations (NGOs), professionals, and environmental experts, who may have an interest in or be impacted by the project.
- **Define Objectives and Scope:** Clearly outline the objectives of the consultation, the key topics for discussion, and the scope of the process to provide clear guidance for the meeting.
- **Develop an Engagement Plan:** Prepare a comprehensive engagement plan that details the activities, timeline, and resources required to conduct the consultation process effectively.
- **Information Preparation:** Gather all relevant project information, such as project plans, Environmental Impact Assessment (EIA) findings, and proposed mitigation measures, to be shared with participants to facilitate informed discussions.

10.3.2. Communication and Outreach:

- **Publicize the Meeting:** Use a variety of communication channels, including local newspapers, radio stations, community notice boards, social media platforms, and direct invitations, to inform the community about the consultation meeting and invite their participation.
- **Multilingual Support:** Provide translation services or materials in local languages to ensure all participants, regardless of language barriers, can engage effectively in the consultation.
- **Engage Local Leaders and Influencers:** Collaborate with local community leaders, respected elders, and influencers to spread the word about the meeting and encourage widespread participation.



10.3.3. Consultation Meeting:

- **Facilitate Open Discussion:** Create a welcoming and inclusive environment that encourages open dialogue. Facilitators should ensure that all attendees have the opportunity to voice their opinions, ask questions, and share their concerns without fear of bias or intimidation.
- **Present Project Information:** Begin the meeting with a clear and concise presentation of the project's overview, its purpose, potential environmental and socio-economic impacts, and the proposed mitigation measures. Use visual aids and straightforward language to enhance understanding.
- **Q&A and Interactive Sessions:** Allocate ample time for participants to ask questions, seek clarifications, and provide feedback. Foster interactive discussions that allow for diverse perspectives and ideas to be shared.
- **Workgroup Activities:** Organize smaller workgroup activities or breakout sessions focused on specific issues or concerns. This approach ensures deeper engagement and allows participants to discuss topics more thoroughly.

10.3.4. Disclosure of Information:

- **Transparent Information Sharing:** Provide all participants with access to relevant project documents, reports, and studies, ensuring complete transparency in the disclosure of project-related information.
- **Written Submissions:** Encourage participants to submit written feedback or complete feedback forms to capture their concerns, suggestions, and recommendations in a structured and organized manner.
- **Follow-Up Communication:** Commit to sharing a comprehensive summary of the meeting, including key points discussed, concerns raised, and proposed actions, to keep all participants informed and maintain transparency.

10.3.5. Evaluation and Incorporation:

- **Evaluate Feedback:** Carefully analyze the feedback and input received during the consultation process to identify recurring themes, concerns, and valuable suggestions.
- **Incorporate Feedback:** Utilize the feedback to refine project plans, adjust mitigation measures, and address community concerns to the greatest extent possible, demonstrating a commitment to responsive and responsible project planning.
- **Communication of Outcomes:** Clearly communicate the outcomes of the consultation process, highlighting how the input received has influenced decision-making, and detailing any modifications made to the project based on the feedback provided by participants.



10.4. Public Consultation Meeting (PCMs)

Public consultation was initiated with the explicit objective of ensuring community participation from the planning stage of the project. The aim was to enhance the study by incorporating opinions and concerns from residents of the impacted area. During the household survey, conducted through a semi-structured questionnaire, knowledgeable individuals, community leaders, and local chairpersons and members were identified and approached for their input.

Bangladesh Ordnance Factories (BOF) organized a public consultation meeting on 8th June, 2026 at the project site located at Gazipur Cantonment, Gazipur. The meeting was attended by approximately 40 participants, including local residents, community leaders, and other interested individuals from various parts of the community.

The consultation provided a platform for open dialogue, allowing stakeholders to express their views, ask questions, and raise concerns about the proposed ammunition manufacturing plant. This inclusive approach helped to gather valuable insights and foster a sense of collaboration and transparency between the project developers and the local community.

10.5. Public Disclosure Meetings (PDMs)

The local response to the proposed project by Bangladesh Ordnance Factories (BOF) has been generally positive. Most residents living close to the project site have expressed no objections to establishing the arms & ammunition manufacturing plant at the chosen location. During interviews, many individuals were unaware of potential environmental hazards and did not perceive the project as threatening their well-being.

Historically, a top-down approach has been common in similar projects, where public involvement in the planning stages is minimal. This approach was also observed in the case of Bangladesh Ordnance Factories (BOF). It contrasts with a bottom-up approach, which would involve local community input throughout the project design and planning phases.

Despite this, the community appears optimistic about the project, primarily due to the anticipated employment opportunities and the potential for improved services. Public participation is limited to engaging residents in construction and related activities, with indirect benefits from associated economic activities.

Key outcomes from the Public Disclosure Meeting include:

- **Quality of Life Improvements:** Local residents believe that the project's implementation will enhance their quality of life. There are no significant concerns regarding disruptions to daily



activities, and the community is positive about the job opportunities that the new facility will provide.

- **Environmental Concerns and Recommendations:** Stakeholders have voiced concerns about potential environmental impacts. They recommended that Bangladesh Ordnance Factories (BOF) adopt sustainable waste reduction, reuse, and recycling practices.
- **Waste Management:** A comprehensive waste management plan is in place. The arms & ammo manufacturing plant will have dedicated systems for managing solid, liquid and other waste, ensuring proper disposal and recycling where feasible.
- **Water Management:** The project includes measures for water management, with plans to maximize water reuse. Initially, a significant percentage of water will be recycled, with the remainder treated before discharge.
- **Consultancy Commitment:** The consultancy firm Environest Engineering (EE) has committed to incorporating recommendations such as waste reduction strategies into the Environmental Impact Assessment (EIA) report. They will work closely with Bangladesh Ordnance Factories (BOF) to ensure these measures are effectively implemented and monitored.

The Public Disclosure Meeting has been instrumental in addressing community concerns and ensuring transparency in the planning and implementation of arms & ammo manufacturing plant.

- **Additional documents for Public Consultation are added in Annexure D.**



Chapter Eleven: Conclusion

The Environmental Impact Assessment (EIA) of the proposed Bangladesh Ordnance Factories (BOF) Arms & Ammunition Production Factory at Gazipur Cantonment, Gazipur has evaluated the potential environmental and socio-economic impacts associated with the project and identified appropriate mitigation and management measures. The proposed development covers approximately 135.87 acres and includes production facilities for Assault Rifles, Small Arms Ammunition (SAA), Primer and Detonator, 12.7 & 14.5 mm ammunition, and Mortars/Bombs. Considering the nature of these manufacturing activities, effective management of wastewater, waste, air emissions, noise, chemical/raw-material handling, occupational health and safety, and emergency risks will be essential for environmentally responsible operation. The effectiveness of the project will therefore depend substantially on proper implementation of the Environmental Management Plan (EMP), pollution-control measures and environmental monitoring program, consistent with the EIA approach of linking identified impacts with mitigation and environmental management commitments.

The principal conclusions of the EIA are summarized below:

Environmental Impact Management: Potential impacts related to air quality, water resources, wastewater discharge, solid/process waste, noise, soil, drainage and other environmental components can be minimized through appropriate engineering controls, good operational practices and regular environmental monitoring.

Water and Wastewater Management: BOF requires approximately 40 m³/day of water and is expected to generate approximately 36 m³/day of wastewater. The proposed 5 m³/hour (40 m³/day) chemical-treatment ETP should be properly operated and maintained, with treated effluent monitored to ensure compliance with applicable discharge requirements before release to the designated drainage system.

Waste Management: Solid, recyclable, process-related, ETP sludge and any chemical-contaminated wastes generated during operation should be segregated at source and managed according to their characteristics. Particular emphasis should be placed on waste minimization, safe temporary storage, recycling/recovery where feasible and environmentally appropriate final disposal.

Air and Noise Pollution Control: Potential emissions and noise from production activities, transportation, utilities and the seven standby generators should be controlled through preventive maintenance, appropriate exhaust and ventilation arrangements, acoustic controls, good housekeeping and periodic monitoring.

Chemical and Raw-Material Management: Because BOF production involves materials such as lead, antimony sulphide, barium nitrate, lead styphnate, red lead powder, lead azide and other production



chemicals, appropriate storage, labelling, containment, handling procedures, PPE and spill-response arrangements should be strictly maintained.

Occupational Health and Safety: Considering the specialized nature of arms and ammunition manufacturing and the approximately 2,125 permanent and temporary personnel, BOF should maintain a comprehensive OHS system covering hazard identification, risk assessment, PPE, machine safety, chemical safety, training, medical surveillance and incident reporting.

Emergency and Fire Management: Fire, chemical release, equipment failure and other accidental incidents require strong preventive and emergency-response arrangements. Process-specific risk assessment, firefighting facilities, emergency exits, evacuation procedures, trained response teams and regular emergency drills should remain integral components of project management.

Socio-Economic Benefits: The project is expected to provide positive socio-economic contributions through direct and indirect employment, technical skill development, associated economic activities and strengthening of domestic production capability for the identified arms and ammunition products.

Environmental Management and Monitoring: The EMP should be implemented throughout project construction and operation, supported by clearly defined responsibilities, adequate resources, record keeping and periodic monitoring of relevant environmental parameters. Continued implementation of mitigation measures is essential for maintaining environmental performance.

Overall, the EIA indicates that the proposed BOF Arms & Ammunition Production Factory will have environmental impacts that require careful and continuous management, particularly because of its specialized manufacturing processes and chemical/raw-material use. However, with effective implementation of the proposed ETP, waste and emission controls, OHS measures, emergency-response systems, environmental monitoring and EMP, the identified adverse impacts can be substantially minimized and managed. Subject to compliance with applicable environmental requirements and sustained implementation of the recommended mitigation and monitoring measures, the project can be operated in an environmentally responsible and sustainable manner while delivering its intended industrial, employment and technical benefits.



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