Feasibility Study REPORT



Providing Consultancy Services for Feasibility Study along with Detailed Design and Drawing of Architectural, Structural, Plumbing, Electro-mechanical and Others Including Relevant Reports for Block B & C of Uttara Apartment Project

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TABLE OF CONTENTS

TABLE OF CONTENTS i

LIST OF FIGURES V

LIST OF TABLES VI

ACRONYMS VII

EXECUTIVE SUMMARY IX

1. BASIC INFORMATION 1

2. INTRODUCTION 3

2.1. Project Background 3
2.2. Objective of the Feasibility Study 3
2.3. Approach and Methodology of the Feasibility Study 4
2.4. Organization of the Feasibility Study 6

3. MAKRET/DEMAND ANALYSIS 7

3.1. Problem Statement 7
3.1.1. Urban Environment– Living and Working Condition 7
3.1.2. Population Growth and Housing Situation in Dhaka 10
3.2. Relevance of the Project Idea 12
3.2.1. The National Context of Housing Provision 12
3.3. Proposed Project Interventions 13
3.3.1. Population Analysis 14
3.3.2. Community Facilities According to Population 14
3.4. Stakeholders 15
3.5. Demand Analysis 15
3.5.1. Background 15
3.5.2. Household Income and Expenditure 16
3.5.3. Cost of Supply Components 17
3.5.4. Current Market Analysis 20
3.5.5. Current Demand 21
3.6. Present And Future Demand of Affordable Housing 21
3.6.1. Demographic Analysis 22
3.6.2. Apartment Choice by Customers 23
3.6.3. Factors Affecting Apartment Purchase Decision 24
3.6.4. Overall Ranking of Factors 28
3.7. Recommendation 29
3.7.1. SWOT Analysis 30

4. TECHNICAL AND TECHNOLOGICAL ANALYSIS 32
4.1. Site Analysis 32
4.1.1. Project Location 32
4.1.2. Site and Surroundings 33
4.1.3. Prevailing Site Condition 35
4.1.4. Environmental Setting 40
4.2. Project Demand Assessment 41
4.3. Major Interventions of the Project 43
4.4. Technical Design 45
4.4.1. Codes and Design Standards 45
4.4.2. Design Consideration 50
4.4.3. Integrating with Transit Oriented Development (TOD) Proposals 54
4.4.4. Block-based Development 57
4.4.5. Calculation of FAR, Density, Floor Area and other Components 60
4.4.6. Addressing climate change and hazard risks in detail design 62
4.4.7. Consideration for Utility 63
4.5. Cost Summary 72
4.6. Implementation Timeline 73
5. ENVIRONMENTAL SUSTAINABILITY, CLIMATE RESILIENCE AND DISASTER RISK ANALYSIS 74
5.1. Environmental, Climate Change and Disaster Risk Analysis 74
5.1.1. Purpose and objective 74
5.1.2. Methodology of Environmental Analysis 74
5.1.3. Project Description 76
5.1.4. Overview of the legal Framework and Policies 77
5.1.5. Project Categorization & Clearance Procedure by ECR'2023 82
5.1.6. Existing Environmental Conditions 87
5.2. Environmental Impacts of the Project 95
5.2.1. Environmental Impacts at Different Phases 95
5.2.2. Disaster & Risk Analysis 99
5.2.3. Environmental Management Action Plan 101
5.2.4. Environmental Monitoring Plan 108
5.2.5. Cost of EMP 110
5.2.6. Public Consultation 112
5.2.7. Recommendations 113
6. COST - BENEFIT ANALYSIS 114
6.1. Financial Analysis 114
6.1.1. Identification of Costs and Benefits 114
6.1.2. Identification of Key Assumptions 115
6.2. Financial Analysis 121

6.2.1. Findings of Financial Assessment 121
6.2.2. Sensitivity Analysis & Switching Value Analysis 122
6.3. Economic Evaluation 123
6.3.1. Introduction 123
6.3.2. Results Of the Economic Evaluation 123
6.3.3. Summary of Economic Analysis 124
6.3.4. Conclusion 124
7. HUMAN RESOURCES AND ADMINISTRATIVE SUPPORT ANALYSIS 125
7.1. Human Resources and Financial Capability of RAJUK 125
7.2. Required Functional Structure for the Implementation of Block-B and C 126
7.2.1. Manpower during Project Supervision 126
7.2.2. Procurement Plan 126
7.2.3. Special Memorandum of Understanding (MoU) with Public Agencies 128
7.3. Consistency with Organizational Capacity 128
8. INSTITUTIONAL AND LEGAL ANALYSIS 129
8.1. Institutional Capabilities and Facilities 129
8.1.1. Institutional Capacity 129
8.1.2. Concept and Definition of Capacity Building 130
8.1.3. Brief Institutional History of RAJUK 130
8.1.4. Institutional Capacity of Project Implementation 130
8.2. Strategic Recommendation for Institution 130
8.2.1. Formulation of Committee 131
8.2.2. Proposed Organogram for the Project 132
8.2.3. Improving the Organizational and Technical Capabilities of Institutions 133
8.3. Legal Boundary of the Project 133
9. RISK AND SENSITIVITY ANALYSIS 139
9.1. Major Risks That May Affect RAJUK Apartment Project 139
9.2. Impact of Risk Factors on Project Implementation 141
9.3. Risk Management and Control 142
9.3.1. Management Process 142
9.3.2. Risk Management Cycle 143
9.3.3. Methods And Tools in Risk Management 143
9.3.4. Risks, Legal and Regulatory Obligations 144
10. ALTERNATIVE OPTIONS ANALYSIS 145
11. RECOMMENDATION AND CONCLUSION 147
11.1. General Recommendation 147
11.2. Specific Recommendation 147
11.2.1. Policy related Guidelines 147

11.2.2. Overview of Apartment in Block-B and C 148
11.2.3. Conserved Green 148
11.2.4. Connectivity 149
11.2.5. Recommendation on Environmental Issues 149
11.2.6. Recommendation on Establishment of Utility Services 149
11.2.7. Recommendation on Project Recovery 150
12. ANNEXES 152

LIST OF FIGURES

Figure 2-1: Methodology of the Feasibility Study 5
Figure 3-1: Stakeholder Tree of the Project 15
Figure 3-2: Land Value in Prime Locations in Dhaka 18
Figure 3-3: Land Value in Prime Locations in Dhaka 19
Figure 3-4: Major Findings of Market Demand Analysis 21
Figure 3-5: Whether customers want to buy an apartment in near future 22
Figure 3-6: Respondents having another land or apartment in Dhaka 22
Figure 3-7: Occupation of Respondents 23
Figure 3-8: Most preferred location by different class of customers 23
Figure 3-9: Whether customers need car parking space 24
Figure 3-10: Ranking of Factors that Influence Buying Decision 28
Figure 3-11: SWOT Analysis of the Project 31
Figure 4-1: Project Location in the Context of the Uttara Third Phase Layout 32
Figure 4-2: Project Area and its Surrounding Major Establishment 33
Figure 4-3: Regional Connectivity of Uttara Apartment Project 34
Figure 4-4: Local Connectivity of Uttara Apartment Project 35
Figure 4-5: Digital Elevation Model of the Project Area and its surrounding location. 36
Figure 4-6: Digital Elevation Model of the Project Area 37
Figure 4-7: Flood Flow Zone in and around the Project Site 38
Figure 4-8: Land Suitability Analysis of the Project Area 39
Figure 4-9: Height Restriction Zoning due to the Airport 40
Figure 4-10: Integrated Planning Frameworks for the Project Implementation 43
Figure 4-11: Community Facilities by the number of populations (a) 48
Figure 4-12: Community Facilities by the number of populations (b) 49
Figure 4-13: Variable Refrigerant Flow (VRF) System 70
Figure 5-1: Methodology of Environmental and Disaster Risk Analysis 74
Figure 5-2: Process of ECC Preparation 82
Figure 5-3: Existing Physical Environment 88
Figure 5-4: Land Elevation of Dhaka Metropolitan Area 89
Figure 5-5: Existing Condition of Solid Waste Open Disposal 90
Figure 5-6: Monthly Average Rainfall in Dhaka (2011-2020) 91
Figure 5-7: Seismic Zones of Bangladesh 92
Figure 5-8: Monthly Average Humidity (%) in Dhaka (2011-2020) 93
Figure 5-9: Flora at the Project Site 94
Figure 5-10: Fauna at the Project Site 95
Figure 5-11: Public Consultation at the Project Site 112
Figure 7-1: Project Supervision Flowchart 126
Figure 7-2: Engineering, Procurement and Construction Contract Structure 127
Figure 8-1: Proposed Organogram for the Project Implementation 133
Figure 9-1: Information map representing the risk sources affecting the project success 141
Figure 9-2: Example risk management cycle 143
Figure 10-1: Conceptual Design of the Block-B and C 146

LIST OF TABLES

Table 3-1: Population, Growth Rate and Density in Dhaka and urban Bangladesh 10
Table 3-2: Brief Description of DNCC Area 11
Table 3-3: Proposed project description at a glance 14
Table 3-4: Standard of Population Distribution 14
Table 3-5: Income-expenditure relationship of different household 16
Table 3-6: Block-wise space price (BDT/SFT) 17
Table 3-7: Ratio of Building cost at Uttara 18
Table 3-8: Expectation of Bedroom Numbers 24
Table 3-9: The apartment must be affordable 25
Table 3-10: Responses regarding the availability of credit/instalment facilities for buying apartment 25
Table 3-11: Preference of location for selection of houses 25
Table 3-12: Preference of communication facilities for selection of houses 26
Table 3-13: Emphasis given on security of the area and the building 26
Table 3-14: Choice of Project Facilities 26
Table 3-15: Demand of physical quality of building 27
Table 3-16: Demand of environmental quality 27
Table 3-17: Choice of Apartment Developer 28
Table 4-1: Allocation of Community Facilities for Block B 44
Table 4-2: Allocation of Community Facilities for Block C 44
Table 4-3: Changes between Imarat Nirman Bidhimala and BNBC 46
Table 4-4: Desired use of Transit oriented development (TOD) area 55
Table 4-5: List of Unauthorized Use 55
Table 4-6: Mixed-Use Terms of Establishment in TOD Areas 56
Table 4-7: Block size and open space in block-based development 57
Table 4-8: Plot-based FAR Calculation for Block-B and C 60
Table 4-9: Area-based FAR Calculation for Block-B and C 60
Table 4-10: Calculation of FAR and other components for the Block-B 60
Table 4-11: Calculation of FAR and other components for the Block-C 61
Table 5-1: Monthly Temperature of Dhaka (2011-2020) 90
Table 5-2: Environmental Management Action Plan for Pre-Construction & Construction Phases ... 101
Table 5-3: Environmental Management Action Plan for Operational Phase 105
Table 5-4: Environmental Monitoring Plan for Construction Phase 108
Table 5-5: Environmental Monitoring Plan for Operational Phase 109
Table 5-6: Cost Estimation of EMP 110
Table 6-1: Capital Expenditure required for construction of the Project 115
Table 6-2: Year-wise Project Recovery of the Apartment Development Project 116
Table 6-3: Summary of Financial Assessment Results in the Base Case of the Project 121
Table 6-4: Sensitivity and Switching Value Analysis (Financial) 122
Table 6-5: Sensitivity and Switching Value Analysis (Economical) 123
Table 7-1: Procurement Plan of the project 127
Table 8-1: Policy, Rule and Regulation for Development of this Project 134
Table 9-1: Critical Risk Factors 140

ACRONYMS

ADB	Asian Development Bank
BBS	Bangladesh Bureau of Statistics
BCR	Benefit-Cost Ratio
BDT	Bangladeshi Taka
BNBC	Bangladesh National Building Code
BRT	Bus Rapid Transit
BWDB	Bangladesh Water Development Board
CAAB	Civil Aviation Authority of Bangladesh
CCTV	Closed-circuit Television
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
CSTP	Central Sewage treatment plant
DAP	Detailed Area Plan
DB	Decibel
DEM	Digital Elevation Model
DESA	Dhaka Electricity Supply Authority
DIT	Dhaka Improvement Trust
DMDP	Dhaka Metropolitan Development Plan
DNCC	Dhaka North City Corporation
DoE	Department of Environment
DPP	Development Project Proforma/Proposal
DSCC	Dhaka South City Corporation
DTCA	Dhaka Transport Coordination Authority
DU	Dwelling Unit
DWASA	Dhaka Water and Sewerage Authority
ECA	Environment Conservation Act 1995
ECC	Environmental Clearance Certificate
ECNEC	The Executive Committee of the National Economic Council
ECR	Environment Conservation Rules
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
FAR	Floor Area Ratio
FBCR/EBCR	Financial/Economic Benefit-Cost Ratio
FFWC	Flood Forecasting and Warning Centre
FGD	Focus Group Discussion
FIRR/EIRR	Financial/Economic Internal Rate of Return
FNPV/ENPV	Financial/Economic Net Present Value
GDP	Gross Domestic Product
GED	General Economic Division
GOB	Government of Bangladesh
GSB	Geological Survey of Bangladesh
GTCL	Bangladesh Gas Transmission Company Limited
HSIA	Hazrat Shahjalal International Airport

ICB	Institutional Capacity Building
IEE	Initial Environmental Examination
IRR	Internal Rate of Return
KII	Key Informant Interview
MBR	Membrane Bioreactor
MoU	Memorandum of Understanding
MRT	Mass Rapid Transit
MSL	Mean Sea Level
MSW	Municipal Solid Waste
NEMAP	National Environmental Management Action Plan
NOx	Nitrogen Oxides
NPV	Net Present Value
NWMP	National Water Management Plan
OMS	Operation Management System
PCSP	Primary Waste Collection Service Providers
PIC	Project Implementation Committee
PM	Particulate Matter
PPA	Population Per Acre
PRLDR	The Private Residential Land Development Rule
PWD	Public Works Department
RAJUK	Rajdhani Unnayan Kartripakkha
RoW	Right of Way
SCC	Site Clearance Certificate
SDG	The Sustainable Development Goals
SFT	Square Feet
SO2	Sulfur Dioxide
Sq.Km	Square Kilometer
STS	Secondary Transfer Stations
SWOT	Strength, Weakness, Opportunity and Threat
TOD	Transit Oriented Development
ToR	Terms of Reference
VOCs	Volatile Organic Compounds

EXECUTIVE SUMMARY

Dhaka, the capital city of Bangladesh, confronts a significant challenge in providing low- and middle-income residents with affordable housing. The city's population of 22,478,116 people poses a threat to the environment and sustainable development. To address this issue, the Bangladeshi government has identified the dearth of available and accessible housing as a significant barrier to improve housing conditions for middle- and low-income households.

Through planned urbanization, the Ministry of Housing and Public Works is constructing multi-story residential complexes around Dhaka city. On 214.44 acres of land in Sector-18, Uttara, Dhaka, RAJUK has begun construction of apartments for low- and middle-income families. The project has been approved by ECNEC, and 6636 apartments in Block A have already been constructed.

The feasibility study seeks to evaluate the financial viability and profitability of a project using the engineering economy method to determine the investment's economic value. The purpose of the study is to analyze the need for affordable housing for the low- to middle-income group in Dhaka, identify necessary infrastructure, and evaluate the proposed infrastructural development scope to ensure that the project will not negatively impact the area's ecological integrity and natural beauty. The purpose of the feasibility study is to assess the viability of a proposed infrastructure facility on a preferred site, taking into account the needs of the community without harming the environment. In addition, it estimates the project's funding and prepare architectural and engineering designs. The study contributes to the analysis of investment opportunities in the housing sector and the effective utilization of limited economic resources.

The methodology of the feasibility study includes a review of existing master plans, architectural drawings, and other pertinent documents. Various techniques, including KII, FGD, scenario development studies, case studies, and questionnaire surveys, are utilized to collect data. Students, teachers, employees, councilors, traffic police, and planning experts are important informants. Using a predictive model, the data collected from both primary and secondary sources is analyzed to forecast future growth. A need assessment is conducted to determine the facilities required by the Authority initiative, followed by a gap analysis and planning considerations to determine the infrastructure development of future interventions.

The organization of the study includes providing basic information about the project, describing the introduction, assessing market demand, conducting a technical and engineering assessment, establishing an environmental baseline, conducting a cost-benefit analysis, determining the required manpower and administrative support, establishing an institutional framework, addressing legal and financial issues, and analyzing different planning options. In addition, the concluding recommendation and conclusion are discussed.

The Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development seek to make cities and human settlements inclusive, resilient, and sustainable. Goal 11 focuses on ensuring access to adequate, safe, and affordable housing, improving transport systems, enhancing inclusive urbanization, protecting cultural and natural heritage, reducing deaths and affected people, reducing adverse per capita environmental impact, providing universal access to safe, inclusive, and accessible green and public spaces, fostering positive economic, social, and environmental links between urban, peri-urban, and rural areas, and increasing telecommunications infrastructure. Since independence,

Dhaka's urban population has increased by an estimated 4% per year, resulting in the urbanization of the city.

However, housing remains a significant issue in the rapidly expanding city, as the development of housing and related infrastructure has not kept pace with population growth. The Block B and Block C project areas seek to create a sustainable, affordable, livable, and equitable environment for the vast population. The government, stakeholders, and target households are essential to addressing Dhaka's escalating housing demand. The affordability of housing in Bangladesh is affected by land value, construction expenses, and housing finance. The terms and conditions of bank loans are available to landlords, service holders, merchants, professionals, and expatriates, but the majority of middle-income individuals are unable to comply. Since independence, land prices in Dhaka city have increased, making it impractical to design a Satellite town until the development process was decentralized to the township level. The implementation of Floor Area Ratio (FAR) has increased the potential for commercial and mixed development in Uttara. With a ratio of 57% land price to total construction costs, building material costs play a significant role in housing affordability. Housing taxes and registration fees also influence the affordability of housing. Block A of RAJUK's 1,654-square-foot apartments are selling for approximately Tk 80 lakh each, with registration fees of 10% of the bid price, which exceeds the middle-class affordability threshold. The Private Residential Land Development Rule (PRLDR) is a regulatory framework for land development in Bangladesh's private housing industry, providing environmental protection methods and regulations during land development. In addition, it specifies the percentage of land that must be reserved for community facilities, the quantity of land to be sold, schools, road hierarchy, and planning requirements. Community facilities, such as Katcha Bazaar, a community center, a retail center, and recreation facilities, are determined based on the number of people living in the project area. The Real Estate Act of 2010 mandates compliance with zoning and land use regulations, building codes, setback and height restrictions, parking and amenity regulations, and environmental sustainability regulations imposed by local authorities. The Uttara Apartment Project's closer to two MRT stations presents an opportunity to build pedestrian-friendly infrastructure and seamless connections between the project and MRT stations. TOD emphasizes the integration of residential, commercial, and recreational spaces near public transportation hubs, creating a prospering community with convenient access to amenities.

RAJUK has initiated a transit-oriented development pilot project within a 500-meter buffer from Block B and Block C of the Uttara Apartment Project and two Metrorail stations. The TOD implementation strategies for DAP include the land redevelopment approach, the land re-adjustment approach, and the implementation of transit-based development by the government or public-private joint ventures following existing land use, land redevelopment methods, or land use reconfiguration methods. With minimal road widths and incentives for building approval, block-based development is suggested for both public and private enterprises. Incentives include a minimum of 30% of a block's area being set aside as open space for public use, a minimum of 25 feet for areas developed under government and private initiatives, and a minimum of 40% of a block's area is set aside as open space for public use. In conclusion, the Private Residential Land Development Rule and the Real Estate Act of 2010 provide land development guidelines for Bangladesh, addressing issues such as unplanned structures, inadequate pedestrian facilities, and inappropriate land use. The Open Space Regulation (DAP) 2022-2035 specifies open space requirements for housing developments. It requires direct connection and access from adjacent roadways, the absence of setbacks, and the availability of open space for the residents of the affected area. The open space may be managed by the Flat Owners Association;

however, the management committee must include at least one local government representative. Setbacks are not required in open areas, except for adjacent open spaces along their boundaries.

Waste management is required for buildings with 100 or more units and for buildings with 50 or more units. The provision for block-based development does not apply to developments permitted under the 2015 Private Land Development Rules. The aforementioned conditions pertain to all block-based developments within the scope of the project. Long-term resilience and sustainability depend on the Uttara Apartment Project's comprehensive design, which takes climate change and natural disaster risks into account. Key considerations include climate-responsive design, restoration and conservation of ecosystems, fire hazards, and significant earthquake risk.

Utilizing energy-efficient technologies and sustainable materials, as well as orienting buildings to take advantage of natural light and winds, constitutes climate-responsive design. To create a more resilient environment, ecosystem restoration and conservation involve protecting trees, green areas, native vegetation, and green corridors. Installing fire alarms and sprinkler systems, providing visible exits, and implementing fireproofing measures are methods for mitigating fire hazards. Major earthquake risk requires addressing seismic assessments, adhering to building codes, incorporating earthquake-resistant structures, conducting geotechnical investigations, taking non-structural elements into consideration, developing an emergency response plan, and instituting continuous monitoring. By integrating these measures, the project can increase the building's seismic resilience and ensure the safety of its residents. Collaboration with experts in seismic engineering and adherence to best practices can guarantee a safe and resilient environment for the occupants.

The financial analysis of the RAJUK Uttara apartment complex involves calculating investment costs, operating expenses, and revenues in accordance with the operations concept and layout planning. The construction and civil works of the infrastructure, sanitary and sewage works, and external electrical works comprise the majority of the project's 1,449,472.40 Lakh Taka investment. The operating expenses of the proposed buildings consist of payroll costs for RAJUK employees, equipment operating costs, maintenance and repair costs, and administrative costs. The anticipated sale price of the apartments, the rental income from commercial spaces, the community centre, and the school are used to calculate the aggregate revenues of the project. RAJUK is currently attempting to sell apartments in Block A for approximately Tk 80 lakh each, and cash flow is presumed for other amenities. The anticipated gross revenue is Tk 1527057.69 lakh. The cash flow analysis (Section 12) is prepared and presented in the appendix. The financial evaluation is based on the proposed investment program and the anticipated increase in operating expenses. To assess the commercial viability of the project, the following financial indicators are calculated: Financial Internal Rate of Return (FIRR), Financial Net Present Value (FNPV), and Financial Benefit-Cost Ratio (FBCR). The calculated financial indicators indicate that the intended development of the project will generate a positive IRR and NPV, making it viable. Governments invest in such development initiatives because they believe that investments in these sectors have substantial direct and indirect multiplier effects on the economy as a whole. UTTARA APARTMENT PROJECT (Block- 'B' & 'C') has a positive IRR and NPV, making it a viable investment opportunity for the government. The commercial viability of the project is evaluated using a cash flow analysis that includes investment costs, operating expenses, and a benefit-cost ratio. The objective of the economic analysis for the development of affordable housing in Uttara, Bangladesh, is to optimize the allocation of spaces for people's economic and other resources and maximize net social benefit. The RAJUK Authority analyzes the valuation of the investment using the benefit-cost method. The project is anticipated to generate significant economic benefits for RAJUK, including time savings,

employment, and incomes; employment generation due to commercial activities around the housing complex; spillover effects of employment to the national economy and other needs; induced employment relating to regional household expenditure generated by people, directly and indirectly, working in project-related activities; and a significant increase in the number of people directly and indirectly employed in project-related activities.

The feasibility study has evaluated the prospective economic effects of improving housing facilities for middle-income individuals. The project is anticipated to generate significant economic benefits for RAJUK, including time savings, employment generation due to commercial activities surrounding the housing complex, and induced employment due to regional household expenditures generated by people working directly or indirectly on project-related activities. The economic costs analyzed for the proposed development of housing in Blocks 'B' and 'C' at Uttara include capital investment, sanitary and plumbing works, investment in external electrical works, registration and consulting service costs, physical contingencies, and operation and maintenance expenses. For experienced workers, the shadow wage rate (or opportunity cost of labor) is 0.78, and for unskilled workers, it is 0.75. The analysis identified the following benefits from the construction of Residential Buildings, Non-Residential Buildings, and other (utility) Buildings to meet the space allocation of students, teachers, and staff: These benefits include direct and indirect benefits, such as rent allowance, employment opportunities for skilled and unskilled labor during construction, and indirect benefits to the surrounding community through occupations.

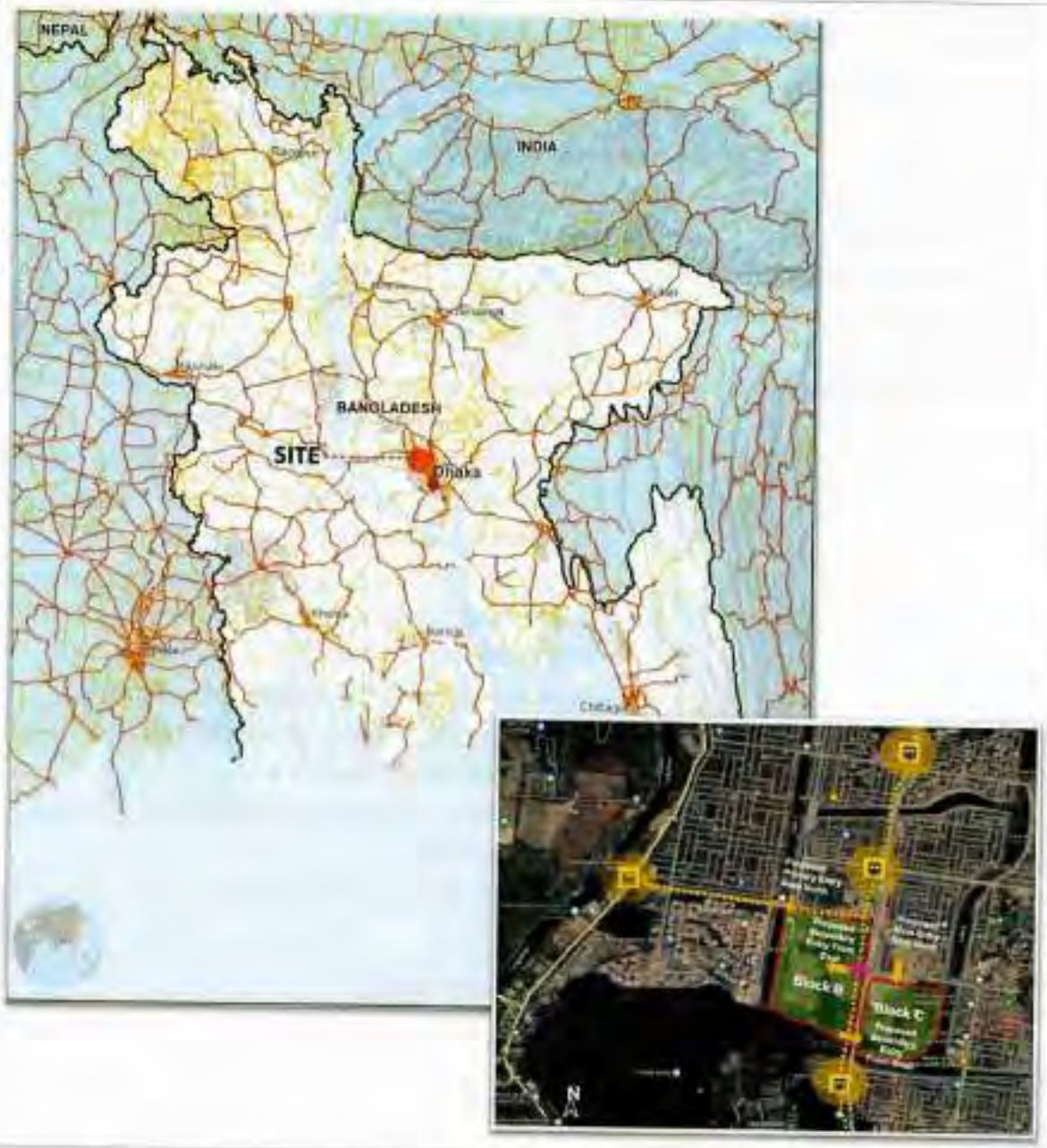
So, the client will receive a constant and risk-free long-term return on the project's investment, making it both economically and socially beneficial. The building's salvage value at the conclusion of its economic life will be economically insignificant. The construction of a variety of buildings, including residential, non-residential, and utility buildings, will result in the construction of environmentally favourable structures that provide substantial socio-economic benefits.

The consultant has provided sector-wise recommendation which need to be followed during project implementation. The recommendations are proposed to tackle the issues of this project. Recommendation chapter highlights the detail recommendation that need to be addressed during housing construction.

In conclusion, UTTARA APARTMENT PROJECT (Block- 'B' & 'C') is a viable remedy to Dhaka's low- and middle-income population's housing problems. The feasibility study validates the project's financial viability, economic benefits, and alignment with sustainable development objectives. The project's comprehensive design, adherence to regulations, and emphasis on inclusive urbanization make it an attractive investment opportunity for the government, ensuring affordable housing access and enhancing the city's overall quality of life.

1. BASIC INFORMATION

1.	Name of the Project	:	CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING FOR LOW- & MIDDLE-INCOME GROUP OF PEOPLE AT SECTOR-18, BLOCK- 'B' & 'C', UTTARA, DHAKA PROJECT
2.	(a) Sponsoring Ministry/Division	:	Ministry of Housing and Public Works
	(b) Implementing Agency	:	Rajdhani Unnayan Kartripakkha (RAJUK)
3.	Project Objectives	:	• To provide residential flats to the lower-and-middle income group of people at an affordable price. • To reduce the pressure of population in Dhaka city by creating opportunity of residential accommodation of the city dwellers in the vicinity of the city. • To maintain the balance of environment by proper urbanization and to create environment friendly and sustainable atmosphere. • To reduce the existing acute problem of housing. • To expand civic facilities by urbanization of the area between Mirpur & Tongi gradually. • Development of new township and to expand economic facilities. • To mitigate future housing demand.
4.	Estimated Project Cost	:	**BDT 1,449,472.40 Lakh**
5.	Sector & Sub-Sector	:	
6.	Project Category	:	Red
7.	Project Geographic Location	:	'Uttara Apartment Project' is situated at Sector 18 of Uttara 3rd Phrase Project covering Block 'A', 'B' & 'C'. The main approach is from Ashulia-Mirpur Flood Protection Embankment Road and Sonargaon Jonopath of Uttara Model Town. There is a plan in future, this project approach will be connected directly to the Jashim Uddin Road of Uttara Model Town. In addition, there are two stations of MRT (Central & South) within the range of walking distance of the project area.



a)	Countrywide	:	No
b)	Division	:	Dhaka
c)	District	:	Dhaka
d)	Thana	:	Uttara
e)	Others (City Corporation/ Paurasahava)	:	Dhaka North City Corporation
8.	Project Duration	:	2024-2029

2. INTRODUCTION

2.1. Project Background

Dhaka, the capital city of Bangladesh, is the sixth-most populated country in the world, in accordance with a latest report of World Population Review. With a density of 23,234 people per square kilometer, the current metro area population of Dhaka is 22,478,116, as of 2022. Lakhs of people reside in the city permanently for various purposes. The housing needed for this large number of people is inadequate. As a result, the city is turning into overcrowded in an unplanned way and becoming a threat to the environment and sustainable development on a global level. It is possible to reduce the pressure of population of Dhaka is a great extent by developing flats/apartments as a permanent resident.

The lack of available and accessible housing problems has been identified by the Government of Bangladesh (GOB) as one of the important hurdles in improving the housing conditions for middle- and lower-income households. A Large number of people reside permanently in Dhaka city for service, business and other purposes. As the dwelling places required for these large number of people are very inadequate, the residential areas of Dhaka city are getting overcrowded and dirty day by day and creating unhealthy environment causing damage to the beauty of city. All these are because of mainly unplanned urbanization. The environmental degradation associated with the unplanned urbanization essentially require establishing permanent residential accommodation for the vast population and developing the surrounding area of Dhaka city in a planned way. The Ministry of Housing and Public Works is concerned to build several multi-storied residential complexes around Dhaka city through planned urbanization.

RAJUK has taken an initiative for construction of apartments for lower-and-middle income group of people over 214.44 acres of land containing 3 blocks (Block 'A', 'B' & 'C') at sector-18, Uttara, Dhaka. The project has been approved by ECNEC on the 10th of October 2011 and meanwhile considering the housing constraints RAJUK has already completed 6636 apartments at Block-A.

2.2. Objective of the Feasibility Study

Feasibility studies are primary studies undertaken in the early stage of a project. They tend to be carried out when the project is large or complex and the investment is high. The key factor for the successful implementation of the scheme is the feasibility of the project investment which is assessed through the value of money and optimal benefits for stakeholders. Every construction project must give benefits for the investor. The influence of identified risk in investment in construction project has to be evaluated and calculated towards the project feasibility. Financial feasibility needs to be clearly analyzed before the implementation of project transactions commences. A financial feasibility analysis determines the financial viability and profitability of a project. The investment analysis model uses the engineering economy method which is a science oriented to the calculation of the economic values contained in an engineering activity plan.

The engineering economy study involves computing a specific economic measure of worth for estimated cash flows over a specific period of time. The economic values used in evaluating the feasibility of project investment are the Internal rate of return (IRR), Net Present Value (NPV), and Benefit-Cost Ratio (BCR). Basically, all evaluation method investments are consistent with each other, meaning that if evaluated by the NPV method and other methods can produce the same

recommendations, however specific information result will be different. Therefore, in practice each the methods are often used together in order to get an overview a more comprehensive approach to investment behavior.

- To briefly analyze the needs of affordable housing for lower to middle income group of people in Dhaka city;
- To identify essential infrastructures for the project to fulfill the demand of study group;
- To assess the proposed infrastructural development scope of the project so that the project implementation does not negatively impact the environment-friendly ecology and natural beauty of the area;
- To evaluate options/opportunities for locating the proposed infrastructural facilities on the preferred site which makes it possible to meet the demand of dwellers without compromising the environment-friendly ecology;
- To estimate the projection of the amount of funding along with architectural and engineering deign to implement the Project.

The study whether the project is feasible or not contribute to analysis of investment opportunities available in housing sector. It also has an effective contribution to the efficient and efficient use of scarce economic resources, considering that capital is a resource. It is rare if used in an investment project that has no requestor in a rigid activity to cause waste of resources of the state, society and investor.

2.3. Approach and Methodology of the Feasibility Study

Methodology refers to the overarching strategy and rationale of a project. It involves studying the methods used in field and the theories or principles behind them, in order to develop an approach that matches project objectives. This Section will briefly describe the methodology and approach that are used in the project feasibility study.

- **Reviewing Existing Master Plan and Other Relevant Documents**

Analyzing previous development intervention has been termed as a Pivotal role for master plan preparation project. This analysis helps to guide the consultant to follow a distinct path and apply methods to achieve the goals and objectives of the project. In this report, the consultant had concisely studied the existing master plan, architectural drawing of the buildings, DPP of previous implemented project and other relevant documents to get a view of the development pattern. This study also helps to identify the shortage or lacking in data collection.

- **Data Collection**

Data collection is the method of assembling and assessing information on targeted variables of a project to enables the consultant to answer relevant questions and evaluate outcomes of that project. It is a major component for every project. In this project both primary and secondary data was collected through various methods. Mostly, data concerning previous development intervention, existing plan, development goals, infrastructural drawing and design, physical environment of Block-B and C Area, topographic data, demand of stakeholders etc. were collected.

- **Sampling for Data Collection**

During data collection, the consultant used random sampling for collecting demand of different stakeholders.

- **Methods for Data Collection**

Different types of data collection methods have been used by the consultant team for conducting this feasibility study. These are: 1) KII, 2) FGD, 3) Scenario Development Study, 4) Case Study, 5) Questionnaire survey etc.



Figure 2-1: Methodology of the Feasibility Study

Source: Prepared by the Consultant, 2023

- **Categorization of different actors as Key informants**

Consultation meeting with primary stakeholders like student, teachers and employees has been conducted. Besides, councilors of the said ward, traffic police, planning experts has been interviewed by the consultant team.

- **Analysis of Data and Application Predictive Model**

Data collected from both primary and secondary sources was analyzed based on the predictive model. This model utilizes the existing data to predict the future growth of an area.

- **Need Assessment**

Detail study area analysis has been conducted by the consultant. This assessment further helps to identify the facilities required by the RAJUK. Need and demand of all the stakeholders are taken by questionnaire survey.

- **Gap Analysis and Planning Consideration**

After assessing the need of the housing for low-income people, gap between the existing and required housing demand has been calculated which will give a solid foundation for the project requirements and also the justifications of why this project should be implemented by the RAJUK.

2.4. Organization of the Feasibility Study

Section 1 : Provide Basic Information about the Project.
Section 2 : Describe Introductory description of the Overall Project.
Section 3 : Assess Market Demand specifically demand of housing for low-income people.
Section 4 : Discuss Technical and Engineering assessment of the project.
Section 5 : Discuss Environmental Baseline for the future development and how to achieve Environmental Sustainability and Disaster Resilience.
Section 6 : Analyze the Project Cost and benefit i.e., Economic and Financial Analysis of the Project.
Section 7 : Provide an overview of required manpower and administrative support for successful project implementation.
Section 8 : Focus on the institutional setup needed for the project and legal issues relevant to the project.
Section 9 : Discuss about the risks related to finance of the project and how to mitigate them.
Section 10 : Analyze different options with planning perspective.
Section 11 : Discuss about the final recommendation and conclusion.
Section 12 : Illustrate annexure of different calculation relevant to the project.

3. MAKRET/DEMAND ANALYSIS

3.1. Problem Statement

Housing is the basic need of human beings. Housing provides shelter, security, social status and privacy of living in a healthy and comfortable environment. In addition, housing creates the ground for employment and earning. Through planned economic development, it is the constitutional obligation of a state to provide decent housing for all to ensure improvement of living standard and enrichment of cultural milieu. The government is committed to provide planned housing to all. The government is concerned about existing housing crisis in both urban and rural areas. "None should be homeless" is the motto of the government. In order to address the housing deficit, the government is playing a proactive role by adopting appropriate planning and management approaches to guarantee access to affordable housing for everyone.

Dhaka has more population than it can accommodate the housing situation is particularly bad for this city. A Large number of people reside permanently in Dhaka city for service, business and other purposes. As the dwelling places required for these large number of people are very inadequate, the residential areas of Dhaka city are getting overcrowded and dirty day by day and creating unhealthy environment causing damage to the beauty of city. All these are because of mainly unplanned urbanization. It is possible to reduce the pressure of population of Dhaka is a great extent by developing Flats/Apartments as a permanent resident.

Focusing the need of housing for lower-and-middle income group of people, the Ministry of Housing and Public Works has taken an initiative to build several multi-storied residential complexes around Dhaka city through planned urbanization. The environmental degradation associated with the unplanned urbanization essentially require establishing permanent residential accommodation for the vast population and developing the surrounding area of Dhaka city in a planned way. Considering the housing constraints RAJUK has already completed 6636 apartments (Block-A) in Sector 18, Uttara within the affordability of low- and middle-income people. RAJUK has now initiated to construct 104 sixteen-storied buildings in Block-B (1250 sft flats in 52 buildings) and Block-C (850 sft flats in 52 buildings) with various civic amenities.

3.1.1. Urban Environment– Living and Working Condition

Tremendous inconsistencies are observed in facing the effects of rapid urbanization by the city management authorities. In most cases, the resources available and the resources needed to meet the needs and demands of the urban population, fall apart with growing deficiency. The followings are the main concerns of the developers, planners and decision makers for sustainable urban area development.

3.1.1.1. Growth of Population and Employment

❖ **Urbanization and Growth of Population**

- High-rate urbanization added to the existing population put pressure on land, urban infrastructure and services.
- Unplanned settlements with high density but with an unacceptable level of urban services.

❖ **Inadequate Employment and Income Generation Developments**

- Unplanned and inadequate employment opportunities,
- Poor industrial development,
- low levels of economic output,
- inappropriate growth of trade of commerce.

3.1.1.2. Provision of Urban Services

❖ **Housing Problems**

- Acute housing shortage,
- Inconsistencies in provision of housing for different income groups,
- Squatter settlements.

❖ **Water Supply and Sanitation Problems**

- Inadequate provision for potable water to residents,
- Pollution at sources and during distribution of water,
- Inadequate sanitation measures resulting in health and environmental problems waste disposal problems.

❖ **Other Services Problems**

- Defective electric distribution system,
- Frequent load shedding in power supply,
- Inadequate gas and fuel supply,
- Telephone communication problem,
- Telephone billing problem,
- Frequent price hike of essential services.

❖ **Problems of Leisure and Recreation**

- Inadequate facilities for recreation,
- Lack of opportunities for leisure and past time.

3.1.1.3. Provision of Urban Development Infrastructure

❖ **Transport and Communications Problems**

- Unplanned and uncoordinated transportation system resulting in difficulties in mobility of people,
- Inefficient transportation and traffic management resulting in intolerable traffic jam and accident risks,
- Problems of Improper and uncoordinated use of different modes of traffic and transportation.

3.1.1.4. Land Use and Land Development

❖ **Land Development**

- Sites and Services Development,
- Development and proper use of low-lying land,
- Development of water bodies,
- Land reform and land allocation,
- Lack of land use guidelines,
- Lack of land use control systems.

❖ **Land Ownership**

- Urban land ownership patterns,
- Land values.
- Tenure security of the migrants in urban areas

3.1.1.5. Planning for Sustainable Environment

❖ **Environmental and Ecological Problems**

- Serious environmental degradation,
- Disturbances in ecological balance,
- Air, water, physical based pollution,
- River pollution and its dangerous effects,
- Lack of open spaces, parks, playground, lakes, water bodies, low land, river, and shrinkage of the existing ones due to unauthorized occupation and improper use.

3.1.1.6. Good Urban Governance

❖ **Urban Management Problems**

- Weak institutional framework for good governance,
- Lack of honest, sincere and productive manpower,
- Lack of skilled and experienced technical manpower,
- Lack of adequate research facilities for promotion of development,
- Lack of an effective planning process,
- Lack of co-ordination among different development agencies.

❖ **Physical Planning Problems**

- Inadequate planning framework,
- Uncontrolled development and unauthorized constructions,
- Inadequate investment programmers.

3.1.2. Population Growth and Housing Situation in Dhaka

3.1.2.1. POPULATION GROWTH

From a humble beginning as a small colonial town, Dhaka emerged as a prominent city when it was selected to be the capital of Bangladesh in the 1970s. With a population of only 2,068,353 in 1974, the city's population increased to 3,440,147 in 1981 and more than tripled to 6,487,459 in 1991 due primarily to rural urban migration that was triggered by urbanized development. The result was that while overall urban population growth averaged 5.4% between 1981 and 1991, Dhaka's growth averaged 6.5%. Since 1991, Dhaka's population experiencing a growth rate of 4.3% compared to a national average of 3.9% (Table 3-1). According to 2001 census, the population of Dhaka mega city was 7,794,086 with an annual growth rate of 4.5%. In accordance with 2011 census, the population of Dhaka mega city was 12,043,977 with an annual growth rate of 1.9%.

Table 3-1: Population, Growth Rate and Density in Dhaka and urban Bangladesh

Year	Bangladesh (Urban)		Dhaka			
	Population (million)	Annual Growth Rate (%)	Population (million)	Annual Growth Rate (%)	Total Area (sq. km)	Gross density (person/sq. km)
1974	6.2	6.6	2.0	10.4	336	6,156
1981	13.2	7.8	3.4	8.1	509	6,759
1991	22.4	5.4	6.4	6.5	1,353	4,795
2001	28.6	3.9	9.9	4.5	1,459	6,771
2011	33.6	3.7	12.0	1.9	1,463	8,229

Source: BBS 2001, 2005, 2011

The city area expanded from only 85 sq. km. in 1951 to 1459 sq. km. in 2001. Annexation of new areas contributed 44.15% of the growth during 1981-1991, while 22.31% was contributed by natural growth during the same period while the other 33.53% increase took place due to migration of rural people into Dhaka city (Islam, 2005). The central city area is commonly referred to as Dhaka City Corporation (DCC) and has an area of 360 sq. km. only with a population size of 5.37 million in 2001 (BBS, 2005, p. 100). The estimated population of DCC is 6.7 million in 2005. Population density of Dhaka mega city was estimated to be 6,771 persons/sq. km. in 2001 which increased to approximately 8,260 persons/sq. km. in 2005. However, the population density in DCC area is more than three times of the mega city area, as in 1991 it was 15,333 persons/sq. km. against estimated density of 18,611 persons/sq.km. in 2005 (Kamruzzaman and Ogura, 2006). The gross population density in the mega city area is 8,260 persons/sq.km., but this figure hides the reality to a large extent. Less than 40 percent of the mega city area has been urbanized.

History of Dhaka North City Corporation (DNCC)

DNCC was established on 29 November 2011. Prior to the establishment of the corporation, this urban area was governed by the former Dhaka City Corporation (DCC). The DCC was dissolved by the Local Government (City Corporation) Amendment Bill 2011 on 29 November 2011, passed in the Parliament of Bangladesh, and formally ceased to exist on 1 December 2011, following the President's approval, making way for a Dhaka North City Corporation (DNCC) and a Dhaka South City Corporation (DSCC).

Table 3-2: Brief Description of DNCC Area

Year	Bangladesh (Urban)	Dhaka		
	Population (million)	Population (million)	Total Area (sq. km)	Gross density (person/sq. km)
2022	52.0	6.9	305.47	6,156

Source: BBS 2022

3.1.2.2. Housing Situation in Dhaka

The housing situation in Dhaka indicates that there exists a huge demand for affordable housing. Dhaka, a city of 12.6 million people increasing at 5% rate, has an annual requirement of 80,000 new dwellings. The growth in housing supply has always lagged behind the demand. This has resulted in overcrowding with high occupancy rates and high room density. The unsatisfactory housing situation is further reflected in the total and per capita availability of floor space of the main living area. Average total floor space for an urban household is only about 30m2 and per capita floor space averaged 5.1m2 in 1991.

Public sector housing production is too limited in Dhaka. So, the city dwellers need to depend on the formal and informal private sectors for their housing solution. In absence of well-established formal land and housing markets in Dhaka, the informal sector has been playing a major role in catering the housing needs. Small-scale builders and developers and (self-help) owner-builders operating in the informal private sector, are the largest suppliers of land and shelters in Dhaka (Islam, 2004). Generally, the informal providers acquire land and gradually construct their houses with or without official approval of plans. Only a small proportion of households' have access to housing finance. The majorities of the informal providers adopt piecemeal construction technique or build the house incrementally (Hoek-Smit, 1998). They start with small finance and develop consistently. This is the prevalent way of house building in the informal sector and thus they became the largest housing provider in Dhaka.

Lower middle and MIGs had been out of the city's housing market as the demand for space and its cost had increased enormously during Dhaka's recent growth. The presence of the study group around the city represents the significance of squatting who only gains access to the city's housing stock through rental markets. Most of the houses in the formal sector are designed and constructed in the western style i.e., spacious and expensive. These houses are constructed to sale to the wealthy groups and the study group abode there on rental basis. Families of lower middle and MIG often share main living and services in such houses. On the other hand, informal providers develop houses of low standard because of financial lacking. This project will develop housing models, design for low- and middle-income people, with affordable individual living space and sharing of services, which exhibits a number of housing options attainable to their means and sustainable to decent housing environment.

3.1.2.3. Tenure Type and Dwelling Structure in Dhaka

Most of Dhaka's low- and middle-income households do not own their house and have to squeeze into small-rented apartments, usually shared, with other families and the landlords. A tenure type analysis done by BBS (1991), which included Dhaka mega city, its municipality and other urban areas revealed that city dwellers are mostly housed in private rental apartments in the municipality area of

Dhaka. Apartments are now very popular for city dwellers. Private rental houses are less common in other urban area where the percentage of owned and purchased houses is much higher.

3.2. Relevance of the Project Idea

3.2.1. The National Context of Housing Provision

Development planning as prescribed in Bangladesh is done on a sectoral basis and hence disregards spatial dimension of planning. Within the national planning perspective, urban development in Bangladesh is an outcome of a process, which is shaped by the functional roles of national sectoral agencies and local government institutions. Special agencies for developing and providing essential services to Dhaka are RAJUK, Dhaka Water and Sewerage Authority (DWASA), Dhaka Electricity Supply Authority (DESA), Titas Gas Transmission Co. etc.

THE 8TH FIVE YEAR PLANS: MINISTRY OF HOUSING AND PUBLIC WORKS

Goal:

Development of sustainable and safe infrastructure through ensuring proper planning, adequate research and optimum use of land for cost effective housing and planned urbanization.

Major Urban Development Functions:

- Planning and undertaking of activities to solve housing problem of the country,
- Preparation of architectural and structural design of public buildings and other infrastructure, their construction and maintenance,
- Preparation of laws and policies to promote housing sector,
- Planned urbanization, proper use of land and development,
- Undertaking activities to solve the accommodation problem of government officers and staff,
- Conducting research and innovate technology on urbanization, housing, construction of buildings, construction materials and techniques,
- Creation of opportunities for involvement of the private sector in solving urbanization and housing problems with monitoring of customer delivery services and help enforcement of contracts.

SUSTAINABLE DEVELOPMENT GOALS (SDGs)

The 2030 Agenda for Sustainable Development states that the Sustainable Development Goals (SDGs) are integrated and indivisible and balance the three dimensions of sustainable development (economic, social, and environmental). SDGs are a collection of 17 interlinked global goals to transform our world. Each of the 17 goals strive for the universal reduction of climate change and poverty, and the improvement of education, health, and economic growth. The SDG's provide worldwide guidance for addressing each of these goals. Crises within the SDG's are faced by most countries and can only be addressed if we work as one global community.

Goal 11 describes about **SUSTAINABLE CITIES AND COMMUNITIES** to make cities and human settlements inclusive, safe, resilient and sustainable. The set goals and targets are as follows:

11.1. By 2030, ensure access for all to adequate, safe and affordable housing and basic services, and upgrade slums.

11.2. By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

11.3. By 2030 enhance inclusive and sustainable urbanization and capacities for participatory, integrated and sustainable human settlement planning and management in all countries.

11.4. Strengthen efforts to protect and safeguard the world's cultural and natural heritage.

11.5. By 2030 significantly reduce the number of deaths and the number of affected people and decrease by y% the economic losses relative to GDP caused by disasters, including water-related disasters, with the focus on protecting the poor and people in vulnerable situations.

11.6. By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management.

11.7. By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, particularly for women and children, older persons and persons with disabilities.

11.7 (a) Support positive economic, social and environmental links between urban, peri urban and rural areas by strengthening national and regional development planning.

11.7 (b) By 2020, increase by x% the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, develop and implement in line with the forthcoming Hyogo Framework holistic disaster risk management at all levels.

11.7 (c) Support least developed countries, including through financial and technical assistance, for sustainable and resilient buildings utilizing local materials.

3.3. Proposed Project Interventions

Since its establishment, Dhaka has grown mostly without planning interventions; substantially organic in nature. The patterns of areal expansion and the urban form of Dhaka have been largely dominated by the physical configuration of the landscape in and around the city. Dhaka's urban population is growing at an estimated 4 percent each year since Independence, at a time when national population growth was at 2.2 percent. This phenomenal growth is partly driven by the reclassification of rural areas into urban areas and natural urban population growth but also partly by considerable rural to urban migration. That large rural-urban population flows have been the key driver of the process of Urbanization of Dhaka city.

In a rapidly growing city, housing comes up as a major problem. The genesis of the problem remains in the fact that the development of housing and related infrastructure hasn't cope with the growth of population. Government's lone effort in terms of resources, capabilities and initiatives is not adequate to resolve the ever-increasing housing problem. As a result, the gap between housing demand and supply becomes wider. Housing is a key factor in making the proposed project area a sustainable, affordable, livable and equitable place for the vast population.

The project particulars at Block – B and Block – C is shown in Table 3-2.

Table 3-3: Proposed project description at a glance

Items	Block- B	Block- C
Land area	67.25 Acre	60 Acre
Flat Size	1250 sft	850 sft
Building No	52	52
Unit Per Floor	6	6
Total No. of Flats	4368	4368

Source: Prepared by the Consultant according to the ToR, 2023

3.3.1. Population Analysis

According to PRLDR, the standard population size per acre is 350, whereas DAP suggests 200 persons per acre. On the other hand, BBS 2022 recommends 4.5 persons per unit. The project is prepared for 19,556 persons for each block. Considering PRLDR data, the population size stays within the prescribed limit, but following DAP the size of population size exceeds the limit. To analyze population size, the standard population size of BBS 2022 is considered. Analysis of population distribution is shown in the following Table 3-3.

Table 3-4: Standard of Population Distribution

Sources	population and planning standard (person/acre)	Standard of Population Distribution		Remarks
		BLOCK B (105 acre)	BLOCK C (76.00 acre)	
PRLDR[1]	350	36,750 persons	26,600 persons	Population for Block-B and Block-C: • Within Range when Population is calculated within terms of PRLDR • Exceeds when Population is calculated within terms of DAP.
DAP[2]	250	26,250 persons	19,000 persons	

Source: PRLDR, 2004 (Amended 2012 & 2015) BNBC; Integrated Detail Area Plan (2022-2035); BBS population census 2022

3.3.2. Community Facilities According to Population

According to PRLDR- 2015, Schedule- 3, minimum thirty percent (30%) of total site area should be provided for community and utility services. Residential roads, Educational Institute, Kutcha Bazar and Market, health center, Mosque, Community Center, Graveyard, Park, Playground, and other Civil

[1] Private Residential Land Development Rule (PRLDR)
[2] Detail Area Plan (DAP)

Utility Services (according to Space Standards for Community Facilities) would be incorporated in this land.

3.4. Stakeholders

Stakeholders are individuals, groups and organizations who are actively involved in the project, or whose interests may positively or negatively affect because of project execution or successful project completion. Following figures will further demonstrates the stakeholders of "CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING FOR LOW- & MIDDLE-INCOME GROUP OF PEOPLE AT SECTOR-18, BLOCK- 'B' & 'C', UTTARA, DHAKA PROJECT".

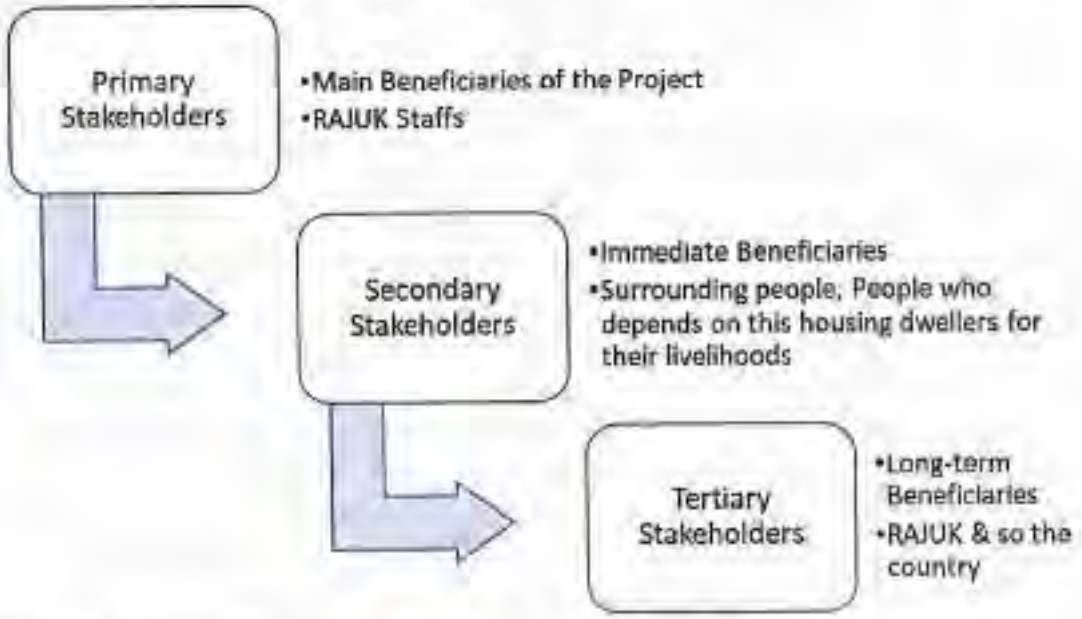


Figure 3-1: Stakeholder Tree of the Project

Source: Prepared by the Consultant, 2023

3.5. Demand Analysis

3.5.1. Background

Affordable housing is housing that is deemed affordable to those with a median household income or below (Sadeque, 2013) as rated by the national government or a local government by a recognized housing affordability index.

The World Bank recommended the median multiple indicate the affordability of housing- "A common measure of community-wide affordability is the number of homes that a household with a certain percentage of median income can afford. 50% affordability for the median home indicates a balanced market." However, it is generally accepted and the most commonly used definition that if a family spends a maximum of 30% of their income on housing, they are in the affordable range. The affordable income ranges in three major groups-higher, middle- and lower-income groups. The middle-income group can be defined in the subgroup as higher middle income, middle-middle income and lower-middle-income group. In Bangladesh, 50% of people are middle-income group people (Islam, 2004).

RAJUK's residential development has been transformed at the result of affordable housing demand. Multiple factors directly or indirectly contribute to the housing affordability of the middle-income

group. Western ideas have influenced the thinking and lifestyle of the middle-income group, also. The traditional joint families have been replaced by the nuclear family. In this section we will analyze different factors for increasing demand of affordable housing in middle-income group of people.

3.5.2. Household Income and Expenditure

Data on household incomes are notoriously difficult to compile since most households and individuals have several sources of income, both formal and informal. National censuses do not document household income. The sources of income data are therefore the various sample surveys conducted by agencies or individual researchers (Islam, Afroz & Shakil, 2020). The most comprehensive and latest data on the income of Dhaka households are available for 2020 from Islam, Afroz & Shakil, 2020. It has made estimates of distribution of households by their incomes in Dhaka city and presented in Table 3-5.

The redeem in affordable housing facilities has created a very positive vibe among middle income group of people as day by day owing apartment or a place in Dhaka city is becoming very difficult. The living cost is also increasing exponentially. As a result, the housing affordability index is also being high for the middle-income group. An individual is considered middle income based on his country's standards, according to ADB those who spend 10- 20 dollar per day for consumption is considered middle income. ADB considered 2005 as their base year. Adopting ADB's definition dollar 20 is 1700 BDT. An average family comprises of 5 individuals in Bangladesh. If the non-housing expenditure is (850*30) 25,500 the group is in lower income group. If the non-housing expenditure is (1700x30) 51,000 then the group falls into the middle-income group. To be in upper middle income, the group needs to spend more than 51,000 BDT. In our survey area middle-income groups are the potential buyers for housing. We collected sample data from a field survey. We presented it in Table 3-2 to distinguish different attributes and variations of the income-expenditure ratio.

Table 3-5: Income-expenditure relationship of different household

Monthly household income group	Average size of family	Monthly Expenditure	House rent	Savings after expenditure (yearly)	% of whole expenditure
40,000-45,000	03	25000	11000	120,000	30%
45,000-55,000	04	42000	20000	144,000	27%
55,000-65,000	03	45000	22000	204,000	31%
65,000-75,000	05	50000	28000	240,000	30%
75,000-85,000	05	55000	30000	264,000	31%
85,000-10,0000	06	60000	30000	295,800	29%
100,000+	05	75000	35000	360,000	30%

Source: Adapted from Pabna University of Science and Technology Studies (2020)

The affordability index is marginal in the project area. In Dhaka, if a family spends more than 30%, they are struggling with other necessity (Sadeque, 2013). From a field survey, data collection conducted per sft price and area of the apartment. Ten samples were collected from the middle-income zone; although samples of higher middle-income areas were avoided from the internet and another source, the study find that the price varies in the minimum percentage.

The target households comprise nearly the middle 50% of the total population in Dhaka.; they invest the right amount of money for housing. Most of the buyers take a loan from a bank, house building or other financial institutes. The percentage of self -financed housing or apartment is very few.

Table 3-6: Block-wise space price (BDT/SFT)

Block: B	Block: C
The flat size is 1,250 sft	The flat size is 850 sft
The mean Price per sft=7289 BDT	The mean Price per sft=7289 BDT
The price of a flat=91,11,250 BDT	The price of a flat=61,95,650 BDT

To buy a flat of 1,259 or 850 sft size on bank loan, one has to pay 81,976 of 55,744 BDT per month respectively. The banking sector provide housing loan to Landlord(s), Service holder(s), Businessmen, Professional(s), Expatriate(s) etc. The interest for a housing loan is redeemed to 9%. Most of the middle-income group people are incapable to comply with the terms and conditions of bank loans.

All eligible regular government officers and employees can apply for housing loan as per eligibility criteria of the loan scheme designed by Ministry of Finance. As per present circular, maximum ceiling for this loan is Tk75 lakh and maximum duration is 20 years. Present applicable rate of interest under this scheme is 9%, where government will provide subsidy at 5% to the employee and employee will bear remaining 4% interest of the loan. However, only the government loan is not sufficient to afford an apartment in Uttara unless the buyer has another source of income or alternative financial source.

3.5.3. Cost of Supply Components

In Bangladesh like other developing countries, house construction is predominantly a self-help activity. The capital of Bangladesh faces an acute shortage of housing. An unholy alliance of social snobbery, technological conservatism and extravagant spending culture has pushed up the cost of construction. A house price is comprised of land cost, labor cost and material cost. Together, the last two costs can be defined as the construction cost. In this section we will try to analyze the land and construction cost and would discuss emerging strategies.

3.5.3.1. Land Cost

The land price of Dhaka city is in rising since independence. From 1966 to 1983, Dhaka city has observed a drastic land price increase (Islam & mallick, 2013). After independence, the country went through rapid political and economic changes. The land price started rising in the mid-seventies. In recent times the expenditure of life and economic growth has spurred the increase in land price at Uttara Thana. The objective of designing a Satellite Town was practical until the development process was decentralized to the township. In practice, the allotment process was open to all, whether the applicants are from Dhaka central business district or from any other area, who can afford to purchase the plot. According to the survey in 1984, only 25% of the allotted plots had built-up structures. Of these structures, 57% were of single-storied buildings, which reflected the low density of the population of the township. The land and the infrastructure were provided so slowly that the price rise and it becomes a commodity and later, the rich buy and speculate in. The roads, electrification works, water supply to all sectors was ensured only in 1984-85, which is 14 years after the initial completion of work. The problem of providing communication was solved in the late 80s. The schools,

colleges and commercial functions began to be built in the late 80s. However, still, the plots were empty in the new areas of sector 17, 18 etc. The introduction of FAR has increased the opportunity of a commercial and mixed development of Uttara. Hence, the land price has increased drastically.

The registration value of the Uttara residential area is 1.5 million by the government (Sadeque, 2013) but the asking price differs by almost 1.5 times from the registered price. Figure 3-1 will provide some ideas regarding present land value and the increase between 2000 and 2021. Residential land values in prime locations of Dhaka range between 80 and 625 lakh BDT per katha.



Figure 3-2: Land Value in Prime Locations in Dhaka

Source: The Business Standard, June 04, 2023 (Accessed on 04/06/2023)

3.5.3.2. Building Cost and Construction

Housing affordability components are seen from two perspectives, namely capital investment – House purchase cost and household's capability, House occupation cost. The capital investment side land, infrastructure, building material, labor, and profits, down payment requirements are considered essential to make housing affordable to purchasers (Akhter, 2013).

Table 3-7: Ratio of Building cost at Uttara

Sl. No.	Locations	Civil cost	Infrastructure	Finishing	Land cost
01.	Uttara sector 10	30%	3%	47%	20%
02.	Uttara sector 13	37%	3%	45%	17%
03.	Doalipara	37%	8%	38%	15%
04.	Bawnia	37%	8%	35%	20%
05	Airport	40%	6%	34%	20%

Source: Field Visit (2020)

The household purchasing ability depends on some criteria like Location of land, Service cost, Building maintenance cost, Interest rates, Payment period, Savings. Labor is available in plenty and still being comparatively cheap in Dhaka; Its impact on the price of units could be overlooked. Among the components mentioned above land, building construction materials, and techniques (often known to

be the physical requirements of housing) are found to be the greatest effective components that profoundly affect the purchase cost of housing especially in the context of Dhaka city.



Figure 3-3: Land Value in Prime Locations in Dhaka

Source: Sadeque, 2013

Glaeser and Gyourko equate the housing price: Housing price = land area + other controls + Structure cost (Sadeque, 2013).

3.5.3.3. Building Material Cost

The costs of building materials and land prices have a considerable impact on housing affordability. There is a gradual price hike in the building industry. Construction costs and building materials have increased for the past two decades. In the metropolitan area of Dhaka, the percentage of land cost to total construction cost is much higher than the standard value. In the middle-income area, the land price is 62% and construction and other cost is 37%, permission cost is 1% (Chowdhury, 2013). In Uttara, the land cost and total construction cost ratio is 57% (Chowdhury, 2013). The area has a building construction market. Thus, transportation and material cost are not the highest but field survey and analysis show that finishing cost is the highest.

3.5.3.4. Housing Tax/ Registration Cost

The price of the apartment cost is comprised of 5 components with the original price of the apartment. Apartment price, registration cost, developer's tax, transfer fee, utility cost, price of parking (Chowdhury,2013) are the components of an apartment unit price.

Total registration cost= stamp duty 3%+gain tax 2% of the bid value+ registration tax 2% of the bid value local government fee (2% of Bid value) + value added tax 1.5 % bid value. The income tax ordinance (1984) is 2000 per sq. meter in Uttara. Apart from apartment price further additional costs affect housing affordability. The land value in Uttara per Katha is 1,500,000 set by the government, however The Business Standard, June 04, 2023, published that the land price per kata was 100 lakhs in 2021 and it is supposed to be increased by the time. So, the land value is assumed to be 50 lakhs according to The Business Standard, June 04, 2023. Say, there are 10 flats, for each flat land is .50 Katha. The construction cost is 2100 sft, the total area will be 1200 sft including 250 sft parking. Then the construction cost will be (1200*2100) 25,20,000 BDT.

As RAJUK is now trying to sell their 1,654sqft flat in BLOCK A for about Tk 80 lakh each (The Daily Star, June 13, 2023). The bid value of the apartment is assumed to be BDT 83,39,100 (Considering per sft value of flats in BLOCK A). The registration cost is 10% of the bid value and the total cost is BDT 91,73,010. In addition to registration costs, every housing unit needs to pay 125000 for utility connection and 250,000 for parking. The total price is 95,48,010, which is above the affordable limit of middle-income group of people.

3.5.4. Current Market Analysis

Multiple factors directly or indirectly contribute to the housing affordability of the middle-income group Multi-Ownership Housing. It is a complex and dynamic chain where the determinants are interdependent and are often difficult to comprehend the affordability conditions of the middle-income group Multi-Ownership Housing. It is expected that the housing Affordability of Multi-Ownership housing can be explained from a different perspective when analyzed by experts from a different discipline. Some of the critical factors that influence housing affordability are land value of the particular vicinity or area, construction cost, housing finance etc. Factors like tax, registration cost, construction material market also influence the housing affordability significantly. Other factors like the price of apartments or similar multi-ownership housing might be subject to market inflation, supply and demand chain etc. which are beyond the scope of this paper.



National Housing Authority (NHA) Recommends Apartment Size Between 800-1500 Sft To Be An Affordable Housing.



According to BIDS Research, Income range for
- Lower group – 35,000-70,000 Tk.
- Middle group – 70,000- 1,20,000 Tk.





30% The Thumb Rule According To Center for Neighborhood Technology(CNT)
- Affordable Range for Consumers of Housing Will Be Within 30 Percentage Of Their Income.

As stated earlier, it is generally accepted and the most commonly used definition that if a family spends a maximum of 30% of their income on housing, they are in the affordable range. For carrying out the research, we are considering the national pay scale-2015 as the private job sector does not have a fixed pay scale. However, the Private sector pay is often coherent to the national pay scale. In Bangladesh, housing finance is one of the major aspects of the middle-income group for housing affordability. There are financial institutes that provide housing loans at different schemes; but the

interest rate for the housing loan is comparatively high that makes the housing loan unaffordable for the middle-income group.

However, the proposed project with affordable payment policy is expected to have a positive impact on the middle-income housing affordability. Considering the case of Uttara, other factors for affordability like the price of apartments or the construction cost, land value etc. as stated earlier have to be met within the affordability range for the middle-income group to afford housing in that particular block. In Uttara, the demand for apartments is highest for 1100-1200 sft flats, which is 33% (Habib & Bhuiyan, 2013). Here, the buyers are willing to pay 5000-5600. However, developers are asking 7000 per sft. There is a gap between the real price and asking price. Such discrepancy significantly affects the housing affordability for the middle-income group. It is seen from the analysis section of the paper that the bank loan is not affordable to the target group of people in Uttara unless the buyer has another source of income or alternative financial source.

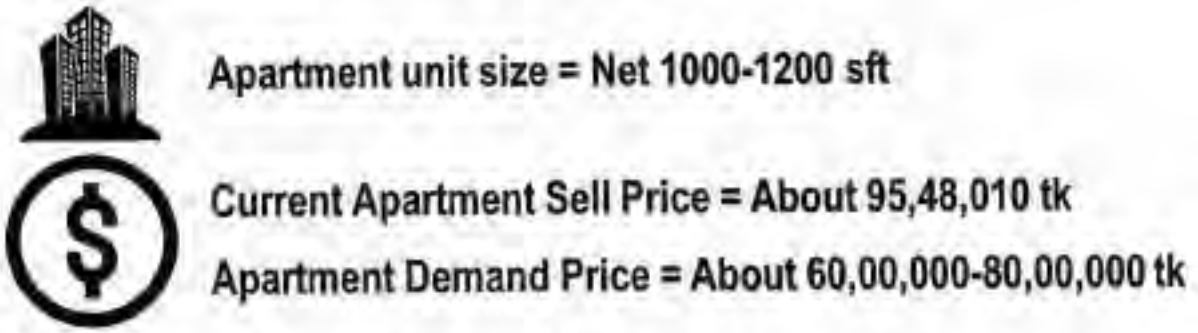


Figure 3-4: Major Findings of Market Demand Analysis

Source: Prepared by the Consultant, 2023

3.5.5. Current Demand

Present trend of housing development in Dhaka city is not only unaffordable to middle-class income group of people but also inadequate to the demand. Particularly, high land prices exacerbate the gap between the cost of new construction and the income of the middle-class income group of people.

Due to the increased cost of raw materials and housing, individual house owners and real estate developers are hesitant to start new projects. As a result, less houses are built causing a decline in the housing supply. This leads to further increases in housing prices and rentals. From a consumer point of view, they might face a price difference because of time interval. If a customer buys a flat from a developer at the initial stage, then the price will differ once the project has been completed. This is because as the material prices are increasing, the cost of flats will increase as well.

The proposed housing project are deemed to be best operated under the informal private sector management who somehow overcome financial barrier, which is regarded as one of the most difficult problems to boost the housing production in Bangladesh despite the existence of other problems including land, deficiency in planning, infrastructure, availability of local materials and ineffective hosing policy.

3.6. Present And Future Demand of Affordable Housing

Housing is a complex social and economic dynamic whose results are the physical patterns of cities and settlements, the qualities of collective living, and the health and well-being of the people. Housing

is thus a social and material fabric of any city and settlement; it is the key to enhancing the quality of life of the immediate dwellers and the overall city. Yet, housing suffers from many misconceptions and poor practices in Bangladesh.

The Consultant has collected data from various sources and analyzed for exploring the factors affecting apartment buying decision of middle-income people in Bangladesh. These are as follows:

3.6.1. Demographic Analysis

Demographic analysis refers to the analysis of different characteristics of population which include age, sex, race etc. (The United States Census Bureau 2020). But the demographic analysis of this research contains some additional characteristics e.g., apartment buying motive of participants, their ownership of lands and apartments, occupation, family size, monthly income, and duration of living in Dhaka.

- **Apartment Buying Motive**

A survey was conducted on people who visited real - estate companies in last 12 month to purchase apartments. The very first question was asked to the respondents on whether they still want to buy an apartment in near future. About 55% of respondents agreed strongly and 36% agreed. Only 9% of respondents remained neutral which implies that may not purchase an apartment in near future but may purchase at later time.



Figure 3-5: Whether customers want to buy an apartment in near future

- **Ownership of other Apartments/Lands in Dhaka**

Respondents were also asked whether they have any other land or apartment in Dhaka. It is found that 18% of respondents already have another apartment or land and 82% do not have any other apartment or land. That means they are first time buyer of apartment.



Figure 3-6: Respondents having another land or apartment in Dhaka

- **Occupation**

The respondents were also asked about their occupation. The following chart shows the percentage of respondents according to their occupation. It is found that 31% of respondents have private job, 25% are government employees, 23% are businessmen, 14% are self-employed (doctor, engineer, lawyer, chartered accountant, freelancer etc.) and 7% are expatriate.

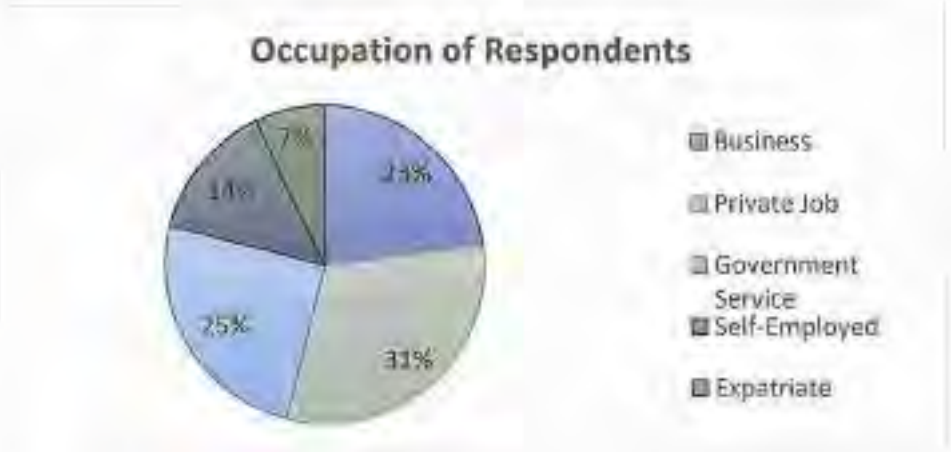


Figure 3-7: Occupation of Respondents

3.6.2. Apartment Choice by Customers

- **Preferred location for Apartment Purchase**

The respondents were also asked about their most preferred location for apartment purchase. In the following chart the responses of customers regarding first choice of location were summarized. It is found that the most preferred location for apartment purchase is Mirpur. It is the most preferred location for Mid-middle and lower-middle people. Due to lower cost of apartment in this area Middle-income people prefer this location. The second most preferred location is Uttara. Uttara is most preferred choice for upper income and upper-middle income class. Uttara is relatively costly area with higher cost of living. Therefore, only Upper income and upper-middle income afford an apartment in this area. The third preferred location is Banasree. It is a preferred location for all three middle-class people. Basundhara Residential Area is also another preferred location for upper-middle and mid-middle-income class. Mohammadpur and Basabo are solely preferred by Mid-Middle-income class. Gulshan and Dhanmondi are preferred by Upper and Upper-Middle class. Wari and Siddeshwari are preferred by upper-middle class.



Figure 3-8: Most preferred location by different class of customers

- **Apartment Amenities**

Participants were asked about the number of bedrooms they want in their apartment. It is found that majority of the respondents (about 55%) want 3-bedroom apartment. About 27% want 2-bedroom apartment and about 18% want 4-bedroom apartment.

Table 3-8: Expectation of Bedroom Numbers

Number of bedrooms required	Frequency	Percent	Valid Percent	Cumulative Percent
2	15	26.8	26.8	26.8
3	31	55.4	55.4	82.1
4	10	17.9	17.9	100.0
Total	56	100.0	100.0	

Survey participants were asked about whether they need any car parking space. About half of the respondents require car parking space, about 32% don't need any car parking space and about 18% respondents may need a car parking space. This means it would be better to get a parking space, but they don't mind if there is no car parking space.

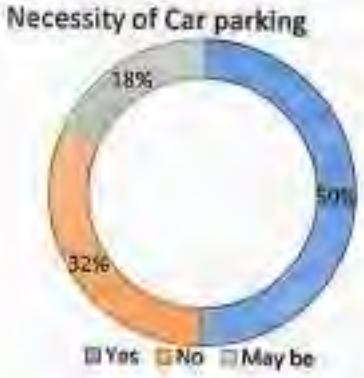


Figure 3-9: Whether customers need car parking space

3.6.3. Factors Affecting Apartment Purchase Decision

Eight factors have been identified as important factors which generally impact apartment purchase decision of customers.

3.6.3.1. Price

Since purchasing an apartment requires a lot of money, price is a crucial factor while purchasing an apartment. Respondents were asked whether their apartment must be affordable. The results are summarized in the following table. From the table it is found that about 27% of respondents strongly agreed to the need of an affordable apartment, about 61% agreed and only 12% remained neutral. This implies to the demand of affordable housing as a large portion of respondents strongly agreed with their affordability and inadequate source of financial inflow.

Table 3-9: The apartment must be affordable

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	7	12.5	12.5	12.5
Agree	15	60.7	60.7	73.2
Strongly Agree	34	26.8	26.8	100.0
Total	56	100.0	100.0	

3.6.3.2. Finance

Finance has been considered a crucial factor for growth of real estate industry. If customers get cheaper finance for long time, they get interested in buying apartments/houses. The survey participants were asked whether there must be instalment or credit facilities for buying apartment. It is found that about 41% of respondents strongly agreed and about 36% agreed to this statement. They need finance from bank or any other sources for buying apartment. Only 23% remained neutral which implies they may not require credit facilities for buying an apartment.

Table 3-10: Responses regarding the availability of credit/instalment facilities for buying apartment

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	13	23.2	23.2	23.2
Agree	20	35.7	35.7	58.9
Strongly Agree	23	41.1	41.1	100.0
Total	56	100.0	100.0	

3.6.3.3. Location and Communication

Primarily price of an apartment depends on its location. Apartment in prime location and having better communication facilities often priced higher the property located in remote area with inadequate communication facilities. Two questions were asked to respondents regarding location and communication. Firstly, they were asked whether they prefer their apartment where they have been living for a long time or nearby relatives' houses. The responses are summarized below. It is found that about 41% of respondents strongly agreed and about 38% agreed that they prefer apartments in the area they have been living for long time and they have relatives' houses nearby. Only 21% remained neutral in this regard which implies they are free to choose apartments in any areas irrespective of their relatives' house nearby.

Table 3-11: Preference of location for selection of houses

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	12	21.4	21.4	21.4
Agree	21	37.5	37.5	58.9
Strongly Agree	23	41.1	41.1	100.0
Total	56	100.0	100.0	

The second question was whether they want an apartment in the area from where communication with their workplaces and other prime locations i.e., markets, school, college, universities etc. is convenient. From the following table it is found that about 89% of respondents agreed and strongly agreed to this statement. They need apartments with easier communication. Only about 11% remained neutral in this regard.

Table 3-12: Preference of communication facilities for selection of houses

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	6	10.7	10.7	10.7
Agree	29	51.8	51.8	62.5
Strongly Agree	21	37.5	37.5	100.0
Total	56	100.0	100.0	

3.6.3.4. Security

Security is another crucial factor for choosing a location for buying an apartment. Therefore, a question was asked to the respondents on whether their prospective apartment buying area must be secured and the building must have adequate security. About 75% people agreed and strongly agreed to this statement. They require a secured area for buying an apartment.

Table 3-13: Emphasis given on security of the area and the building

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	14	25.0	25.0	25.0
Agree	33	58.9	58.9	83.9
Strongly Agree	9	16.1	16.1	100.0
Total	56	100.0	100.0	

3.6.3.5. Project Facilities

An apartment is not a commodity, it is purchased for lifetime. Therefore, customers choose an apartment by considering different facilities available in or near the project. Two questions were asked to the respondents in this regard. Firstly, customers were asked about what they expect nearby their apartment, such as school, playground, park, mosque/church/temple and other public facilities. It is found that almost all (about 96%) respondents either agreed or strongly agreed to this statement. Only 4% remained neutral in this regard.

Table 3-14: Choice of Project Facilities

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	2	3.6	3.6	3.6
Agree	16	28.6	28.6	32.1
Strongly Agree	38	67.9	67.9	100.0
Total	56	100.0	100.0	

In the second question respondents were asked whether they need lifts, CC Camera, garbage disposal and other modern facilities in the building. It is found that about 64% of respondents agreed strongly about 30% agreed normally and only about 5% remained neutral in this regard. This implies customers give most emphasis on project facilities.

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	3	5.4	5.4	5.4
Agree	17	30.4	30.4	35.7
Strongly Agree	36	64.3	64.3	100.0
Total	56	100.0	100.0	

3.6.3.6. Physical Quality of the Building

Since, most of the customers buy apartment for their living and spend significant amount of money behind an apartment, they may want best quality building materials and fitting for their safety and mental satisfaction. The respondents were asked whether the construction materials and fittings used in the apartment should be good quality. Half of the respondents agreed to this statement and other half strongly agreed. This implies customers don't want to compromise about construction material quality.

Table 3-15: Demand of physical quality of building

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Agreed	28	50.0	50.0	50.0
Strongly Agreed	28	50.0	50.0	100.0
Total	56	100.0	100.0	

3.6.3.7. Environmental Quality

The environment or the living condition impacts the physical and mental condition of people. Therefore, the researcher wanted to know from respondents whether they want a good, clean, and green internal living environment for their apartment. The responses are summarized below. From the table it is found that about 23% of respondents agreed strongly, about 59% of respondents agreed and about 18% remained neutral in this regard. The majority of the respondents want a good living environment.

Table 3-16: Demand of environmental quality

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	10	17.9	17.9	17.9
Agree	33	58.9	58.9	76.8
Strongly Agree	13	23.2	23.2	100.0
Total	56	100.0	100.0	

3.6.3.8. Reputation of the Developer

In Bangladesh, there are hundreds of cases where developers could not deliver apartments on time. There are also some cases where the relator fled with booking money of buyers. There are also cases where a single apartment was sold to multiple customers. Moreover, sometimes developers build apartments on illegal properties and use low quality construction materials. Therefore, reputation of the developer is included as a factor in this study which is not used by previous studies as factor for buying apartments. The respondents were asked whether the developer or relator must have previous good record regarding timely hand over and quality works. About 52% of respondents strongly agreed, about 36% agreed and about 12% remained neutral.

Table 3-17: Choice of Apartment Developer

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Neutral	7	12.5	12.5	12.5
Agree	20	35.7	35.7	48.2
Strongly Agree	29	51.8	51.8	100.0
Total	56	100.0	100.0	

3.6.4. Overall Ranking of Factors

The respondents were also asked to rank these 8 factors according to their importance to them. The following chart summarizes the ranking of factors according to their importance. From Figure 3-9 it is found that project facility is the highest regarded factor in rank 1. The second most considered factor is Price and Third most considered factor is Finance, the fourth most considered factor is Quality of construction materials and fittings, the fifth most regarded factor is location and communication of the apartment, the sixth most important factor is reputation of the developing company the seventh important factor is environment and the least important factor is security in rank 1.

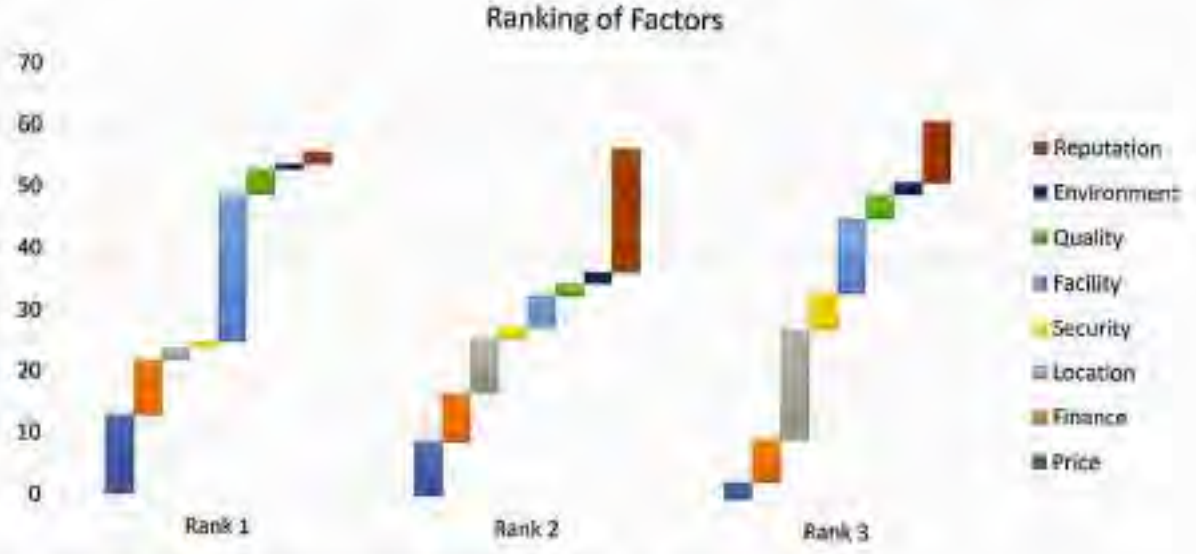


Figure 3-10: Ranking of Factors that Influence Buying Decision

In rank 2, the most important factor is Reputation of the developer. The second most important is price, the third most important factor is availability of financing facilities, the fourth most important factor is location, the fifth important factor is project facilities, the sixth important factor is quality of construction. Internal living environment and security are also ranked in the second group.

In rank 3, it is found that location is the most important factor. The second most important factor is project facility, the third most important factor is reputation of developer, the fourth important factor is finance, the fifth important factor is security the sixth important factor is price. Internal environment and construction quality are ranked as seventh and eighth in the third rank.

Considering the data, it is found that the most important factor for buying an apartment by different middle-income group of people. From the figure 3-9, it is found that project facility is the most regarded factor by mid-middle-class customers. The second most important factor to this class of customers is the reputation of the developer, price and finance are simultaneously ranked as third important factor by this class. Location is ranked as fourth most important factor for buying an apartment and quality is the fifth most important factor to them.

On the other hand, upper-middle class regarded location as most important factor. They emphasized on apartment price, facility, and reputation equally. They emphasized quality as the third most important factor, financing facilities as fifth most important factor, living environment as sixth important factor and security as seventh important factor. The lower-middle class considered price and finance facility as most important factor for purchase decision for an apartment. They also emphasized on location and project facility as important factors.

The upper-class considered project facility and location as most important factors. They also marked internal living environment and security as important factor for buying an apartment. They also emphasized on quality of construction materials.

3.7. Recommendation

As part of the Sustainable Development Goals set by the UN in 2015, goal 11 aims to make cities inclusive, safe, and sustainable. For this to happen, affordable housing must be made available to all by 2030 around the world and in our country. There is a scarcity of affordable housing in Bangladesh, particularly in Dhaka city. As of 2021, approximately 22 million people reside in the greater Dhaka metropolitan area, according to the World Population Review. The urban population of Bangladesh makes up approximately 40 per cent of the total population, and it is projected that by 2030, it will be 50 per cent. With temperatures and sea levels rising, the number of climate refugees from low-lying areas of the country moving to urban areas will reach approximately 20 million.

The middle-income population of the city is increasing, and so is the demand for housing. The middle-income population is expected to be 37 per cent of the total population by 2025, according to the IFC. However, the rent per square feet of the homes that cater to the middle-income people is on the higher side compared to those catered towards the upper-middle and upper economic segments. Middle-income and lower-middle-income groups living in urban areas of Bangladesh are paying high amounts of rent per square foot to live in cramped spaces. In many instances, they are paying amounts that are equivalent to the rent of commercial spaces. There is a significant affordable rental housing gap. The needs of the middle-income population are being undervalued. The present demographic

dividend creates a huge growth opportunity for Bangladesh. We have one of the youngest populations in the world. So, more and more people will be looking into better housing facilities as the working-age population grows larger.

With proper policy and adequate support, monthly rent payments can be converted into instalments towards homeownership. This will help the people with monthly household incomes between Tk 50,000 and Tk 100,000 become homeowners. In addition, financial institutions would assist these buyers of this income group to own an apartment. According to the Bangladesh Bank, mortgage finance penetration in the housing market is only 3 per cent (compared to the 50 to 70 per cent in developed countries), and home loans only make up about 6 per cent of the total loans in the financial sector. At present, the mortgage interest rate for a period of 20 years is about 7 to 8 per cent, which is too high.

3.7.1. SWOT Analysis

The consultant has prepared a SWOT analysis to better understand the demand and feasibility of the whole project.

SWOT Analysis: Dhaka's growing population and government policies aim to promote affordable housing, with private developers and skilled labor being key factors in the construction industry. However, high land and construction costs, lack of government regulation, and limited access to finance for low-income households make it challenging to build affordable housing. Opportunities include infrastructure development, subsidies, tax breaks, and partnerships between the government and private sector. Threats include rising land and construction costs, policy changes, and the private sector losing interest in affordable housing. To address these challenges and create a more affordable housing market, the government, private sector, and NGOs must collaborate. The SWOT analysis of affordable housing highlights its strengths, such as increasing demand, growing awareness, government support, innovative financing solutions, and strong partnerships between public and private sectors. It also highlights weaknesses like high construction and land costs, limited access to capital, regulatory hurdles, and stigma. Opportunities include a growing population and economy, government funding, new technologies, public-private partnerships, and increased awareness. Threats include rising housing costs, declining funding, political will, economic changes, and natural disasters. The diagram of SWOT of affordable housing project is given below:



Figure 3-11: SWOT Analysis of the Project

Source: Prepared by the Consultant, 2023

4. TECHNICAL AND TECHNOLOGICAL ANALYSIS

4.1. Site Analysis

4.1.1. Project Location

Sector 18 in the third phase of Uttara houses the Uttara Apartment Project, comprising Blocks A, B, and C. The project enjoys a favorable location with convenient access provided by the Ashulia-Mirpur Flood Protection Embankment Road and the Sonargaon Jonopath of Uttara Model Town. These well-connected highways facilitate easy accessibility to the project site.

Notably, there is a future proposal to establish a direct connection between the Uttara Apartment Project and Jashim Uddin Road in Uttara Model Town. This proposed connection holds significance as it will greatly enhance the accessibility and convenience for the project's residents, providing them with a direct route to Jashim Uddin Road.

Furthermore, residents of the Uttara Apartment Project will have the advantage of being within walking distance of two stations on the Mass Rapid Transit (MRT) system. The Central and South MRT-6 stations are conveniently located in close proximity to the project site. This offers the inhabitants seamless access to the extensive MRT network, ensuring convenient citywide transportation.



Figure 4-1: Project Location in the Context of the Uttara Third Phase Layout

Source: RAJUK, 2023

In summary, the Uttara Apartment Project boasts a strategic location with multiple transportation options. The existing road connections and the planned future direct access to Jashim Uddin Road further enhance its accessibility. Additionally, the presence of nearby MRT stations adds to the project's appeal by providing residents with convenient access to efficient public transportation.

4.1.2. Site and Surroundings

Except for the northern orientation, Block-B and Block-C of the Uttara Apartment Project are primarily surrounded by a lake. This element enhances the aesthetics and creates a tranquil environment for the occupants of these apartment buildings. The lake provides a beautiful view and can contribute to a tranquil living environment.

The Uttara Apartment Project site is well-connected to extensive road networks, making it easily accessible for residents and guests. The availability of broad roads facilitates traffic flow and provides residents with convenient transportation options, making it simpler for them to travel to the project area.

The campus of the World University is located on the eastern edge of Block-C. Students or faculty members who choose to reside in the Uttara Apartment Project may benefit from this proximity to an educational institution. It is convenient for commuting and access to educational institutions.

Both Uttara Central and Uttara South MRT stations are located on the northern side of the construction site. This is extremely advantageous for Uttara Apartment Project residents, as it provides easy access to the Mass Rapid Transit (MRT) system. The MRT stations serve as key transportation hubs, connecting residents to different parts of the city and facilitating efficient and smooth commutes.



Figure 4-2: Project Area and its Surrounding Major Establishment

Source: Google Earth Pro and Prepared by the Consultant, 2022

In conclusion, Block-B and Block-C of the Uttara Apartment Project present a picturesque lakeside setting. The location is well-connected by extensive road networks, making it easily accessible. Moreover, the proximity of the Uttara Central MRT station and the Uttara South MRT station provides residents with convenient access to the MRT system, thereby enhancing connectivity and transportation options.

4.1.2.1. Regional Connectivity

Regional Connectivity: The Uttara Apartment Project (Block- 'B' & 'C'), which is located in Dhaka, benefits from a variety of connectivity advantages, which improves access to key areas. This analysis investigates the project's connectivity to Gazipur, Mirpur, and Hazrat Shahjalal International Airport, revealing valuable information about transportation links.

The Project is strategically located approximately 23 kilometres north of Gazipur for access to the city. Although the precise route may fluctuate, the general direction from Gazipur to Dhaka is south. This connectivity provides residents and commuters with simple access to the industrial areas and natural attractions of Gazipur.



Figure 4-3: Regional Connectivity of Uttara Apartment Project

Source: Detailed Area Plan, 2022-2035 and Google Maps

4.1.2.2. Local Connectivity

Connectivity between Mirpur and Uttara: The National Highway (Gabtali Embankment - Uttara) has enhanced connectivity between Mirpur and Uttara in the project area. This highway has considerably shortened the distance between Mirpur and Uttara, which is now only about 6 kilometres. Commuters traveling from Mirpur to the Uttara Apartment Project have easy access to this direct and well-connected route, which facilitates seamless transportation and shortens travel times.

The Uttara Apartment Project is located approximately 10 kilometres to the west of Hazrat Shahjalal International Airport, which is in close proximity. Residents and visitors can take a direct route west from the airport to reach the project. This brief distance provides easy access to air travel, allowing frequent flyers to commute efficiently and facilitating connections to domestic and international destinations.



Figure 4-4: Local Connectivity of Uttara Apartment Project

Source: Detailed Area Plan, 2022-2035 and Google Maps

4.1.3. Prevailing Site Condition

4.1.3.1. Topography

The project site is found to have lower elevation comparing to the surrounding areas during the analysis of digital elevation data. Most of the developed land of the Uttara Area has an elevation value of 5-6m whereas average land elevation of the project area is about 3.2m. Block-B has an existing low-lying land that will be preserved during housing development.

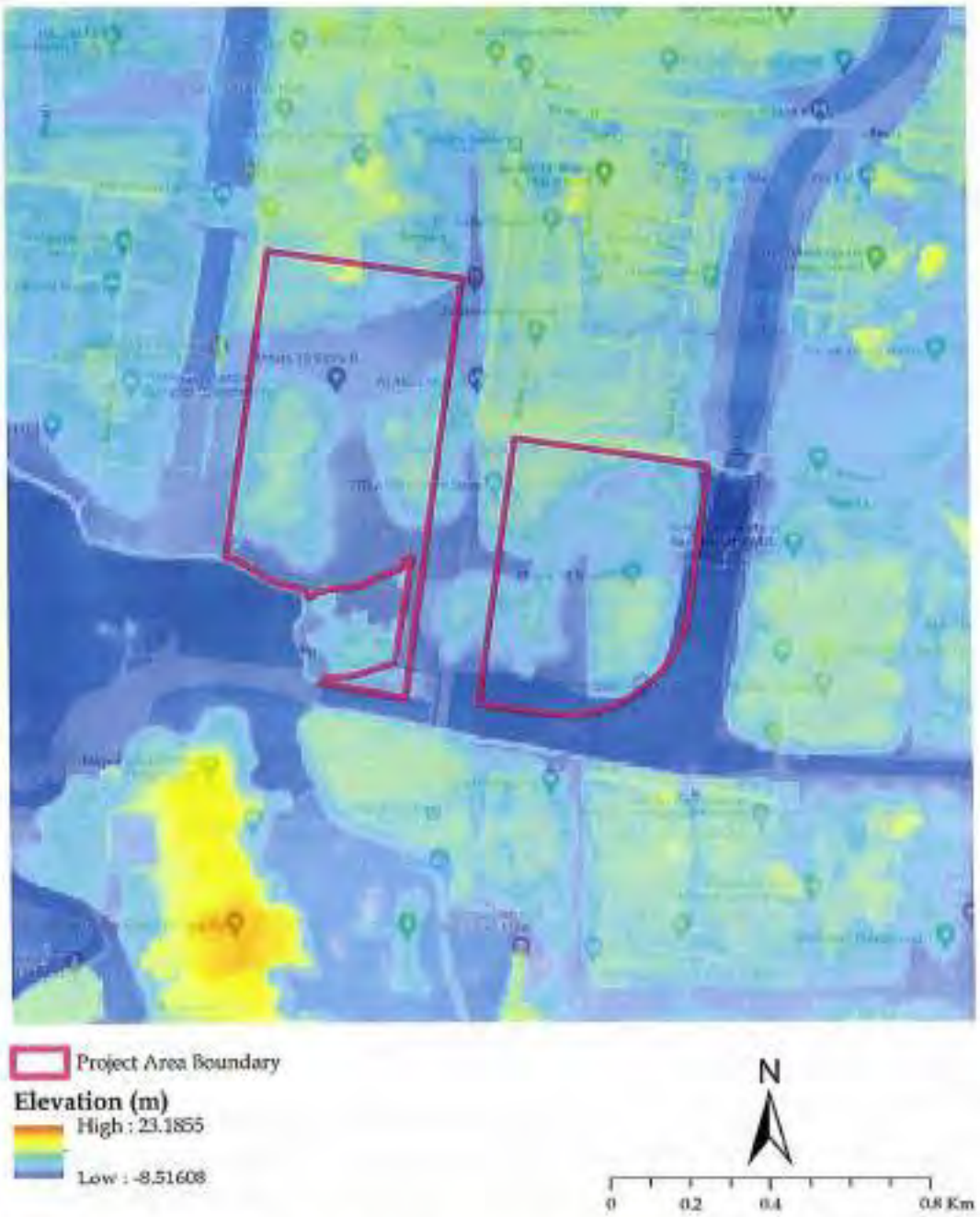


Figure 4-5: Digital Elevation Model of the Project Area and its surrounding location.

Source: Detailed Area Plan, 2022-2035

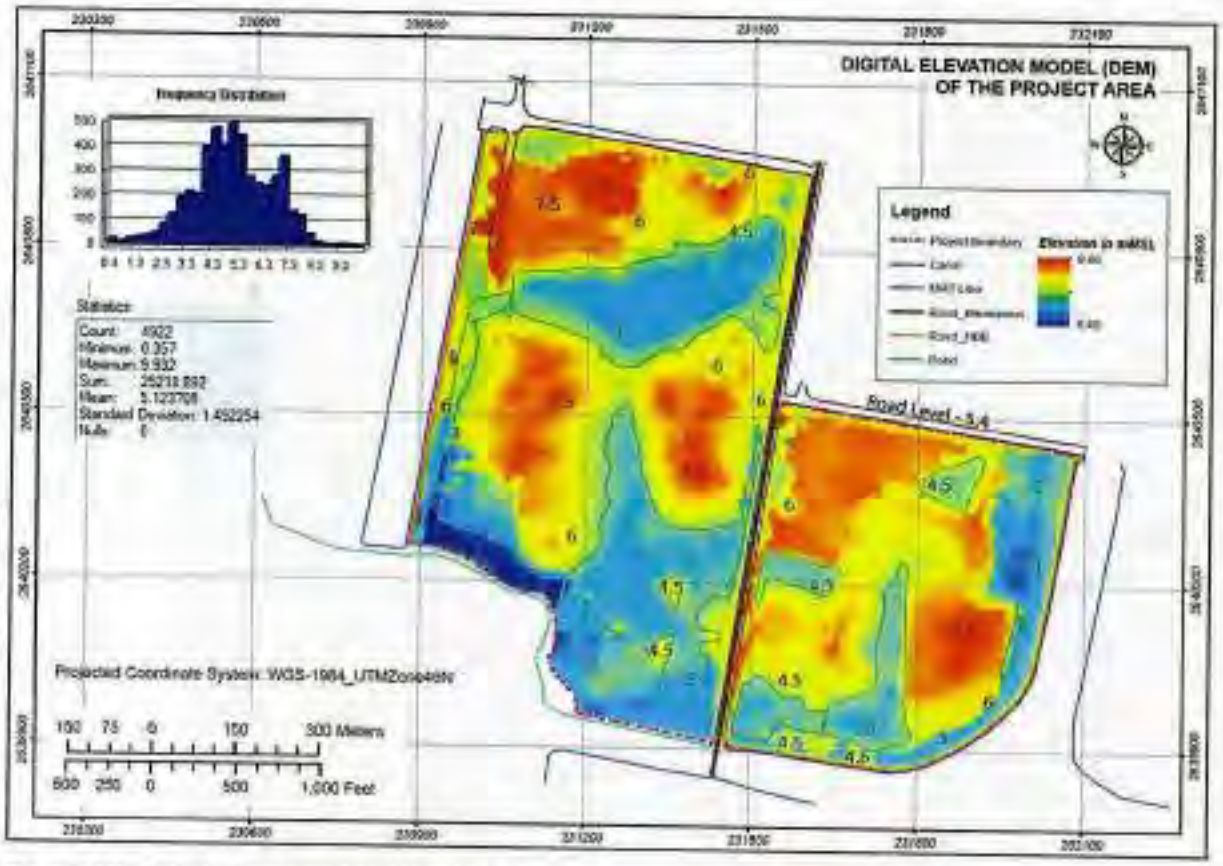


Figure 4-6: Digital Elevation Model of the Project Area

Source: RAJUK, 2023

According to the data collected from the RAJUK, elevation of the Block-B and Block-C varies from 0.40m to 9.86m. Northern part of the Block-B has higher elevation than the southern part. Similarly, Block-C has low-lying land on the eastern part.

4.1.3.2. Flood Flow Zone

DAP (2022-2035) highlights the flood flow zone that need to be preserved for ensuring the quality of the environment as well as easy flow of the storm water. There is major three zones under the flood flow zone demarcation according to DAP. Central Dhaka is considered as flood-free area and is not part of the flood flow zoning. Uttara third phase project lies within the flood-free area marked in DAP report. Following figure illustrates the flood flow zoning of the project and its surrounding areas.

According to FFWC of BWDB, Turag River at Mirpur Point:

- Highest Flood Level = 7.89 mMSL
- Danger Level = 5.5 mMSL



Figure 4-7: Flood Flow Zone in and around the Project Site

Source: Detailed Area Plan, 2022-2035

4.1.3.3. Land Suitability

Geological Survey of Bangladesh (GSB) has prepared a land suitability map of Dhaka City to identify the vulnerable area for high-rise development. According to the data collected from the GSB, land suitability of the Dhaka City has been categorized into five classes. These are:

1. 1 - Suitable for all kind of infrastructure
2. 2 - Suitable for all kind of infrastructure
3. 3 - Small infrastructure already requires pile foundation
4. 4 - Weak foundation conditions, pile foundation required
5. 5 - Very weak foundation conditions required specialized foundation design

According to the GSB data, land within and outside of the project area has very weak foundation and structure requires specialized foundation for development.



Figure 4-8: Land Suitability Analysis of the Project Area

Source: Detailed Area Plan, 2022-2035

According to the GSB data, land within and outside of the project area has very weak Soil Condition and structure requires specialized foundation for development.

4.1.3.4. Airport Height Zone

Project site is located within closer proximity of Hazrat Shahjalal International Airport (HSIA). Therefore, height restriction imposed by the Civil Aviation Authority of Bangladesh (CAAB) will be applicable for the project. According to the data collected from the CAAB, height restriction for the project site is 45m.



Figure 4-9: Height Restriction Zoning due to the Airport

Source: Detailed Area Plan, 2022-2035

According to the data collected from the Civil Aviation Authority of Bangladesh (CAAB), height restriction for the project site is 53.7 m MSL.

4.1.4. Environmental Setting

1) Geology: A hard sand layer arises under a clay and silt layer 10 m below ground with a N value of 5 to 11. The bearing stratum is 16–30 m underground. The elevated structure and station will be supported by a bored pile pushed into the hard sand layer. Ground subsidence is expected to have little influence.

2) Air Quality: Bangladesh's ambient air quality norms are met by NOx and SO2, but PM 10 and PM 2.5 levels surpass them, especially in the dry season. The Project scenario may reduce emissions by 10% by 2025.

3) Water Quality: Three Project-area bodies of water were examined for water quality. The pH values at three spots passed environmental limits, while total coliform and COD showed that home wastewater contamination exceeded standards at all locations. The Project's discharge may not have a major impact.

4) Noise: At five places, a noise survey found noise levels significantly above the standard. In metropolitan settings, the Project's 65 dB noise level may not be a problem.

5) Fauna and Flora: The project site from Uttara North to Pallabi is undeveloped and will be a new settlement. The project site was assessed for Bangladesh Red Data Book-listed rare and precious species. This survey missed uncommon and valuable species.

4.2. Project Demand Assessment

According to the latest study by World Population Review, Dhaka, the capital of Bangladesh, is ranked sixth in terms of population size. As of 2022, the metro region of Dhaka housed approximately 22,478,116 people, resulting in a high population density of 23,234 individuals per square kilometer. However, due to various factors, such as migration and limited housing availability, the city is experiencing unintended overpopulation, posing risks to the environment and hindering sustainable growth. In response to the need for housing, particularly for the lower and middle-income groups, the Ministry of Housing and Public Works, under the guidance of the Honorable Prime Minister, has initiated a planned urbanization project. The objective is to construct multi-storied residential complexes in strategic locations around Dhaka city. This planned approach aims to address the environmental degradation associated with unplanned urbanization and provide permanent housing for the significant population. The proposed Uttara Apartment Project plays a crucial role in this endeavor, as it involves the preparation of a master plan and design drawings for the construction of buildings and infrastructure components.

The United Nations adopted the Sustainable Development Goals (SDGs) with the aim of eradicating poverty, protecting the planet, and ensuring prosperity for all. These goals are especially crucial for developing countries, as they are home to the majority of the world's impoverished and vulnerable populations. By collaborating and working together, developing nations can strive to eliminate extreme poverty, safeguard the environment, and foster inclusive economic growth. These goals are not only achievable but also have the potential to create a better future for everyone.

One of the specific SDGs, SDG 11.1, focuses on providing safe, affordable housing, basic services, and improved living conditions for individuals living in slums. However, numerous challenges such as rapid urbanization, growing inequality, and the impacts of climate change make achieving this goal complex. To address these challenges, governments and businesses must make investments in affordable housing, offer financial assistance, enhance the quality of housing in slums, and raise awareness about the importance of adequate housing. By pursuing this objective, we can foster a sustainable and equitable world, significantly improving the lives of millions of people and establishing a more resilient future.

The study for the preparation of a master plan and design drawings for the proposed buildings and infrastructure of the Uttara Apartment Project serves to determine the viability of the components to be constructed or implemented within the project. This comprehensive assessment will ensure that the proposed elements are both legally and technically feasible, as well as economically justifiable. Through this study, the project's goal is to ensure that the Uttara Apartment Project aligns with its

objectives, adheres to established regulations, and meets the needs of the community it serves. Additionally, the study will evaluate the project's feasibility in terms of its social and environmental impacts, guaranteeing that it contributes to providing safe, affordable housing, basic services, and improved living conditions for its residents. Planning Frameworks

During planning of a housing project, it is essential to follow a structured frameworks for a successful project implementation. Following figure briefly illustrates the framework for the project implementation.

1. Needs Assessment

Conduct a comprehensive needs assessment to determine the specific housing requirements of the target population. Consider factors such as demographic data, income levels, family sizes, and preferences. This assessment will help identify the type, size, and affordability of housing units needed.

2. Site Selection and Feasibility Analysis

Identify suitable locations for the housing project based on factors like accessibility, infrastructure availability, proximity to amenities, and future development potential. Conduct a feasibility analysis to evaluate the viability of each potential site, considering factors like land cost, environmental impact, and regulatory requirements.

3. Master Planning

Develop a master plan that outlines the overall layout and design of the housing project. This plan should include the distribution of housing units, common spaces, infrastructure, and amenities within the project area. Consider aspects such as walkability, green spaces, parking facilities, and community facilities to enhance livability.

4.Stakeholder Engagement

Engage with various stakeholders, including local communities, government agencies, housing authorities, and non-profit organizations. Seek their input and feedback throughout the planning process to ensure the project aligns with their needs and aspirations. Encourage participation and collaboration to foster a sense of ownership and inclusivity.

5. Regulatory Compliance

Understand and adhere to the relevant local, regional, and national regulations, building codes, and zoning requirements. Ensure that the housing project complies with legal and technical standards related to construction, safety, accessibility, and environmental sustainability.

Following figure illustrates the overall planning framework of the project.



Figure 4-10: Integrated Planning Frameworks for the Project Implementation

Source: Proposed by the Consultant, 2022

4.3. Major Interventions of the Project

The project is mainly to develop a housing project for middle- and low-income people. Development of Master plan of UTTARA APARTMENT PROJECT (Block- 'B' & 'C') is progressed by design considerations and concepts along with rules and regulations. The updated site Area of Block B and Block C are 105.87 and 73.64 acre respectively. The concept of Transit Oriented Development and consideration of Detailed Area Plan (DAP, 2022-2035) is incorporated in design considerations. Population and ratio of built form, soak able green and open spaces are considered from DAP.

The concept will be acknowledged during the design process by including elements like block-based multistorey housing that promotes pedestrian-oriented development, green buffer and public spaces next to main connectivity for noise and air pollution screening, streetscape with tactile paving, cycle tracks, and safety measures for street crossings. Additionally, existing waterbodies in site are part of design process. Surrendered land for bock-based housing according to DAP generate a challenge in the design process, whereas the plots for surrendered land are placed along Transit Oriented Development zone for further development and alongside Avenue roads which will be easily accessible from external roads and segregated from residential zone. Furthermore, Community and utility facilities provided in the housing project are allocated in the central portion along main axis for ease of accessibility, walking environment with wide pavement and cycle tracks interconnecting within the block, reduce traffic congestion and adjacent neighbourhood will be facilitated as well. According to PRLD- 2015, minimum thirty percent (30%) of total site area should be provided for community and utility services Residential roads Educational Institute, *Kotcha* Bazar and Market health centre,

Mosque, Community Canter Park, Playground, and other Civil Utility Services (according to Space Standards for Community Facilities) would be incorporate in this land. So,

for Block B (105.87*30%) =31.76-acre land should be kept for community and utility services &

for Block C (73.64*30%) =22.09-acre land should be kept for community and utility services

Allocation of Areas for Community Services for each residential Block B & Block C for population 21,174 and 14,728 are provided below:

Table 4-1: Allocation of Community Facilities for Block B

No.	Community Facilities	Facility (Acres) per 1000 people	Required Area (Acres) 21,174 people
	EDUCATION		
1.	School	0.038	0.80
	College	0.040	0.84
2.	**HEALTH**		
	Health Care Center	0.030	0.635
	COMMUNITY ORGANIZATION		
3.	Community Center	0.020	0.42
	Mosque	0.020	0.42
	RECREATION		
4.	Playground	0.030	0.63
	Park	0.030	0.63
5.	**ADMINISTRATION**		
	CBD	0.020	0.42
	COMMERCIAL		
6.	Corner shop/ Market/ Kutcha Bazar	0.030	0.63
7.	**ROADS**		
	Residential roads	0.600	12.70
	TOTAL		**18.12**

Source: PRLDR- 2015, Schedule- 3

Table 4-2: Allocation of Community Facilities for Block C

No.	Community Facilities	Facility (Acres) per 1000 people	Required Area (Acres) 14,728 people
1.	**EDUCATION**		
	School	0.038	0.56
	College	0.040	0.58
2.	**HEALTH**		
	Health Care Center	0.030	0.44
3.	**COMMUNITY ORGANIZATION**		
	Community Center	0.020	0.30
	Mosque	0.020	0.30

4.	**RECREATION**		
	Playground	0.030	0.44
	Park	0.030	0.44
5.	**ADMINISTRATION**		
	CBD	0.020	0.30
6.	**COMMERCIAL**		
	Corner shop/ Market/ Kutcha Bazar	0.030	0.44
7.	**ROADS**		
	Residential roads	0.600	8.83
TOTAL			**12.63**

Source: PRLDR- 2015, Schedule- 3

4.4. Technical Design

4.4.1. Codes and Design Standards

4.4.1.1. Bangladesh National Building Code 2020

The Bangladesh National Building Code (BNBC) includes comprehensive guidelines and regulations for apartment building construction. The BNBC specifies the following norms and considerations for the construction of apartments:

- The BNBC specifies the minimum structural requirements for apartment buildings, such as load-bearing capacities, seismic resistance, foundation design, and structural stability.
- The BNBC emphasizes fire safety measures in apartment buildings, including requirements for fire-resistant building materials, adequate fire escapes and staircases, fire detection and alarm systems, fire extinguishing equipment, and emergency evacuation plans.
- The BNBC provides guidelines for the selection and use of suitable building materials in apartment construction, ensuring durability, strength, and resistance to environmental factors such as moisture, heat, and corrosion.
- Electrical and Plumbing Systems: The BNBC establishes standards for apartment building electrical and plumbing installations, including wiring, electrical safety, plumbing fixtures, water supply, waste disposal, and drainage systems.
- Ventilation and Natural Lighting: The BNBC stresses the importance of proper ventilation and natural lighting in apartments, mandating the provision of adequate apertures, air circulation, and light access to ensure a healthy and comfortable living environment.
- The BNBC includes provisions for accessibility in apartment buildings, including provisions for ramps, elevators, and barrier-free design, to ensure that common areas, entrances, corridors, and facilities are accessible to persons with disabilities.
- The BNBC outlines safety measures for apartment occupants, such as regulations for balcony and railing design, minimum ceiling heights, appropriate noise insulation, and guidelines for preventing accidents and hazards.
- The BNBC encourages environmentally sustainable apartment building practices by promoting energy-efficient design, refuse management systems, rainwater harvesting, and other green building techniques.

4.4.1.2. Dhaka Mahanagar Imarat Nirman Bidhimala 2008

The bidhimala was enacted from Building Construction Act, 1952 (Act No. II of 1953) under section 18 for building construction guidelines. It will be also enacted for development of planned area under Town Improvement Act 1953 (Act No. XIII of 1953).

Rules and regulations by considering building requirements with proper allocation of spaces, Parking facilities, room size and dimensions needs to be implemented following the guidelines.

According to Dhaka Imarat Nirman Bidhimala-2008, Table-4:

a. Parking

Residential facility

For 850 sft multi-family apartment 1 car parking needed for every 4 units.

For 1250 sft multi-family apartment 1 car parking needed for every 2 units.

Educational institution

1 car parking needed per 200 sq.m. Area

Hospital facility

1 car parking needed for every 5 beds

Commercial facility

For office space, shops, department store, 1 car needed per 200 sq.m. Area

For restaurant, 1 car needed per 100 sq.m. Area

Community facility

For party center/community center, 1 car needed per 100 sq.m. Area

For Masjid, 1 car needed per 100 sq.m. Area

b. Minimum Standard of a Dwelling

Table 4-3: Changes between Imarat Nirman Bidhimala and BNBC

functions	Dhaka Imarat Nirman Bidhimala-2008	Bangladesh National Building Code 2020
Bedroom size	• Minimum height of a bed room must be 2.75 m. • In a residential unit minimum one bed room must have 9.5 sq.m area where width of the room can't be less than 2.5 m.	• All habitable rooms used for sleeping and other purposes of a dwelling unit shall not be less than 9.5 m^2 of net floor area with a minimum width of 2.9 m.
Kitchen size	• Minimum area of a kitchen must have 4 sq.m where minimum width will be 1.5m. • Minimum height kitchen must be 2.75m.	• The minimum floor area of kitchen without provision for dining shall be 4 m^2 with a minimum width of 1.5 m. The minimum floor area of a kitchen which is intended to provide dining or

functions	Dhaka Imarat Nirman Bidhimala-2008	Bangladesh National Building Code 2020
		occasional sleeping space shall be 7.5 m^2 with a minimum width of 2.2 m • The minimum clear height of kitchen measured from the finished surface of the floor to the finished ceiling shall be 2.75 m, except for any floor trap of the upper floor which shall have a minimum clearance of 2.15 m above the finished floor. The minimum clear height of kitchen shall be 2.15 m where mechanical exhaust is installed
Toilet size	• Minimum area of a toilet with basin, water closet and shower facility must be 2.75 sq.m with minimum width 1m. • Minimum height must be 2.13m	• The minimum requirement of floor area and width of a bathroom with 3 fixtures must be 3sq.m with minimum width of 1.25 m. • The height of any bathroom, toilet or water closet shall not be less than 2.15 m measured from the finished floor surface to the finished ceiling.
Stair size	• For apartment building stair width must have 1.15 m • For educational building, stair width must have 1.5 m • For masjid, community center & large shop, stair width must have 2 m • For office space, stair width must have 2 m	
Non-habitable rooms	Other non-habitable rooms in the dwelling unit shall have a minimum area of 5 m^2 with a minimum width of 2 m.	Other non-habitable rooms in the dwelling unit shall have a minimum area of 5 m^2 with a minimum width of 2 m.

Source: Imarat Nirman Bidhimala, 2008

4.4.1.3. Private Residential Land Development Rule (PRLDR), 2004 (1st Amendment 2012, 2nd Amendment 2015)

The Private Residential Land Development Rule (PRLDR) is for regulating land development in Bangladesh's private housing industry. It offers methods and regulations for environmental protection during land development. It also provides percentages of land that must be kept for community

facilities, amount of land to be sold out, school sites, road hierarchy and importantly planning standards, for example, allocation of land per 1000 population.

(৯) তফসিল-৩ এর পরিবর্তে নিম্নরূপ তফসিল-৩ প্রতিস্থাপিত হইবে, যথা:—

"তফসিল-৩

[বিধি ৯(১) এবং বিধি ১০(৩) দ্রষ্টব্য]

ক্রমিক নং	জনসংখ্যার ভিত্তিতে আবেদন কমিউনিটি সেবাসমূহের আনুপাতিক পরিমাণ একর (হেক্টর)											
	কমিউনিটি সেবাসমূহ	প্রতি ১০০০ জনসংখ্যায় সেবাসমূহ	জনসংখ্যার আকার									পরবর্তী যে কোন জনসংখ্যার ক্ষেত্রে প্রয়োজ্য প্রতি অতিরিক্ত পরিমাণ একর (হেক্টর) অনুযায়ী নির্ধারিত হইবে
			১৫০০	৫০০০	১০০০০	১৫০০০	২০০০০	২৫০০০	৩০০০০	১০০০০০	১৫০০০০	
১	২	৩	৪	৫	৬	৭	৮	৯	১০	১১	১২	১৩
শিক্ষা												
১.	কাচারি এবং প্রাথমিক বিদ্যালয়*	০.০৫৮ (০.১৪)	০.০৮৫ (০.২১)	০.১৮০ (০.৪৫)	০.৩৬০ (০.৯০)	০.৪৭০ (১.১৬)	০.৭৯০ (১.৯৫)	০.৯৩০ (২.৩০)	১.৯০ (৪.৭০)	৩.৯০০ (৯.৬৩০)	৫.৭৯০ (১৪.২০৩)	–
২.	মাধ্যমিক বিদ্যালয় এবং কলেজ*	০.০৪০ (০.১০)	০.১০০ (০.২৫)	০.২৪০ (০.৬০)	০.৩৩০ (০.৮২)	০.১৮০ (০.৪৫)	১.১৭০ (২.৯০)	২.০৫০ (৫.০৪)	৪.৮০০ (১১.৮৫)	৯.৮০০ (২৪.২০)	১৪.৫০০ (৩৫.৮৩)	–
স্বাস্থ্য সেবা												
৩.	ছোট ক্লিনিক এবং ডায়াগনোস্টিক*	০.০৯০ (০.২২)	০.০৭৫ (০.১৯)	০.১৫০ (০.৩৭)	০.৩০০ (০.৭৪)	০.৪৩০ (১.০৬)	০.৬০০ (১.৪৮)	০.৭৫০ (১.৮৫)	১.৫০০ (৩.৭০)	৩.৩০০ (৮.১৫)	৫.৩০০ (১৩.০৯)	–
কমিউনিটি সেবাসমূহ												
৪.	প্রশিক্ষণ এবং কমিউনিটি সেন্টার*	০.০৯০ (০.২২)	০.০৩০ (০.০৭)	০.১০ (০.২৫)	০.২০ (০.৪৯)	০.৩০ (০.৭৪)	০.৪০ (০.৯৯)	০.৫০ (১.২৩)	১.০০ (২.৪৭)	২.০০ (৪.৯৪)	৩.০০ (৭.৪১)	–
বাণিজ্যিক												
৫.	কাঁচা পণ্য/ বাজার/দোকান বাজার*	০.০৫০ (০.১২)	০.০৭৫ (০.১৯)	০.১৫০ (০.৩৭)	০.২৫০ (০.৬২)	০.৪০০ (০.৯৯)	০.৫০০ (১.২৩)	০.৭৫০ (১.৮৫)	১.৫০০ (৩.৭০)	৩.০০০ (৭.৪১)	৪.৫০০ (১১.১২)	–
প্রশাসনিক												
৬.	স্থানীয় প্রশাসনিক সিটির (সিটিজি)*	০.০৫০ (০.১২)	০.০৬০ (০.১৫)	০.১০ (০.২৫)	০.১৫ (০.৩৭)	০.২০ (০.৪৯)	০.৩০ (০.৭৪)	০.৪০ (০.৯৯)	১.০০ (২.৪৭)	২.০০ (৪.৯৪)	৩.০০ (৭.৪১)	–
কমিউনিটি সেবাসমূহ												
৭.	খেলার মাঠ	০.০৪০ (০.১০)	০.০৪০ (০.১০)	০.১০ (০.২৫)	০.১৫ (০.৩৭)	০.২০ (০.৪৯)	০.২০ (০.৪৯)	০.২০ (০.৪৯)	১.০০ (২.৪৭)	১.০০ (২.৪৭)	১.০০ (২.৪৭)	–

Figure 4-11: Community Facilities by the number of populations (a)

Source: PRLDR, 2015

Community facilities will be determined on the basis of number of populations residing on the project such as Kutcha Bazaar, Community Center, Shopping Center and as such. Recreation facilities will also be determined by number of populations which includes play-field, park, open space and green public square. Project Area residing with 20,000 population needs to provide an open field of 1.6 Acre. Area for developing Waste Water and Sewerage Treatment Plant for housing needs to be provided in the

layout plan. Under Act 10 of sub-act 3, 30% of the total developed land needs to preserved for Community and Utility Facilities. Community facilities required with 20,000 populations (as per calculation of Block B and Block C with 200 ppa) is mentioned in the following figure.

৫৫৫৬ বাংলাদেশ গেজেট, অতিরিক্ত, জুলাই ৭, ২০১৫

১	২	৩	৪	৫	৬	৭	৮	৯	১০	১১	১২	১৩
চিত্র বিনোদন												
৮.	খোলা মাঠ	০.০৩০ (.০৩২)	০.০৩৫ (.০৩৬)	০.১৫০ (.০৯৩)	০.৩০০ (.১২০)	০.৪৫০ (.১৮০)	০.৬০০ (.২৪)	০.৭৫০ (.৩০১)	১.৫০০ (.৬০২)	৩.০০০ (১.২০০)	৪.৫০০ (১.৮০৫)	-
৯.	পার্ক/মেলা	০.০৩০ (.০১২)	০.০৩৫ (.০৩৩)	০.১৫০ (.০৬০)	০.৩০০ (.১২০)	০.৪৫০ (.১৮০)	০.৬০০ (.২৪)	০.৭৫০ (.৩০১)	১.৫০০ (.৬০২)	৩.০০০ (১.২০০)	৪.৫০০ (১.৮০৫)	-
রাস্তা												
১০.	সব ধরণের আবাসিক রাস্তা**	০.৯০০ (১.৪৮৩)	১.৫০ (.৬০৭)	৩.০০ (১.২১)	৭.৫০ (২.৪৩)	৯.০০ (৩.৬৪)	১২.০০ (৪.৮৫)	১৫.০০ (৬.০৭)	৩০.০০ (১২.১)	৬০.০০ (২৪.৩)	৯০.০০ (৩৬.৪)	-
১১.	কমিউনিটি সেন্টারভুক্ত (মোট প্রয়োজন পরিমাণ সেন্টার)	০.১৫৮ (.০৪৭)	২.১৯ (.৮৭)	৪.১৯ (১.৭৪)	৮.৩৮ (৩.৩৮)	১২.৫৭ (৫.০৯)	১৬.৭৬ (৬.৭৮)	২১.০৩ (৮.৫০)	৪২.১০ (১৭.০৩)	৮৪.১০ (৩৪.০৭)	১২৬.১৮ (৫১.১৯)	-
১২.	নীট আবাসিক এলাকা	১.১৬৩ (০.৮৬০)	৫.০০ (২.০২)	১০.০০ (৪.০৫)	২০.০০ (৮.১২)	৩০.০০ (১২.১৬)	৪০.০০ (১৬.১৯)	৫০.০০ (২০.২৩)	১০০.০০ (৪০.৪৬)	২০০.০০ (৮১.০৯)	৩০০.০০ (১২১.৭৫)	-
১৩.	সামষ্টিক (Gross) আবাসিক এলাকা	২.১৫৭ (১.১৪৬)	৭.১৪ (২.৯৬)	১৪.২৮ (৫.৭৮)	২৮.৫৭ (১১.৫৬)	৪২.৮৫ (১৭.৩৪)	৫৭.১৪ (২৩.১২)	৭১.৪৩ (২৮.৯০)	১৪২.৮৬ (৫৭.৮২)	২৮৫.৭১ (১১৫.৬২)	৪২৮.৫৭ (১৭৩.৪৪)	-
১৪.	জলাধার/ফাঁকা এলাকা প্রভৃতি	৩৫০ (১৬৪)	৩৫০ (১৬৪)	৩৫০ (১৬৪)	৩৫০ (১৬৪)	৩৫০ (১৬৪)	৩৫০ (১৬৪)	৩৫০ (১৬৪)	৩৫০ (১৬৪)	৩৫০ (১৬৪)	৩৫০ (১৬৪)	-

** সব ধরনের রাস্তা অর্ন্তভুক্ত (বিদ্যমান সরকারি রাস্তা বাদীত)।

Figure 4-12: Community Facilities by the number of populations (b)

Source: PRLDR, 2015

4.4.1.4. Real Estate Act 2010

- Zoning and Land Use: The Endeavor must comply with local authorities' zoning regulations and land use designations. These regulations determine the types of structures permitted in particular areas.
- Compliance with building codes is essential for ensuring the structural integrity and safety of the apartments. Accessibility, materials, construction techniques, fire safety measures, electrical and drainage systems, and more are covered by building codes.
- Before construction can begin, it may be necessary to obtain a variety of permits and approvals from the local government. Typically, this includes building permits, environmental clearances, and water and drainage system approvals.

- Density and Floor Area Ratio (FAR): Regulations may impose limits on the density and floor area ratio, which determine the maximum number of apartments and total floor area permitted on a given parcel of land.
- Setbacks and Height Restrictions: Setbacks are the required minimum distances between a structure and property lines, roads, or other structures. Height restrictions may limit the apartment building's utmost height.
- Parking and Amenities: Depending on the number of units, real estate laws frequently stipulate parking space requirements. In addition, regulations may require the provision of amenities such as green spaces, recreational facilities, and common areas.
- There might be regulations governing safety and security measures, such as fire safety equipment, emergency exits, CCTV surveillance systems, and other security features.
- Some jurisdictions may have regulations regarding environmental sustainability, energy efficiency, refuse management, and green building techniques.

4.4.2. Design Consideration

The development of Master plan of Block B and C of RAJUK Uttara Apartment Project is progressed by design considerations and concepts along with rules and regulations. The updated site Area of Block B and Block C are 105.87 and 73.64 acre respectively. The concept of Transit Oriented Development and consideration of Detailed Area Plan (DAP) (2016-2035) is incorporated in design considerations. Population and ratio of built form, soak able green and open spaces are considered from DAP.

The concept will be acknowledged during the design process by including elements like block-based multistorey housing that promotes pedestrian-oriented development, green buffer and public spaces next to main connectivity for noise and air pollution screening, streetscape with tactile paving, cycle tracks, and safety measures for street crossings. Below mentioned are design considerations and strategies for housing development.

Design Considerations:

- Location and orientation - Location wise the site acts as a community hub as facilitated by metro station centers which improves connectivity of the site. From environmental perspective, the retention pond and existing water bodies are in the south side which will enhance the water network, act as water drainage for the housing community and improve air flow from south east zone.
- Guidelines - Rules and Regulations are the prime parameters of the design process. Population density, introduction of block-based housing, ratio of open space and built-form are followed from Detailed Area Plan (2016-2035), Area for community spaces from Private Residential Land Development Rules (2015), unit and parking design standards from Imarat Nirman Bidhimala 2008 are considered as guidelines of the masterplan.
- Block-based housing- The concept of block-based housing in Detailed Area Plan (DAP) 2016-2035 is encouraged to introduce in the masterplan. According to the concept about 25% of land needs to be dedicated for community use such as park, play field that will not be enclosed by physical boundary more than 5feet height. This will eventually shrink the barrier of community strata and neighborhood will be facilitated by the housing. Vertical extension of cluster of housing will increase green spaces and enhance public connectivity within community by discouraging plot-based housing.

- Connectivity- Vehicular connectivity is designed with a linking diagonal axis connecting Block B and Block C which act as a main axis and primary road of 100feet for the sites. Community facilities are allocated in compact pattern in the central portion along main axis for reducing traffic congestion and ease of accessibility. Secondary and tertiary roads of 60 feet and 40feet are placed for connecting internal housing blocks and cluster connectivity. Roads number are emphasized to minimize to promote more open and green spaces.
    - Pedestrian and trails- Wide roads with enlarge pedestrians and connecting bicycle trails are a component of the design. Block based housing provide spaces for pocket greens, open public spaces which are linked with pedestrian network promoting a walking environment.
    - Blue network- The site has a positive potential of having water bodies within the site which is preserved as open space. Green community park is placed alongside as to balance the blue green network within the site. The water body acting as a source of water drainage and maintain hierarchy of spaces of built form, green and water connectivity.
    - Zoning- Housing project is mostly emphasized on a residential one with community facilities as supporting ones. Implementation of block-based housing promotes on surrendering land for community and open green spaces (Total open spaces 50% of land) which guided in the zoning of land use pattern. Community and social facilities are placed in the central portion of the site and residential housing along the green and blue network for benefitting the users.
    - Courtyards and interconnectivity- Hierarchy of spaces, internal courtyards and pocket green spaces within housing blocks escalates inter connectivity within the site. This improves ventilation, air flow circulation which in a bigger scenario has a positive impact on health and well-being. Vehicular connectivity is minimized within blocks and pedestrian connectivity are increased by linking building blocks.
    - Limitations- Block –based housing encourages on surrendering 25 % open green spaces for community which facilitate the housing environment and the neighborhood community. Having a limitation on height restriction, vertical extension on buildings is hindered which results in reduction in clusters of housing numbers.

4.4.2.1. Consideration for the Development of Block-B and C

Community Development

The Five-Minute Walk is a standard that is best described as the average distance that a pedestrian is willing to walk before opting to drive or take any public transport.

A pedestrian friendly area will be developed so that the people living in the zone can get to all the facilities and common services by walking.

- Safe routes to school.
- Interior roads not wider than required for specific use and given easy access to shops and community center.
- Shopping and economic districts in periphery at traffic junctions and preferably bunched in form to avoid traffic in interior roads.



Road design

Roads are the essence of our communities and the foundation of our urban economies. They make up more than 80 percent of all public space in the project area and have the potential to foster business activity, serve as a front yard for residents, and provide a safe place for people to get around, whether on foot, bicycle, car, or by public transport. The vitality of urban life demands a design approach sensitive to the multi-faceted role streets play in our cities.

As the area is located in the influence zone of MRT-6, main priority has been given to the pedestrian walkability within the block. Interconnectivity with the whole Uttara Model Town has been considered through connecting the Avenue roads proposed in the already approved plan of the Uttara Area. Major road will be developed as the boulevard concept (Divide very large streets into parallel urban realms, buffering the residential street from the high-speed throughway by means of multi-way operations and frontage roads building an urban arterial. The boulevard also has green barriers in-between road and pedestrian, making a secure and user-friendly walk way).

Local streets in residential block are considered to be built as to provide safe and inviting places to walk with direct access to local stores and schools. Design for local streets can combine storm water management features, curb extensions, vertical speed control elements, and bicycle facilities that encourage safe speeds and meter through traffic.

Vehicular Road with pedestrian facilities is preferable and categorized in three types in Block B and Block C-

Primary Road- 80 feet with separate footpath of 12 feet and cycle track of 10feet.



Secondary Road – 65feet wide road with 10 feet footpath and 6 feet wide cycle track line on both sides.



Tertiary Road- 40feet including NMT lane with 5 feet footpath on one side and 10 feet on other side. This road provides direct access to residential plots.



Pedestrian:

- Wider walkway varying from 12feet to 5 feet are designed and connected with buildings.
- Wider footpath along the 300 feet wide lake

Public Facilities and space design

Great public spaces are the breathing zones of the city - the place where people come together to enjoy the city and each other. Public spaces make high quality life in the city possible - they form the stage and backdrop to the drama of life. Public spaces range from grand central plazas and squares, to small, local neighborhood parks.



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4.4.3. Integrating with Transit Oriented Development (TOD) Proposals

The project area partially falls within the influence area of the TOD. Thus, guidelines and regulations regarding TOD will be applicable for this project. However, emphasizing on the maximum utilization of the project area, RAJUK authority can choose on how much the project will follow the guidelines of the TOD development area.

The consultant assesses the scenario and has proposed the policy guidelines describe in the DAP (2022-2035) to be applicable for the project site if the authority decide to develop TOD within the influenced area.

RAJUK has already initiated a pilot project of transit-oriented development within a 500-meter buffer from two Metrorail stations. As a result, Block B and Block C of the Project are inside this area. As the TOD project report is not yet finalized, TOD can be implemented in the apartment project area as per DAP policy.

The following are the TOD Implementation strategies for DAP:

- The method is only applicable to more or less densely populated buildings or vacant land.
- Following the land redevelopment approach.
- Following the Land re- adjustment approach.
- Transit-based development can be implemented by the government or public-private joint ventures following existing land use, land redevelopment methods, or land use reconfiguration methods.

Private entrepreneurs are generally not interested in implementing transit-based development because the investment is returned in the long term. In this case, financial or design approval and FAR incentives can be given by the government. Private entrepreneurship should be adopted as a strategy to implement transit-based development. Subjects on which step incentives can be given are as follows:

- If public space is created for the public in transit-oriented development areas, high-density housing and high-rise buildings beyond the prescribed permitted limits may be permitted. The amount of the FAR incentive will be decided at the meeting of the authorities.
- The building approval process can be simplified in Transit-Oriented development-covered areas.
- Private entrepreneurs can be given loans at low interest rates with long repayment terms.
- To facilitate the implementation of transit-based development, separate laws or detailed instructions will be prepared by RAJUK or DTCA if necessary, in the future.

Land use, activities and its features near the transit station

- Attracts large numbers of people due to high employment and high-density housing.
- Attracts more pedestrians.
- More passenger transport is possible.
- Encourages and activates people to walk and cycle.
- Approves activities till night on working day.

In addition, land use activities which always attract passengers' day and night and at the same time create a safe environment, should be given priority.

Table 4-4: Desired use of Transit oriented development (TOD) area

Features of Transit Assistant	Desired use
Employment	General Industrial (Green / Orange A) Commercial Institutional Mixed use: commercial, industrial, etc.
High density housing	Multi-unit residential Apartment Bachelor's quarters Labor Quarters Hostel etc.
Recreational and cultural facilities	Open space (parks, playgrounds, social facilities) Water Reservoir

Land use activities that are not conducive to transit should not be encouraged:

- Activities that produce more vehicles but do not create employment opportunities.
- Low intensity use, which uses large plots of land or plots. Such as large factories.
- Activities that are highly dependent on vehicles and require a lot of parking space.

Land use management

Under the prepared detailed zone plan, the 500 and 200-meter influence zones of the transit station have been specially identified as TOD zones. Note that a plot falling partially within this zone of influence can be considered to belong to this zone if at least 20 percent of the plot falls within the zone of influence. The zone of potential (TOD) map is presented in Figure 3.26. Although the impact zone area of all the stations of the MRT and BRT routes under implementation is initially identified on this map, only the TOD policies will be applicable to the stations and their determined impact zone areas when they are finally identified, designated, or announced by RAJUK or the appropriate authority.

Table 4-5: List of Unauthorized Use

List of Unauthorized Uses
TA 01
CHA 03, CHA 05, CHA 09, CHA 13
JA 02, JA 03, JA 07, JA 08 (Without Public Toilet, Commercial Car Parking)
EON 01 (@) (Only Bus Depot)
Orange B and Red categories, as described in the classification list of industries provided by the Department of Environment

Source: DAP, 2022-2035

Terms:

- Bus depot can be constructed near transit station (buffer zone), if only depot is connected to bus terminal and terminal is used as mixed-use area.
- Except for public toilets near the transit station (buffer zone), any other use listed in F08 list will not be allowed.
- Near the transit station (buffer zone) F08 written use will be allowed, only if mixed use (along with other permitted uses) is used as ground.

Management of non-residential uses in TOD areas

Conditions applicable to mitigating the potential adverse effects of mixed use have been mentioned earlier (Note 3.12.1). If any place is situated in the TOD area, then only the following terms shall be applicable instead of the conditions mentioned in Section 3.12.1 for that place:

Table 4-6: Mixed-Use Terms of Establishment in TOD Areas

Mixed Use	Existing Road Width (Feet)	Permitted Non-Residential Use	Additional setback forward in case of exceeding the permissible limit
Residential Area	80+	100	1.0 (Only for Ground Floor)
	60- 80	10	
	40- 60	10	
	20- 40	10	
	<20	10	
Residential Predominance of Mixed-Use Areas	80+	100	
	60- 80	50	
	40- 60	30	
	20- 40	20	
	<20	10	
Commercial Predominance of Mixed-Use Areas	60+	100	
	40- 60	70	
	20- 40	60	
	<20	45	
Industrial Predominance of Mixed- Use Areas	60+	100	
	40- 60	70	
	20- 40	60	
	<20	45	

Source: DAP, 2022-2035

Note

- The total area shall be determined in accordance with the guidelines set forth in Development Prevalence/Intensity Management of Section 3.6 of this FAR Chapter.
- Shall be applicable in addition to the applicable front setback as per building regulations.
- "The permitted non-residential use of the establishment in the TOD area shall be permitted as per the percentage of permitted non-residential use applicable to the road in the preceding step from the adjacent road width table. For example, if there is a TOD zone in a mixed

residential area and the plot adjacent to the road is less than 20 feet in that area, instead of the prescribed 10 percent permitted non-residential use, 20 percent non-residential use applicable for upper-level roads, i.e., 20–40 feet, will be allowed.

- If any floor is partially non-residential as per the table and the remaining area of that floor is less than the smallest residential unit in the building, then only the remaining portion of that floor can be converted to non-residential if the applicant wants. For example, if a floor has a gross floor area of 1,000 square feet and a determined non-residential floor area of 700 square feet, and the smallest residential unit in the building is 500 square feet, the remaining 300 square feet of that floor may be used by the applicant for non-residential use.

4.4.4. Block-based Development

The detailed area plan has recommended development through the implementation of block-based development in public/private enterprises. In the case of block-based development, if you want to construct a building by fulfilling certain conditions, need to follow special instructions.

Table 4-7: Block size and open space in block-based development

Sl No	Location	Block Size	Conditions to be considered as block-based development	Minimum width of roads	Incentives
01	Wards or sub-wards / blocks with area-based FAR index less than 1.5 (Appendix 3.6)	Minimum 10 katha to 20 katha	At least 30% of the area of the block should be dedicated as open space for public use such as a park or playground. The block needs to be developed through small plot amalgamation.	• Areas developed under the initiative of government and private projects- 25 feet • spontaneous area- 20 feet	Net population density - 15% Area-Based FAR - 15% * Plot-based FAR - 0.25
02	The whole urban area	20 Katha to 2 acres	At least 40% of the area of the block should be dedicated as open space such as a park or playground for public use.	• Existing 25 feet- Running or detailing is suggested in many plans.	Net population density - 20% Area FAR - 25% * Plot-based FAR - 0.50
03		2+ acres to 5 acres	At least 45% of the area of that block should be surrendered as open space for public use.	• Existing 40 feet- Running or detailing is suggested in many plans.	Net population density - 25% Area-Based FAR - 25% * Plot-based FAR - 0.75
04		More than 5 acres	At least 50% of the area of the block should be dedicated as open space such as a park or playground for public use.	• Existing 60 feet- Running or detailing is suggested in many plans.	Net population density - 30% Area-Based FAR - 30% * Plot-based FAR - 1.0

Source: Detailed Area Plan (2022-2035), RAJUK, 2022

* In the case of block-based development like plot-based development, if the value of FAR based on the area of a particular block is less than 1.25, the minimum FAR value for that block should be applied to 1.25.

Open Space

- For block-based development, any amount of the block should conserve 40% of the total land for open space (playground/ park/ green space). Setback will not be included in this area and 50% of the total conserved land will need to be kept together. Besides, for calculating MGC, 80% area of the total block will need to be considered. For example, if a block has 20 katha of land, 8 katha (40%) of the block will need to be conserved for open space. Moreover, according to the above rule, 50% MGC will be applicable for 80% of the total land, that is, on 16Kathas of land, building will be constructed over 8 Kathas. Rest of the 4Kathas will be used for building setbacks and other greeneries.
- The open space should have direct connection and accessibility from the adjacent road. In case of multiple roads, only one road connection is required.
- Land cover may not exceed 10% of the land or less than 4000 sq ft whichever is less. For other conditions the instructions of the plan (paragraph 3.5.3.1c) must be followed
- In addition, a maximum of 25 per cent of the open space (in addition to the above) will be usable only for paved walkways, play pitches, tennis courts, basketball courts, roller skating etc. as additional land cover.
- However, at least 75% of the open space should be fully preserved as soil.
- The setback will not be included in the open space portion, i.e. the setback will be applicable in accordance with the guidelines of Section 3.6.2 and Building Rules for the development of the remaining portion after submission of open space as per the table.
    - The length of the smallest arm of a dedicated land cannot be less than half the length of the largest arm.
- The size of this road will not be included in the surrendered open space of the block if any connecting road is required for the installation of the block from the adjoining road.
- The land that will be handed over as a park and playground for the locals cannot be enclosed by solid walls around the land, the maximum height of the walls must be limited to 5'-0 ". However, the boundary walls on the side of the playground and park where the building will be constructed can be solid up to a maximum of 5'-0 ", and the walls of the grill can be up to a maximum of 3'-0" above 5'-0 ".
    - After surrendering the land for the road (if surrender is required) a certain percentage of the applicable land should be handed over to the City Corporation / Municipality for use as a park and playground for the people of the area, to use the land in the City Corporation / Municipality for any other purpose. The original ownership of the land will remain as non-share, unmarked land to the shareholders of the block development. This field cannot be rented to anyone. The building will have to be constructed using usable FAR and land cover in compliance with the applicable conditions on the remaining land after surrender.

Setback

- Setbacks are not mandatory along the boundary adjacent to the open space only in the developable part of the block except the open space.

- Except for adjacent open spaces shall be determined in accordance with the guidelines of Section 3.6.2 and Building Rules.
- In this case, other directions have to be determined by facing the entrance of the block
- In case of multiple entrances, one has to determine the other direction along the main entrance

Population Density and Residential Unit

- Maximum Approved Population Density of Block (Residential Unit / Katha) = Targeted Net Density of Relevant Ward / Sub Ward (Residential Unit / Katha)) (Appendix 3.6) 1.15 / 1.2 / 1.25 (Block Volume According to the Incentives received on the basis of)
- Total number of residential units in the block = Maximum allowable population density of the block (residential unit / katha-including surrendered open space) * area of the block (katha).

FAR and total Floor Area

- Block Area Based FAR = Maximum Allowed Population Density of Block × Average Area of Residential Unit in the concerned ward / sub-ward (sq. feet)) (Appendix 3.6) / 720 × 1.15 / 1.25 / 1.30 According to)
- If any block (areas wise AR) 5 become less than 20, than FAR will be considered 2.0 for their aforesaid place.
- FAR based on plot of block = FAR due to width of road adjacent to block (Appendix 3.5) + 0.25 / 0.50 / .75 / 1.0 (according to incentive received based on block size)
- In the light of area based FAR and plot based FAR, based FAR and maximum FAR should be determined as per the method described in this chapter (Note 3.6.4)
- Base FAR will be unconditionally due; Specific conditions will apply for its additional construction (see Table 3.33).
- The total FAR receivable will not exceed the value of the maximum FAR
- Maximum floor area available for block = Total receivable FAR Total volume of block (including surrendered open space) (sq. m./sq. feet)
    - If land is surrendered for the road, the total amount of land will be used in determining the total construction area as per FAR.

Waste Management

- Blocks with 50 units or more should have their own solid waste management system
- Blocks with 100 units or more should have their own waste management through micro STP (Sewage Treatment Plant).

Ancillary /Services for inhabitants/citizens School

- In case of block-based development, if the school is kept as per the criteria given in the plan, the school space can be sold but the usage cannot be changed in any way.

If the area of the block stands at 5+acre, then ancillary services have to be kept aside as per population (census) number and according to criteria set by Detailed Area Plan (Fig 6.1).

4.4.5. Calculation of FAR, Density, Floor Area and other Components

Following table illustrates the findings of the different components of housing facilities according to the standard prescribed in DAP, 2022-2035.

Table 4-8: Plot-based FAR Calculation for Block-B and C

Building Class	Building Sub-class	Usage Pattern	Maximum permissible FAR index corresponding to road width								
			Below 1.8m to 2.5m	Below 2.5m to 3.65m	Below 3.65m to 4.8m	Below 4.8m to 6.0m	6.0 m	9.0 m	12.0 m	18.0 m	24.0 m or above
			5.9-<8.2	8.2-<11.87	11.87-<15.75	15.75-<19.68	19.68	29.5	39.4	59	78.7
A: Residential (Outer city area)	A3	Flat or Apartment House	1.25	1.5	1.75	2.00	2.5	3.0	3.5	3.75	4.25

Source: Detailed Area Plan (2022-2035), RAJUK, 2022

Table 4-9: Area-based FAR Calculation for Block-B and C

Density Block	Locality / Thana	Area in Acres	Functional net Habitable Area (%)	Gross / Net Ratio	Desirable Gross Density ppa	Desirable Net Density (DU/ Katha)	Avg. DU Size (sft)	Area FAR	Remarks
DNCC_Ext_Ward-52-P		1,970	59.76	1.67	200	1.4	1,579	3.1	DNCC 22-P

Source: Detailed Area Plan (2022-2035), RAJUK, 2022

Based on the findings of the above-mentioned rules and regulations and FAR incentives, FAR for the development of Block-B and C has been developed below:

Table 4-10: Calculation of FAR and other components for the Block-B

Parameters/ Components	Unit	Value
Mauza Name		Baunia
Density Block		DNCC_Ext_Ward-52-P
Land Area	Katha	6405
Existing Road Width	Meter	24
Existing Road Width	Feet	80
Desirable Net Density	DU/Katha	1.4
Average Residential Unit Size	Square Feet	1579
Area-wise FAR		3.1
Plot-wise FAR		4.25
Net Density Incentive	%	30
Area-wise FAR Incentive	%	30

Parameters/ Components	Unit	Value
Plot-wise FAR Incentive		1.0
Net Density after Incentive (30% more than the Desirable Net Density)	DU/Katha	1.82
Area-wise FAR applicable for the Block (Recalculated based on the incentivized Net Density)		3.99
Area-wise FAR for the Block after incentive (30% more than the Area-wise FAR applicable for the Block)		5.19
Plot-wise FAR after Incentive (Plot-wise FAR+ Plot-wise FAR Incentive)		5.25
Base FAR (Whichever is smaller between Plot-wise and Area-wise FAR, will be unconditionally due)		5.25
Maximum Permissible FAR (If Plot-wise FAR > Area-wise FAR, then Plot-wise FAR will be Maximum)		5.25
Number of Total Unit (Total Land Area (Katha) * Net Density after Incentive)		11657
Total Floor Space according to Base FAR (Total Land (Katha)* Base FAR * 720	sft	2,42,10,900

Source: Prepared by the Consultant, 2023

Table 4-11: Calculation of FAR and other components for the Block-C

Parameters/ Components	Unit	Value
Mauza Name		Baunia
Density Block		DNCC_Ext_Ward-52-P
Land Area	Katha	4455
Existing Road Width	Meter	24
Existing Road Width	Feet	80
Desirable Net Density	DU/Katha	1.4
Average Residential Unit Size	Square Feet	1579
Area-wise FAR		3.1
Plot-wise FAR		4.25
Net Density Incentive	%	30
Area-wise FAR Incentive	%	30
Plot-wise FAR Incentive		1.0
Net Density after Incentive (30% more than the Desirable Net Density)	DU/Katha	1.82
Area-wise FAR applicable for the Block (Recalculated based on the incentivized Net Density)		3.99
Area-wise FAR for the Block after incentive (30% more than the Area-wise FAR applicable for the Block)		5.19
Plot-wise FAR after Incentive (Plot-wise FAR+ Plot-wise FAR Incentive)		5.25
Base FAR (Whichever is smaller between Plot-wise and Area-wise FAR, will be unconditionally due)		5.25

Parameters/ Components	Unit	Value
Maximum Permissible FAR (If Plot-wise FAR > Area-wise FAR, then Plot-wise FAR will be Maximum)		5.25
Number of Total Unit (Total Land Area (Katha) * Net Density after Incentive)		8,108
Total Floor Space according to Base FAR (Total Land (Katha)* Base FAR * 720	Square Feet	1,68,39,900

Source: Prepared by the Consultant, 2023

Based on the findings of FAR and other policy guidelines from the above discussions, housing has been developed in Block-B and C. Detail information regarding conceptual layout and housing information of Block-B and C has been added in Chapter-10 of this report.

4.4.6. Addressing climate change and hazard risks in detail design

The Uttara Apartment Project's long-term resilience and sustainability depend on its comprehensive design, which takes into account the effects of climate change and the hazards posed by natural disasters. Key factors to keep in mind when combining climate change and hazard risk mitigation strategies are as follows:

4.4.6.1. Climate Change

Climate-Responsive Design Reduce the project's negative effects on the environment and increase its resilience by incorporating climate-responsive design concepts. This involves using energy-efficient technologies and sustainable materials, as well as orienting buildings to take advantage of natural light and breezes. Energy consumption can be decreased and climate-related hazards mitigated by the use of green building methods like rainwater collection, solar panels, and green roofs. Strategies for adjusting to climate change involve looking ahead to the difficulties posed by things like rising temperatures, harsh weather, and rising sea levels. Design for future sea-level rise and storm surge threats and include green spaces to reduce the impact of urban heat islands. Use resilient materials that can resist harsh weather.

Ecosystem Restoration and Conservation Identify ways in which the project area's ecosystems can be restored or conserved. Trees and green areas should be protected, native plants should be used, and green corridors should be established so that wildlife can thrive. The natural environment can be made more resilient to climate change and human impact by maintaining and improving it. The Uttara Apartment Project may benefit from these climate change and hazard risk mitigation methods by including them in the project's comprehensive design. These steps will increase the development's resilience, decrease its vulnerabilities, and create a more sustainable and secure environment for the residents to call home.

4.4.6.2. Fire Hazards

The Uttara Apartment Project must implement comprehensive fire safety measures to ensure the welfare of its residents in the event of a fire. This includes the installation of fire alarms and sprinkler systems throughout the entire project, as well as the provision of a sufficient number of clearly marked, readily accessible exits in all areas of the buildings. To prevent the spread of fire, fireproofing measures should be implemented, such as using fire-resistant materials in construction and ensuring

appropriate compartmentalization. With distinct directions to exits and prominent emergency signage, the layout of the buildings should be created to minimize the risk of fire hazards and facilitate efficient evacuation. By incorporating these fire safety features and factors, the project can prioritize the safety and well-being of its residents in the event of a fire.

4.4.6.3. Major Earthquake Risk

The Uttara Apartment Project must address earthquake risks in its design and construction to ensure the safety and resilience of its residents. Key considerations include conducting a seismic assessment to understand potential hazards and vulnerability, adhering to building codes, incorporating earthquake-resistant structures, conducting a thorough geotechnical investigation, considering non-structural elements, developing an emergency response plan, and implementing continuous monitoring. By addressing these risks, the project can enhance the building's resilience and ensure the well-being of its residents during seismic events. By collaborating with seismic engineering experts and adhering to best practices, the project can ensure the well-being of its residents during seismic events.

4.4.7. Consideration for Utility

Development of housing in Blok-B and C will require supporting utility facilities like electricity, water, gas, waste management, telecommunications, internet etc. following section illustrates the important consideration for the development of utility facilities in Block-B and C.

4.4.7.1. Electricity Supply

On the basis of Client approved detailed Architectural designs, the Consultant shall prepare detailed internal & external electrical & Electro-Mechanical design which will be efficiently using energy or reduce energy consumption, protecting occupant health, reducing waste, pollution and environmental degradation. High performance low power consumption electrical equipment will be considered in design to optimize the energy consumption. On site generation of renewable energy by solar energy system, the cost of energy consumption may be reduced significantly. All electrical system will be designed in conformity with the rules, regulations, standards and recommendation as specified in the Bangladesh National Building Code (BNBC 2020). Special attention will be given to the international regulations and standards: IEEE, IEC, NFPA, BS etc. Particular attention shall be given to meet the requirements of Local Electric Supply Authority, BTCL, Electricity Licensing Board, Fire Service Department and the rules adopted in Bangladesh for ensuring adequate safety to the personnel. The design shall consider the total load requirements for the buildings and provide for the installation and commissioning of the following list of equipment:

Electro-Mechanical Work

- Sub-Station
- Standby Generator with Auto-Switchover system
- Lift
- Air Conditioning System
- Fire Fighting, Security & Safety related works
- Solar Energy related works
- Water pumping system for the entire premises including fire-fighting system

The detail design, drawing and specification to be prepared and submitted for approval of the Client are:

A. **Internal Electrical drawing:** General Electrical Works

- Lay-out plan of fittings and fixing (light, fan, exhaust fan, A.C.3 or 2 Pin socket, telephone outlet, etc.)
- Circuit diagram with size.
- Position & size of DB, SDB, circuit barker, SB, bus0-bar
- Cable line route with size
- Laying of PVC/GI pipe (concealed/surface)
- Earthing details
- LEGEND

B. **External electrical drawings:** External Electrification

- Site plan/lay out plan showing H.T./L.T. distribution line/electric poles
- Cable route with size
- Area and Security Lightning
- Service connection
- Transformer with substation equipment including layout plan & detail with lightening arrestor
- Outdoor transformer (pole mounted) at lightening arrestor and drop out fuse.
- Any other as determined essential during design phase

C. **Electro Mechanical Design:**

- Air-conditioning System
- Lift
- Fire Fighting
- Standby Generator & Sub-Station
- HVAC
- Solar energy system

D. **Telephone, Internet, Cable TV and central security system including CCTV camera.**

Short description of some important items:

➢ **Internal Wiring**

In general, concealed conduit wiring using PVC insulated sheathed and non-sheathed cable as per BS6004: 1975, BS2004:1961 and VDE 0271 will be used. Bus-bar trunking/riser may be used in certain areas. Separate circuitry system will be provided for normal lights, emergency light, general power, air-conditioning, lifts and other services. For wiring purpose locally made cables, which conform to internationally accepted standards, will be used. Communication cables such as those for computer, telephone, antenna, telex, fax etc. will be physically separated from power cables to avoid interference.

➢ **Conduit**

Conduit will be installed in ceiling, in walls, in earth or exposed outside of the buildings. For concealed work in slab or wall standard/approved quality water grade PVC conduits with wall

thickness not less than 1.5 mm will be used. G.I. and M.S. conduits will be used at road crossing and some special places.

- **Socket Outlets**

Convenient socket outlets such as 2 pin 5A and 3 pin 15A/13A will be provided in accordance with internationally accepted codes of practice.

- **Distribution Boards, Busbar and Cable Riser**

Each floor of the buildings will be provided with required nos. of distribution board (DB). Separate distribution board will be used for normal power and emergency power. The normal power will connect lights, fans and power utilities, which will be on continuous operation and for general use. Emergency power boards will be connected with the special purpose utilities such as lifts, water supply, and firefighting system and emergency lights. Each floor will have appropriate no. of electrical sub-distribution boards as required. Spare circuit and space will be provided in each sub-distribution board as per applicable standard.

- **Earthing**

The buildings will be suitably and adequately earthed by central earthing system. All the MDB/SDBs will be brought under the central earthing system. Earth continuity conductors will be drawn to each switchboard, socket outlet, to provide system protection and safety of users. Separate earthing for transformer neutral will be provided.

- **Lightning Protection System**

The buildings will be provided with adequate lightning protection, in accordance with IEE, NEC, NFPA, Bangladesh Standard and other internationally recommended standards.

- **Substation**

Clients own sub-station shall have to be designed as per requirement of the power authority of Bangladesh. The incoming will be 11KV, AC, 50Hz, 3 phase system and the outgoing will be 415V, 3 Phase, 4 Wires, earthed neutral system. The substation will be located at a suitable location, preferably at the load center. One no. electrical sub-station will be designed to cater the entire electrical load and will be placed at the suitable location considering power distribution network of the buildings. The sub-station will be equipped with 11KV automatic voltage regulator (if required), HT switchgear, Transformer, LT switchgear and PFI plant. Cast resin insulated dry type transformer will be considered as it is life time maintenance free and non-flammable i.e., no risk of fire hazards and environment friendly.

- **Power Factor Improvement and Energy Conservation**

As per requirement of the Power Supply Authority, Power factor (Pf) shall have to be maintained at 0.95 or above at consumer metering point. This shall be taken into consideration and achieved through selection of appropriate utilities and installation of power factor improvement plant as required.

- **Standby Generator**

A standby generator will be installed to meet up emergency power requirement in case of power failure in consultation with the Client to determine the capacity of the Generator. This will be

installed in a place away from residences to avoid noise pollution. Safety will be considered against shock and fire hazard. The Generator shall be auto-start, auto-stop. The Generator may be gas or diesel generator depending an investment cost, operation cost, reliability, clean environment, fire hazard etc. Provision of alternative emergency power generation and supply will be considered to provide power to utilities, such as emergency lighting, telephone, lifts, stair cases, firefighting equipment, parking areas, etc. The requirement and extent of such emergency supply will be determined after discussion with the Client.

➢ **Area and Security Lightning**

Adequate area lighting will be provided for general purpose and security. The lights shall be installed on pole or exterior building wall. Discharge light such as mercury/sodium light/LED will be preferred.

- **Wi-Fi & CCTV**

Central electronic security system including Wi-Fi & CCTV system will be installed as per requirement.

➢ **Cable TV**

Floor wise TV outlet and distribution system will be finalized as per Client's requirement.

➢ **Telecommunication & Intercom & central PABX system**

Telecommunication system for the buildings will be as follows:

➢ **Main distribution Frame**

There shall be a main distribution frame (MDF) located either at ground floor or at any convenient location where all the incoming telephone, fax & data lined from BTCL shall be terminated in the incoming side of the termination blocks. Distribution cables for all the floors shall be terminated in the outgoing termination blocks of the MDF.

➢ **Telephone Distribution Box (TDB)**

Each floor shall be provided with individual floor telephone distribution board. Where incoming cables from MDF and all the outgoing cables to each of the telephone outlets shall be connected.

➢ **Rises cables**

From MDF to individual floor TDB, there shall be independent multi pair telephone riser cable of sizes as per telephone requirements of that particular floor. All these riser cable shall be fixed with vertical cable ladder.

➢ **Telephone outlets**

Sufficient telephone outlets shall be incorporated in the design for each floor depending on the use. These outlets generally be provided on the columns, periphery wall and position walls at skirting level.

➢ **Fire Detection and Fighting System**

Fire safety and protective measures are essential entities for a public congregational arena such as the proposed International Cricket Stadium Complex. Considering the devastating consequences and life of the spectators of the Cricket matches it is very important to have an effective and reliable

fire detection and firefighting system for the stadium and adjacent buildings/ structures. The system will incorporate the following items:

- The design will be based on NFPA/BNBC code/ ICC requirements;
- Required nos. of fire detectors (smoke and heat), alarm bell and manual pull station;
- A number of portable Fire Extinguishers to tackle small and localized fire;
- A firefighting system (wet riser type) with pumps and nozzles and hoses to tackle relatively large fire for at least 30 minutes and to facilitate the firefighting workers;
- Water reservoir, pumps and water line of adequate capacity for firefighting will be considered.

The Consultant will Provide suggestions on active and passive fire control system, and identify important relevant infrastructure in the layout map of the stadium complex.

Automatic Fire Sprinkler System

A fire sprinkler system is an active fire protection method, consisting of a water supply system, providing adequate pressure and flow rate to a water distribution piping system, onto which fire sprinklers are connected. Although historically only used in factories and large commercial buildings, systems for homes and small buildings are now available at a cost-effective price, Fire sprinkler systems are extensively used worldwide. In buildings completely protected by fire sprinkler systems, over 96% of fires were controlled by fire sprinklers alone.

An automatic fire sprinkler system typically comprises a series of individual components including: Pipe, Stop Valve, Alarm Valve, Fire Sprinkler (head), Alarm Test Valve and Motorized Alarm Bell. (In addition to this there are additional components that support this arrangement including a Valve Monitor, Pressure Switch and Flow Switch. The illustration to the right shows each of these components, and the approximate location within the arrangement.

Principle of operation: Normally a wet pipe automatic fire sprinkler system is fully charged with water coming from a known reliable water supply. The installation is pressurized with the alarm valve secured in the open position. When a fire sprinkler is exposed for a sufficient time to a temperature at or above the temperature rating of the heat sensitive element (glass bulb or fusible link) it releases, allowing water to flow from only the affected sprinkler. Additional fire sprinklers may also operate if they too are exposed to sufficient heat.

Fire Hydrant System

Fire Hydrant system: Fire Hydrant system (Hydrant pump, Hydrant hose reel, Hydrant Valve, Hose pipe, Hose Box, Booster pump) are the most commonly used systems, in many residential and industrial projects. If you have ever seen a "Red" color pipe, circulating around a building or factory, you have seen a Fire Hydrant Pipe. In most news clippings about a fire, you can see fireman shooting water, that fire man is using the Fire Hydrant System. Such is the power of the Fire Hydrant System that water can be shot directly into the fire.

Two main types of fire hydrants are found in most areas—wet barrel and dry barrel hydrants. Each of these has different types of structure and allow for a different style of firefighting. Additionally, there is a third, similar, structure called a standpipe, which can often be used alongside fire hydrants to make for a complete firefighting system.

- **Wet Barrel Hydrants:** A wet barrel hydrant is the basic, traditional style of a fire hydrant. The outlet valves and nozzles are easy to access, and all work independently. This means that firefighters can add additional discharge lines without risking Wet Barrel Hydrants shutdown.
- **Dry Barrel Hydrants:** With dry barrel hydrants, the main valve exists in the hydrant's base. The water line is all underground—below the frost line. With this style of hydrant, no water stays within the system after use. Because of this, there is much less risk of freezing and damage to the hydrant due to frost.

Standpipes: While different from hydrants, standpipes are another valuable tool for firefighting. They are a fixed interior pipe that serves as an alternative to automatic sprinkler systems. These allow firefighters to distribute water to a section of the building, or even allow people who cannot exit the building a way to suppress the fire on their own. They can be an essential tool for firefighting—especially in larger buildings.

Design Methodology

During designing and selection of building materials necessary steps will be taken to select materials which have less potential for fire hazards and resist propagation of fire. Moreover, necessary provisions will be made so that area of fire may be isolated by proper steps.

During preliminary design phase of the system a study will be made to locate spots of fire hazards so as to install fire-fighting equipment within a reasonable distance. The design will be as per international standard to incorporate sufficient number of fire extinguishers.



Fire Alarm


Fire Extinguisher


Fire Stand Pipe & Floor Hose Station


Fire Sprinkler System

➢ **Lift / Elevator System**

Lifts will be installed in the buildings/ structures for vertical transfer of people and goods as desired by the Client. Suitable types of lift will be recommended keeping in mind the requirements of non-residential buildings. The following methodology will be used for the design of lifts.

Design Methodology

During design, enough study will be made to ascertain traffic quantity and pattern. Study will include investigation of lifts of similar buildings in Bangladesh. Moreover, discussions will be held with the Architect, the Structural Engineer and the Client to finalize the design data.

System Selection Criteria

Layout of lifts will be done giving due consideration of traffic pattern and movement so that any person can avail the services of lift(s) with a minimum effort. In this regard adequate number of signs will be provided to guide a passenger. In general, the selected lift system will have the following:

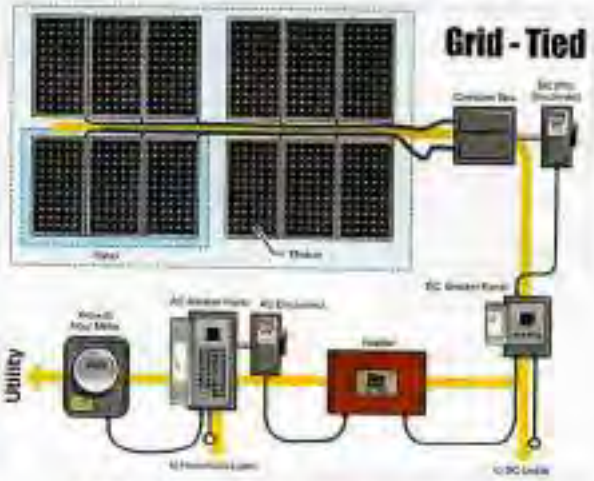
Type	•Geared/Gearless traction type.
Drive System	•Electronically regulated A.C. Drive.
Signals	•Directional indicators in each floor and in lift. Digital floor indicators in each floor and car position indicator inside the lift.
Door	•Centre opening type.
Control & Safeties	•Necessary controls for automatic operation and safeties from hazards etc.

However, all these factors along with other important and recent modern features of a lift will be finalized after discussion with the representatives of Client during finalization of design and specification.

➢ **Solar Power system**

Utilization of renewable energy source is one of the present requirements of the world from the point of view of energy efficiency. To utilize the maximum sunlight, battery less grid tie solar energy system will be designed for this project. The system consists of Photovoltaic (PV) Module, Grid Tie Inverter, System Monitoring/Data Logger, AC & DC Combiner Box etc. Battery backup solar power system will be designed to supply the solar power at night to some designated places. The solar energy system will be designed as requirement of the power supply authority of Bangladesh.





➢ **Heat, Ventilation & Air Conditioning System (HVAC)**

The main purpose of commercial HVAC (Heat, Ventilation & Air conditioning) systems is to provide the people working inside the building with "conditioned" air. "Conditioned" air means that air is clean and odor-free, and the temperature, humidity, and movement of the air are within certain comfort ranges. The Consultant will prepare heating, ventilation and air-conditioning (HVAC) system as per requirement of the building. The design will be carried out in conformity with the rules, regulations,

standards and recommendation as specified in the Bangladesh National Building Code (BNBC). Special attention will be given to the international regulations and standards.

Provisions of floor wise air-conditioning system (Window or Split System) or Variable Refrigerant Flow (VRF) System or Central air-conditioning system shall be kept after discussion with the Client during finalization of design and specification.

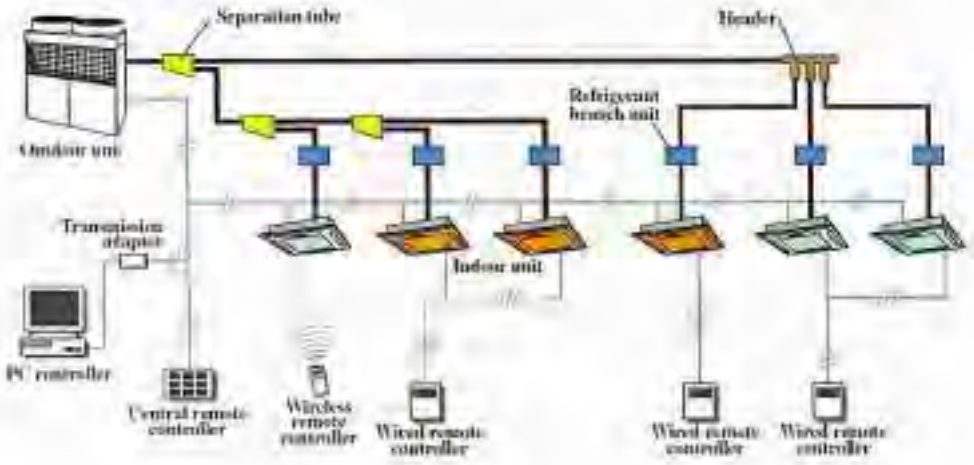


Figure 4-13: Variable Refrigerant Flow (VRF) System

A detailed study will be carried out at the preliminary design stage to ascertain the various requirements of the buildings with respect to the air-conditioning system. Factors, which will be taken into consideration, are:

- Structure/ Building orientation and layout;
- Building structure and building materials used;
- Internal heat generating sources, viz. people, lights, equipment etc.;
- Volume of air-conditioned space;
- Use of air-conditioned space;
- Environmental conditions viz. dry bulb temperature, relative humidity, surface temperature, air velocity, etc.;
- Ventilation air requirement;
- Space requirement for air-conditioning equipment.

The Consultant will also prepare electrical and electro-mechanical designs for the existing buildings/ structures/ facilities which will need renovation, repair and maintenance according to survey.

4.4.7.2. Water Supply System

Reducing water consumption and protecting water quality are key objectives in modern buildings. The protection and conservation of water throughout the life of a building may be accomplished by designing for dual plumbing that recycles water in toilet flushing or by using water for washing purpose. Waste-water may be minimized by utilizing water conserving fixtures such as ultra-low flush toilets and low-flow shower heads. To recycle the waste water, a water treatment plant, if desired, may be considered in the design. Rain water harvesting system will be considered in the design to meet the Green Building requirement. The system will incorporate the following items:

- Suitable water supply sources will be selected to meet the demand of water consumption of the building;
- The total water consideration of the building will be determined from the average daily water consumption depending on nature of activity in different part of the building;
- Water reservoirs of capacity sufficient to store water to meet the demand of minimum two-day's consumption will be provided in the building if there is no dependable water supply available from city main/source;
- Pressure booster pumping system will be considered;
- Pump shall be provided for lifting of water from the reservoir to roof top tank. The capacity of the pump shall be selected on rate of discharge and head required to overcome the line losses;
- Pipes shall be sized for permanently clean bores assuming that supplied water will be of soft type. Pipe sizes shall be selected on flow rate to be determined from the number of fixtures in simultaneous use at peak hours;
- Necessary shut off and control valves shall be provided on the supply pipes at suitable locations to facilitate system operation and maintenance;

Separate water heaters of adequate capacity will be provided in the system where hot water will be required. The selection of hot water supply point will be done as per requirement of the users.

Design Standards and Regulations

In order to ensure proper standard and safety, the following authorized codes and regulations shall be followed and adapted as guide for design development.

BNBC – Bangladesh National Building Code	UPC – Bangladesh National Building Code	NPC – National Plumbing Code (ASA A 40.8-1933)	WASA – Water and Sewerage Authority (Local)	B.S. – British Standards (to be applied for locally produced products)

4.4.7.3. Sewage & Sewerage Disposal System

The system will incorporate the following items:

- The drain pipes for sewer and waste disposal shall be sized on the basis of discharge rating of individual fixtures in simultaneous use at peak hours;
- The stack sizes will be selected on the nos. of connected fixture units and the type of fittings;
- Necessary traps for water sealing and venting arrangements shall be provided in drainage system to prevent fouling of inside environment;
- The design of sewage disposal system which comprises of septic tank, seepage pit or sub-soil bed will be based on the volume of sewage to be treated which is to be determined on the "equivalent occupancy" and character of the soil expressed by its "relative absorption" (if direct sewage disposal system is not available).

The Consultant will submit following Plumbing Design Drawings

i) Internal plumbing drawings:

- Roof drainage plan
- Water supply and drainage plan of floors
- Details of bathroom fittings and pipelines
- Details of soil pipes, waste water pipes, rain water pipes
- Ground floor water supply and drainage plan showing drains and R.C. pipe lines.

ii) External plumbing drawings:

- Details of Sewerage disposal system
- Details of surface drains, layout
- Position and details of out fall
- Lay out and details of inspection pit, soak-pit/soak-well and septic tank.
- Details of soil pipe.
- Detail rain water reservoir

4.4.7.4. Rain Water Harvesting

The rain water harvesting system is going to utilize this for daily use and watering the green roof areas. First the water collected from roof and stored in the underground reservoir. Then this water will be used in daily works like hand wash, cooking and other activities where fresh water is needed. Then this used water will be stored in another tank and treated to feed the toilets and the green roof. Finally, the flushed water will be drained to the sewerage.



4.5. Cost Summary

This feasibility study also assesses, in detail, about the required financial investment for the project implementation. Detail financial and economic analysis of the project has been added in the Chapter-6 of this report. The total cost of the project is about 1,449,472.40 lac BDT.

Total cost detail has been addressed in Chapter-6 of this report. Total cost estimation of this project has been conducted by following the PWD rate schedule, 2022 (Source: PWD Rate Schedule, 2022, Annexure- A: Plinth Area Rates, Page: 344-356).

4.6. Implementation Timeline

The implementation period of the project is 64 months (from 2024-2029) and the assignment will be implemented in two stages:

- **Tendering Period:** The tendering period will be 4 Months
- **Construction Period:** The construction period will be 60 Months

5. ENVIRONMENTAL SUSTAINABILITY, CLIMATE RESILIENCE AND DISASTER RISK ANALYSIS

5.1. Environmental, Climate Change and Disaster Risk Analysis

5.1.1. Purpose and objective

The overall goal of the environmental review is to identify significant environmental consequences that will be brought on by the project's implementation and to suggest mitigation actions to prevent or lessen negative environmental impacts while enhancing positive ones. The environmental review was undertaken with the following goals in mind:

- To make it easier to comprehend the components of the current baseline conditions in the project's area of effect against which any potential environmental effects will be convenient to measure due to the project's implementation;
- To identify the project elements most likely to have a substantial negative impact on the environment resources/receptors at different project stages;
- To estimate how significant, the Project's effects will be on environment and if there is any requirement for more study and research;
- To enhance knowledge of the impact management and monitoring as a requisite portion of mitigation process and this will further lead to an effective Environmental Management Plan Development (EMP).

5.1.2. Methodology of Environmental Analysis

The methodology gives the apparent view of the required procedures to complete an initial screening of the environmental issues that will lead to prospective consequences subsequently. The initial environmental review is usually used to assess the potential environmental impacts of a proposed project, based on available preliminary information and information readily acquired through rapid environmental surveys or secondary research. The consultant team generated the data needed to describe the current environment and determine the potential repercussions to the construction and operation of the project using a combination of desk studies, field investigations, structured interviews, focus group discussions (FGDs), google maps and reports. Public consultations were used to carefully capture local knowledge about the ecosystem and issues related to the project's activities, which was then used in the impact assessment and the creation of the mitigation plan.



Figure 5-1: Methodology of Environmental and Disaster Risk Analysis

Source: Prepared by the Consultant, 2023

5.1.2.1. Initial Review and Discussions

Initial discussions on the proposed project, including project activities and choices under consideration, are held with the client and stakeholders. Essential information on the current environmental conditions in the project region, including documents, data, maps, reports, and other materials are gathered and reviewed. Both an overview of the gap analysis and what other studies have accomplished for the project are given.

5.1.2.2. Legal Framework and Policy

Determination and evaluation of relevant institutional and regulatory frameworks for the environment and society at the local, state, national, and international levels. Major relevant acts and rules are described below:

- Bangladesh Environmental Conservation Act, 1995
- Bangladesh Environment Conservation Rules, 2023
- National Environmental Policy, 1992
- Water act 2013
- Water Reservoir Conservation Act, 2000
- National Forest Policy, 1994
- National Land Use Policy, 2001
- Environment Court Act, 2000

5.1.2.3. Existing Environmental Conditions

The baseline conditions of the project site are retrieved by the following works.

- Comprehensive surveys have to be carried out to look at the project area's social and environmental features. In order to prepare a preliminary evaluation of the physical and social environment, biodiversity, and conservation value of the designated project area, a review of secondary sources and informal initial field surveys were conducted. The preliminary literature assessments also helped to identify data gaps that may be filled in by conducting field surveys to get more first-hand data.
- Important issues during the project's planning, construction, and operation phases are discussed with the project's stakeholders. Primary data/information came from surveys, observations, and conversations with stakeholders, at significant project locations and in the area that the project influenced. The fundamental goal of this strategy was to gain a clear understanding of how the public felt about the project, its effects on the environment, and potential solutions.
- Gathering baseline information on the project site and surrounding area related to water, ambient air quality, noise level, etc. From various governmental and non-governmental organizations, relevant data/information was gathered, particularly on-site characteristics, climate (weather), terrain, geology, waterbodies, surface/groundwater quality, ecology/biology, socioeconomics, and other factors. Where available, previous environmental site assessments as well as related literature and websites were studied.

- Through the gathering of secondary data, an ecological assessment of the site's and the project's area's flora and fauna is made. In addition, reviewing pertinent literature, making observations, and conducting surveys at the project sites were used to determine the status of the flora and fauna in the project region within the Right of Way (RoW).
- By compiling secondary data about the location and supplementing it with consultations with the surrounding people, one may assess the socioeconomic environment was assessed and local's perception about the project and its operations was learnt.

5.1.2.4. Impact Assessment

Environmental and social impact assessments and mitigating actions for the periods of preconstruction, construction, and operation have to be identified and assessed. There will also be proposed mitigating strategies to lessen the negative effects. Consultation with local community carries a good value in this regard.

5.1.2.5. Formulation of Environment Management Plan (EMP)

Environment Management Plan (EMP) is formulated with:

- Mitigation of hazardous and unfavourable environmental effects;
- Systemic framework - management methods for implementing risk-reduction measures and environmental implications;
- Monitoring and documentation of the conditions and procedures for carrying out the recommended mitigations successfully
- Arrangements for effective mitigation of the proposed project's risks will be monitored.

5.1.3. Project Description

According to a recent survey by World Population Review, Dhaka, the capital of Bangladesh, has been classified as the sixth most populous city in the world. Dhaka's metro area has a population of 22,478,116 as of 2022 or 23,234 persons per square kilometer. To do their jobs, conduct business, and for other reasons, these people live permanently in Dhaka. The amount of housing that is needed is far insufficient to accommodate everyone.

Because of this, Dhaka's residential areas are becoming more and more crowded, filthy, and unhealthy as a result. By creating permanent housing for this enormous population and carefully planning the development of the land around Dhaka city, it is possible to significantly lessen the pressure caused by the city's population growth. The Ministry of Housing and Public Works takes the initiative to create multiple multi-story residential complexes throughout Dhaka city through planned urbanization in order to address the housing need for lower- and middle-income groups of people, as promised by the Hon'ble Prime Minister. ECNEC authorized a Development Project Proposal (DPP) on October 10th, 2011 for Sector-18, Uttara, Dhaka, to build 22000 apartments for persons of lower and middle incomes across 214.44 acres of land with 3 blocks (Block 'A', 'B', and 'C'). Meanwhile, Block-A has already seen the completion of 6,636 flats. At Blocks "B" and "C," RAJUK would like to start building 93 apartment buildings having 15 stories (G+14), one basement floor, and 7,812 flats.

However, apartment projects have an impact on the environment due to construction of various infrastructures. The major document of legislation now governing environmental preservation in

Bangladesh is the Environment Conservation Act 1995 (ECA-95). According to Article-12 of Environment Conservation Act 1995, "No industrial unit or project shall be established or undertaken without obtaining, in the manner prescribed by rules, an Environmental Clearance Certificate from the Director General."

Thus, any industrial unit or project must obtain Department of Environment (DoE) approval under this Act. Following that, in August 1997 (ECR-97), a set of pertinent rules to implement the ECA'95 was adopted and thus preparation of an IEE and subsequent EIA is a prerequisite to issue a Site Clearance Certificate (SCC), and then the Environmental Clearance Certificate (ECC) by Department of Environment (DoE). This Environmental Conservation Rules was further amended into Environmental Conservation Rules 2023.

In this respect, potential environmental impacts of the proposed apartment project need to be identified in the environment review where adverse effects and mitigation measures as well as benefits would be addressed.

5.1.4. Overview of the legal Framework and Policies

The regulations established by the Government of Bangladesh (GoB) for the preservation of the environment and its resources as well as the protection of the social environment from negative effects related to project development are highlighted in this section.

5.1.4.1. National Environmental Policy, 1992

With the introduction of the Environment Policy, 1992, the idea of environmental protection through national efforts was first acknowledged and announced. The policy outlines a comprehensive set of sector-specific action guidelines as well as the fundamental framework for environmental action.

5.1.4.2. National Environmental Management Action Plan (NEMAP), 1995

In response to global demands for such plans, the National Environmental Management Action Plan (NEMAP) is a comprehensive 10-year action plan that ran from 1995 to 2005. It expands and builds upon the ideas expressed in the National Environmental Policy. NEMAP was created to solve problems, manage needs, and lay out the framework for putting the National Conservation Strategy's recommendations into practice. It is a framework that:

- Suggests for reducing pollution and safeguarding the nation's resources.
- Identifying the principal environmental problems that Bangladesh is facing;
- Identifying measures to halt or slow down the rate of environmental degradation, improving the natural environment;
- Conserving habitats and biodiversity, promoting sustainable development, and enhancing people's quality of life are all important.

5.1.4.3. Bangladesh Environmental Conservation Act (BECA), 1995 (amended 2010)

The principal element of legislation governing environmental protection in Bangladesh is the Bangladesh Environmental Conservation Act (BECA) of 1995 (as revised in 2000, 2002, and 2010). This comprehensive legislation covers regulations for environmental protection, the designation of ecologically sensitive areas, limits on the use of cars that generate harmful smoke, steps to repair

ecosystem damage, raising environmental standards, reducing environmental pollution, and more. The Department of Environment (DOE) was established by this act, and its Director General is empowered to take whatever actions he or she finds necessary, including conducting investigations, averting expected accidents, obtaining compensation from the polluter, working with other authorities or agencies, and gathering and disseminating information about environmental pollution.

According to Article-12 of Environment Conservation Act 1995, "No industrial unit or project shall be established or undertaken without obtaining, in the manner prescribed by rules, an Environmental Clearance Certificate from the Director General." The functionality of the act can be pointed as follows:

- An option to obtain an environmental clearance certificate before beginning a project or business;
- To declare ecologically critical regions and outline the processes or actions that are not permitted to begin or continue there;
- Restrictions on the use of automobiles that create environmentally harmful smoke;
- Measures to repair ecosystem damage;
- Prohibition on switching wetland classifications;
- The specification of standards for the soil, noise, air, and water quality for various locales and activities;
- Specifying standard limits for waste discharge and emission;
- Whenever necessary, formulating and announcing environmental standards; and
- Limitations on the creation, procurement, transportation, and containment of hazardous waste.

5.1.4.4. Environment Conservation Rules (ECR), 2023

In accordance with the authority granted by the Environment Conservation Act of 1995, the Government of Bangladesh enacted the Environment Conservation Rules, 1997 and finally amended to Environment Conservation Rules, 2023. These Rules address, among other things, the following areas:

- Declaration of ecologically critical areas.
- Provision of standards for the quality of air, water, and sound as well as acceptable limits for emission from vehicles and other sources.
- Procedures for obtaining the Environmental Clearance Certificate. As per Environmental Conservation Rules, 2023 to implement the Environment Conservation Act, 1995 it is mandatory to obtain Environmental Clearance for each and every type of industry and project.
- Classification of industries and projects into 4 categories. For the purpose of issuing an Environmental Clearance Certificate, industrial units and projects must be divided into the following four groups based on their location and environmental impact namely
    - Green,

- Yellow
- Orange
- Red.

- Requirement for IEE/EIA depending on the category of the project. All industrial projects and units, both proposed and existing, falling under the Green Category must be granted immediately with an environmental clearance certificate. For the ones under Orange-A or Orange-B an Environmental Clearance Certificate must be given after a Site Clearance Certificate. For Red category industries, a Location Clearance Certificate must be obtained first, followed by Environment Impact Assessment (EIA) approval and an Environmental Clearance Certificate.
- Renewal of Site Clearance Certificate (SCC) or Environmental Clearance Certificate (ECC).
- Determination of who is responsible for paying damages in the event of ecosystem harm
- Limitations on the sale and manufacturing of products that are damaging to the environment.
- Establishing a standard limit for waste emissions and discharges

5.1.4.5. Water Act 2013 and Natural Water Reservoir Conservation Act, 2000

Water act 2013 and Water Reservoir Conservation Act, 2000 clearly define wetland. According to Water Act 20013 wetland is; "Wetland" means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and in normal circumstances, support or would support vegetation typically adapted to life in saturated soil.

According to water reservoir conservation Act, 2000 "Natural wetland" means- the place declared as the flood flowing land as River, canal, beel, pond, stream, fountain indicated in master plan by the government gazette or government and flowing water and the land the government gazette or government and flowing water and the land which conserve the rain water should be included here.

- Establishment of wetland resource sustainability principles to keep wetlands useful and valuable for resource management and economic growth.
- Protection from deterioration and restoration of natural waterbodies impacted by human interventions or other causes, such as lakes, ponds, beels, khals, tanks, etc.
- Preservation of the existing baseline of biological diversity.
- Any construction if affects the flow of navigable waterways, it must have permission from the appropriate authorities.
- For the protection of the ecology and natural aquifers, stop any filling of public depressions and waterbodies in cities. Also, upland flows in canals should be kept to protect the ecology.
- Stop haphazard building along riverbanks and indiscriminately clearing vegetation from newly acquired land.

5.1.4.6. National Water Management Plan, 2001

In 2001, a development strategy for the National Water Management Plan (NWMP) was approved. This National Water Management Plan has been created in accordance with policy and the development strategy to offer a framework at the national and regional levels within which line agencies, local government, and other stakeholders may plan and implement their own projects and activities in a coordinated manner, consistent with overall national and sectoral objectives. This plan covers broad policy goals and development difficulties, such as

- Decentralizes and devolved water management, environmental issues, and the promotion of private sector involvement. It also
- Outlines key objectives, a situation assessment, and activities with a focus on institution development, river development along major rivers, water for towns, rural areas, and major cities, disaster management, agriculture and water management, and water for the environment and aquatic resources.
- The primary goals of water management for the natural environment and aquatic resources shall be:
    - To ensure the availability of clean water for multiple uses;
    - To restore and maintain fish habitats;
    - To ensure the availability of water for sustainable use;
    - To preserve key wetlands features; and
    - To ensure the provision of water for future protection of the aquatic environment, particularly through institutionalizing EIA and environmental management procedures.

5.1.4.7. Environment Court Act, 2010

The Environment Court Act, 2010, which replaced the earlier Environment Court Act, 2000, was passed by the government of Bangladesh with the prosecution of crimes associated with environmental pollution and matters ancillary thereto as a top priority. The Act of 2010 underwent a renovation with a new adjudication system that is effective in protecting, conserving, and preserving the environment as well as advancing environmental justice. Environmental offenses may also be tried in Special Magistrates and Special Magistrate Courts in addition to Environment Courts.

5.1.4.8. The Sound Pollution (Control) Rules, 2006

The rules pave a way for reporting noise complaints to the attention of municipal authorities for injury assessment. According to the Noise Pollution (Control) Rules of 2006, the acceptable sound limit is 50 dB during the day and 40 dB at night in silent areas, 55 dB during the day and 45 dB at night in residential areas, 60 dB during the day and 50 dB at night in mixed areas, 70 dB during the day and 60 dB at night in commercial areas, and 75 dB during the day and 70 dB at night in industrial areas. According to the regulations, it's illegal to surpass a given area's maximum noise level.

5.1.4.9. Bangladesh National Building Code (BNBC), 2020

Construction needs to be monitored and regulated in order to guarantee the best return on the significant number of national resources involved in building construction, in both the public and private sectors, and to achieve adequate performance of any building. It was necessary to modernize, rationalize, and combine these devices. Therefore, it was thought that a thorough construction code would fulfill the need for a uniform national norm. To serve the aforementioned purposes the BNBC 2020 carries out the following functions.

(1) To protect life, limb, health, property, and the general welfare within reasonable bounds, this Code establishes basic standards for design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings within Bangladesh.

(2) In order to accomplish the same goal, this section also regulates the installation and use of specific equipment, services, and appurtenances that are related to, connected to, or attached to such buildings.

(3) The stated purpose of this Code is to ensure public safety, health, and general welfare insofar as they are impacted by the construction, alteration, repair, removal, demolition, use, or habitation of buildings, structures, or premises. This is accomplished through structural strength, stability, means of egress, safety from fire and other hazards, sanitation, light, and ventilation.

5.1.4.10. National Land Use Policy 2001

The Ministry of Land developed the National Land Use Policy, which specifies elements to make sure land use activities are in line with environmental sustainability and conservation. There are established land zoning procedures in Bangladesh for both urban and rural areas. The policy supports strategies like tree planting on riverine and coastal islands to improve forest cover, better use of alluvial lands, preservation of khash lands, decrease of soil contamination, etc. to promote sustainable and deliberate use of land resources in the nation. To be more specific this policy assists in the following sectors.

- To reduce the rate of agricultural land reduction.
- To control unplanned growth of residential area through zoning system according to nature of lands.
- To ensure best use of alluvial land (char land). Preservation of future potential and government khash land.
- To ensure land use favorable to ecology. Best use of land for poverty alleviation and employment and to reduce trend of increasing landless people.
- Saving natural forest, blocking river erosion and reduce hill track damage.
- To prevent soil pollution. Ensure minimum land using multi storied government and private building for institutions.

5.1.4.11. National Forest Policy 1994 (Updated 2016)

According to the 1994-adopted National Forest Policy, the government must work to preserve soil, water, biodiversity, natural forests in hilly areas, and the catchments of rivers throughout the nation.

These areas must be designated as protected areas, game sanctuaries, or national parks as per necessity. The main objectives of the National Forest Policy 1994 are:

- To begin various afforestation programs in forest lands, fallow lands, lands not suitable for agriculture, hinterlands, and other potential areas in order to meet the basic needs of the present and future generations and to ensure that the forestry sector contributes more to economic development. This would afforest about 20% of the country's total area.
- To promote biodiversity by preserving the remaining bird and animal habitats in the present degraded woodlands;
- To support the growth of sectors associated to forestry, particularly by protecting land and water resources, in order to strengthen agriculture;
- To implement different initiatives and government-ratified agreements including global warming, desertification, and the regulation of trade and commerce in wild birds and animals in order to uphold national pledges and obligations.
- To stop unlawful seizure of forest lands, tree cutting, and shooting of wild animals by engaging locals more
- To promote the efficient use of forest products at different stages of processing.
- To finance and carry out planting campaigns on both public and private areas.

5.1.5. Project Categorization & Clearance Procedure by ECR'2023

5.1.5.1. Project Categorization

The Apartment Project of Block 'B' & 'C' of Uttara falls under red category according to the DoE list under the Environmental Conservation Rules (ECR), 2023 as the project is a land development and housing project of more than 25 acres. As the Department of Environment classified the project as "Red" necessitating the issuance of a Site Clearance Certificate (SCC) as well as the creation of an EIA and, later, an Environmental Clearance Certificate (ECC) by the DoE.



Figure 5-2: Process of ECC Preparation

5.1.5.2. Clearance Procedure

Site clearance:

(1) An application for site clearance is to be submitted by the entrepreneur of the concerned industrial unit or project to the concerned Divisional Officer of the Department of Environment (DoE) through prescribed form-3 under Environment Conservation Rules 2023 (ECR'2023) along with appropriate prescribed processing fees under schedule-6, relevant documents, description, draft terms of reference of Environmental Impact Assessment (EIA) mentioned under Environment Conservation Rules 2023. The following relevant documents specified below should be submitted along with the application.

(2) In the case of making an application mentioned in point (1), the application processing fee mentioned in schedule-6 of ECR'2023, related documents, details, and draft ToR of environmental impact assessment should be submitted and applicable guidelines mentioned in Schedule-9 of ECR'2023 should be followed.

(3) The draft Terms of Reference (ToR) of the environmental impact assessment shall be formulated as per the guidelines mentioned in Schedule-10 of ECR'2023.

(4) After receiving the application, the relevant office of the Directorate shall conduct a site visit to the proposed site of the concerned industrial establishment or project and after reviewing the documents and all relevant matters, a report with an opinion on the rationale of granting the locational clearance and the draft environmental impact assessment shall be sent to the Environmental Clearance Committee of the Head Office of the Directorate and Copy thereof shall be forwarded to the Regional and Divisional Offices, as applicable.

(5) After receiving the documents under point (4), the Environmental Clearance Committee shall, after evaluating and considering all matters, submit a report in this regard to the Director General for approval.

(6) With the approval of the Director General, approval of the draft ToR of environmental impact assessment shall be provided from the concerned office within not more than 30 (thirty) working days of the receipt of the application to the concerned industrial establishment or project promoter:

Provided that if any additional information or documents are required, the applicant shall be provided with not more than 7 (seven) Instructions for depositing the same shall be issued within working days:

It is further provided that if the application is rejected after reviewing the overall aspect, the applicant shall be notified in writing stating the reasons within 7 (seven) working days of the said decision.

Environmental Impact Assessment Survey

(1) A red category industrial establishment or project promoter shall conduct an environmental impact assessment survey based on Terms of Reference (ToR) approved by a listed environmental consultant following the guidelines framed by the Department and submit an environmental impact assessment report:

'Provided, however, that the environmental impact assessment guidelines of any international or development aid organization may be followed for conducting the environmental impact assessment survey of those sectors for which the Department does not have an environmental impact assessment guideline and in this case, it is contrary to the plans, policies or decisions adopted by the government to be considered.

(2) Enrolled environmental consultants shall carry out their activities independently and impartially in consultation with all concerned in the conduct of environmental impact assessment studies: 'Provided, however, that the environmental management plan and monitoring program formulation shall be discussed and consulted with the entrepreneur.

(3) The enlisted Environmental Consultants shall follow the guidelines set out in Schedule-11 of ECR'2023 in preparing the Environmental Impact Assessment Report and the Environmental Management Plan Report as part of this report.

(4) All the activities, steps, plans, or monitoring programs mentioned in the environmental management plan of a red category project shall be properly followed to the concerned entrepreneur shall be given a declaration following Form-6 of ECR'2023.

(5) The entrepreneur of red category industrial establishments and projects shall submit the environmental impact assessment report to the environmental clearance committee of the head office of the directorate.

Public Consultation for Environmental Impact Assessment

(1) As part of the environmental impact assessment, any red category industrial establishment or project promoter shall, in the presence of the concerned stakeholders and the officials of the relevant office of the directorate, take measures to verify public opinion in the said industrial establishment or project related area:

Provided that, in the case of a large and specialized industrial institution or project, or if the location of the industrial institution or project is spread over more than one department, public opinion verification measures have to be taken at the regional or national level.

(2) For verification of public opinion, the industrial organization or project promoter should apply to the concerned office along with the environmental impact assessment report and 3 (three) sets of Bengali summaries related thereto and the copy thereof should be sent to the head office.

(3) Within 7 (seven) working days of receiving the application under point (2), the concerned industrial establishment or project promoter shall fix the date, time, and place of public opinion verification and publish a notice in a widely circulated local and national daily newspaper.

(4) Detailed information related to the verification of public opinion shall be published on the website of the Directorate and the website of the said industrial organization or project promoter, if any.

(5) Regarding the environmental impact assessment report, opinions can be given in the relevant office including the website of the Directorate within 30 (thirty) working days of the publication of the circular:

'Provided that, within 45 (forty-five) working days of the preparation of the draft environmental impact assessment report, public opinion verification shall be completed:

It is further provided that if it is not possible to complete the public opinion verification within the stipulated time, the time will be extended by a maximum of 15 (fifteen) working days.

(6) Individuals, groups and organizations related directly or indirectly to the related industrial organization or project initiative and having knowledge and experience in this matter should be involved as much as possible in the public opinion verification process.

(7) At the time of verification of public opinion, the concerned industrial establishment or the promoter of the project shall present the following information, namely:

- Basic information about the industrial establishment or project;
- Potential benefits of the project;
- The environmental impact of the industrial establishment or project and, where applicable, the social impact;
- Means of mitigating environmental and social impacts; and

- Other matters relating thereto.

(8) The minutes of the said meeting shall be approved by the concerned office of the directorate within not more than 7 (seven) working days of holding the meeting for verification of public opinion.

(9) Minutes approved under point (8) shall be attached to the environmental impact assessment report.

(10) Necessary changes shall be made in the environmental impact assessment report and environmental management plan in light of the environmental opinion received in the public opinion verification process.

Evaluation of Environmental Impact Assessment Reports

(1) According to point (1) of above-mentioned rule in section 5.2.2., the concerned industrial organization or project promoter will be invited to the environmental clearance committee meeting to provide clarification on the information and conclusions of the environmental impact assessment report.

(2) If it appears necessary by the environmental clearance committee, it may ask for an opinion on the environmental impact assessment report from the concerned department or organization and the said opinion shall be accepted within the prescribed time frame for granting the clearance in favor of the concerned industrial establishment or project.

(3) The Environmental Clearance Committee in its meeting shall consider the following matters while assessing the environmental impact of the industrial establishment or project concerned, namely —

- Determined environmental impact, proposed environmental management plan and monitoring program;
- the opinion obtained after verifying public opinion and the measures taken in the light of such opinion;
- possible alternatives of the concerned project and, if necessary, site inspection of the proposed site of the said project;
- requests for additional information if the information in the report appears to be insufficient;
- Review of terms and conditions of positional clearance.

(4) The Environmental Clearance Committee shall review other reports submitted in terms of the scope of the Environmental Impact Assessment Report such as the Social Impact Assessment Report, Accident and Disaster Response Jury Plan, Victims Relocation and Rehabilitation Plan, and Risk Assessment and Management Plan.

Approval of Environmental Impact Assessment Report

(1) The Environmental Clearance Committee of the Head Office of the Directorate, after receiving the environmental impact assessment report of the related industrial establishments and projects of the red category, shall consider the following issues and send it to the Director General for approval with recommendations, namely:

- Assessment of Environmental or Social Impact to an adequate extent, whether done;

- whether the proposed environmental management plan and monitoring program are accurate, effective, practical, and adequate;
- whether the environmental impact of the proposed industrial establishment or project will be within acceptable 'standards' by implementing the proposed environmental management plan and adopting mitigation measures; and
- whether the concerned industrial establishment or project proposal is contrary to Government policy and planning.

(2) According to point (5) of above-mentioned rule in section 5.2.2, the environmental impact assessment report shall be approved within 30 (thirty) working days after submission of the environmental impact assessment report.

(3) If the recommendation for approval of the environmental impact assessment report by the Environmental Clearance Committee is approved by the Director General, the concerned industrial establishment or project promoter shall be called upon to pay the fee mentioned in Schedule-7 within not more than 7 (seven) working days.

(4) According to point (2) the location clearance shall be given to the industrial establishment or project promoter within not more than 7 (seven) working days of submitting the proof of payment of the fee to the concerned office.

(5) Considering the issues mentioned in point (1), if there is any objection to the environmental clearance committee's application for the locational clearance of the concerned industrial establishment or project, the applicant shall be informed in writing within 7 (seven) working days of the decision being taken by the Director General.

(6) If the concerned industrial establishment or project promoter fails to take corrective action within 7 (seven) working days of receipt of the written objection as per point (3), the concerned application shall be rejected.

(7) After receiving the location clearance, the concerned industrial establishments or project promoters can start related activities including land development, construction of infrastructure or facilities, and opening of Letters of Credit (L.C).

(8) The approved environmental impact assessment report mentioned in point (2) shall be uploaded on the website of the Directorate for public information.

Environmental Clearance Certificate Granting Procedure

(1) After the issuance of the locational clearance, the entrepreneur intending to start the related industrial establishment or project shall apply to the concerned office of the Directorate for receiving the environmental clearance.

(2) After receiving the application under point (1), the concerned office of the directorate shall conduct an on-site inspection of the industrial establishment or project and prepare a report along with opinions on the conditions of the location clearance, recommendations of the environmental impact assessment report, and all related matters.

(3) The report prepared under point (2) shall be sent to the environmental clearance committee of the head office of the directorate and a copy thereof shall be sent to the concerned regional or divisional office, as the case may be.

(4) After reviewing the reports received under point (2) and related documents, the Environmental Clearance Committee shall give recommendations to the Director General regarding the granting of favorable environmental clearance to the concerned industrial establishment or project.

(5) After the recommendation received under point (4) is approved by the Director General, the concerned office shall issue environmental clearance in favor of the said industrial establishment or project.

(6) Environmental clearance shall be issued within 30 (thirty) working days of receipt of the application for environmental clearance from the concerned industrial establishment or project:

Provided that if the application for environmental clearance is rejected, the applicant shall be notified in writing stating the reasons within not more than 7 (seven) working days of the decision of rejection:

It is further provided that while the red category industrial establishment or project is in progress, the directorate will issue instructions to the entrepreneur to update the environmental impact assessment report taking into account the effectiveness of the monitoring report and environmental management plan and any relevant new environmental or social issues.

5.1.6. Existing Environmental Conditions

5.1.6.1. Physical Environment

The Uttara Model Town is a Northern Thana and suburb of the Bangladeshi metropolis, Dhaka. It is close to Shahjalal International Airport and is located on the route leading to Gazipur. Geographically elevated from southern Dhaka to protect it from flooding, Uttara is mainly planned as a square grid residential suburb.

The Uttara Residential Model Town's Third Phase is located about 20 kilometers (12 miles) from Dhaka City's center. It is situated on the western edge of the second phase of the Uttara Model Town Project. On the west, the Flood Protection Embankment runs through Mirpur-Ashulia, and on the south, the Mirpur Cantonment.

B' & 'C' Block of Uttara is located in Sector 18 and are almost surrounded by lake. For the aquatic eco-system to be protected, lakes must be conserved. The lakes should be effectively maintained because they aid in a number of monsoon-related functions, including reducing water logging, enhancing drainage, providing fresh water, and increasing water retention capacity. Additionally, the lakes replenish groundwater and support wildlife.



Figure 5-3: Existing Physical Environment

Source: Field Visit, 2023

5.1.6.2. Soil and Topography

The Madhupur Tract and Floodplain area, where Dhaka City is located, includes the southern river system. Regional elevation in the region ranges from 3 to 5 meters above mean sea level, with a progressive fall in elevation as one moves south into the Buriganga River. The city and its surroundings are covered by two distinctive geological units, including alluvial deposits from more recent times and Pleistocene-aged Madhupur Clay. The Madhupur Clay is the oldest silt that has been found in or near the city and has distinctive morphology and drainage.

The Dhaka terrace, low areas known as floodplains, depressions, and abandoned canals are the city's three main geomorphic components. Other significant topographic characteristics are low-lying bogs and marshes that surround the city. The ground progressively rises in height from the east to the west. Uneven elevation is a land characteristic in Dhaka and it is clearly visible in Figure below. The region was once covered in lush flora. Land has been turned over to urban usage as a result of the recent fast population increase and industrialization.

For the site, it is a low land with wetlands. Red soils with clay and silt are present in the region. Iron quantity is high in the soil. The average height of the region is 4.37 meters above sea level which is 0.72 meters lower than the average height of the central region. The soil of this region is in hydrologic soil category D type. That is, the rate of infiltration of water into the ground here is comparatively less. Soil slope (0%-2%). As per mentioning detailed area plan, the soil in the project area is 38% pervious and 62% impervious. Hence the load bearing capacity for infrastructure construction is relatively lower here.

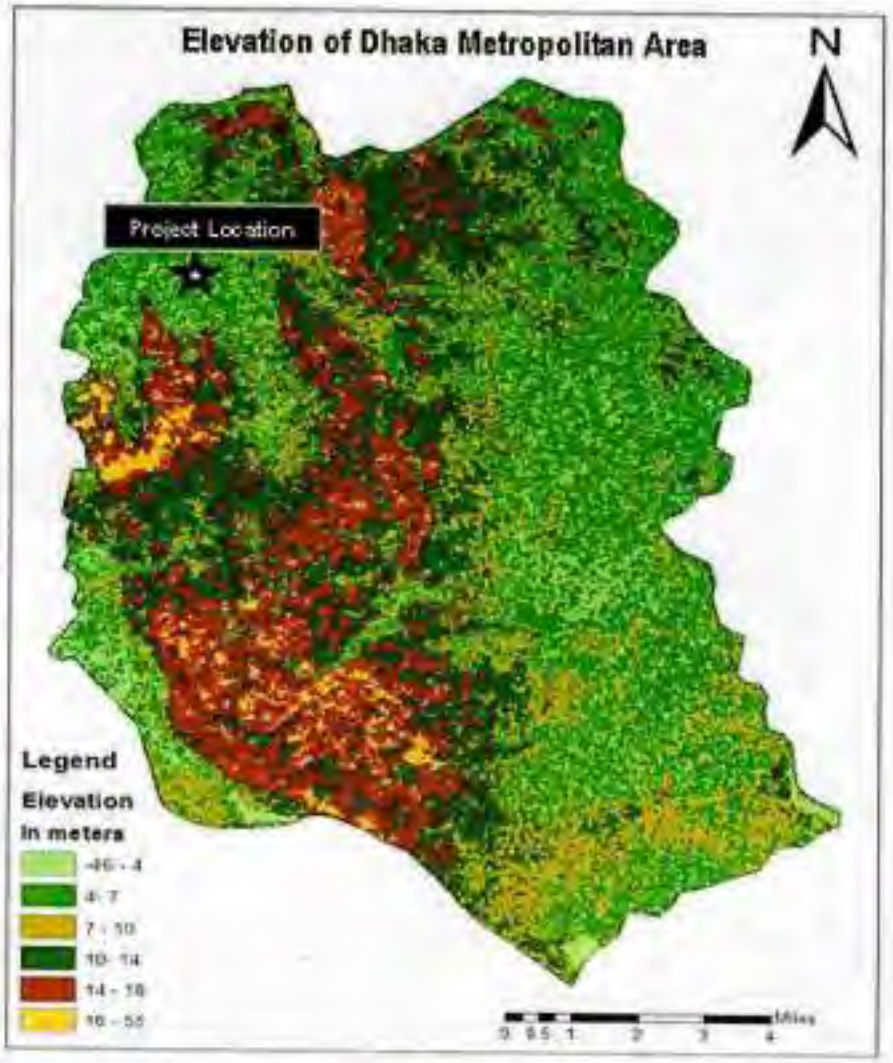


Figure 5-4: Land Elevation of Dhaka Metropolitan Area

5.1.6.3. Climate

Bangladesh's climate is significantly influenced by the Asian monsoon. Three distinct seasons are produced by the effect of the monsoon. Pre-monsoon season, that is hot (from March to May), monsoon season, which is humid (from June to September), and cool, dry winter season (from October to February).

The Himalayan Mountain range has contributed to the creation of a tropical macroclimate that covers the majority of the east Bengal land mass despite less than half of Bangladesh is located in the tropics. Seven climate zones can be found in Bangladesh. South-central zone is where the proposed project area is situated. Tropical weather is prevalent in Dhaka, which is in South-central zone.

5.1.6.4. Solid Waste Management

The solid waste in the project and its adjoining area is authorized by the Dhaka North City Corporation (DNCC). The wastes are supposed to end up in Secondary Transfer Stations (STS) of Uttara Sector 12 by Primary Waste Collection Service Providers (PCSP). But while visiting the project area the consultants have found that the solid wastes end up in empty places. The restaurants and the food café usually do not follow the assigned solid waste management system. The apartment project can

be expected to start the proper practice of Solid Waste Management complying with the systematic approach of DNCC. Hence the area can be saved from open disposal or dumping of waste.



Figure 5-5: Existing Condition of Solid Waste Open Disposal

Source: Field Visit, 2023

5.1.6.5. Temperature

The warmest months are from April to October, and the coolest months are January, February, November, and December. Seasonal fluctuations in temperature are visible throughout the year. The following table displays the last decade's year-by-year temperature range of Dhaka City.

Table 5-1: Monthly Temperature of Dhaka (2011-2020)

Year	Maximum Temperature		Minimum Temperature	
	Degree (◦ C)	Month	Degree (◦ C)	Month
2011	36.2	September	8.2	January
2012	37.3	March	9.6	December
2013	37.1	May	7.2	January
2014	40.2	April	10.3	January
2015	36.5	June	11.4	January
2016	39	April	10	January
2017	37	May	11.3	January
2018	37.6	July	9.5	January
2019	37.1	April	12	January
2020	38	April	11.3	February

Source: BMD, 2022

The lowest temperature ever recorded over the past ten years was 7.2 degree Celsius in the month of January 2013, and the highest temperature ever recorded was 40.2 degree Celsius in the month of April 2014. The lake surrounding the Block B and C keeps the temperature of the project area comparatively lower than the other urbanized Dhaka as land cover- and built-up area index are a major factor of land surface temperature.

5.1.6.6. Rainfall

The city of Dhaka receives just more than 1890 mm of rainfall annually. As is to be expected, the temperature range is considerably less than that of the west, but slightly greater than that of the south-western zone. This area serves as a transitional area between the North-eastern, South-

western, and Western zones. The Bangladesh Meteorological Department (BMD) station's rainfall data shows that the winter months of November to February see the lowest rainfall and the summer months of June to September see the highest rainfall. Dhaka experiences more than 290 mm of rain during the monsoon, according to statistical data from 2011 to 2020. Around 5 mm of rainfall fell in the area of the Dhaka weather station in the winter months of December and January.

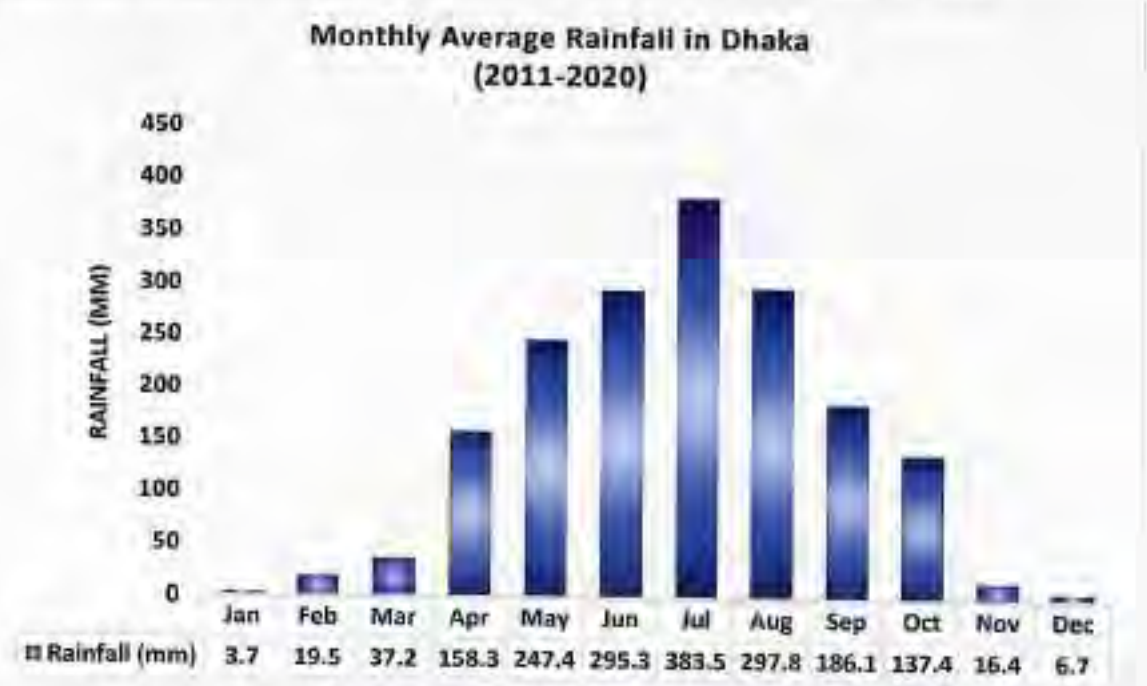


Figure 5-6: Monthly Average Rainfall in Dhaka (2011-2020)

Source: BMD, 2022

5.1.6.7. Seismicity

Bangladesh is located where three significant active tectonic plates namely the Indian Plate, the Tibet Sub-Plate, and the Burmese Sub-Plate meets together. The project area falls over the northward-moving Indian Plate. The Himalayan Arc and Shillong plateau in the north, the Burmese Arc, the Arakan Yoma anticlinorium in the east, and the complicated Naga-Disang-Jaflong thrust zones in the northeast are all seismically active areas that border Bangladesh. In addition, it is home to the Dauki Fault System, a number of active subsurface faults, and a flexure zone known as the Hinge Zone. Again, Bangladesh itself is split into 4 seismic zones namely Zone I, II, III and IV. These zones were generated depending on the ranges of the seismic coefficient, due to the position of pertinent plates, fault lines, and hinge zones.

The project area is located in Zone II, which includes the south-central region of Bangladesh, according to the seismic zone map. The project area with a seismic coefficient Z=0.20 is therefore vulnerable to moderate seismic activity. The project area is at relatively more prone seismic risk than any other natural calamities as geological fault line passed by the east of the Uttara region. Evidently there have recently been no large earthquakes in the project locations.



Figure 5-7: Seismic Zones of Bangladesh

Source: Bangladesh National Building Code (BNBC) 2020

5.1.6.8. Relative Humidity

The humidity in Dhaka is highest during the summer season. The average monthly humidity ranges from 79% to 82% from June to September. The humidity gets low during the winter season from January to April with a range of 58% to 69%. From the radar chart below, it is quite evident that the minimum humidity all year around is nearly 60% and the maximum is nearly 82%.

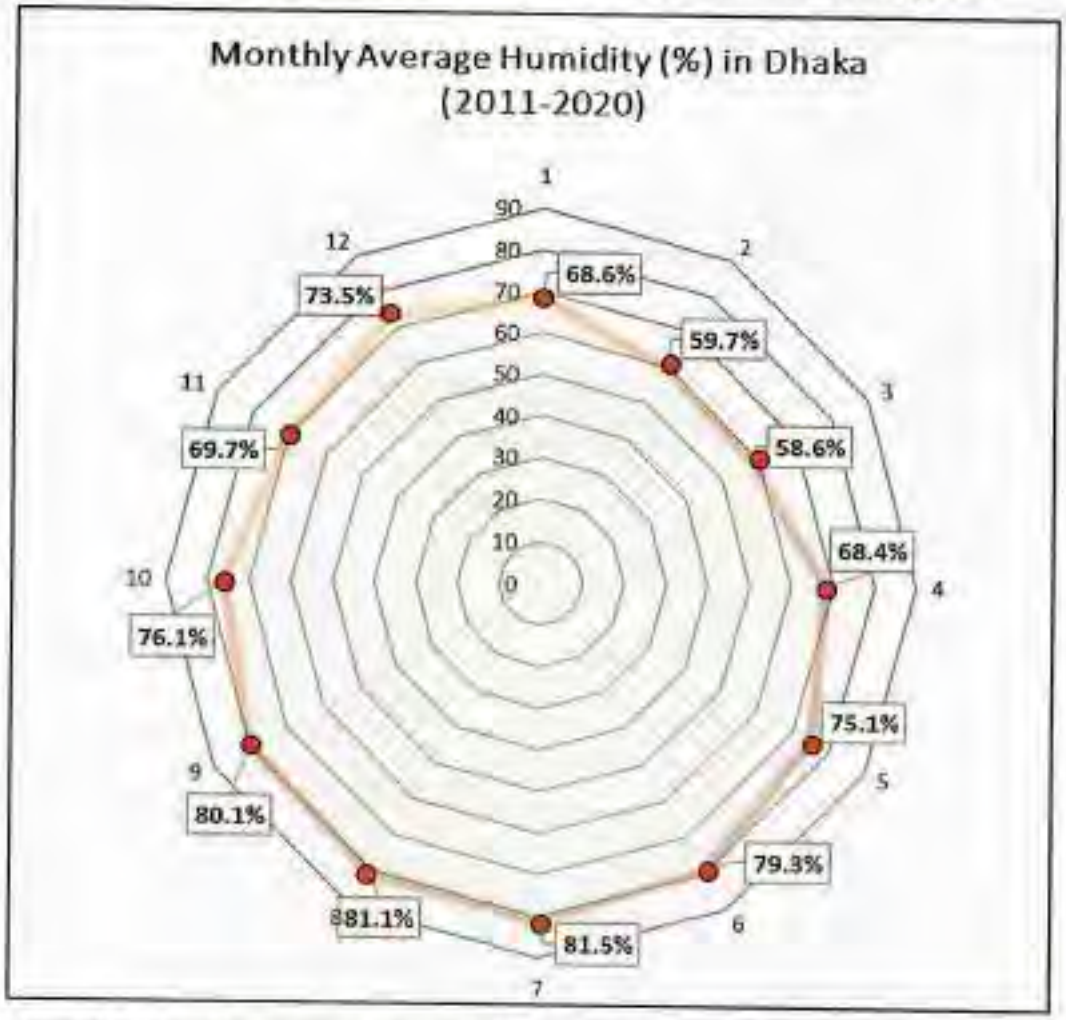


Figure 5-8: Monthly Average Humidity (%) in Dhaka (2011-2020)

5.1.6.9. Biological Environment

The project site and the surrounding area are home to both terrestrial and aquatic ecosystems. Comparatively speaking, there are few plants and animals at the project site. Within the current environment, the urban terrestrial ecosystem is crucial.

Flora

Some natural trees can be found on the project site. There are not many shrubs and herbs, albeit some do naturally grow in a distributive manner in the project area. With a few scattered weedy shrubs, low grassland dominates the area due to the prevailing favorable climate. The majority of the homestead's vegetation is made up of woody plant species, a few medicinal herbs, and a few fruit and vegetable trees. These provide roosting spots for the neighborhood birds.

The remarkable Flora found were Sil koroi (Albizia procera), Banyan (Ficus benghalensis), Custard Apple (Annona squamosal), Mango (Mangifera indica), Papaya (Carica papaya), Black plum (Syzygium cumini), Jackfruit tree (Artocarpus heterophyllus), Coconut (Cocos nucifera), Elephant wood apple (Feronia limonia), Guava (Psidium guajava), Neem (Azadirachta indica), Bengal Quince (Aegle marmelos), Banana (Musa acuminate), Taro (Colocasia esculenta), Kalmi or water spinach (Ipomoea aquatic) and Kans Grass or wild sugarcane (Saccharum spontaneum), Palmyra Palm (Borassus flabellifer), Water Hyacinth (Eichhornia crassipes).







Figure 5-9: Flora at the Project Site

Source: Field Visit, 2023

Fauna

There are a lot of fishes in the wetland and adjacent lake of Block B and C at the project area. Although there are some native cows, foxes, dogs, turtles, birds etc. present, there are no large animals at the location. At the site area, there are remarkable birds which has a major role in the prevailing ecosystem and biodiversity in the area.

The birds like Cormorant (Phalacrocorax carbo), Great Egret (Casmerodius albus), Intermediate Egret (Ardea intermedia), Black Drongo (Dicrurus macrocercus), Black kite (Milvus migrans), domestic duck (Anas platyrhynchos domesticus) have been observed by the consultant team themselves in the projects site. The locals also said they use to see Baali Hansh or Lesser whistling duck (Dendrocygna javanica) in the wetland region and sometimes Dove (Spilopelia chinensis). Also, according to the site residents, there are some species of snakes indwelling at the project site.

The fishes that are found in the wetland and adjacent lake of Block B and C are as follows, Ruhi (Labeo rohita), Kalibaos (Labeo calbasu), Stinging Catfish (Heteropneustes fossilis), Walking Catfish (Clarias batrachus), Tilapia (Oreochromis niloticus), Giant Snakehead (Channa marulius), Giant river-catfish (Sperata seenghala).



Figure 5-10: Fauna at the Project Site

Source: Field Visit, 2023

5.2. Environmental Impacts of the Project

5.2.1. Environmental Impacts at Different Phases

Environmental impact identification is a crucial aspect of any project, whether it involves constructing infrastructure, developing a residential area, or establishing industrial facilities. The process of identifying environmental impacts aims to assess and understand the potential consequences that a project may have on the surrounding environment. This proactive approach helps in developing effective mitigation strategies and sustainable practices to minimize and manage adverse effects.

The identification of environmental impacts spans across different phases of a project's lifecycle, including the pre-construction, construction, and operational periods. Each phase presents unique challenges and opportunities to address environmental concerns. By thoroughly assessing these impacts, project developers, environmental consultants, and stakeholders can work together to promote sustainable development and reduce the ecological footprint of the project.

5.2.1.1. Impacts during Pre-Construction Phase

During the pre-construction phase, the focus is on evaluating the potential environmental impacts that may arise from the project design, site selection, and planning stages.

CLEARANCE OF VEGETATION

In order to start building the structures, the land will be prepared by clearing away any grasses, shrubs, and trees as well as the overburden. Loss of biodiversity, soil erosion, sedimentation, and siltation, as well as increased runoff and deteriorated surface water quality, are all linked to clearance of vegetation. Removing vegetation, increasing pavement surface, and industrial activity are all likely to temporarily alter the microclimate, which could result in a spike in temperature, particularly during the day.

UTILITY SHIFTING

Potential spills of lubricating oil, fuel oil, concrete, etc. can contaminate the soil.

SITE PREPARATION

Soil erosion due to vegetation clearance and excavation activities.

REMOVAL OF EXISTING SOLID WASTE

Among the above negative impacts one positive impact is that the existing openly disposed solid waste at the site will be removed.

IMPACT ON WETLAND

The wetland will be landfilled and occupied for the project construction purpose. So, there will be a halt in the ecosystem and agricultural activity. Mitigation plans have to be taken with care to re-establish the ecosystem.

5.2.1.2. Impacts during Construction Phase

Once the project moves into the construction phase, various activities are undertaken that can significantly impact the environment. Identifying and managing these impacts is vital to ensure compliance with environmental regulations and minimize disturbances to the surrounding ecosystems.

IMPACTS ON COMPONENTS OF LANDSCAPE

Landscapes are intangible concepts that are impossible to measure properly. However, in general, when an industrial building is not planned with the landscape in mind, it obstructs people's views. By converting a green space into a built-up region, the planned project somewhat alters the local landscape. For the local population, this will alter the balance of the natural and visual world.

Any structure added to the project should be created with the landscape's primary considerations in mind, such as coherence, readability, hierarchy, harmony, and stability. It is anticipated that the project will feature a contemporary architectural style with minimal visual obtrusion.

IMPACTS ON SOIL

Degradation of the top soil will take place due to construction works. In general, earth filling is necessary to raise the level of any project site above the existing ground level. If suitable mitigation

measures are not chalked out and taken, the natural surface of the earth will be disturbed by this land rising from its original level, which will hinder the natural drainage system of the area. Retaining the natural characteristics of the soil at the site is a challenge as the landfilling soil might not have the similar features. Moreover, soil can possibly be contaminated due to potential spills of oil or chemical materials for construction from utility shifting by transportation etc.

IMPACTS ON AIR

Construction activities, if improperly managed, may result in dust emissions in certain situations. Significant amounts of dust may be emitted from moving construction-related vehicles and concrete batching plant operations. The duration and location of the activity, the weather, and the efficacy of suppression measures will all affect the level and dispersion of dust emissions. The trucks needed to carry materials and the construction machinery and equipment will all emit gases while the project is being built. Carbon monoxide, Sulphur dioxide, and oxides of nitrogen will be released when machinery and vehicles are operated. The areas closest to site access will be most affected by car and industrial emissions in terms of air quality. In general, the increased number of vehicle movements caused by the construction phase could have an impact on the local air quality close to the project site, and the concentration of pollutants is expected to decrease the further away the project is from the source.

NOISE AND VIBRATION

The operation of equipment, machinery, and vehicles will be the main source of noise during the installation of the project route and construction of infrastructure. Excavators, graders, and vibratory rollers, for example, have the capacity to produce loud noises. These machines generate noise levels of over 70 dB (A). This can create disturbance for the neighborhood, the area next to the road, or anything within 500 meters' radius from the worksite. The community, especially those living around the project site, would experience inconveniences as a result of the noise created during building. The utilization of generators during the operation time could cause noise to be produced.

WASTE GENERATION

Excavated soil, rocks, concrete, wooden pallets, steel filings and cuttings, packaging materials made of paper or plastic, wood, and metals, among other materials, make up the construction waste produced on site. The labor camp and construction site will also produce municipal domestic trash such as food waste, plastic, glass, aluminum cans, and waste paper. Hazardous waste, such as spent oil, hydraulic fluids, waste gasoline, grease, and waste oil-containing rags, will also be produced during the construction process. Solid waste management practices could have an adverse effect on the local environment, including the air, water, and human health.

IMPACTS ON WATER

During the construction if wastes and raw materials are not properly managed, there will be impacts on water at project site. There is Lake of Block B and C adjacent to the project site. The surface runoff will carry the open wastes away, contaminating the aquatic system in the process. Water will be needed during the construction phase for construction and domestic needs alone. As a result, there will be much of an impact on the groundwater table since only a percentage of drinking water would be drawn from the ground.

IMPACTS ON FLORA

The proposed project site has good vegetation and diversity of terrestrial plants. For the project to be finished, this overgrowth must be eliminated. Terrestrial undergrowth makes a significant contribution to the current ecology, and clearing or removing it would have some negative effects as well. However, there are enough terrestrial habitats in the project study regions to support a fair number of terrestrial floral species, even though none of them are endangered in Bangladesh.

IMPACTS ON FAUNA

Due to their highly sensitive and reactive behavior in response to disturbance that may occur at or near their habitat, the existing aquatic and terrestrial fauna could be negatively impacted (directly and indirectly) by construction activities associated with the proposed apartment project. The most affected animal species would be those that are delicate to either direct (human activities and transportation) or indirect (noise) disturbance. For a specific amount of time, habitat disruption would lessen the habitat's usefulness and availability to mammals, reptiles, amphibians, birds, and their predators. The use of vehicles or machinery across terrestrial or aquatic faunal habitats also carries some risk of direct amphibian, reptile, bird, and mammal mortality as well as their relocation. Although it is impossible to quantify these losses, the impact is anticipated to be minimal and short-lived.

Diverse project activities close to fish habitats i.e. Lake of Block B and C may have some potential negative effects on fish, including mortality, disruption of fish passage during monsoon, deposition of excavated soil on the fish habitat, contamination of water, destruction of shallow fish habitat or saturated ground by project vehicle movement, etc. It may be challenging to determine the effects on fish right away, but by monitoring the availability of a few representative fish species, the effects can be assessed.

5.2.1.3. Impacts during Operational Phase

During the operational phase, the project is in full swing, and its ongoing activities can have continuous environmental consequences. It is important to identify and monitor the potential impacts associated with the project's operations, such as energy consumption, water usage, waste generation, emissions, and their effects on air and water quality. Regular environmental monitoring, audits, and compliance with environmental regulations help identify any deviations from sustainability goals and enable the implementation of corrective measures to minimize adverse impacts.

IMPACTS ON AIR

Poor indoor air quality can result from inadequate ventilation, the release of volatile organic compounds (VOCs) from building materials, furnishings, or cleaning products, as well as the presence of allergens, dust, or mold. Inefficient or poorly maintained heating, ventilation, and air conditioning (HVAC) systems can also contribute to the deterioration of indoor air quality.

The energy demands of an apartment complex can have indirect impacts on air quality. Depending on the energy sources used, the generation of electricity can release pollutants into the atmosphere, contributing to air pollution and greenhouse gas emissions.

The transportation activities associated with an apartment complex, such as residents' commuting, delivery vehicles, and maintenance vehicles, can contribute to air pollution. Emissions from vehicles, especially those powered by fossil fuels, release pollutants like carbon monoxide (CO), nitrogen oxides

(NOx), particulate matter (PM), and volatile organic compounds (VOCs), which contribute to smog formation and respiratory issues.

Improper waste management practices, including the incineration or open burning of waste, can release harmful pollutants into the air. Additionally, the accumulation of organic waste in dumpsters or trash chutes can produce unpleasant odors and attract pests, leading to potential air quality issues.

IMPACT ON WATER

Sewage discharge from residential areas would have an impact on water quality. STP should be there to ensure the standard of surface water fixed by ECR' 2023 before discharging it in Lake adjacent to Block B and C. The surface water quality in these discharging options needs to be monitored on a regular basis to make sure that it complies with national guidelines for surface water quality.

IMPACT OF SOLID WASTE

Refuse or municipal solid waste (MSW) is any nonhazardous garbage from a community that needs to be collected and transported to a processing or disposal location. Garbage and waste are included in refuse. Decomposing food waste makes up the majority of garbage, whereas rubbish includes dry materials like glass, paper, linen, and wood. Unlike rubbish, garbage is easily decomposable. Bulky waste such as old refrigerators, couches, and enormous tree stumps are examples of trash. Trash needs distinctive management and pickup. No solid waste can be kept open or disposed here and there because the surface runoff will carry the open wastes away, contaminating the aquatic system in the process.

5.2.2. Disaster & Risk Analysis

The project area for both Block B and C is comprised of wetlands which are planned for housing sites and land filling according to Detailed Area Plan (DAP). Earthquake vulnerability is a significant concern for buildings constructed on landfills in wetland areas, particularly in a country like Bangladesh. Bangladesh is located in a seismically active region, making it susceptible to earthquakes. When wetlands are filled with materials to create solid ground for construction purposes, the resulting landfill can have distinct characteristics that influence the building's vulnerability to seismic events.

5.2.2.1. Seismic Vulnerability Assessment

One crucial factor affecting the earthquake vulnerability of buildings on landfills is the nature of the fill materials used. Wetland areas often consist of loose and water-saturated soil, which can pose challenges for constructing stable foundations. When the wetland is filled to create a solid base, the load-bearing capacity and stability of the ground may be compromised. This can increase the risk of ground settlement and liquefaction during an earthquake event.

Liquefaction is a phenomenon that occurs when saturated or partially saturated soil loses its strength due to shaking during an earthquake. The combination of loose soil and the presence of water in wetlands can make the landfill more prone to liquefaction. During an earthquake, the ground shaking can cause the water-saturated soil particles to lose contact with each other, resulting in a temporary loss of strength. This can lead to the sinking or tilting of buildings, damaging their structural integrity.

Furthermore, the irregular topography of wetland areas adds another layer of complexity to the earthquake vulnerability of buildings on landfills. The uneven surface of wetlands can create differential settlement, where different parts of the landfill settle at different rates. This differential

settlement can exert additional stress on buildings, potentially leading to structural failure or damage during an earthquake.

5.2.2.2. Seismic Vulnerability Mitigation

To mitigate the earthquake vulnerability of buildings constructed on landfills in wetlands, several measures can be taken. First and foremost, a comprehensive geotechnical investigation should be conducted to assess the suitability of the wetland for landfilling and identify potential risks. This investigation should include soil testing, analysis of the water table, and evaluation of seismic hazards. Based on the findings of the geotechnical investigation, appropriate foundation design techniques can be employed to enhance the stability and earthquake resistance of the buildings. These may include deep pile foundations, soil improvement techniques, and the use of seismic isolation systems.

Additionally, stringent building codes and regulations should be implemented and enforced to ensure that structures are designed and constructed to withstand potential seismic forces. Bangladesh National Building Code 2020 (BNBC 2020) provides essential and effective design criteria in this regard. Regular inspections and maintenance of the buildings are crucial to detect any signs of structural deterioration or settlement.

Lastly, it is essential to consider the long-term effects of climate change on wetlands and their seismic vulnerability. Rising sea levels, increased rainfall, and changes in groundwater levels can further exacerbate the challenges associated with constructing buildings on landfills in wetland areas. Adaptation strategies, such as sustainable land use planning and ecosystem-based approaches, should be considered to minimize the risks and promote resilient development practices.

5.2.2.3. Public Health and Safety

During the construction of the apartment project, safety is a key concern, especially employee safety. Construction work along the road may make it more dangerous for vehicles and pedestrians to move about. To reduce these effects, it is crucial that construction projects are scheduled, building materials are delivered on time, and traffic is properly managed. As part of an occupational health and safety strategy, safety concerns, in particular occupational health and safety, should be addressed for general construction operations. Another significant problem is accident during the construction period. To lessen the likelihood of such mishaps during the construction phase, certain precautions must be taken, such as routine equipment maintenance and the usage of protective clothing.

5.2.2.4. Potential risk for Flood, Cyclone, Tornado, Earthquake, Lightning, Draught etc.

There is a possibility of several incidents during construction period due to the climatic effects and resulting of occurring accident, injury and illness of workers/officers. To address the natural disaster properly, an on-site Disaster Management Committee (DMC) should be formed by the PIC. The role of the PIC should be:

- Responsible for disseminating emergency news, bulletin
- In case of tropical cyclone, committee shall forecast the early warning system
- Camping for awareness on lightning, heatwave to avoid unwanted incidents
- Arrangement of shelters, food, utility services etc. for the affected people

- A day care centre is to be established into the campus area with first aid facilities to provide emergency health services

In case of manmade disaster like fire, chemical explosion, machinery/equipment fall down, the committee should ensure:

- Risky materials like oil, grease, heavy metals should be stored in secure places
- Precautionary measures to be taken for using of gas cylinder
- Prevent from unskilled handling of heavy machinery equipment
- Routinely checking machineries, equipment etc.

5.2.3. Environmental Management Action Plan

An array of mitigation strategies is included in the environmental management plan (EMP), as are provisions for environmental monitoring that allow for the observation of changes brought on by project interventions. Institutional arrangements are also included for the environmental management plan's implementation.

Table 5-2: Environmental Management Action Plan for Pre-Construction & Construction Phases

Issues	Potential Impacts	Proposed Mitigation Measures	Responsible Parties
		Pre- Construction & Construction Phase	
LANDSCAPE CHANGE **- Filling wetlands at Block B and C** **-cutting & filling of some part of the terrain to attain the required level.** **-Clearing trees/ bushes for the construction works.**	-Prone to soil erosion, which can clog drains and sewage systems. -Loss of plants/ vegetation and flora/ fauna habitat -Loss of a part of aquatic biome in the region.	(i) Prior to preparing the site for building development, the soil on the property will be examined, and suitable safety practices will be devised to limit the likelihood of increasing soil erosion. (ii) Clearing and grading the ground surface within authorized work limits, separating the top soil layer from the subsoil, stacking the removed dirt in authorized places to be retrieved during landscaping and site restoration are some of the steps used to control erosion. (iii) After work is finished, drainage systems are to be cleared and the natural vegetation is to be reinstalled. (iv) Along the lake belt of Block B and C trees are to planted to keep the hampered ecosystem restored. Some blue spaces should be created inside the Blo0ck B and C as a mitigation measure for existing wetland fill up. Hence the volume of water body will be restored.	Contractors/ Developers and Supervising Consultants (under supervision of RAJUK)

Issues	Potential Impacts	Proposed Mitigation Measures	Responsible Parties
WORKER INFLUX	- Production of sewage and solid waste - Potential for employee-transmitted disease	(i) Building a septic tank system and sanitary latrine (one latrine for 20 persons) (ii) Building "no litter" signs and providing trash cans or bins where necessary (iii) Waste minimization, recycling, and reuse (iv) Standard garbage disposal (in specified dumpsters) (v) A clean bill of health is a requirement for employment. (vi) Workers should be regularly monitored for medical issues.	Contractors/ Developers and Supervising Consultants (under supervision of RAJUK)
WASTES FROM EXCAVATED MATERIAL AND CONSTRUCTION.	-Clogging of drainage -Contamination of soil	(i) Within the project area, all solid waste should be properly disposed of in dumpsters or drums. (ii) The stacking and disposal of such material shouldn't interfere with the use of the nearby area. (iii) It is prohibited to dispose of rubbish near, in, or on streams or their beds. Additionally, no waste shall be dumped in wetlands. (iv) Must be disposed of at the specified disposal location determined by the Dhaka North City corporation.	Contractors/ Developers and Supervising Consultants (under supervision of RAJUK)
WATER RESOURCES & POLLUTION	-Increased surface runoff as a result of more pavement potentially causing flooding in local areas. -Increased poilution transmission from the surrounding area to surface and subsurface water resources,	(i) By building a site drainage system connected to the existing storm water system, allowing for cross drainage diversion structures and a project-specific drainage plan, storm water will be managed for surface runoff controls.	Contractors/ Developers and Supervising Consultants (under supervision of RAJUK)

Issues	Potential Impacts	Proposed Mitigation Measures	Responsible Parties
DEGRADATION OF AIR QUALITY	-Producing dust and particulate matters	(i) All loose material must be stored on site for the least amount of time possible and covered appropriately, preferably with tarpaulin. (ii) Water shall be sprayed where it is predicted that dust would be generated. (iii) The workers must be equipped with the appropriate personal protective equipment, such as dust masks, to reduce the occupational health risk. (iv) All motor vehicles and/or construction equipment must adhere to all applicable National Regulations regarding exhaust emission controls and safety in order to reduce vehicular emissions.	Contractors/ Developers and Supervising Consultants (under supervision of RAJUK)
NOISE POLLUTION	-Annoyance in the project area and surrounding communities	(i)All mechanical engines and equipment being used on the project site should have mufflers and silencers attached to their exhaust systems. (ii) Avoid using construction equipment that makes excessive noise during school hours and at night. (iii) Isolate the source and sensitive receptors during the construction phase to reduce the effects of noise and vibration. (iv) Provide ear muffs or ear plugs to workers who are near or operating high level noisy equipment or machinery to prevent occupational hazards.	Contractors/ Developers and Supervising Consultants (under supervision of RAJUK)
TRAFFIC CONGESTION	- A possible traffic jam could be caused by an increase in local traffic. - A communication issue	(i) In discussion with the Traffic Department, schedule material and equipment delivery outside of school hours and after regular business hours. (ii) In discussion with the Traffic Department, schedule material and equipment delivery outside of school hours and after regular business hours. (iii) Use flagmen, slow down traffic, and put up enough signs and lights to regulate traffic and prevent accidents.	Contractors/ Developers and Supervising Consultants (under supervision of RAJUK)

Issues	Potential Impacts	Proposed Mitigation Measures	Responsible Parties
		When applicable, call the police for help with traffic control and security. (iv) Set up road signs to warn drivers of the risks of passing on impacted roads.	
SANITATION & SOLID WASTE	- Worker health - Production of solid waste and sewage - Production of toxic solid waste and electronic waste	(i) Construction workers must have access to strategically placed, well-maintained temporary restroom facilities. (ii) Additionally, there must be a sufficient number of separate collection bins for both biodegradable and non-biodegradable waste. Each day, waste from these containers must be collected separately. (iii) Installation of a "no litter" sign (iv)Adherence to the principles of trash minimization, recycling, and reuse Implementing upstream waste management. (v) Garden waste is made up of dead leaves and other vegetative matter. In order to prevent surface runoff that could clog drains, these must be gathered in a secure area. (vi)For the safe disposal of hazardous items such paint residue, solvents, diesel fuel, etc., special procedures should be made. employees' awareness (vi) A clear medical report and educating employees on good hygiene habits is a requirement for work	Contractors/ Developers and Supervising Consultants (under supervision of RAJUK)
	-Cutting of trees and removal of plants at the top soil - Filling wetlands at Block B and C	(i) Grading and clearing the ground surface within the permitted work limit to prevent biodiversity loss (ii) Separating the top soil layer from the subsoil and storing it in designated areas so that it may be retrieved for site restoration and landscaping around the building structure.	Contractors/ Developers and Supervising Consultants (under supervision of RAJUK)

Issues	Potential Impacts	Proposed Mitigation Measures	Responsible Parties
ECOLOGICAL CHALLENGE		(iii) After work is finished, clearing the area's drainage systems and replacing the natural vegetation. (iv) The surrounding lands will be replaced with grass, flowers, and native trees in addition to other locally accessible species. (v) Along the lake belt of Block B and C trees are to planted to keep the hampered ecosystem restored. (vi) Some blue spaces should be created inside the Block B and C as a mitigation measure for existing wetland fill up. Hence the volume of water body will be restored.	
SAFETY HAZARD	-Accidents and injuries	(i) Take the necessary steps to maintain the stability and safety of structures (ii) Adhere to accepted safety procedures. (iii) The provision of safety equipment, including uniforms, helmets, boots, and first aid facilities.	Contractors/ Developers and Supervising Consultants (under supervision of RAJUK)

Source: Proposed by the Consultant, 2023

Table 5-3: Environmental Management Action Plan for Operational Phase

Issues	Potential Impacts	Proposed Mitigation Measures	Responsible Parties
Operational Phase			
WATER POLLUTION	- Congestion of Drainage	- To prevent surface runoff, a suitable drainage system and reuse option should be provided. - Provisions for collecting rainwater may be established, replenishing the local aquifer enough. - The project site's drainage system needs to be cleaned and maintained on a regular basis to ensure proper water flow.	RAJUK Authority/ Management

Issues	Potential Impacts	Proposed Mitigation Measures	Responsible Parties
		- Facilities for treating waste water according to ECR'2023 standard before discharging to natural sources	
AIR POLLUTION	-Unhealthy air quality brought on by vehicle emissions (SO_x, NO_x, CO_x, HC)	(i) Maintaining the interior roadways properly to reduce dust emissions. (ii) In order to reduce pollutants to the atmosphere, adequate greenbelt will be constructed and maintained (iii) Vehicles and equipment must undergo regular technical inspections. (iv) Improper waste management practices, including the incineration or open burning of waste by the residents must be restricted.	RAJUK Authority/ Management
SOLID WASTE	-Due to inappropriate management and disposal of solid waste, there may be soil contamination, insect attraction, and unpleasant odors. -Groundwater contamination from lead, barium, and other heavy metals and the release of toxic phosphorus - Glass dust, tin, lead, brominated dioxin, beryilium cadmium, and mercury air pollutants and discharge into rivers - Direct discharges of PAHs, heavy metals, and brominated flame retardants into waterbodies that acidify fish and flora. -Pollution of surface and groundwater with tin and lead. -Brominated dioxins, heavy metals, hydrocarbons and PAH air emissions	(i) The project's solid wastes will be kept in closed containers designated for particular waste kinds, such as household solid wastes and packaging wastes. (ii) Domestic solid wastes ought to be kept in a transitional storage location until assigned waste collectors picks them up. (iii) Electronic garbage generated will be kept in sealed bins designated for certain waste kinds, such as Cathode ray tubes (used in computer monitors, ATMs, video cameras, and more), Printed circuit board, which is depicted behind the table as a thin plate on which chips and other electronic components are mounted, computer wires and plastics from printers, keyboards, monitors, etc. should be kept in a temporary storage place until assigned collectors pick up the waste. (iv)Adherence to the principles of trash minimization, recycling, and reuse implementing upstream waste management.	RAJUK Authority/ Management

Issues	Potential Impacts	Proposed Mitigation Measures	Responsible Parties
	- Release of PAHs into the atmosphere, water, and soil.		
NOISE POLLUTION	-High levels of noise produced by cars that are disruptive to the environment	(i)According to the requirements of ECR'2023, all the equipment that will be utilized within the the Block B and C shall be with a noise level that does not exceed 70 dBA. (ii) Encourage people not to honk in the project complex. (iii) Discourage loud vehicular horns through signage.	RAJUK Authority/ Management
TRAFFIC PROBLEM	-The presence of a high-tech manufacturing facility will stress the current highways with additional traffic.	(i) A traffic control system should be in place to facilitate the entrance and exit of ambulances and emergency vehicles. (ii) To regulate and maintain smooth traffic flow and prevent traffic bottlenecks as a result of increased traffic flow to the project, special traffic management signs must be installed.	RAJUK Authority/ Management
FIRE PROTECTION	-Risk of suffering serious injuries and dying -Loss of property	(i) Provide appropriate fire escapes, post emergency exit plans in conspicuous locations, add fire ladders and extra gates to fire ladders, clear obstructions from escape routes at all times, and post emergency exit plans in strategic locations on each floor. (ii) Install sufficient emergency exit signs (direction plates), illuminate signs, and illuminate pathways. (iii) Place fire hoses and portable fire extinguishers inside buildings. (iv) Install a smoke control system. (v) Set up a pressurization system to supply fresh air. (vi) Arrange for frequent fire drills.	RAJUK Authority/ Management

Source: Proposed by the Consultant, 2023

5.2.4. Environmental Monitoring Plan

Along with appropriate strategies to reduce any negative consequences and/or enhance positive outcomes, the monitoring plan should include regular reviews of any impacts that were either unanticipated or could not be sufficiently assessed prior to the start of the activity. The primary environmental parameters that must be tracked are described in this section, along with the timing of the monitoring activity and the suggested frequency of tracking throughout the project's development phase. The requirements for specific environmental monitoring throughout the construction phase are shown in Table below.

Table 5-4: Environmental Monitoring Plan for Construction Phase

Factor to be Monitored	Location	Monitoring Parameters	Suggested Monitoring Frequency
	Construction Phase		
NOISE LEVEL	Prior to beginning activities, one set of measurements should be taken at the property lines of selected vital locations (the nearest residential plot, other residential areas, highways, etc.). Another set of measurements should be taken during construction at the same places.	Equivalent Noise level (L_{eq}) with GPS location, wind speed and direction.	Monthly basis
AIR QUALITY (DUST PARTICLES/ PARTICULATE MATTER)	Measurements should be taken only in a few well-chosen essential sites that are downwind of site activities (prior to work beginning) and close to human receptors (especially the adjoining residential plot). Later during construction another set of data is taken only in a few well-chosen key sites, close to human receptors, and downwind of construction site activity.	PM10, PM2.5 with GPS location, wind speed and direction	Once in three months
SURFACE WATER QUALITY	One measurement from each of the waterbodies like lake adjacent to Block B and C.	Turbidity, Total Suspended Solids, Dissolved Oxygen, oil and grease, BOD, COD	Monthly basis
GROUND WATER QUALITY	Chemical analysis of tube-well water used as the workers' source of drinking water	Drinking water parameters as per standard	Once in six months
SOIL QUALITY	Sample chosen at random from one or more places at the project site	Selected heavy metals (Pb, Cr, Cd)	Once in six months

Factor to be Monitored	Location	Monitoring Parameters	Suggested Monitoring Frequency
SITE CONDITION	Before beginning work, a visual inspection of the proposed site has to be conducted. Again, visual inspection of the project site throughout the whole construction period should also be carried out.	visually surveying traffic conditions, pedestrian activity, vegetation clearance,	Weekly
SAFETY MEASURES	Visual inspection of the project site throughout the whole construction period should also be carried out.	Management of construction waste, traffic flow along roads and rivers, handling of flammable materials, if any, use of PPE, etc.	Weekly

Concerns about noise pollution, solid/liquid waste and air pollution are generated by Block B and C must all be taken into account during environmental monitoring throughout operation.

Table 5-5: Environmental Monitoring Plan for Operational Phase

Factor to be Monitored	Location	Monitoring Parameters	Suggested Monitoring Frequency
	Operational Phase		
NOISE LEVEL	Prior to beginning activities, one set of measurements should be taken at the property lines of selected vital locations (the nearest residential plot, other residential areas, highways, etc.).	Equivalent Noise level (L_{eq}) with GPS location, wind speed and direction.	Monthly Basis
AIR QUALITY (DUST PARTICLES/ PARTICULATE MATTER)	At entrance of Block B and C premises.	SPM, SO_x, NO_x, CO, VOC, PM10, PM2.5 with GPS location, wind speed and direction.	Once in three months
SURFACE WATER QUALITY	One measurement from each of the waterbodies like lake adjacent to Block B and C.	Turbidity, Total Suspended Solids, Dissolved Oxygen, oil and grease, BOD, COD	Once in four months
GROUND WATER QUALITY	Chemical analysis of tube-well water used as the workers' source of drinking water	Drinking water parameters as per standard	Once in four months
SOIL QUALITY	Sample chosen at random from one place at the project site	Selected heavy metals (Pb, Cr, Cd)	Yearly

Factor to be Monitored	Location	Monitoring Parameters	Suggested Monitoring Frequency
MANAGEMENT OF SOLID WASTE	A visual inspection of the Block B and C has to be conducted.	Solid waste management	Weekly
MANAGEMENT OF WASTE WATER & TREATMENT PLANT	Visual inspection of the total Block B and C waste water management and treatment system.	BOD, COD, TSS, TKN, Ammonia Nitrogen, Total Phosphorous and Oil and Grease	Twice in a year
MANAGEMENT OF SEWAGE TREATMENT PLANT	Visual inspection of the total sewage management and treatment system.	Sewage management	Once in a year
SAFETY MEASURES	A visual inspection of the park complex has to be conducted.	Traffic flow along roads and rivers, handling of flammable materials, if any, use of PPE, etc.	Weekly

Source: Proposed by the Consultant, 2022

5.2.5. Cost of EMP

Many of the EMP-related tasks, such as hiring local labor when necessary, arranging material/item delivery during off-peak hours, maintaining good housekeeping, preventing spills, etc. would not incur any additional direct costs. Internal medical professionals are capable of doing medical examinations. However, some activities would come at an additional expense. Direct costs would be associated with environmental monitoring during the construction phase. The approximate budget amount has been shown in the following table.

Table 5-6: Cost Estimation of EMP

Sl No	Monitoring Items	Parameters	Sampling No/Quantity	Unit Rate	Amount in BDT
01	Ambient Air	PM10, PM2.5, SOx, NOx, CO, O3	2/quarter for 4 years = 8x4=32 no	25000/	800,000/
02	Noise Level	Decibel (dB)	4/quarter for 4 years = 16x4=64 no	5000/	320,000/
03	Vibration	Velocity, displacement, acceleration	4/quarter for 4 years = 16x4=64 no	3000/	192,000
04	Surface Water	pH, DO, BOD, COD, TDS, Pb, Phosphate (PO_4), EC	3/quarter for 4 years = 12x4=48 no	12000/	576,000/
05	Ground Water	FC, TC, As, Turbidity, Chloride,	3/quarter for 4 years = 12x4=48 no	10,000/	480,000/

Sl No	Monitoring items	Parameters	Sampling No/Quantity	Unit Rate	Amount in BDT
		Fe, Pb, Mn, pH, TDS, Oil & Grease, Temperature			
06	Dust Suppression Measures	Daily Water Spray at least 3 times	4 years. 15 days /month for 3 years (540 days)	Lump Sum Tk.5000/day	2700,000/
07	Solid Waste Management	Daily basis	4 years	Lump Sum	20,00,000/
08	Personal Protective Equipment	Workers and Supervisors	4 years	Lump Sum	800,000/
09	Traffic signage and Road Safety	Installation of traffic signage at different location of the project site		Lump Sum	400,000/
10	First Aid Treatment Facilities including qualified & registered Nurse/ Paramedics	All staffs	4 years	Lump Sum	2520,000/
11	Environmental Management Officer	Environmental Management Officer (EMO)	24 man-month for 4 years	120,000	2880,000/
12	Gardening/Plantation with fencing	Tree Species-Fruit, Wood, Medicinal, Ornamental	Included with project cost		00
13	Caretaker/Arborist for Plantation	-	04 Arborist/ Caretaker for 2 years	Tk. 10,000/ month/ Caretaker	960,000/
14	Drainage Facilities	-		Lump Sum	1000,000/
15	Training on Occupational Health, Safety (OHS) and EMP	-		Lump Sum	500,000/
16	Rainwater harvesting and aquifer recharge	Installation of rainwater harvesting system and aquifer recharge		Lump Sum	2000,000/
17	Internal lake Management	Additional 2 Pump Installation		Lump Sum	2000,000/
		Total cost			181,28,000

Source: Prepared by the Consultant, 2023

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5.2.6. Public Consultation

The purpose of public consultation meetings was to invite comments and detailed suggestions on any social or environmental issues that locals in the project's vicinity thought were important. The public consultation program has been implemented throughout the study to make sure that the information, experience, and opinions of stakeholders and the general public are taken into consideration during the review process. It is a crucial component of the social review process.

The local people called the project area as 'Sholohati Village' from the very origin. It was a place with a lot of wetlands. The main livelihood of the people were agriculture activities. Vegetation and livestock still prevail in some areas where there is inhabitation of the local people. They are concern about the shift of the land use. They are already in a transition period of their profession change process. Some are shifting their profession to hawker, shopkeeper etc. The apartment project must look forward to keeping their way of income unblocked. Their concern regarding their residential crises has already been taken into account as housing for low-income people is one of the objectives of the apartment project.



Figure 5-11: Public Consultation at the Project Site

Source: Conducted by the Consultant, 2023

5.2.7. Recommendations

At the project area, development must be done in an environmentally responsible way. The development of the Hi-Tech Park must be carried out in a way that protects the environment at all phases of construction and operation if desired outcomes are to be achieved. Hence, during the construction and operational phase, it is essential to adhere rigorously to all recommendations given in the environmental assessment for reducing or eliminating negative environmental impacts and enhancing positive ones. It is also important to make sure that growth is planned for and sustained. Investment is repelled by deteriorated, filthy, and unhealthy environments; on the other hand, a clean and healthy environment at the apartment project would draw citizens' investment in buying the flats and foster economic development. The following environmental regulations have been suggested for the project in light of this.

- The ISO 14001:2015 environmental management system must be installed in both the blocks.
- Appropriate waste management systems must be installed in both the blocks (including, waste treatment systems).
- It should be made mandatory to recycle and reuse resources (like paper) in every unit in the complex.
- Encouragement of organic and inorganic waste separation at the source should be prioritized.
- There should not be any "open" waste bin system inside the blocks.
- Solid garbage must be collected daily and transported (beyond the Block boundaries).
- Any hazardous material that is present should be properly labeled and stored separately until it is collected and transported for disposal.

6. COST - BENEFIT ANALYSIS

This chapter analyses the financial viability of "Consultancy Services for Feasibility Study along with Detailed Design and Drawing of Architectural, Structural, Plumbing, Electro-Mechanical and Others including Relevant Reports for UTTARA APARTMENT PROJECT (Block- 'B' & 'C'). Analysis considers required investments in infrastructure and equipment, resulting operating costs and estimated revenues from the housing project. The financial analyses are presented from the project point of view.

The ultimate goal of project analysis is the determination of investment worth of the projects which is defined as the net benefits over costs of projects. It is to mention here that projects differ from one another in respect of their benefits. Benefits are divided into tangible and intangible benefits. Tangible benefits may be quantified. So far as the intangible benefits are concerned, these may be quantified only indirectly through compensation principle, prospective beneficiary, being ready to pay towards the cost of the project for the psychological satisfaction, one would have to forego had the project been shelved. These are projects which provide only service benefits which can hardly be quantified. Such benefits may accrue either to an individual or to a community.

6.1. Financial Analysis

This chapter analyses the financial viability of construction of residential apartment building at sector-18 of Uttara for low- & middle-income group of people. Analysis considers required investments in infrastructures and installation of equipment, resulting operating costs and estimated revenues from the operations of the organization. The financial analyses are presented from the project point of view.

The project period covers the years 2024 to 2036, while it is assumed that the implementation of the project will be begin in 2024. All calculations are made in BDT at constant prices as of June 2022 assuming that inflation and changing interest rates have the same impact on prices and costs.

In the first step, investment costs, administrative expenses and revenues for the new infrastructures are calculated based on the operations concept and layout plan. Thereafter, these calculations are summarized in a cash flow analysis, which is then used to calculate commonly used financial indicators to evaluate the overall commercial viability of the project.

6.1.1. Identification of Costs and Benefits

a. Investment Cost

The capital expenditures required for the planned apartment development project in Sector 18, Uttara can be divided into civil works in field level infrastructures and equipment investments. Based on the activities of the proposed development on the one hand and the resulting infrastructural layout planning on the other hand, the required investments in the apartment development project are calculated. The overall infrastructure investment cost for the construction of the project stands at 1,449,472.40 Lakh Taka and base cost is 1,449,472.40 Lakh Taka.

The Table 6-1 below provide an overview on the Capital Expenditure required to establish the housing of Block-B and C.

Table 6-1: Capital Expenditure required for construction of the Project

Sl. No.	Expenditure of Project	(BDT Lakh)
Investment Costs		**Total**
a. Recurring Expenses (Revenue)		**7,920.04**
b. Capital Expenditure:		
Civil Cost:		
i.	Land Purchase	837,052.86
ii.	Land Development, Landscaping, Arboriculture & Park	6,378.97
iii.	Residential Building	51,830.25
iv.	Internal Road	8,952.47
iv.	STP & Drainage	21,015.23
v.	Property Boundary, Security Gate including Guard Room & Site Office	20,363.89
vi.	Water Supply	15,216.91
vii.	Electrification including External Electricity	15,378.88
viii.	Rainwater Harvesting	1,057.80
ix.	Central LPG Supply Network	100.00
ix.	Purchase of Vehicles	30,345.53
x.	Office Supply	
xi.	Non-residential Building (Commercial buildings, Mosque, Mandir, School, Convention Hall, Swimming pool & Health club)	
xii.	Office Furniture	
Sub Total (Capital expenses)		**1,440,552.37**
c.	Physical contingency	1,000.00
d.	Price contingency	0.00
Total Project Costs (a + b + c + d)		**1,449,472.40**

Source: Prepared by the Consultant, 2023

6.1.2. Identification of Key Assumptions

6.1.2.1. Recurring Expenses

The historical operational costs of apartment project of RAJUK have been used as the basis for estimating and projecting its O&M costs. The operating expenses for the proposed project consist of the following components:

- Payroll expenses for RAJUK personnel;
- Cost of supply and services;
- Administrative expenses like general office cost, third party expenses, marketing, training, security management, consultancy services etc.
- Cost of petrol, oil, gas and lubricant;
- Maintenance of vehicles cost.

Considering the possibility for preventive maintenance, maintenance and repair (M&R) cost of equipment have been estimated by using a fixed percentage of the initial investment for each equipment type, based on past experience. For infrastructure, the annual M&R cost have been calculated with a uniform rate of 0.5% on the initial construction cost and cover the purchase of consumables, e.g., lubricants, spare parts and renewals. Total Operational Expenses is considered 7,920.04 Lakh Taka.

6.1.2.2. Yearly Recovery of Cost

Yearly recovery from the apartment project is calculated based on the proposed throughput and applying the current market price. However, based on discussions with leading representatives of RAJUK, the price has been used for all components of the project. This is based on the assumption that by 2040 recovery of cost is defined as the 'cash-in-flows' directly paid by users of goods or services. However, based on discussions with a representative of RAJUK and analyzing the current market price of apartment, recovery from the project would be BDT 1,527,057.69 lakh.

The recovery from the apartment development project in Sector 18, Uttara is shown in the following Table 6-2:

Table 6-2: Year-wise Project Recovery of the Apartment Development Project

1st Year Recovery (2024-2025):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	1st Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	3600.00	10305.00	0.00	13905.00
1693	2700	5500	10800.00	20626.31	0.00	31426.31
C Block						
1230	3300	5000	9900.00	15468.75	0.00	25368.75
						70700.06

2nd Year Recovery (2025-2026):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	2nd Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	0.00	13905.00	0.00	13905.00
1693	2700	5500	0.00	31426.31	0.00	31426.31
C Block						
1230	3300	5000	0.00	25368.75	0.00	25368.75
						70700.06

3rd Year Recovery (2026-2027):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	3rd Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	0.00	13905.00	0.00	13905.00
1693	2700	5500	0.00	31426.31	0.00	31426.31
C Block						
1230	3300	5000	0.00	25368.75	0.00	25368.75
						70700.06

4th Year Recovery (2027-2028):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	4th Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	0.00	13905.00	0.00	13905.00
Car Parking	900	500000.00	0.00	4500.00	0.00	4500.00
Utility	900	300000.00	0.00	2700.00	0.00	2700.00
1693	2700	5500	0.00	31426.31	0.00	31426.31
Car Parking	2700	500000.00	0.00	13500.00	0.00	13500.00
Utility	2700	300000.00	0.00	8100.00	0.00	8100.00
C Block (Flat Size: 1140 sft)						
1230	3300	5000	0.00	25368.75	0.00	25368.75
Car Parking	3300	400000.00	0.00	13200.00	0.00	13200.00
Utility	3300	250000.00	0.00	8250.00	0.00	8250.00
						120950.06

5th Year Recovery (2028-2029):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	5th Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	0.00	6952.50	5005.80	11958.30
1693	2700	5500	0.00	15713.16	11313.47	27026.63
C Block (Flat Size: 1140 sft)						
1230	3300	5000	0.00	12684.38	9132.75	21817.13
						60802.05

6th Year Recovery (2029-2030):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	6th Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	0.00	6952.50	4380.08	11332.58
1693	2700	5500	0.00	15713.16	9899.29	25612.44
C Block (Flat Size: 1140 sft)						
1230	3300	5000	0.00	12684.38	7991.16	20675.53
						57620.55

7th Year Recovery (2030-2031):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	7th Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	0.00	6952.50	3754.35	10706.85
1693	2700	5500	0.00	15713.16	8485.10	24198.26
C Block (Flat Size: 1140 sft)						
1230	3300	5000	0.00	12684.38	6849.56	19533.94
						54439.05

8th Year Recovery (2031-2032):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	8th Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	0.00	6952.50	3128.63	10081.13
1693	2700	5500	0.00	15713.16	6159.56	21872.71

C Block (Flat Size: 1140 sft)						
1230	3300	5000	0.00	12684.38	6828.81	19513.18
						51467.02

9th Year Recovery (2032-2033):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	9th Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	0.00	6952.50	2502.90	9455.40
1693	2700	5500	0.00	15713.16	4927.65	20640.80
C Block (Flat Size: 1140 sft)						
1230	3300	5000	0.00	12684.38	5463.05	18147.42
						48243.62

10th Year Recovery (2033-2034):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	10th Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	0.00	6952.50	1877.18	8829.68
1693	2700	5500	0.00	15713.16	4242.55	19955.71
C Block (Flat Size: 1140 sft)						
1230	3300	5000	0.00	12684.38	3424.78	16109.16
						44894.54

11th Year Recovery (2034-2035):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	11th Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	0.00	6952.50	1251.45	8203.95
1693	2700	5500	0.00	15713.16	2828.37	18541.52
C Block (Flat Size: 1140 sft)						
1230	3300	5000	0.00	12684.38	2283.19	14967.56
						41713.04

12th Year Recovery (2035-2036):

B Block (Gross Area)	No of Flat Selling	Rate per sft	Security Deposit	12th Installment Amounts	Interest @ 9%	Amounts in Lac
2060	900	6000	0.00	6952.50	625.73	7578.23
1693	2700	5500	0.00	15713.16	1414.18	17127.34
C Block (Flat Size: 1140 sft)						
1230	3300	5000	0.00	12684.38	1141.59	13825.97
						38531.53

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Commercial Part									
Sl. No	Community Facilities	Area (sft)	Sellable Area 100% (sft)	Rate per sft	Amount in Lac	2024-2025	2025-2026	2026-2027	2027-2028
Block B:									
1	Convention Hall	45440	45440	12000.00	5452.80	1363.58	1363.036416	1363.20	1362.98
2	Commercial Bldg. (Type-1):	753152.40	753152.40	12000.00	90378.29	22600.90	22591.86065	22594.57	22590.96
3	Commercial Bldg. (Type-2):	533084.83	533084.83	12000.00	63970.18	15997.02	15990.62585	15992.54	15989.99
4	Shop & Kitchen Market (Type-1):	29558.40	29558.40	12000.00	3547.01	887.00	886.6455898	886.75	886.61
5	Shop & Kitchen Market (Type-2):	25159.80	25159.80	12000.00	3019.18	755.01	754.7034247	754.79	754.67
6	Primary Schools:								
	Structure	122500.00	122500.00	6000.00	7350.00	1838.01	1837.2795	1837.50	1837.21
	Land	35000.00	35000.00	6944.45	2430.56	607.81	607.5660208	607.64	607.54
7	Secondary School & College:								
	Structure	136654.00	136654.00	6000.00	8199.24	2050.38	2049.564023	2049.81	2049.48
	Land	39044.00	39044.00	6944.45	2711.39	678.04	677.7659348	677.85	677.74
8	Health Care Center :	183224.00	183224.00	12000.00	21986.88	5498.26	5496.060394	5496.72	5495.84
9	Mixed Use 1:	487872.00	487872.00	12000.00	58544.64	14640.26	14634.40366	14636.16	14633.82
10	Mixed Use 2:	1006236.00	1006236.00	12000.00	120748.32	30195.53	30183.45755	30187.08	30182.25
11	Mixed Use 3:	1131253.20	1131253.20	12000.00	135750.38	33947.10	33933.52349	33937.60	33932.17
12	Swimming Pool & Health Club:								
	Structure	6000.00	6000.00	12000.00	720.00	180.05	179.9784	180.00	179.97
	Land	45738.00	45738.00	6944.45	3176.25	794.28	793.967276	794.06	793.94
Block C:									

Commercial Part									
SL. No	Community Facilities	Area (sft)	Sellable Area 100% (sft)	Rate per sft	Amount in Lac	2024-2025	2025-2026	2026-2027	2027-2028
13	Convention Hall .	426700	426700	12000.00	51204.00	12804.58	12799.46388	12801.00	12798.95
14	Commercial Bldg. (Type-1):	365904.00	365904	12000.00	43908.48	10980.19	10975.80275	10977.12	10975.36
15	Commercial Bldg. (Type-2) :	762300.00	762300.00	12000.00	91476.00	22875.40	22866.25572	22869.00	22865.34
16	Commercial (Type-3) :	304920.00	304920.00	12000.00	36590.40	9150.16	9146.502288	9147.60	9146.14
17	Shop & Kitchen Market(Type -1) :	28268.52	28268.52	12000.00	3392.22	848.29	847.9538333	848.06	847.92
18	Shop & Kitchen Market (Type-2):	26091.90	26091.90	12000.00	3131.03	782.98	782.6630692	782.76	782.63
19	Primary Schools:								
	Structure	93684.50	93684.50	6000.00	5621.07	1405.66	1405.098868	1405.27	1405.04
	Land	26767.00	26767.00	6944.45	1858.82	464.84	464.6491337	464.70	464.63
20	Secondary School & College:								
	Structure	114502.50	114502.50	6000.00	6870.15	1718.02	1717.331396	1717.54	1717.26
	Land	32715.00	32715.00	6944.45	2271.88	568.13	567.9006392	567.97	567.88
21	Health Care Center :	183224.00	183224.00	12000.00	21986.88	5498.26	5496.060394	5496.72	5495.84
Total					**796296.04**	**199129.75**	**199050.1202**	**199074.01**	**199042.16**

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6.2. Financial Analysis

After completion of construction in 2028, the recovery from selling the apartments will exceed the cost. Net present value of the project for the project period is positive against the recovery will be generated from the project during this period. In order to attain 12% of FIRR under the condition that the current tariff will not change, supporting measures from the government, such as flexibility in paying EMI and financial assistance, should be applied during the recovery period will be 2028-2040.

The cash flow statement is prepared and shown in the Annexure (Section 12). The financial assessment has been done based on the proposed investment program and on the expected development of operational cost. To assess the commercial viability of the project, the following most commonly used financial indicators have been calculated:

- Financial Internal Rate of Return (FIRR)
- Financial Net Present Value (FNPV)
- Financial Benefit-Cost Ratio (FBCR)

The **IRR** is the discount rate at which the present value of all outflows of cash (e.g., investment cost, operating expenses) is exactly equal to the present value of all inflows of cash (e.g., revenue). It indicates the actual return of the total investment outlay and is a good indicator of the profitability of a project. It offers the investor the possibility to compare projects quantitatively.

The **NPV** is calculated by discounting separately the net cash flow for each year accruing throughout the project life at a fixed predetermined interest rate. A positive NPV indicates that the project under consideration is more profitable than an alternative investment with a return equal to the discount rate. For the purpose of this project, a discount rate of 12.00% has been assumed for calculating the NPV taking into consideration rates and required attractiveness of an infrastructure investment.

A **BCR** is used in a cost-benefit analysis to summarize overall relationship between relative costs and benefits of a project. The Benefit-Cost Ratio (BCR) is the present value of project benefits (B) divided by the present value of project costs (C). If B/C >1, the project is suitable because the benefits are greater than the costs.

6.2.1. Findings of Financial Assessment

The calculated financial indicators show that the planned development of the project yields a positive IRR and NPV and would therefore in general be considered viable. In general, governments invest in such development projects as they believe that investments in such kind of sector have strong direct and indirect multiplier effects on the entire economy (e.g., higher tax income, reduced unemployment) and the planned development. A summary of financial assessment results is presented in Table 6-3 and details are given in Annexure:

Table 6-3: Summary of Financial Assessment Results in the Base Case of the Project

	Viability Indicator	Financial
1.	Total Investment Cost (Lakh BDT)	1,449,472.40
2.	Benefit Cost Ratio (BCR @ 12%)	1.01
3.	Net Present Value (NPV @ 12%) Lakh BDT	5,693.18
4.	Internal Rate of Return (IRR %)	18.81%

Source: Prepared by the Consultant, 2023

6.2.2. Sensitivity Analysis & Switching Value Analysis

To assess the influence of the project risks, a sensitivity analysis and switching value analysis have been conducted based on the cash flow, results of which are summarized in the Table 6-4 below.

Throughout this study, a conservative and well-founded approach for assumptions and for estimates of expected investments, costs and revenues has been followed. Despite such a conservative approach, the potential risks to the project should not be overlooked. The potential risks are: (i) increase in capital expenditure, (ii) decrease in operation costs, (iii) increase in capital expenditure & decrease in revenue simultaneously.

Switching Value Analysis: Switching value is the value of the variable at which the project investment decision is changed. Usually is defined as percentage change from the base case. Percentage change in a variable required to reduce the net present value (NPV) to 'zero' at the Opportunity Cost Capital (OCC) 12%.

Table 6-4: Sensitivity and Switching Value Analysis (Financial)

Sl. No.	Variables	FIRR	NPV (Lakh Taka)	Sensitivity Indicator	Switching Value (SV) of ENPV
	Base Case	**18.81%**	**5,693.18**		
1	Increase in Capital Expenditure by 10%	11.34%	(38,920.56)	(198.52)	(0.50)
2	Decrease in Revenue by 10%	11.05%	(50,722.16)	199.52	(0.50)
3	Increase in Capital Expenditure and decrease in revenue Simultaneously by 10%	8.03%	(134,267.48)	6.27	15.96

Source: Prepared by the Consultant, 2023

In the case of an increase in investment cost of 10%, the sensitivity indicator is (198.52). This means that the changes of 10% in the variable (investment cost) results in a change of (-198.52×10%) = -19.85% in the NPV. It follows that the higher the sensitivity indicator the more sensitivity the NPV is to the change in the concerned variable.

In the same case, the switching value is -0.50% which is the reciprocal value of the SI×100. This means that a change (increase) of -119.85% in the key variable (investment cost) will cause the NPV to become zero. The lower the SV, the more sensitive the NPV is to the change in the variable concerned and the higher the risk with the project.

In the example of decrease in revenue of 10%, the sensitivity indicator is 199.52 and the switching value is 0.50. The sensitivity indicator of 199.52 means that there are 19.95% changes in the NPV and thus affects the variability of the project. Also, the SV of 0.50% means that the project is sensitive to variation (decrease) in revenue.

If changes in both investment cost (increased) and revenue (decreased) of 10% simultaneously, the sensitivity indicator is 6.27 and switching value is 15.96%. It can be inferred that a change of 10% in both investment cost and revenue would result in 0.63%% change in NPV.

Thus, increase in investment cost is less sensitive to the project if there is increase in the variable by 10%. It follows also that the variable is less sensitive to the project. At this point, the results of the sensitivity analysis should be reviewed. It should be asked:

- Which are the variables with high sensitivity indicator?
- How likely are the (adverse) changes (as indicated by the switching value) in the values of the variable that would alter the project decision?

6.3. Economic Evaluation

This section presents costs-benefits analysis and economic impacts of the proposed project. The objective of this analysis is to assess whether the proposed developments would deliver a net economic benefit to Bangladesh economy.

6.3.1. Introduction

The economic analysis is undertaken by comparing the economic costs to be incurred, i.e., investment/capital, and operation and maintenance costs and the benefits to be generated by the project under the "with" and "without" project scenario. The "without" project scenario assumes if no interventions are initiated. The "with" project scenario assumes that the Construction of project is implemented, incurring investment/capital costs for construction, recovery from selling apartments and incremental revenue generation from commercial facilities and employment generation for the community. The analysis time period is 12 years.

Economic Discount Rate: Discount rate is the interest rate at which future values are discounted to the present and vice-versa as defined in the Development Project Proposal (DPP) Manual, March 2014, General Economic Division (GED), Planning Commission. This is either the opportunity cost of capital (applied to investment Taka) or the time preference for consumption. The same source also suggested for using discount rate of 12%, Vide memo No. 20.00.0000.404.014.027.18.177, dated: 29.08.2018.

- The computed Economic Internal Rate of Return (EIRR) should be > 12%; and
- The computed Economic Net Present Value (ENPV) should be > 0 at the 12% discount rate.

6.3.2. Results Of the Economic Evaluation

Using the economic costs and benefits estimated, the measures of project worth were computed for the projected job opportunities and rental benefits. The results show that the project is feasible, assuming an economic discount rate or economic opportunity cost of capital of 12%. The estimated EIRR is 18.81%, ENPV at 12% is (5,809.34) Lac Taka and BCR is 1.01. Following table highlights the economic assessment of the project.

Table 6-5: Sensitivity and Switching Value Analysis (Economical)

Sl. No.	Variables	FIRR	NPV (Lakh Taka)	Sensitivity Indicator	Switching Value (SV) of ENPV
	Base Case	**18.81%**	**5809.34**		
1	Increase in Capital Expenditure by 10%	19.65%	(97,667.14)	(178.12)	(0.56)
2	Decrease in Revenue by 10%	13.44%	(7,403.48)	(0.64)	(156.13)

Sl. No.	Variables	FIRR	NPV (Lakh Taka)	Sensitivity Indicator	Switching Value (SV) of ENPV
3	Increase in Capital Expenditure and decrease in revenue Simultaneously by 10%	15.20%	48,053.37	(15.08)	(6.63)

6.3.3. Summary of Economic Analysis

- The project will be a worthwhile investment economically as well as socially.
- It will also ensure a steady and risk-free long-term return for the client. Estimated return on the basis or current market revenue from such a long-term investment is undoubtedly very attractive.
- The salvage value at the end of economic life of the building of 12 years will be Economically negligible.
- It may be pointed out that at the construction of different buildings (residential, non-residential and construction of other (utility), buildings) will be an environmentally friendly structure with immense socio-economic benefits.

6.3.4. Conclusion

Investment project takes time to be implemented and the longer it takes to be executed, the more the need to rely on forecast figure and consequently, the more the need for sensitivity test or analysis. The changing nature of cash flows and discount factor underscored the imperative of sensitivity analysis in any project. Sensitivity analysis is useful at all stages of project processing at the design stage to incorporate appropriate changes; at the appraisal stage to establish a basis for monitoring, and during project implementation to take corrective measures. The uncertainty surrounding the results of the economic and financial analysis is expected to decrease as the project moves into the operational phase.

7. HUMAN RESOURCES AND ADMINISTRATIVE SUPPORT ANALYSIS

This section describes functional structure and institutional capacity of RAJUK (in terms of both technical and financial) required for implementation and operation of the project(s). It also discusses managerial and skilled workforces that are needed during implementation and operational phases of the project.

7.1. Human Resources and Financial Capability of RAJUK

RAJUK has been mandated to control the development of the capital city, Dhaka by the TI Act of 1953. Since the dawn of its formulation RAJUK has been working to develop a sustainable and planned cities with all the necessary amenities closer to city dwellers. As per the approved organogram, the RAJUK has about 1980 manpower. However, about 1107 position has been filled with officials through direct/deputation. According to the Annual report (2018-2019) of RAJUK, the authority has about 24000 crore BDT of assets and has annual surplus of about 500 crore BDT. This proves that RAJUK has both the financial and functional capability to implement the project. This project will be implemented by RAJUK by its own fund (ROF).

- RAJUK's ability to provide the managerial and skilled workforces needed for implementation of the project: RAJUK has already successfully implemented the housing project at Block-A which is the same calibre project. The project has already been implemented by the RAJUK officials and is now in operational phase. Thus, the institution has skilled officials for providing services in implementation and operations phases.
- Institutional capacity (financial and technical) of RAJUK to retain the project output functional: RAJUK is able to implement large-scale development like Purbachal and Jhilmil housing project through its financial and functional capability. This project will also be successfully implemented by the RAJUK itself. The required functional structure of the project is described in the next chapter of this report.
- Adequacy of skilled and experienced workforce to operate the project: RAJUK has adequate skilled manpower to operate the project. A project office has already been set up for the implementation of Block-A. The required manpower will need to be accommodated at site office with all the necessary equipment.
- Adequacy of fund under its recurring budget to bear the operational expenditure of the project output: Generally, RAJUK develops the housing area and sell it to the eligible buyers. After that, the operation of the housing community will be managed and other operation will be monitored by a committee formed by the inhabitants. RAJUK only plays liaison between the committee and other government agencies to operate the utility and other facilities
- Consistency of timing of the project with organizational capacity (in terms of quantity and other): During the construction of the Block-A, total construction time took 6 years due to some funding issues and other materials issues. Considering the overall feasibility of the project, the project duration of 4 years has been assessed.

7.2. Required Functional Structure for the Implementation of Block-B and C

Required manpower for planning, designing and implementing Block B and Block C of the Uttara Apartment Project will be appointed by the Planning, Development and Works Committee. The committee may assign consultants and contractors in the following three ways.

- Project Supervision
- Procurement Plan
- Special Memorandum of Understanding (MoU) with Public Agencies

7.2.1. Manpower during Project Supervision

Most of the development works of the RAJUK follows a strict hierarchy of officials from planning to implementation. Uttara Apartment project will also be monitored and supervised by the separate team of officials selected for the project implementation. The following figure illustrates the flowchart of the project supervision.

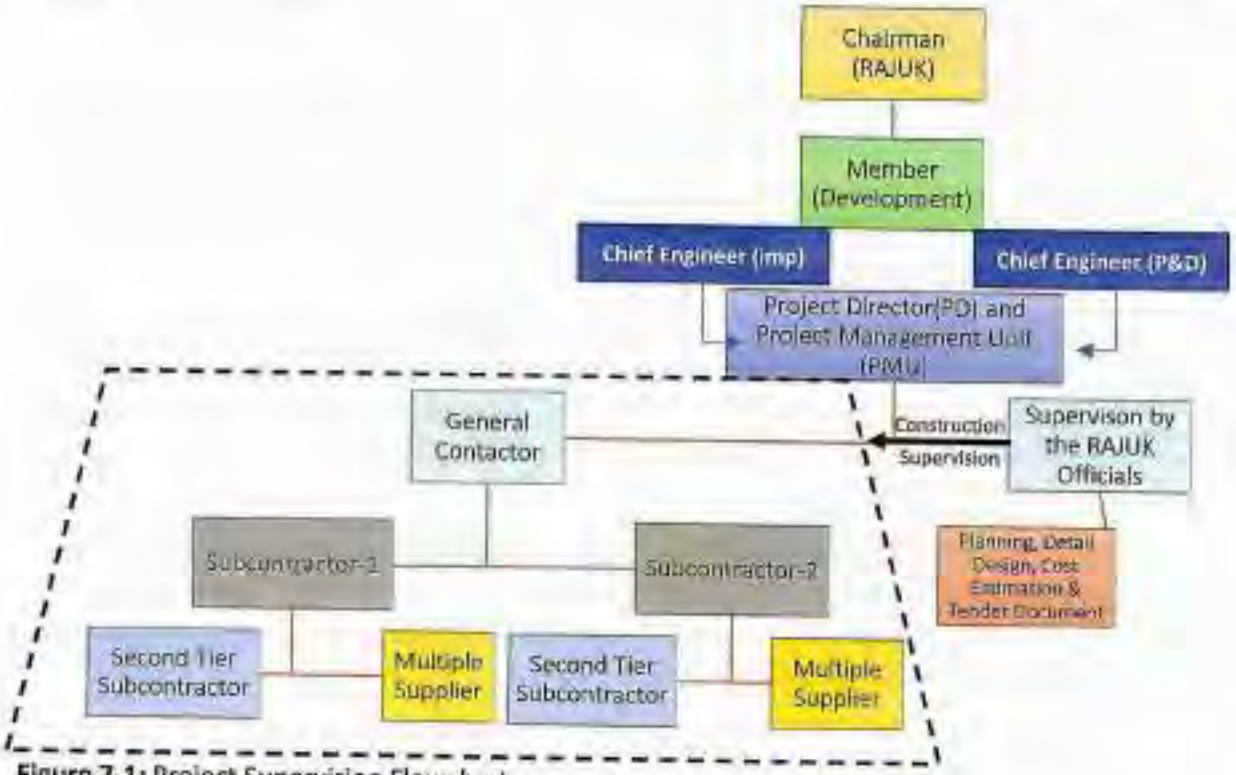


Figure 7-1: Project Supervision Flowchart

Source: Prepared by the Consultant, 2023

7.2.2. Procurement Plan

Total development works under this project will need to be subdivided into packages and sub-packages which will be later use to call for tender (detail will be developed in DPP).

The procurement under this project will be through open tendering or limited or direct tendering method (OTM, LTM, DPM). Following table highlights the important tasks and its procurement plan.

Table 7-1: Procurement Plan of the project

Major Activities	Procurement Method
Construction of Apartment Buildings	Open Tendering Method
Utility Facilities	Open Tendering Method/ Direct Procurement Method
Street Lighting	Limited Tendering Method/ Open Tendering Method
Security System with CCTV	Limited Tendering Method/ Open Tendering Method
Telecom Services	Limited Tendering Method/ Open Tendering Method
Pumping Facilities	Limited Tendering Method/ Open Tendering Method
Solar System	Limited Tendering Method/ Open Tendering Method
Rain Water Harvesting	Limited Tendering Method/ Open Tendering Method

Source: Prepared by the Consultant, 2023

Under an EPC contract a contractor is obliged to deliver a complete facility to a developer who need only turn a key to start operating the facility. The structure of EPC contract is discussed below.

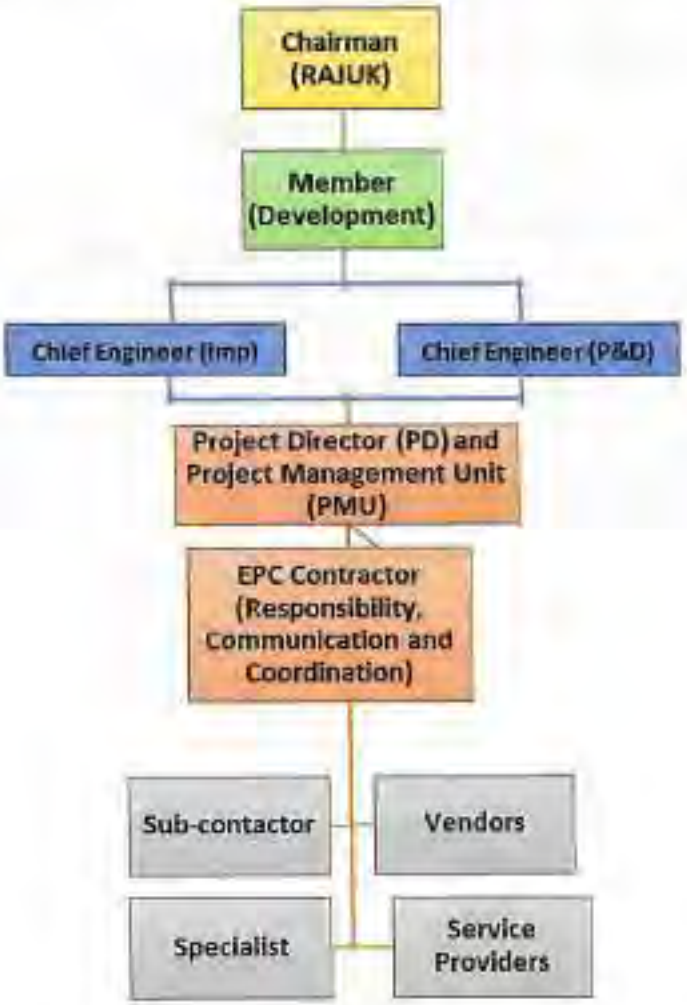


Figure 7-2: Engineering, Procurement and Construction Contract Structure

Source: Prepared by the Consultant, 2023

7.2.3. Special Memorandum of Understanding (MoU) with Public Agencies

Provisions of efficient utility services are crucial to effectively function of the housing. In this regard, due to some restrictions from the government side, the consultant has proposed to develop Central LPG station to supply Gas, central sewerage treatment plant (CSTP) for sewerage system, rain water harvesting etc in Block-B and C. However, RAJUK should form a Special Memorandum of Understanding (MoU)with responsible Government agencies to provide detailed utility services for the Block B and Block C of the Uttara Apartment Project when the government eases the restrictions. For providing electricity and water with other utility facilities in Block- B and C, RAJUK should form MoU with the following agencies.

- Dhaka North City Corporation (DNCC)
- Bangladesh Power Development Board (PDB)
- Dhaka Electric Supply Company Limited (DESCO)
- Bangladesh Telecommunication Company Limited (BTCL).
- Fire Service and Civil Defence (FSCD)
- Bangladesh Gas Transmission Company Limited (GTCL)

7.3. Consistency with Organizational Capacity

The Block B and Block C area itself along with its associated facilities has to be designed to avoid or minimize impacts on the environment and people wherever practical. RAJUK would ensure implementation of mitigation measures to reduce negative environmental and social impacts on Health, Environment, and Safety, and would ensure the protection of health and safety of not only its operating personnel but also for that of the developer and its service contractors as well as members of the neighboring public. A well-designed Operation Management System (OMS) inbuilt in the organizational set-up of RAJUK has provided a consistent delivery mechanism to address potential adverse impacts, to enhance project benefits and to introduce standards of good practice to be adopted for project activities.

8. INSTITUTIONAL AND LEGAL ANALYSIS

8.1. Institutional Capabilities and Facilities

The implementation of affordable housing projects in Bangladesh is a complex and challenging process, but there are initiatives underway to address the need. These include the National Housing Authority's Low-Income Community Housing Project (LICHP), the Government of Bangladesh's Housing for All (HFA) program, the Bangladesh Bank's Housing Finance Development Fund, and the UNDP's Sustainable Cities and Human Settlements Program. These initiatives are making progress in addressing the need for affordable housing, but there are still challenges to overcome. The development of affordable housing in Bangladesh is hindered by high land prices, lack of access to finance, lack of construction skills, and lack of government support. Despite these challenges, there are opportunities to promote affordable housing in Bangladesh, such as the provision of land, financial assistance, and tax breaks. There is a growing demand for affordable housing due to the rapid growth of the urban population and the rising cost of living. The government, private sector, and civil society are working together to address the issue.

Implementation issues with respect to housing project into reality are of great challenge and deserve top most attention from all corners. The implementation issues may be of routine nature, special issues requiring special skill/inputs, unforeseen or newly created issues due to changed circumstances/imposed conditions or otherwise required being executed due to unavoidable adjustment of the Master Plan preparation parameters. Implementation issues will be addressed and dealt inconformity with basic structure and philosophy of the Master Plan. The magnitude and intensity of respected issues will differ and need individual attention, at the same time, they will need legal, financial, managerial support and beneficiary participation along with a sense of belongingness having a commitment to take care and maintain the implementation schemes/project/activity in line with Master Plan. Transparency, so as to say good governance, is another very important element in implementation process, property administered, will make the implementation successful and praise worthy.

8.1.1. Institutional Capacity

Institutional capacity is the ability of an institution to achieve its stated goals. It includes the ability to set and achieve goals, develop and implement policies and programs, manage resources effectively, monitor and evaluate performance, communicate effectively with stakeholders, build and maintain relationships with other institutions, and achieve positive outcomes. It is essential for the effective delivery of public services and the achievement of development goals, and can be strengthened through a variety of means, such as training and development of staff, provision of technical assistance, financial resources, reform of structures and processes, and partnerships with other institutions. Strong institutional capacity is essential for effective governance and sustainable development. It helps to ensure that public resources are used efficiently and that services are delivered effectively to those who need them most. It also helps to build trust and confidence between citizens and their government. Institutional Capacity Building (ICB) encompasses three main activities: (i) skill upgrading, (ii) procedural improvements, and organizational strengthening. This is the most frequent definition found in World Bank documents.

8.1.2. Concept and Definition of Capacity Building

Capacity building is the process of developing and strengthening the skills, knowledge, abilities, and resources of individuals, organizations, and communities to enable them to perform at a higher level. It is a long-term process, but it can be an effective way to improve the lives of individuals, organizations, and communities. Examples of capacity building initiatives include training programs, technical assistance, information and knowledge sharing, and financial support. It can help to reduce poverty, improve health and education, protect the environment, and build peace. It is a complex and challenging process, but it is an essential investment in the future of individuals, organizations, and communities.

8.1.3. Brief Institutional History of RAJUK

The first "Dhaka Improvement Trust" (DIT) was founded in 1956 under The Town Improvement Act, 1953 (East Bengal Act) (Act No. XIII of 1953) with the unique authority of development and extension of Dhaka and its adjacent areas. By amending the Act in 1987, the former DIT—which was governed by a board of trustees—became the "Capital Development Authority" or RAJUK. RAJUK grew to 590 square miles in 1987, taking in parts of Savar, Keraniganj, and other places. The Master Plan of Dhaka was initially created in 1959 by the Dhaka Improvement Trust (DIT). The design originally encompassed 220 square miles, but eventually expanded to 320 square miles. A 590 square mile strategic plan and a detailed area plan (DAP) were created in 1995 as part of the Dhaka Metropolitan Development Plan (DMDP). The Dhaka metropolitan area, which includes the nation's capital Dhaka and its surrounding urban areas and hinterlands, is currently managed by the chairman and five members of the council. RAJUK is working toward the planning, development control, and development of the capital Dhaka to meet the challenges of the 21st century.

8.1.4. Institutional Capacity of Project Implementation

RAJUK already have vast experiences of housing Project. Some key examples are:

- Uttara Model Town
- Purbachal Residential Model Town
- Ashulia
- Keraniganj

Currently ongoing affordable housing project:

- Jatrabari
- Dhanmondi
- Mirpur

8.2. Strategic Recommendation for Institution

A strategic process for a housing project is important because it can help to ensure that the project is completed on time, within budget, and to the required quality standards. A strategic process can also help to identify any potential risks or challenges that may need to be addressed, and to develop strategies for mitigating those risks.

8.2.1. Formulation of Committee

For the smooth implementation of the project, following committee is required to be formulated. These are:

- Project Monitoring Team (PMT)
- Project Implementation Committee (PIC)
- Project Steering Committee (PSC)

Project Monitoring Team (PMT)

This committee will be headed by the Additional Secretary (Development) of Ministry of Housing and Public Works. The committee will hold meeting in every 2/3 months interval. This team will visit the project area and oversee the development works and make necessary recommendation to ensure quality works. The team may consist of (but not limited to):

1.	Additional Secretary (Development), Ministry of Housing and Public Works	Convener
2.	Member (Development), RAJUK	Member
3.	Chief Engineer (Implementation), RAJUK	Member
4.	Representative of Public Works Department (PWD) (Not below the rank of Superintending Engineer)	Member
5.	Representative of Department of Architecture (DOA) (Not below the rank of Deputy Chief Architect)	Member
6.	Representative of Concerned IMED Sector (Not below the rank of Director)	Member
7.	Representative of Physical Infrastructure Division, Planning Commission (Not below the rank of Deputy Chief)	Member
8.	Project Director, Uttara Apartment Project, RAJUK	Member Secretary

Project Implementation Committee (PIC)

This committee will play the pivotal role in implementing the project. Chairman of RAJUK will be the convener of this committee. The main task of the committee is to oversee the project implementation and guide the executing agency in order to complete the project in time. The committee will submit monthly progress report to the ministry and hold meeting once or as and when required to smooth out the project implementation.

1.	Chairman, RAJUK	Convener
2.	Member (Development), RAJUK	Member
3.	Chief Engineer, RAJUK	Member
4.	Chief Architect/Representative, Department of Architecture (DOA)	Member
5.	Representative of Concerned IMED Sector	Member
6.	Representative of Planning Commission (Physical Infrastructure Division, Programming Division, General Economic Division)	Member
7.	Director, Town Planning/Representative, RAJUK	Member

8.	Deputy Chief, Planning Cell, Ministry of Housing and Public Works	Member
9.	Director (Finance), RAJUK	Member
10.	Project Director, Uttara Apartment Project, RAJUK	Member Secretary

Project Steering Committee (PSC)

This committee will work-out the guidelines for the implementation of the project and provide solutions for the issues of the project execution. The committee will hold meeting once in three months interval.

1.	Secretary, Ministry of Housing and Public Works	Convener
2.	Chairman, RAJUK	Member
3.	Chief Engineer, PWD	Member
4.	Chief Architect, Department of Architecture (DOA)	Member
5.	Joint Secretary, Ministry of Housing and Public Works	Member
6.	Member (Development), RAJUK	Member
7.	Member (Finance), RAJUK	Member
8.	Representative of Planning Commission (Physical Infrastructure Division, Programming Division, General Economic Division)	Member (s)
9.	Chief Engineer, RAJUK	
10	Deputy Chief, Planning Cell, Ministry of Housing and Public Works	Member
11	Project Director, Uttara Apartment Project, RAJUK	Member Secretary

8.2.2. Proposed Organogram for the Project

About 204 of different skilled and managerial manpower has been proposed for the smooth implementation of the project. Major hierarchy of the project are as follows. Detail of the manpower listing has been added in annexure.

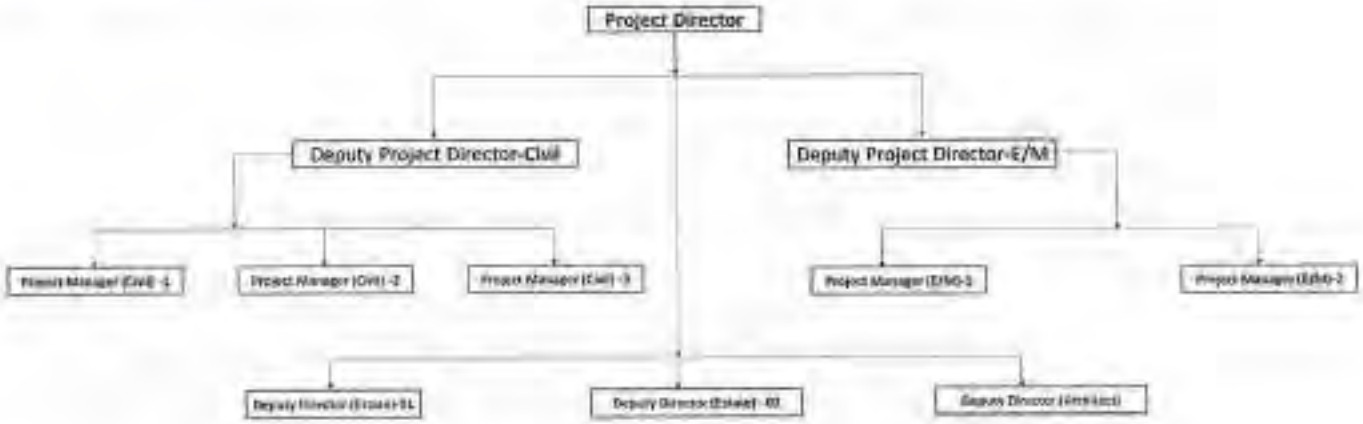


Figure 8-1: Proposed Organogram for the Project Implementation

Source: Prepared by the Consultant, 2023

8.2.3. Improving the Organizational and Technical Capabilities of Institutions

The RAJUK is a government agency responsible for planning and development of Dhaka, Bangladesh. It needs to improve its organizational and technical capabilities through training and development programs, investing in new technology, and improving coordination and collaboration with other government agencies and private sector organizations. These programs should focus on planning and development, project management, financial management, law and regulation, and information technology. Invest in new technology, improve coordination and collaboration with other government agencies and private sector organizations, create a more efficient and effective organizational structure, improve the quality of data and information used for planning and development, develop a comprehensive and integrated approach to planning and development, and build public awareness and support for planning and development initiatives. Technical assistance in terms of personnel. To improve the organizational capacity of RAJUK for this development project we can follow the strategy below:

We can add two designated Planner from the planning Division of RAJUK to proper ordinance of Detailed Area Plan (DAP, 2022-2035). The authority can also appoint individual consultants for the same tasks.

The DAP for the Dhaka Metropolitan Area (DMA), which is in effect until 2035, has been finalized by gazette notification. DAP (2022–2035) represents a great accomplishment for RAJUK and implementing it through this project will certainly bring positive results for the dwellers of the Dhaka City. It is a strategy that could have a significant positive impact on how Dhaka Metropolitan City develops.

8.3. Legal Boundary of the Project

This section examines the current legal and regulatory landscape and discusses how it relates to and affects this project. The Government of Bangladesh developed and publicized laws, guidelines, and legal constraints that may hinder or find suitable for the project during its implementation. The policy offers a summary of organizational structure and sector-specific national policy compliance.

The table below covers key Bangladeshi policies along with their significant features and relevance to the project.

Table 8-1: Policy, Rule and Regulation for Development of this Project

Applicable Planning Regulations	Significant Features	Applicability to the Project
Detailed Area Plan, 2022-35	It is a gazetted document to control the future development of Dhaka City. Major housing projects have to follow the guidelines prescribed in the DAP. Major guidelines include: • Block-based development • Transit-oriented Development • Major Connectivity for the Block development • Flood-flow Zoning • Urban Life-line • Height Restrictions due to Airport • Road width and configuration	Most of the development of the housing in this project will follow the guidelines provided in the DAP report. These are: • Block-based development • Transit-oriented Development • Urban Life-line • Height Restrictions due to Airport
The Private Residential Land Development Rule 2004 (Amendment in 2012, and 2015)	The Private Residential Land Development Rule (PRLDR) is for regulating land development in Bangladesh's private housing industry. It offers methods and regulations for environmental protection during land development. It also provides percentages of land that must be kept for community facilities, amount of land to be sold out, school sites, road hierarchy and importantly planning standards, for example, allocation of land per 1000 population. Community facilities will be determined on the basis of number of populations residing on the project such as Kutcha Bazaar, Community Center, Shopping Center and as such. Recreation facilities will also be determined by number of populations which includes play-field, park, open space and green public square. Project Area residing with 20,000 population needs to provide an open field of 1.6	For this project, under Act 10 of sub-act 3, 30% of the total developed land needs to be preserved for Community and Utility Facilities. Community facilities required with about 20,000 populations (as per calculation of Block B and Block C with 200 ppa) are calculated through the guidelines of the PRLDR.

Applicable Planning Regulations	Significant Features	Applicability to the Project
	Acre. Area for developing Waste Water and Sewerage Treatment Plant for housing needs to be provided in the layout plan.	
Bangladesh National Building Code (BNBC), 2020	The Bangladesh National Building Code was formulated in 1993 and enacted in 2006, which was followed by an amendment to the Building Construction Act of 1952. This Code shall be applicable to the planning, development, use or occupancy, modification, relocating unless otherwise specified in other laws controlling and regulating structures, destruction and repair of any building or structure.	During the individual building design (architectural and structural) of the project, most of the guidelines will be followed from the BNBC, 2020
Dhaka Mahanagar Imarat Nirman Bidhimala, 2008	The bidhimala was enacted from Building Construction Act, 1952 (Act No. II of 1953) under section 18 for building construction guidelines. It will be also enacted for development of planned area under Town Improvement Act 1953 (Act No. XIII of 1953). Major Features are: **a. Proper allocation of space** **b. Parking facilities,** **c. Room size and dimensions etc.** **d. non-habitable room size** **e. Stair Size**	In this project, Building, Utility facilities, Parking, Room Spaces will be followed through guideline of Dhaka Mahanagar Imarat Nirman Bidhimala,2008.
Transit-oriented development (TOD)	TOD is a planning and design strategy that focuses on creating urban development patterns which facilitate the use of public transit, walking and cycling, as primary modes of transport and which supports vibrant, diverse and livable communities. RAJUK has already developing TOD guidelines for specific points. The project is ongoing and those guidelines will be applicable for TOD designated area.	Some area of Block-B and C falls within the influence area of the TOD of Uttara Central MRT Station. Those area can be developed according to the guidelines of the TOD report. Even following the guidelines of the DAP, the housing area will be given FAR incentives if it falls within the TOD influence area and follows the guidelines of the TOD.

Applicable Planning Regulations	Significant Features	Applicability to the Project
Environment Conservation Act, 1995 (amendment in 2000, 2002 and 2010)	Key provisions of the Environment Conservation Act, 1995: • Establishment of the Department of Environment (DoE) as the national regulatory body for environmental protection. • Issuance of environmental clearance certificates for all commercial and industrial activities. • Monitoring and enforcement of environmental laws. • Prohibition of environmental pollution. • Penalties for violations, including fines, imprisonment, and the closure of businesses.	Environmental Clearance Certificate (ECC) for the project area will need to be collected under the guidelines of this act.
Environment Conservation Rules (ECR), 1997; (Amendment in 2002, 2003 and 2017)	Key provisions of the Environment Conservation Rules, 1997: • Categorization of projects: The ECR categorize projects into four categories: Green, Orange-A, Orange-B, and Red. The Green category is for projects that are considered to have a low impact on the environment, while the red category is for projects that are considered to have a high impact on the environment. • Environmental impact assessment: The ECR require that projects in the Orange-A, Orange-B, and red categories undergo an environmental impact assessment (EIA). The EIA is a study that evaluates the potential environmental impacts of a project. • Environmental clearance: The ECR require that projects in the Orange-A, Orange-B, and red categories obtain an environmental clearance certificate (ECC) from the Department of Environment (DoE). The ECC is a permit	This rule is enacted to fulfill the ECA, 1995 act. Under this rule, the consultant will categorize the project into Green, Orange-A, Orange-B, and Red. The rules also applicable on how to achieve the ECC for the project site

Applicable Planning Regulations	Significant Features	Applicability to the Project
	that allows a project to proceed after the DoE has determined that the project will not have a significant negative impact on the environment. • Monitoring and enforcement: The ECR require that the DoE monitor and enforce environmental laws. The DoE has the authority to inspect projects, issue notices, and take enforcement actions against violators. The ECR have been amended several times since they were enacted. The most recent amendment was in 2017. The 2017 amendment made a number of changes to the ECR, including: • Streamlining the EIA process: The 2017 amendment streamlined the EIA process by reducing the number of steps involved and by clarifying the roles and responsibilities of the DoE and the project proponent. • Strengthening the enforcement of environmental laws: The 2017 amendment strengthened the enforcement of environmental laws by increasing the penalties for violations and by giving the DoE more authority to inspect projects and to take enforcement actions. • Promoting sustainable development: The 2017 amendment promoted sustainable development by requiring that projects consider the environmental impacts of their activities and by requiring that projects adopt measures to mitigate these impacts.	
Noise Control Rules, 2006	The Noise Control Rules, 2006 are an important piece of legislation that has helped to reduce noise pollution in Bangladesh. The Rules have been effective in reducing the level of noise	As a residential housing project, noise level within project area will need to be kept minimum for ensuring the serene environment for the dwellers. Guidelines of this

Applicable Planning Regulations	Significant Features	Applicability to the Project
	in many areas, and they have helped to improve the quality of life for many people. However, there is still more work to be done to reduce noise pollution in Bangladesh. The government of Bangladesh needs to continue to enforce the Rules, and it needs to take additional measures to reduce noise pollution.	rule will be applicable for ensuring minimization of the noise level of the project area.
Waste Management Rules, 2021	The Waste Management Rules, 2021 are an important piece of legislation that has improved the management of waste in Bangladesh. To further improve, the government needs to increase investment, raise public awareness, involve communities, and cooperate with other countries.	Solid Waste Management of the project area will be addressed following guidelines of this rule.

Source: Prepared by the Consultant, 2023

9. RISK AND SENSITIVITY ANALYSIS

The primary concern is whether the construction cost of the project can be executed within the budget. Several interlinked factors that control the entire cost of a construction project. It includes the priorities of the client, nature of the project, designer who develops the building design, choice of procurement options, prevailing market conditions, legislative constraints, etc.

9.1. Major Risks That May Affect RAJUK Apartment Project

Risks in Construction Projects: There are variety of risks involved in construction projects, they may be internal and external risks. A fuzzy model for bidder's risk assessment was developed at the bidding stage. The risks that are widespread in the external environment of projects, may be defined as external risks. Some examples of external risks are given below:

- Due to inflation
- Currency exchange rate fluctuations
- Technology change
- Client induced changes
- Politics
- Climate and weather conditions
- Natural disaster or major accidents

External risks are factually of non-controllable nature so there is every need to frequently scan and make a prediction about these risks in connection of company's strategy. Likewise internal risks are relatively more controllable in nature and may vary between projects. Some examples of internal risks are given below:

- Uncertainties due to labour, plant & material
- Subcontractor
- Resources and site conditions

Many researchers have identified several risk factors, these are grouped in different types on the basis of their nature of risks. Prominent researchers were Mustafa in 1991, Akinci et al, in 1998, Prasanta kumar Dey in 2002, Ghosh et al., in 2004, Wiguna and Scot in 2005, Enshasi and Mosa in 2008, Wang et al., in 2010, Razakhani in 2012 and Goh et al., in 2013. According to them the risk factors are dependent on nature of risks like physical, environmental, design. Financial, contractual, legal, construction, political, management, natural hazards, safety and delay risks.

Identification of Critical Risk Factors: On the basis of studies on different types of projects like residential, industrial, commercial and infrastructure development in various foreign countries, the critical risks factors identified are shown in Table 9-1.

Table 9-1: Critical Risk Factors

Critical Risk Factors	Mustafa et al, 1991	Prasanta Kumar Dey, 2002	Ghosh et al, 2004	Laryea, 2007	Enhassi and Mosa, 2008	Sun & Meng, 2008	Wang et el, 2010	Eybpoosh, 2011	Rezakhani, 2012	Goh et el, 2013
Scope and design changes, Technology Implementation		▲	▲	▲	▲			▲	▲	▲
Site conditions and Unknown Geological conditions				▲	▲	▲		▲		▲
Inflation, Country economic condition and rules and regulations	▲		▲	▲	▲	▲	▲	▲		
Unavailability of funds, financial failure	▲		▲	▲	▲	▲			▲	
Inadequate Managerial skills, Improper Coordination between Teams						▲				▲
Lack of Availability of resources				▲		▲		▲		▲
Weather and Climatic conditions		▲			▲				▲	
Statutory Clearance and approvals		▲					▲			
Poor safety procedures					▲				▲	
Construction Delays			▲		▲		▲			▲

On the basis of information in Table 9-1 it was concluded that following are the critical risk factors in various international projects.

- Inflation, (Country economic condition)
- Environmental and geological risk (weather & climatic conditions)
- Statutory Clearance before planning a project
- Design risk
- New technology implementation
- Poor safety procedures
- Construction delays
- Inadequate managerial skills

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- Improper coordination between teams
- Resource risk (lack of availability of resources)

It was concluded that there is necessity for an information map which represents the sources of critical risk factors on successful completion of a construction project. Accordingly, information map was developed.

9.2. Impact of Risk Factors on Project Implementation

From the study and review of literature the major sources of risks and their impacts were identified. The information map representing the sources of critical risk factors and its effect on project success is shown in Figure 9-1.

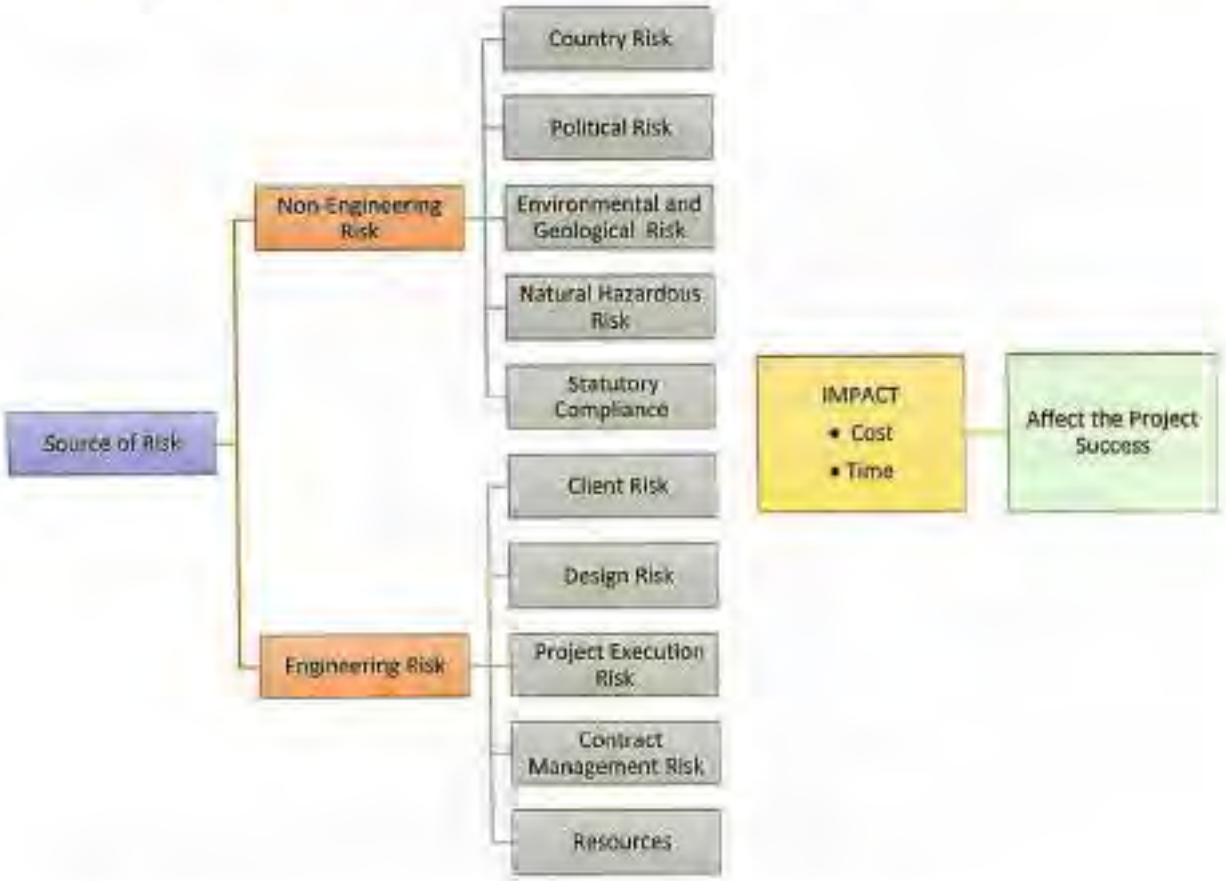


Figure 9-1: Information map representing the risk sources affecting the project success

Various risk factors are shown in flow chart as shown in Figure 9-1. Engineering risks are predictable whereas non engineering risks are unpredictable. The prediction should be forecasted in earlier stages of projects whereas unpredictable factors involve uncertainties, this should also be accounted for successful completion of project to avoid any adverse effect on cost, time and quality of the project.

9.3. Risk Management and Control

9.3.1. Management Process

The management process can be carried out in four different ways. However, the selection of appropriate way to respond to risk is the result of much research and conditions. Therefore, reactions presented below may serve us only as an example of how in a given situation the investor/contractor/interested party may proceed when making decisions on emerging risks because the management methods listed and characterized below are only selected cases:

- Avoiding risk - that is an attempt to change the current partner for the project in order to avoid the expected risk. Avoidance may also manifest itself in resigning from investing in endangered process.
- Risk mitigation - reduction of risk by limiting exposure to it or simply by minimizing the anticipated damage.
- Dispersion of risk – namely, the creation of such environment for the investment in which the potential risk will be able to disperse, and thus, minimize the negative effects. An example of such action may be to create a consortium to carry out the planned project.
- Absorbing risk - that is, action to strengthen own position to be able to bear the shock associated with occurrence of certain events, risks, etc. This can be done by increasing the number of personnel, changing the location of the project, creating time buffers to undertake key actions or creating capital reserves.

Basically, the management process consists of six phases:

Process Phases	Proposed Actions
Risk identification and early warning system	• Determining the causes of risk; • Determining possible consequences; • Identifying entities affected by risks.
Risk analysis	• Determining the probability of event; • Determining the consequences of event;
Formulating variants	• Identifying possible alternatives; • Analyzing expenditures and costs of different variants.
Risk assessment	• Declaring readiness and determining ability of the entity to make decisions; • Determining the actual level of risk; • Qualifying the use of possible alternatives to manage risk.
Decisions and actions in the area of risk (risk control)	• Choosing tools; • Setting priorities; • Using optimal combination.
Control, monitoring and evaluation of undertaken activities	• Checking and ex post evaluation of impact of undertaken actions; • New formation of risk management process in the case of wrong decision; • Further use of tools which ensured success in risk management.

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9.3.2. Risk Management Cycle

Thoughtful and strategic risk management primarily maximizes the effect of positive events and minimizes the negative effects, thus increasing the chance of project's success. Effective actions are possible if we have developed a proper project management cycle. Properly adopted scheme not only help make difficult and controversial decisions but above all provide invaluable information to investors on what action to take and according to which scheme to achieve the best results with minimal effects of 'negative' risk. Below is presented an example risk management cycle consisting of four main stages:

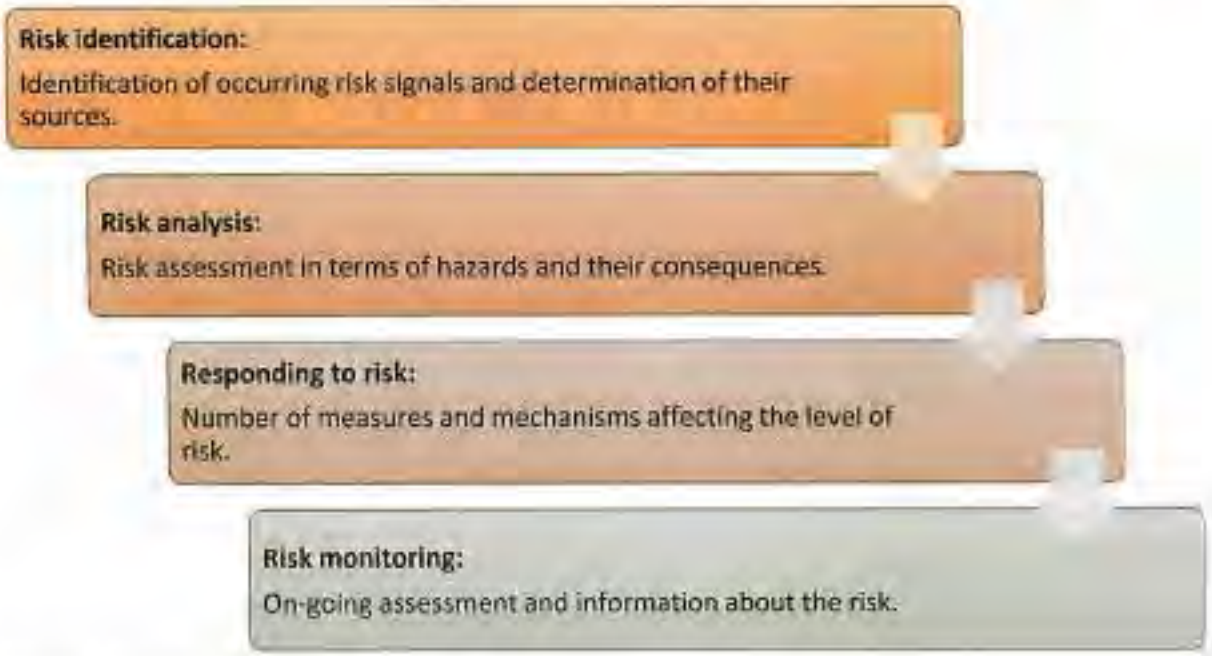


Figure 9-2: Example risk management cycle

9.3.3. Methods And Tools in Risk Management

The management process would not be possible without the help of methods that are commonly available on the market. Selection of the correct method is the key action in risk management. Note, however, that to succeed we will often be forced to use a few of them in order to justify the firm conviction that our hypothesis is correct and justified. The most common methods include:

- Brain storming
- Delphi method
- SWOT analysis
- Ichikawa method
- Sensitivity method
- Modelling and computer simulations
- Risk matrix.

To fully explain the issue of tools and techniques in risk management it should be mentioned that there are a number of mathematical methods focusing on estimating the scale of risk probability. They allow primarily formalizing incomplete knowledge and analyzing the risks associated with inability to anticipate the future. However, the main methods include:

- PERT method
- Decision trees
- Probabilistic methods and probability theory
- Fuzzy sets
- Artificial neural networks

9.3.4. Risks, Legal and Regulatory Obligations

The current design is the result of a systematic multi-criteria analysis in previous phases where different technical options or alternatives considered have been analyzed from different points of views, including the environmental scenario for this apartment project will be economically viable.

The major negative impacts of the proposed project will be noise, air quality and dust pollution, ecosystem destruction, erosion, loss of trees and wildlife habitat, wastes and drainage obstruction. Social environment impacts will be extensive and will involve land acquisition, homestead loss, loss of agriculture production, income loss, split communities, etc. All environmental impacts can be mitigated and, in many cases, avoided by careful planning and compliance with EMP actions during the construction period. The impacts will be monitored regularly during construction stage.

It should be noted that the expected benefits resulting from the project by far outweigh the foreseen negative impacts. The most important positive and permanent impacts of the project on society and economy will happen during operation stage, as for opportunities for dwellers, benefits at local and national level, better access and connectivity, minimizing of housing scarcity for middle income group of people and increase of socio-economic development. These positive impacts increase the value of the acceptance of the project.

However, for the majority of middle-income group, public apartments are the foremost choice seeking affordable housing. Under the Ministry of Housing and Public Works, RAJUK, Public Works Department (PWD) and NHA are involved in providing housing for civil servants as well as for the general public. But the contribution of public sector is not very significant. Middle income class is always neglected. Housing problem is acute for middle income class of Dhaka city. So, government should notice that with importance. Overall housing cost must be minimizing with the direct cooperation of government. Housing cost is directly related to housing affordability of target group. Minimizing housing unit cost, control over land price and control over the market of construction materials price is also important. Housing finance for middle income people must be ensuring with government and private both sector by giving subsidy. Some special services for tenure can also introduce to solve the housing problem.

The additional benefits that apartment project of RAJUK would yield are as follows:

- The project would ensure a steady and risk-free long-term return for the client
- Estimated returns on the basis or current market revenue from such a long-term investment are undoubtedly very attractive
- It may be pointed out that at the end of the project life, the project will not only retain its economic value but its market value will also considerably appreciate.

Therefore, this investment will be a major economic hub along with gaining steady income to meet client's financial requirements, consequently, is worth undertaking.

10. ALTERNATIVE OPTIONS ANALYSIS

According to the Project ToR, the housing will need to be designed for Apartment size of 1250sft and 850sft for Block-B and C respectively. However, according to the proposals of the latest report of Detailed Area Plan, 2022-35, average dwelling unit of the project area can be raised up to 1579sft. The consultant has developed two types of options according to the recommendation of DAP and directives of ToR. Following figure highlights the conceptual design and overall project brief of the two options.

Following section highlights the proposed number of buildings, its height, floor area etc.

Area Details

Block B-

Total Land Area - 105.87 Acre

Green Area = 50% of Land Area = 42.35 Acre

Number of Buildings - 12 nos. of 1600sft apartments and 36 nos. of 1250sft apartments

Total no. of units (2700+900) = 3600 Units

Building Height - Ground+ 13 Storied = 46.6m

Block C-

Total Land Area - 73.64 Acre

Green Area = 40% of Land Area = 29.47 Acre

Number of Buildings - 44 nos. of 850sft apartments

Total no. of units - 3300 Units

Building Height- Ground+ 13 Storied = 46.6m

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Figure 10-1: Conceptual Design of the Block-B and C

Source: Prepared by the Consultant, 2023

11. RECOMMENDATION AND CONCLUSION

11.1. General Recommendation

Uttara Housing Project for middle- and low-income group will yield a positive result to resolve the housing problems of Dhaka City. The project aims not only to provide housing for the vulnerable group of Dhaka city and achieve inclusiveness but also improve the overall quality of living of the housing area of middle- and low-income group. Following recommendations need to be followed in order to achieve desired results.

- Block-based Development guidelines is required to be followed for the development of housing in Block-B and Block-C
- It is recommended to utilize the adjacent area of the major corridor to be developed as commercial establishment as per the guideline of the DAP
- **Inclusive Planning:** Since Bangladesh is a signee of SDG goals, sub-goal for *providing housing for all* should be the motto of the housing development
- **Stakeholder Engagement:** similar to the planning stage/Feasibility study phase of the project, relevant stakeholder is required to be engaged during the implementation of the project
- Existing Blue and Green Network are required to be preserved following the guidelines of the Detailed Area Plan
- Incorporate sustainable design principles into the housing project, including energy-efficient technologies, green building materials, and waste management systems. Emphasize the use of renewable energy sources and encourage green spaces to enhance the overall quality of life and environmental sustainability.

11.2. Specific Recommendation

11.2.1. Policy related Guidelines

The housing project in Block-B and C of Uttara Sector-18 will be the first of its kind as RAJUK wants to implement Block-based development approach to develop a sustainable housing for the city dwellers. The consultant has proposed some recommendation to implement the housing project following the guidelines of Block-based Development and Transit Oriented Development (TOD) sighted in DAP, 2022-2035.

This apartment project will also include housing for Middle- and Low-Income People which will fulfill the SDG, 8th Five-Year Plan and the current Government Manifesto.

For this feasibility study, the consultant has assessed that the Middle-Income Group will have the monthly income of 70,000- 1,20,000 Tk whereas the Lower Income Group will have the monthly income of 35,000-70,000 Tk (BIDS Research, 2019).

11.2.2. Overview of Apartment in Block-B and C

1. Unit Size:

Block-B = Net 1250sft & Net 1600sft

Block-C = Net 850sft

N:B: 3 bedrooms for flats of 1600 and 1250 sq.ft net area and

2 bedrooms for flats of 850 sq.ft net area has considered.

2. Number of Floor:

Due to height restriction as per CAAB rules highest floor for B & C is = G+14

3. Land Use:

Minimum 40% of the land of the two blocks are required to be soak-able green or open space. This will ensure quality of living for the dwellers.

4. Density and Population:

Density of the Project is 250 PPA as per the DAP (2022-2035) guidelines. Thus, the project area will have a total Population of about 45000

5. Building Height:

In consideration from civil aviation height restriction, building height is considered as 154.88 feet (47.22m).

6. Parking:

- For 1600sft and 1250 sft – Provision of 1 parking per unit is recommended for such unit type.
- For 850 sft – Provision of 1 parking per unit is recommended for such unit type.

11.2.3. Conserved Green

1. For Block Based development- 40% of the total land area will be conserved as open spaces like green areas, playfield or park.
2. Due to height restriction from Civil Aviation Authority of Bangladesh (CAAB) on Block B and Block C, percentage of surrendered land can be taken under special consideration as it does not meet the requirement of population density and vertical extension of housing.

11.2.4. Connectivity

1 Pedestrian-friendly Road network should be developed and will be connected with the MRT-06 stations.

2 Shady and Green Footpaths connected with the major urban amenities

3 Block B and Block C are proposed to connect via foot-over bridge in consideration of clear height below metro rail tracks.

11.2.5. Recommendation on Environmental Issues

1 Approval from the Department of Environment (DoE) i.e. Site Clearance Certificate (SCC) and Environment Clearance Certificate (ECC) is required before any development takes place in the area.

2 Environment Management Plan (EMP) from the feasibility study must be followed to mitigate negative impacts on the environment.

3 For solid waste management system Upstream Management (Prevention, Reduction, Reuse, Recycling, Energy Recovery, Disposal) is recommended.

4 Separate bins for Inorganic and Organic Wastes should be provided. Classified solid waste is easy to recycle and for energy recovery.

5 Biogas chambers of volume according to population demand and waste generation are recommended to be placed for each block (outside the boundary preferable) and the overall biogas plant will serve the energy recovery purpose.

6 Overflown rainwater harvested should be carried with a vertical pipe in the ground to serve the groundwater recharge purpose. The height of the pipe will be determined according to the test results for aquifer.

7 To reduce seismic vulnerability detail geotechnical investigations must be conducted at first and then appropriate foundation design techniques with ultimate strength design method must be used as per Bangladesh National Building Code (BNBC 2020), ASCE 7-05 and ACI 318-08 considering seismic zone coefficient is z=0.2.

11.2.6. Recommendation on Establishment of Utility Services

Electrical System

1 RMU for each apartment block through underground (buried in ground) cable from 33/11 kV DESCO Sub-Station.

2 11/0.415 kV Sub-Station for each apartment building and commercial space.

3 Diesel generator for backup the power supply of each building.

4 For external lighting and power distribution, all cable will be underground (buried in ground).

5 Low power consumed LED light fittings for internal & external used.

6 Lighting Protection and Earthing System.

7 Telephone Cable, Internet Cable (Optical Fiber), TV from Govt. Own Company / Local service provider.

8 Security surveillance system (CCTV)

9 Grid -Tie solar energy system as per government energy regulation (3% for residence and 10% of light and fan load for commercial).

Mechanical System

1 **Air-conditioning system:** Education Institution, Commercial area, Community Centre & Healthcare center will be partially air-conditioned as per BNBC & ASHRAE codes.

2 **Fire Protection system:** House Building, Parking area, Commercial area, Community Centre & Healthcare center and open space will be provided with Fire system as Hydrant/ Pillar Hydrant, Fire Extinguisher, Sprinkler, etc. as per BNBC and NFPA codes. 2 Units of each building will be used as fire refuse

3 **Elevator System:** House Building will be provided passenger Lift & Goods/ Bed Lift for easy and comfortable movement of the dwellers.

4 **Gas Supply:** Central LPG for Block-B and C separately

External Plumbing & Sanitary Works

1 **Water Supply System:** Sufficient number of deep tube-well (DTW) to be installed at a suitable location into project area with pipe networking from deep tube well to Underground water reservoir (UGWR) of each building.

2 **Sewage Treatment Plant (STP):** One Central Sewage treatment plant (CSTP) will be considered for block B and another one for Block C with pipe networking from each building to CSTP. Treated water do not used for flushing (WC) due to higher initial cost involved for pipe networking & additional water reservoir/tank. STP will be membrane Bioreactor (MBR) type.

3 **Rainwater Harvesting System:** Roof rain water to be used for ground recharge and gardening. One ground recharge point will be consisting 4 nos. of apartment building.

4 **Drainage System:** The storm/rain water from roof, building premises, road & surrounding area shall be collected by rain water gutter/pipe and will be discharged into drain pipe for onward disposal to the road side surface drain or pipe conduit and finally to be disposed into lake/Pond.

11.2.7. Recommendation on Project Recovery

1 Cross-subsidy will need to be given to low-income people in order to subsidized the apartment cost

2 Per square feet cost for bigger apartment will be higher compare to the smaller apartment

3 Project can further recover its cost by selling commercial plot

4 The consultant proposes to sell the land for residential space for 5000 tk/sft for 850sft flat, 5500 tk/sft for 1250sft flat & 6000 tk/sft for 1600sft flat

5 Selling price for commercial plot will be 12,000 tk/sft

6 Community facilities like shopping complex, katcha Bazar and corner shops will be sold for 12,000 tk/sft

7 Financial BCR of the project will be kept low as RAJUK will not take benefit from this project. It will provide housing for low- and middle-income group as per its mandate. The consultant calculated that the FBCR of the project is 1.01

8 Considering its gross area, the selling price would be, 5000 taka per sq. ft. for a net 850 sq. ft. flat, 5500 taka per sq. ft. for a net 1250 sq. ft. flat, and 6000 taka per sq. ft. for a net 1600 sq. ft. flat.

9 In the case of cost recovery, analysis has been done by considering the payment of 50% of the total price for residential flats in 4 instalments of 4 years on the first call and for the second call the remaining 50% in 8 annual instalments.

10 In the case of cost recovery of commercial space, analysis can be done by taking into account the fact of paying the total cost in 4 annual instalments.

11 In the case of commercial space, considering the gross area, the base price per square foot has been analyzed at 12,000 taka.

12 Green and Blue Network will not be for sale

13 RAJUK will build one regional park which will be used by both the block residents and the surrounding people. Rest of the park area will be handed over to the City authority

After careful analysis and consideration, it is clear that the housing project in Uttara, Dhaka has significant potential to address the growing demand for quality housing in the area. Uttara is one of the fastest-growing residential areas in Dhaka, and it offers a favorable environment for investment and development. The project's location, accessibility, and market demand make it a promising opportunity for urban development.

The project is located in a prime area of Uttara, with easy access to major roads, public transportation, and schools. The demand for housing in Uttara is high, and the project is well-positioned to meet this demand. The project is also designed to be sustainable, with features such as solar power and rainwater harvesting.

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12. ANNEXES

Field Survey Data for Market Demand Analysis

Response No.	Residence Location	Flat size (sq ft)	Rooms	Rent (Tk.)	Family size	Rent/ sqft	sqft/ person	Transportation mode (in and out Uttara)
1	Sector 13, Uttara	1400	3 BHK	30000	4	21.4	350	Shanto Mariam University Bus
2	Hazaribag	1100	3 BHK	16000	3	14.5	367	World University Bus
3	Basabo	1250	3 BHK	18000	4	14.4	313	World University Bus / local Bus &Auto Rickshaw
4	Sector 13, Uttara	1250	3 BHK	26000	4	20.8	313	Public Transport
5	Sector 12, Uttara	850	2 BHK	18000	3	21.2	283	Public Transport
6	Sector 12, Uttara	1400	3 BHK	32,000	5	22.9	280	Private Transport
7	Sector 12, Uttara	1600	3 BHK	35,000	4	21.9	400	Private Transport
8	Outskirts of Sector 5, Uttara	1250	3 BHK	24,000	2	19.2	625	Private Transport
9	Sector 11, Uttara	900	2 BHK	17,000	3	18.9	300	Public Transport
10	Sector 11, Uttara	1150	3 BHK	21000	4	18.3	288	Public Transport
11	Sector 05, Uttara	900	2 BHK	20000	3	22.2	300	Public Transport
12	Sector 03, Uttara	1900	3 BHK	60000	4	31.6	475	Private Transport
13	Sector 18A (RUAP), Uttara	1250	3 BHK	18500	4	14.8	313	Private Transport
14	Sector 18A (RUAP), Uttara	1250	4 BHK	18500	3	14.8	417	Private Transport

Source: Field Survey, 2023

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Calculation for Community Facilities

Community Facility	Occupancy Type	Land Area (Acre)	Land Area (Sft)	MGC	FAR	Total Build Area	Number Of Floors	Population Density
School	B1	0.61	26,767.00	13,383.50	3.5	93,684.50	7	4,353.37
College	B1	0.75	32,715.00	16,357.50	3.5	114,502.50	7	5,320.75
Mosque	E6	0.60	25929.00	12964.5	2.5	64822.5	5	20,081.32
Healthcare/ Clinic	D1	1.05	45,806.00	22,903.00	4	183,224.00	8	1,135.22
Convention Hall	E1	0.98	42,670.00	21,335.00	1	42,670.00	2	5,665.16
Shops And Kutcha Bazaar	F3	0.22	9,422.84	4,711.42	3	28,268.52	6	875.73
Shops And Kutcha Bazaar	F3	0.20	8,697.30	4,348.65	3	26,091.89	6	808.30
Commercial Building	F1	1.20	52,272.00	26,136.00	7	365,904.00	14	3,400.59
	F1	2.50	108,900.00	54,450.00	7	762,300.00	14	7,084.57
	F1	1.00	43,560.00	21,780.00	7	304,920.00	14	2,576.21
Community Green		14.73	641638.8	-	-	4000	1	
Out-community Green		14.73	641638.8	-	-			

Value of Output / Recovery

Recovery form Residential Structures									
i) Apartment Block-B, Apartment Size - 1600 sft									
Net Area=	1600.00		sft	No. of Apartment =	900	Nos.			
Gross Area=	2060.00		sft	Car Parking =	500000.00	per unit.	Utility =	300000.00	per flat.
Selling Price of Apartment =	6000.00		per sft	Interest @ 9% =	22526.10				
Car Parking (100% of total flats) =	900		Nos.						
(i) Total Selling Price:									
a) For Appartment =	11124000000.00	104457.60	Taka.	2060 X 6000 X 900 =	11124000000.00				
b) For Car Parking =	4500000000.00	4680.00	Taka.	900 X 500000 =	4500000000.00				
c) For Utility Services =	2700000000.00	2808.00	Taka.	900 X 300000 =	2700000000.00				
	11844000000.00		Taka.						
	1,18,440.00		lac						
Net Area=	1250		sft						
Gross Area=	1693		sft	No. of Apartment =	2700	Nos.			
Selling Price of Apartment =	5500.00		per sft	Car Parking =	500000.00	per unit.	Utility =	300000.00	per flat.
Car Parking (100% of total flats) =	2700		Nos.	Interest @ 9% =	49270.17				
(ii) Total Selling Price:									
a) For Appartment =	25141050000.00	24864 8.40	Taka.	1693 X 5500X 2700	25141050000.00				
b) For Car Parking =	1350000000.00	14040.00	Taka.	2700X 500000 =	1350000000.00				
c) For Utility Services =	8100000000.00	8424.00	Taka.	2700 X 300000 =	8100000000.00				
	27301050000.00		Taka.						
	2,73,010.50		lac						
iii) Apartment Block-C, Apartment Size - 850 sft									
Net Area=	850.00		sft						
Gross Area=	1230.00		sft	No. of Apartment =	3300	Nos			

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Selling Price of Apartment =	5000.00		per sft	Car Parking =	400000.00	per unit.	Utility =	25000.00	per flat.
Car Parking (100% of total flats)=	3300		Nos.	Interest @ 9% =	43114.88				
(iii) Total Selling Price:									
a) For Appartment=	2029500000.00	195624.00	Taka.	1230 X 5000 X 3300=	2029500000.00				
b) For Car Parking=	1320000000.00	17160.00	Taka.	3300 X 300000 =	1320000000.00				
c) For Utility Services=	825000000.00	10296.00	Taka.	3300 X 200000 =	825000000.00				
	2244000000.00	Taka.							
	224400.00	lac							

Recovery from Non-residential Structures:

Convention Hall:

Floor Area (sft)=	22720.00
Level=	2
Total Area (sft)=	45440.00
Sellable Area (100%) =	45440.00
Rate per sft=	12000.00
Total Amounts in lac tk =	**5452.80**

Commercial Building (Type -1):

Floor Area (sft)=	53796.60
Level=	14
Total Area (sft)=	753152.40
Sellable Area (100%) =	753152.40
Rate per sft=	12000.00
Total Amounts in lac tk =	**90378.29**

Commercial Building (Type -2):

Floor Area (sft)=	38077.49
Level=	14
Total Area (sft)=	533084.83
Sellable Area (100%) =	533084.83
Rate per sft=	12000.00
Total Amounts in lac tk =	**63970.18**

Commercial Building (Type -3):

Floor Area (sft)=	21780
Level=	14
Total Area (sft)=	304920
Sellable Area (100%) =	304920
Rate per sft=	12000
	3659040000
Total Amounts in lac tk =	**36590.4**

Shop & Kitchen Market (Type-1):

Floor Area (sft)=	4926.40
Level=	6
Total Area (sft)=	29558.40
Sellable Area (100%) =	29558.40
Rate per sft=	12000.00
Total Amounts in lac tk =	**3547.01**

Shop & Kitchen Market (Type-2):

Floor Area (sft)=	4193.30
Level=	6
Total Area (sft)=	25159.80
Sellable Area (100%) =	25159.80
Rate per sft=	12000.00
Total Amounts in lac tk =	**3019.18**

Mixed use -1:

Floor Area (sft)=	34848.00
Level=	14
Total Area (sft)=	487872.00
Sellable Area (100%) =	487872.00
Rate per sft=	12000.00
Total Amounts in lac tk =	**58544.64**

Mixed use -2:

Floor Area (sft)=	71874.00
Level=	14
Total Area (sft)=	1006236.00
Sellable Area (100%) =	1006236.00
Rate per sft=	12000.00
Total Amounts in lac tk =	**120748.32**

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Project Director (Addl. Charge)
Uttara Apartment Project
RAJUK, Dhaka-1000

Mixed use -3:

Floor Area (sft)=	80803.80
Level=	14
Total Area (sft)=	1131253.20
Sellable Area (100%) =	1131253.20
Rate per sft=	12000.00
Total Amounts in lac tk =	**135750.38**

Primary Schools (Block- B):

	Area	Unit	Rate	Amounts in Lac Taka
Structure	122500.00	Sft	6000.00	7350.00
Land	35000.00	Sft	6944.445	2430.56
		Total Amounts in lac tk =		**9780.56**

Secondary School & College (Block- B):

	Area	Unit	Rate	Amounts in Lac Taka
Structure	136654.00	Sft	6000.00	8199.24
Land	39044.00	Sft	6944.445	2711.39
		Total Amounts in lac tk =		**10910.63**

Health Care Center (Block- B):

Floor Area (sft)=	22903.00
Level=	8
Total Area (sft)=	183224.00
Sellable Area (100%) =	183224.00
Rate per sft=	12000.00
Total Amounts in lac tk =	**21986.88**

Health Care Center (Block- C):

Floor Area (sft)=	22903.00
Level=	8
Total Area (sft)=	183224.00
Sellable Area (100%) =	183224.00
Rate per sft=	12000.00
Total Amounts in lac tk =	**21986.88**

Swimming Pool & Health Club:

	Area	Unit	Rate	Amounts in Lac Taka
Structure	6000.00	Sft	12000.00	720.00
Land	45738.00	Sft	6944.445	3176.25
			Total Amounts in lac tk =	3896.25

Primary Schools (Block – C):

	Area	Unit	Rate	Amounts in Lac Taka
Structure	93684.50	Sft	6000.00	5621.07
Land	26767.00	Sft	6944.445	1858.82
			Total Amounts in lac tk =	7479.89

Secondary School & College (Block – C):

	Area	Unit	Rate	Amounts in Lac Taka
Structure	114502.50	Sft	6000.00	6870.15
Land	32715.00	Sft	6944.445	2271.88
			Total Amounts in lac tk =	9142.03

Recovery Schedule

(Financial & Economical)

Total Value of Output = **1527057.69** Lac Taka

Year	Apartment	Commercial	Total
2024-2025	70700.06	199129.7498	269829.81
2025-2026	70700.06	199050.1202	269750.18
2026-2027	70700.06	199074.009	269774.07
2027-2028	120950.06	199042.1572	319992.22
2028-2029	60802.05	0.00	60802.05
2029-2030	57620.55	0.00	57620.55
2030-2031	54439.05	0.00	54439.05
2031-2032	51467.02	0.00	51467.02
2032-2033	48243.62	0.00	48243.62
2033-2034	44894.54	0.00	44894.54
2034-2035	41713.04	0.00	41713.04
2035-2036	38531.53	0.00	38531.53
Total	**730761.65**	**796296.0361**	**1527057.69**

Internal Rate of Return (IRR) (Financial)

BASE CASE

Year	Total Benefit	Total Investment (PV)	Net Benefit (PV)	Discount Factor @ 20% (P)	NPV @ Discount Factor 20% (M)	Discount Factor @ 12% (S)	NPV @ Discount Factor 12% (N)
2024-2025	269774.07	2,42,061.89	27,712.18	1.0000	27,712.18	1.0000	27,712.18
2025-2026	269774.07	2,30,031.27	39,742.80	0.8333	33,119.00	0.8929	35,484.64
2026-2027	269774.07	2,63,079.24	6,694.83	0.6944	4,649.19	0.7972	5,337.08
2027-2028	320024.07	2,50,033.99	69,990.08	0.5787	40,503.52	0.7118	49,817.56
2028-2029	60802.05	4,64,266.01	(4,03,463.96)	0.4823	(1,94,571.74)	0.6355	(2,56,408.64)
2029-2030	57620.55	0.00	57620.55	0.4019	23,156.41	0.5674	32,695.45
2030-2031	54439.05	0.00	54439.05	0.3349	18,231.53	0.5066	27,580.52
2031-2032	51467.02	0.00	51467.02	0.2791	14,363.50	0.4523	23,281.07
2032-2033	48243.62	0.00	48243.62	0.2326	11,219.92	0.4039	19,484.79
2033-2034	44894.54	0.00	44894.54	0.1938	8,700.86	0.3606	16,189.42
2034-2035	41713.04	0.00	41713.04	0.1615	6,736.89	0.3220	13,430.48
2035-2036	38531.53	0.00	38531.53	0.1346	5,185.88	0.2875	11,076.90
Total	**15,27,057.69**	**14,49,472.40**	**77585.29**	**5.33**	**(992.86)**	**6.94**	**5,681.44**

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Project Director (Addl. Charge)
Uttara Apartment Project
RAJUK, Dhaka-1000.

Internal Rate of Return (IRR) (Financial)

INVESTMENT COST INCREASED BY 10%

Year	Total Benefit	Total Investment (PV)	Net Benefit (PV)	Discount Factor @ 20% (P)	NPV @ Discount Factor 20% (M)	Discount Factor @ 12% (S)	NPV @ Discount Factor 12% (N)
2024-2025	269829.81	2,66,268.08	3,561.73	1.0000	3,561.73	1.0000	3,561.73
2025-2026	269750.18	2,53,034.40	16,715.78	0.8333	13,929.82	0.8929	14,924.81
2026-2027	269774.07	2,89,387.17	(19,613.09)	0.6944	(13,620.20)	0.7972	(15,635.44)
2027-2028	319992.22	2,75,037.39	44,954.83	0.5787	26,015.53	0.7118	31,997.96
2028-2029	60802.05	5,10,692.61	-449890.56	0.4823	-216961.11	0.6355	-285913.58
2029-2030	57620.55	0.00	57620.55	0.4019	23156.41	0.5674	32695.45
2030-2031	54439.05	0.00	54439.05	0.3349	18231.53	0.5066	27580.52
2031-2032	51467.02	0.00	51467.02	0.2791	14363.50	0.4523	23281.07
2032-2033	48243.62	0.00	48243.62	0.2326	11219.92	0.4039	19484.79
2033-2034	44894.54	0.00	44894.54	0.1938	8700.86	0.3606	16189.42
2034-2035	41713.04	0.00	41713.04	0.1615	6736.89	0.3220	13430.48
2035-2036	38531.53	0.00	38531.53	0.1346	5185.88	0.2875	11076.90
Total	**1527057.69**	**1594419.65**	**-67361.95**	**4.33**	**(99,479.24)**	**6.94**	**(1,07,325.90)**

Internal Rate of Return (IRR) (Financial)

REVENUE DECREASED BY 10%

(In Lac Taka)

Year	Total Benefit	Total Investment (PV)	Net Benefit (PV)	Discount Factor @ 20% (P)	NPV @ Discount Factor 20% (M)	Discount Factor @ 12% (S)	NPV @ Discount Factor 12% (N)
2024-2025	242846.83	2,42,061.89	784.94	1.0000	784.94	1.0000	784.94
2025-2026	242775.16	2,30,031.27	12,743.89	0.8333	10,619.91	0.8929	11,378.48
2026-2027	242796.66	2,63,079.24	(20,282.58)	0.6944	(14,085.12)	0.7972	(16,169.15)
2027-2028	287993.00	2,50,033.99	37,959.01	0.5787	21,967.02	0.7118	27,018.47
2028-2029	54721.85	4,64,266.01	-409544.16	0.4823	-197503.94	0.6355	-260272.72
2029-2030	51858.50	0.00	51858.50	0.4019	20840.77	0.5674	29425.90
2030-2031	48995.14	0.00	48995.14	0.3349	16408.37	0.5066	24822.46
2031-2032	46320.32	0.00	46320.32	0.2791	12927.15	0.4523	20952.96
2032-2033	43419.26	0.00	43419.26	0.2326	10097.93	0.4039	17536.31
2033-2034	40405.09	0.00	40405.09	0.1938	7830.78	0.3606	14570.48
2034-2035	37541.73	0.00	37541.73	0.1615	6063.20	0.3220	12087.43
2035-2036	34678.38	0.00	34678.38	0.1346	4667.29	0.2875	9969.21
Total	**1374351.92**	**1449472.40**	**-75120.48**	**4.33**	**(99,381.70)**	**6.94**	**(1,07,895.22)**

IRR = 17.08%

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Uttara Apartment Project
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Internal Rate of Return (IRR) (Financial)

INVESTMENT COST INCREASED AND REVENUE DECREASED SIMULTANEOUSLY BY 10%

Year	Total Benefit	Total Investment (PV)	Net Benefit (PV)	Discount Factor @ 20% (P)	NPV @ Discount Factor 20% (M)	Discount Factor @ 12% (S)	NPV @ Discount Factor 12% (N)
2024-2025	242846.83	2,66,268.08	(23,421.25)	1.0000	(23,421.25)	1.0000	(23,421.25)
2025-2026	242775.16	2,53,034.40	(10,259.23)	0.8333	(8,549.36)	0.8929	(9,160.03)
2026-2027	242796.66	2,89,387.17	(46,590.50)	0.6944	(32,354.51)	0.7972	(37,141.66)
2027-2028	287993.00	2,75,037.39	12,955.61	0.5787	7,497.46	0.7118	9,221.55
2028-2029	54721.85	0.00	54721.85	0.4823	26389.78	0.6355	34776.72
2029-2030	51858.50	0.00	51858.50	0.4019	20840.77	0.5674	29425.90
2030-2031	48995.14	0.00	48995.14	0.3349	16408.37	0.5066	24822.46
2031-2032	46320.32	0.00	46320.32	0.2791	12927.15	0.4523	20952.96
2032-2033	43419.26	0.00	43419.26	0.2326	10097.93	0.4039	17536.31
2033-2034	40405.09	0.00	40405.09	0.1938	7830.78	0.3606	14570.48
2034-2035	37541.73	0.00	37541.73	0.1615	6063.20	0.3220	12087.43
2035-2036	34678.38	0.00	34678.38	0.1346	4667.29	0.2875	9969.21
Total	**1374351.92**	**1083727.03**	**290624.89**	**4.33**	**48,397.61**	**6.94**	**1,03,640.08**

Benefit - Cost Ratio (Financial)

Discount Rate @ 12%

BASE CASE

(In Lac Taka)

Year	Total Benefit	Total Investment (PV)	Net Benefit (PV)	Discount Factor	Discounted Total Cost	Discounted Benefit
2024-2025	269829.81	2,42,061.89	27,767.92	1.0000	2,42,061.89	269829.81
2025-2026	269750.18	2,30,031.27	39,718.91	0.8929	2,05,385.06	240848.38
2026-2027	269774.07	2,63,079.24	6,694.83	0.7972	2,09,725.16	215062.24
2027-2028	319992.22	2,50,033.99	69,958.23	0.7118	1,77,969.26	227764.14
2028-2029	60802.05	4,64,266.01	(4,03,463.96)	0.6355	2,95,049.44	38640.80
2029-2030	57620.55	0.00	57620.55	0.5674	0.00	32695.45
2030-2031	54439.05	0.00	54439.05	0.5066	0.00	27580.52
2031-2032	51467.02	0.00	51467.02	0.4523	0.00	23281.07
2032-2033	48243.62	0.00	48243.62	0.4039	0.00	19484.79
2033-2034	44894.54	0.00	44894.54	0.3606	0.00	16189.42
2034-2035	41713.04	0.00	41713.04	0.3220	0.00	13430.48
2035-2036	38531.53	0.00	38531.53	0.2875	0.00	11076.90
Total	**1527057.69**	**1449472.40**	**77585.29**	**6.94**	**1130190.81**	**1135883.99**
					NPV =	**5693.18**
					BCR=	**1.01**

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Uttara Apartment Project
RAJUK, Dhaka-1000

Benefit – Cost Ratio (Financial)

Discount Rate @ 12%

INVESTMENT COST INCREASED BY 10%

(In Lac Taka)

Year	Total Benefit	Total Investment (PV)	Net Benefit (PV)	Discount Factor	Discounted Total Cost	Discounted Benefit
2024-2025	269829.81	2,66,268.08	3,561.73	1.0000	266268.08	269829.81
2025-2026	269750.18	2,53,034.40	16,715.78	0.8929	225923.57	240848.38
2026-2027	269774.07	2,89,387.17	(19,613.09)	0.7972	230697.68	215062.24
2027-2028	319992.22	2,75,037.39	44,954.83	0.7118	195766.18	227764.14
2028-2029	60802.05	5,10,692.61	-449890.56	0.6355	324554.39	38640.80
2029-2030	57620.55	0.00	57620.55	0.5674	0.00	32695.45
2030-2031	54439.05	0.00	54439.05	0.5066	0.00	27580.52
2031-2032	51467.02	0.00	51467.02	0.4523	0.00	23281.07
2032-2033	48243.62	0.00	48243.62	0.4039	0.00	19484.79
2033-2034	44894.54	0.00	44894.54	0.3606	0.00	16189.42
2034-2035	41713.04	0.00	41713.04	0.3220	0.00	13430.48
2035-2036	38531.53	0.00	38531.53	0.2875	0.00	11076.90
Total	**1527057.69**	**1594419.65**	**-67361.95**	**6.94**	**1243209.90**	**1135883.99**
					NPV =	**-107325.90**
					BCR =	**0.91**

Benefit – Cost Ratio (Financial)

Discount Rate @ 12%

REVENUE DECREASED BY 10%

(In Lac Taka)

Year	Total Benefit	Total Investment (PV)	Net Benefit (PV)	Discount Factor	Discounted Total Cost	Discounted Benefit
2024-2025	242846.83	242061.89	784.94	1.0000	242061.89	242846.83
2025-2026	242775.16	230031.27	12,743.89	0.8929	205385.06	216763.54
2026-2027	242796.66	263079.24	(20,282.58)	0.7972	209725.16	193556.01
2027-2028	287993.00	250033.99	37,959.01	0.7118	177969.26	204987.73
2028-2029	54721.85	464266.01	-409544.16	0.6355	295049.44	34776.72
2029-2030	51858.50	0.00	51858.50	0.5674	0.00	29425.90
2030-2031	48995.14	0.00	48995.14	0.5066	0.00	24822.46
2031-2032	46320.32	0.00	46320.32	0.4523	0.00	20952.96
2032-2033	43419.26	0.00	43419.26	0.4039	0.00	17536.31
2033-2034	40405.09	0.00	40405.09	0.3606	0.00	14570.48
2034-2035	37541.73	0.00	37541.73	0.3220	0.00	12087.43
2035-2036	34678.38	0.00	34678.38	0.2875	0.00	9969.21
Total	**1374351.92**	**1449472.40**	**-75120.48**	**6.94**	**1130190.81**	**1022295.59**
					NPV =	**-107895.22**
					BCR =	**0.90**

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Benefit – Cost Ratio (Financial)

Discount Rate @ 12%

INVESTMENT COST INCREASED AND REVENUE DECREASED SIMULTANEOUSLY BY 10%

(In Lac Taka)

Year	Total Benefit	Total Investment (PV)	Net Benefit (PV)	Discount Factor	Discounted Total Cost	Discounted Benefit
2024-2025	242846.83	266268.08	(23,421.25)	1.0000	266268.08	242846.83
2025-2026	242775.16	253034.40	(10,259.23)	0.8929	225923.57	216763.54
2026-2027	242796.66	289387.17	(46,590.50)	0.7972	230697.68	193556.01
2027-2028	287993.00	275037.39	12,955.61	0.7118	195766.18	204987.73
2028-2029	54721.85	0.00	54721.85	0.6355	0.00	34776.72
2029-2030	51858.50	0.00	51858.50	0.5674	0.00	29425.90
2030-2031	48995.14	0.00	48995.14	0.5066	0.00	24822.46
2031-2032	46320.32	0.00	46320.32	0.4523	0.00	20952.96
2032-2033	43419.26	0.00	43419.26	0.4039	0.00	17536.31
2033-2034	40405.09	0.00	40405.09	0.3606	0.00	14570.48
2034-2035	37541.73	0.00	37541.73	0.3220	0.00	12087.43
2035-2036	34678.38	0.00	34678.38	0.2875	0.00	9969.21
Total	**1374351.92**	**1083727.03**	**290624.89**	**6.94**	**918655.51**	**1022295.59**
					NPV =	**103640.08**
					BCR =	**1.11**

Development Design Consultants Limited

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Project Director (Addl. Charge)
Uttara Apartment Project
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Benefit Cost Ratio (BCR), Net Present Value (NPV), Internal Rate of Return (IRR)

(Economical)

BASE CASE

(In Lac Taka.)

Year	Total Benefit	Total Cost (PV)	Economic Conversion Factor	Economic Value of Cost	Economic Value of Benefit	Net Benefit (S)	Discount Factor (S=12%)	Discounted Cost	Discounted Benefit	Net Present Value @ 12% (N)	Discount Factor (P=20%)	Discounted Cost	Discounted Benefit	Net Present Value @ 20% (M)
2024-2025	209829.81	242061.89	0.87	210593.85	234751.94	24,158.09	1.000	210593.85	234751.94	24,158.09	1.000	210593.85	234751.94	24,158.09
2025-2026	269750.38	230831.27	0.87	200127.21	234682.66	34,555.45	0.893	178693.58	209548.15	30,854.56	0.833	166766.00	195561.06	28,795.06
2026-2027	269774.07	263079.24	0.87	228878.94	233703.44	5,824.50	0.797	182469.65	186113.13	4,643.48	0.694	158938.54	162982.87	4,044.33
2027-2028	310992.22	250033.99	0.87	217529.57	278393.23	60,863.66	0.712	154844.68	198164.31	43,319.63	0.579	125884.36	161104.16	35,219.80
2028-2029	608020.05	464286.01	0.87	403911.43	529697.79	(8,513.64)	0.635	256705.34	336191.11	(2,133.86.22)	0.482	194806.48	255124.80	(1,69,2 93.88)
2029-2030	976305.55	0.00	0.87	0.00	501299.88	50,129.88	0.567	0.00	284464.41	28,446.41	0.401	0.00	201473.20	20,147.20
2030-2031	544390.05	0.00	0.87	0.00	473619.97	47,381.97	0.506	0.00	239935.57	23,993.57	0.334	0.00	158615.52	15,861.52
2031-2032	514670.02	0.00	0.87	0.00	447768.31	44,776.31	0.452	0.00	202523.32	20,252.32	0.279	0.00	124975.07	12,497.07
2032-2033	482430.62	0.00	0.87	0.00	419719.95	41,971.95	0.403	0.00	169524.47	16,952.47	0.233	0.00	97626.68	9,762.68
2033-2034	448940.54	0.00	0.87	0.00	390580.25	39,058.25	0.360	0.00	140840.40	14,084.40	0.194	0.00	75894.49	7,589.49
2034-2035	417130.04	0.00	0.87	0.00	362903.34	36,290.34	0.321	0.00	116456.49	11,645.49	0.162	0.00	58900.89	5,890.89
2035-2036	385310.53	0.00	0.87	0.00	335224.43	33,522.43	0.286	0.00	96377.70	9,637.70	0.135	0.00	45123.12	4,512.12
Total	15270 57.69	14,49,47 2.40	10.44	12,51, 040.99	13,28, 540.19	67,499 .20	6.99 78	9,83,3 03.10	9,88,2 49.01	4,945. 91	5.32 71	8,56,9 84.23	8,56,1 28.80	(853.4 3)

BCR =	1.01
NPV =	5809.34
IRR =	18.81%

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Uttara Apartment Project
RAJUK, Dhaka-1000

Benefit Cost Ratio (BCR), Net Present Value (NPV), Internal Rate of Return (IRR)

(Economical)

INVESTMENT COST INCREASED BY 10%

(In Lac Taka.)

Year	Total Benefit	Total Cost (PV)	Economic Conversion Factor	Economic Value of Cost	Economic Value of Benefit	Net Benefit (S)	Discount Factor (S=12%)	Discounted Cost	Discounted Benefit	Net Present Value @ 12% (N)	Discount Factor (P=20%)	Discounted Cost	Discounted Benefit	Net Present Value @ 20% (M)
2024-2025	269829.81	266268.08	0.87	231653.23	234751.94	3,098.71	1.000	231653.23	234751.94	3,098.71	1.000	231653.23	234751.94	3,098.71
2025-2026	269750.18	253034.40	0.87	220139.93	234682.66	14,542.73	0.892	196567.94	209548.15	12,980.21	0.833	183455.72	195468.79	12,013.07
2026-2027	269774.07	289387.17	0.87	251766.83	234703.84	(17,063.39)	0.797	200716.61	187113.13	(13,603.48)	0.694	200812.72	193933.70	(6,878.02)
2027-2028	319992.22	275037.39	0.87	239282.53	278393.21	39,110.70	0.712	170324.75	198164.31	27,839.56	0.579	138643.08	160813.18	22,170.10
2028-2029	609802.05	510602.61	0.87	444302.37	530897.79	(3,91,404.79)	0.636	282375.87	337618.11	(2,48,756.76)	0.482	214211.79	255976.97	(1,81,234.82)
2029-2030	576205.55	0.00	0.87	0.00	501293.88	501,293.88	0.567	0.00	284464.41	284,464.41	0.402	0.00	201555.31	201,555.31
2030-2031	544390.05	0.00	0.87	0.00	473613.97	473,613.97	0.507	0.00	239933.57	239,933.57	0.335	0.00	158755.03	158,755.03
2031-2032	514670.02	0.00	0.87	0.00	447761.31	447,761.31	0.452	0.00	202522.32	202,522.32	0.279	0.00	125269.32	125,269.32
2032-2033	486430.62	0.00	0.87	0.00	423158.95	423,158.95	0.404	0.00	170932.47	170,932.47	0.233	0.00	98902.47	98,902.47
2033-2034	448940.56	0.00	0.87	0.00	390584.25	390,584.25	0.360	0.00	140684.40	140,684.40	0.194	0.00	75798.40	75,798.40
2034-2035	417130.04	0.00	0.87	0.00	362900.34	362,900.34	0.321	0.00	116485.49	116,485.49	0.162	0.00	58847.69	58,847.69
2035-2036	385310.53	0.00	0.87	0.00	335222.43	335,222.43	0.286	0.00	95937.70	95,937.70	0.135	0.00	45299.70	45,299.70
Total	15270557.69	15,94,419.65	13.64	13,87,145.69	13,28,540.19	(58,604.90)	6.938	10,81,633.41	9,88,249.01	(93,384.40)	1.100	2,53,956.79	2,58,239.54	4,282.74

BCR =	0.91
NPV =	-97667.14
IRR =	19.65%

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Benefit Cost Ratio (BCR), Net Present Value (NPV), Internal Rate of Return (IRR)

(Economical)

REVENUE DECREASED BY 10%

(In Lac Taka.)

Year	Total Benefit	Total Cost (PV)	Economic Conversion Factor	Economic Value of Cost	Economic Value of Benefit	Net Benefit (S)	Discount Factor (S=12%)	Discounted Cost	Discounted Benefit	Net Present Value @ 12% (N)	Discount Factor (P=20%)	Discounted Cost	Discounted Benefit	Net Present Value @ 20% (M)
1024-2025	24284 6.83	242061. 39	0.87	21059 3.85	21127 6.74	683.90	1.00 00	21059 3.85	21127 6.74	683.90	1.00 00	21059 3.85	21127 6.74	682.90
2025-2026	24277 5.36	230051. 27	0.87	20012 7.21	21121 4.19	11,087 .19	0.89 29	17869 3.58	18859 3.33	8,889. 75	0.83 33	16676 6.00	17600 4.95	9,238 95
2026-2027	24279 6.06	263079. 24	0.87	22887 8.94	21123 3.10	(17,64 5.84)	0.79 72	18246 0.63	16840 1.82	(14,66 7.83)	0.69 44	15893 3.54	14668 0.26	(12,25 3.27)
2027-2028	28798 3.00	250033. 99	0.87	21752 9.57	25055 5.91	33,034 .34	0.71 18	15484 0.68	17814 7.88	23,507 .20	0.57 87	12588 4.36	14499 5.55	19,111 .18
2028-2029	54721 .85	464266. 91	0.87	40391 1.43	47808. 01	(3,56,3 03.42)	0.63 55	25670 5.34	30257 .20	(2,26,4 48.13)	0.48 23	19480 6.48	22961 .34	(1,71,8 45.14)
2029-2030	51858 .50	0.00	0.87	0.00	45116. 89	45,116 .89	0.56 75	0.00	25601 .76	25,601 .76	0.40 19	0.00	18132 .48	18,132 .48
2030-2031	48999 .14	0.00	0.87	0.00	42625. 77	42,625 .77	0.50 66	0.00	21594 .22	21,594 .22	0.33 49	0.00	14275 .37	14,275 .37
2031-2032	46320 .32	0.00	0.87	0.00	40298. 68	40,298 .68	0.45 23	0.00	18227 .09	18,227 .09	0.27 91	0.00	11247 .30	11,247 .95
2032-2033	43419 .26	0.00	0.87	0.00	37774. 76	37,774 .76	0.40 39	0.00	15257 .22	15,257 .22	0.23 26	0.00	8786. 41	8,786. 41
2033-2034	40405 .09	0.00	0.87	0.00	35152. 42	35,152 .42	0.36 06	0.00	12675 .96	12,675 .96	0.19 38	0.00	6812. 54	6,812. 54
2034-2035	37541 .73	0.00	0.87	0.00	32661. 31	32,661 .31	0.32 20	0.00	10516 .94	10,516 .94	0.15 15	0.00	5274. 80	5,274. 80
2035-2036	34678 .38	0.00	0.87	0.00	30170. 19	30,170 .19	0.28 75	0.00	8673. 93	8,673. 93	0.13 46	0.00	4050 91	4,050 91
Total	13743 51.92	14,43,47 2.00	10.44	12,61, 040.99	11,98, 686.17	(65,35 4.82)	6.93 78	9,88,3 03.10	8,89,4 24.31	(93,87 8.99)	5.32 71	8,56,8 84.23	7,78,5 08.72	(88,47 5.51)

BCR =	0.90
NPV =	-7403.48
IRR =	13.44%

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Benefit Cost Ratio (BCR), Net Present Value (NPV), Internal Rate of Return (IRR)

Economical

INVESTMENT COST INCREASED AND REVENUE DECREASED SIMULTANEOUSLY BY 10%

(In Lac Taka.)

Year	Total Benefit	Total Cost (PV)	Economic Conversion Factor	Economic Value of Cost	Economic Value of Benefit	Net Benefit (S)	Discount Factor (Sn12%)	Discounted Cost	Discounted Benefit	Net Present Value @ 12% (N)	Discount Factor (R=20%)	Discounted Cost	Discounted Benefit	Net Present Value @ 20% (M)
2024-2025	24284 6.83	265268. 08	0.87	23165 3.23	211278 .74	(20,37 6.49)	1.00 00	23165 3.23	21127 8.74	(20,37 6.49)	1.00 00	23165 3.23	21127 8.74	(20,37 6.49)
2025-2026	24277 5.16	253034. 40	0.87	22015 8.93	211214 .39	(8,925 .53)	0.89 29	19656 2.94	18859 3.33	(7,969 .61)	0.83 33	18344 2.60	17600 4.95	(7,437 .65)
2026-2027	24279 6.66	289387. 17	0.87	25176 0.83	211235 .10	(40,53 3.74)	0.79 72	20071 6.61	16840 1.82	(32,31 4.80)	0.69 44	17482 5.89	14668 0.26	(28,14 6.63)
2027-2028	28799 3.00	275037. 39	0.87	23928 2.53	250553 .51	11,271 .38	0.71 18	17032 4.75	17834 7.88	8,023. 13	0.57 87	13847 2.80	14499 5.55	6,522. 75
2028-2029	54721. 85	0.00	0.87	0.00	47608. 01	47,608 .01	0.63 55	0.00	30257. 20	30,25 7.20	0.48 24	0.00	22961. 34	22,96 1.34
2029-2030	51858. 50	0.00	0.87	0.00	45116. 89	45,116 .89	0.56 75	0.00	25601. 76	25,60 1.76	0.40 19	0.00	18132. 48	18,13 2.48
2030-2031	48995. 14	0.00	0.87	0.00	42625. 77	42,625 .77	0.50 66	0.00	21594. 22	21,59 4.22	0.33 49	0.00	14275. 37	14,27 5.37
2031-2032	46320. 32	0.00	0.87	0.00	40298. 68	40,298 .68	0.45 23	0.00	18227. 09	18,22 7.09	0.27 91	0.00	11247. 36	11,24 7.36
2032-2033	43819. 26	0.00	0.87	0.00	37774. 76	37,774 .76	0.40 39	0.00	15257. 22	15,25 7.22	0.23 36	0.00	8786.4 1	8,786. 41
2033-2034	40405. 09	0.00	0.87	0.00	35152. 42	35,152 .42	0.36 06	0.00	12675. 96	12,67 5.96	0.19 38	0.00	6812.5 4	6,812. 54
2034-2035	37541. 73	0.00	0.87	0.00	32661. 31	32,661 .31	0.32 20	0.00	10516. 94	10,51 6.94	0.16 15	0.00	5274.8 0	5,274. 80
2035-2036	34678. 38	0.00	0.87	0.00	30170. 19	30,170 .19	0.28 75	0.00	8673.5 3	8,673. 93	0.13 46	0.00	4060.9 1	4,060. 91
Total	13743 51.92	10,83,72 7.09	10.44	9,42,8 42.52	11,99,6 80.17	2,52,8 43.65	6.93 78	7,99,2 57.54	8,89,4 24.11	90,16 6.57	5.32 71	7,28,3 95.52	7,70,5 08.72	42,11 3.20

BCR =	1.11
NPV =	48053.37
IRR =	15.20%