Payra-Kuakata Comprehensive Plan Focusing on Eco-Tourism

Structure Plan of Amtali Upazila: 2021-2041

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Executive Summary

The structure plan is the long-term plan to guide the development of an area by identifying existing physical feature situation like land use patterns and nature of infrastructure (including transportation links), open space, other key features and constraints that influence for the future development. The Structure Plan is also a policy guideline that sets the ground and serves as the guideline for subsequent local level plans. The overarching purpose of the Structure Plan is to promote long-term, comprehensive development of the Amtali Upazila through integrated planning and implementation involving several organizations and community participation for optimal resource utilization and poverty reduction. The planning area includes Seven unions, namely Amtali, Gulishakhali, Athrogasia, Kukua, Haldia, Arpangasia and Chowra. Amtali Municipality is subdivided into 9 wards and 14 mahallas.This report provides detailed findings from socio-economic, environmental, transportation and other aspect. Besides this, with the help of secondary databases, many analyses for the decision making have been conducted in this report. The overall goal of this structure plan is to lead the development of Amtali Upazila in order to enhance the residents' socio-economic status, Socio-spatial Forecasting and development prospects, Population projection, Hosing, water, electricity demand etc. are discussed here.

Chapter two describe the critical planning issues like Natural Resources, Transportation, Housing, Topographic condition, disaster and vulnerabilities, Ecologically Critical Areas, Cropping Pattern, Hydro-geology etc. are the critical issues for Amtali Upazila. Socio-spatial Forecasting and development prospects are discussed in Chapter 3. Population projection, Hosing demand projection, economic forecasting, water, electricity demand etc. are discussed here. In addition, the areas of traffic and transportation, drainage and flood, and basic services will be discussed as development perspectives. Chapter 4 provided sectoral and structure plan policies that will help to guide particular environment so that social harmony and peace are maintained and well-being is guaranteed. Depending on the key issues and development prospects, some guidelines have been compiled for the zones proposed in the structural plan. Chapter 5 is the most important chapter which included the composite structure plan. In this chapter existing land use, Geological, Hydro-geological, Strategic Service Centre suitability are discussed. Moreover, multicriteria analyses on infrastructure, Human Settlement and Economic Region also included in this chapter. The proposals of structure plan and recommendations are also described here. Chapter 6 emphasize on Implementation Phasing of Proposals, Responsible Agencies And Relevant Issues. This chapter also discussed about institutional strengths and Capacity Building. Chapter 7 describe development restrictions or permission to be applied for the development of a particular area where it is required is discussed. The Permitted and Conditional Uses of the Structure Plan Zones also given in this chapter. Finally, Chapter 8 provide Conclusion.

Structure plan consists of a composite map depicting the key elements of the major strategic decisions. From the existing land use survey, it is found that Water logging, Cyclone, flood, Communication Network among unions (mostly Katha road) and transportation problems like narrow and earthen roads, Recreational facilities, solid waste management system, Insufficient drinking water are major problems in the Upazila. There are some zones has been proposed in the Structure Plan. Moreover, the plan proposes widening of roads, reconstruction of embankments, economic zones, bridges and culverts to improve road management and connectivity with other unions. It identifies the extent and direction of expected urban growth incorporating the future broad functions of various strategic areas and defines a comprehensive set of sectoral policies considered necessary to achieve the vision and objectives of the overall plan. It is expected that this zone will facilitate the investment of public and private investors.

A thorough and in-depth plan has been created, called the Structural Plan of Amtali Upazila, to guarantee the region of Payra sustainable kuakata's and integrated development. The ability to communicate effectively and the availability of contemporary amenities are crucial for the region's development. Furthermore, it is anticipated that significant increase in vehicle traffic on the water, the air, the rails, and the roads. The socioeconomic situation, as well as the region's current land use pattern, would be impacted by this occurrence in both positive and bad ways. Any likely changes in the Upazila's socioeconomic situation and land use pattern would be guided by the suggested plan. Also, the negative effects of such changes will be covered by this plan. It can also guarantee the socioeconomic growth of nearby communities and preserve biodiversity. As a result, local communities can benefit economically from ecotourism and create jobs by conserving their biodiversity and developing their ecotourism management skills. The proposed plan would direct such likely changes in the Upazila's socioeconomic situation and land use pattern. This strategy will also deal with the negative effects of such developments. Within the coastal region, each Upazila has unique topographic and racial characteristics. To handle the variations, a distinct Upazila level structure plan is necessary.

1.1 DEFINITION OF THE STRUCTURE PLAN

The Structure Plan outlines a long-term vision for Amtali Upazila's growth for the 20 years from 2021 to 2041. The structure plan report includes a number of supporting maps as well as a composite map at the right scale that highlights important aspects of important strategic choices. The main goal of the Plan is to support the Upazila's long-term, all-encompassing development through integrated planning and implementation including a number of organizations and community involvement for the best possible resource utilization and reduction of poverty. The background of this stragegic plan is to propose a strategic and integrated land use zones considering its hydrological, geological, disaster risk sensitiveness, socioeconomic, and other relevant facility settings, for managing the protection, use and development of the Upazila environment.

1.2 OBJECTIVE OF THE STRUCTURE PLAN

The overall goal of this structure plan is to lead the development of Amtali Upazila in order to enhance the residents' socio-economic position by following the guidelines laid out in the regional plan and focusing on eco-tourism.

Specifically, The objective of this structure plan is to formulate strategic development paths for regional plan considering functional and land use requirements with hazard vulnerability.

- To reach the objective the plan has been prepared considering existing physical features, socio-economic scenario, transportation, disaster, hydro-geology, geology, hydrology and natural resources like forest, river etc.

1.4 APPROACHES TO PLANNING

During the creation of the Structural Plan, various procedures and approaches were used. Here are some strategies that can be taken to prepare a structured plan for Amtali Upazila.These were adopted at various points, from the project's mobilization until the plan's completion. The key activities and methodologies involved the collection of mouza maps and secondary documents, the execution of various surveys, the use of 3D photogrammetric technology for the creation of base maps and GIS databases, consultation with stakeholders, the establishment of planning standards, the review of secondary data, the analysis of national policies and laws, and the preparation of planning documents. . Structure Plan was prepared based on the agreed planning standards and land use categories. Development proposals of Amtali Upazila were made considering different propositions on future growth and development. The flow diagram of approaches and methodologies are given below.

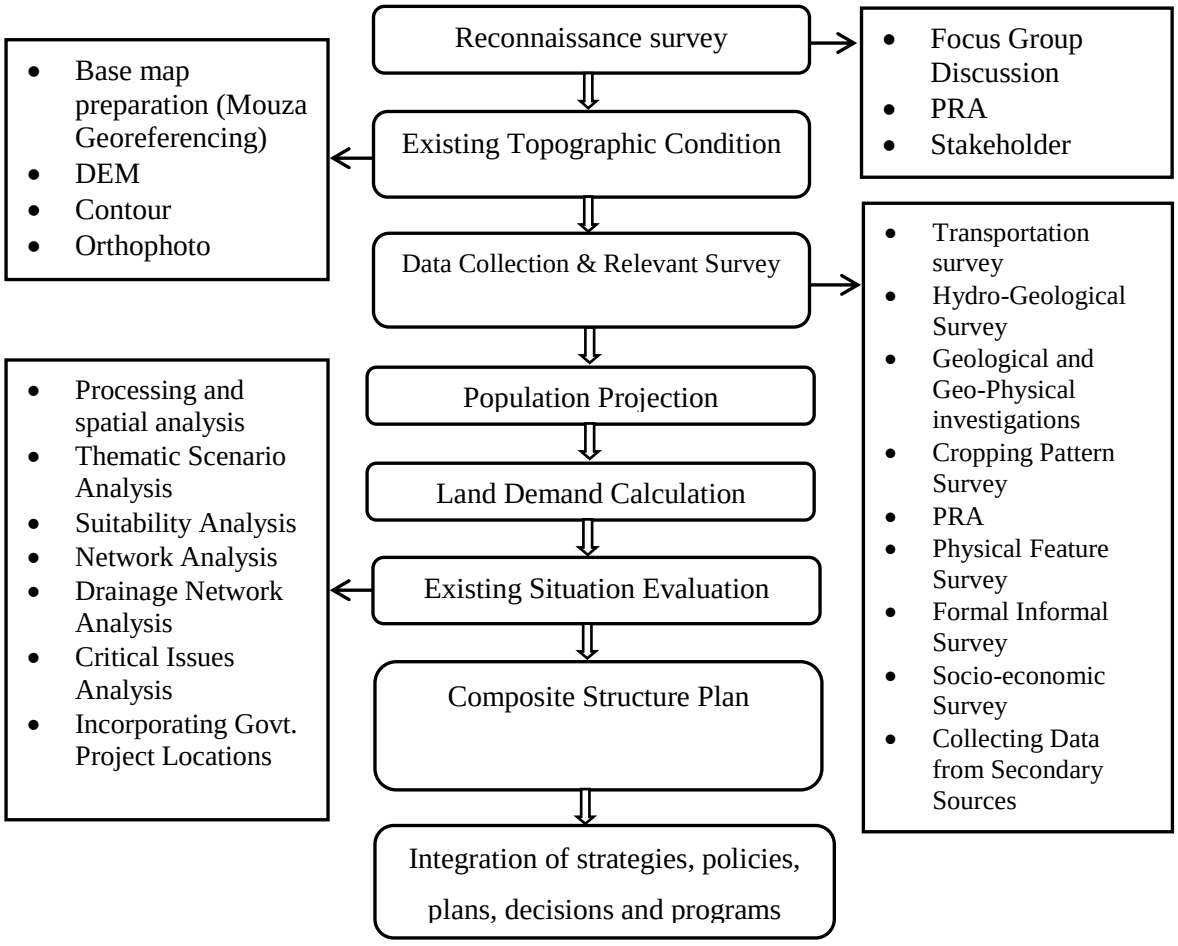


Figure 1.1: Technical Methodology of Structure Plan Preparation

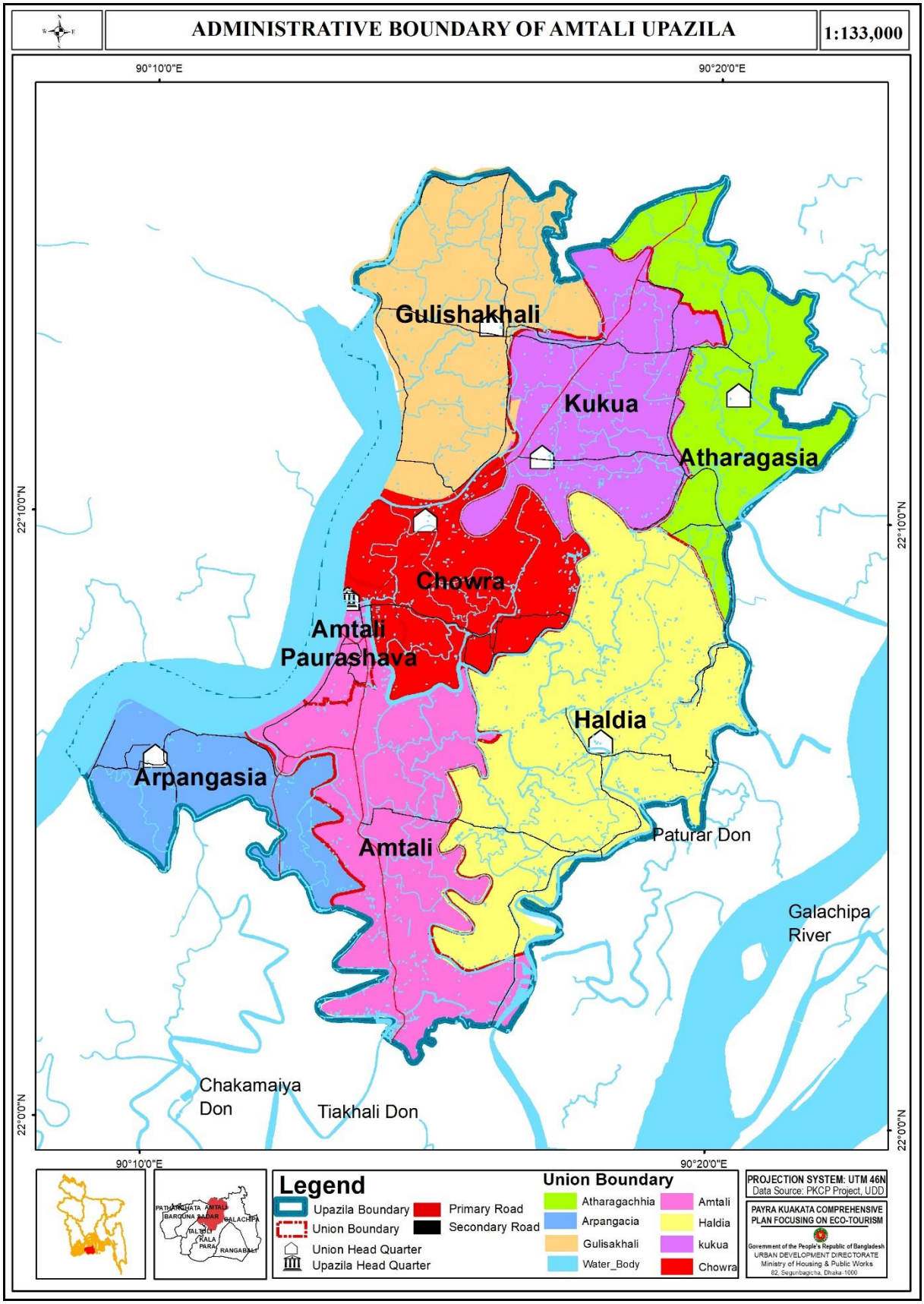
1.5 COMPONENT OF THE STRUCTURE PLAN

The preparation of the structural plan involves examining both above-ground and below-ground scenarios and multiple components have also been considered. These components include physical feature survey, socio-economic survey, transportation, disaster, hydro-geology, geology and forest. The physical feature survey collects location and dimension data using RTK GPS and total station survey method. The socio-economic survey aims to analyze societal concerns and needs statistically. Transportation survey provides an idea about the existing traffic demand and available infrastructure. Disaster assessment includes disaster risk assessment and proposing possible solutions. Hydro-geological study assesses the availability and quality of water. Geology investigates the local geology to plan infrastructure sustainably. Hydro-geology studies are critical for water resource planning and development. The forest component involves identifying existing biodiversity and selecting suitable native plant species to control pollution and enhance biodiversity.

1.3 BACKGROUND OF THE STUDY AREA

Amtali Upazila is located on the way to Dhaka-Kuakata and Patuakhali-Amtali highway inside the district of Barguna. Namakaran folklore is that in the far past, During the time of the boat building, there was a time when Amtala to Amtali. On the other hand, the flow of the Payra river on the eastern side of the Amtali port from Amtali river to the north. During the period of the transport of the boat, the boat was on the banks of the Amtali river, the settlement and commercial center. Local community values the recreational and lifestyle opportunities that the provides. It offers a range of economic benefits and attracts industries and businesses reliant on the Resource.

The Amtali Upazila's precise name history is unknown. Barguna's district, in the Barisal division, is known as Amtali Upazila. On the Barishal-Kuakata Highway route, it is located. Amtali Upazila serves as the route of the lone roadway from Barishal to Kuakata. The location of it is in Bangladesh's southern region. The Amtali Upazila is one of the six Upazilas of the Barguna Zila. A total of 720.76 square kilometres make up the Upazila. 22°84.23N, 90°1413.92E are the coordinates of its location. Amtali Upazila had 63,212 houses and 270,802 inhabitants as of the 2011 Bangladesh census, 8.1% of whom were in urban areas. 10.3% of people in the population were under the age of 5. Compared to the national average of 72.8%, the literacy rate (for those aged 7 and older) was 89.8%. The overall land area is estimated to be 461.81 sq. km., according to the survey report. Amtali Upazila has a range of 14.9% urban population (BBS, 2011).



Map 1.1:Administrative Boundary of Amtali Upazila

Source: PKCP project, UDD, 2018

CHAPTER TWO: CRITICAL PLANNING ISSUES

Examining the major planning difficulties is crucial before making future plans. This chapter examined demographic, geographic, and socio-economic aspects of growth to comprehend both natural and human-caused expansion.

2.1 DEMOGRAPHIC SETTING OF THE UPAZILA

In 2011 the total population of the Amtali Upazila was 163,689 of which 79,708 were males and 85,779 were females. Analysing the population growth history, it is explored that in 1991, the total population of the Amtali Upazila was 1,63,244. Figure 2.1 clearly describing age-sex wise population distribution. Therefore, insight could be drawn that in the coming year Amtali needs more employment opportunity to sustain residence's livelihood and to support elderly dependent population.

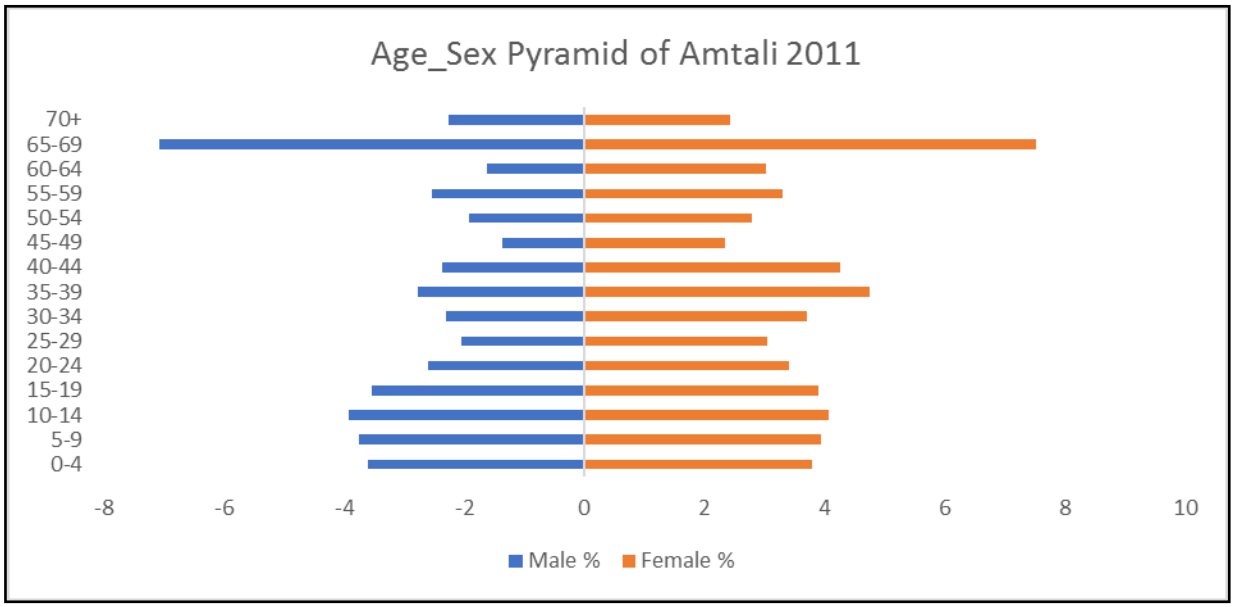


Figure 2.1: Age-sex pyramid of Amtali Upazila

Source: PKCP project, UDD, 2018

2.2 NATURAL RESOURCE

The villages of Amtali Upazila under Barguna districts surrounded by Payra River, Burishwar River, Andharmanik river, Gulishakhali river, Kukua river, Chawra river, Amtali River, Tiakhali River, Arapangasiya river, Don Kachupatra, Boro Bagir canal, Bagir Don.

Agricultural Resources: Ownership of agricultural land Landowner 53.25%, landless 46.75%. Main crops Paddy, wheat, potato, onion, pulse, vegetables. Extinct or nearly extinct crops Sesame, linseed, kaun. Main fruits Mango, jackfruit, papaya. Fisheries, dairies and poultries.

Fisheries Resources: Fisheries are one of the natural resources of Amtali Upazila. The livelihood of most people of this Upazila is dependent on fishery resources. In the Amtali Upazila, the amount of fish resources extracted from the river is higher than freshwater fish.

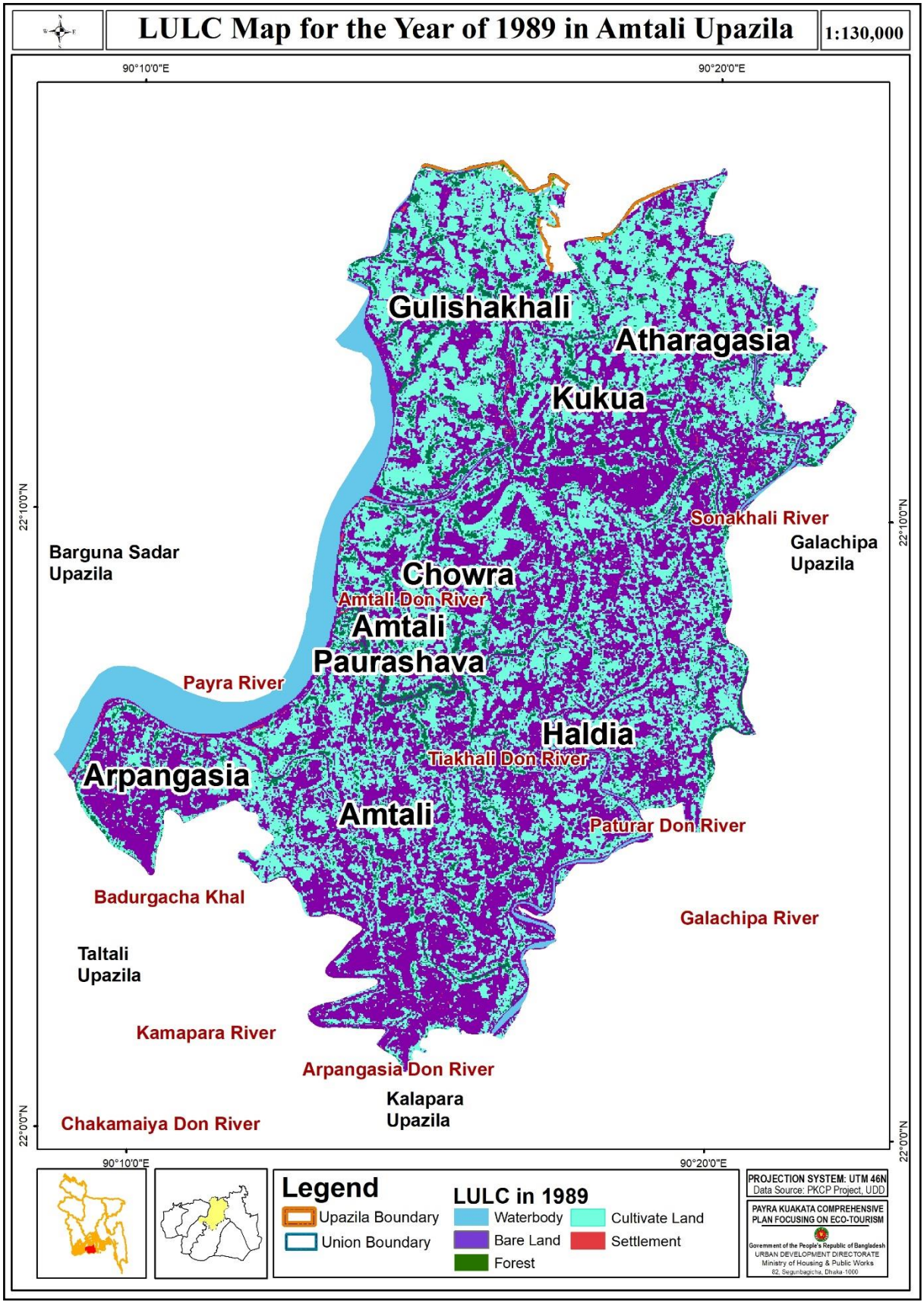
2.3 LAND COVER CHANGE

The study area has observed rapid changes in land use and landcover in the last 4 decades. Landsat satellite images of historical data over the study area are assessed from 1989 to 2021. Changes of different types of land use classes are assessed using satellite data. Below figures show land use map in 1989, 1999, 2009 and 2021. A summary the Upazila-wise changes in water bodies, forests, bare land, cultivable land, and Build up areas in the Amtali Upazila.

Table 2.1.: Land use/ Land cover (LULC) changes for Amtali Upazilas from 1989 to 2021

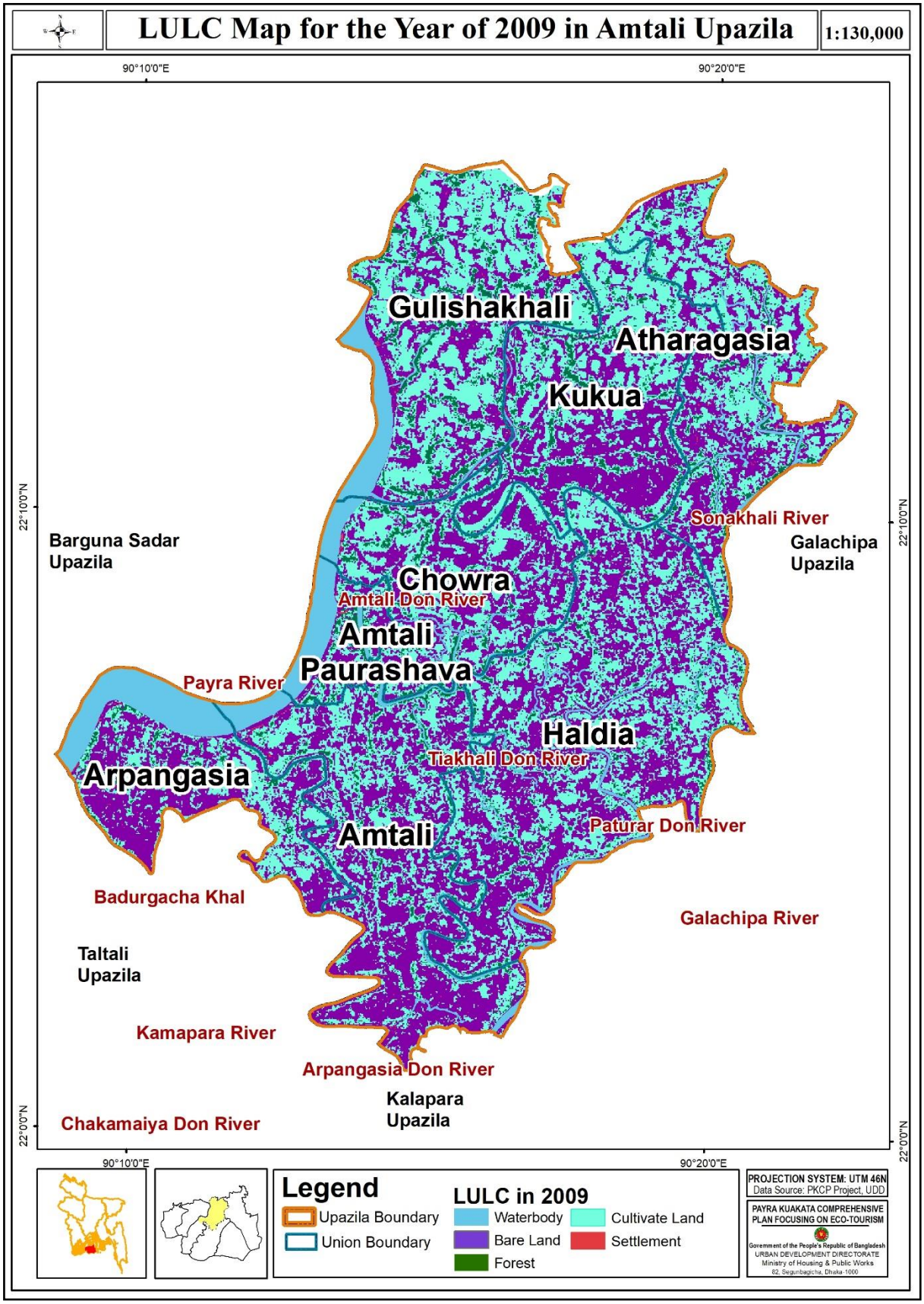
LULC type	1989	1999	2009	2021	Change	(%)
Water body	19.8477	19.9404	19.2474	19.3698	-0.4779	-2.41
Forest	8.4897	19.017	41.9634	49.662	41.1723	484.97
Bare land	167.5917	134.2827	75.915	44.4276	-123.164	-73.49
Cultivate land	106.5087	129.9078	165.8331	187.7661	81.2574	76.29
Build up land	1.2654	0.5553	0.7443	2.4777	1.2123	95.80

Source: PKCP Project, UDD,2022



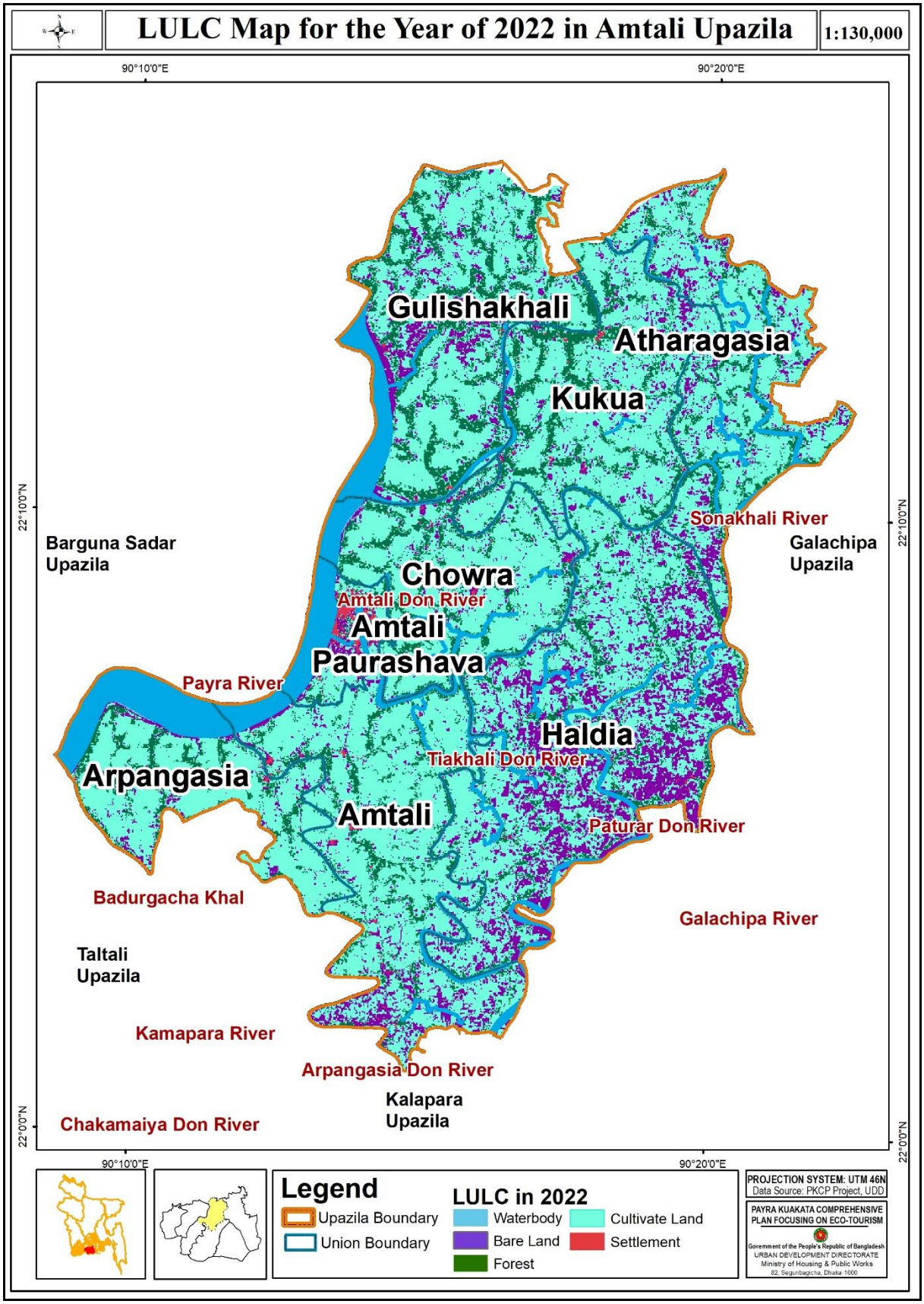
Map 2.1: LULC map of Project area for the year of 1989

Source: PKCP Project, UDD,2022



Map 2.2: LULC map of Project area for the year of 2009

Source: PKCP Project, UDD, 2022



Map 2.3: LULC map of Project area for the year of 2022

Source: PKCP Project, UDD, 2022

Map 2.4: LULC map of Amtali Upazila for the year of 2041

Source: PKCP Project, UDD,2022

From the above table bare land decrease 31082.13 acre, build up land increase 321.92 acre, cultivate land increase 20370.81 acre, Water body decrease 123.48 acre from 1989 to 2021.

2.4 HOUSING AND HOUSE BUILDING MATERIAL

It has been observed that people do not want to leave their houses for group shelters due to concern for their belongings and livestock. This causes higher casualties during cyclones. People in these disaster-prone areas make their own ways of surviving through housebuilding techniques and settlement patterns. Since traditional houses are made of indigenous materials with crude methods, the loss of life and property are enormous. With proper construction techniques, houses will be able to withstand storm surges, possibly increase survival rates and decrease property damage. The catastrophe is especially severe in this area because of the shape and nature of its coastline. Following house construction characteristics were found:

- RCC post and metal/wooden frames are dominant in structure.
- CGI/plain metal sheets are used as wall and roofing material.
- Timber used as door and window frames.
- Both pucca and semi-pucca plinths are found in structure.
- Bamboo mats/ tarpaulins are used under roofs in order to mitigate the heating.
- An additional semi-outdoor space known as “Pashchati” surrounds the main core house and helps in accommodating various service oriented functional requirements of households.

2.5 TOPOGRAPHIC CONDITION

The topography of a region describes its structural elements. Usually, these characteristics consist of natural formations like rivers, canals, ponds, etc. Roads, dams, and other man-made constructions might also be present. The topographic map was primarily interpreted in terms of human settlement, modes of transportation and communication, land use, relief, and drainage, etc. Amtali Upazila is located in Bangladesh's coastal region. In comparison to other places of Bangladesh, the Upazila is on a lower plateau. The hydrodynamic and bio-geomorphological conditions in coastal locations are quite diverse, and there are significant socio-economic and ecological challenges as well. They are immediately impacted by the rise in sea level, the frequency and intensity of storm surges, and the recurrence of coastal river flooding caused by climate change.

2.6 DISASTER AND VULNERABILITY

Amtali Upazila under the Barguna coastal districts are susceptible to various natural calamities. The main risks are flooding, storm surge, cyclones, saline intrusion, sea level rise, tidal floods, bank erosion, and waterlogging. Because of the shallow depth of the continental shelf, the energy of the cyclone is forced to come (Sadeque, 2018).

2.6.1 Water Logging and Drainage Congestion

Amtali is the mostly affected districts in water logging and drainage congestion. Main reasons of water logging are excessive rains, inadequate drainage networks, siltation, encroachments, dumping of wastages and polyethylene bags and the absence of pumping facilities etc. Cleaning up dumping wastages, enhancing drainage capacity, taking strong actions against encroachments, installing pumping facilities should be proposed to solve or at least minimize the issue. In addition, carrying out research for finding out new options for removing drainage congestion and water logging. Ensure regular and timely O&M of water management and drainage (sluices, regulators, culverts, etc.). Propose sites for relevant structures and embankments to reduce drainage issues.

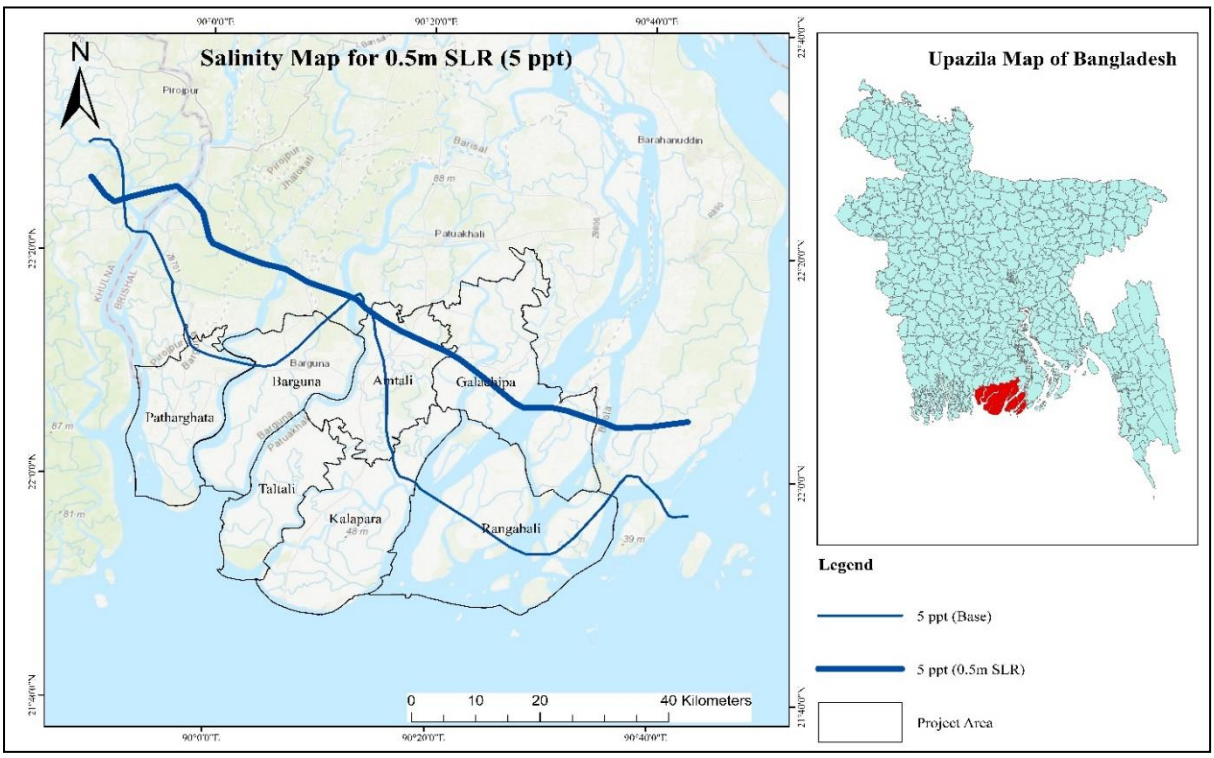
2.6.2 Salinity Intrusion

The salinity levels in Amtali Upazila vary depending on the time of year and the location within the Upazila. During the dry season (November to April), when there is less rainfall and freshwater flowing into the area, salinity levels tend to be higher. Conversely, during the Monsoon season (June to September), when there is more rainfall and freshwater, salinity levels tend to be lower. Analyzing secondary information from DoE for an SLR of 0.50 m, Amtali will be affected by 1 ppt under 0.5 m SLR. The salinity levels in Amtali Upazila range from 5 to 20 parts per thousand (ppt) during the dry season and from 0.5 to 5 ppt during the monsoon season. These levels can vary depending on factors such as distance from the coast, elevation, and proximity to freshwater sources such as rivers and canals.

Table 2.2: Salinity coverage of Project area for different scenario of 0.5m SLR

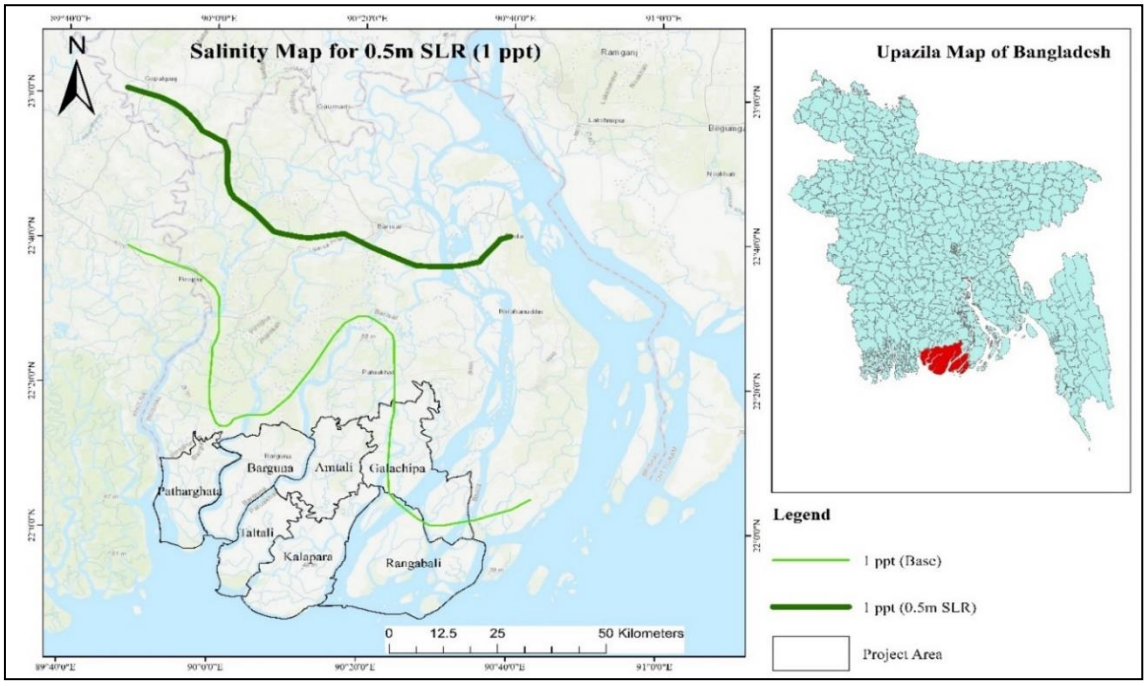
Upazila	1 ppt				5 ppt			
	baseline		0.5 SLR		baseline		0.5 SLR	
	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%
Amtali	311.81	100	311.81	100	136.02	43.62	265.43	85.12

Source: PKCP Project, UDD, 2022



Map 2.5: Salinity Map of 5 ppt for 0.50 m SL

Source: PKCP Project, UDD, 2022



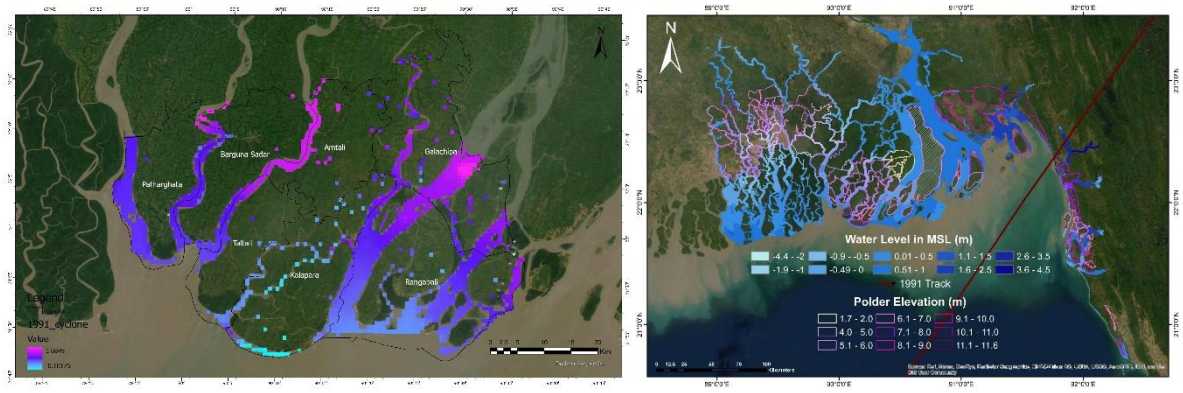
Map 2.6: Salinity Map of 1 ppt for 0.50 m SLR

Source: PKCP Project, UDD, 2022

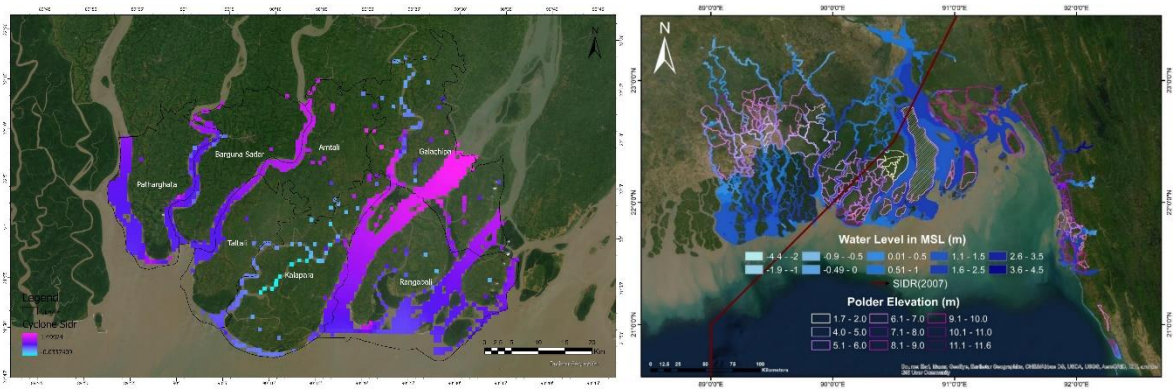
2.6.3 Sea Level Rise

According to various studies and reports, the sea level in Bangladesh has been rising at a rate of around 7 millimetres per year, which is higher than the global average. This rise in sea level has significant impacts on the coastal communities of Amtali Upazila and the surrounding areas, including increased coastal erosion, inundation of low-lying areas, and saltwater intrusion into freshwater sources.

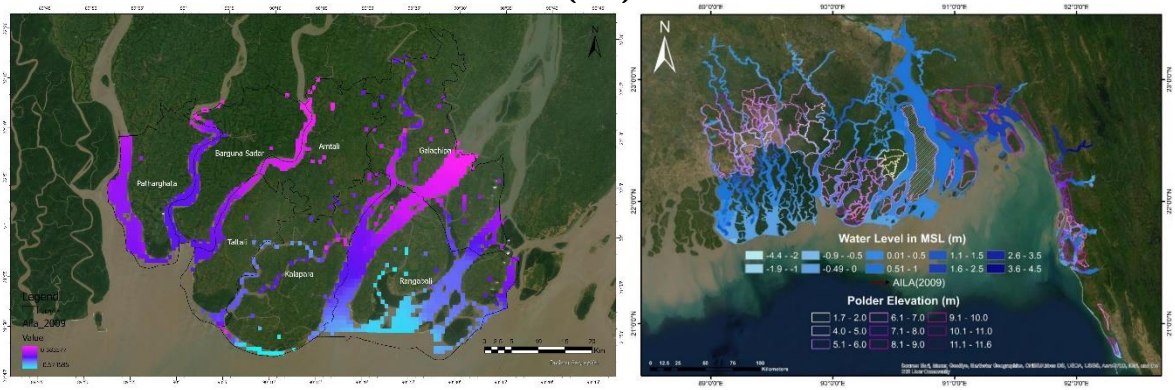
Simulated water level in the study area during landfall time along the coast with polder level in meter MSL is shown from Map 2.5 to 2.8.



Map 2.7: Simulated water level in m MSL for 1991 cyclone in the study area

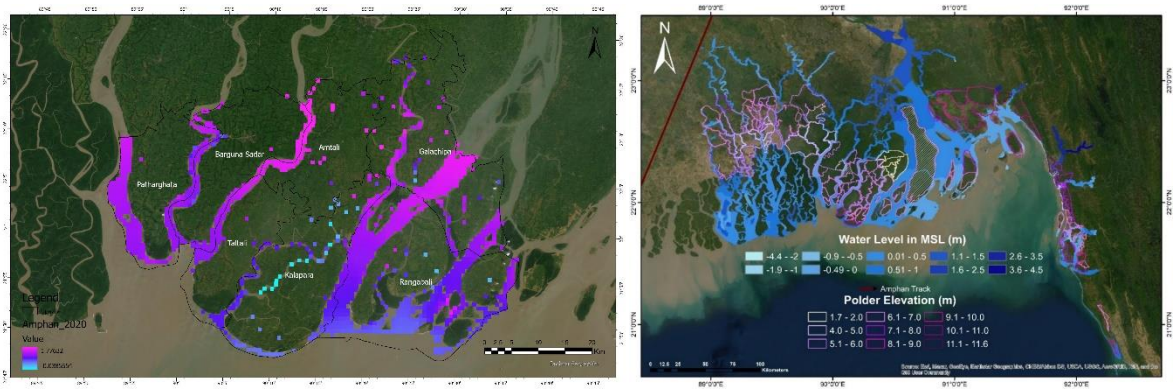


Map 2.8: Simulated water level in m MSL for cyclone Sidr in 2007 in the study area (left)



Map 2.9: Simulated water level in m MSL for cyclone Aila in 2009 in the study area (left)

Source: PKCP Project, UDD, 2022



Map 2.10: Simulated water level in m MSL for cyclone Amphan in 2020 in the study area (left)

Table 2.3: Maximum Strom Inundation Level in Amtali Upazila

Upazila	Maximum Strom inundation level (m)	Maximum Strom inundation level (m) under 0.5m SLR scenarios
Amtali	1.73	2.23

Source: PKCP Project, UDD, 2022

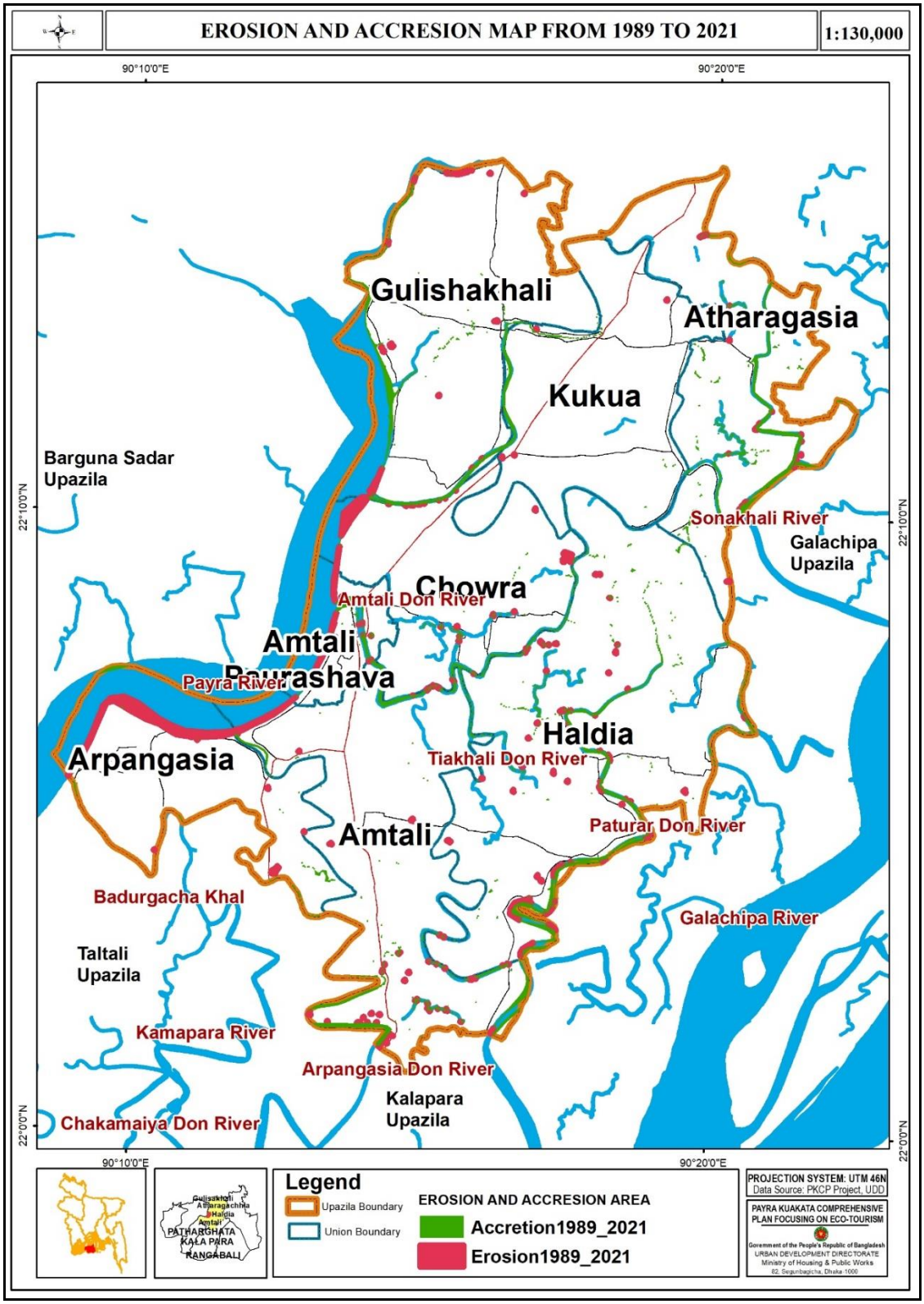
2.6.4 Erosion and Accresion of Amtali Upazila

Amtali Upazila is surrounded by numerous river. So, there erosion area is 337.71 acre and accresion area is 1386.55 acre from the year 1989 to 2021 based on satellite image analysis.

Table 2.4: Accretion and erosion areas between 1989 and 2021 in Amtali Upazila

Upazila	1989-1999		1999-2009		2009-2021		1989-2021	
	Accretion	Erosion	Accretion	Erosion	Accretion	Erosion	Accretion	Erosion
Amtali	2.26	5.28	11.08	6.28	0.91	0.75	5.12	1.35

Source: PKCP Project, UDD, 2022



Map 2.11: Erosion and accretion between 1989-2021 based on satellite image analysis

Source: PKCP Project, UDD, 2022

2.6.5 Climate Change and Vulnerability Assessment

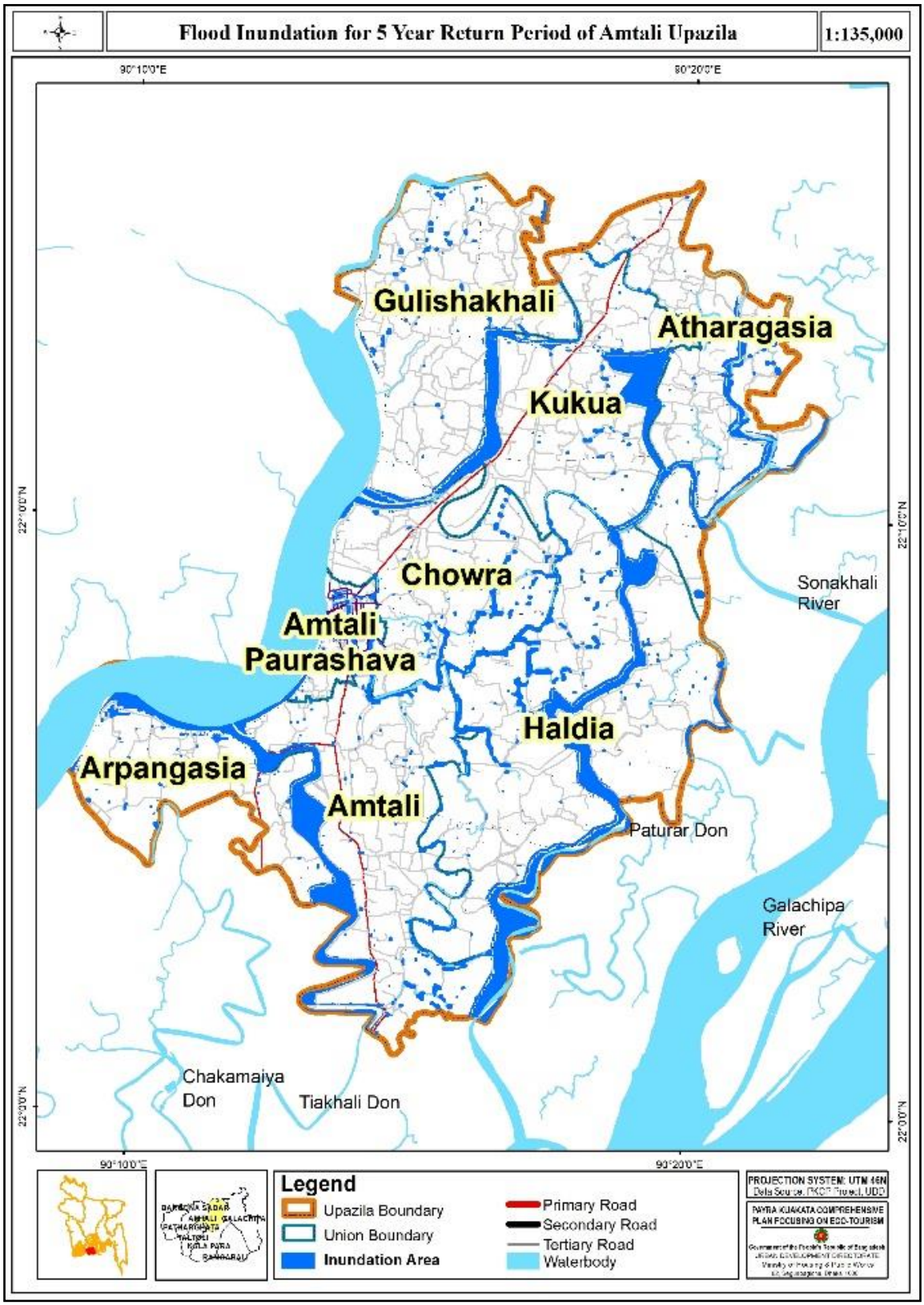
A community-led strategy is sometimes a better option because it is local village people who are often the real experts on climate change. In saline areas, this may involve using ancient local technologies such as the huge locally fired clay pots that harvest and store rainwater from roofs, the selection of saline-tolerant rice varieties that have traditionally been cultivated by the sea, or belts of salt-tolerant trees such as mangroves planted along coastal areas to prevent saline intrusion. Due to severe saline issues, the soil became unsuitable for agriculture production, changing the land use pattern. (Kabir and Eva, 2014). Climate change will exacerbate infrastructure vulnerability on its own, but increased storm surges associated with intensifying cyclones represent the biggest threat for all forms of infrastructure.

2.6.6 Cyclone and Storm Surge

Cyclones are increasing in Amtali Upazila. From the historical trend analysis, it is observed that a severe cyclone strikes on average every three years. Twenty-one tropical cyclones (wind speed >117 km/hr) and severe cyclones (wind speed between 87 to 117 km/hr) struck the between 1960 and 2010 (MoEFCC, 2018). Of these, 33% happened in the pre-monsoon season, while the remaining 67% occurred in the post-monsoon season. Hazards such as excessive rainfall, polder or coastal embankment breach, deteriorated water quality, saline water ingress, internal displacements, etc. have been predicted to increase if storm surge heights increase, which will stimulate crop damage, ecosystem degradation, biodiversity extinction, forest damage, habitat condition damage, loss of houses and damage to properties, WASH problems, disruption of the urban economy, gender and domestic violence, food and medicine crises, human deaths, loss of livelihoods, destruction of livestock and poultry farms, feed shortage of animals, loss of production in livestock sector and death of livestock and poultry.

2.6.7 Inundation Senario of Amtali Upazila

The estimated values of flood levels for different return periods for the nearby gage stations are interpolated with spline with barrier algorithm techniques and created flood scenario raster images for 2.33-, 5-, 20-, 50-, and 100-year return periods for the projected area. After the preparation of two raster datasets i.e., elevation and the return period-based water levels arranged as input into the Raster Mathematics module of Spatial Analysis Tools in ArcGIS 10.8. The Subtraction operation was implemented by taking away the values of the water level from the elevation values. The result of the inundation analysis was mapped where negative values of the map indicate the inundated area while the remaining values indicate the non-inundated area. The derived flood inundation maps corresponding to 5-, 20-, 50- and 100-year return periods.



Map 2.12: Flood inundation map for the 5 year return period

Source: PKCP Project, UDD, 2022

Map 2.13: Flood inundation map for the 50-year return period

Source: PKCP Project, UDD, 2022

Map 2.14: Flood inundation map for the 100-year return period.

Source: PKCP Project, UDD, 2022

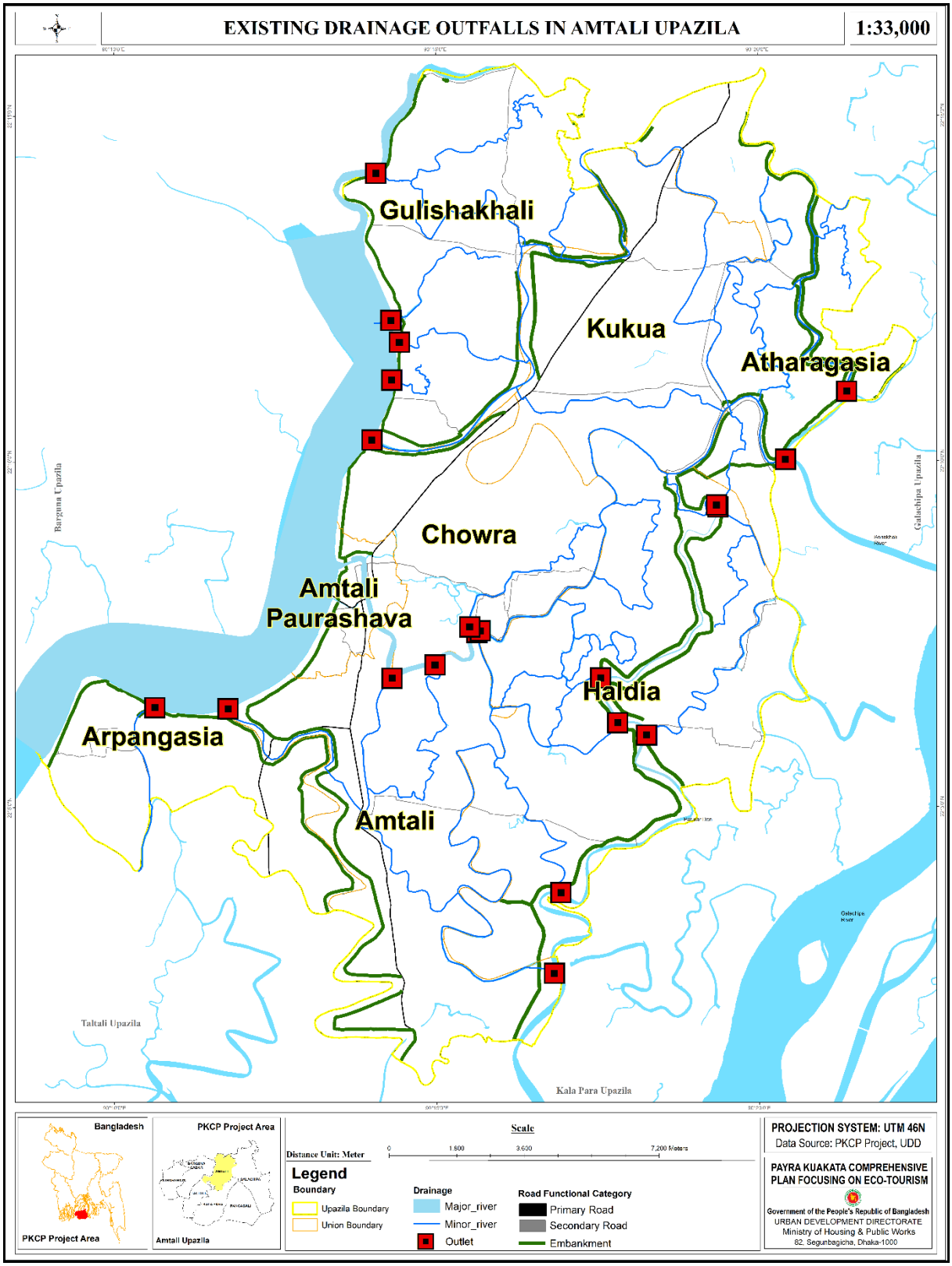
The analysis of the spatial extent of the inundated and non-inundated areas within the project area. The flood inundation mapping suggests that the project area which polder is free from river flooding. However, it can be vulnerable due to inundation caused by cyclonic storm surges.

2.6.8 Flood Control and Drainage Management

The area is also vulnerable due to extreme precipitation, especially during cyclones that occur during the pre-monsoon and post-monsoon periods. The extreme precipitation and storm surges can cause drainage problems in the area as well. The IDF curves and hyetographs are used for rainfall-runoff analysis to estimate peak runoff rates. The IDF curves are used for rainfall-runoff analysis by the rational method. The rainfall intensity used is for a duration equal to the time of concentration. The time of concentration is the time required for a drop of water falling on the most remote part of the drainage basin to reach the basin outlet. The gage station nearest to project site at Amtali is located beside the Amtali Don River. These data would be used to assess the extent of inundation due to floods and drainage problems.

Steps of Flood Control and Drainage Management

- Large-scale flood control schemes
- Small-scale flood control
- Estuary development to mitigate against river erosion and prevent saline water
- intrusions, including land settlement
- Building new and enhancing existing drains, taking into account 2040 rainfall
- projections.



Map 2.15: Drainage outfalls of the canals and tidal creeks

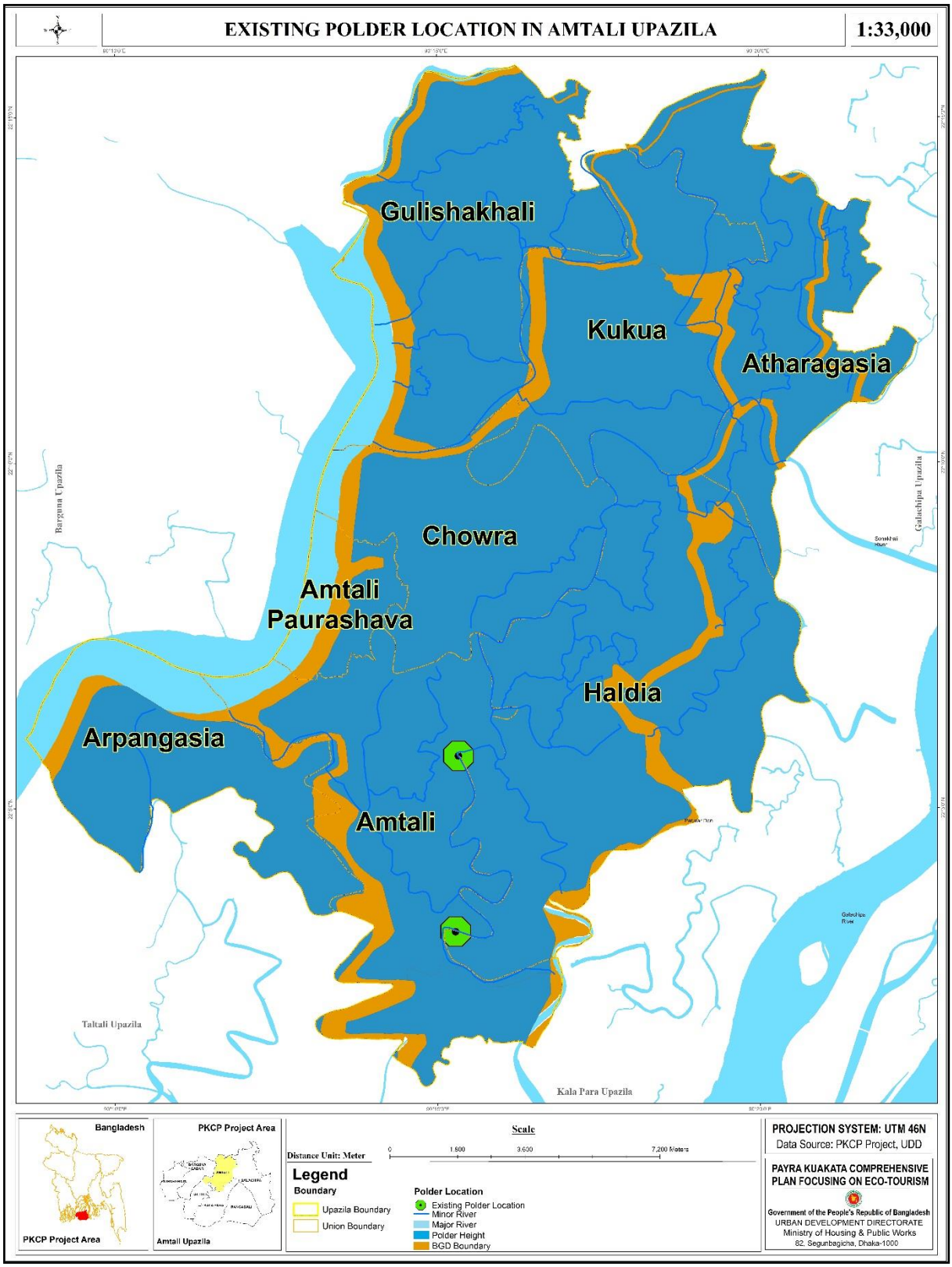
Source: PKCP Project, UDD, 2022

2.6.9 Mitigation Measures

Amtali Upazila faced different types of hazard like cyclones, storm surges, floods, wind storms, etc. Public and private investment program is required to create resilient infrastructure, including drainage and flood control, water supply, sanitation, cyclone shelters, emergency access roads and bridges, slum improvements, bus terminals, boat landings, and markets. Program should be assessed for climate risk on the basis of agreed technical criteria and climate projections for 2040 in detailed designs. The institutional capacity to integrate climate and disaster risks into urban and regional planning and infrastructure management also needs to be addressed. The priority investment program for mitigating natural disasters and ensuring the safety and protection of the coastal population should focus on the following:

Coastal Embankment Construction and Rehabilitation, including:

- Protection from saline water
- River bank and khal protection schemes
- Rehabilitation of polders, as well as an extension of polders
- Construction of new embankments
- Protection and extension of irrigation systems
- Excavation of river and branch channels
- Multipurpose cyclone shelter centers



Map 2.16: Polder Locations in Amtali Upazila

Source: PKCP Project, UDD, 2022

2.6.10 Riverbank Erosion Control

Climate change is likely to increase rainfall in the Payra River in the monsoon season. This is likely to cause further instability in the already unstable river system. Higher rainfall in upper catchments may also increase sediment movements. Overall, river systems are expected to become more unstable as a result of climate change. Effective River training works is the only option as an adaptation measure to control river erosion.

2.7 COMPOSITE HAZARD OF AMTALI UPAZILA

Project area is one of the hazard prone area, a composite hazard map is prepared considering the above scenarios. The composite hazard map is prepared using four main hazard components that are prominent in the study area. These are – 1) Salinity level of 1ppt, 5ppt, 25ppt for 0.5m SLR, 2) Maximum inundation of Strom surge water level (m), 3) Erosion-Accretion from 1989 to 2021 and 4) Flood inundation for 20-year return period.

A normalization statistics equation is used to convert all the layer values from 0 to 1. After normalizing all values, all the layers of hazard component are reclassified into three classes i.e., 0.0 to 0.329, 0.33 to 0.67, 0.67 to 1. The reclassify score of all hazard layers are given in table below. Then Normalization statistics equation is used to convert all the layer values from 0 to 1. The Normalization equation is given below.

Standard Normalization = (Value-Min)/(Max-Min)

After normalizing all values, all the layers of hazard component are reclassified into three classes i.e., 0.0 to 0.329, 0.33 to 0.67, 0.67 to 1. The reclassify score of all hazard layers are given in table below. A summary of the scores of different major hazards over the study area after normalizations is presented in Table 10 12.

Table 2.5: Scores of different major hazards after normalizations

Salinity		Erosion-Accretion		Strom surge inundation		Flood Inundation	
Reclass	**Score**	**Reclass**	**Score**	**Reclass**	**Score**	**Reclass**	**Score**
0.0 -0.33	1	0.0 -0.33	3	0.0 -0.33	1	0.0 -0.33	3
0.33-0.67	2	0.33-0.67	2	0.33-0.67	2	0.33-0.67	2
0.67-1.00	3	0.67-1.00	1	0.67-1.00	3	0.67-1.00	1

Source: PKCP Project, UDD, 2022

Map 2.17: Composite Hazard Map of Amtali Upazila

Source: PKCP Project, UDD, 2022

2.8 ECO-TOURISM POTENTIALITY

In order to clarify and carry out particular development measures in the tourism sector over a specific time period, including government support for development, a timely and tourism industry-friendly tourism master plan is necessary. Due to the distinctive qualities (such as social, cultural, and political) of each region within the nation, the experts' panel underlined the need for a regional tourist policy. Additionally, the experts support a bottom-up strategy, suggesting that extra layers can be established at the divisional or local levels to assist site-specific management. In Amtali Upazila, Arpangasia union have great potential for ecotourism.

2.9 ECONOMIC CONDITION OF THE UPAZILA

Amtali Upazila has a poor economic situation. One of the primary economic pillars in this area is the enormous production of watermelons and fishing. The majority of the locals in this Upazila rely on fisheries for their living. The amount of fish resources taken from the river in the Amtali Upazila is more than the amount taken from freshwater fish. This Upazila's trade and commerce are primarily dependent on fishing. Agriculture is the second most important economic sector. As a result, rice business is conducted here. A strong demand is made for local residents to have alternative sources of income.

2.10 LANGUAGE AND CULTURE

The terrain and location of the Upazila have influenced the development of the language and culture of its residents. On the basis of seasonal celebrations like Nowkabaich (boat recessing), Baishakhi Mela, Pausch Sanchini, Maharram Mela, etc., cultural events are dispersed throughout Amtali Upazila.

2.11 HAT BAZAR

Growth Centres (GC) are those areas where maximum economic growth in a certain region is expected. For the study area, it is assumed that most economic activities in the present scenario take place in the major growth centres. Considering existing economic function growth centers has been scored to identify major growth centers, where function includes commercial activity, service facilities and manufacturing and processing. Functional hierarchy has been explored considering union wise population-which means the ration between union population and economic functions. However, it is expected that lower ranked GCs will also develop to be of the same attributes as those of the existing GCs with the overall development of the study area. Following are some gross findings on existing growth centers:

- **Catchment Area:** Growth centres serve mainly the nearest and surrounding unions.
- **Road Network:** Every growth centre is connected with mainly union roads. Some GCs are accessible via waterway. Some other village roads are connected with the prominent access road. These connected roads ease the accessibility to other areas.
- **Road Condition:** Most of the roads are Pucca, Katcha and Brick soling roads, which are in good condition. During a flood, the road goes under and becomes muddy. Condition of launch ghat and ferry ghat is not good.
- **Parking Facility:** There is no parking facility in the growth centres. Vehicles are parked on the street. There are some bus depots where people can access the growth centre by bus. There are also some ghats for goods loading and unloading.
- **Mode of Travel:** The major modes of travel are motorbike, easy bike, auto-rickshaw, three-wheeler, Mahindra, cycle-rickshaw, bicycle, bus etc. In the waterway, trawler, boat and launch areas are available to travel.

Table 2.6: Following table illustrating the list of growth center within Amtali Upazila

Sl.	Name	Union_Name	Name	Union_Name
1	Charghat Bazar	Amtali	Shakharia Bazar	Atharagasia
2	Pujakhola Bazar	Amtali	Purbo Chondra Bazar	Chowra
3	Kholyan Market	Amtali	Gazi Market	Chowra
4	Fokirbari Bazar	Amtali	Chalitabunia Bazar	Chowra
5	Khuriar Kheyaghat Bazar	Amtali	Talukder Bazar	Chowra
6	Tujir Bazar Haldia	Amtali	Ghatkhali Bazar	Chowra
7	Mitha Bazar	Amtali Paurashava	Khekuani Bazar	Gulishakhali
8	Tarikata Bazar	Arpangasia	Goshkhali Bazar	Gulishakhali
9	Arpangasia Bazar	Arpangasia	Purbo Gulishakhali Bazar	Gulishakhali
10	Chorokgachia Bazar	Arpangasia	Gulishakhali Bazar	Gulishakhali
11	Ghopkhali Chan Mia Market	Arpangasia	Kalagachia Bazar	Gulishakhali
12	Ghopkhali Bazar	Arpangasia	Paschim Chila Bazar	Haldia

Sl.	Name	Union_Name	Name	Union_Name
13	Gazipur Bazar	Atharagasia	Kanaimridha Hat	Haldia
14	Budhbarer Bazar	Atharagasia	Uttor Purbo Chila Bazar	Haldia
15	Sonakhali Bazar	Atharagasia	Dakshin Toktabunia Bazar	Haldia
16	Gerabunia Bazar	Atharagasia	Tepura Bazar	Haldia
17	Atharogachia Shukrobarer Bazar	Atharagasia	Julekhar Hat Bazar	Haldia
18	Selimer Hat	Atharagasia	Dafader Bazar	Haldia
19	Chawla Bazar	Atharagasia	Nachnapara Gramo High School Bazar	Haldia
20	Brick Field Bazar	Atharagasia	Nosor Uddin Hawladar Bazar	Kukua
21	Subondhir Bazar	Haldia	Puran Bazar	Kukua
22	Kukua Bazar	Kukua	Sultan Bazar	Kukua
23	Amargachiya Market	Kukua	Hazar Takar Badh Bazar	Kukua
24	Kukua Union Parishad Bazar	Kukua	Cunakhali Market	Kukua
25	Shaheb Bari Bazar	Kukua	Mohishkata Bazar	Kukua

Source: PKCP Project, UDD, 2022

Map 2.18: Existing Hat/Bazar of Amtali Upazila

Source: PKCP project, UDD, 2022

2.12 AGRICULTURAL CROPPING PATTERN

The economy of the Amtali Upazila is dominated by agricultural activities. Most of the households are engaged in farming activities that produce varieties of crops namely local and HYV of rice such as ayus, amon, boro, wheat, vegetables, spices, cash crops, pulses and others.. Water melon is widely produced in the whole area of Amtali Upazila. Fish of different varieties abound in this district which enjoys the advantages of marine fishing. Moreover, Bangladesh Fish Development Corporation in this Upazila has influence for the development of fish processing industries. Hilsa fish is abundantly available in this Upazila. Conducting a workshop with union level agricultural officer it is explored that about 1% of the agricultural lands are single cropped, others are double cropped and a very few lands are triple cropped.

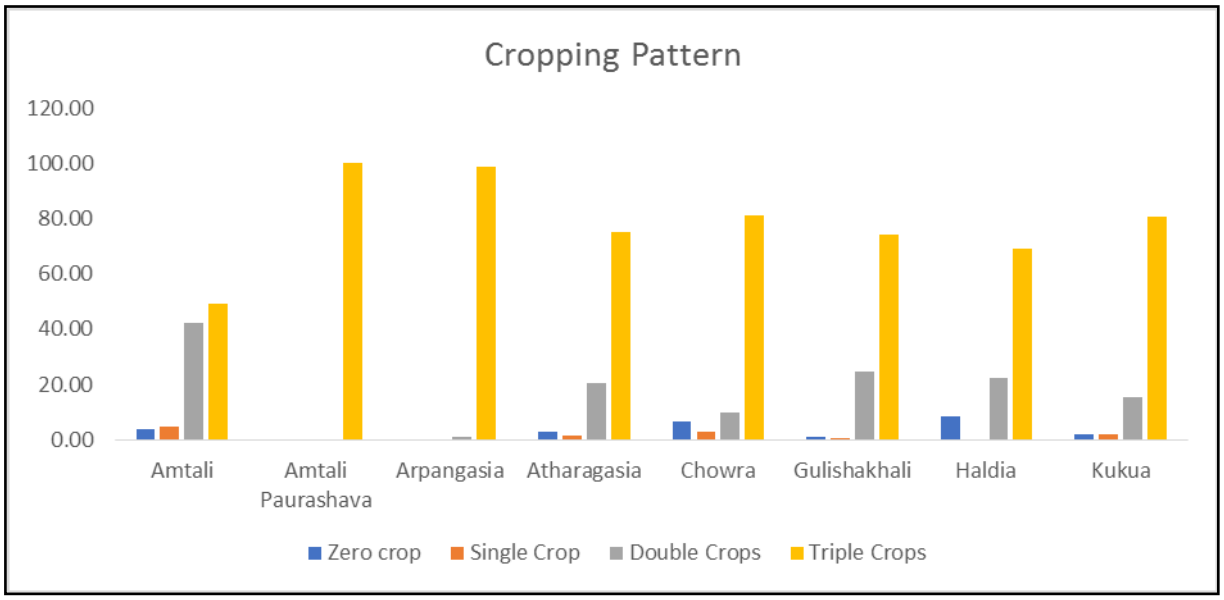


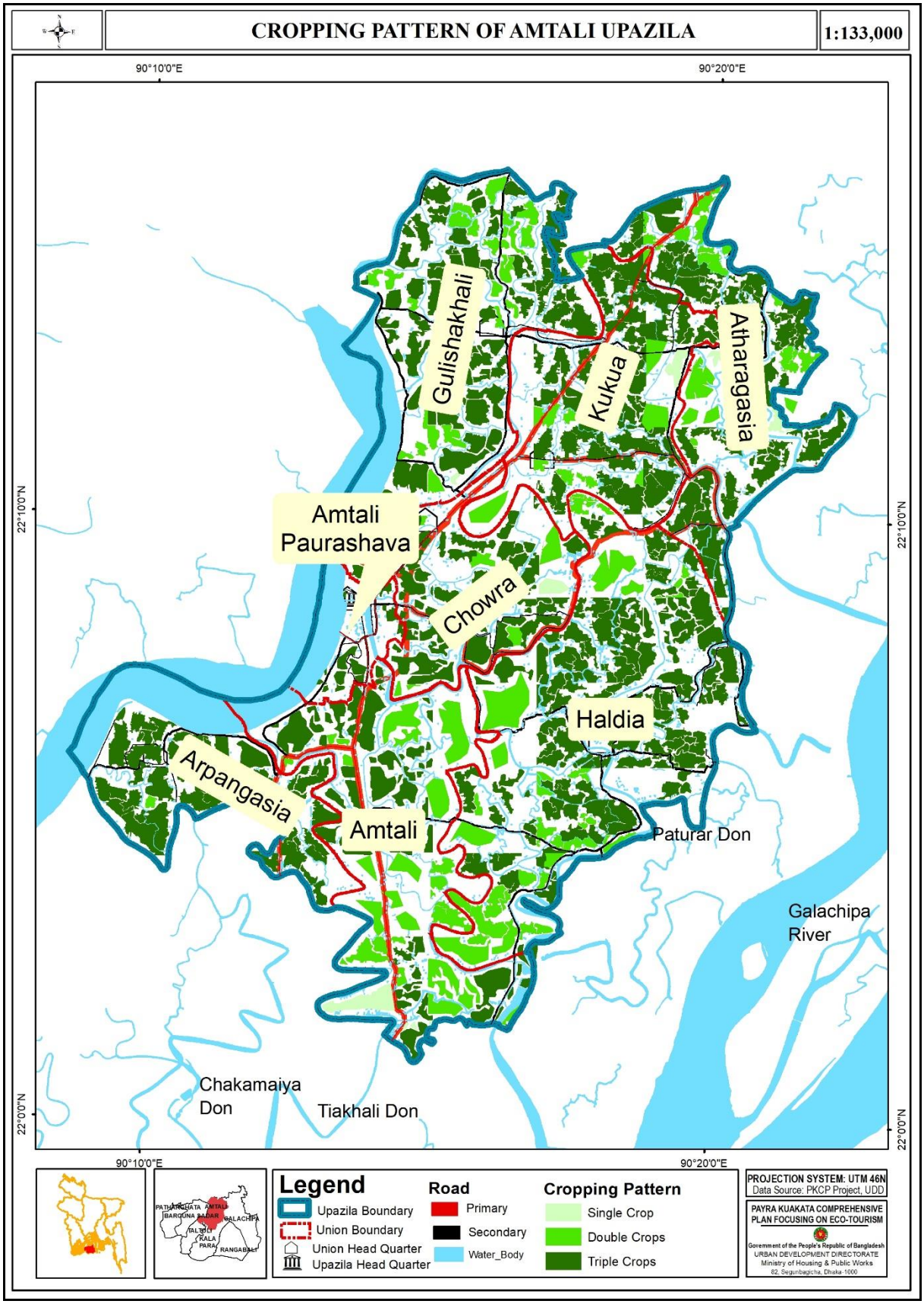
Figure 2.2: Cropping Pattern Map of Amtali Upazila

Source: PKCP Project, UDD, 2022

Table 2.7: Cropping Pattern of Amtali Upazila

Cropping Pattern	Name of Crop	Area (Acre)	%
Single	Amon	515.72	1.59
Double	Aus, Amon	7108.81	21.99
Triple	Aus, Amon, Robi/Mug Dal	24698.40	76.41
Total		32322.93	100

Source: PKCP Project, UDD, 2022



Map 2.19: Cropping Pattern Map of Amtali Upazila

Source: PKCP Project, UDD, 2022

2.13 WATER, SANITATION AND HYGIENE

From socio-economic sample survey it is explored that Tube-well (70.69%) is the main water source for the people of Amtali paurashava. The second main source of water in paurashava area is pond water. Without these two sources in paurashava area people collect water from own Deep tube well, rain water and pump.

Pipeline water service is not available in Amtali Upazila. Tube well is the main water source for the people of Amtali Upazila. About 99% of the people are dependent on their personal Tube Well as a clean source of drinking water. The main problem related to water collection in Amtali Upazila is dominated by location of sources far away from the people's resident. Secondly, people also mention spending long time during water collection as their water collection problem. tube-well vs. walking distance of household also demonstrating the same.

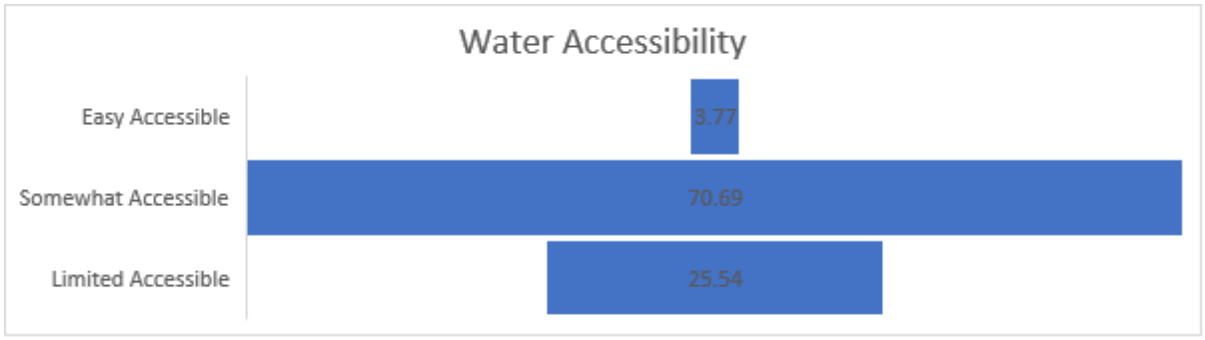
Easy accessibility to a water source: drinking water from an improved water source that is accessible on premises, available when needed. -3.77%

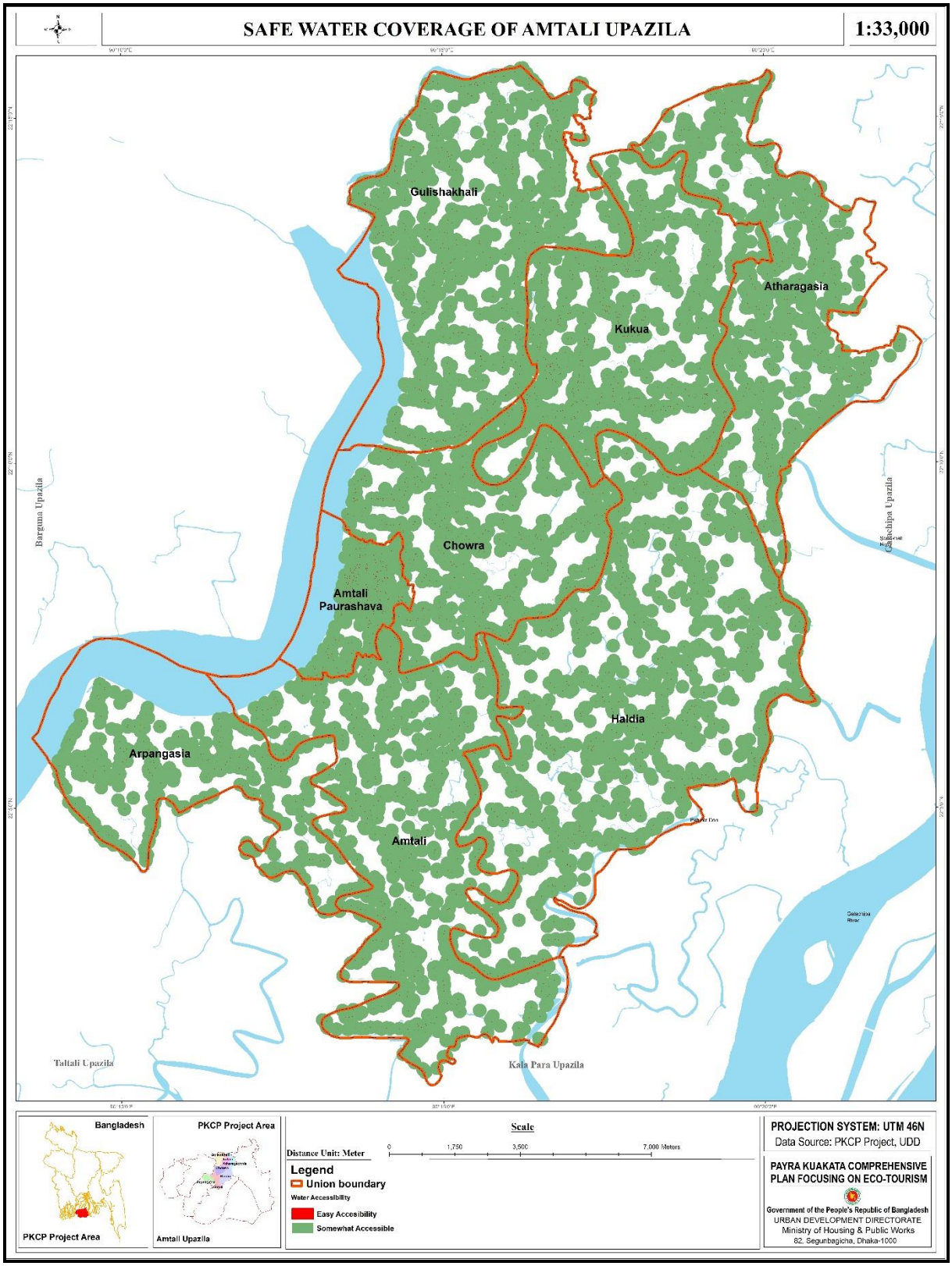
Somewhat accessibility to a water source: drinking water from an improved source, provided collection time is not more than 30 minutes for a roundtrip, including queuing. -70.69%

Limited accessibility to a water source: drinking water from an improved source for which collection time exceeds 30 minutes for a roundtrip, including queuing. -25.54%

Based on tube-well vs. walking distance of household, it is explored that only 70.69 percent household has somewhat access to quality drinking water source only 3.77 percent has easy accessibility. From physical feature survey it is found that 82.97 percent toilets are in average condition, 15.44 percent are in poor condition, only 1.59 percent were in good condition. This scenario clearly illustrates the sanitation facility is low in quality.

Figure 2.3: Accessibility to Drinking Water Source



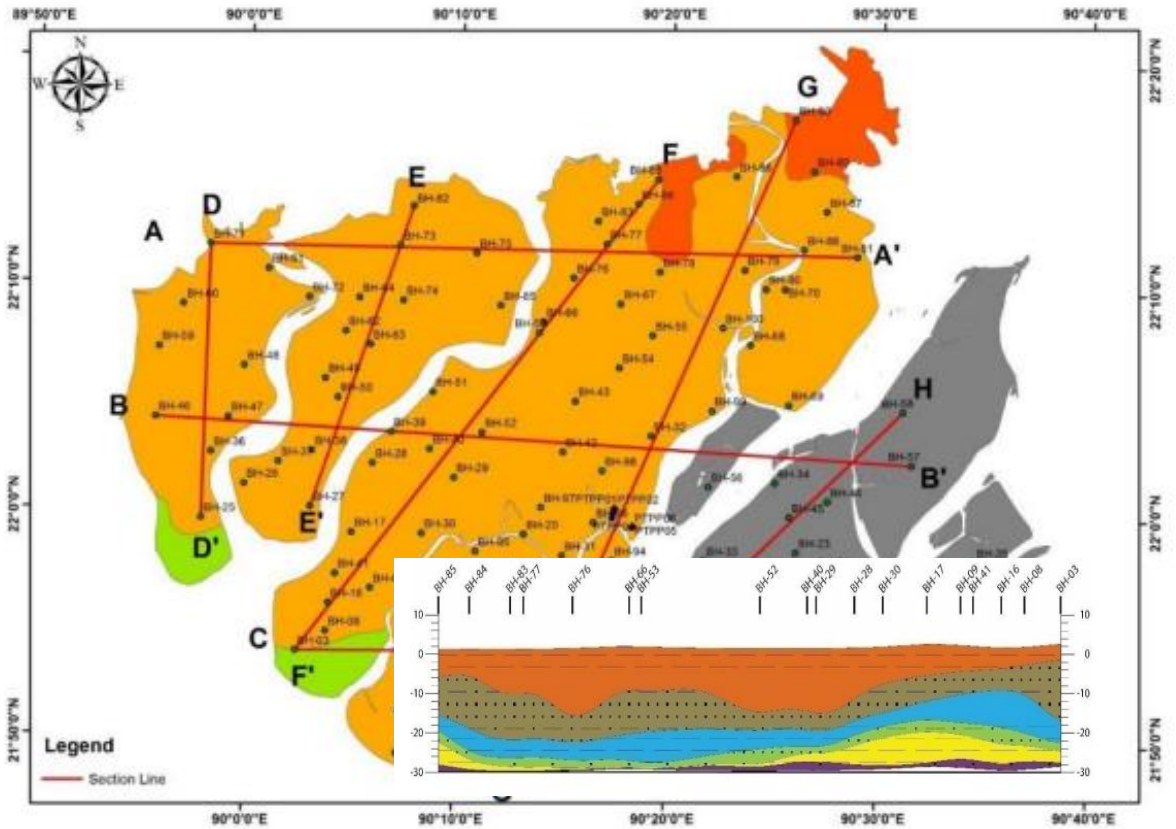


Map 2.20: Safe Water Coverage of Amtali Upazila

Source: PKCP project, UDD, 2022

2.13 HYDRO-GEOLOGICAL ANALYSIS

Subsurface geology is the study of the physical properties and location of rock and soil found below the ground surface. Any development work requires assessment of the availability of water and its quality. Our geophysical investigation and borehole data suggest that the aquifer system in this area is highly heterogeneous. However, depending on the relative sandiness the aquifer system down to a depth of 300 m can be subdivided in to three depth zones. The shallowest depth zone extends around 70 m on average. The intermediate zone is the thickest and lies between 70 m and 250 m. The deepest zone lies below 250 m. Distribution of underlying sediments especially clay layers change throughout the section. Thus, any uniform trend of thickness is difficult to establish. Subsurface lithology is dominated by sand grains particularly fine-grained sand. A thick deposition of clayey silt spotted at 130 m depth which is coexisted with clay layer of the Amtali Upazila. Clay layer below top soil unit is almost 20 m thick in the south-west part. The layer is discontinuous at several places and shows no uniformity in thickness variation. Such uneven distribution is also found for other underlying layers. However, there is a fine-grained sandy soil layer between top soil and clay layer is absent in Amtali area. Amtali is dominated by medium grained sand.

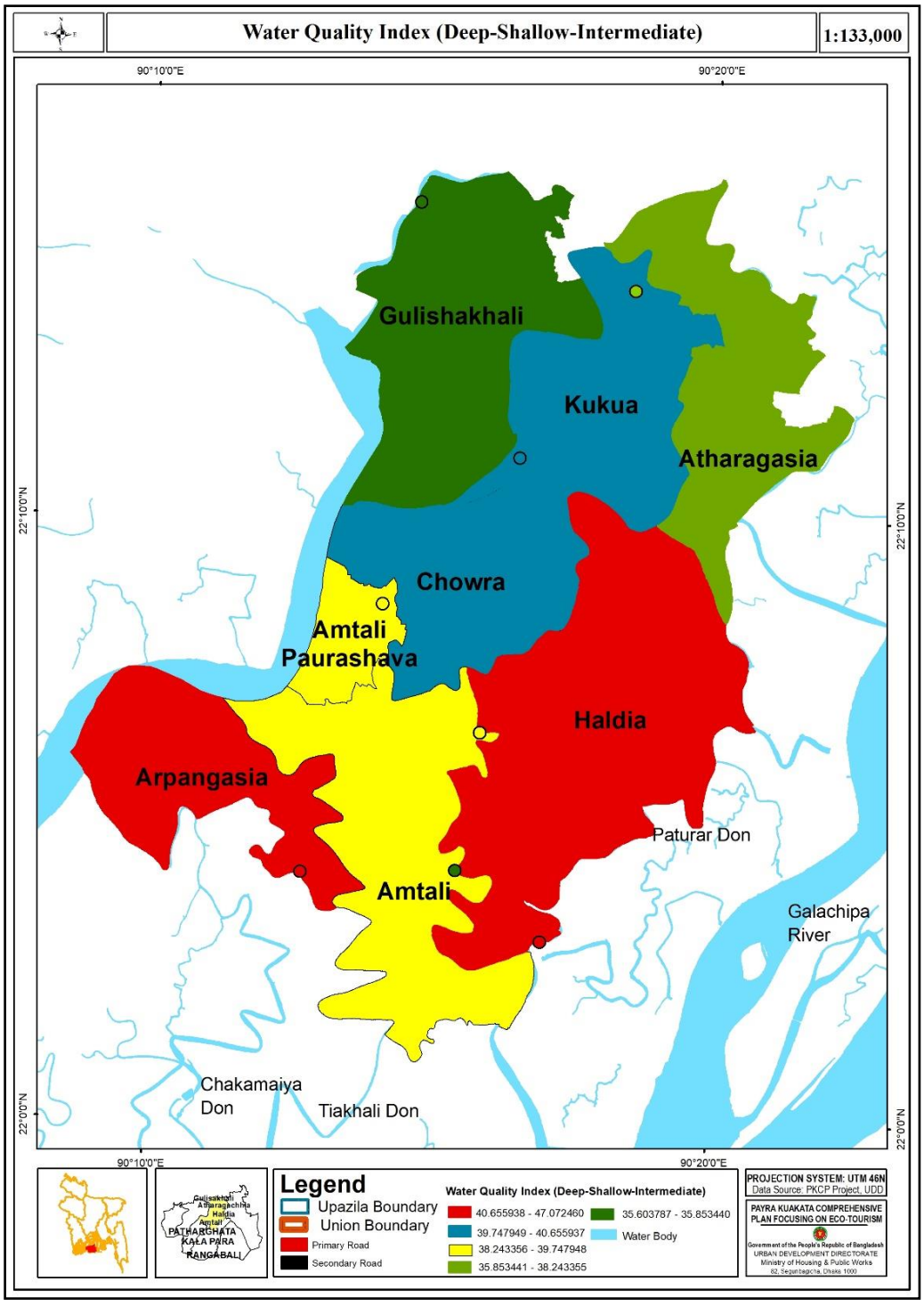


Map 2.21: Subsurface lithology of Amtali Upazila

Source: PKCP Project, UDD, 2022

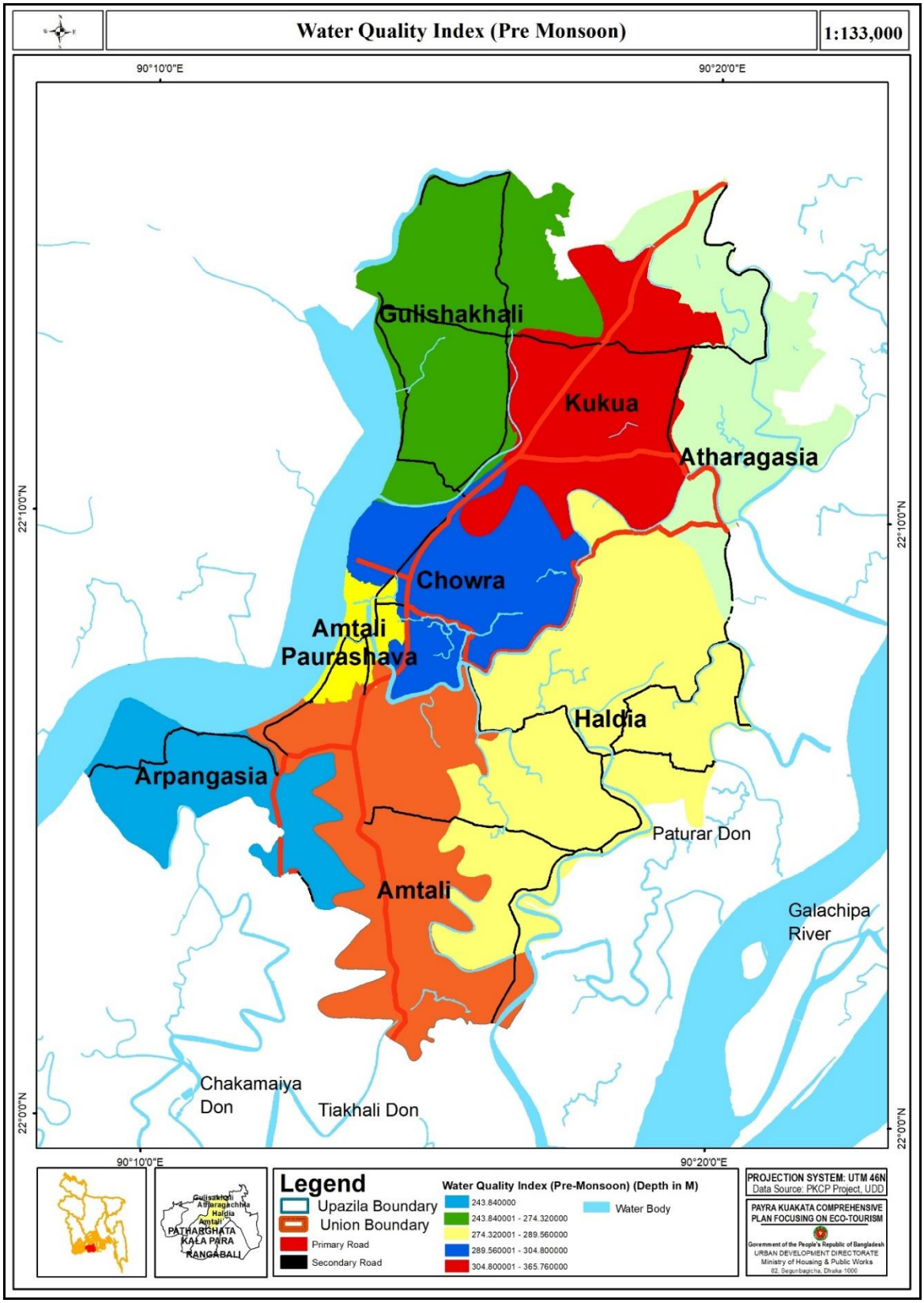
2.13.1 Water Quality Index

The shallow aquifer water level reveal that 35m is not appropriate for drinking, according to the WQI. The value (40-47)m demonstrated that good grade water in the intermediate aquifer in arpangasia and haldia union. Poor water quality can be found throughout the union.



Map 2.22: Water Quality Index (Deep-Shallow-Intermediate) of Amtali Upazila

Source: PKCP project, UDD, 2018



Map 2.23: Water Quality Index (Pre Monsoon) of Amtali Upazila

Source: PKCP project, UDD, 2018

2.14 GEOLOGICAL ANALYSIS

Geology, which examines how the earth was formed, its structure and composition, and the various forces affecting it, is the fundamental study of the planet. The study area shows three prominent geo-morphological units such as 1) Fluvio-Tidal Deltaic Plain, 2) Natural Levee, and 3) Intertidal/Supratidal units. The surface of the study area is fully covered by the recent sediments, which are divided into two major surface geological units, i.e., 1) Tidal Deltaic Deposit and 2) Mangrove Swamp Deposit. Based on the SPT-N value of boreholes, Layer 4 (average SPT-N value 22) and Layer 6 (average SPT-N value 42) are considered deep foundation layers for the study area. The seismic hazard maps for the study area are presented in the figures below, displaying spatial distribution of PGA and PSA at 0.2s, 0.3s, and 1s computed for 10% and 2% probability of exceedance in 50 years, which correspond to 475 and 2475-year return period, respectively. The results show that the PGA of the study area ranges from 0.167g to 0.239g for a 0% probability of exceedance in 50 years and range from 0.339g to 0.509g for a 2% probability for aceclidine of 50 % probability.

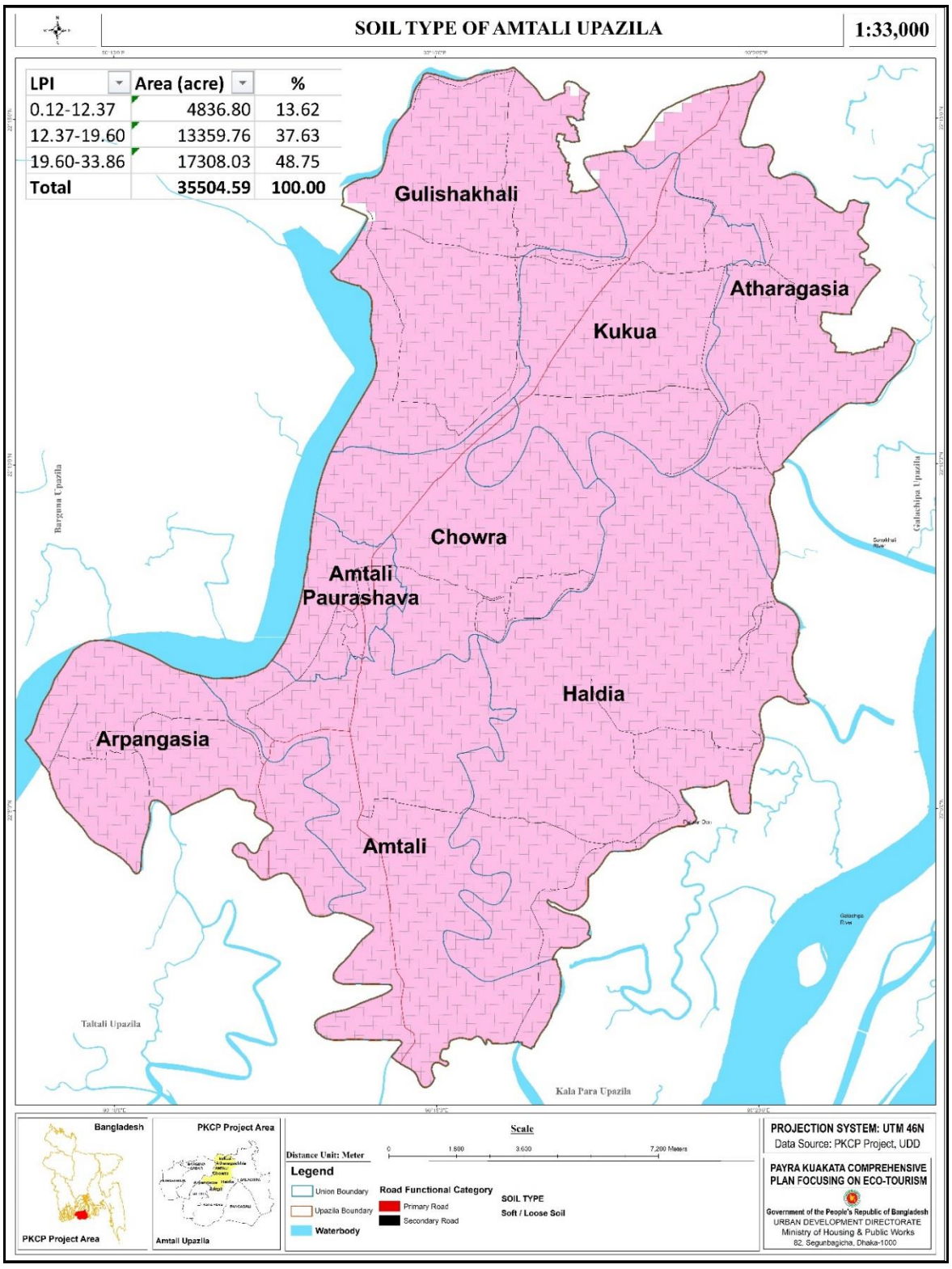
Peak spectral acceleration (PSA) is an important tool for determining the building height of an area. Here PSA for 1.0 and 0.3 seconds is used for identifying the appropriate location for high rise and low-rise buildings, respectively. A building height map is produced for the study area using PSA, which represents low-rise and high-rise buildings. Low-rise indicates 3 stories building, and high rise represents 10 stories building (Ishiyama, 2011).

Table 2.8: Geological classification for infrastructure development

Sl No.	Geological Suitability	Infrastructure foundation suitability	Suggested Geologically Suitable land use
1	Good	4-6 story light infrastructure is suitable with a foundation depth of around 12 - 20m. Large and tall infrastructure requires pile foundation placed on layer no 4 or 6.	Commercial area Residential area, Industrial zone
2	Moderate	4-6 story light infrastructure requires on-site subsoil investigation and proper foundation design. Deep pile foundation is needed for large infrastructure.	Industrial zone, Residential area, Commercial area, Agricultural Zone, Park and Recreation
3	Poor	Detail subsoil investigation and proper foundation design is required for all types of infrastructure, due to low suitability with hazard potential.	Agricultural zone, Wetland Rural settlement Park and Recreation
4	Very Poor	Detail subsoil investigation for deep pile foundation is essential, due to very low soil resistance and high hazard potential. Shallow foundation is not preferred.	Agricultural zone, Wetland Rural settlement Park and Recreation

2.14.3 Soil Type

Soils are soft and loose. a chart of soil types. Figure depicts the average shear wave velocity in the top 30 meters of the project area based on the soil class.

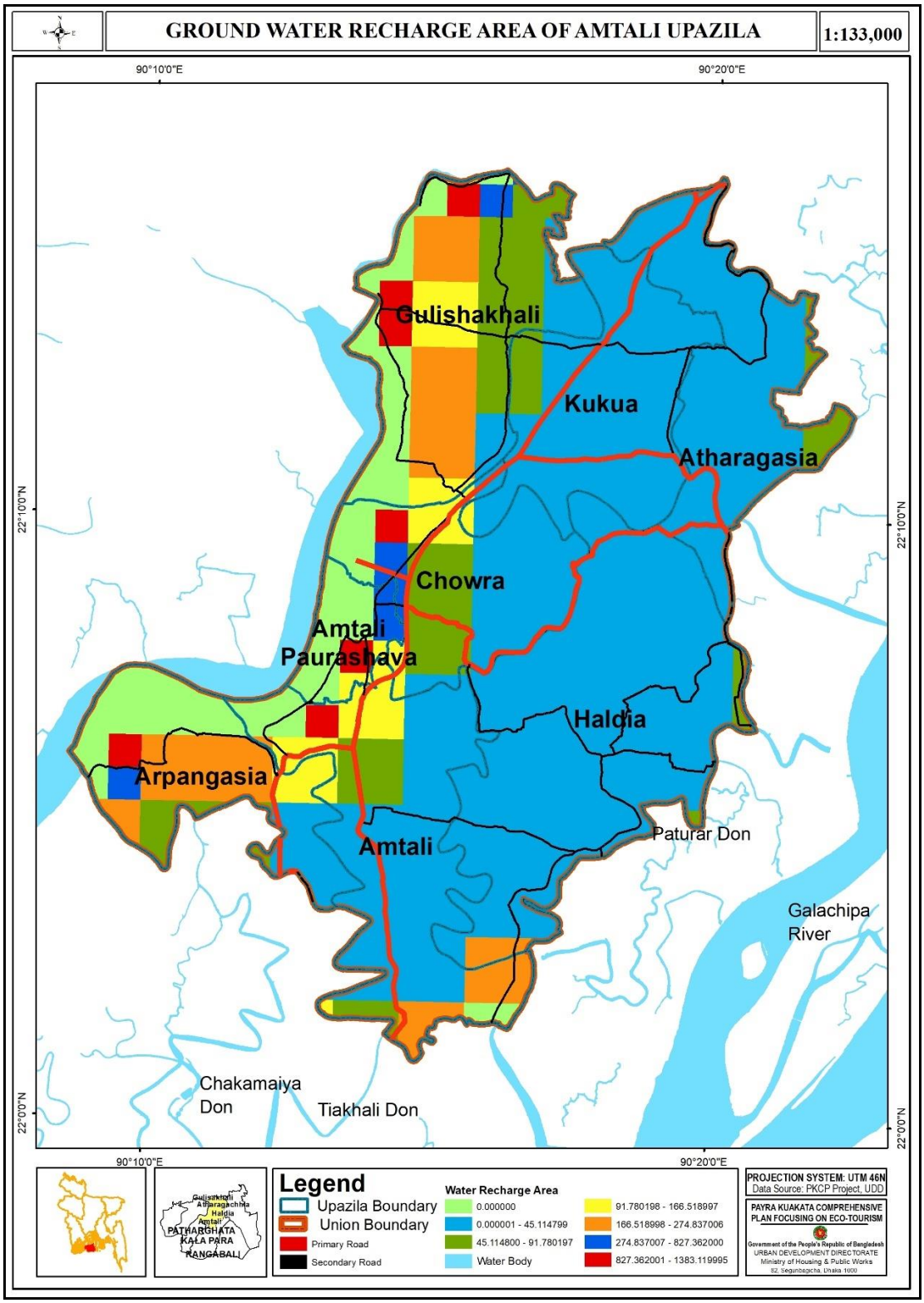


Map 2.24: Soil Type Map of Amtali Upazila

Source: PKCP project, UDD, 2018

2.14.4 Ground Water Recharge

Majority of the ground recharge areas were found alongside the river banks.



Map 2.25: Ground Water Recharge Area of Amtali Upazila

Source: PKCP project, UDD, 2018

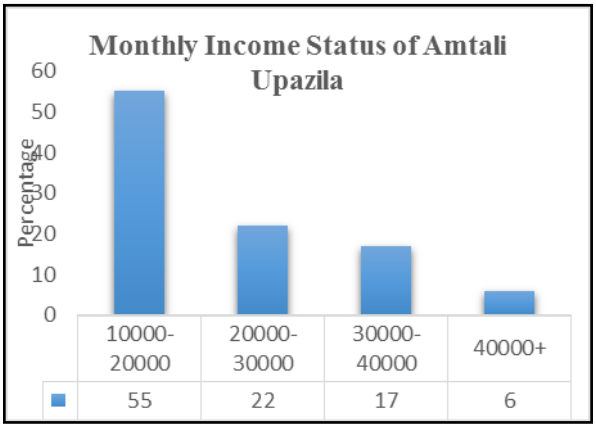
2.15 SOCIO-ECONOMIC STATUS

2.15.1 Plinth Height of the structure

Considering the plinth height and structure type, primary data shows that the majority of the structure's plinth height is 2 feet and a huge number of structures has 1 feet plinth height.

2.15.2 Income Range Distribution

The income range for most people (around 55%) is between 10,000 and 20,000 per month. A significant percentage of people live below the poverty line, as evidenced by the fact that 22% of persons have incomes of between 20,000 and 30,000. The income range for 17% of persons is between 30,000 and 40,000 per month. Less and fewer people are in the higher income bracket.



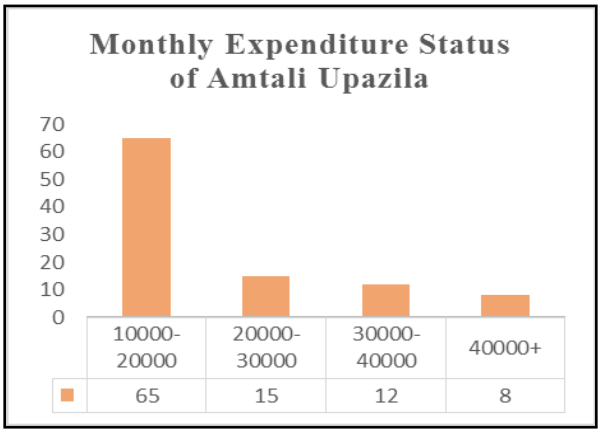


Figure 2.4: Monthly Income Status **Figure 2.5: Monthly Expenditure Status**

2.15.3 Expenditure Range Distribution

The expenditure range is analogous to the income range. The majority of consumers spend between 10,000 and 20,000 dollars per month, or around 65%. The monthly income range for 15% of persons is 20,000 to 30,000. A very small number of people spend more than 40,000.

2.15.4 Drinking water source, availability and water quality The primary source of water for the Amtali locals is a tube-well. According to the socioeconomic sample survey, the Tube well (70.69%) is the primary source of water for the residents in Amtali Upazila. Some people rely on surface water, particularly rainwater and pond water. Just 20% of the 98% have their own Tube-well on the property, with 78% using the shared Tube-well.

2.15.5 Distance of Local Hat-Bazars and Mode of transport

Over 32% of the respondents in Amtali Upazila, who make up the majority of the population, reside within 1-2 kilometres of the neighbourhood Hat-Bazar. Just 18% of people live within 1 kilometre of their local Hat-Bazar, 28% of people live within 2-3 km, and 22% of people live within 3 km. The majority of respondents feel secure walking anywhere. The local Hat-bazar is a 20–30 minute walk for the maximum respondent. Many people possess their own motorcycles and bicycles. Local residents rely heavily on Easy Bike and auto rickshaws these days.

2.15.6 Modification of the embankment height-required or not

The majority of respondents claimed that the embankment's height was not sufficient to safeguard the land, however it should be emphasized that some of the respondents had some information of the embankment's height. The planning team may therefore require input from relevant authorities or specialists. Approximately 27% of the respondent has said that embankment height is good to protect the area, average condition of embankment is 70% regarding the height of the embankment.

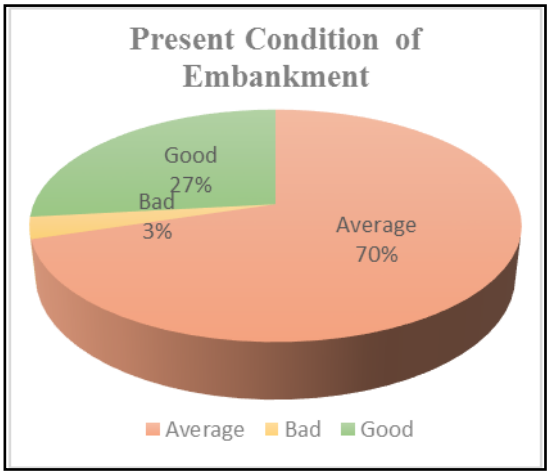


Figure 2.6: Present Condition of Embankment

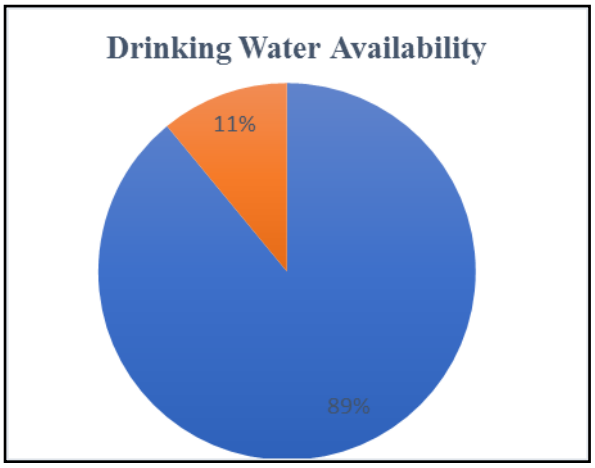


Figure 2.7: Drinking Water Availability

2.15.7 Drinking water source, availability and water quality

Pipeline supply, pond water and common tube-well are the available water source in the Upazila. It is noted that 11 percent of the respondent claimed about inadequate supply of water.

2.15.8 Migration

Almost 87% of the migrants came from Patuakhali. Maximum migration (67%) occurred in the Amtali Upazila within 1990 to 2010, 7% migrants coming in the last decade, only 47% migration occurred between 1950 to 1970.

2.15.9 Waste disposal practice

In the case of waste disposal, the respondents practise an unhealthy way, which is throwing outside of the house. Only 10% use nearest canal/river to dispose of waste.

2.15.10 Physical Feature

Structure use: The physical feature survey explored that 9% of structures were used for residential purposes, and 7.69% used for community service.

Table 2.9: Structure Use of Amtali Upazila

Sl No.	Structure Use	Area (Acre)	%
1.	Administrative/ Public service	2.35	0.24
2.	Agriculture	11.58	1.19
3.	Commercial	23.97	2.46
4.	Community Service	20.90	2.14
5.	Education and Research	29.87	3.06
6.	Manufacturing & Processing	4.64	0.48
7.	Mixed Use	23.14	2.37
8.	Residential	802.13	82.27
9.	Service Activity	19.45	2.00
10.	Transportation and Communication	2.21	0.23
11.	Under Construction	34.77	3.57
		975.00	**100.00**

Source: PKCP project, UDD, 2018

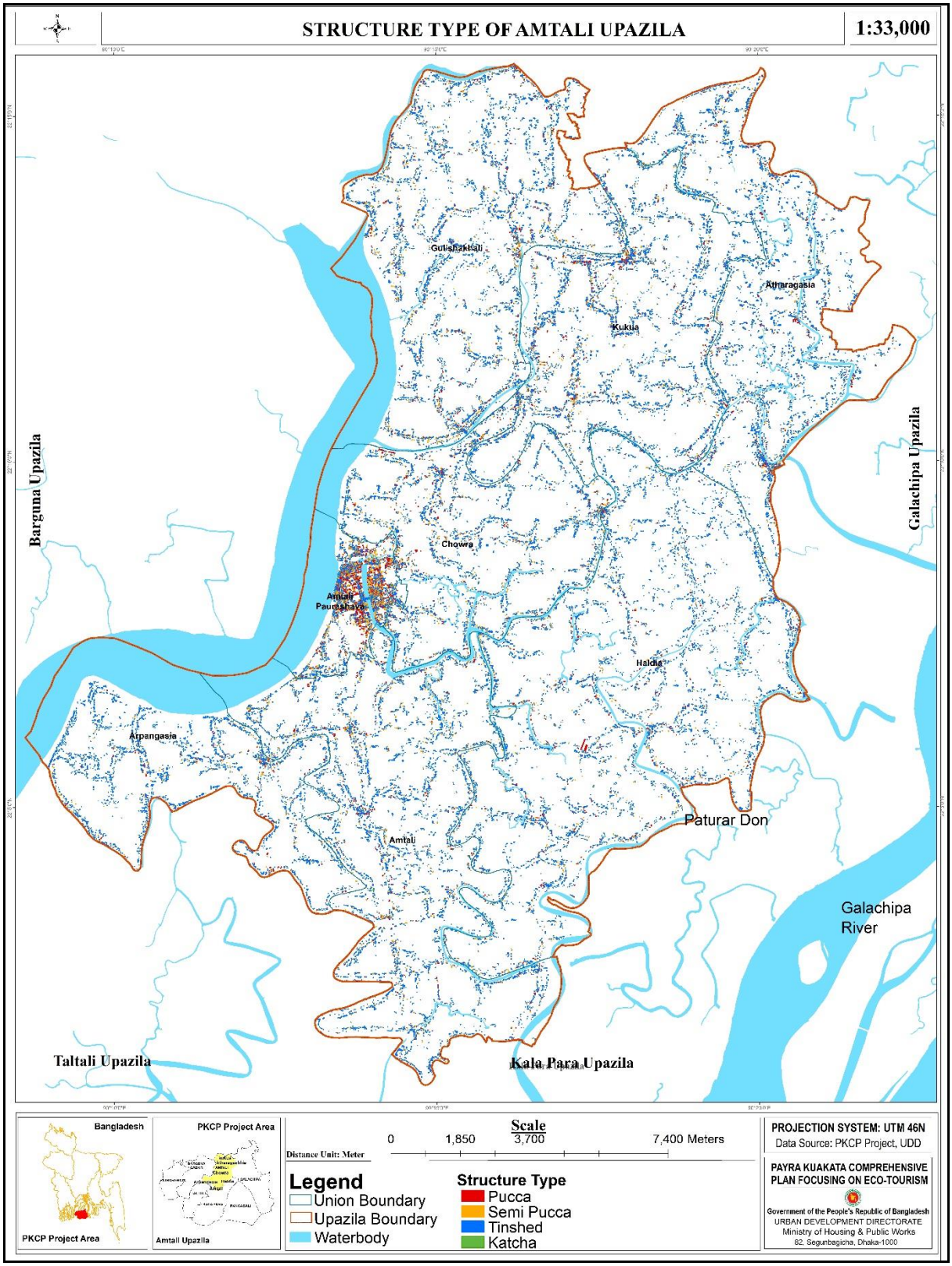
2.15.11 Structure Type

Physical condition of living houses is vulnerable. Almost 70% of the structure are Tin shed. 18% are Semi Pucca Structure. Only 11% are pucca structure.

Table 2.10: Structure Type of Amtali Upazila

Sl No.	Construction Type	Area_Acre	%
1	Katcha	2.35	0.24
2	Pucca	107.30	11.01
3	Semi Pucca	178.29	18.29
4	Tinshed	687.07	70.47
		975.00	**100.00**

Source: PKCP project, UDD, 2018



Map 2.26: Structure Type Map of Amtali Upazila

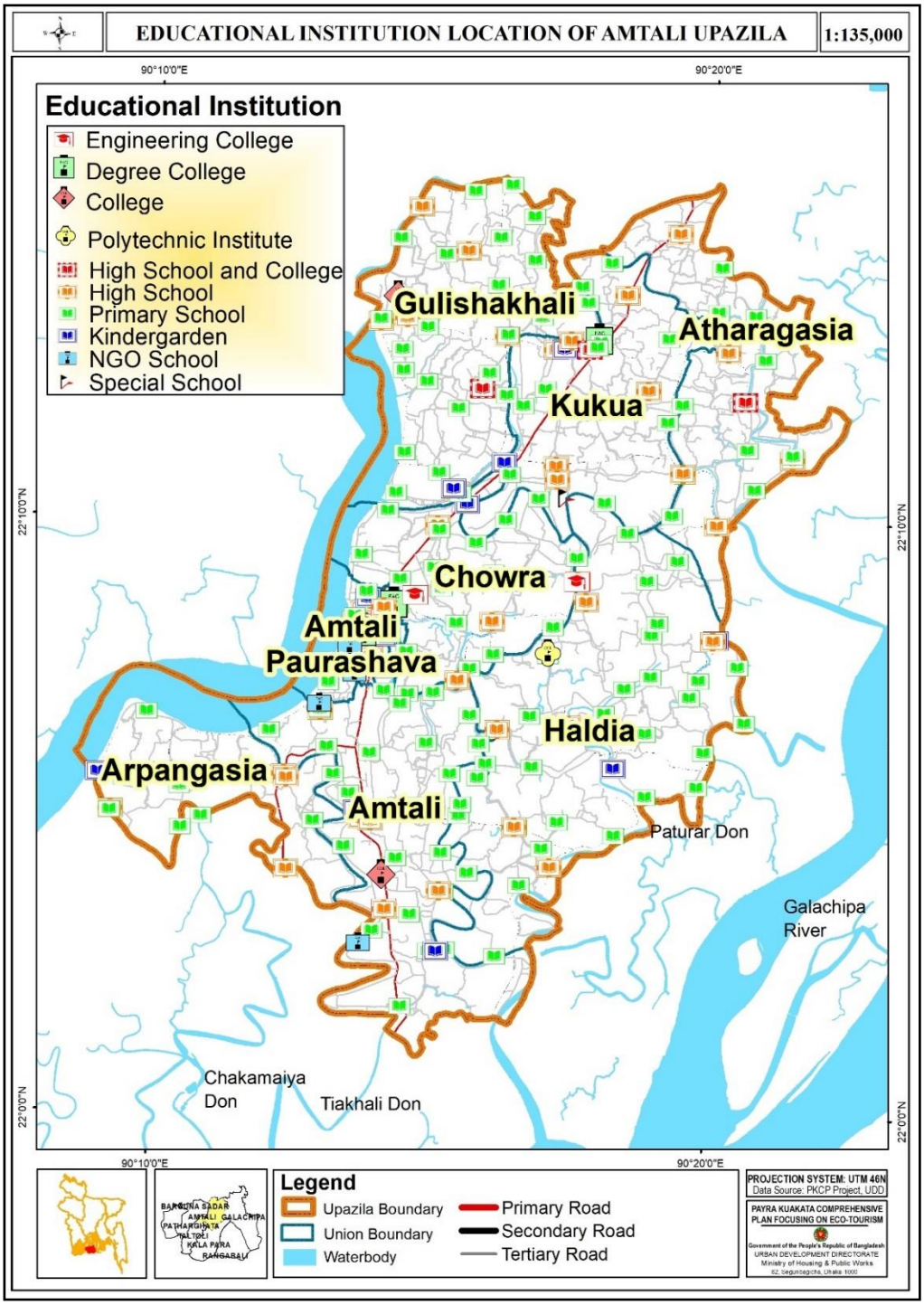
Source: PKCP project, UDD, 2022

2.16 Administrative Area Administrative office is the most important areas in Amtali Upazila. There are 42 administrative areas are found in Amtali Upazila.

Map 2.27: Administrative Office of Amtali Upazila

Source: PKCP project, UDD, 2022

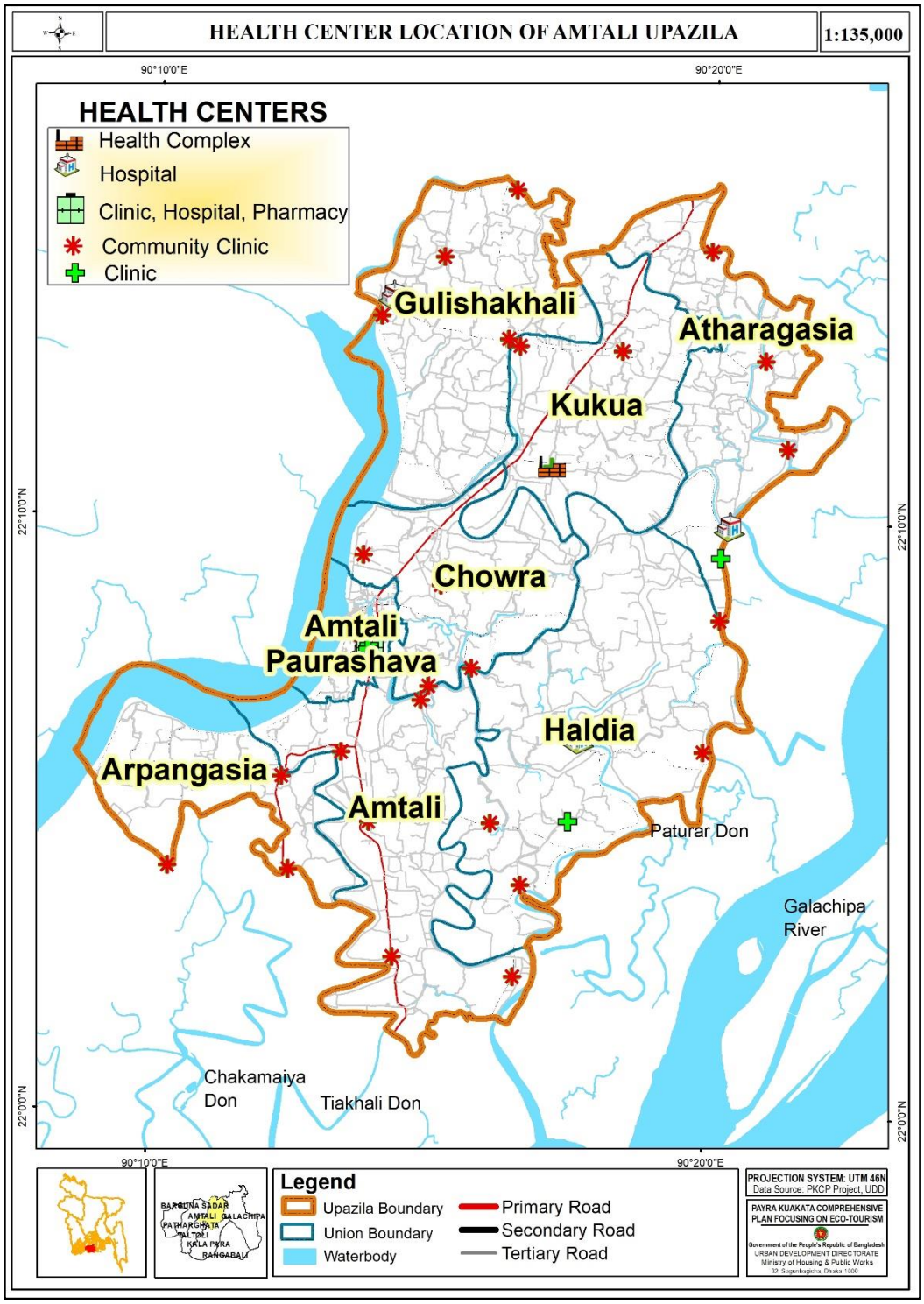
2.17 Educational and Research There are total 222 educational institutions in Amtali Upazila. There are two engineering college, three Degree College, one polytechnic institute, four high school and college, forty-two Higher Secondary Schools, and 150 no. of Primary Schools. There are also 13 no. of kindergartens, 4 no. of NGO school and one special school for the disables.



Map 2.28: Educational Institutions of Amtali Upazila

Source: PKCP project, UDD, 2022

2.18 Health Centre Facilities There are 39 no. of health centre facilities of Amtali Upazila. There is only one Upazila Health Complex with a very limited facility. There are also 4 no. of hospital, 5 no. of clinic and 28 no. of community clinic.

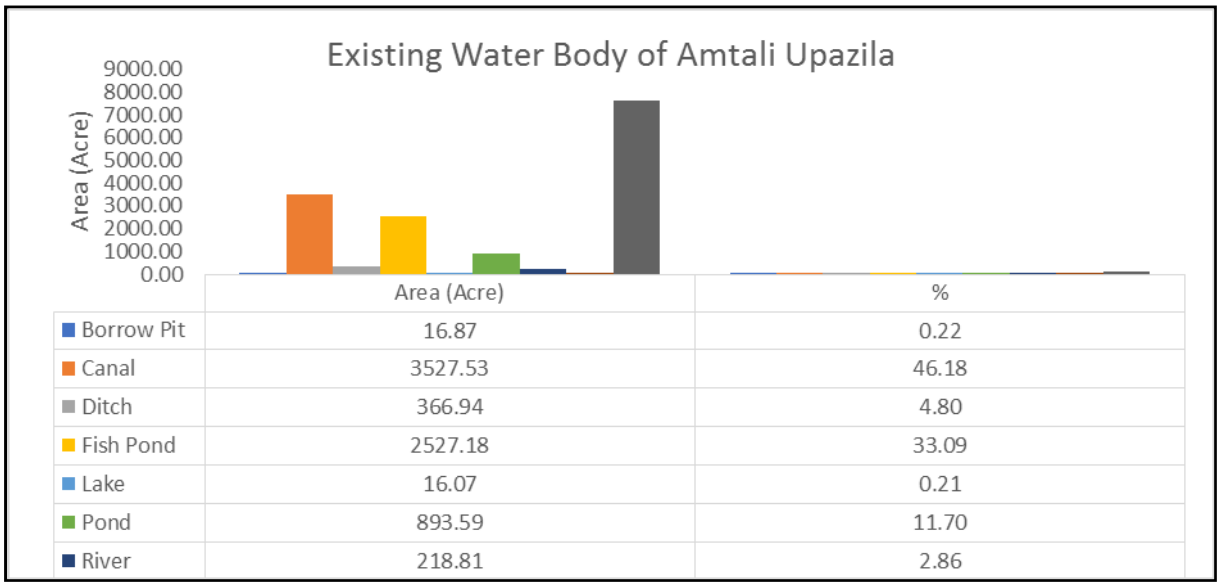


Map 2.29: Health Center Facilities of Amtali Upazila

Source: PKCP project, UDD, 2022

2.19 Waterbodies

The following figure represents the present scenario of existing Water body of Amtali Upazila. There is existence of canals, ditches, fish ponds, and river. Majority of water bodies of this Upazila covered with Canal which is 46.18%.



	Area (Acre)	%
Borrow Pit	16.87	0.22
Canal	3527.53	46.18
Ditch	366.94	4.80
Fish Pond	2527.18	33.09
Lake	16.07	0.21
Pond	893.59	11.70
River	218.81	2.86

Figure 2.8: Existing Water body of Amtali Upazila

Source: PKCP project, UDD, 2018

Map 2.30: Waterbodies of Amtali Upazila

Source: PKCP project, UDD, 2018

2.20 Existing Embankment in Amtali Upazila

There is 11479.14 m of embankment exist in Amtali Upazila which height is below 5m.

Map 2.31: Embankment in Amtali Upazila

Source: PKCP project, UDD, 2022

2.21 NATURAL BARRIERS

Amtali Upazila is exposed to various natural hazards. Despite this, there are some natural barriers in place that help protect the area from these hazards. Natural barriers are given below:

Rivers and creeks: The area is crisscrossed by numerous rivers and creeks that act as natural drainage channels and help to reduce the impact of flooding. These waterways also provide a source of livelihood for the local population, through fishing and other water-related activities.

Overall, while Amtali Upazila is vulnerable to natural hazards, the presence of these natural barriers helps to mitigate the impact of these hazards and protect the local population and their livelihoods. However, these natural barriers can be degraded by human activities such as deforestation, pollution, and land use change, which can increase the area's vulnerability to natural hazards.

CHAPTER THREE: SOCIO-SPATIAL FORECASTING AND DEVELOPMENT

3.1 POPULATION PROJECTION

Cohort technique was used to forecast the population. The cohort-component technique divides the population into age-sex groups or birth cohorts and takes each cohort's fertility, mortality, and migration patterns into consideration.

Projected population: The Amtali Upazila had a population of 163,689 in 2011 and a 1.23 annual growth rate, according to BBS. According to Table 3.1, there will be 2,05,012 people living in 2031 and 2,25,109 people in 2041, correspondingly.

Table 3.1: Area and Population Projection of Amtali Upazila

Union Name	Area (Acre)	2011	2021	2031	2041
Amtali Union	15914	24155	27187	30733	33825
Gulishakhali Union	13887	28458	32030	36208	39851
Athrogasia Union	11269	23444	26387	29829	32830
Kukua Union	11288	24028	27044	29829	32830
Haldia Union	22154	27929	30460	33021	35817
Arpangasia Union	8624	14873	16740	18924	20827
Chowra Union	10239	20802	23413	26467	29130
Total		**163689**	**183262**	**205012**	**225109**

Source: PKCP project, UDD, 2018

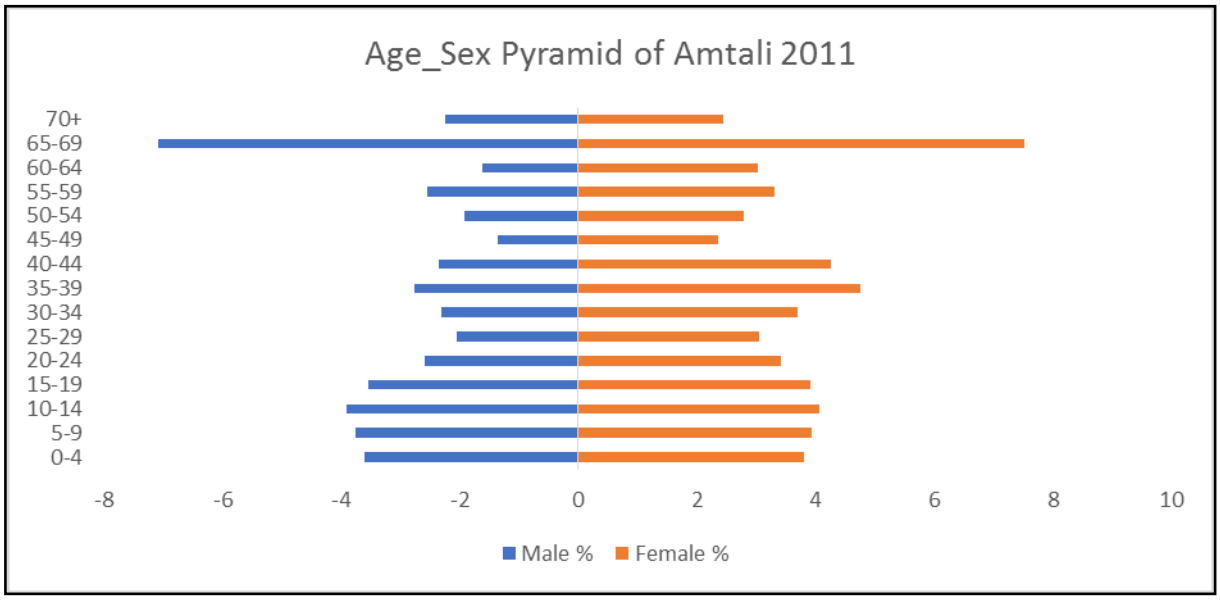
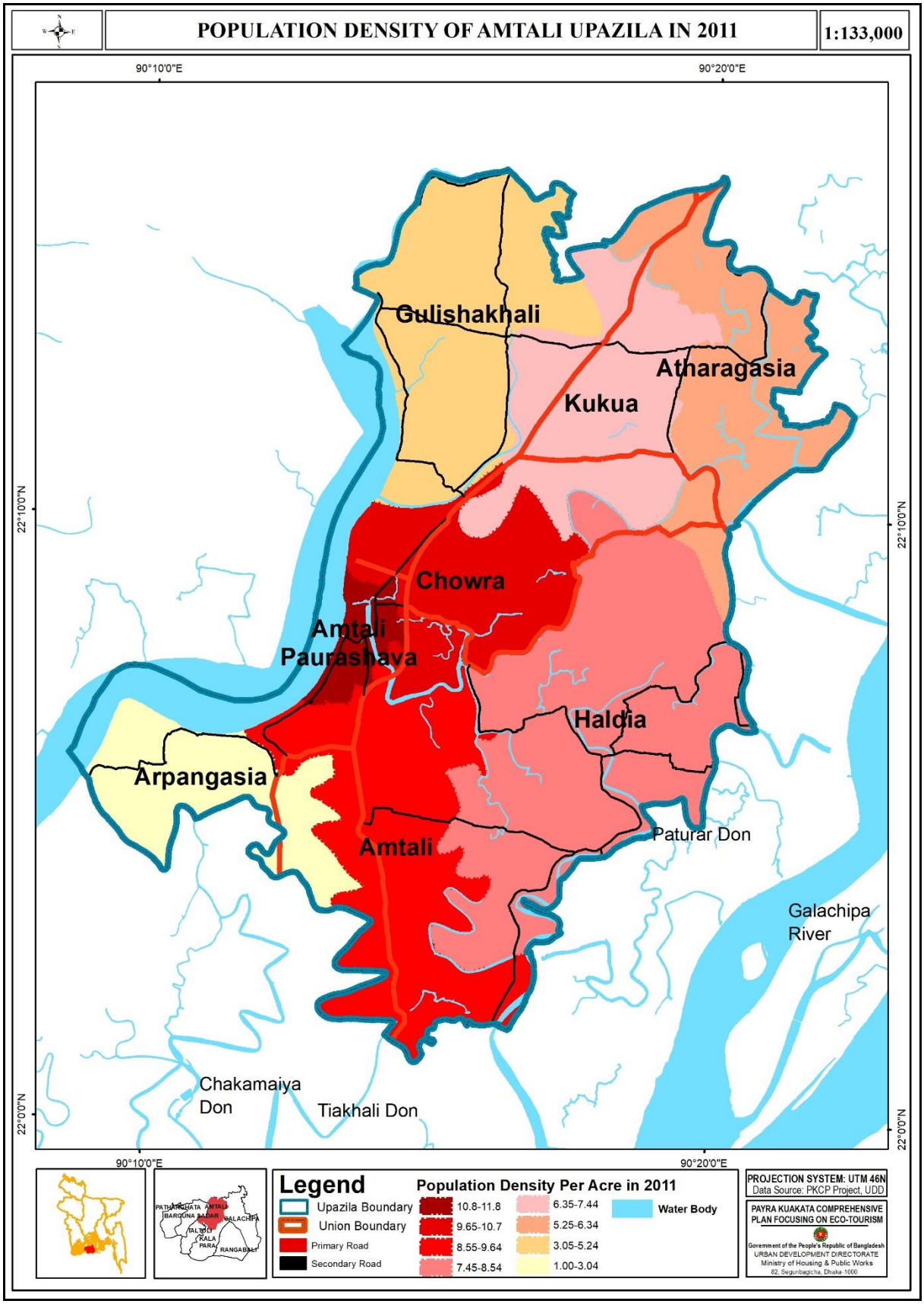


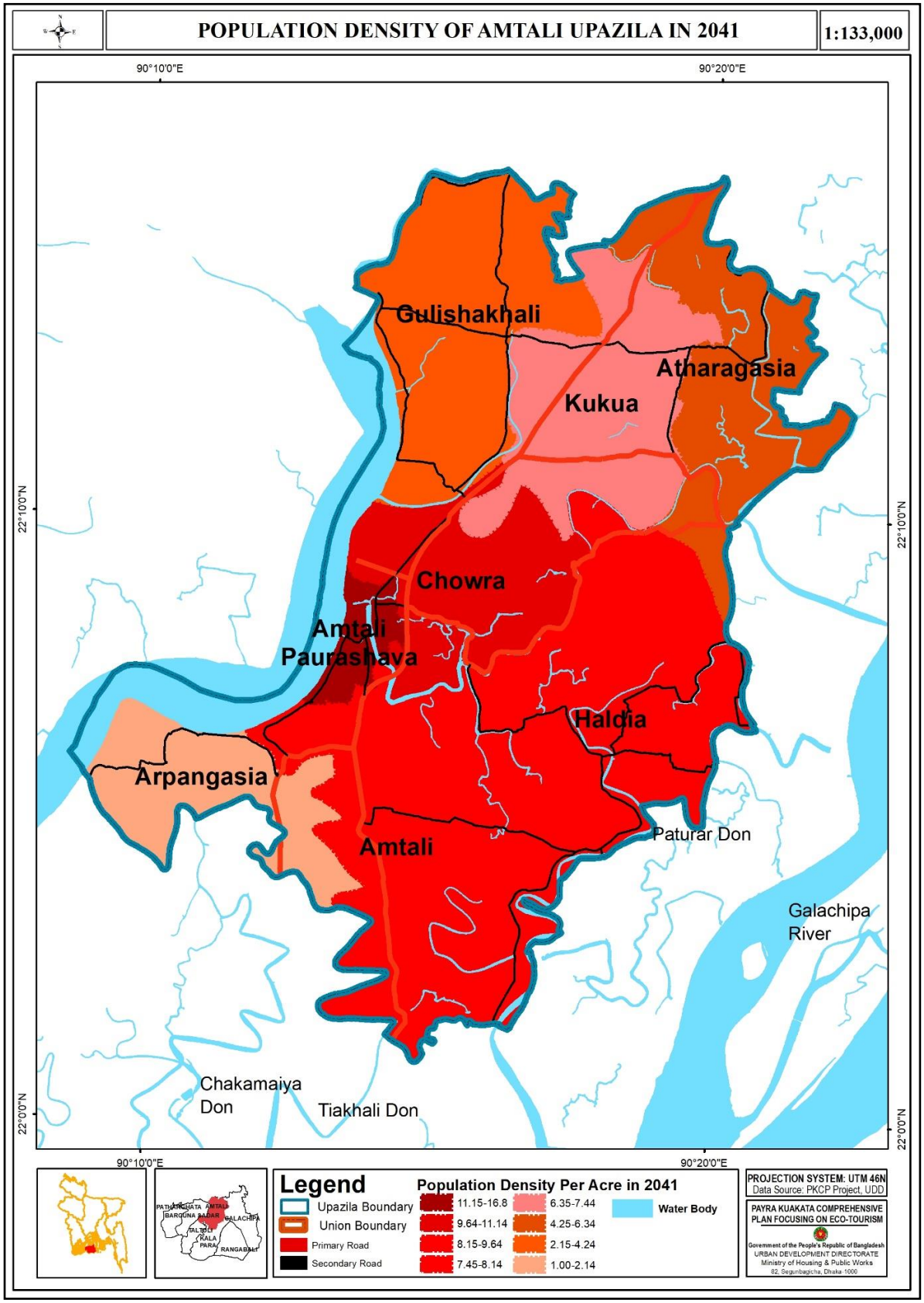
Figure 3.1: Illustrating the age wise male and female population on 2011

Source: PKCP project, UDD, 2018



Map 3.1: Population Density of Amtali Upazila in 2011

Source: PKCP project, UDD, 2018



Map 3.2: Population Density of Amtali Upazila in 2041

Source: PKCP project, UDD, 2018

3.2 HOUSING DEMAND PROJECTIONS

Demand forecasting is the process of predicting future home demand using previous data. It provides an estimate of how many dwelling units people are expected to seek during a given time period in the future. The threshold population has been determined using the current population and the number of structures. After that, the future demand for housing units has been calculated while taking the expected population into account. In 2041, Amtali Upazila have 2,25,109 populations. There will be needed 54,904 livable building considering the household size is 4.1(Barguna District Dwelling Unit BBS,2011).

3.3 ECONOMY & EMPLOYMENT/ECONOMIC FORECASTING

Findings from Basic and Non-Basic Employment

The percentage rise in basic employment in Amtali Upazila from 2003 to 2013 was 108%, while the percentage increase in total employment was 71%. Total employment is influenced by basic employment. In Amtali, basic employment makes about 27% of all jobs. Hence, even though basic employment contributes to non-basic employment, which may be determined by the economic base multiplier, the majority of employment is not tied to exports.

Findings from Economic Base Multiplier

Economic base multiplier can be used for projections and is used to assess employment as a measure of activities. By calculating the future prospects of the core regional economic activity and employing a multiplier, one can assess the future total employment of a region. From 2003 to 2013, the economic base multiplier for Amtali Upazila increased from 0.5 to 0.75. The ratio of all basic and non-basic employment to basic employment is known as the economic base multiplier. Hence, the multiplier's growth suggests that over the past ten years, the proportion of basic employment to total employment has dropped. This implies that Upazila is seeing a decline in various economic activity and is earning less from exports and outside the area.

Findings from Shift-Share Analysis

Shift Share analysis of the industrial structure sheds light on Upazila's development. Amtali Upazila's growth rate is lower than the national average, which indicates that it is lagging behind. Instead of growing to the anticipated 3567, wholesale and retail trade increased to 1322. This is the outcome of an unfavourable industry mix and a disadvantageous geographical environment. Given that it outgrew national expansion, the industrial sector exhibits a good deal of promise. This industry benefits from both regional and local advantages, which produces a positive Net Shift Component. The industry mix also benefits

the transportation, storage, and communication sectors. A local advantage benefited the hotel and restaurant industry.

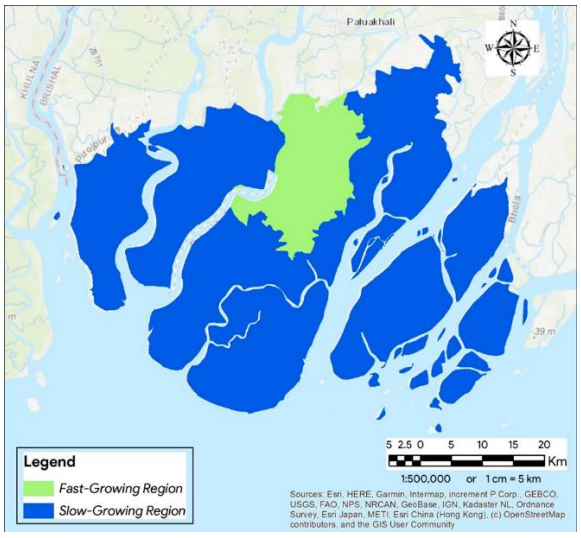
Table 3.2: Industrial Structure Analysis

Upazila	Growth (G_j)	National Share (NS)	Industrial Mix (IM)	Regional Shift (RM)	Net Shift Component
Amtali	**12257**	**17216**	**-1979**	**-2278**	**-3997**

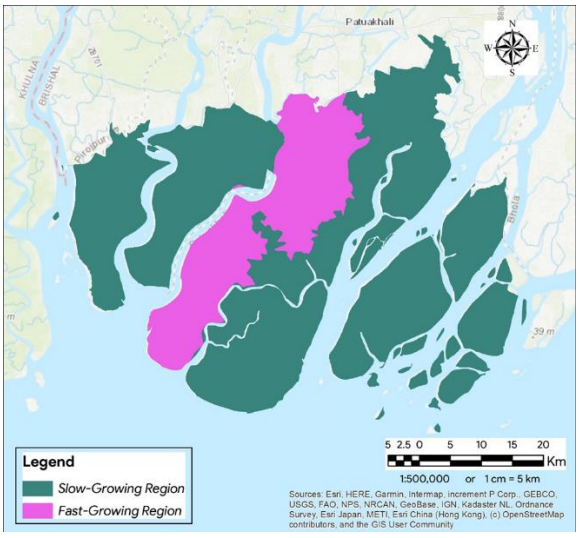
Source: PKCP project, UDD, 2022

General Findings: General findings have been drawn by comparing Amtali Upazila with other six Upazilas within the project region. Upazilas as Fast-Growing or Slow-Growing regions based on the Total Growth of Employment (G_j) in each region with respect to their National Share (NS). A region is classified as Fast-Growing or Slow-Growing depending on whether its Gj value exceeds its respective NS value. Based on their industry mix, the Upazilas are divided into fast-growing and slow-growing zones in Figure. (IM). The area is categorized as Fast-Growing if the IM value is positive. Region of Slow Growth, otherwise. Amtali Upazila has been identified as a location with slow IM growth. As a result, the Upazilas are not significantly employed in the fast-growing (sectoral growth rate is higher than the national average growth rate) economic sectors on a national scale.

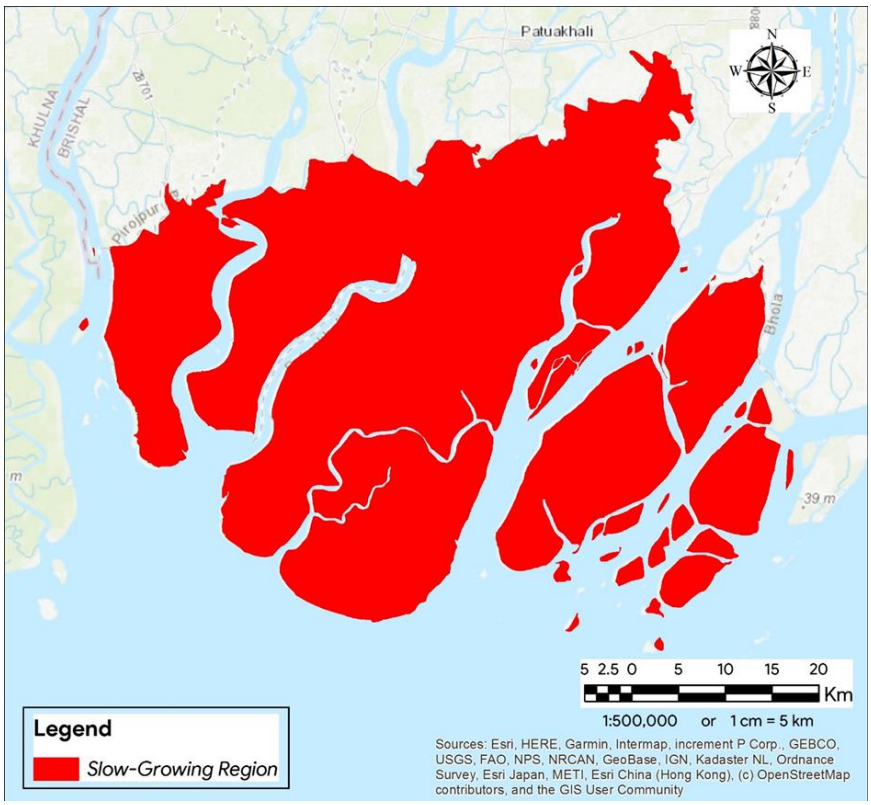
According on regional advantages, Map 3.3 separates the Upazilas into Fast-Growing or Slow-Growing regions based on the Regional Shift (RS) component. When it comes to local/regional advantages, Amtali Upazila is considered fast-growing. As a result, the employment growth rates in a variety of industries in these Upazilas are lower than the growth rates in similar industries on a national basis.



Map 3.3: National Shift



Map 3.4: Regional Shift



Map 3.5: Industrial Mix

3.4 TRAFFIC & TRANSPORTATION

Household Survey

The household survey represents the trip making behaviour of each household including their demographic and social information. These insights will help calculate the trip generation in the first step of transport model. From the survey, the modal share and purpose of the trip will also be found which will help in understanding the existing scenario and in forecasting the future trip behaviour of the people.

Table 3.3: Average trips per household

Zone ID	Union	Total Households	No. of Trips per day	Avg. trips/ HH
11	Gulisakhali	6457	30671	4.75
12	Kukua	5652	25575	4.53
13	Atharagashia	5349	22733	4.25
14	Haldia	6836	38794	5.68
15	Chowra	4741	24653	5.20
16	Amtali	9632	59718	6.20
17	Arpangashia	3534	16875	4.78

Source: PKCP project, UDD, 2022

Trip Purpose

The consultant team divided all intents into five groups for simplicity of analysis: educational, shopping (including trips to Bazar), professional, recreational, and others (personal, treatment etc.). A category named "Home Based Trip" is in addition to these other categories and it contains all travels that are intended for a household. The household survey findings can be used to produce the following pie chart, which shows the percentage of trips made for various purposes. In Amtali, it is observed that 23% of journeys are done for work-related reasons, while 19% of trips are undertaken for educational purposes. 3% of excursions are made for shopping.

Table 3.4: Trip purpose of Amtali Upazila

Zone ID	Union	Educational	Work	Shopping	Recreation	Home Based
11	Gulisakhali	10%	12%	17%	7%	45%
12	Kukua	14%	24%	13%	2%	46%
13	Atharagashia	11%	18%	14%	3%	48%
14	Haldia	14%	11%	10%	0%	56%
15	Chowra	13%	22%	13%	4%	41%
16	Amtali	19%	23%	3%	1%	49%
17	Arpangashia	23%	14%	2%	0%	50%
11	Gulisakhali	10%	12%	17%	7%	45%

Source: PKCP project, UDD, 2022

Mode Choice

In the overall scenario for the whole Study area, people make most of the trips by walking, which is 79.9% of total trips. These trips are generally short-distance trips. Again, 11.5% are made by Easy bike, 2.6% by easy bike and 2.3% by Small Launch. Among the other modes, except walking water modes is in total 3% (where boat 2.6% and trawler 0.4%).

Travel Cost and Time

The below table represents the average travel cost (in Taka) and travel time (in minutes). The travel cost is lower in the zones where major modes of trip are walking and cycling, though their travel time may be higher. Also, people in the study area use multiple modes, including water transport.

Table 3.5: Travel Cost and Time

Zone ID	Union Name	Avg. Trip Length (minutes)	Avg. Travel Cost (tk.)
11	Gulisakhali	36.27	18.53
12	Kukua	58.01	35.17
13	Atharagashia	36.25	23.38
14	Haldia	38.30	29.19
15	Chowra	43.87	29.06
16	Amtali	19.73	13.97
17	Arpangashia	24.96	14.01

Source: PKCP project, UDD, 2022

Type of Trip

The below table illustrates the type of trips in each zone. The higher number of intra-zonal trips in most cases may be due to the fact that most of the facilities such as rural markets, educational institutions, health facilities, administrative and other offices etc. are available within most zones, and the local inhabitants do not usually have to move to other zones or distant places for their day-to-day activities. Another reason is that most of the areas are separated by river networks, and it results in local people's movement within the zones. However, the zones with a higher amount of inter-zonal traffic are more dependent on other zones for their day-to-day activities.

Table 3.6: Type of Trip

Zone ID	Zone Name	Intra-zonal Trips (%)	Inter-zonal Trips (%)
11	Gulisakhali	86	14
12	Kukua	88	12
13	Atharagashia	66	34
14	Haldia	41	59
15	Chowra	28	72
16	Amtali	95	5
17	Arpangashia	53	47

Source: PKCP project, UDD, 2022

Travel behaviour in Dry and Rainy Season (Travel Time and Cost)

As the study area is surrounded by a river network and the most disaster-prone area, so the travel pattern is not as same as the dry season in the rainy season. The consultant team tried to find out the change in travel patterns in both dry and rainy seasons. Three criteria: Mode, Travel time and Cost, have been considered to determine the change. The major observation is that mainly travel pattern changes in case of travel time and cost. In the study area, travel time increases by an average of 4.1 minutes and cost increases by 0.75 takas on an average.

Table 3.7: Trip length covered and cost spent by local people

Zone ID	Union/ Zone	Dry Season		Rainy Season	
		Avg. Trip Length (minutes)	Avg. Travel Cost (tk.)	Avg. Trip Length (minutes)	Avg. Travel Cost (tk.)
11	Gulisakhali	36.27	18.53	45.24	20.53
12	Kukua	58.01	35.17	66.55	65.33
13	Atharagashia	36.25	23.38	46.59	23.41
14	Haldia	38.30	29.19	44.60	26.21
15	Chowra	43.87	29.06	52.62	24.57
16	Amtali	19.73	13.97	23.79	15.71
17	Arpangashia	24.96	14.01	29.19	13.48

Source: PKCP project, UDD, 2022

Traffic Volume Count Survey

The major travel mode of Amtali is mainly easy bike. People use Motor Bike for their daily movement as there is no public transport such as bus service. For Short distance travel and travelling for surrounding areas easy bike is used. Other important modes are baby taxi, rickshaw, van and tempo. Two peak times have been found when vehicle volume is highest. The morning peak time varies from 9:30 am to 11:15 am, and the evening peak varies from 4:45 pm to 6:00 pm. The graphical presentation of modal share and temporal vehicle volume (average) distribution is shown below.

Table 3.8: Traffic volume of Amtali

Upazila	**Major Three Modes**					
	Mode- 1		Mode- 2		Mode- 3	
	Up	Down	Up	Down	Up	Down
Amtali	Easy Bike (82.8%)	Easy Bike (83.6%)	Tempo (11.6%)	Tempo (10.6%)	Bicycle (4.9%)	Bicycle (5.2%)

Source: PKCP project, UDD, 2022

On the Union Road, the volume of vehicles is 787 vehicles per hour. On the Union road, the volume of unconventional modes and non-motorized vehicles is high. Volume is too low on the major road because of the rural characteristics and discontinuity of road connectivity by river network and people's dependency on water transport. The figure below shows traffic volume at different survey stations in Amtali:

Table 3.9: Traffic Volume of Amtali

Survey Station	**Traffic Volume**			**Road Type**
	Up-Direction	**Down-Direction**	**Total**	
Site 13	371	416	787	Union
Site 16	379	358	737	Union

Source: PKCP project, UDD, 2022

Origin Destination Survey

Amtali Upazila is like an island totally surrounded by river network and there is no other alternative route accept waterway. So, people use only vehicle within the Upazila. Among all the unions major trips occur in Amtali. Major vehicular trips are seen within the unions or near the surrounding unions of the same Upazila or other Upazilas. The cause may be these unions are well established in terms of infrastructural facilities such as well enough educational facilities, health facilities, hat, Bazar etc. Another reason may be that these areas are major hubs of commercial activities. Another reason can be that; road connectivity is good in these areas. Other than that, most trips were distributed to Barisal, Bhola, Barguna from the study area.

Stakeholder Interview Survey Outcome

The participants indicated that lack of parking facilities, narrow roads, and on-street parking all contribute to congestion. They also spoke about the lengthy journey time caused by boat crossings.

3.5 BASIC SERVICES AND FACILITIES FORECASTING

Existing Facilities: The distribution of socioeconomic facilities that are currently in use by Upazila is shown in Table, and Table also shows the distribution of facilities per 10,000 people, which provides a comparative picture of the Upazila's facility availability. For instance, there are just 0.67 high schools per 10,000 people in Amtali Upazila.

Requirements of Social Facilities in Future: Requirements of socio-economic facilities have been determined on the basis of the threshold population for each facility, as discussed above. The threshold population of each facility in the study area as calculated on the basis of the Reed-Muench method is shown below:

Table 3.10: Estimated threshold population for a particular facility

Facility	Threshold Population
Primary school	450
Madrasa	8315
High school	7217
College	31783
Upazila health complex/ hospital	208403
Family welfare centre	22001
Community clinic	24975
Growth centre	38202
Rural market	2850
Cyclone shelter	2569

Source: PKCP project, UDD, 2022

For calculating threshold population, Mouza, Union and Upazila level population data are required. That is why population data from the 2011 population Census have been used for this purpose. Table 3.10 presents the projected requirements of socio-economic facilities in different Upazilas in 2021, while table 3.13 and table 3.14 show the projected requirements of facilities in different Upazilas in 2031 and 2041, respectively. Table indicates that if facilities are provided on the basis of threshold population, then there would be very little disparity among the Upazilas of the project region in terms of the availability of facilities under study.

Table 3.11: Distribution of Existing Facilities by Upazilas

Facility	Total Number of Existing Facilities									
	HS[1]	PS[2]	MDSA[3]	UHC/H[4]	FWC[5]	CC[6]	GC[7]	RM[8]	CS[9]	COL[10]
Amtali	28	186	34	4	19	24	3	47	22	6

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

Table 3.12: Existing Facilities per 10,000 People in Different Upazilas

Facility	Number of Existing Facilities per 10,000 People									
	HS[1]	PS[2]	MDSA[3]	UHC/H[4]	FWC[5]	CC[6]	GC[7]	RM[8]	CS[9]	COL[10]
Amtali	1.53	10.17	1.86	0.21	1.04	1.31	0.16	2.57	1.20	0.33

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

Table 3.13: Projected Requirement of Facilities by Upazilas in 2021

Facility	Total Number of Facilities Required by 2021									
	HS[1]	PS[2]	MDSA[3]	UHC/H[4]	FWC[5]	CC[6]	GC[7]	RM[8]	CS[9]	COL[10]
Amtali	29	469	25	1	10	8	6	74	82	7

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

Table 3.14: Projected Requirement of Facilities by Upazilas in 2031

Facility	Total Number of Facilities Required by 2031									
	HS[1]	PS[2]	MDSA[3]	UHC/H[4]	FWC[5]	CC[6]	GC[7]	RM[8]	CS[9]	COL[10]
Amtali	32	514	28	1	11	9	6	81	90	7

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

Table 3.15: Projected Requirement of Facilities by Upazilas in 2041

Facility	Total Number of Facilities Required by 2041									
	HS[1]	PS[2]	MDSA[3]	UHC/H[4]	FWC[5]	CC[6]	GC[7]	RM[8]	CS[9]	COL[10]
Amtali	35	559	30	1	11	10	7	88	98	8

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

Table 3.16: Facilities per 10,000 People if Required Facilities are Provided

Facility	Number of Facilities per 10,000 People in 2041 if Required Facilities are Provided									
	HS[1]	PS[2]	MDSA[3]	UHC/H[4]	FWC[5]	CC[6]	GC[7]	RM[8]	CS[9]	COL[10]
Amtali	1.39	22.23	1.19	0.04	0.44	0.40	0.28	3.50	1.39	0.38

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

Source: PKCP project, UDD, 2022

3.6 WATER DEMAND PROJECTION BASED ON AQUIFER

Scenario prediction: The water balance calculation was carried out for shallow and intermediate aquifers, which are refilled by rainfall, in accordance with the model's simulation of recharge assessment. The summary of the water demand and resource calculations is shown.

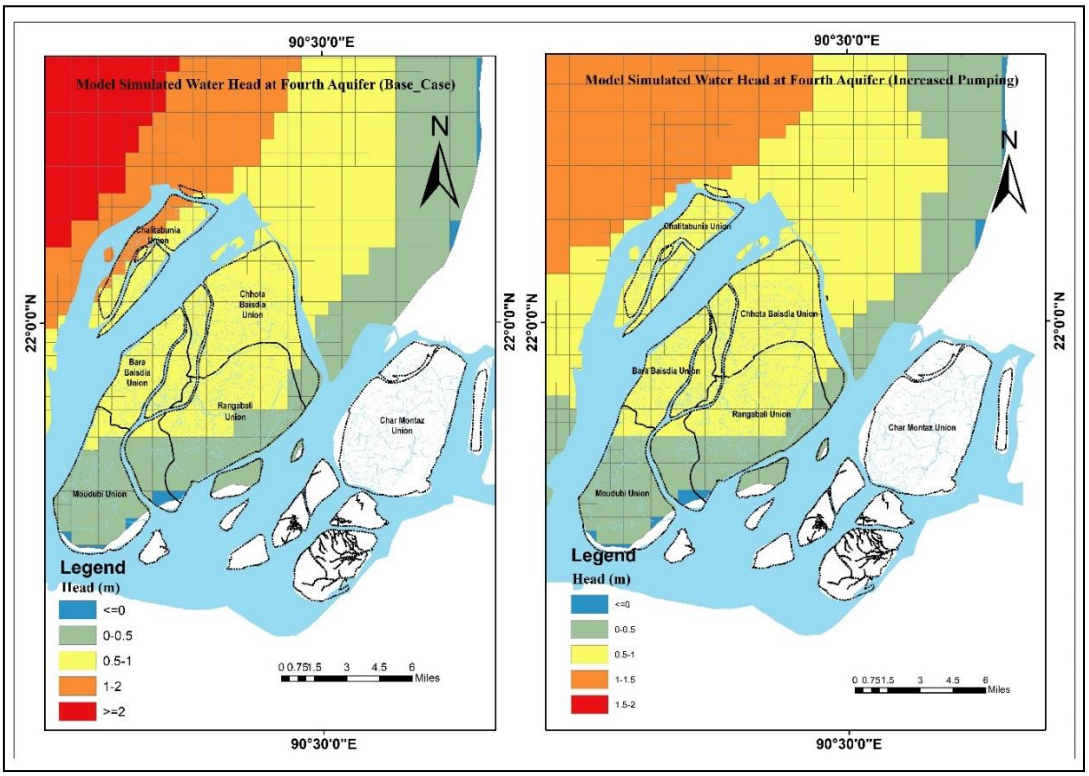
Table 3.17: Water Balance Calculation

Water Balance Calculation for Shallow and Intermediate aquifers in the Payra-Kuakata Project area					
Aquifer	**Set Up**	**Population status**	**Water Demand**	**Water Availability**	**Comments**
Shallow and Intermediate	Rural	1,145,570	26.05	200.25	Current water abstraction rate is OK
Shallow and Intermediate	Urban	1,145,570	74.06	200.25	Current water abstraction rate is OK
Shallow and Intermediate	Rural	2,398,000	50.13	200.35	Double water abstraction also Ok
Shallow and Intermediate	Urban	2,398,000	167.10	200.35	Double water abstraction also Ok
Deep aquifer	Rural/ Urban	1200000	23	13	The difference of 13 million m3/y, which must be added to the aquifer via vertical flow that will affect deep aquifer quality by salt water intrusion and consequent subsidence of the area

Source: PKCP project, UDD, 2022

The purpose of this model is to predict future scenarios. The most significant issue in this area is the probable increase in water consumption in the near future. So, a future scenario with more pumping has been considered. We are all excited and concerned about the Amtali, Barguna, and another significant seaport in Bangladesh. This location is anticipated to develop into a significant commercial area once various operations through this port begin, with numerous people traveling there every day for business purposes. In general, a variety of

industries will grow here. So, it is obvious that there would be a significant increase in the demand for water. People will start pumping groundwater more frequently than they do now because it is the only supply of fresh water in this area. The model simulated result shows that the water level drops greatly from the base case condition and goes down to the MSL (mean sea level), which indicates that there is a very high possibility for saltwater intrusion during the dry season.



Map 3.6: Comparison between deep aquifer in Base Case condition in December 2022 (left) and in increased pumping condition in December 2025 (right)

Source: PKCP project, UDD, 2022

3.7 WATER DEMAND PROJECTION

Majority of the people in the Upazila have access to safe drinking water. The scenario is different for the rural areas. For the purpose of future planning of the water supply system in the Upazila, estimates of water demand over the plan period are determined. For the purpose of future planning of the water supply system in the Upazila, estimates of water demand over the plan period are determined. According to Journal of Water and Health published by IWA and funded by AusAID in 2006 water consumption pattern of rural area of Bangladesh has been calculated as following

1. Drinking purpose- 3.53 (l/D)
2. Cooking -6.71(l/D)
3. Bathing -27.26 (l/D)
4. Domestic washing -12.18 (l/D)
5. Toileting and cattle feeding- 12.75 (l/D)

Total consumption- 62.47 (l/D). The planning team uses this rate to calculate water demand for the planning area.

Table 3.18: Water Demand Projection in Amtali Upazila

Union Name	Population,2021	Water demand (litre)	Population,2026	Water demand (litre)	Population,2031	Water demand (litre)	Population,2036	Water demand (litre)	2041	Water demand (litre)
Amtali Union	27187	1698381	28955	1808813	30733	1919920	32376	2022518	33825	2113060
Gulishakhali Union	32030	2000933	34113	2131038	36208	2261936	38143	2382812	39851	2489483
Athrogasia Union	26387	1648390	28103	1755571	29829	1863407	31423	1962985	32830	2050862
Kukua Union	27044	1689452	28103	1755571	29829	1863407	31423	1962985	32830	2050862
Haldia Union	30460	1902855	28103	1755571	33021	2062836	34510	2155825	35817	2237479
Arpangasia Union	16740	1045747	17828	1113744	18924	1182155	19935	1245329	20827	1301078
Chowra Union	23413	1462626	24936	1557729	26467	1653412	27882	1741769	29130	1819742
Total	**183262**	**11448383**	**190140**	**11878037**	**205012**	**12807073**	**215691**	**13474223**	**225109**	**14062566**
Total Water Demand (Gallon)		**3024342**		**3137845**		**3383270**		**3559512**		**3714936**

Source: PKCP project, UDD, 2022

Total projected water demand for Amtali Upazila is 14062566 Litre or 3714936 Gallon.

3.8 ELECTRICITY DEMAND PROJECTION

Power and energy supplies to the Upazila depend largely on the availability of electricity. For both domestic and commercial purposes, people in urban areas greatly rely on energy. For the public and private sectors to deliver community services in an effective manner, year-round access to electricity is required. Together with population growth and urbanization, energy demand will increase over the next few years. The amount of electricity used in the Upazila is calculated. Provision of Electricity is most essential for supplying power and energy to the Upazila. In the urban area people are highly dependent on the electricity for both domestic and commercial consumption. For smooth functioning of the community services by public and private sectors, electricity supply has to be ensured round the year. With the growth of population and increase in the level of urbanization, electricity consumption will also increase in the future. From the World Bank standard, at present Energy consumption per capita is around 497 kWh of electricity. As the growth of our country people's lifestyle, it's assumed that every year this demand will increase 3% per year. An estimation of electricity consumption for the Upazila is given below:

Table 3.19: Electricity Demand Projection in Amtali Upazila

Union Name	Population, 2021	Electricity Consumption (kwh)	Population, 2026	Electricity Consumption (kwh)	Population, 2031	Electricity Consumption (kwh)	Population, 2036	Electricity Consumption (kwh)	Population, 2041	Electricity Consumption (kwh)
Amtali Union	27187	13512013	28955	16562210	30733	20191886	32376	24508503	33825	29495571
Gulishakhali Union	32030	15919059	34113	19512622	36208	23788892	38143	28874477	39851	34749946
Athrogasia Union	26387	13114288	28103	16074703	29829	19597540	31423	23787098	32830	28627372
Kukua Union	27044	13440971	28103	16074703	29829	19597540	31423	23787098	32830	28627372
Haldia Union	30460	15138766	28103	16074703	33021	21694946	34510	26123886	35817	31232293
Arpangasia Union	16740	8319775	17828	10197878	18924	12432785	19935	15090663	20827	18161359
Chowra Union	23413	11636386	24936	14263179	26467	17389013	27882	21106433	29130	25401236
Total	**183262**	**91081259**	**190140**	**108760000**	**205012**	**134692602**	**215691**	**163278157**	**225109**	**196295149**
Total		**91081**		**108760**		**134693**		**163278**		**196295**

Source: https://www.enerdata.net/estore/energy-market/bangladesh/

According to Ministry of Power Energy and Mineral Resources (Power Division), At present total power Generation capacity in the Barishal Region 2265 MW, in which Amtali upazila's capacity is 22.4 MW.

3.9 SOLID WASTE GENERATION

Solid waste management is a major concern to local governments to protect human health, the environment and to preserve natural resources. The design and operation of an effective solid waste management system requires accurate estimation of future waste generation quantities. The main objective of this study was to develop a model for accurate forecasting of solid waste generation that helps waste related organizations to better design and operate effective solid waste management systems. The waste generation unit is 0.11 kg per person per day. According to survey, Amtali Upazila produced 19.85 tons of solid waste in 2021 as opposed to 27.2 tons in 2041.

Table 3.20: Solid Waste Generation Projection in Amtali Upazila

Union Name	2011	Waste Generation(day/person/kg)	2021	Waste Generation(day/person/kg)	2031	Waste Generation(day/person/kg)	2041	Waste Generation(day/person/kg)
Amtali Union	24155.00	2657.05	27187.15	2990.59	30733.46	3380.68	33825.20	3720.77
Gulishakhali Union	28458.00	3130.38	32030.30	3523.33	36208.36	3982.92	39850.86	4383.59
Athrogasia Union	23444.00	2578.84	26386.90	2902.56	29828.83	3281.17	32829.55	3611.25
Kukua Union	24028.00	2643.08	27044.21	2974.86	29828.83	3281.17	32829.55	3611.25
Haldia Union	27928.52	3072.14	30460.29	3350.63	33021.23	3632.33	35816.85	3939.85
Arpangasia Union	14873.00	1636.03	16739.99	1841.40	18923.57	2081.59	20827.25	2291.00
Chowra Union	20802.00	2288.22	23413.25	2575.46	26467.30	2911.40	29129.86	3204.28
Total	**163688.52**	18005.74	**183262.09**	20158.83	**205011.57**	22551.27	**225109.12**	24762.00

Source: PKCP project, UDD, 2022

4.1 DEVELOPMENT PLANNING STRATEGY AND SECTORAL POLICIES PROPOSED IN THE STRUCTURE PLAN

Several national plan policies have been reviewed to determine the strategies for Amtali Structure Plan area. Some of the important plans and policies that have been reviewed that are the following: Perspective Plan (2021-2041), Perspective Plan (2010-2021), the 8th Five-Year Plan, 7th Five Year Plan, the Bangladesh Climate Change Strategy and Action Plan (2009), Bangladesh National Conservation Strategy (2016-2031), National Adaptation Programme of Action (NAPA) 2009, Coastal Development Strategy 2006, National Food Policy 2008, Coastal Zone Policy 2005, the Country Programming Framework (2010), Coastal Environment and Management Plan for Bangladesh 1988, Environment Policy and Implementation Plan 1992, National Environmental Policy 1992, Environmental Court Act 2000, National Water Policy 1999, Bangladesh Water Act 2013, National Agriculture Policy 1999, Land Use Policy 2001, Tourism Master Plan of Bangladesh, the Bangladesh Water Act 2013, Environmental Conservation Act 1995, National Environmental Management Plan 1995, the Bangladesh Delta Plan 2100, the National Adaptation Plan and the Sustainable Development Goals.

4.1.1 URBAN SECTOR

In the urban sector the policy recommends strategies to promote sustainable urban development, including the creation of adequate and affordable housing, the provision of basic urban services such as water supply and sanitation, and the development of sustainable transportation systems. This also recommends the adoption of policies that encourage the use of renewable energy, the reduction of greenhouse gas emissions, and the promotion of green spaces and public parks. Additionally, effective land use planning is critical to ensure proper urban development and sustainable economic growth. The policy strategy highlights the importance of developing effective land use plans to ensure that land resources are utilized in the most efficient manner.

The government's lone effort in resources, capabilities and initiatives is inadequate to resolve the ever-increasing housing problem. As a result, the gap between housing demand and supply becomes wider. The genesis of the problem remains in the fact that the development of housing and related infrastructure can't cope with the growth of the population. Affordable, equitable and accessible urban services is the key to ensuring sustainable development of urban areas.

US-01: Prepare more detailed land use zoning for pourashavas/urban areas.

Justification

Land use development is more intensive and diverse in urban areas. So, more detailed zoning is necessary for urban part of the Upazila.

Strategies

1. Apply urban area land use zoning for guiding building permission in the potential urban area.

2. Maintain maximum possible flexibility in the land use to enable development where pressure is high for development permission.

3. Urban green spaces should be enhanced to promote better lifestyles and healthier environments. Trees and green spaces should be preserved to improve air quality, lower urban temperatures, promote physical activity, and enhance general health.

US-02: Limiting urban expansion to the Proposed Urban Area

Justification

Limiting urban expansion to the proposed urban area is an important aspect of urban planning and development to ensure balanced urban growth and management of cities.

Strategies

1. For Upazila, infill construction is recommended. Every land proposal should be made in close proximity to an already developed area. Due consideration should be given to safeguard urban water bodies, playgrounds and high-value urban agriculture.
2. To preserve quality of life in urban places include integrated polycentric development, multiple functions, and high-quality public space. Polycentric development in terms of morphological aspects that focus on population size, employment rate, land use combinations, and functionality mainly emphasizes the activity exchange and metabolism of the fabric.
3. Economic competition should be encouraged based on the city's current natural resources, human resources, and revenue-generating assets. Current resources and abilities should be utilized to their fullest potential. Assets in the areas of culture, heritage, industry, and environment should be prioritized.
4. Urban areas should be connected with their rural surroundings. Cities heavily rely on nearby rural areas for food, labour, water supply, and the disposal of food waste.

Implementing Agency

The UDD is a government agency under the Ministry of Housing, Payra Development Authority and Public Works that is responsible for urban planning, development, and management at the national level in Bangladesh. Local government authorities, such as city corporations, municipalities, and pourashavas are responsible for the planning and development of urban areas at the local level in Bangladesh.

US-03: Ensure proper drainage, modern sewerage, proper waste management and clean air in cities.

Justification

To promote sustainable urban development the creation of adequate and affordable housing, the provision of basic urban services such as water supply and sanitation, and the development of sustainable transportation systems are utmost important.

Strategy

Waste management should include prevention, minimization, recycling and reuse of wastes, biological treatment, incineration, and landfill disposal. Prioritize nature-based solutions to ensure proper drainage, simultaneously protecting and enhancing the environment and minimizing management cost. By adopting multifunctional sustainable drainage systems, it is possible to create new habitats and mitigate climate change impacts in collaboration with stakeholders while minimizing management costs. Additionally, the installation of modern sewage systems should be based on need and feasibility assessments.

Implementing Agency

The UDD is a government agency under the Ministry of Housing, Payra Development Authority and Public Works that is responsible for urban planning, development, and management at the national level in Bangladesh. Local government authorities, such as Development Authorities and municipalities are responsible for the planning and development of urban areas at the local level in Bangladesh.

US 04: Promote urban physical environment with proper balance between ecology

Justification

Urban ecology seeks to develop a balance between human culture and the natural environment in areas where paved surfaces, high-density homes and businesses, and other urban-related elements dominate the landscape. This equilibrium can be attained using a technique called ecological urban planning. Making choices about how to use land and other resources in a way that reduces harmful effects on the environment while maximizing positive effects for people.

Strategy

1. In order to encourage urban agriculture, which can lower CO2 emissions from food transportation and increase access to nutrient-dense foods, farmland within cities should be maintained. Farmers' markets might be encouraged in order to foster diverse local supply chain. Urban green spaces should be enhanced to promote better lifestyles and healthier environments. Trees and green spaces should be preserved to improve air quality, lower urban temperatures, promote physical activity, and enhance general health.

Implementing Agency

Municipalities, and pourashavas are responsible for local level planning and development of urban areas under the guideline of Regional Plan, Structure Plan and Urban Area Plan prepared by Urban Development Directorate (UDD).

4.1.2 RURAL SECTOR

RS-1: Ensuring urban services into rural areas following the government agenda "My Village My Town"

Justification

Development of infrastructure such as road, power, irrigation, prevention of river erosion and flood protection will boost rural economy. Surplus rural capital will be invested in agricultural and non-agricultural activities creating new jobs.

Strategies

Better connectivity should be established to unlock the potential of the rural economy. Community people and local government should work together to promote a common vision of how to develop and improved an Upazila where culture and tourism may play a significant role. Gear up infrastructure development activities with domestic and foreign funding.

Implementing Agency

Greater role to be played by REB, BADC, Krishi Bank, LGED, BWDB by taking up more development projects.

RS-2: Improve the coverage of primary education, health, sanitation and safe drinking water facilities

Justification

This approach takes into consideration various factors such as social, economic, environmental, and cultural aspects of rural areas to ensure that development initiatives are sustainable, inclusive, and aligned with existing rural settlement patterns.

Strategies

- Only fundamental services in the areas of health, education, social safety, and communication infrastructure may be considered for inclusion in the plan.
- Facilities need to be located at a distance of 500 meters or less from union headquarters or current growth centres.

Implementing Agency

Ministry of Agriculture, Ministry of Housing and Public Works, Ministry of Education, Upazila and Zila Parishads.

RS 03: Flexible planning for rural land zones, infrastructure and facilities

Justification: Rural land may have a diverse mix of uses, and its zoning may not accurately reflect the variety of land uses actually being used there. Rural areas may also contain areas

with important environmental qualities, habitat for certain species, and local and regional landscape values. So, while making plans for rural area, it is crucial to take these issues into account.

Strategies:

1. Growth centre hierarchy has been determined considering functional and geographical relevance, the hierarchy will be considered when establishing road connectivity. other facilities such as telecommunications, including internet connectivity, health centres, sanitation and waste management, market infrastructure, quality education, safe drinking water, information technology facilities and high-speed internet, as well as better sewage facilities, community space and recreation, banking, rural resources, power and energy supply, modernization and mechanization of agriculture would be provided on the basis of the hierarchy of growth centres.
2. Prioritize nature-based solutions to ensure proper drainage, simultaneously protecting and enhancing the environment and minimizing management cost.
3. Private conservation can be provided via environmental conservation or landscape protection, which enables the plan to more accurately represent current land usage.

Implementation Agency

Urban Development Directorate (UDD) and LGED.

RS 04- Encourage the best possible use of the land and its conservation in order to increase agricultural output and produce food.

Justification

Agricultural land is land that has comparative advantages in terms of soils, climate, water (rain or irrigation), and availability to services. It is significant for agriculture and/or food production on a state, regional, or municipal level. The State's food supply, especially its supply of fruits and vegetables, is primarily derived from agricultural land.

High-quality agricultural land data that has undergone consultation and refinement to remove land needed for current and future urban/development areas, public use areas, and land needed for environmental objectives is the foundation for the identification of priority agricultural land.

Strategies

1. Increase the variety of crops and livestock used in business operations.
2. Make use of mixed pastures and crop rotations based on legumes
3. Combine various crop kinds
4. When selecting varieties that tolerate a specific bug or disease, choose those that have multiple genes rather than just one or two
5. Give open-pollinated crops the edge over hybrids due to their greater genetic diversity and capacity to respond to local circumstances

6. Plant cover crops in crop fields, vineyards, and orchards
7. At the field's edge, leave strips of natural vegetation
8. Create passageways for wildlife and helpful insects
9. Engage in agroforestry, which combines trees or shrubs with livestock or crops to increase the continuity of the natural enemies' habitat
10. Plant native plants and trees that can alter the microclimate to create hedgerows or windbreaks
11. Provide a water supply for insects and birds

Implementation Agency

Urban Development Directorate (UDD).

4.1.3 AGRICULTURE SECTOR

For the sake of food production, there is a need to conserve high-yielding agricultural lands from encroachment by severely competing non-farm land use demand. In disaster prone areas, strategies are recommended to protect agricultural land. Investing in agro-based industries and food processing are key steps to move forward to secure food supply and agricultural growth.

AS-1: Intensification of agriculture and crop diversification to increase food security; develop salt tolerant crop varieties.

Justification

Diversifying crops can help increase crop intensity by growing different crops in the same field or rotating crops between seasons. This practice can help reduce pest pressure, increase soil fertility, and optimize water use, leading to higher crop yields without expanding agricultural land. To save the agricultural land for food security in the country, it is necessary that further loss of agricultural land is prevented.

Strategies

Cropping pattern information, ground water quality and quantity and interpolated surface geology information will assist relevant agencies to take adaptive strategies to save and protect at least double and triple cropped agriculture lands. The strategy has identified Upazilas affected by salinity at various levels due to 0.50m, 0.62m, 0.95m, and 1m SLR, which will let pertinent agencies make decisions to increase Productivity, cropping pattern of the region has been surveyed which will help to conduct R&D to shift in agriculture paradigm and lay emphasis on the necessity of coastal polders for protecting agricultural fields from saltwater incursion.

Fish stocks must be managed responsibly by utilizing the bounty of the ocean, lakes, and rivers to produce food and nourishment, or else the resource will go extinct and negatively impact both people and the aquatic environment. Agro-fisheries equipment should be environment friendly and affordably priced and simple to use, which can increase yields.

AS -2: Prevent non-agricultural use of the fertile agricultural lands.

Justification

Bangladesh is an agricultural country. Its economy is mostly dependent on agriculture. But in order to provide housing, most of the agricultural lands are being converted to residential areas. As a result of expansion of residential areas, the total amount of agricultural lands is decreasing day by day which is harmful for future food production. So, it is the demand of the time to discourage residential expansion in the agricultural land and keep suitable agricultural lands free from any kind of encroachments.

Strategies

Keep suitable agricultural lands free from any kind of encroachments particularly from human settlements.

The plan should identify the cropping pattern of the study region in order to identify high productive fields and restrict non-agricultural use of land resources through defining them as Agriculture zone.

4.1.4 TRANSPORTATION AND TRAFFIC MANAGEMENT

TT-01: Develop an integrated network of communication including highways, rural roads, railways and water ways.

Justification

The first step would be to establish a comprehensive transportation plan that considers the needs and demands of local, regional, and national transportation systems. This would require coordination among various government agencies. Development of local transportation network will help build up improved internal road and waterway transport system within the Amtali Upazila.

Strategies

1. Proposals will be made for widening the existing narrow roads where possible and development of new roads where accessibility is poor.
2. Infrastructure like, terminals, parking spaces for motorized and non-motorized vehicles, traffic signals, automobile workshops and garages, pick up and drop off spaces for passengers and goods, etc. would be developed depending on the needs.
3. Plan would consider integration among road, rail and water ways.
4. Establishment of connectivity by inter-regional highways with economic zone areas, ports, airports, power stations, inland water transport facilities, rail stations and major tourist resorts.
5. Upgrading of all inter-district roads to at least 4 lane facilities and upgrading /extending existing bridges; Upgrading zilla and Upazila roads to at least 2 lanes. Conversion of village roads to asphalt standard with at least one lane.
6. Creation of physical segregation of the primary road from the local activities and local traffic including manually operated vehicles.

7. Establishment of road hierarchy among primary, secondary and tertiary roads.

Implementation Agency

Ministry of Road Transport and Bridges, Road Transport and Highways Division, Bridge Division, Roads and Highways Department (RHD).

TT-02: Promote bike lanes and pedestrian walkways, recommend light transports, tourist-oriented sightseeing electric bus/ boats.

Justification

For achieving a better quality of life in the Paurashava and other urban areas, safe sidewalks and bicycle paths are required along the road system. An exclusive bicycle trails can also be created in suitable areas or along the roads with low traffic volume for supporting healthy lifestyle of local communities.

Strategies

1. Walking and bicycling facilities should link all the important services, community facilities and recreational spaces in the Paurashava and other urban areas. The width of the roads/right of ways for roads should be designed with required planning standards to accommodate the sidewalks and bicycle paths.

Implementation Agency

Ministry of Road Transport and Bridges, Local Government Division, Pourasava.

TT-03: Prioritize inter-regional river connectivity to facilitate trade, commerce and tourism; improve the navigability and river port infrastructure.

Justification

Bangladesh being a country with many rivers, Inland Water Transport (IWT) is a major mode for the transport of goods and people. IWT is the cheapest mode of transport compared to road or rail. The study region is well connected with inland water transportation system.

Strategies

1. Conduct regular dredging activities to maintain river transportation; develop and maintain river ports, ferry ghats and terminal facilities in ports/ ghats.
2. Provide modern water vessel/ ship in these routes.

Implementation Agency

Ministry of Shipping, BIWTA, BIWTC.

4.1.5 WATER RESOURCE AND DRAINAGE

Water resource planning and management is concerned with hydrology, water supply, sanitation, sewerage and drainage etc. Ensuring sustainable management of surface and ground water is the key to enhancing efficiency in water use in an equitable manner. Conservation and preservation strategies are highlighted for supply of safe water. Industrial

development in recharge areas is to be restricted to prevent water pollution. Water treatment plants and regular monitoring is needed to maintain the quality of water. Application of 3R policy, preservation of recharge areas, and rainwater harvesting schemes are some of the proposed strategies.

WR-01: Promote rainwater harvesting in coastal areas, and preserve and maintain the existing natural water bodies for drainage to save crop and property, control flood and protect the environment

Justification

The only economically reasonable alternative of groundwater is rainwater. The most important advantage of rainwater harvesting is that it has no connection with sanitation problem and it requires no or minimal treatment for drinking. If people of the study area are interested about the rainwater harvesting and do it spontaneously then it will largely decrease the groundwater abstraction pressure from subsurface water bearing zones. Rainwater harvesting boosts soil fertility, lessens the need for chemical fertilizers, increases well water use, replenishes groundwater, and makes better use of all the water that falls on the farm to increase crop yield. The most crucial factors in the optimization of Rain Water Harvesting Systems is the tank location and the distribution technique selected.

Strategy

Strategies such as wetland conservation, stormwater management, watershed management, floodplain management, ecosystem restoration, monitoring and enforcement, and education and outreach can help ensure the sustainability and condition of natural water bodies for current and future generations. In order to promote sustainable water management practices, rainwater harvesting systems should be incentivized by lowering installation and equipment costs for collecting and storing rainwater for domestic use or to recharge aquifers.

The water problems can be solved and climate resilience can be increased through the use of green infrastructure, which relies on vegetation, soil and natural systems to manage rainfall runoff.

Conserve big ponds with clean water as a source of drinking water. Local agencies could take lease private owned such ponds. It is important to protect water pockets and bodies as a safeguard measure. Construction and rehabilitation of flood and drainage management measures should follow eco-engineering solutions.

The expansion and conservation of green and blue infrastructure can improve urban environments and drainage systems.

To increase fresh water supply restoration of water reservoirs the following critical elements should be considered: Catchment processes (interaction between geology, topography, evapotranspiration, rainfall, and land use and cover causing runoff and the production and transportation of pollutants, nutrients, carbon, and sediment), Flow regime (Hydrology

(magnitude, frequency, duration, and timing of flows), surface and groundwater interactions), Habitat (Sediment mobilization and deposition; hydraulic habitat from interaction of hydrology and physical form), Water quality and sediment chemistry (Temperature, nutrients, salinity, DO, turbidity, metals, toxins, carbon), Aquatic and riparian biodiversity (Abundance and organization of flora, fauna and microorganisms; ecological processes (metabolism, nutrient cycling)).

Implementation Agency

Public health Engineering Department, pourashava, NGOs/CBOs

WR-2. Provision of safe and affordable drinking water supply with special attention to salinity prone coastal areas.

Justification

Safe in context of salinity, arsenic contamination etc. is a basic requirement of people. It is also a crucial need of the people of coastal area.

Strategy

Long-term water resource management strategies documented by the Government. following IWRM concept (such as examining large-scale O&M activities in embankments and polders to prevent salinity intrusion, identifying and implementing the best option and undertaking desalinization activities) should be incorporated. Coastal embankments also need to be rehabilitated. Arsenic mitigation measures should be taken. Industrial development in water recharge areas should be restricted to prevent water pollution. The plan ranks sites based on availability of quality ground water which will help to make proper use of ground water; the plan identifies surface water network by analysing DEM and field survey. In Urban area plan the location of water treatment plant should be located.

The option to treat drinking water at home using filters, solar disinfection or flocculants will be made available to ensure safe drinking water for all.

Encourage cost-effective methods to improve water quality, such as using chlorine tablets or exposing plastic bottles to sunlight.

It should be given priority to conserve, manage and re-excavate the wetlands.

Implementation Agency

Public health Engineering Department, pourashavas, NGOs/CBOs

WR-3. Reduce dependency on groundwater and ensure natural and artificial recharge of groundwater.

Justification

To reduce groundwater dependency, demand-side management interventions and supply-side engineering measures is important. Aquifer recharge improvement with excess surface runoff, urban wastewater reuse and complementary local supply-side steps like rainwater harvesting should always be promoted.

Strategy

The plan should identify highest recharge area to maintain the areas unpaved. Coastal Afforestation zone may be proposed in this area.

Industrial development in water recharge areas should be restricted to prevent water pollution.

Implementation Agency

Plan implementing agencies like Public Health Engineering Department, Pourashava, Development Authority, NGOs/CBOs

4.1.6 RENEWABLE ENERGY

Power is a part of modern living. Progress in all respect cannot be moved forward without adequate power supply. This is an essential part of everyday life. Target has been set in Bangladesh Delta Plan 2100 for at least 30% energy production from renewable sources by 2041 in the context of being a prosperous country.

RE-1: Extension of power supply to unserved rural areas/char land

Justification

Government has to take steps to extend power supply to rural areas through REB. Necessary budget should be sanctioned in this regard. If it is delayed alternative measures may be promoted.

Strategies

1. Take up power supply as major national development policy.
2. Crush program by REB with necessary budget allocation.

RE -2: Emphasis on development of renewable energy, particularly solar homes and biogas plants; Include energy saving devices in all infrastructure; Reduce the use of fossil fuel; Investment to harness wind energy particularly in coastal areas.

Justification

Take necessary steps to promote solar energy, renewable energy and Wind Mill as alternative national power supply. Involve private sector to meet the supply gap through sustainable energy.

Strategies

1. Involve private commercial agencies and energy sector NGOS to supply domestic solar system.
2. Introduce soft credit facility for users to purchase solar system.
3. Renewable energy use such as solar plants, bio-gas plant and wind mills should be given priority; the plan should identify suitable locations for eco-town development to lower carbon impact.

Implementation Agency

In Bangladesh, several agencies and organizations are involved in the implementation of renewable energy initiatives. Some of the key implementing agencies for renewable energy in Bangladesh include: Sustainable and Renewable Energy Development Authority (SREDA), Infrastructure Development Company Limited (IDCOL), Bangladesh Power Development Board (BPDB) and Grameen Shakti.

4.1.7 DISASTER MITIGATION AND CLIMATE CHANGE ASPECT

Disaster arising from climate change or non-climate change phenomena is very common in Bangladesh. People of the country are highly resilient to disasters like, flood, cyclone, and river bank erosion. Remarkable disasters that strike Amtali Upazila are, tropical storm, Salinity and monsoon flooding.

DPM-01: Ensure better flood control, Control riverbank erosion, Control sea-water intrusion and reduce salinity.

Justification

Natural disasters, such as floods, inundation of water, cyclones, erosion etc, are threats to safety and loss of human life and properties. This has to be given due consideration in the development processes.

Strategies

Building new and enhancing existing drains; identifying inundation area and depression area for taking necessary measure for infrastructure development; facilities such as water treatment plant, septic tanks, toilets etc should be constructed above flood level to avoid inundation level.

The strategy of implementing disaster-resilient infrastructure can be adopted to face the challenges of future disasters.

Implementation Agencies

The local government authorities, particularly the Upazila Parishad should work through different committees formed as per National Disaster Management Plan at the local levels. The Disaster Management Directorate under the Ministry of Disaster and Relief should be monitoring such actions for people's safety and national security purposes.

DPM-02: Construct adaptive and flood-storm-surge resilient building; extension and improvement of multipurpose cyclone shelters.

Justification

Proactive action for sustainable infrastructure is necessary to tackle climate change impacts. Multipurpose cyclone shelter should be a solution to comprehensive and productive use of structure. The plan should propose embankment construction considering people who live in the area between the river and the wall (strategies or compensation provision to their homes, farms, animals, pastures, livelihoods); the plan should also recommend measures to include

protection from saline water, river bank and khal protection schemes, rehabilitation of polders, as well as an extension of polders, canal excavation, construction of new embankments, protection and extension of irrigation systems, excavation of river and branch channels, and multipurpose cyclone shelters.

Strategies

Infrastructure should be built higher above the flood plain. Build Using Flood Resistant Materials – Materials that can withstand contact with floodwaters for at least 72 hours without suffering major damage are considered flood resistant.

Construct coastal embankments and polders to control flooding; construct sluices to facilitate drainage.

Flood proofing the critical infrastructures such as hospitals, power stations, industrial plants, major communication networks require development of embankments, barriers, water control structures etc. Steps are also needed for extension and improvement of multipurpose cyclone shelters and preparation of guidelines for designing climate change resilient infrastructure. Upazila level public sector development agencies need to follow guidelines during development of infrastructure.

Implementation Agencies

The local government authorities, particularly the Upazila Parishad should work through different committees formed as per National Disaster Management Plan at the local levels. The Disaster Management Directorate under the Ministry of Disaster and Relief should be monitoring such actions for people's safety and national security purposes.

CLI-1: Take necessary measures to educate people about the dangers of climate change in all spheres of life.

Justification

Awareness would cause people to take proactive measures to create resilience against the negative impacts of climate change.

Strategies

Program initiative by the Upazila Parishad in collaboration with the Department of Disaster Management to educate people about climate change and its consequences.

CLI-2: Adopt climate change resilient production technology in agriculture including seed.

Justification

To avoid disaster in agricultural production, prior action to evolve new agro-tech in agriculture is necessary to cope with climate change.

Strategies

Research program initiative by BADC and BRRI to evolve new technology and paddy Resilient to climate change.

CLI-3: Identification, protection and management of environmentally sensitive and biologically potential areas.

Justification

Preservation of environmentally sensitive areas can serve as safe guard to bio-diversity and disaster.

Strategies

1.Identify critical habitat areas of crab, crocodile, deer, dolphins, fox, migratory ducks, reptiles, resident birds, resident water birds, sea turtles, sea gull, wild boar, wild buffalo, wild cat, hilsha sanctuary etc. proposal has been made considering the mentioned areas to remain undisturbed.

2. Earmark environmentally sensitive areas in the master Plan.

3. Control development in those areas; take over land if possible to preserve the areas.

CLI-4: Organize and keep activated the disaster management committees at various levels of the administration

Justification

Regular meeting of Disaster Management Committees will keep members conscious about their responsibilities.

Strategies

Hold regular meeting of Upazila, Union Disaster Management Committees.

Implementing Agency

In Bangladesh, the implementing agency responsible for addressing climate change is the Ministry of Environment, Forest and Climate Change (MoEFCC). The MoEFCC is the primary government body in Bangladesh responsible for formulating and implementing policies, plans, and programs related to environmental conservation, forest management, and climate change mitigation and adaptation.

4.1.8 CONSERVATION ZONE

CZ-1: Promote conserve and sustainable management natural/environmental resources and use of terrestrial ecosystems and forests.

Justification

Conserving natural and environmental resources, such as water bodies, forests, and char lands (riverine islands), is critical for maintaining ecosystem services, supporting livelihoods, and preserving biodiversity.

Strategies

1. River and Khal protection zone has been created to protect existing water bodies. 50m buffer zone has been created from the edge of the river and 10m buffer zone has been created from the edge of the khals. Continental embankment, road and

beautification with tree plantation have been proposed in this buffer zone. It will protect the river and khal from further development.

2. For conservation of forests, GOs and NGOs should assess forest resources, delineate reserved areas, identify suitable locations for reforestation by categorization of forest areas, control the economic exploitation of forest products, defend against calamities, create national parks, and promote growth of social forestry, agroforestry and other forestry practices. Moreover, master plans for both the long and short terms should be made.
3. Fresh water needs to be conserved as much as possible. In this case, water banking through conserving big water bodies could be a solution.
4. Trees and forests should be preserved, especially large trees and mature forests, as they serve as habitat for a variety of species, store carbon, uphold water quality, regulate climate, and offer areas for recreation and contact with nature
5. Plant trees in the coastal and terrestrial environments or the intertidal zone, along coasts which will work as a barrier against disaster.
6. Ocean acidification needs to be reduced, because its impact could potentially jeopardize the marine food web and undermine the adaptability of marine ecosystems, notably corals.
7. Nutrient inputs must be decreased by sewage treatment and measures targeting agricultural practices in order to combat the threats of coastal eutrophication.
8. Coastal plants will serve as a mitigation measure to lower coastal erosion and retain silt by slowing the current.
9. Coastal plantation can minimize the risks of loss and damage to individuals and property during natural disasters such as cyclones and storm surges by reducing wind and water velocity.
10. To reduce environmental degradation, preserve wetlands and conserve wildlife habitats and biodiversity. All food, wood plants, livestock, microorganisms and farm animals should be protected. All economically significant organisms should be recognized and protected. First and foremost, unique ecosystems should be protected. The resources should be used as efficiently as possible.
11. To conserve wildlife habitats and biodiversity, wild animal poaching and hunting should be prohibited, reserves and protected places must be carefully planned, pollutant levels in the environment should be lowered, and deforestation should be stopped at all costs by enforcing environmental rules.

CZ-2: Execute land use planning for the enhancement of ecosystem and species diversity.

Justification

Land use planning plays a crucial role in enhancing ecosystem and species diversity by promoting sustainable and responsible land management practices. Here are some steps that can be undertaken to execute land use planning for the enhancement of ecosystem and species diversity.

Strategies

1. Conservation Zone has been created in the char area to protect char area from further development. This zone will preserve the natural condition and attract tourist more.
2. The government must be convinced that the ecosystem of a particular area has reached or is in danger of reaching a critical state or condition as a result of environmental deterioration before proclamation of ECA.
3. Following factors must be considered while declaring any ECA: a) human habitat, b) ancient monument, c) archaeological site, d) forest sanctuary, e) national park, f) game reserve, g) wild animals' habitat, h) wetland, i) mangrove, j) forest area, k) biodiversity of that area along with other relevant factors.
4. Plants and animals that are useful and endangered should be conserved in their natural and artificial habitats.
5. The importance of biodiversity protection should be made known to the general public. Elected public body must be held accountable for acting on behalf of ecosystems and biodiversity.

Implementation Agency

There are some of the key agencies involved in conservation zone protection in Bangladesh. However, it's important to note that conservation efforts in Bangladesh also involve collaboration and partnerships among various stakeholders, including government agencies like Ministry of Environment, Forest and Climate Change (MoEFCC), Bangladesh Forest Research Institute (BFRI), Bangladesh Wildlife Conservation Trust (BWCT), Bangladesh Forest Department (BFD), National River Conservation Commission (NRCC), NGOs, local communities, and other relevant organizations.

4.1.9 ECONOMIC ZONE

EZ-01: Light industries need to be developed to flourish the industrial sector development

Justification

In order to accelerate the economic development of Amtali Upazila in the long run, it is required to encourage the establishment of industries within Upazila area.

Strategies

To control the haphazard growth in the midst of industrial development, measures will be undertaken as follows:

- Following the category of industries as categorized by DOE (Green Category) and Bangladesh National Building Code (low and medium category hazards)

- Following Bangladesh National Building Code, 1993 & 2006 and Building Construction Regulation, 1952 (amendment in 1996) for providing Road, setback etc. before construction of any industrial structures.

EZ-02: Promote Agro based Industries in the Growth Centres

Justification

Amtali Upazila is dependent on agriculture and small business through direct or indirect involvement of private and public sectors. Emphasis is required for accelerating the economic development trend by restoring the economic base of the area. Small growth centres should be developed in different unions. Public and private investment should concentrate in such growth centres. This policy will create opportunities for developing basic agro-based industries in Amtali Upazila.

Strategies

Agro-based industries will help the existing producers to increase their earning and increase the employment opportunities through ensuring increased capacity.

EZ-03: Promotion of Rural Growth Centres as Trading Hub of the Rural Area.

Justification

Promoting rural growth centres as trading hubs in rural areas can contribute to the economic development of rural communities by facilitating trade and commerce, creating employment opportunities, and promoting local entrepreneurship.

Strategies

If national business establishments can be encouraged to locate in the Upazila, they will provide earning capacity for their locally recruited employees. However, this would depend on the availability of services to support the businesses. The Upazila will assist central government in promoting Upazila as potential location for inward investments.

EZ-04: Employment Generation through Development of Potential Sectors

Justification

Generating employment opportunities through the development of potential sectors can be a key strategy for economic growth and poverty reduction.

Strategies

In order to promote economic activity of the Upazila for longer period with proper sustenance, particular attention should be given on agriculture and small-scale business. Proper planning and coordination among these sectors and future potential sectors would make it possible to engage local active labour force. Following measures will be encouraged to implement this policy implication:

- Industrial Zone declaration in Land Use Zone (mainly light industries)
- Infrastructure development to flourish agro industry (Market, Storage facility, electricity etc.)

- Involvement of active labour force and community participation in different management activities of Upazila such as solid waste management, road maintenance, public sanitation etc.

Implementation Agency

In Bangladesh, the implementing agency for economic zones is the Bangladesh Economic Zones Authority (BEZA). BEZA is a government agency under the Prime Minister's Office which is responsible for planning, development, operation, and management of economic zones in Bangladesh.

4.1.10 FOREST AREA

Policy FA-01: Conserve forest resources and improve bio-diversity, foster development through conservation, increase forest cover and protect biodiversity; take steps for forest regeneration and afforestation; bring coastal areas under mangrove rehabilitation program; give priority to the creation of a coastal green belt.

Justification

The forest area in Bangladesh is approximately 2.62 million hectares, which is about 17% of the country's total land area. Perspective Plan (2021-2041) has set the target to achieve 20% area under forest resources by 2041. However, it's worth noting that the forest cover in Bangladesh has been declining over the years due to various factors such as deforestation, illegal logging, encroachment, and infrastructure development.

Preserve trees and forests, especially large trees and mature forests, as they serve as habitat for a variety of species, store carbon, uphold water quality, regulate climate, and offer areas for recreation and contact with nature.

Strategies

1. Forest, char areas and areas which are still on Geological formation stage have been proposed as Conservation Zone for forest resources.
2. Encourage establishment of parks and discourage detrimental suburban sprawl and other development in order to preserve forests; Reforestation is a crucial component of the fight against climate change, and recovering ecosystems that have been damaged creates vital habitat for endangered species.
3. Expand social forestry program
4. For conservation of forests, GOs and NGOs should assess forest resources, delineate reserved areas, identify suitable locations for reforestation by categorization of forest areas, control the economic exploitation of forest products, defend against calamities, create national parks, and promote growth of social forestry, agroforestry and other forestry practices. Moreover, master plans for both the long and short terms should be made.
5. To conserve wildlife habitats and biodiversity, wild animal poaching and hunting should be prohibited, reserves and protected places must be carefully planned, pollutant levels in the

environment should be lowered, and deforestation should be stopped at all costs by enforcing environmental rules.

6. Afforestation may lead to a more balanced regional water cycle by minimizing run-off and flooding, tightening control over groundwater recharge and protecting watersheds. Additionally, a well-established tree cover can improve water quality and prevent surface erosion.

Implementation Agencies

Several agencies and organizations are involved in forest conservation efforts in Bangladesh. Some of the key implementing agencies for forest conservation in Bangladesh include- Bangladesh Forest Department (BFD) Local Government Department (LGD), Bangladesh Forest Research Institute (BFRI), and Community-based Organizations (CBOs).

4.1.11 TOURISM DEVELOPMENT

The PKCP area has been identified as having high potential for attracting tourists. One of the key strategies to increase tourism in the PKCP area is through ecotourism. Ecotourism is a form of tourism that focuses on visiting natural areas in a way that is ecologically sustainable and socially responsible. In addition, a massive tourism marketing strategy should be developed to promote the PKCP area as a tourist destination. The marketing strategy should emphasize the unique features of the PKCP area, such as its natural beauty, cultural heritage, and recreational opportunities. Capacity building in the tourism sector is also an important instrument for expanding tourism in the PKCP area. Expanding tourism in the PKCP area can have a significant impact on the local economy by creating jobs, boosting GDP growth, and supporting conservation efforts. To achieve this, a combination of strategies is required as mentioned below.

TD-01: Encouraging eco-tourism development

Justification

Investments in eco-tourism can be positive for environmental conservation as well as income generation. The natural sites at the Upazila level have potential for such investments and development.

Strategies

Eco-tourism development prospects in the Upazila should be explored for investment in ecotourism. Attractive natural sites will be identified and offered for eco-tourism development.

Establishing independence. The degree to which the tourism experience is successful depends on the sense of community ownership. Let them manage their own tourism industry and reap the rewards. Incorporating interactive components. In the age of the experience economy, tourists need engaging, instructive, imaginative, and visually appealing activities.

Ensure social Infrastructure facilities such as, restroom, worship place for Muslim, health centre facility, security facility, education and leisure facilities, arts and culture facilities,

sports facilities, traffic signs, safety signs, information centre, the facility for disabled, locker-room.

Implementation Agencies

Bangladesh Parjaton Corporation and the National Tourism Development Board should be supporting and guiding tourism development at local levels by enacting favourable policies and laws. Local and regional trade associations are important for promoting tourism development in the Upazila.

TD-02: Promoting and attracting public and private investments in Tourism Development

Justification

Tourism can be an important sector for revenue earning by the local authorities. The process of development in this sector attracts investments in various services. There is scope for promoting tourism development in the Upazila.

Strategies

Identifying, demarcating and developing suitable locations within the Upazila for creating attractions may be potential for attracting investment. Investment can be encouraged by creating attractive sites for development in the tourism locations. The local and regional investors can be attracted with possible options of incentives.

Provide economic infrastructure facilities such as, route to the tourism destination, ticket window, public transportation availability, parking area, bus stops, gazebo, hotel/resort, restaurants, souvenir shops, minimart, relevant telecommunication, electricity, ATM/Money Changer.

5.1 EXISTING LAND USE

Geographically, Amtali Upazila is primarily an island and majority of Upazila is rural. Some wards are primarily composed of urban features. However, the growth and spread of activities have already been impacted in recent years by the development of communication. The existing land use of the Upazila shows that 63.43 percent of the land is used for agricultural activity, and other mentionable land-use area is 19.27 percent residential, 0.99 Vegetation land and 12.41 percent Water body.

Table 5.1: Existing Land Use of Amtali Upazila

Existing Land use			
Sl. No.	**Land use Type**	**Area (Acre)**	**(%)**
1	Administrative/ Public Service	32.07	0.04
2	Agriculture	47344.51	63.43
3	Commercial	87.27	0.12
4	Community Service	273.30	0.37
5	Education and Research	207.54	0.28
6	Health Service	13.18	0.02
7	Manufacturing and Processing	251.67	0.34
8	Mixed Use	60.35	0.08
9	Open Space and Recreational	2.03	0.00
10	Residential	14379.97	19.27
11	Road	1070.22	1.43
12	Service Activity	30.38	0.04
13	Transportation and Communication	364.17	0.49
14	Vacant Land	517.37	0.69
15	Vegetation	738.48	0.99
16	Water body	9263.26	12.41
	Total	**74635.84**	**100**

Source: PKCP project, UDD, 2018

Map 5.1: Existing Land Use of Amtali Upazila

Source: PKCP Project, UDD, 2022

5.2 SUITABLE SITE RANKING-FINDINGS FROM SUITABILITY ANALYSIS

5.2.1 Ranking Suitable Areas Based on Geological Attributes

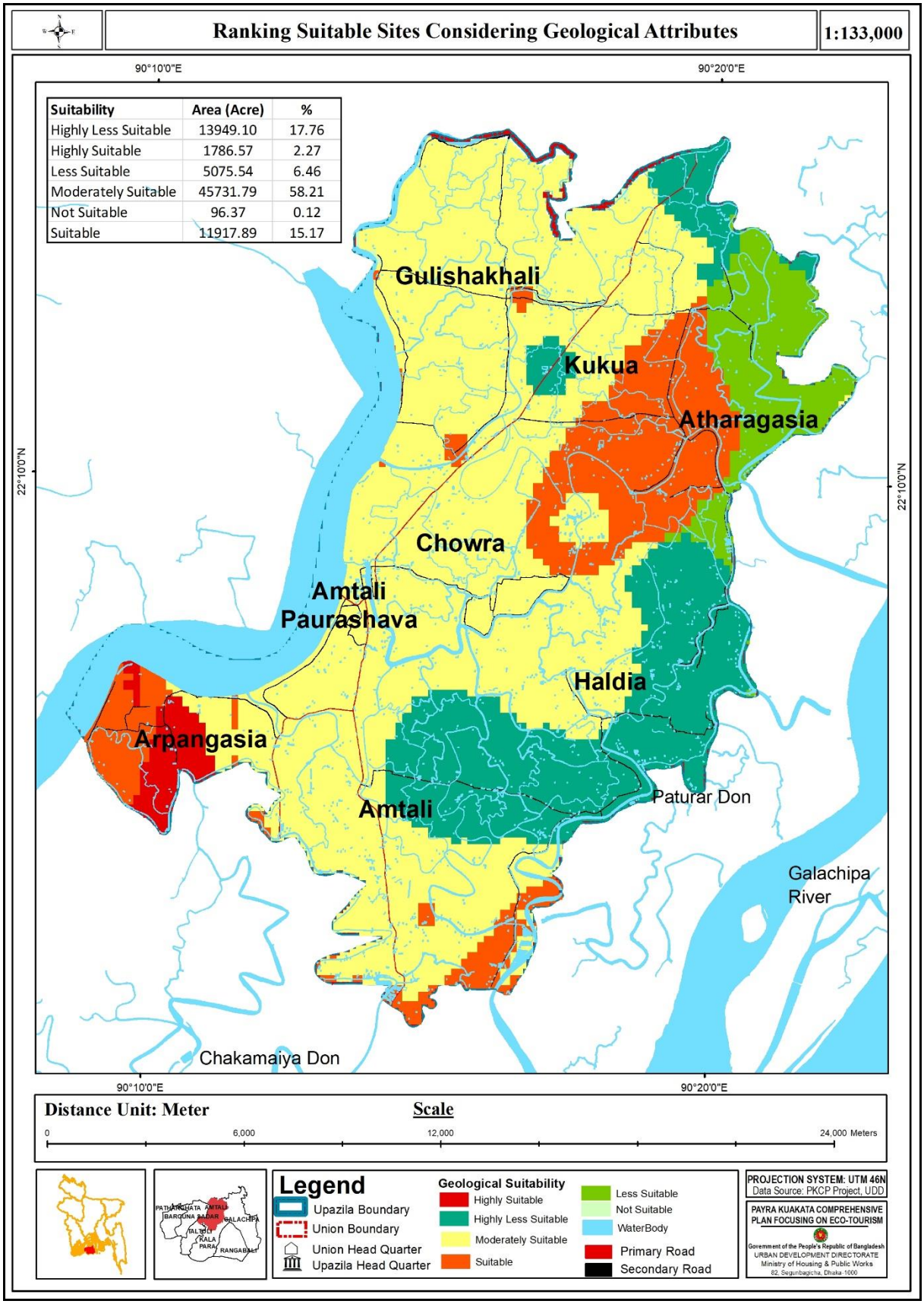
Geological attributes are important to ensure safe, stable and economic design. Two-step multi-criteria decision making (MCDM) technique has been applied to rank Geological suitability sites. PGA, Foundation layer depth, Soil Type, Liquefaction Potential Index, and Building Height Recommendation has been considered as important dependent variable and to find out the relative weight of these variable AHP pairwise comparison has been applied. Construction technology commonly employees pile foundation in a variety of scenarios such as when there is an unstable layer of soil beneath the surface which is incapable of supporting the weight of the building in case like earthquake- in such case the load must be transmitted to the layer of firmer soil or rock beneath the weak layer.

Three prominent geomorphological units such as 1) Fluvio-Tidal Deltaic Plain, 2) Natural Levee, and 3) Intertidal/Supratidal units. The surface is fully covered by the recent sediments, 1) Tidal Deltaic Deposit and 2) Mangrove Swamp Deposit. After getting the weighted value, the weighted sum model was applied to find the suitability, around 58.21 percent area were found moderately suitable and 6.46 percent found less suitable for infrastructure development. To rank suitable sites for infrastructure development geological attribute, elevation and building height zones has been considered.

Table 5.2: Geological Suitability Area of Amtali Upazila

Geological Suitability	Area in Acre	Percentage (%)
Highly Less Suitable	13949.10	**17.75**
Highly Suitable	1786.57	**2.27**
Less Suitable	5075.54	**6.46**
Moderate Suitable	45731.79	**58.21**
Suitable	96.37	**0.12**
Not Suitable	**11917.89**	**15.17**

Source: PKCP Project, UDD, 2022



Map 5.2: Ranking of suitable sites considering geological arrtibutes of Amtali

Source: PKCP project, UDD, 2022

5.2.2 Ranking Suitable Areas Based On Hydro-Geological Attributes

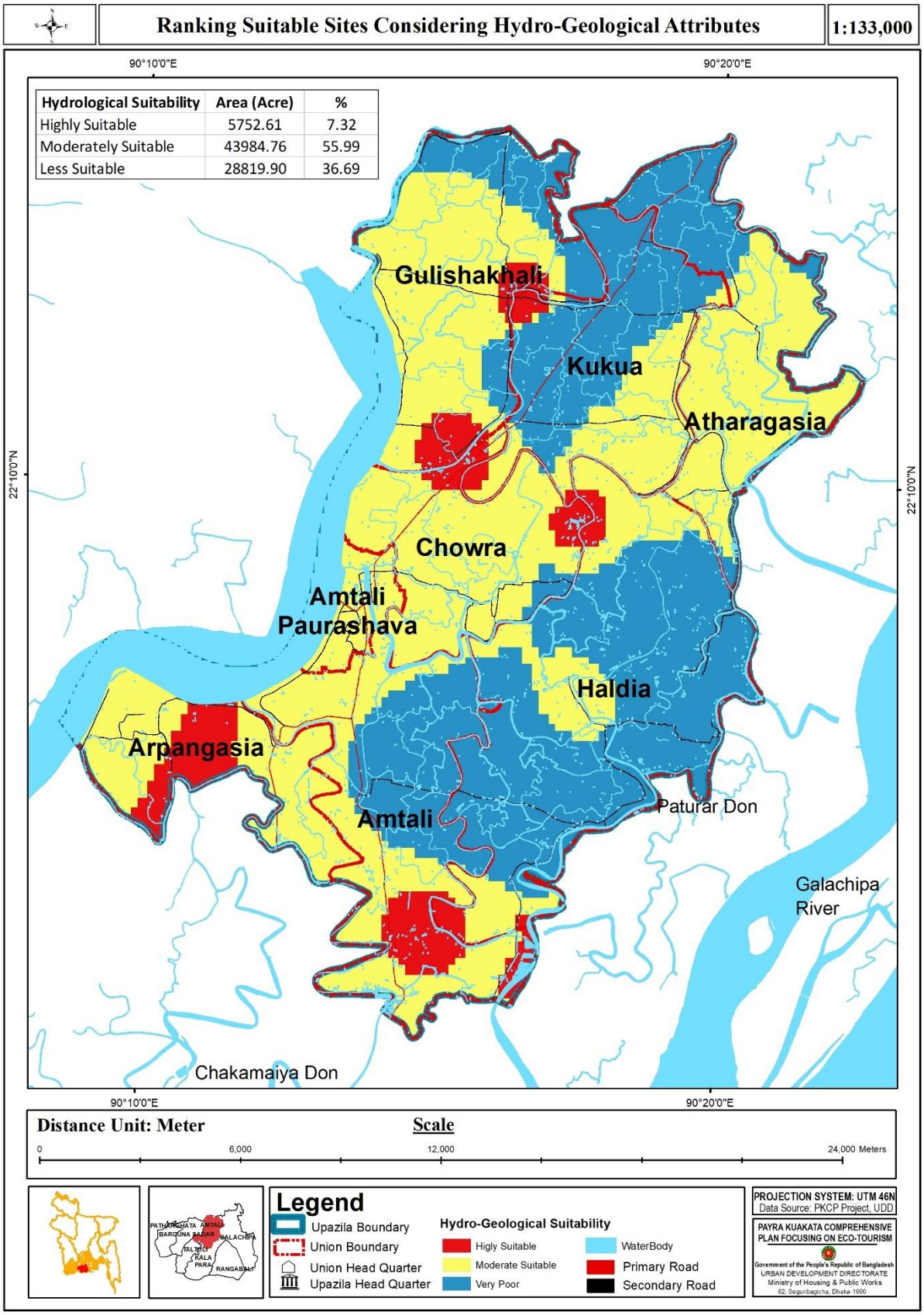
Water is essential to the majority of natural processes. Hydrogeological study has been conducted to understand water flow and distribution below the earth's surface Suitable sites based on hydrological attributes have been judged considering the availability of quality ground water for human use. To rank the water quality, WQI has been considered and to rank the availability of freshwater findings from slug tests and water head depth in the dry season has been considered. To rank suitable sites for infrastructure development geological attribute, elevation and building height zones has been considered.

The shallow aquifer receives less than 300 mm recharge annually from rainfall. The intermediate aquifer seems resembles the same water quality as the shallow aquifer. The deep aquifer is likely not getting any vertical local recharge through the overlying aquifers. Illustrates the findings of the suitability analysis. It is found that the 55.99 percent of the area was found hydro-geologically moderately suitable for development, only 5.22 percent of the Chowra union and Amtali Union were with good attributes.

Table 5.3: Hydro-geological Area Amtali Upazila

Hydro-geological Suitability	Area in Acre	Percentage (%)
Highly Suitable	5752.61	**7.32**
Moderate Suitable	43984.76	**55.99**
Less Suitable	**28819.90**	**36.69**

Source: PKCP Project, UDD, 2022



Map 5.3: Hydro-geological Suitability

Source: PKCP project, UDD, 2022

5.2.3 Ranking Strategic Service Centers Considering Existing Function

Based on a numerical range, growth centres have been divided into four categories: Trade and Commerce, Strategic service centre 1st order, 2nd order and 3rd Order. Major economic activity will be fostered inside trade and commerce hubs, while public services including schools, colleges, and health facilities will be encouraged within various level service centres.

Map 5.4: Strategic Service Center

Source: PKCP project, UDD, 2022

5.3 SUITABLE SITE RANKING- FINDINGS FROM MULTI-CRITERIA ANALYSIS

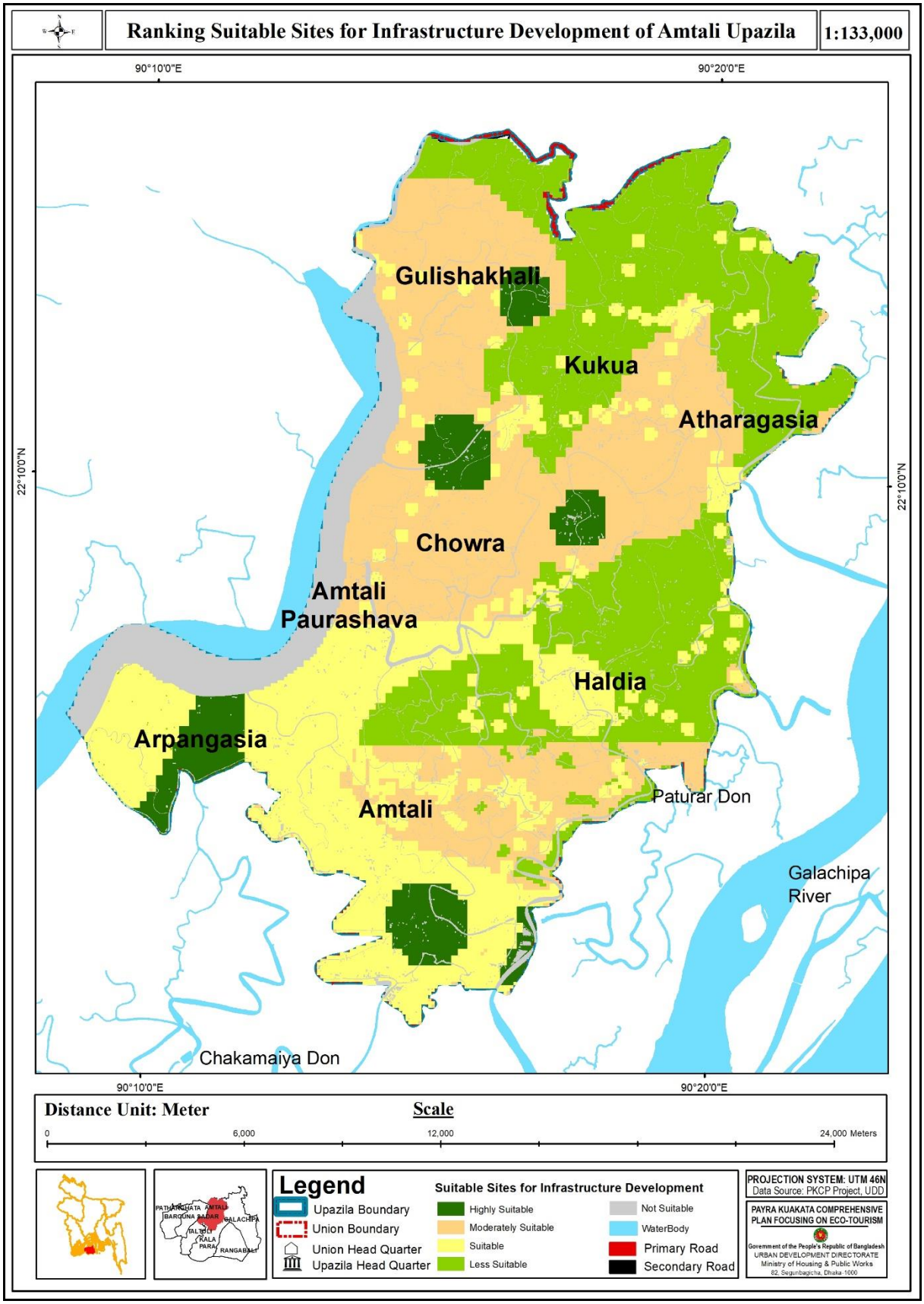
5.3.1 Ranking Suitable Areas for Infrastructure Development

Infrastructures are the necessary tools and facilities to manufacture a something or provide a service. As a result, it is directly related to the good or service and affects its quality. The main goal of a suitability study for infrastructure development is to make sure that the infrastructure is sound, reliable, and sustainable and will help the organization achieve its goals and ambitions. Infrastructures encompass all of the tools, applications, interfaces, and facilities required to bring products or services to market, from concept to delivery and post-delivery. To rank suitable sites for infrastructure development geological attribute of the Upazila, disaster risk, elevation and building height zones have been considered. Due to up-gradation of construction technology it is possible to reach foundation depth 25 to more than 30 m. while the Upazila's soil condition is suitable for low rise and high-rise building construction. To rank suitable sites for infrastructure development geological attribute, elevation and building height zones has been considered.

The primary purpose of a suitability analysis for infrastructure development is to ensure infrastructure are intact, sustainable and stable; will support organization in achieving quality targets and plans. Infrastructures encompass all of the tools, applications, interfaces, and facilities required to bring products or services to market, from concept to delivery and post-delivery. The primary purpose of a suitability analysis for infrastructure development is to ensure infrastructure are intact, sustainable and stable; will support organization in achieving quality targets and plans. Criteria/Parameter: geological attribute (20 %) Disaster risk (20 %), elevation (35 %),

Table 5.4: Ranking Suitable Areas for Infrastructure Development

Geological Suitability	Percentage (%)
Highly Suitable	**6.32**
Moderate Suitable	**57.87**
Suitable	**31.95**
Less Suitable	**4.86**



Map 5.5: Ranking of Suitabile Sites for Infrastructure Development

Source: PKCP project, UDD, 2022

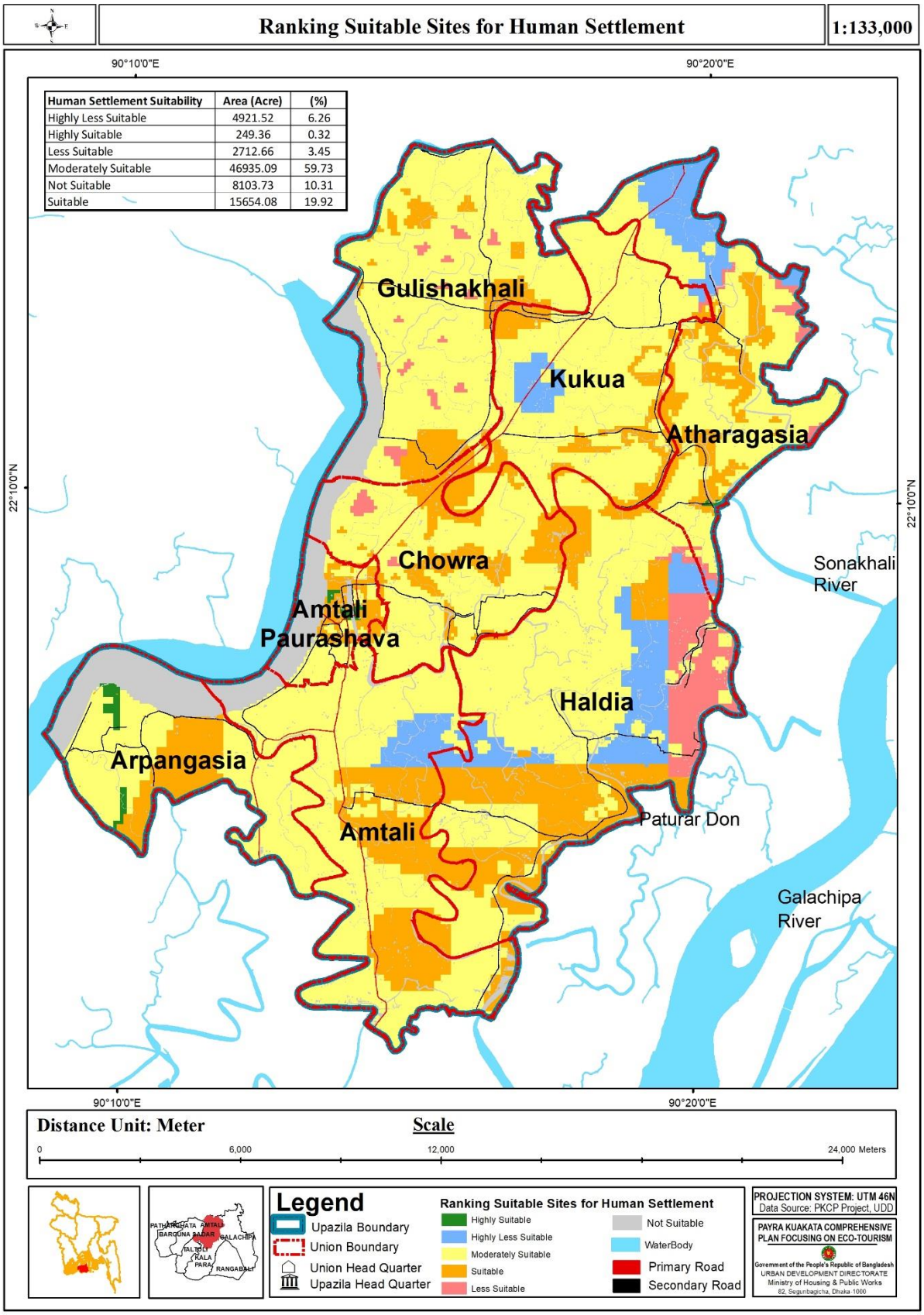
5.3.2 Ranking Suitable Areas For Human Settlement

The human settlement environment includes both surface spaces and space places that are inextricably linked to human activity and life. Amtali Upazila is a seaside location with a low level of urbanization. However, it comes with a number of issues, including a scarcity of high-quality water and the threat of disaster. Hydro-geological and geological features, proximity to roadways, elevation, and disaster risk level have all been considered when ranking human settlement sites. To rank suitable sites for infrastructure development geological attribute, elevation and building height zones has been considered.

Table 5.5: Area percentage of ranks and other land uses

Ranks	Area in percentage
Highly suitable	0.32%
Highly Less Suitable	6.26%
Moderately suitable	59.73%
Less Suitable	3.45%
Suitable	19.92
Not Suitable	10.31%
Grand Total	100.00

Source: PKCP project, UDD, 2022



Map 5.6: Ranking of Suitabile sites for Human Settlement

Source: PKCP project, UDD, 2022

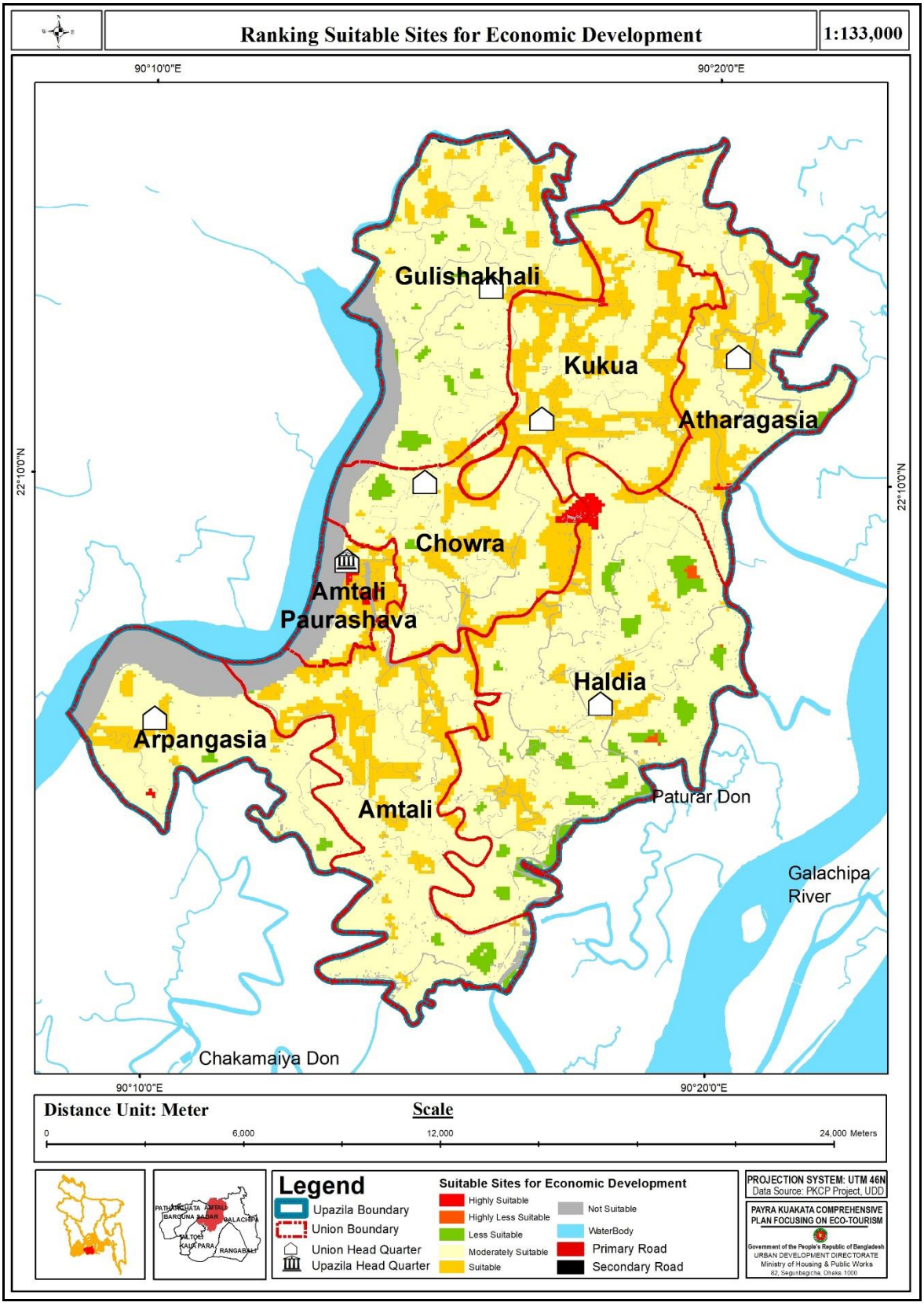
5.3.3 Ranking Suitable Areas For Potential Economic Region

Location of growth centres directly affect the land use and ecosystem. Rapid infrastructure development and the uncontrolled growth of cities' economic hubs result inefficiency of infrastructure facilities, loss of agricultural land, water bodies, open spaces, and a variety of microclimatic changes. The Upazila's exceptional rise of growth centres will result in an uneven distribution of basic services such as transportation and communication. Geological and hydro-geological attributes of the Upazila, disaster risk level, existing growth centre location, and existing road. To rank suitable sites for infrastructure development geological attribute, elevation and building height zones has been considered.

Table 5.6: Area percentage of ranks and other land uses

Ranks	Area in percentage
Highly less suitable	0.57%
Less suitable	0.34%
Moderately suitable	9.22%
Suitable	6.99%
Other land uses	
Agriculture	24.15%
River	44.35%
Grand Total	100.00%

Source: PKCP project, UDD, 2022



Map 5.7: Ranking of Suitabile Sites for Potential Economic Region

Source: PKCP project, UDD, 2022

5.4 DIRECTIVES FROM REGIONAL PLAN

Some suggestions are motivated by and integrated into the regional plan. According to study, Amtali was created from necessary amenities, which were incorporated into the structure plan, which is why some zones are suggested as structure plan zones. The regional plan's primary directives are listed below:

- Conservation and Ensuring sustainable management of natural resources and protection of biodiversity.
- Proposal of wind mills and solar plants to promote sustainable energy sources
- Construct polders and coastal green belt to prevent saline water intrusion
- Promote eco-friendly water-based transportation

5.5 COMPOSITE STRUCTURE PLAN

The Structure Plan identified some strategic areas where future development will take place and provided strategies and techniques for future spatial development. Designation criteria for each strategic management area are provided in structure plan proposal Table. They are more substantive over the 14 categories of zones selected in the Amtali Upazila. For future planned development of the Upazila and as well as to protect natural resources including agriculture and major water body, a strategic land use zoning plan has been prepared for the entire Upazila. The Upazila has been divided into several strategic zones named Agriculture, Coastal Afforestation and Foreshore, Economic Region, Potential Agro-Fisheries Zone, Circular Network, Rural settlements, Potential Urban Area, Trade and Commerce, 1st Order Strategic Service Centre, 2nd Order Strategic Service Centre, 3rd Order Strategic Service Centre and Water body. Following are descriptions of the proposed structure plan:

5.5.1 PLAN ZONE DEFINITION

5.5.1.1 Agriculture

Agricultural zoning is a type of zoning that allows people to keep their farming tradition. The term "agriculture zone" refers to area that is ideal for agricultural production, including both crops and livestock. Land used for annual crops such as cereals, other technical crops, potatoes, vegetables, and melons, as well as land left fallow, land used for permanent crops such as fruit plantations, and land used for natural grasses and livestock grazing. The permissible activities in the agricultural zone are: Vegetable Cultivation, Livestock, Horticulture, Dairy Farming, Crop Cultivation, Botanical Garden, Agricultural Shelter and Gazing.

5.5.1.2 Potential Urban Area

The term "Urban Area" refers to places with high population density, as well as strong roadways, pathways, and market share. The built-up area is another name for this area. The location with the greatest concentration of services is referred to as this. It also has the population density and concentration at its highest point. There are disparities in the amount of service provision within this area, especially between the formally constructed and planned areas and the majority of unplanned areas. In the planned area, the level of service should be maintained. Auto-rickshaw stands, banks and financial institutions, bus and auto passenger stop, highways, garages, retail shops, restaurants, rickshaw stands, educational facilities, electric substation, fire station, health facilities, high school, hospitals, parking facilities are all permitted activities in the Potential Urban Area.

5.5.1.3 Core Urban Area

The term "urban core" refers to places with high population density, as well as strong roadways, pathways, and market share. The built-up area is another name for this area. The location is also with the greatest concentration of services. It also has the population density and concentration at its highest point. There are disparities in the amount of service provision

within this area, especially between the formally constructed and planned areas and the majority of unplanned areas. In the planned areas, the level of service should be maintained. Autorickshaw stands, banks and financial institutions, bus and auto passenger stops, highways, garages, retail shops, restaurants, rickshaw stands, educational facilities, electric substation, fire station, health facilities, high school, hospitals, parking facilities are all permitted activities in the Core Urban Area.

5.5.1.4 Rural Settlement Area

People living in a vast landscape with a few houses with greeneries where people are often depending on agriculture, farming and fishing activity for their sustainability. the areas with relatively low density of population and located outside the paurashava area, rural roads, or high way where there are isolated houses or open ground are called rural settlement area. This zone will be facilitated with all type of amenities so that people can live healthy and happy life. Any kind of activities that will not hamper natural and cultural environment and will follow national laws and regulation will be allowed within the zone. Basic facilities for living will be provided within the zone.

5.5.1.5 Water Body

A Water body is defined as any natural or manmade collection of water, including rivers, streams, creeks, ditches, swales, lakes, ponds, marshes, wetlands, and ground water. This category includes water with an area equal to or more than 0.25 acres, excluding canals, irrigation canals, and rivers. Development and building activities are prohibited within 10 metres on either side of the canal in this region. There is no development or industrial activity allowed within 50 metres on both banks of the river.

5.5.1.6 Economic Region

Potential economic zone is a specially marked territory within the Upazila that has attributes to attract national as well as foreign investment to generate employment opportunities. In this zone, the investor will get geological, hydrological and better communication facility benefit to earn profit within short time. The zone has been declared in order to facilitate rapid economic growth and to connect the Upazila with the mainstream of national economy. Authority will offer special incentives and security to attract local, national and international investment, EPZ, Autorickshaw stands, banks and financial institutions, bus and auto passenger stops, highways, cottage industry, dairy farming, garages, garments, factories, retail shops, restaurants, and rickshaw stands are all permitted activities in the potential economic zone.

5.5.1.7 Industrial and Manufacturing Zone

The economy of Amtali Upazila is mainly based on fisheries. Agriculture is also dominated here. By considering the nature of the crops, the structure plan recommends an agro based industry for the development and conservation of agro products. The demand for food in Bangladesh and around the world is changing rapidly. Driven by economic growth, rising

incomes, and urbanization, demand is shifting away from traditional staples toward high-value food commodities. High value commodities of Agriculture include fruits, vegetables, spices, fish, and livestock products, many of them processed before reaching the market. This represents an enormous opportunity for food producers, processors, and sellers. Owing to the greater labor intensity characteristic of high value agricultural production, it also provides an opportunity to generate rural employment and raise rural incomes. The main products of Amtali Upazila are Sunflower, water-melon, Fish and rice. The agro based industry can manufacture and process any type of agro product for the betterment of the employment opportunities.

5.5.1.8 Agro-Fisheries

Local people catch fish from sea and river. It's one of the main professions of the majority people. The marine fisheries sector contributes significantly to the country's food and nutrition security as well as economy through direct income, employment and foreign exchange. So, the agro-fisheries area is a place of abundant supply of fisheries and agricultural products. For this reason, the structure plan recommends to develop the place as a hub of agro-fisheries area.

5.5.1.9 Strategic Service Centers

They are mostly transitional areas changing from rural to urban, and could have much potential for future urbanization and development activities. It is understood that new land conversion will continue to occur, particularly in locations adjacent to presently developed and developing areas and in spite of high flood risk and a paucity of infrastructure services and other social and community services provision.

The hierarchy of Strategic Service Centers created under the conceptual framework is a functional one. To begin with, the whole concept of the Upazila area has evolved with the assumption that the key services or functions performed by the trade and commerce center have spread their influence to outer areas.

Trade and Commerce Center

It is the center of activities in the established of Amtali Upazila having its service area in the whole Upazila area. This is the place for high density mixed used structure, public and private structure and services. It is mainly talukdar Bazar area of the Amtali Upazila. Commerce and Shopping, Open Space and Recreation, Miscellaneous, Utilities and Transportation facilities can be developed in the Trade and Commerce center.

Strategic Service center-1st Order

This type of Strategic Service Centers is the main retail, business and employment center for its community. It supports local employment and provides goods and services of a wide range to meet the local demand. It has high levels of health and education services to cater to the

needs of the local demand. It also has better communication network. This is the major facilities which have the potentiality for development.

- Community Facilities
- Government Services
- Health
- Education
- Transportation
- Open Space and Recreation
- Residential
- Miscellaneous
- Utilities

Strategic Service Center-2nd order

It has an economic activities and public gathering place for the local community. It is basically an employment destination providing work for a specialized sector e.g. manufacturing / service industry, health facilities etc. The growth center analysis identifies seven places as second order like five different bazar area of Amtali Upazila. The second order service center include the following facilities-

- Community Facilities
- Health
- Education
- Transportation
- Open Space and Recreation
- Residential
- Miscellaneous
- Utilities

Strategic Service center- 3rd order

Centre to support the convenience of residents; designated community center with consideration of accessibility by transportation, adjacency to other centers. There are eleven different bazar area which are categorized as third order and include the following categories service.

- Health
- Education
- Community Facilities
- Transportation
- Open Space and Recreation
- Residential
- Miscellaneous

- Utilities

5.5.1.10 Coastal Afforestation and Foreshore Area

By stabilising coasts and creating a green belt, coastal afforestation attempts to improve climate-resilient ecosystems and livelihoods. The landmass is also successfully protected from excessive flooding and erosive processes by this green belt. To establish well-stocked plantations, vacancy filling and sometimes replanting are done. Furthermore, during land quiver recharging, a green belt along the coastline acts as a filter. Botanical garden and gardening are permitted activities in the Foreshore Area.

5.5.1.11 Circulation Network

It includes major circulation covering primary and secondary roads.

5.5.1.12 Urban Frienge Area

The urban fringe, also known as the outskirts, urban, peri-urban, or urban hinterland, is a terrain boundary between town and country, or a transition zone where urban and rural activities mix and frequently clash. According to demographic projections, this zone will require additional land for future urban planning. Existing physical growth patterns and potential areas must be taken into account when planning new urban land development. Road, drain, walkway, waste transfer station, and other civic services will be provided as new facilities and services. In the year 2032, this area is expected to expand. Autorickshaw stands, banks and financial institutions, bus and auto passenger stop, highways, garages, retail shops, restaurants, rickshaw stands, educational facilities, electric substation, fire station, health facilities, high school, hospitals, parking facilities are all permitted activities in the Urban Fringe Area.

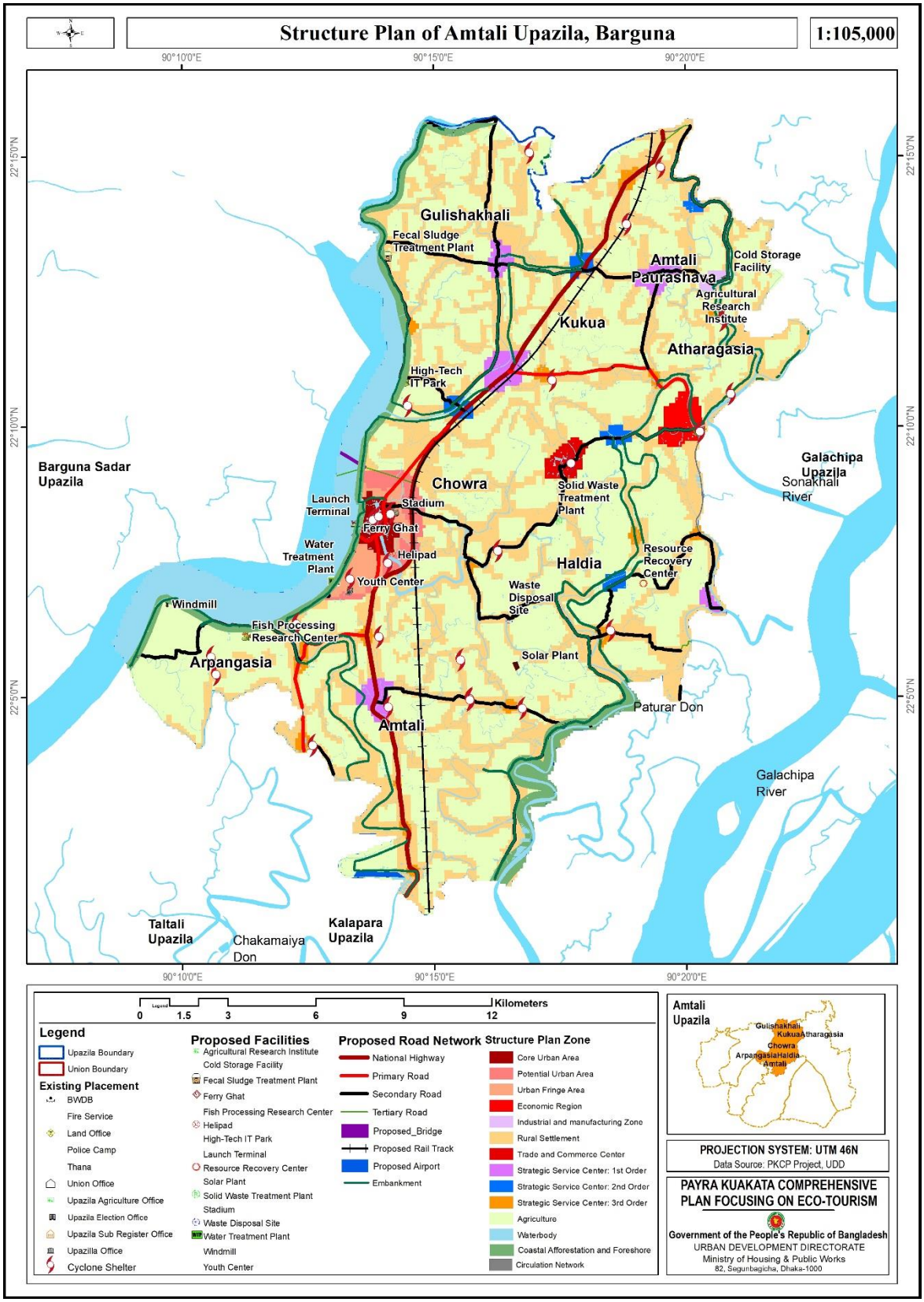
5.6 STRUCTURE PLAN OF AMTALI UPAZIA

Agricultural lands are cultivated and cultivable lands that have to be protected for food safety of the country, it is about 41% of the total Upazila area; Circular network (1.45%) which includes primary, secondary and tertiary roads; Urban Core Area 0.57 % of land of the Upazila. Rural settlement (32.19%) encompasses rural housing structures and surrounding vacant land and vegetations- which is the second heights land use. Potential Urban Area covers 0.94%, Urban Fringe Area 0.89% of the Upazila, Coastal afforestation and foreshore covers 2.34% area mainly proposed near river side, and 10% of water body that includes canals and ponds with 7882.04 acres area. This structure plan has proposed 74635.84 acres land. It is expected this zone will assist and encourage government and private investor to invest. In Amtali Upazila under this zone two major things are included Agriculture and Rural Settlement Zone. Strategic Service Centre is also sub-divided into four categories named- Trade and Commerce Investment for industrial development will help to achieve the objective of the structure plan that is to enhance the residents' socioeconomic position.

Table 5.7: Proposed Zones Structure Plan Of Amtali Upazila

SL NO.	Proposed Structure Plan Zone	Area	Percentage (%)
01	Agriculture	34652.94	46.43
02	Circular Network	1085.74	1.45
03	Core Urban Area	422.79	0.57
04	Potential Urban Area	702.22	0.94
05	Urban Fringe Area	667.50	0.89
06	Economic Region	494.74	0.66
07	Industrial and manufacturing Zone	118.90	0.16
08	Coastal Afforestation and Foreshore Area	1743.02	2.34
09	Rural Settlement	24023.38	32.19
10	Trade and Commerce Center	316.66	0.42
11	Strategic Service Center: 1st Order	1165.69	1.56
12	Strategic Service Center: 2nd Order	563.55	0.76
13	Strategic Service Center: 3rd Order	796.67	1.07
14	Water body	7882.04	10.56
	Total	74635.84	100.00

Source: PKCP project, UDD, 2022



Map 5.8: Structure Plan Map of Amtali Upazila

Source: PKCP project, UDD, 2022

5.6.1 STRUCTURE PLAN PROPOSAL

Structure suggestions have been made in accordance with Upazila residents' needs. The Upazila Chairman offered many broad-category facilities from the workplace that will enhance the growth and economic development of the Upazila.

Table 5.8: Structure Plan Zone Proposal at a Glance

Sl No.	Structure Plan Proposal	Location
01.	Urban Core Area	High population density area inside the paurashava boundary. This location is located near the mitha bazar and pollobi road.
02.	Urban Fringe Area	Comparatively low density area inside the paurashava boundary. This location is located near noyabangoli Road.
03.	Potential Urban Area	Comparatively low density area outside the paurashava boundary. This location is located near Dhaka Kuakata and Patuakhali Amtali Highway Road.
04.	Trade and Commerce	There is one Trade and Commerce zone which is located near talukdar Bazar of Amtali Upazila. It's the most famous bazar for trade and commerce.
05.	Strategic Service Center 1st Order	There are five strategic Service Center 1st Order in Amtali Upazila. Which are located Goshkhali Bazar near thana road, Hazar takar badh bazar near sakharia road, Shahed bari bazar near Patuakhali Dhaka highway road, tepura bazar at Haldia and Khuriar Kheyaghat Bazar at Amtali
06.	Strategic Service Center 2nd Order	There are five strategic Service Center 2nd Order in Amtali Upazila. Which are located at Chawla Bazar in Atharagasia, Mohishkata Bazar, Khukuani Bazar at Kukua and gulishakhali, Subondhir Bazar at Kukua and Haldia, Dafader Bazar at Haldia.
07.	Strategic Service Center 3rd Order	There are seventeen strategic Service Center 3rd Order in Amtali Upazila. Which are located at Brick field, sonakhali Bazar in Atharagasia, Kukua Bazar, Kukua Union Parishad Bazar, Kathalia Bazar, Dakshin toktabunia bazar, Paschim chila bazar at Haldia, Charghat bazar, kholyan bazar at Amtali, Arpangasia bazar, Nachnapara gramo high school Bazar etc.
08.	Economic Region	Economic Region is located near Gazipur Bazar at Atharagasia.

5.6.2 STRUCTURE PLAN PROPOSAL ZONE

5.6.2.1 Core Urban Area

As there is an existing paurashava in Amtali Upazila. So, core urban area has been proposed in paurashava. About 422.79 acre is proposed for core urban area.

5.6.2.2 Water body

A Water body is defined as any natural or manmade collection of water, including rivers, streams, creeks, ditches, swales, lakes, ponds, marshes, wetlands, and ground water. This category includes water with an area equal to or more than 7882.04 acres, excluding rivers. Development and building activities are prohibited within 10 metres on either side of the canal in this region. There is no development or industrial activity allowed within 50 metres on both banks of the river.

5.6.2.3 Potential Urban Area

From Amtali Paurashava Boundary to Chowra Union and some parts of Amtali Union are identified aspotential future Urban area. As there is a proposed residential area which is in the Amtali Paurashava and some parts is in the Chowra Union, So, these areas are considered as potential Urban area. The structure plan recommend the area as future urban area for the development. At the same time, this area is in the centre point of communication with other growth centre, hat-bazar and Union.

5.6.2.4 Economic Region

Agro Based Industry

Amtali Upazila economy is based on agriculture. By considering the nature of the crops, the structure plan recommends an agro based industry for the development and conservation of agro products. The demand for food and around the world is changing rapidly. Driven by economic growth, rising incomes, and urbanisation, demand is shifting away from traditional staples toward high-value food commodities. High value agricultural commodities include fruits, vegetables, fish, and livestock products, many of them processed before reaching the market. This represents an enormous opportunity for food producers, processors, and sellers.

Agro-produce processing units – These units are not involved in manufacturing and mainly deal with the preservation of perishable products and utilization of by-products for other uses. Rice and Dal processing mills are perfect examples of these kinds of units.

Agro-produce manufacturing units – These units engage in the manufacturing of new products where the finished goods are entirely different from the raw materials used. Sugar factories, solvent extraction units and textile mills are some of the examples of these kinds of units.

Agro Service Centres – Agro service centres are workshops and service centres, which are engaged in the repairing and servicing of pump sets, diesel engines, tractors and other types of farm equipment.

5.6.2.5 Proposed Road Network

New road has been proposed through ghatkhali, Chowra, Chota Nachna Para to Amtali mouza for enhancing regional connectivity.

Table 5.9: Proposed Road Network

Proposed Class	Proposed Width (ft)	Planning Decision
Regional Road	300	Widening
Primary Road	80	Widening
Secondary Road	60	Widening
New Road	300	Pucca Road

Map 5.9: Proposed Road Network

Source: PKCP project, UDD, 2022

5.6.2.6 Improvement of Existing Road and Embankment

Amtali Upazila is well connected area of Bangladesh. There are well connected internal road network among the union. Only Ferry, and Boat is the medium of communication with mainland. Most of the road has widening proposal in the plan.

Bangladesh Water Development Board (BWDB) built coastal embankments along the coast of the Amtali Upazila for the safety of the people and their property against natural disasters in the early 1970s. Part of the embankment about 11479.14m embankment is within the study area. This embankment-cum road needs huge repair. If this embankment-cum road will be renovated and repair properly, the communication will improve which enhance the attraction of this area for eco-tourism.

5.6.2.7 Ferry Ghat and Bridge

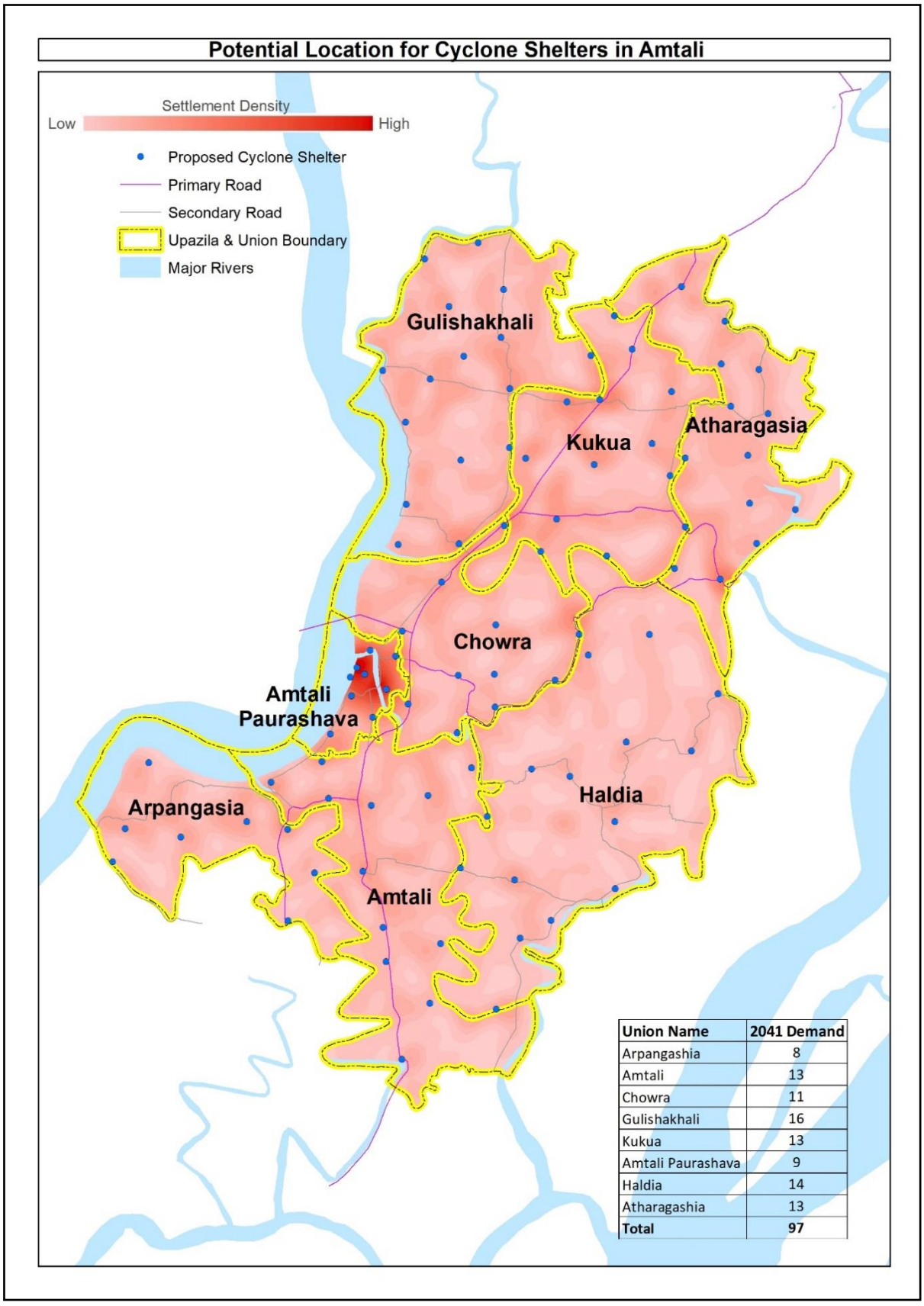
Communication is time consuming and difficult in the Amtali Upazila. To ease travelling, their need to introduce new bridge and modern ferries. The plan proposed new bridge.

5.6.2.8 Coastal Afforestation and Foreshore Area

Tree plantation are very much beneficial for environment. Trees and shrubs that live in the zone. These roots allow the trees to handle the daily rise and fall of tides, which means that most trees get flooded at least twice per day. The roots also slow the movement of tidal waters, causing sediments to settle out of the water and build up the muddy bottom. Mangrove forests stabilize the coastline, reducing erosion from storm surges, currents, waves, and tides. The intricate root system of mangroves also makes these forests attractive to fish and other organisms seeking food and shelter from predators. The proposed mangrove afforestation location is shown in Structure Plan. The recommended area for new Coastal Afforestation and Foreshore Area is 1743.02 acres. This area is along the bank of the river. The Structure plan contain 250 m for coastal afforestation to protect from erosion and storm surge.

5.6.2.9 Cyclone Shelter

Though Amtali Upazila is a disaster prone area, 97 locations has been identified as potential cyclone shelters here. When specific warnings for cyclone and tidal surges are announced by the appropriate authorities, the building would be open for safe shelters of local communities and cattle.



Union Name	2041 Demand
Arpangashia	8
Amtali	13
Chowra	11
Gulishakhali	16
Kukua	13
Amtali Paurashava	9
Haldia	14
Atharagashia	13
Total	**97**

Map 5.10: Proposed Cyclone Shelter in Amtali Upazila

Source: PKCP Project, UDD, 2022

5.6.2 DEVLOPMENT PROPOSALS FOR STRUCTURE PLAN

The development proposals on the basis of planning standards are provided for land uses in different sectors for various phases of plan period in the project Upazila. Some major development projects with possible guidelines are proposed in this plan. The possible sources of funding the projects have also been identified in the Structure Plan.

Table 5.10: List of Development proposals for Structure Plan

Proposals Name	Quantity	Location
Strategic Zones	14	Overall Upazila
Economic Zones	1	Gazipur Bazar at Atharagasia.
High-Tech IT Park	1	Gulishakhali
Proposed Bridge	46.76 acre	Purakata Launch Terminal - Amtali Launch Ghat
Primary Road	64.34 km	Connecting Growth Center
Secondary Road	122.21 km	Connecting Growth Center
Cyclone Shelter	97	Overall Upazila
Proposed Airport	71.77 acre	Amtali Upazila
Solar Plant	1	Haldia
Agricultural Research Institute	1	Atharagasia
Cold Storage Facility	1	Atharagasia
Fecal Sludge Treatment Plant	1	Gulishakhali
Fish Processing Research Center	1	Arpangasia
Waste Disposal Site	1	Haldia
Water Treatment Plant	1	Amtali Paurashava

Source: PKCP project, UDD, 2022

Map 5.11: Proposed Facilities of Amtali Upazila

Source: PKCP project, UDD, 2022

CHAPTER SIX: DEVELOPMENT MANAGEMENT

6.1 DEVELOPMENT RESTRICTIONS TO BE APPLIED FOR DEVELOPMENT OF A PARTICULAR AREA

Existing agricultural land has been classified by cropping pattern in order to promote the high agricultural value of high yielding agricultural land. In order to secure food security, the structure plan recognizes high agricultural value lands. Given the expected future population growth in settlement areas, high agricultural lands, such as triple and double-cropped land, will continue to be used for agriculture.

It is recommended that the urban sub-central area and rural sub-central area settlements areas in diverse places of the urban and rural sections of Amtali Upazila be preserved in order to accommodate future population expansion. It is necessary to specify existing rural settlement areas to be kept in their morphological characteristics during the Structure Plan period in order to achieve compact development and preserve high-value agricultural fields.

According to the Structure Plan's policy and strategy, developed in the sub-central zones will be regulated, and only limited interventions in service demand will be permitted in the intermediate zones. Non-agricultural activity expansion will be discouraged, and the development of non-permitted land uses will be regulated.

Any non-compatible development will be controlled in the central area of the urban area and rural trade and commercial zones. Activities, as specified in the sector policy in Structure Plan Report, will be allowed only in the national interest /societal interest.

The high initial investment in developing tourism facilities can be questionable as the site is directly exposed to the sea. Moreover, as there is ECA on the side, heavy construction requires checking whether it violates the ECA rules and guidelines.

Land Use Control

Land use zoning is an evitable element of development plan that regulates the haphazard land use and ensure enough space for proper uses and creates homogeneous land uses. Land use zoning practices have practiced in local planning system since the beginning of the post-World War II in the form of physical planning approach. The aim of land use zoning is outlined below:

Land use control or regulation and land use development will ensure sustainable development of the environment and urban growth. Enables issuance of land use clearance for development.

The land use development proposals are prepared considering the permitted, conditional and non- permitted uses of land in the Structure Plan Zones (SPZs). The matrix (Below Table) prepared in this respect will guide the development process in the Upazila in general. The

projects that are required for major development interventions at the Upazila level are considered in the structure plan of the Upazila. The details of the priority projects are provided in the Action Area Plan of the Paurashava and the Urban Promotion Areas (UPAs) at union level of the Upazila.

Table 6.1: Permitted & conditional uses of different Land use category

Facilities	Agriculture	Fisheries Zone	Airport	Foreshore and Coastal Afforestation Zone	Inner Urban Fringe Area	Potential Economic Region	Potential Urban Area	Road Network	Rural Settlement	Strategic Rural Center Zone-1st Order	Strategic Rural Center Zone-2nd Order	Strategic Rural Center Zone-3rd Order	Trade and Commerce Center	Urban Core Area	Recreational Zone	Foreshore Area	Water body
Agricultural Shelter & Gazing	P	P	N	C	C	C	C	N	P	P	C	C	N	C	N	C	N
Agri Business & Services	P	P	N	C	P	P	P	N	C	P	C	C	P	P	N	C	N
Aquaculture & Fisheries	C	P	N	C	P	P	P	N	P	P	P	P	N	N	C	C	C
Arboriculture	P	P	N	P	P	N	P	N	P	N	N	N	N	N	C	C	N
ATM Booth	N	N	N	N	P	P	P	N	C	P	P	P	P	P	C	N	N
Auditorium Meeting Hall	N	N	N	N	C	C	C	N	N	N	N	N	N	P	C	N	N
Automobile Works	N	N	N	N	P	C	P	N	C	C	C	C	P	P	C	N	N
Autorickshaw Stand	N	N	N	N	P	P	P	N	P	P	P	P	N	P	C	N	N
Bank & Financial Institutions	N	N	N	N	P	C	P	N	P	P	P	P	P	P	N	N	N
Billboard (Advertisement Structure)	N	N	N	N	C	C	C	N	C	P	N	N	P	C	C	N	N
Boarding & Rooming House	N	N	N	N	P	P	P	N	C	P	P	P	P	P	P	N	N
Brick Fields	N	N	N	N	N	N	N	N	C	N	N	N	N	N	N	N	N
Bus/Auto Passenger Shelter/Stops	N	N	N	N	P	P	P	N	P	N	P	P	N	P	N	N	N
Causeways: Road, Railways	N	N	N	N	R	R	R	P	R	R	R	R	R	R	N	N	N
Cash Crop Cultivation	P	C	N	C	P	P	P	N	P	N	N	N	N	P	C	C	N
Carnival & Fair	N	N	N	N	C	C	C	N	C	N	C	C	N	C	N	N	N
Cemeteries/ Graveyard	N	N	N	N	P	N	P	N	P	N	N	N	N	P	N	N	N
Cinema Hall	N	N	N	N	C	N	C	N	C	N	N	N	N	C	P	N	N
Clinics/ Medical	N	N	N	N	P	P	P	N	P	P	P	N	P	P	N	N	N
Clubs, Private	N	N	N	N	N	C	N	N	N	C	C	N	P	N	N	N	N

Facilities	Agriculture	Fisheries Zone	Airport	Foreshore and Coastal Afforestation Zone	Inner Urban Fringe Area	Potential Economic Region	Potential Urban Area	Road Network	Rural Settlement	Strategic Rural Center Zone-1st Order	Strategic Rural Center Zone-2nd Order	Strategic Rural Center Zone-3rd Order	Trade and Commerce Center	Urban Core Area	Recreational Zone	Foreshore Area	Water body
Colleges/Universities	N	N	N	N	P	N	P	N	N	N	N	N	P	P	N	N	N
Convention Center	N	N	N	N	P	P	P	N	P	C	N	N	P	P	N	N	N
Communication Service Facilities	N	N	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Communication Tower with Height	N	N	N	N	C	P	C	N	C	P	P	P	P	C	C	N	N
Community Center	N	N	N	N	P	P	P	N	C	P	P	P	P	P	C	N	N
Cottage Industry	N	N	N	N	P	P	P	N	C	P	P	P	N	P	N	N	N
Library	N	N	N	N	C	C	C	N	C	C	C	C	C	C	N	N	N
Cyber Café/IT Center	N	N	N	N	P	P	P	N	P	P	P	P	P	P	N	N	N
Dairy Farming	P	C	N	C	P	P	P	N	P	P	P	P	P	P	N	C	N
Deep Tube well	N	N	N	N	P	P	P	N	P	P	P	P	N	P	N	N	N
Diagnostic Centers	N	N	N	N	P	P	P	N	P	P	P	P	P	P	N	N	N
Docks & Jetties	C	C	N	N	P	N	P	N	N	N	N	N	N	P	P	N	P
Dormitory / NGOs Rest House	N	N	N	N	C	P	C	N	C	P	P	P	P	C	N	N	N
Ducker	N	N	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Dwellings, Farm	C	P	N	N	P	C	P	N	P	C	C	C	C	N	N	N	N
Dwellings, Minimal Housing	N	N	N	N	P	N	P	N	P	N	N	N	N	P	P	N	N
Dwellings, Single/ Multifamily	N	N	N	N	P	N	P	N	P	N	N	N	N	P	N	N	N
Educational Facilities	N	N	N	N	C	C	C	N	P	N	N	N	N	C	N	N	N
Electric Sub Station	N	N	N	N	P	P	P	N	P	P	P	P	P	P	C	N	N
Emergency Shelter	C	C	N	N	C	C	C	N	C	C	C	C	C	C	C	N	N
Explosive Manufacture & Storage	N	N	N	N	P	P	P	N	C	P	P	P	P	C	N	N	N
Fire Station	N	N	N	N	C	P	C	N	C	P	P	P	P	P	N	N	N
Food Kiosk	N	N	N	N	P	P	P	N	P	P	P	P	P	P	C	N	N
Flood Management Structures	N	N	N	N	C	P	C	N	C	P	P	P	P	C	P	N	N
Freight Transport Facilities	N	N	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N

Facilities	Agriculture	Fisheries Zone	Airport	Foreshore and Coastal Afforestation Zone	Inner Urban Fringe Area	Potential Economic Region	Potential Urban Area	Road Network	Rural Settlement	Strategic Rural Center Zone-1st Order	Strategic Rural Center Zone-2nd Order	Strategic Rural Center Zone-3rd Order	Trade and Commerce Center	Urban Core Area	Recreational Zone	Foreshore Area	Water body
Garages/ Workshops	N	N	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Garments & Factory	N	N	N	N	P	P	P	N	C	P	P	P	P	C	N	N	N
Government Office / Guest House	N	N	N	N	C	P	C	N	N	P	P	P	P	P	N	N	N
Green Belt/ Green Space	N	N	N	N	P	C	P	N	P	C	C	C	C	P	N	N	N
Hatchery	P	P	N	N	P	P	P	N	P	P	P	P	P	N	C	N	N
Health Facilities	N	N	N	N	P	P	P	N	P	P	P	P	P	P	N	N	N
High School	N	N	N	N	C	N	C	N	N	P	P	P	P	C	N	N	N
Horticulture	P	C	N	N	P	P	P	N	P	P	P	P	P	N	C	P	N
Hospitals/ Health Centers	N	N	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Hotel Guest House	N	N	N	N	C	P	C	N	N	P	P	P	P	C	N	N	N
Hotel International Class	N	N	N	N	C	P	C	N	N	P	P	P	P	C	N	N	N
Husking/ Grinding (Rice, Wheat, Pulse)	N	N	N	N	P	P	P	N	P	P	P	P	P	P	N	N	N
Industrial Class 1	N	N	N	N	P	P	P	N	N	N	N	N	N	P	N	N	N
Industrial Class 2	N	N	N	N	P	P	P	N	N	N	N	N	N	P	N	N	N
Institutions	N	N	N	N	C	N	C	N	C	P	P	P	P	C	N	N	N
Irrigation Facilities (Flood Wall/ Canal)	C	P	N	N	C	C	C	N	C	C	C	C	C	C	C	N	P
Livestock	C	N	N	C	P	P	P	N	P	P	P	P	P	P	N	C	N
Major Development	N	N	N	N	P	P	P	N	P	C	C	C	C	P	N	N	N
Multi stored Car park	N	N	N	N	C	C	C	N	N	C	C	C	C	C	N	N	N
Nursery School	N	N	N	N	C	N	C	N	N	P	P	P	N	C	N	N	N
Offices/ Services	N	N	N	N	C	P	C	N	N	P	P	P	P	C	N	N	N
Open Theatre	N	N	N	N	C	P	C	N	N	P	P	P	P	C	P	N	N
Orphanage	N	N	N	N	P	P	P	N	N	P	P	P	P	P	N	N	N
Outdoor Religious Events	N	N	N	N	P	P	P	N	N	P	P	P	P	P	N	N	N
Parking Facilities, Commercial	N	N	N	N	C	P	C	C	C	P	P	P	P	C	N	C	N
Parking Facilities	N	N	N	N	C	P	C	P	C	P	P	P	P	C	N	C	N
PC Culture	C	C	N	C	P	P	P	N	C	P	P	P	P	N	P	C	N

Facilities	Agriculture	Fisheries Zone	Airport	Foreshore and Coastal Afforestation Zone	Inner Urban Fringe Area	Potential Economic Region	Potential Urban Area	Road Network	Rural Settlement	Strategic Rural Center Zone-1st Order	Strategic Rural Center Zone-2nd Order	Strategic Rural Center Zone-3rd Order	Trade and Commerce Center	Urban Core Area	Recreational Zone	Foreshore Area	Water body
Petrol Stations	N	N	N	N	N	P	N	N	N	P	P	P	P	P	N	N	N
Plantations	N	P	N	N	P	N	P	N	C	N	N	N	N	P	P	N	N
Mosque/ Temple	N	N	N	N	C	C	C	N	C	C	C	C	C	P	N	N	N
Places of Worship	N	N	N	N	C	N	C	N	C	N	N	N	N	P	P	N	N
Packaging & Processing	N	N	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Play Field	N	N	N	N	P	N	P	N	C	N	N	N	N	P	P	C	N
Police Box/ Barak	N	N	N	N	C	P	C	N	C	P	P	P	P	P	N	N	N
Post Office	N	N	N	N	C	P	C	N	C	P	P	P	P	P	N	N	N
Postal Facilities/ Courier	N	N	N	N	C	P	C	N	N	P	P	P	P	P	N	N	N
Poultry	P	P	N	N	C	P	C	N	C	P	P	P	P	C	N	N	N
Primary School	N	N	N	N	C	N	C	N	N	N	N	N	N	P	N	N	N
Prisons	N	N	N	N	P	P	P	N	N	P	P	P	P	P	N	N	N
Printing/ Publishing House	N	N	N	N	C	P	C	N	N	P	P	P	P	C	N	N	N
Public Uses & Structures	N	N	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Public Transport Facilities	N	N	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Recreational Facilities, outdoor	N	P	N	N	P	P	P	N	C	P	P	P	P	P	P	N	N
Religious Facilities & Structures	N	N	N	N	P	P	P	N	N	P	P	P	P	P	N	N	N
Repair Shops, Major	N	N	N	N	P	P	P	N	N	N	N	N	N	P	N	N	N
Repair Shops, Minor	N	N	N	N	C	N	C	N	C	P	P	P	P	C	N	N	N
Retail Shops & Restaurants	N	N	N	N	C	P	C	N	N	P	P	P	P	C	N	N	N
Retention Ponds	N	C	N	N	P	N	P	N	C	N	N	N	N	P	C	N	C
Rickshaw Stands	N	N	N	N	P	P	P	N	P	P	P	P	P	P	N	N	N
Salvage, Storage & Processing	N	N	N	N	P	P	P	N	N	P	P	P	P	P	N	N	N
Saw- Mill	N	N	N	N	C	P	C	N	N	C	C	C	C	C	N	N	N
Schools, Private	N	N	N	N	N	N	N	N	N	P	P	P	N	N	N	N	N
Schools, Government, Religious	N	N	N	N	C	N	C	N	C	N	N	N	P	C	N	N	N

Facilities	Agriculture	Fisheries Zone	Airport	Foreshore and Coastal Afforestation Zone	Inner Urban Fringe Area	Potential Economic Region	Potential Urban Area	Road Network	Rural Settlement	Strategic Rural Center Zone-1st Order	Strategic Rural Center Zone-2nd Order	Strategic Rural Center Zone-3rd Order	Trade and Commerce Center	Urban Core Area	Recreational Zone	Foreshore Area	Water body
Scientific Research Establishment	N	N	N	N	P	P	P	N	N	C	C	C	C	P	N	N	N
Ship & Boat Servicing	N	N	N	N	P	P	P	N	C	P	N	N	P	P	P	N	N
Special Function Tent	N	N	N	N	C	P	C	N	N	P	P	P	P	C	N	N	N
Stadium Sports	N	N	N	N	C	P	C	N	N	P	P	P	P	C	P	N	N
Swimming Court/ Pool	N	N	N	N	C	P	C	N	N	P	P	P	P	C	P	N	N
Tea Stall/ Coffee Shops	N	N	N	N	C	P	C	N	C	P	P	P	P	C	P	N	N
Tennis Court / Club	N	N	N	N	P	P	P	N	N	P	P	P	P	P	P	N	N
Terminals, Train, Bus, Truck, Freight	N	N	N	N	P	P	P	C	C	P	P	P	P	P	N	N	N
Trade Centers	P	C	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Transformer stations	N	N	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Transmission Lines	N	N	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Utility Installations/ Lines	N	N	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Vegetable Cultivation	C	N	N	N	P	N	P	N	C	N	N	N	N	P	P	N	N
Ware Housing & Distribution	N	N	N	N	P	P	P	N	N	P	P	P	P	P	N	N	N
Water pump, Reservoir	C	C	N	N	P	P	P	N	C	P	P	P	P	P	N	N	N
Waste Disposal & Processing	N	N	N	N	C	C	C	N	C	C	C	C	C	C	N	N	N
Water Based Recreational Park	N	N	N	N	C	C	C	N	N	C	C	C	C	C	P	P	P
Water Treatment / Purification Plant	N	N	N	N	P	C	P	N	C	C	C	C	C	P	N	P	C
Wood / Iron Furniture Production	N	N	N	N	P	P	P	N	N	P	P	P	P	P	N	N	N
Zoo	N	N	N	N	C	C	C	N	N	N	N	N	N	C	P	P	N
Eco Tourism	C	C	N	p	C	P	C	N	N	C	C	C	C	C	P	p	N

Note: Permitted Use – P, Conditional Use –C, Plan Review Required- R, Not Permitted- N

Source: PKCP project, UDD, 2022

CHAPTER SEVEN: IMPLEMENTATION PHASING OF PROPOSALS, RESPONSIBLE AGENCIES AND RELEVANT ISSUES

7.1 INTRODUCTION

The most important responsibility for the stakeholders is to implement the plan. This chapter outlines the numerous steps that must be followed to carry out the plan's recommendations. The whole planning process's most crucial step is effective implementation.

7.2 LEGAL FRAMEWORK FOR IMPLEMENTATION

The implementation of Structure Plan, Urban Area Plan, Rural Area Plan, and Action Area Plan will be legally guided by the Local Government Acts of all Local Government Units within the Upazila - (i) Local Government (Upazila Parishad) Act, 2009; (ii) Local Government (Paurashava) Act, 2009; and (iii) Local Government (Union Parishad) Act, 2009.

Some other Acts are relevant for taking actions in matters of preserving and conserving the water bodies and environment of the Upazila. The Water Act 2011 and Act 2000 for protecting the water bodies, playfields, and environment are particularly important.

There are national policies for most of the sectors. The relevant sector policies are consulted in this project for the preparation of Structure Plan of the Upazila, Urban Area Plan for the urban areas, and Rural Area Plan for the rural area and Action Area Plan for the selective areas. These sector policies will be important for adopting measures of executing development projects as indicated in the plan documents. For further details of the policies and strategies, the implementing agencies may consult the national policy documents for any sector.

7.3 CUSTODIAN OF THE PLAN

The Urban Development Directorate (UDD) under the Ministry of Housing and Public Works is the custodian of the Plan prepared under the current project. The present planning project of the Urban Development Directorate (UDD) addresses all aspects of development within the Upazila. There are multi-sectoral tasks to be carried out by multiple stakeholders at the Upazila including Upazila Parishad, Paurashava, and Union Parishad.

All the stakeholders must be involved in carrying out the implementation of the plan proposals. Planning proposals are essentially much time-bounded, therefore, execution of the proposals should move ahead once the government formally approves the plan. A development Authority will be established to implement all the plan. Amtali Upazila will be the main custodian of the total plan package. It will also be responsible for executing the monitoring and implementation phase of the development projects by other development as well as Upazila Nirbahi Officer (UNO).

The Agricultural Extension Department of the Ministry of Agriculture, the Ministry of Water Resources and the Ministry of Fisheries and Livestock with the help of Upazila Parishad will play the key role to control development in the Urban Promotion Control Area (UPCAs). For any non-agricultural development within the UPCAs will require No Objection Certificate (NOC) from these authorities.

The Upazila Parishad have the overriding tasks of supervising the implementation of the Action Area Plans across the UPAs within the Upazila with the help of Union Parishads. The governmental agencies performing diverse sectorial responsibilities within the Zila, Upazila, Paurashava and Union Parishads have to coordinate their functions with the local governments of the respective areas of jurisdiction. The Urban Development Directorate (UDD) is to assist this implementation process and provide No Objection Certificate (NOC) for governmental projects.

The Amtali Plan implementation authority will be responsible for the implementation of the Structure Area Plan of the Upazila as per the Local Government Act.

7.4 INSTITUTIONAL STRENGTHENING

In Bangladesh, the central Government Grant is an important source of income. Such grant supplements the income of an area from local sources in order to fulfil its functional responsibilities. At present, Central Grants are of the following types:

a. Direct grants (non-development grants)
b. Subvention (Salary Support)
c. Matching grants (Linked to Projects)
d. Development grants (Block grants)

Block grants can be used effectively to influence resource enhancing behaviour. Block grants, therefore, should be distributed on the basis of a fixed formula. The current distribution mechanism of intergovernmental transfers (ADP block grants) in Bangladesh is not based on any formula. A formula based on Area, Population and level of development of the potential urban area could be adopted. Once adopted, it should not be tampered with or changed for an extended period of time; otherwise, it would lose its effectiveness. To influence the revenue generation, allocation of block grants may be done in two stages.

The priority areas constituting coastal development strategy need to be translated into programs and projects. Projects must be formulated through an institutional process. These projects intended for implementation over a specified duration will form part of the Investment Plan to be updated on an annual basis. Projects will have indicative budget requirements and duration of implementation, as well as implementation arrangements.

7.4.1 Priority Areas

The Coastal Development Strategy puts forward a set of priority areas that should constitute the Investment Strategy which has a direct correspondence to the objectives of the investment strategy spelt out in the coastal zone policy as indicated above. These are as follows:

- Mitigation of natural disasters, safety and protection.
- Environmental management – protection and regeneration of the environment.
- Water resources management.
- Rural livelihoods and sustainable economic opportunities for coastal communities.
- Productive economic activities and focused development of tourism and fisheries sectors.
- Infrastructure development.
- Social development includes health and nutrition, education, and water and sanitation.

7.5 CAPACITY BUILDING OF LOCAL ACTORS

Local governments lack the capacity and resources to carry out their responsibilities properly. To raise working capability, training programs should be arranged and modern office and working equipment should be installed.

7.5.1 Local Actors

They represent the public and the private sectors. The public sector encompasses all relevant central government agencies, Paurashavas and city corporations, while the private sector includes formal and informal enterprises and services, local communities and relevant NGOs.

Local Government Bodies

Capacity building of local government bodies needs to focus on strengthening managerial, technical, financial and regulatory capabilities. Capacity building in holding tax administration is also vital as it is a major source of revenue. Further, enhanced capacity in cost accounting systems is needed to control service and monitor cost-effectiveness and efficiency.

Private Sector Organizations

Both formal and informal private sector enterprises need to build capacity in various aspects affecting urban development.

7.5.2 Capacity Building Tools

Appropriate capacity building tools need to be developed to acquire the skills related to urban development and management. Public sector training and technical assistance programmes would be very useful for local government technical and managerial staff. Public information and outreach programs can be designed by local governments and NGOs to promote public participation and support.

7.5.3 Institutions for capacity building

Undergraduate and post-graduate level education in managerial, technical, financial and regulatory aspects is offered by various Universities and Institutes in the public and private sectors. Particular emphasis should be placed on planning education. Steps should be taken to strengthen planning education and increase the output of graduate planners. Steps should also be taken to train various professionals, especially engineers, in various aspects of urban planning so that they can carry out development activities in conformity with urban planning principles and regulations.

7.5.4 Involving Local Stakeholders in Urban Development

Effective partnerships between local governments and the private sector can generate considerable benefits. Private companies, informal sector enterprises, CBOs, and NGOs can provide urban services, mobilize finance (or voluntary labour), introduce innovative technologies and undertake land development activities. Private sector actors with whom partnership arrangements can be made include the following:

7.5.5 Community-based organizations (CBOs)

These organizations are formed when neighbourhood residents get organized and join forces to improve local security, housing quality, basic utilities, social services and the neighbourhood environment. Municipal community partnership (MCP) has now emerged as an innovative institutional model. MCPs are particularly suitable for delivering specific goods and services, e.g. sanitation, refuse collection, roads and environmental maintenance, social housing etc. MCPs should be developed as part of an overall municipal strategy.

7.5.6 Non-governmental Organization (NGOs)

Unlike CBOS, Non-governmental organizations usually originate outside of the communities with which they work. NGOs may be understood as a “third system” between the public and private, concentrating their support at the community level while at the same time mediating between the community and the government. NGOs are effective agents for building local awareness, mobilizing community action, enabling access to credit, strengthening CBOs etc. In the context of vast needs, limited capacity and constrained financial resources, the local governments should recognize the role of NGOs as partners in urban development and management activities.

7.5.7 Private enterprises

These include informal workers and small-scale enterprises as well as large-scale business firms that may be entrusted with the task of operating or developing infrastructure facilities and urban services. The private sector enterprises can play more productive and sustainable roles in urban development by working in partnership with local government, especially in delivering certain urban services, formulating and implementing local economic development strategies and taking part in Philanthropic activities for the promotion of social good and environmental quality.

7.6 ROLE OF URBAN DEVELOPMENT DIRECTORATE

The multifaceted professional requirements of the plan for execution make it difficult to implement the Structure Plan. For the plan to operate effectively, an appropriate authority to oversee the tasks undertaken under the plan would be needed.

Urban Development Directorate (UDD) is directly involved with the Upazila development plan and UDD is currently doing the Upazila Development Plan. The role of the Urban Development Directorate (UDD) should expand to monitor and evaluate the development plans of Upazilas directly to make it more practical and fruitful. Urban Development Directorate (UDD) can provide technical services for the effective implementation of the plan.

7.7 MONITORING, REVIEW AND UPDATING OF THE PLAN COMPONENTS

Planning is always a continuous process. The plan package needs to be updated regularly to make it respond to the spatial changes over time. The proposed Payra-Kuakata Development Authority always monitor and review the implementation of the plan. The review will aim to analyse the status of implementation of plan provisions, the changing physical growth pattern, infrastructure development, and the trend of public and private physical development including growth direction. Structure Plan will be reviewed periodically once in every 10 years. For regular updating and changes and plan implementation monitoring, the Upazila should immediately set up a planning section with planners and staff.

7.8 CIRCULATION OF THE PLAN DOCUMENTS

The strength of the statutory plan is yet to be established among the stakeholders including common citizens and the public sector development agencies. As the custodian of the plan, Urban Development Directorate (UDD) will be responsible to disseminate and establish the true spirit of the plan. UDD will remain responsible to inform all the government organizations that a statutory plan has been prepared for the corridor, because of its statutory nature; it has to be followed by all. It should be adhered to them while taking up development programs and projects within the jurisdiction of the plan area.

To achieve the objective of the plan, it has to be disseminated among all the government agencies. Copies of the plans including maps and reports will have to be sent to them with a letter stating under what legal authority the plan has been prepared.

The plan would be uploaded on the UDD website so that people can download, study, and be aware of the plan. Besides, hard copies of the document would be made available for sale at a reasonable price. UDD can also contact the line agencies through the letter to make them aware of the projects proposed under this plan and the role of the respective line agencies to implement the same.

7.9 PLAN REVIEW COMMITTEE

A Plan Review Committee would be required for reviewing the cases of demand for change the plan special plan requirements. A Plan Review Committee can serve this purpose following the recommending made by UDD Composition of this Plan Review Committee can be as follows:

Convener – Secretary, Ministry of Housing and Public Works
Member – Joint-Secretary (Local Government Division), Ministry of Local Government, Rural Development and Cooperatives
Member – Joint-Secretary, Ministry of Agriculture,
Joint-Secretary, Ministry of Land,
Joint-Secretary, Ministry of Environment,
Joint-Secretary, Ministry of Water Resources,
Joint-Secretary, Ministry of Road Transport and Bridges
Member – President, Bangladesh Institute of Planners (BIP)
Member – Head, Department of Urban and Regional Planning, BUET.
Member – Deputy Commissioner (DC), Patuakhali District
Member-PD, PKCP Project, Urban Development Directorate (UDD)
Member Secretary – Director, Urban Development Directorate (UDD), Ministry of Housing and Public Works

7.10 DEVELOPMENT CONTROL

Any unauthorized or unlawful development within the Upazila should be controlled to fulfill the aim of planned development. Following are some measures that the concerned Local Government Authority may apply.

Restrictions on development are required in certain cases in order to stop illegal construction and encroachment. For example, no low land can be filled up and no obstruction to drainage system will be allowed. Prior permission of the Local Governments in the respective areas of jurisdiction will be required for filling of any low lands. Ponds should not be allowed to fill up as they are a good source of urban water supply as well as serve as open space.

Infrastructures are developed by public sector agencies for public benefit. But in case of some developments, it is observed that major benefits are reaped by a particular section of the community where development takes place. This is particularly true for road construction.

In the BC Rules 1996, specific provisions are made for parking in housing and commercial areas. But no provision has been suggested for mixed use areas. According to the rules in commercial area, 23 sq.m area has to be reserved for every 200 sq. m of commercial space. The BC Rules for parking in the commercial area can also be applied for mixed-use areas under the current plan.

7.11 EXECUTION OF DEVELOPMENT PROPOSALS

The government agencies should respect the plan provisions and the legal provisions of EBBC Act 1952. When the plan will be ignored by the government agencies, the general public will have little respect for it and plan will gradually lose its credibility as a statutory document.

Many public agencies will be responsible for carrying out infrastructure development. The Local Governments within the Upazila will execute many projects for public interests. The extent of execution of proposals by public sector agencies will largely depend on the size of resources made available for implementing the development schemes. The PPP approach for execution of development projects can be adopted by the local governments.

It should be recognized that planning is an integral part of administration. It should not be expected that planned development would be highly remunerative in the immediate future, but it is sure that execution of development proposals, in the long run, will accrue positive dividends. It will improve health and comfort of the people that will lead to increased comfort for living and efficiency for working.

The plan proposals are time-bound and proposals that are not executed in time will lose their viability over time. As development proceeds, it will be difficult to find suitable vacant land for infrastructure development, which may negatively impact on physical and social environment. Timely execution of development project is therefore important.

7.12 RESOURCE MOBILIZATION FOR DEVELOPMENT

Implementation of development projects proposed in the plan will be a challenging task as they will require huge number of resources. The development projects are expected to be executed by a number of agencies. However, it is beyond doubt that the Local Governments will have to shoulder the heaviest financial burdens. The Local Governments suffer from resource constraint. This calls for increasing revenue earning by generating new revenue sources.

7.13 SCOPE FOR LAND ACQUISITION

Due to low supply and higher demand, land value is higher in urban areas compared to rural hinterland. As a result, land acquisition through legal process is cumbersome and lengthy in urban areas. Land acquisition is expensive in the urban areas as land owners are generally unwilling to offer their lands for development as it is a lucrative source of income in urban areas. It is comparatively easier to acquire land in fringe than in the core areas. Fringe areas are usually characterized by low density, where land value is also comparatively low.

CHAPTER EIGHT: CONCLUSION

8.1 CONCLUSION

Structure Plan will give a guideline to develop the area according to the demand of local people. The Structure Plan summarized the general state of affairs, significant planning concerns, and anticipated population growth in the Upazila. The plan consists of written statement and a map or series of maps along with policy guidelines. The planned township and integrated rural development will require infrastructure and service facilities that can be done by the proper utilization of such urban and rural area plan. The above-mentioned strategic objectives have been designed to enhance the general state of the current planning and governance system in Upazila level. If carefully implemented, national policies and initiatives are seen to have significant effects. The strategic measures suggested are targeted to achieve these policies at the Upazila level. The implementing agencies will have an important role to play once the Development Plan gets approval of the government for execution.

The Structure Plan for Amtali Upazila is a policy document aimed at promoting long-term development through integrated planning and community participation. It addresses challenges such as embankments, waterlogging, communication networks, and inadequate facilities. The plan proposes solutions like road widening, economic and agro-fisheries zones, recreational areas, and rural service centres. It follows regional planning guidelines and aims to attract public and private investment for sustainable development and poverty reduction in the area. The success of the plans will depend on the capacity of the local governments in implementing the plans. The supports of the national government for the execution of the plans are always necessary. The national government should be increasingly engaged with the local governments at the Upazila level in improving the policy and legal framework for the implementation of local physical plans. This will enhance the institutional strength of the local governments in the execution of the planned development process.

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ANNEXURE-A

Table A1: Status of Physical and Aggregate Properties

Parameters	Unit	Buriswar-Payra	Andarmanik (Upstream)	BD Standards	Remarks
Temp.	^{0}C	30	33	20-30	Within the range
pH	Value	7.1	6.6	6.5-8.5	Within the range
TDS	mg/l	74	5720	1000	Complied the standard except Andarmanik
EC	µS/cm	148	11420	1200	Complied the standard except Andarmanik
Salinity	ppt	0.1	6.8	0	Complied the standard except Andarmanik
TSS	mg/l	11	8	50-150	Within the range
Turbidity	NTU	52	64	50	Higher than the standard
Alkalinity	mg/l	40	30	20-120	Within the range
Hardness	mg/l	180	470	200-500	Within the range

Source: CEGIS Survey, May 2022

Table A2: Status of Inorganic Non-metallic Constituents

Parameters	Unit	Buriswar-Payra	Andarmanik (Upstream)	BD Standards/WHO*	Remarks
Chloride	mg/l	20	4150	250	Complied the standard except Andarmanik
Sodium	mg/l	6	2432	200*	Complied the standard except Andarmanik
Potassium	mg/l	4	128	12*	Complied the standard except Andarmanik
Nitrate	mg/l	6.6	5.4	2.5	Higher than the standard
Phosphate	mg/l	0.1	0.4	0.5	Complied the standard
Sulphate	mg/l	15	212	400	Complied the standard

Source: CEGIS Survey, May 2022

Table A3: Status of Aggregate Organic Constituents

Parameters	Unit	Buriswar-Payra	Andarmanik (Upstream)	BD Standards	Remarks
DO	mg/l	5	4	5 or more	Within the standard except Andarmanik
BOD	mg/l	2	1	Less than 10	Complied the standard
COD	mg/l	8	4	Less than 25	Complied the standard

Source: CEGIS Survey, May 2022

Table A4: Status of Metal Constituents

Parameters	Unit	Buriswar-Payra	Andarmanik (Upstream)	EPR'86, India	Remarks
Iron	mg/l	0.4	0.5	0.1	Higher than the standard
Zinc	mg/l	0.03	0.03	2	Complied the standard
Manganese	mg/l	0.23	0.13	3	Complied the standard
Lead	mg/l	0.005	0.002	2	Complied the standard
Chromium	mg/l	0.012	0.029	0.05 (BD, Drinking)	Complied the standard
Nickel	mg/l	0.030	0.030	5	Complied the standard
Copper	mg/l	0.030	0.030	1 (BD, Drinking)	Complied the standard
Cadmium	mg/l	0.00015	0.00015	0.005 (BD, Drinking)	Complied the standard except Tetulia

Source: CEGIS Survey, May 2022

Table A5: Status of Oil & Grease and Phenol

Parameters	Unit	Buriswar-Payra	Andarmanik (Upstream)	Standards	Remarks
Oil & Grease	mg/l	<2.0	<2.0	10 (ECR'2017 ammed.)	Within the standard
Phenol	mg/l	<0.5	<0.5	-	-

Source: CEGIS Survey, May 2022

Table A6: Noise Quality of Different Land Use Types

Amtoli					
Location ID	**Zone**	**Morning (dB)**	**Std. (Noise control rules, 2006) (dB)**	**Evening (dB)**	**Std. (Noise control rules, 2006) (dB)**
NL-1	Commercial	74	70	89	60
NL-2	Residential Area	62	55	68	45
NL-3	Mixed	63	60	72	50

APPENDIX B:

Appendix B: ESO Objectives, Indicators and Institutions Responsible for Monitoring

This table is a work-in-progress. It will be updated again in the Final SEMP, and will require to be further developed by the SCU during year 1 in consultation with implementing agencies, and kept under rolling review throughout the next 20 years.

Appendix

Themes		Objective		Indicator	Unit	Baseline figure	Year of baseline data	Source	Concern Ministry	Institution responsible for data Gathering	Supported by	How often	Resources needed (budget, equipment, training, etc…)
Forest, Protected areas and biodiversity	1	Reduce over-exploitation/ degradation of habitats, loss of biodiversity and ecosystem(s) integrity and services	1	Status of the mud crab (Scylla spp.) as a key indicator of aquatic biodiversity in the PKCP region	None yet	None yet	None yet	None yet	Ministry of Fisheries and Livestock (MoFL) Secretary, MoFL, email: secretary@mofl.gov.bd, Phone: 9545700 & Ministry of Environment Forest and Climate Change (MoEFCC) Secretary, MoEFCC, email: secretary@moef.gov.bd, Phone: 9540481	Department of Fisheries (DoF) Director General, DoF email: dg@fisheries.gov.bd, Phone: 9562861 & Bangladesh Forest Department (BFD) Chief Conservator of Forests, BFD email: ccf-fd@bforest.gov.bd, Phone: 01999000001	Department of Fisheries (DoF) 1. Director, Finance & Planning, DoF. email: ddfinance@fisheries.gov.bd Bangladesh Forest Department (BFD) 2. Conservator of Forests, Wildlife and Nature Conservation Circle, BFD, Dhaka. email: mihir_fd@yahoo.com, Cell: 01712566001	Annual	Survey needed and the SCU will finalize all the need assessment.
			2	Status of suitable habitat for dolphin (in sanctuaries & hotspots)	Poor Good Very good1	Very good	2018-19	BFD, 2020	Ministry of Environment Forest and Climate Change (MoEFCC) Secretary, MoEFCC, email: secretary@moef.gov.bd, Phone: 9540481	Bangladesh Forest Department (BFD) Chief Conservator of Forests, BFD. email: ccf-fd@bforest.gov.bd Phone: 01999000001	BFD 1. Conservator of Forests, Wildlife and Nature Conservation Circle, BFD, Dhaka. email: mihir_fd@yahoo.com,	Propose Every 3 years	
			3	Area of Protected (PA) Forests and other designated areas	Hectare	Reserve forests 43,453	2022	BDF 2022	Ministry of Environment Forest and Climate Change (MoEFCC) Secretary, MoEFCC, email: secretary@moef.gov.bd, Phone: 9540481	Bangladesh Forest Department (BFD) Chief Conservator of Forests, BFD. email: ccf-fd@bforest.gov.bd Phone: 01999000001	BFD 1. Conservator of Forests, Wildlife and Nature Conservation Circle, BFD, Dhaka. email: mihir_fd@yahoo.com,	Propose Every 3 years	
Waste and Pollution	2	Reduce poor management and unsafe disposal of	4	Capacity of recycling plants in the PKCP Area	Very good/Good/ Moderate	0	2022	Local consultations	Ministry of Environment Forest and Climate Change (MoEFCC) Secretary, MoEFCC, email:	Department of Environment (DoE) Director General, DoE email: dg@doe.gov.bd	DoE 1. Director, NRM, DoE, email: dirnrm@doe.gov.bd, Cell: 01718114188	Annually	

1.Poor: Where the environmental factors and food accessibility for dolphins is not enough for basic life cycle requirements and where interference by fishermen and boat movement disturbance is high.

Good: Where the environmental factors and food accessibility for dolphins is enough for basic life cycle requirements, and interference by fishermen and boat movement disturbance is low.

Very good: Where the environmental factors and food accessibility for dolphins is abundant for basic life cycle requirements, and there is no interference by fishermen and boat disturbance.

Themes	Objective		Indicator		Unit	Baseline figure	Year of baseline data	Source	Concern Ministry	Institution responsible for data Gathering	Supported by	How often	Resources needed (budget, equipment, training, etc…)
		solid and liquid waste (urban & industrial)			/ Poor/ Very poor2				secretary@moef.gov.bd, Phone: 9540481	Phone: 8181800	2. Director, Barishal Divisional Office, DoE,		
			5	Total volume waste per capita in Amtali, Kalapara and Brguna Sadar	Kg/ person/ day	0.11, 0.20, 0.24 respectively	2022	Calculated	Ministry of Environment Forest and Climate Change (MoEFCC) Secretary, MoEFCC, email: secretary@moef.gov.bd, Phone: 9540481	Department of Environment (DoE) Director General, DoE email: dg@doe.gov.bd Phone: 8181800	DoE 1. Director, NRM, DoE, email: dirnrm@doe.gov.bd, Cell: 01718114188 2. Director, Barishal Divisional Office, DoE,	Annually	
			18	No hrs. in which noise exceeds 45dBA in the 'Silent Zone' in the reserve forests)3	Hrs./day	0 4	2022	CEGIS 2022	Ministry of Environment Forest and Climate Change (MoEFCC) Secretary, MoEFCC, email: secretary@moef.gov.bd, Phone: 9540481	Department of Environment (DoE) Director General, DoE email: dg@doe.gov.bd Phone: 8181800	DoE 1. Director, Department of Environment, Dhaka Laboratory Office E-mail: dhakalab@doe.gov.bd, Cell: 01712125880 2. Director, Air Quality Management, Department of Environment. Mail: nazmul@doe.gov.bd, Cell: 01819427358	Methodology, duration and coverage to be revised	Survey needed
Climate change and disasters	4	Reduce vulnerability to climate change and natural disasters	26	Storm surge inundation	% of PK Region	Cyclone Sidr: 10	2007	WB, 2011	Ministry of Disaster Management and Relief (MoDMR) Secretary, MoDMR email:	Department of Disaster Management (DDM) Director General, DDM email: dg@ddm.gov.bd, Phone: 8835	DDM 1. Deputy Director (Research) Disaster Management Division, email: nurulhaqu	Event based – the data are only collected	Storm surge inundation

2Very good =The state where all the municipal solid waste in urban areas of PK Region is recycled and properly managed without posing any threats to environment, and 70-90%) of waste is converted into resources.

Good = The state where all the municipal solid waste in the urban areas of PK Region is recycled and properly managed without posing any threats to environment, with 50-69% of waste converted into resources.

Moderate = The state where 50 –75% of the municipal solid waste in the urban areas of PK Region is recycled and properly managed without posing any threats to environment, with 30-49% of waste converted into resources.

Poor = The state where around 25% of the municipal solid waste in the urban areas of PK Region is recycled and properly managed only, with no waste comverted into resources.

Very Poor = The state where less than 25% of municipal solid waste in the urban areas of PK Region is recycled and properly managed, with no waste converted into resources.

3Bangladesh standard (Environmental Conservation Rule-ECR-1997) for Silent zone (45 dBA)

4Discontinuously when Cargo and ships move and honk

Themes	Objective	Indicator		Unit	Baseline figure	Year of baseline data	Source	Concern Ministry	Institution responsible for data Gathering	Supported by	How often	Resources needed (budget, equipment, training, etc…)
	(floods, storm surges, etc.)							secretary@modmr.gov.bd Phone: 9540877	495	echowdhury@gmail.com, Mobile: 01711399633	after the event	
		27 (a)	Salinity intrusion (Surface water & ground water)	% of Region: 1PPT in SW	71.5	2011	CEGIS Bay of Bengal Model	Ministry of Water Resources (MoWR) Secretary, MoWR email: secretary@mowr.gov.bd, Phone: 9576773 & Ministry of Local Government, Rural Development & Co-operatives	Bangladesh water Development Board (BWDB) Director General, BWDB email: dg@bwdb.gov.bd, Phone: 222230011 & Department of Public Health Engineering (DPHE) Chief Engineer, DPHE, email: ce.dphe@gmail.com. Phone: 55130752	BWDB Chief Engineer (Civil), Hydrology, email: ce.hydrology@bwdb.gov.bd, Phone: 029550815 DPHE Superintending Engineer (Ground Water Circle), email: se.gwc@dphe.gov.bd, Phone: 02-9342485	Continuous	Measure this in wells. There are a number of monitoring wells. The monitoring is already in place
		27 (b)	As above	% of Region: 5PPT in SW	52.5	As above	As above	As above	As above	As above	As above	As above
		28	Number of Households severely affected5 during cyclone, storm surge, extreme flood or related climate change event	No.	31,228 on average per annum (from 2015-2020)	2015 - 2020	BBS, 2022	Ministry of Environment Forest and Climate Change (MoEFCC) Secretary, MoEFCC, email: secretary@moef.gov.bd, Phone: 9540481	Bangladesh Bureau of Statistics Statistics and Informatics Division Ministry of Planning	Bangladesh Bureau of Statistics Statistics and Informatics Division Ministry of Planning	calamity/ event based Data collated every 5 years	Existing monitoring system already in place

5Severely affected means: house, crops, livestock, fish farms destroyed

BBS (2022). Bangladesh Disaster-related Statistics 2021: Climate Change and Natural Disaster Perspectives—Final Draft. Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

Appendix

Themes	Objective		Indicator		Unit	Baseline figure	Year of baseline data	Source	Concern Ministry	Institution responsible for data Gathering	Supported by	How often	Resources needed (budget, equipment, training, etc…)
Economic growth	5	Ensure significant economic development and diversification, and increase in economic growth	29	Per capita GDP for PK Region (in constant price of 2010)	PPP6 international $	2096	2018-19	BBS, 2019	Ministry of Planning Secretary, Statistics and Informatics Division (SID) email: secy@sid.gov.bd, Phone: 02-55007373	Planning Commission Director General, Planning, Commission, E-mail: hamidul.haque@imed.gov.bd Phone (Office): 9180677, Mobile: 01718022712 & Statistics and Informatics Division (SID), Additional Secretary, Informatics Wing, SID email: addlsecy@sid.gov.bd, Phone: 55007377	Bangladesh Bureau of Statistics (BBS) Director General, BBS, E-mail: dg@bbs.gov.bd, Phone: 02-55007056	Annually	
			30	GDP for PK Region (in constant prices of 2010)	PPP international $ billion	44.29			same as above	same as above	same as above	Annually	
			31	GDP in PK Region as share of national GDP	%	14	2018-19	Est.	same as above	same as above	same as above	Annually	
			32	Industry as share of GDP of PK Region	%	24.08	2018-19	BBS, 2019	same as above	same as above	same as above	Annually	
Employment	6	Enhance opportunities for employment and new/improved livelihoods (particularly for fisheries, agriculture, eco-tourism)	33	People employed in industry in PK Region	% of total people employed	5	2012	BBS, 2012	Ministry of Industries (MoI) Secretary, MoI, email: indsecy@moind.gov.bd, phone: 02-47120800	Bangladesh Industrial Technical Assistance Centre (BITAC) Director General, BITAC email: dg@bitac.gov.bd, phone:8870700	Bangladesh Industrial Technical Assistance Centre (BITAC)	Annually	

6 PPP: purchasingpowerparity

Themes	Objective		Indicator		Unit	Baseline figure	Year of baseline data	Source	Concern Ministry	Institution responsible for data Gathering	Supported by	How often	Resources needed (budget, equipment, training, etc…)
Health and sanitation	7	Improve health services and health of society (e.g. by reducing vulnerability to diseases)	34	No of health service providing organization	No.	352 beded 5 hospitals in five Upazilas, 60 bedded private hospitals in two upazila	2021	PKCP Regional Plan	Ministry of Health and Family Welfare (MoHFW) Secretary, Health Service Division, MoHFW email: secretary@hsd.gov.bd, phone: 9577199	Directorate General of Health Services (DGHS) Director General (Health), email: alamdr2003@ yahoo.com, phone: 55067172 & Bangladesh Bureau of Statistics (BBS) Director General, BBS, E-mail: dg@bbs.gov.bd, Phone: 02-55007056	DGHS 1. Director DGHS, Khulna Division Email: kdho@ld.dghs.gov.bd Mobile: 01711195754, 01716821339 BBS 2. Director, Census/computer Wing, Bangladesh Bureau of Statistics (BBS), email: mahfuz.bablu@gmail.com, phone: 02-55007331	Annually	
			35	Life expectancy	Yrs	72.10	2018	BBS, 2019	Ministry of Health and Family Welfare (MoHFW) Secretary, Health Service Division, MoHFW email: secretary@hsd.gov.bd, phone: 9577199	Directorate General of Health Services (DGHS) Director General (Health), email: alamdr2003@ yahoo.com, phone: 55067172 & National Institute of Population Research and Training (NIPORT) Director General, NIPORT, email: dg.niport1977@gmail.com, phone: 9662495	RPTI 1. Regional Population Training Institute (RPTI), Barishal 2. Director, Census/computer Wing, Bangladesh Bureau of Statistics (BBS), email: mahfuz.bablu@gmail.com, phone: 02-55007331	Annually	
Education. skills and training	8	Improve access to education for all, increase attendance (by reducing drop-out rates), and improve skills development and training	36	Enrolment in higher secondary education (16+ years)	% of population	22.42	2019	PKCP Regional Plan, 2019	Ministry of Education (MoEDU) Secretary, MoEDU, email: Secretary@moedu.gov.bd Phone: 9576679	Directorate of Secondary and Higher Education (DSHE) Director General, DSHE, email: dg@dshe.gov.bd, Phone: 9553542 & BANBEIS Director General, BANBEIS, email: dg@banbeis.gov.bd, phone: 02-9665457	DSHE 1. Deputy Director, DSHE, Khulna Email: ddkhl@yahoo.com, Mobile: 01712141429 BANBEIS 2. Chief Statistics, BANBEIS, email: alamgir_asif@yahoo.com, phone: 02-55151815	Annual	

Appendix

Themes	Objective		Indicator		Unit	Baseline figure	Year of baseline data	Source	Concern Ministry	Institution responsible for data Gathering	Supported by	How often	Resources needed (budget, equipment, training, etc…)
Migration	9	Reduce migration from rural (including disaster-prone and risk-prone) areas to urban areas	37	Rate of migration to urban areas in PK Region	%	3.24	2019	BBS, 2019	Ministry of Planning Secretary, Statistics and Informatics Division (SID) email: secy@sid.gov.bd, Phone: 02-55007373 & Ministry of Expatriates' Welfare and Overseas Employment	1. Bangladesh Bureau of Statistics (BBS) Director General, BBS, E-mail: dg@bbs.gov.bd, Phone: 02-55007056 2. Bureau of Manpower, Employment and Training (BMET) Director General, BMET, email: dg@bmet.gov.bd, phone: 49349925 3. Statistics and Informatics Division (SID) Additional Secretary, Informatics Wing, SID email: addlsecy@sid.gov.bd, Phone: 55007377	Statistics and Informatics Division (SID) 1. Additional Secretary, Informatics Wing, SID email: addlsecy@sid.gov.bd, Phone: 55007377 BBS 2. Joint Director, BBS, Khulna, Email: mostofa43@gmail.com, Mobile: 01720212215 2. Refugee and Migratory Movements Research Unit (RMMRU), University of Dhaka E-mail: info@rmmru.org, Tel: + 880-2-9360338	Annually	Rate of migration to urban areas in PK Region
Conflicts and security	10	Reduce conflicts over use of land	38	No of fisher-farmer land-related disputes / clashes	No.	None yet	None yet	http://peaceobservatory-cgs.org/#/division/district	Ministry of Public administration (MoPA) Secretary, MoPA, email: secretary@mopa.gov.bd, Phone: 02-9570100	Divisional Commissioner, Khulna Division email: divcomkhulna@mopa.gov.bd, phone: 01713400394	Divisional Commissioner office. 1. Additional Divisional Commissioner (Revenue)	Annual	Need Study to cover both reported and unreported cases

Appendix

Themes	Objective		Indicator		Unit	Baseline figure	Year of baseline data	Source	Concern Ministry	Institution responsible for data Gathering	Supported by	How often	Resources needed (budget, equipment, training, etc…)
Food	11	Improve food security	39 (a)	Status of food security - as measured by availability,	Very good7	Moderate	2020	https://foodsecurityindex.eiu.com/Index	Ministry of Food Secretary, Ministry of Food, email: secretary@mofood.gov.bd, phone: 029540088	Directorate General of Food Director General, Directorate of Food, Dhaka, emial: dg@dgfood.gov.bd, phone: 02-9584834	Regional Controller of Food Regional Food Department, Barishal Division	annual	
		Improve food security	39 (b)	quality	Good	Moderate	As above	As above	As above	As above	As above	As above	
		Improve food security	39 (c)	safety food to all people at all time	moderate	Moderate	As above	As above	As above	As above	As above	As above	
Power and energy	12	Enhance the capacity of power generation and distribute sustainable power to the consumer.	40	At present total power Generation in the Barishal Region (PKCP is the part of Barishal Region)	MW	2265	2020	BPDB, 2020; Daily Production Report, PGCB	Ministry of Power Energy and Mineral Resources (Power Division) Secretary, Power Division, email: secy@pd.gov.bd, phone: 02-9511030	Bangladesh Power Development Board (BPDB) Chairman, BPDB, email: chairman@bpdb.gov.bd, Phone: 9562154 Bangladesh Rural Electrification Board (BREB) Chairman. BREB Mobile: 88028900007 Email: chairman@reb.gov.bd	BPDB 1. Member, Generation, BPDB, email: member.generation@bpdb.gov.bd, phone: 9564667 2. Deputy Secretary, Development-5, Power Division Mobile: +8801817508251 Email: dev-5@pd.gov.bd	Standing indicator – only changes when a new power station is built	
		Increase production and consumption of energy	41	Power production per capita (installed capacity	W / capita	122	2020	BPDB, 2020 and Expert Judgement	Ministry of Power Energy and Mineral Resources (Power Division) Secretary, Power Division, email: secy@pd.gov.bd, phone: 02-9511030	Bangladesh Power Development Board (BPDB) Chairman, BPDB, email: chairman@bpdb.gov.bd, Phone: 9562154	BPDB 1. Member, Generation, BPDB, email: member.generation@bpdb.gov.bd, phone: 9564667 2. Deputy Secretary,	25	

7Very Good: Food affordability, availability, quality and safety is good enough or surplus to all people at all time. It includes safe and nutrition food to meet dietary need.

Good: Food affordability, availability, quality and safety is sufficient or just enough to feeding all the people at all time.

Moderate Good: Food affordability, availability, quality and safety is not enough to feeding all the people at all time.

Poor: Food affordability, availability, quality and safety is insufficient or deficit to meet demand and need improve access to sufficient, safe and nutrition food to meet dietary need.

Link SEA

https://en.wikipedia.org/wiki/Global_Food_Security_Index

https://foodsecurityindex.eiu.com/Index

Appendix

Themes	Objective		Indicator		Unit	Baseline figure	Year of baseline data	Source	Concern Ministry	Institution responsible for data Gathering	Supported by	How often	Resources needed (budget, equipment, training, etc…)
											Development-5, Power Division Mobile: +8801817508251 Email: dev-5@pd.gov.bd		
	13	Increase access to affordable energy	42	Power production per GDP (installed capacity)	W / 1000 $ international (PPP, constant prices of 2010)	58.1	2020	BPDB, 2020	Ministry of Power Energy and Mineral Resources (Power Division) Secretary, Power Division, email: secy@pd.gov.bd, phone: 02-9511030	Bangladesh Power Development Board (BPDB) Chairman, BPDB, email: chairman@bpdb.gov.bd, Phone: 9562154	BPDB 1. Member, Generation, BPDB, email: member.generation@bpdb.gov.bd, phone: 9564667 2. Deputy Secretary, Development-5, Power Division Mobile: +8801817508251, Email: dev-5@pd.gov.bd	26	
Tourism	14	Improve tourism management and behaviour to limit noise, pollution and other negative impacts and remain within the carrying capacity of the Exclusive Tourist Zone (ETZ)	43	Visitors to the various destinations of the project area. Like: Number of visitors to the Exclusive Tourist Zone, Sonar char No. of tourists for river/sea cruising	No.	On the weekend, Sonar Char was visited by 80-100 tourists, compared to 30-40 tourists on Sunday through Thursday. Still there were no river or sea cruising facilities	Jan 2023	Union level Consultation	1. Ministry of Environment Forest and Climate Change (MoEFCC) Secretary, MoEFCC, email: secretary@moef.gov.bd, Phone: 9540481 2. Ministry of Civil Aviation & Tourism (MOCAT) Secretary, MoCAT, email: secretary@mocat.gov.bd, phone: 02-9514884	A K Shamsuddin Chairman, Char Montaz 01715332567 Md. Mosaref Hossain Union Parishad Member, 7 no. ward 01735727636 1. Bangladesh Forest Department (BFD) Chief Conservator of Forests, BFD. email: ccf-fd@bforest.gov.bd Phone: 01999000001 2. Bangladesh Parjatan Corporation (BPC), Chairman, BPC, email: chairman@parjatan.gov.bd, phone: +88 02 44826504	BFD 1.Conservator of Forests, Barishal Circle. MOCAT Deputy Secretary (Tourism 1) Email: dstourism1@mocat.gov.bd	Daily	
Infrastructure, transportation and communications	15	Improve connection of communities, and improve access to infrastructure,	44	Number of Educational Institute (Primary School, Secondary	Nos	1230	2021	UDD, 2021	Ministry of Education (MoEDU) Secretary, MoEDU, email: Secretary@moedu.gov.bd Phone: 9576679 Ministry of Primary and	Directorate of Secondary and Higher Education (DSHE) Director General, DSHE, email: dg@dshe.gov.bd, Phone: 9553542 & BANBEIS		Standing figure until new railway is built	

Themes	Objective		Indicator		Unit	Baseline figure	Year of baseline data	Source	Concern Ministry	Institution responsible for data Gathering	Supported by	How often	Resources needed (budget, equipment, training, etc…)
		services and facilities		school, College, Technical and Vocational institutes)					Mass Education (MoPME) Secretary, MoPME, email: scy@mopme.gov.bd Phone: +88-02-55100484 9576679	Director General, BANBEIS, email: dg@banbeis.gov.bd, phone: 02-9665457		Update figure	
			45	Density of roads in PK Region	Km roads per 100 Km2	22.13	2022	RHD & LGED 2022	Ministry of Road Transport and Bridges Secretary, Road, Transport and Highways Division, email: secretary@rthd.gov.bd, phone: 02-9511122	Road, Transport and Highways Division Secretary, Road, Transport and Highways Division, email: secretary@rthd.gov.bd, phone: 02-9511122	Roads and Highways Division Deputy Secretary, Estate Branch, Roads and Highways Division, Email: dsestate@rthd.gov.bd, Mobile: 01716442348	Standing indicator – only changes when a new road is built	
	16	Optimize the existing and future physical footprint of transport services (rail, road, air, waterways)	46	Extent of railways in PK Region	Km	214	2022	BR, 2022	Ministry of Railways (MoR) Secretary, Ministry of Railways, email: secretary@mor.gov.bd, phone: 9578199	Ministry of Railways (MoR) Secretary, Ministry of Railways, email: secretary@mor.gov.bd, phone: 9578199	Addl. Director General (Infra), Bangladesh Railway, Email: adgi@railway.gov.bd, Mobile: 01711505301	Standing figure until new railway is built Update figure annually	
			47	Ships carrying coal handled at Payra Port	Nos	102	2022 8	PPA website	MoS	Traffic Department, Payra Port Authority			
			48	Amount of Coal handled at Payra Port	Metric Ton	28,12,669	2022	PPA website	MoS	Traffic Department, Payra Port Authority			
			49	Other Commercial Cargo Ships handled at Payra Port	Nos	19	2022	PPA website	MoS	Traffic Department, Payra Port Authority			
			50	Other Commercial Cargo Handled at Payra Port	Metric Ton	210,387	2022	PPA website	MoS	Traffic Department, Payra Port Authority			
			51	Domestic	Nos	825	2022	PPA	MoS	Traffic Department, Payra			

8 Data available up to December 31, 2022

Themes	Objective		Indicator		Unit	Baseline figure	Year of baseline data	Source	Concern Ministry	Institution responsible for data Gathering	Supported by	How often	Resources needed (budget, equipment, training, etc…)
				Lighterage/Bulkhead ships handled at Payra Port				website		Port Authority			
			52	Domestic Lighterafe/Bulkhead cargo handled at Payra Port	Metric Ton	980,909	2022	PPA website	MoS	Traffic Department, Payra Port Authority			
Urban area expansion	17	Sustainable and eco-friendly development of urban area	53	Existing urban area (Paurashava)	%	1.38	2023	Payra Kuakata Comprehensive Plan Focusing on Eco-Tourism	Ministry of Housing and Public Works Ministry of Housing and Public Works Secretary, Ministry of Housing & Public Works secretary@mohpw.gov.bd, phone: 55100465 (office)	UDD Director, Urban Development Directorate director.UDD1965@gmail.com Phone: 223382728 (Office)		Standing figure until new plans are implemented.	
Agriculture	18	Increase agricultural productivity	54	Milk demand	M M Ton/yr	0.21	2018	DLS, 2018	Ministry of Fisheries And livestock (MoFL) Secretary, MoFL, email: secretary@mofl.gov.bd, phone: 9545700	Department of Livestock Services (DLS), Dhaka DG, DLS	Upazila Livestock Officer (ULO), of respective Upazila	Annually	
			55	Meat demand	M M Ton/yr	0.20	2018	DLS, 2018	Ministry of Fisheries And livestock (MoFL) Secretary, MoFL, email: secretary@mofl.gov.bd, phone: 9545700	Department of Livestock Services (DLS), Dhaka DG, DLS	Upazila Livestock Officer (ULO), of respective Upazila	Annually	
			56	Rice and Non-Rice crop production	Million Metric (MM Ton)/yr	Rice – 451,578 MT; Non-rice – 352,202 MT	2021-22	DAE field report and CEGIS calculation based on field survey, 2022	Ministry of Agriculture (MoA) Secretary, MoA, email: secretary@moa.gov.bd, phone: 9540100	Department of Agriculture Extension (DAE) Director General, DAE email: dg@dae.gov.bd,	Deputy Director of Department of Agricultural Extension (DDDAE) of Barguna and Patuakhali District email: dg@dae.gov.bd, Phone: 55028369 Upazila Agriculture Officer (UAO) of the respective upazila	Annually	

Themes	Objective		Indicator		Unit	Baseline figure	Year of baseline data	Source	Concern Ministry	Institution responsible for data Gathering	Supported by	How often	Resources needed (budget, equipment, training, etc…)
Fisheries	19	Promoting inland fisheries	57	Fish production in PKCP Region	MT/yr	0.81	2018	DoF, 2019	Ministry of Fisheries and Livestock (MoFL) Secretary, MoFL, email: secretary@mofl.gov.bd, Phone: 9545700	Department of Fisheries (DoF) 1. Director General, DoF email: dg@fisheries.gov.bd, Phone: 9562861	District Fisheries Officer (DFO) Director, Finance & Planning/ PSO(FRSS), DoF Email: ddfinance@fisheries.gov.bd, Mobile: 01712581599	Annually	
		Promoting inland fisheries	58	Fish production in PKCP Region	MT/yr	0.81	2018	DoF, 2019	Ministry of Fisheries and Livestock (MoFL) Secretary, MoFL, email: secretary@mofl.gov.bd, Phone: 9545700	Department of Fisheries (DoF) 1. Director General, DoF email: dg@fisheries.gov.bd, Phone: 9562861	District Fisheries Officer (DFO) Director, Finance & Planning/ PSO(FRSS), DoF Email: ddfinance@fisheries.gov.bd, Mobile: 01712581599	Annually	
Water Resources	20	Increase dry season freshwater flow in rivers	59	Average daily dry season (Jan-May) discharge on Gorai at Railway Bridge	Cumec	84	1997 - 2019	BWDB	MoWR	Bangladesh Water Development Board Director General dg@bwdb.gov.bd, dg.bwdb.bd@gmail.com Phone: 01318234567	Bangladesh Water Development Board (relevant district office)	Daily	
		Reduce high/peak water level in Tetulia channel during monsoon season	60	Average daily monsoon (Jul-Aug-Sept) WL in Tetulia Channel	mPWD	2.75	1989 - 2002	BIWTA	MoWR	Bangladesh Water Development Board Director General dg@bwdb.gov.bd, dg.bwdb.bd@gmail.com Phone: 01318234567	Bangladesh Water Development Board (relevant district office)	Daily	

ANNEXURE-C: PROJECT TEAM

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