Payra-Kuakata Comprehensive Plan Focusing on Eco-Tourism
Structure Plan: 2021-2041

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Executive Summary

The Structure Plan is basically a policy document 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 Galachipa Upazila through integrated planning and implementation involving several organizations and community participation for optimal resource utilization and poverty reduction and to formulate strategic development planfollowing the guideline of regional plan considering functional and land use requirement with hazard vulnerability. Galachipa upazila has 12 unions, and one paurashava.

The report presents summary information and discussion on the survey results of various aspects of the Upazila. The survey on Land Use, Physical Features, Socioeconomic conditions, Topography, Hydrology, Hazards, Environment, Agriculture, Drainage and Flood Control, andTransportation have provided useful data and information and are used in the Structure Plan. Astructure Plan is prepared to provide flexibility through laying down the development strategies.This stratum of the plan is developed for the whole project area. It has a duration of 20 years.

In 2011, the population of the project area was 2,55,815 (BBS, 2011). The Structure plan reportused population data for a twenty-year plan period in the future from the estimates of the cohort method for Upazila, Union, and Urban Area. The projected figure of the population is 369922 forthe year 2041.

Different types of thematic maps were prepared based on 6 types of surveys during the survey stage. Each survey has a distinct output. The outputs of survey works were presented in the form of thematic maps. The thematic maps are Digital Elevation Model (DEM), existing Land Use, Road type, cropping pattern, Salinity level in deep water, groundwater recharge area, foundationdepth, etc.

Suitability analysis is a prime requirement for the preparation of the structure plan of any urban and rural area. Two types of suitability maps were prepared after analyzing the suitability of the existing features. Through this analysis, suitable areas for infrastructure, economic region, human settlement, and development potentiality were identified. Tourism suitability had been carried out for identifying tourist spots for exclusive tourist zone at Sonar Char and the surrounding area.

The stakeholder's views were gathered through meetings at Upazila and Union levels for consideration in the planning decisions. Based on the analysis of survey information, critical planning issues of the Upazila have been identified. Estimates on the future growth pattern for potential sectors have been useful in planning decisions and land use allocations following planning standards. Structure plan consists of a report which is a policy document with various supporting maps and an appropriate scale composite map depicting the key elements of the major strategic decisions.From the existing land use survey, it is found that agriculture occupies about 57% of the land, 20% used as residential, water bodies about 16% and char area occupies 4.27% of the total. Embankment, Water logging, Cyclone, flood, Communication Network among unions (mostly katcha road) and transportation problems like narrow and earthen roads, Recreational facilities, solid waste management system, Insufficient drinking water are major problems in the upazila.17 zones has proposed in the Structure Plan. In this structure plan about 803.4 acres of road (.6%) network is proposed (widening) 0.14% land is proposed as 0.57% economic zone, and proposasls like agro fisheries site and tourist sites. Besides, 30 strategic rural service centers, a fish processing and research center is proposed for this upazila as a large number of people depend on agriculture and fisheries.

Moreover, the plan proposes widening of roads, reconstruction of embankments, economic zones, bridges and culverts to improve road management and connectivity with other unions and municipalities. Here, a Bangabandhu Uposohor is proposed as planned residential area. Besides,Burir Char, Char Biswas, Char Kajol's abandoned gas field area is a tourist attraction proposed as tourist site in the Structure Plan. It identifies the extent and direction of expected urban growth incorporating the future broad functions of various strategic areas and defines a comprehensiveset of sectoral policies considered necessary to achieve the vision and objectives of the overall plan. Also, regional planning guidelines are also followed in the structure plan by following policy guidelines. It is expected that this zone will facilitate the investment of public and private investors.

CHAPTER ONE: INTRODUCTION

Structure Plan of Galachipa Upazila is a comprehensive and detailed plan that has been developed to ensure sustainable and integrated development of Payra-kuakata region region. The success of developing the region as a tourist centre depends much on good communication facilities and availability of modern amenities. Moreover, it is predicted that the Payra sea port would generate many ports related new activities including huge vehicular traffic such as air, rail, road and water. This phenomenon would have both positive and negative impact on the socio-economic condition and existing land use pattern of the region. The proposed plan would guide such probable changes in the socio-economic condition and land use pattern of the Upazila. This plan will also address the adverse impact of such changes.

The Structure Plan provides long term strategy for the 20 years from 2021-2041 for the development of Galachipa Upazila. It is basically a policy document that establishes an indicative and flexible long-term strategy which will demonstrate the future direction for corresponding development and provide a framework as well as guidelines for subsequent local level plans. Structure Plan is basically a policy document that sets the ground and serves as the guideline for subsequent local level (urban and rural area) plans. Generally, Galachipa Structure 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.

1.1 Background Of The Study Area

Galachipa upazila is located inside the district of Patuakhali and is located on Bangladesh's outer coast as proposed by Ahsan's (2013). Local elevation differences are typically less than 1m, compared to 2-3m on the Ganges floodplain. The sediments are mostly non-calcareous clays, but they are silty and slightly calcareous along the riverbanks and in a transitional zone in the east adjacent to the lower Meghna.Galachipa Upazila (patuakhali district) area 548.90 sq km, located in between 21°48' and 22°21' north latitudes and in between 90°15' and 90°37' east longitudes. It is bounded by patuakhali sadar, bauphal and dashmina upazilas on the north, bay of bengal and Galachipa upazila on the south, Dashmina and char fasson upazilas on the east, amtali and kalapara upazilas on the west.

Galachipa Upazila has many rivers and canals. The Bay of Bengal is very close here. However, Galachipa is situated on the bank of the Ramnabad in Patuakhali District. Due to the river,

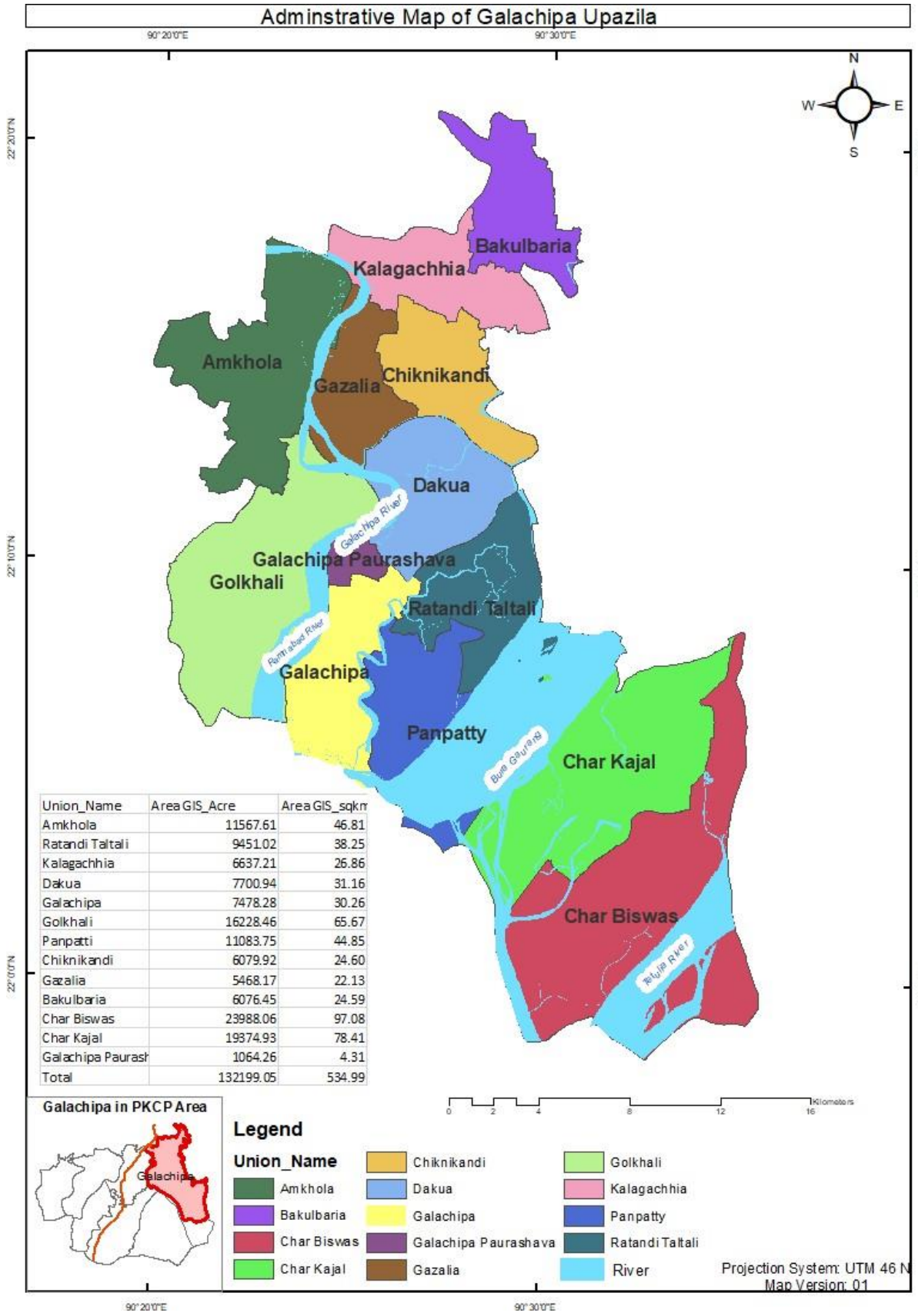


Figure 1 Administrative Map of Galachipa Upazila

Source: PKCP Project, UDD,2018

Galachipa is a famous port for rice andother crops. A large Hat takes place every Saturday base on the river. It is one of the largest Haats of greater Barisal. Another famous river of Galachipa are Agunmukha, Bura Gaurang. There is total 238681 Population; among them male population 119189, female population 119492; Muslim 217588, Hindu 21050, Buddhist 11 and others 32. (Banglapedia)

There are 12 unions in Galachipa Upazila. They are: Amkhola, Gazalia, Galachipa, Golkhali, Dakua, Kalagachia, Char Kajal, Char Biswas, Chiknikandi, Panpatty, Bakulbaria, Ratandi Taltali. Only one paurashava, Galachipa paurashava exists in the study area. Administration Galachipa Thana is formed in 1873 and it is turned into an Upazila in 1983. (Wikipedia, 2018)

Table 1 Study Area Overview

Galachipa Upazila							
Number of Union	Upazila Area(Sq.Km)	Population(BBS, 2011)	Number of Mouza	Number of Village	Total Household	Community Clinic	Education Institution
12	548.90	238681	99	236	53366	13	290

Source: PKCP Project, UDD,2018

1.2 Goal and Objective of the Structure Plan

The overall goal of this structure plan is to lead the development of Galachipa Upazila in order to enhance the residents' socioeconomic 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 plan for regional plan considering functional and land use requirement 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, Char etc.

1.3 Component of the Structure Plan

In order to prepare the structural plan, not only the above-ground scenario but also the below-ground scenario was examined. To inspect the comprehensive circumstances, multiple components have been taken into account. These components are forest, hydro-geology, geology, transportation, disaster, socio-economic and physical feature survey.

1.4 Approaches to Planning

In Bangladesh, approach to planning can be particularly important given the country's rapid population growth, urbanization, and other economic and social challenges. Here are some issues that can be taken to prepare a structure plan for Galachipa upazila of Bangladesh.

- Selection of the project area for sustainable planning and development.
- Collection and Geo-referencing of the entire upazila mouza map and preparation of basemap.
- Available data collection from secondary sources i.e. hydro graphic chart, water level, water flow, meteorological, disaster data and any research conducted on study area.
- Review of available data and reports.
- Field survey for Hydrological, Geology, Transport, Agriculture and Physical feature survey.
- Collection of tentative government project at the project area.
- Identify the source of sweet water for industrial, Agricultural, Residential and other uses;
- Planning of the proposed development work considering the natural beauty of this area for tourism;
- Devise the plan for development work keeping the wetland, khals and other natural resources uninterrupted in order to preserve the environmental balance.
- Reserve the rain water for different uses.
- Fisherman culture conservation and declare as eco-tourism spot.
- Provide service facilities to the char area and include their livelihood opportunities.
- Recommendation for improvement of existing communication facilities in the project area.
- Provision for recreational facilities would be entertained while designing the coastal protection facilities.
- A mega plan to develop villages to have a range of civic amenities and growth centres around the country is on the targeted project under “My village My Town Project”.

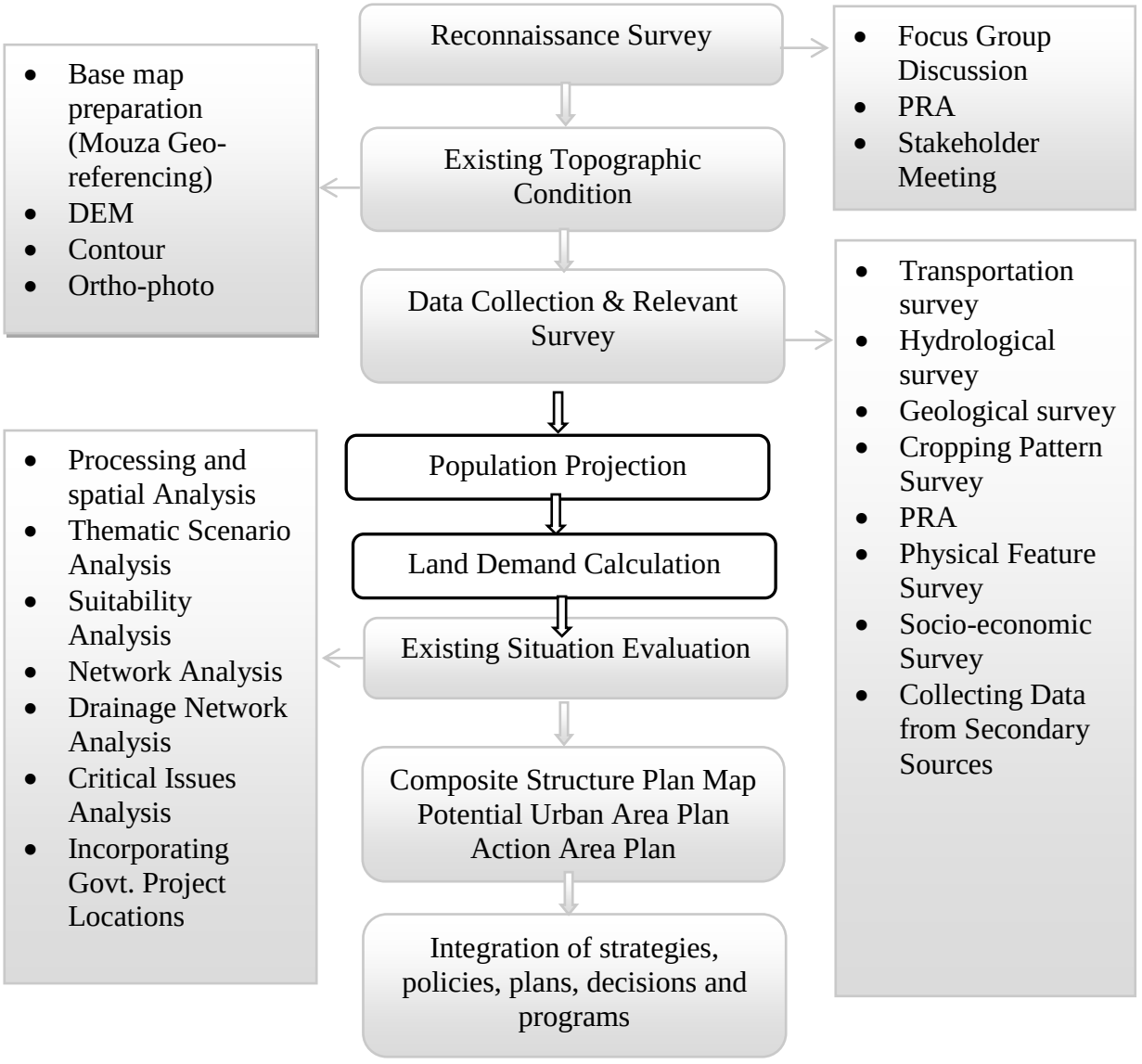


Figure 2 Technical Methodology of Structure Plan Preparation Source: PKCP Project, UDD,2018

Identify the key needs and challenges facing Bangladesh in terms of social, economic, and infrastructure development. This can involve analysing demographic data, assessing infrastructure gaps, and conducting surveys and stakeholder consultations to gather input from communities, businesses, and other stakeholders. Identify and prioritize strategies and policies that will help achieve the goals and objectives of the plan. Engage with stakeholders throughout the planning process to ensure that their needs and concerns are taken into account and to build support for the plan. Overall, the structure plan approach to planning can help Galachipa Upazila problems, address the complex challenges it faces and achieve sustainable, inclusive development that benefits all of its stakeholder.

CHAPTER TWO: CRITICAL PLANNING ISSUES

2.1 Overview of the Planning Issues

It is necessary to investigate the past scenario in order to plan for the future. In this chapter, demographic, topographic and socio-economic aspects have been investigated to learn about natural and anthropogenic expansion. Paying attention to efficient planning and the frameworks that direct the upazila's trendy expansion is a crucial component of the development strategy for the upazila. One of the primary reasons to consider promoting the suitability of cities is the effects of the increased construction to the environment. There necessitates an understanding that upgrading of the facilities promotes a sustainable existence.

2.1.1 Demographic Setting of the Upazila

In 2011, the total population of the Galachipa Upazila was 258515, of which 127249 were males, and 131266 were females (BBS, 2011). The sex ratio of Upazila was 96, which has remarkably decreased in 2011 compared to sex ratio 104 in 2001. The sex ratio has increased from 2011 and onwards. It illustrates detail population growth trend of Galachipa Upazila from 1981 to 2011 which is the last national census of Bangladesh, where percentage of dependent population was high. Therefore, insight could be drawn that in the coming year Galachipa upazila needs more employment opportunity to sustain residence's livelihood and to support elderly dependent population.

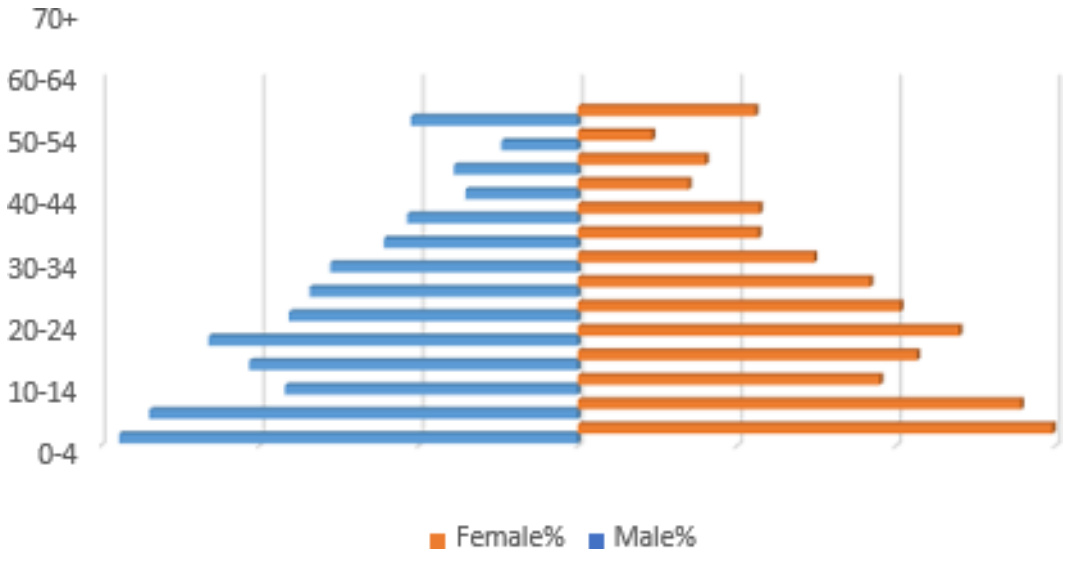


Figure 3 Age-sex pyramid of Galachipa Upazila (BBS, 2011) Source: PKCP project, UDD, 2018

2.1.2 Natural Resources

The study area consists about 19,000 ha of mangrove forest coverage (CEGIS Land Use Analysis, 2022). Most of the forests are lies within the intertidal area and south facing along the coastal part of the forest area of the PKCP. In last 5 years in Patuakhali and Barguna districts under Coastal Forest Division, Patuakhali total 1164.5 seedling kilometre plantation had been raised under social forestry program.

Main rivers Tetulia, Galachipa, Ramnabad Channel is notable. Galachipa Upazila is encircled by wet lands on almost all the sides. It is situated on the bank of Galachipa river, Ramnabad river, Bura Gaurang river and Tetulia river and close proximity to the Bay of Bengal which is in the south of the Upazila. Because of close proximity to the Bay of Bengal and three rivers, there is a huge number of wetlands encompassed the area. A lot of natural khals and canals are connecting the main land to the rivers and sea. Also, there are a great number of ponds and ditches. Apart from that, char lands exist alongside the rivers of Galachipa Upazila.

2.1.3 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 house building 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.

A typical cyclone forms in the deep sea passing over one of the largest continental shelves along the coastal area of Bangladesh. Because of the shallow depth of the continental shelf, the energy of the cyclone is forced to come to the shore with a sea surge and is further constricted because of the funnel-shaped coastline of the northern Bay (Sadeque, 2018).

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.

2.1.4 Disaster and Vulnerability

The PKCP area is typically exposed to cyclone, storm surge, erosion, lightning, drought, etc. According to the INFORM sub-national risk index of 2022 Barguna district is ranked at 4th and Patuakhali is ranked at 11th according to the multi-hazard risk level within the country. For the PKCP area, cyclone, storm surge, are river bank erosion are strategically important natural hazards.

Galachipa Upazila has many rivers and canals. The Bay of Bengal is very close here. However, Galachipa is situated on the bank of the Ramnabad in Patuakhali District. The communities of Galachipa Upazila under Patuakhali coastal districts are vulnerable to different natural disasters because of their proximity to the Bay of Bengal and surrounded several Rivers. The major hazards are flood, storm surge, cyclone, salinity intrusion, sea level rise, tidal floods, bank erosion, and waterlogging. In addition to present vulnerability, the socio-economicperformance, health and way of life of the coastal people would all suffer as a result of climatechange. The coastal areas of Bangladesh are different from rest of the country not only becauseof its unique geo-physical characteristics but also for different socio-political consequences thatoften limits people's access to endowed resources and perpetuate risk and vulnerabilities.

Water Logging

Water logging problems is very prevalent in this upazila. As drainage system is not fully developed and during monsoon season water stagnant problem has seen everywhere.

Climate change

The coastal region of Bangladesh, including Galachipa Upazila, is highly vulnerable to climate change, which is causing sea-level rise, increased temperatures, and more frequent natural disasters such as cyclones, floods, and tidal surges. Another problem is waterlogging because of improper drainage condition. Deforestation, soil degradation, and loss of biodiversity are some of the significant environmental vulnerabilities of Galachipa Upazila. These environmental issues can have adverse effects on the livelihoods of local communities and the sustainability of the area's natural resources.

Salinity

The salinity levels in Galachipa 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.

According to a study conducted by the Bangladesh Water Development Board, the salinity levels in Galachipa 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.

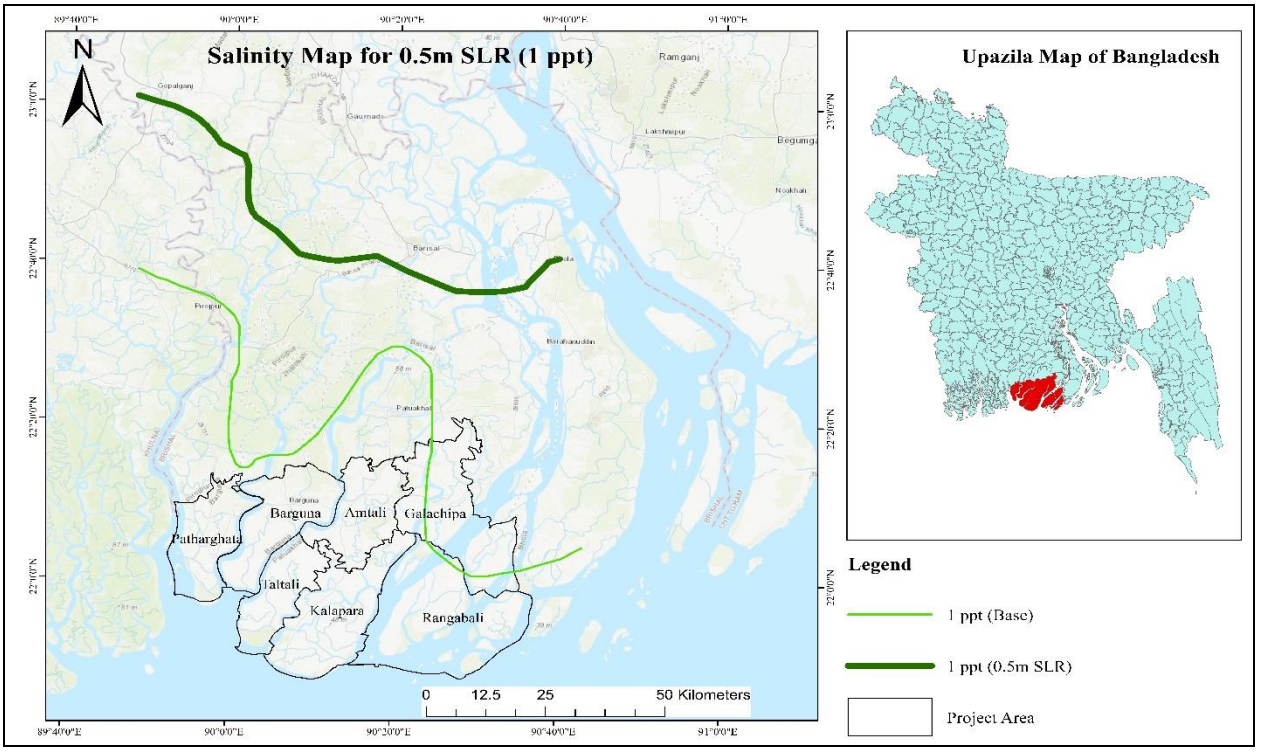


Figure 4 Salinity Map of 1 ppt for 0.50 m SLR Source: PKCP Project, UDD,2018

The Sea Level Rise would increase the salinity ingress. According to CEGIS analysis, the 1 ppt salinity affected areas will be increased by 7.5% in midterm, while the 5 ppt salinity area will increase by 9%. The situation will be worse on the western coast. This scenario of gradual salinity intrusion into the coastal areas of Bangladesh is very threatening to the primary production system (consist 30% of the country's cultivable land), coastal biodiversity and human health.

Salinity intrusion in the southwest region reduces the freshwater supported area, resulting in decreased agricultural production in many parts of the coastal zone, especially the Khulna and Patuakhali region and small areas in the Noakhali and Chattogram.

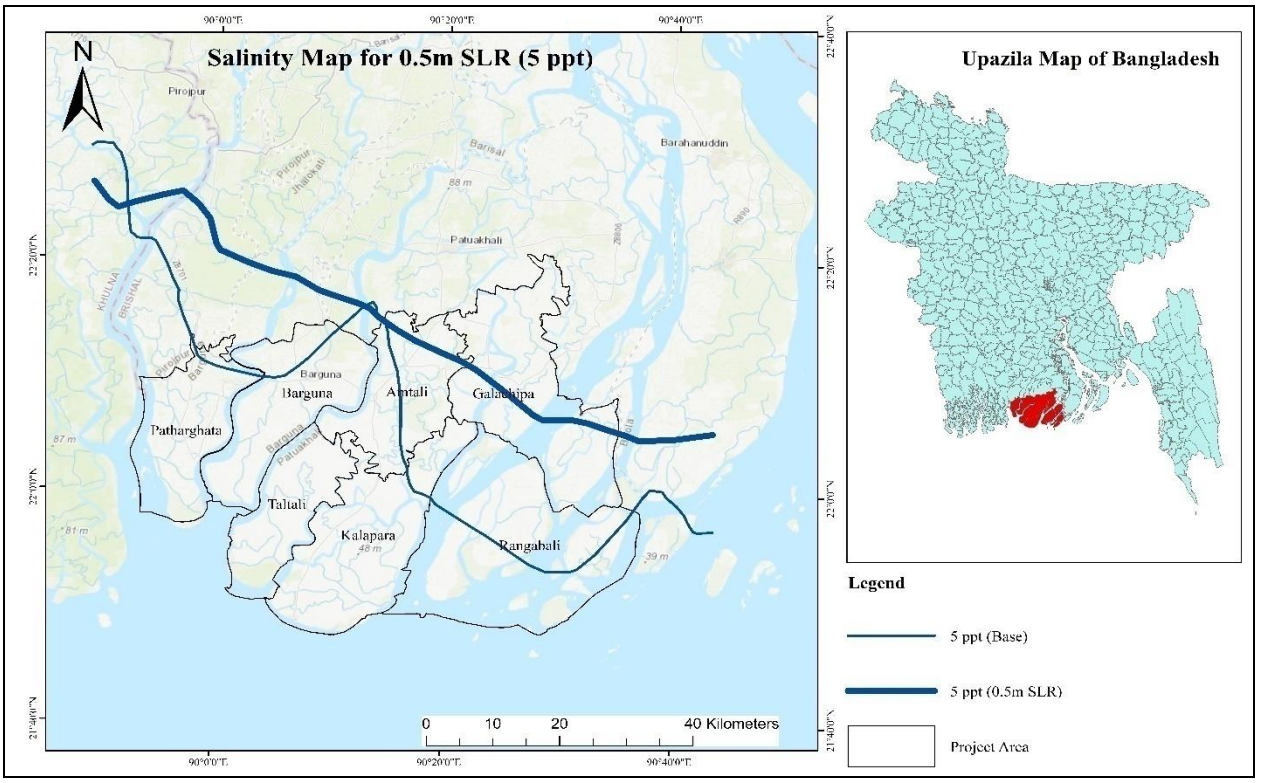


Figure 5 Salinity Map of 5 ppt for 0.50 m SLR

Source: PKCP Project, UDD,2018

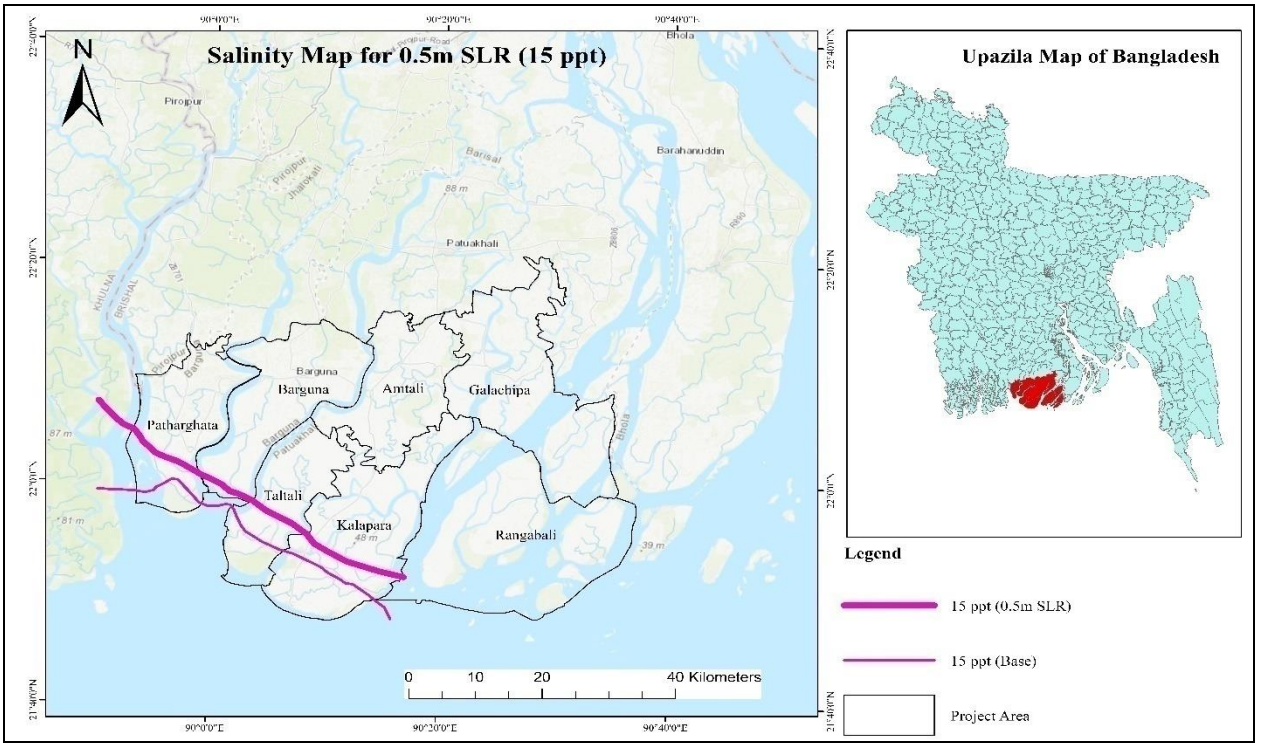


Figure 6 Salinity Map of 15 ppt for 0.50 m SLR.

Source: PKCP Project, UDD,2018

Table 2 Salinity coverage of Galachipa Upazila for different scenario of 0.5m SLR.

Upazila	1 ppt				5 ppt				15 ppt			
	baseline		0.5 SLR		baseline		0.5 SLR		baseline		0.5 SLR	
	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%	Area (km^2)	%
Galachipa	156.64	29.27	534.99	100	0	0	256.22	47.89	0	0	0	0

Source: PKCP, UDD, 2018

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 Galachipa Upazila and the surrounding areas, including increased coastal erosion, inundation of low-lying areas, and saltwater intrusion into freshwater sources.

The impacts of sea level rise are particularly severe during cyclones and storm surges, which are becoming more frequent and intense due to climate change. These events can cause widespread damage to infrastructure, homes, and crops, as well as loss of life.

Changes in Land use and Land cover

The study area has observed rapid changes in land use and land cover in the last 4 decades. Future changes of LULC are predicted for 2041 using the Cellular Automata (CA) with Markov model. The Cellular Automata(CA) model is a discrete model with a spatially extended dynamic system based on a defined transition rule that relates the new state to the previous state of the LULC type (Guan et al., 2011). CA-Markov model develops with a combination of Cellular Automata and the Markov Chain to predict spatiotemporal changes of LULC. Figure 2-9 shows CA-Markov model simulated LULC map of study area for the year of 2010, 2021 and 2041.

A summary of the predicted of LULC changes in the future over the study area is presented in Table 2-4. It has been found that agricultural area wil be reduced in the future while natural forests and Settlement will be increase. On the hand, natural water bodies will be reduced by being filled up or transferred to other land use types.

Table 3 LULC changes in the area from 2010 to 2041 using CA-Markov model.

LULC type	Area (km^2)		
	2010	2021	**2041**
Agriculture Land	1583.53	1420.4	**1263.36**
Settlements	518.814	648.304	**799.848**
Water	118.759	105.617	**94.0923**
Forest	156.789	183.157	**184.211**
Chars/Fallow Land	**16.4016**	**36.8154**	**52.7805**

Source: PKCP Project, UDD,2018

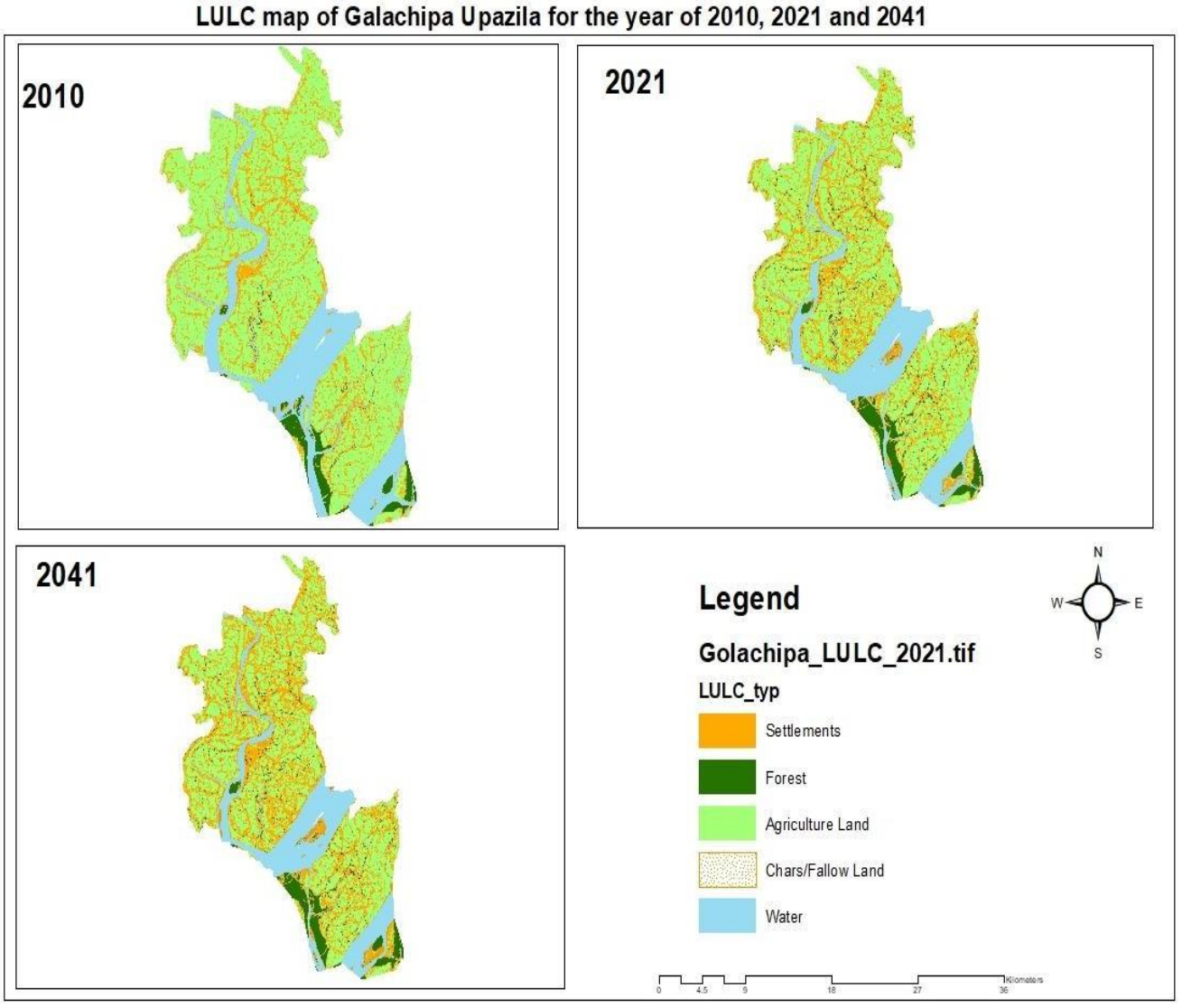


Figure 7 Model simulated LULC map of study area for the year of 2010, 2021 and 2041.

Source: USGS, Landsat 5TM 2010, 2021

Erosion and Deposition

Land pattern change in Galachipa Upazila is a complex process influenced by several factors. Sustainable land management practices, such as afforestation, soil conservation, and integrated land use planning, are essential to ensure the long-term sustainability of the area's land resources. In 1988, 2010 and 2022, satellite image analysis has done to find the land use coverand land use change of this upazila during these years. Mosly, Erosion and deposition occurs in Galachipa Upazila. It has seen that char areas are in deposition and areas alongside the riverfalls in erosion.

Table 4 Upazila-wise accretion and erosion areas between 1989 and 2021

Upazila	1989-1999		1999-2009		2009-2021		1989-2021	
	Accreti On(Sq. Km)	Erosi on(Sq .Km)	Accreti on(Sq. Km)	Erosi o n(Sq. Km)	Accreti o n(Sq.K m)	Erosi o n(Sq. Km)	Accreti o n(Sq.K m)	Erosi o n(Sq. Km)
Galachipa	45.48	15.59	34.29	12.17	11.87	9.60	42.98	16.98

Source: USGS, Landsat 2021

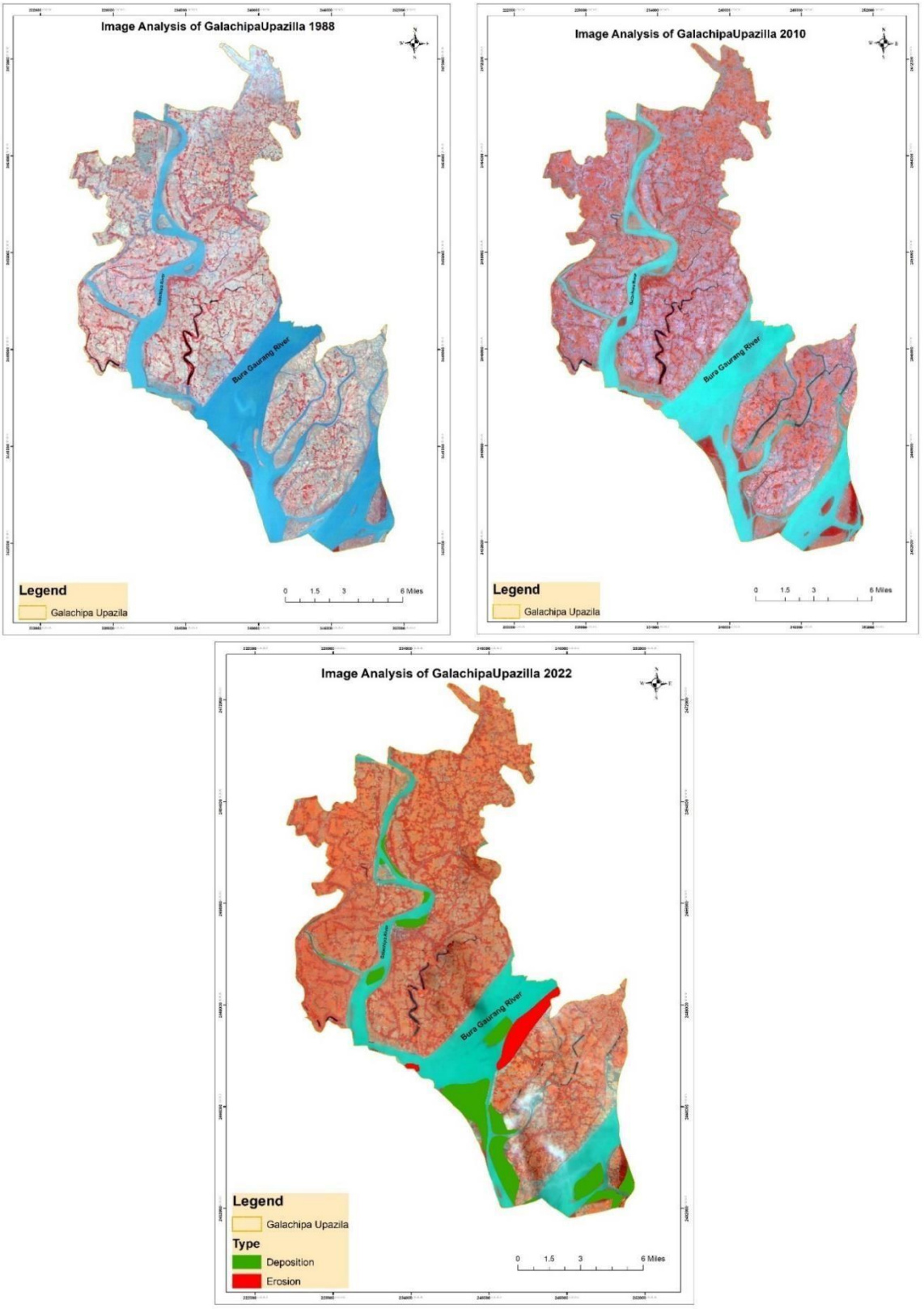


Figure 8 Chronological Changed Satellite Image (Erosion/deposition) of Galachipa Upazila for 1998, 2010 and 2022

Source: PKCP project, UDD, 2018

Cyclone and Storm Surge

Records of the last 200 years show that at least 70 major cyclones have hit the coastal belt of Bangladesh. The Khulna/Sundarbans and Barisal-Noakhali coasts received about 30 percent of the cyclones. Payra-Kuakata region falls in the high-risk area.

Upazila-wise maximum water level (m) was determined for major historical cyclones occurred in the study area as presented in Maximum water level (m) for major histrocial cyclones in the study areas are presented in **below map.**

Table 5 Upazila-wise maximum water level (m) for major historical cyclones considering 0.5m SLR secnarios.

Upazila	Maximum Strom inundationlevel (m)	Maximum Strom inundation level (m)under 0.5m SLR scenarios
Galachipa	1. 87	2. 37

Source: PKCP project, UDD, 2018

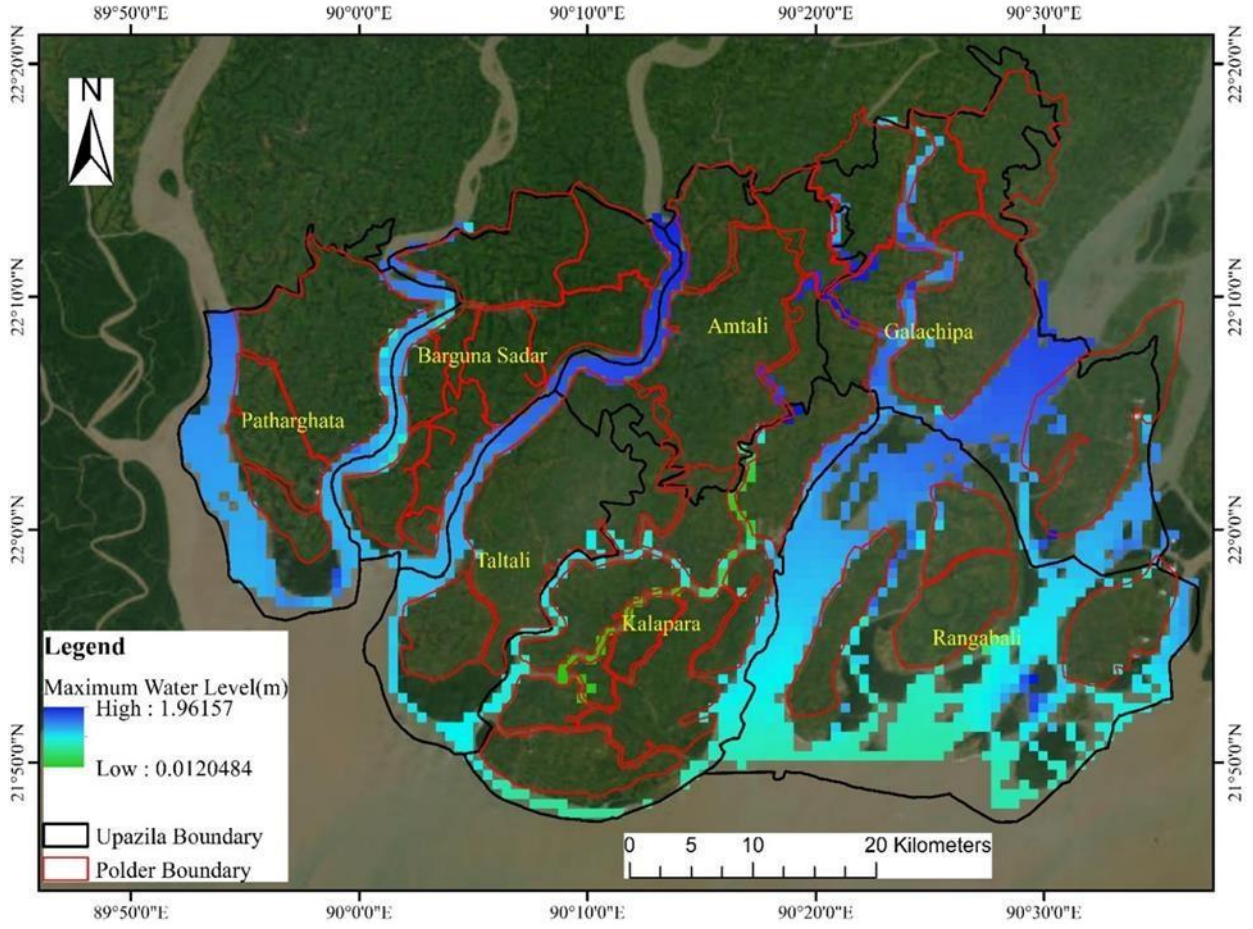


Figure 9 Maximum Water Level (m) for historical major cyclones occurred in the study area.

Source: PKCP project, UDD, 2018

Composite Hazard *Scenario*

As the project area is one of the hazard prone areas of Bangladesh, 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.

Table 6 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, 2018

The weighted overlay technique is used to prepare the final composite hazard map. As Salinity and Erosion- accretion processes are mainly dominated in the projected area, the influence factors i.e., 35% for Salinity, 35% for Erosion-Accretion process, 15% for Strom surge inundation and 15% for Flood Inundation are sequentially assigned.

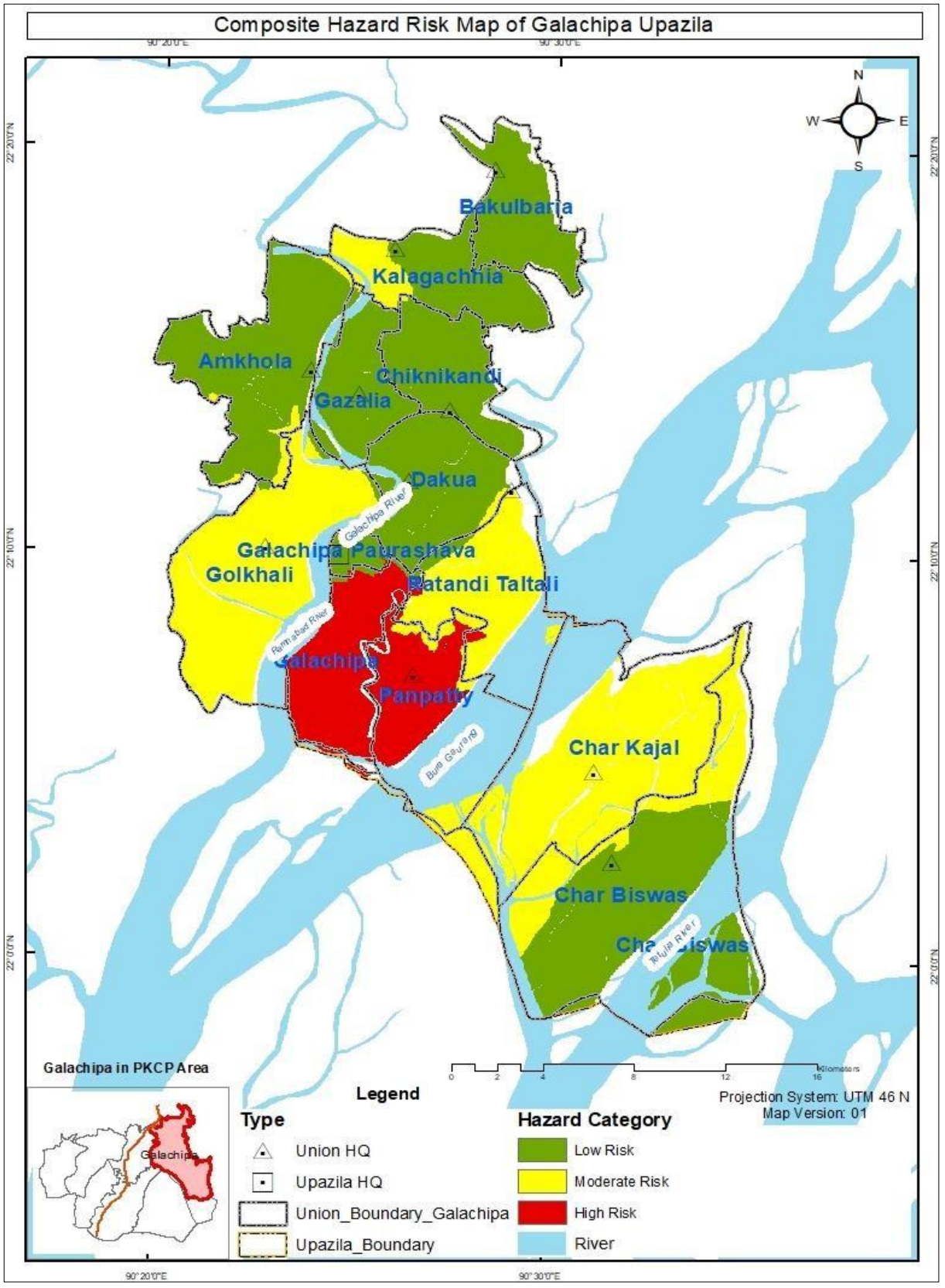


Figure 10 Composite Hazard Map of Galachipa Upazila

Source: PKCP project, UDD, 2018

2.1.5 Bangabondhu Uposhahor

Bangabandhu Uposohor is a proposed residential development area which includes in Govt projects. This project belongs to Ministry of Housing and Public Works and this uposohor cumresidential area will be developed with their own fund.Detail layout plan of Bangabandhu uposohor will develop in urban area plan.Tentative area of this Residential area 210 acres.

2.1.6 Topographic Condition

Topography describes the physical features of an area. These features typically include natural formations such as sea, rivers, lakes etc. Manmade features such as roads, dams, and structures may also be included. Human Settlement, Means of Transport and Communication, Land Use, Relief and Drainage etc. mainly interpreted the topographic map. Galachipa Upazila is situatedin the costal belt of Bangladesh. The Upazila is comparatively in the low land than the other areasof Bangladesh. Coastal regions are very complex environments with various hydrodynamic and bio-geomorphological circumstances and with important socio-economic and ecological difficulties. They are directly affected by the impact of climate change on sea level, storm surges frequency and strength, as well as recurrence of coastal river floods.

2.1.7 Eco-Tourism Potentiality

A timely and tourism industry-friendly tourism master plan is required for the purpose of clarifying and implementing specific development measures in the tourism sector over a certain time period, of course, with government funding for development. The experts' panel emphasized the necessity of a regional tourism policy due to its unique characteristics (e.g., social, cultural, and political) of each region within the country. Additionally, the experts advocate for a bottom-up approach, implying that additional layers can be added at the divisional or local levels to facilitate site-specific administration. As Galachipa is an agro based upazila and an area near Amkhola Bazar is very potential for Eco-Tourism in Galachipa Upazila.

2.1.8 Economic Condition of the Upazila

Agriculture is one of the main economic bases of Galachipa Upazila. The livelihood of most of the local people of this Upazila is dependent on agriculture and fisheries resources. Due to the coastal Upazilas, sea fish are more available here. The trade and commerce of this Upazila are mainly agriculture and fishery based. Thus, alternative livelihoods for the local people are a persuasive demand.

2.1.9 Language and Culture

The geography and geographical location of the Upazila have *played a role in the formation* of the language and culture of the people of this Upazila. Cultural events are spread in Galachipa Upazila on the basis of seasonal events such as Baishakhi Mela, Pausch Sanchini, Maharram Mela etc. They have their own language and Culture.

2.1.10 Water, Sanitation and Hygiene

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.

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.

Easy accessibility to a water source: drinking water from an improved water source that is accessibleon premises, available when needed 3.03%

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 81.45%

Limited accessibility to a water source: drinking water from an improved source for which collection time exceeds 30 minutes for a roundtrip, including queuing 15.52%.

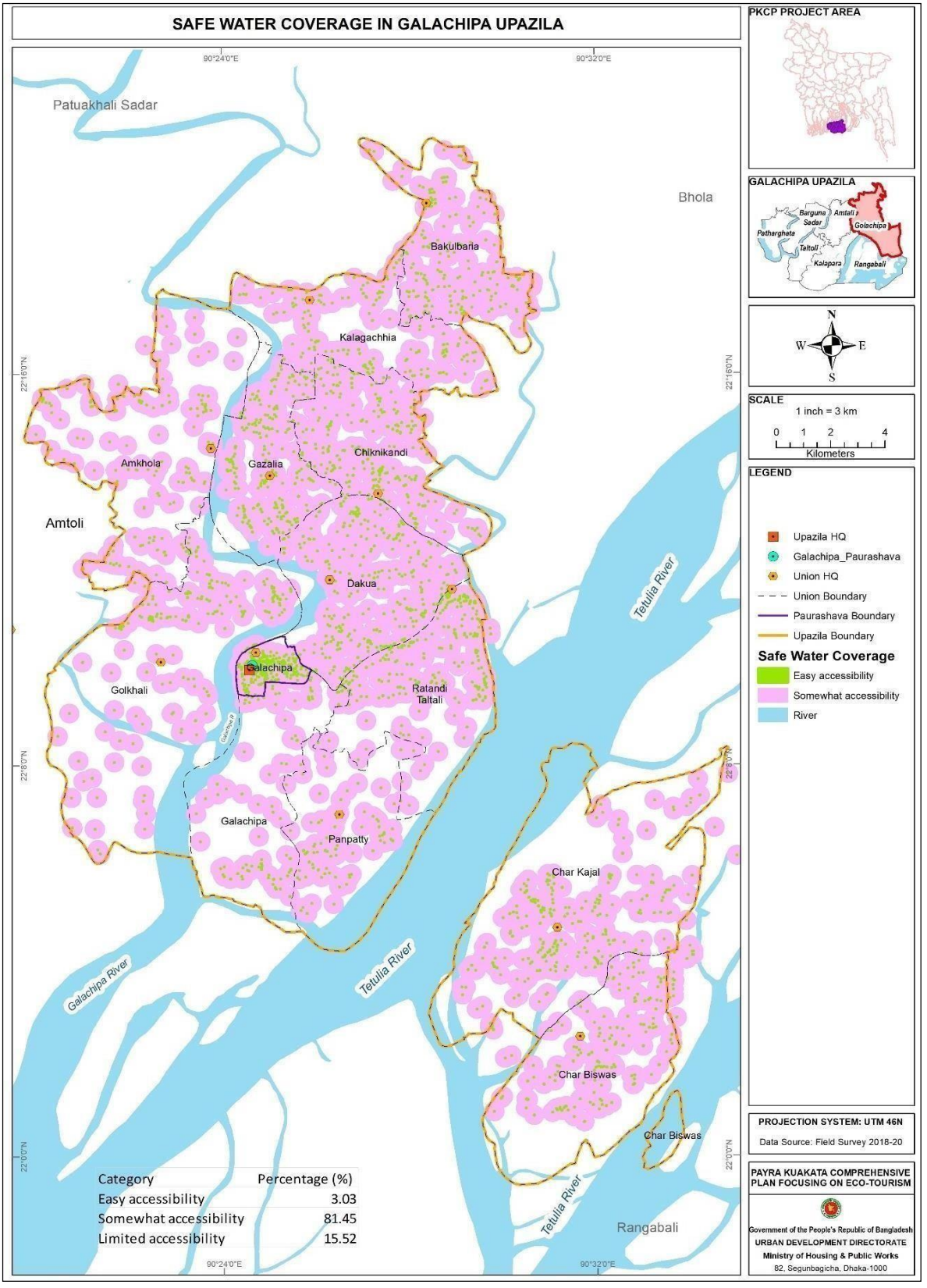


Figure 11 Safe water coverage map

Source: PKCP project, UDD, 2018

2.1.11 Hydro-geological attributes

Galachipa Upazila is located in the coastal area of Bangladesh and is surrounded by the Bay of Bengal on the south and west. The hydrogeology of Galachipa Upazila is complex, with a combination of different aquifer systems; including unconfined, confined, and mixed aquifers. The unconfined aquifer is the most common and is found in the upper layer of the soil. It is mainly composed of sand, silt, and clay, with a thickness varying from a few meters to tens of meters. This aquifer is recharged by rainfall and infiltration from rivers and canals.

The confined aquifer is found at a deeper level, beneath the unconfined aquifer. It is composed of sand, gravel, and clay, and is confined by impermeable layers of rock or clay. This aquifer is generally under high pressure, and the water quality is relatively good.

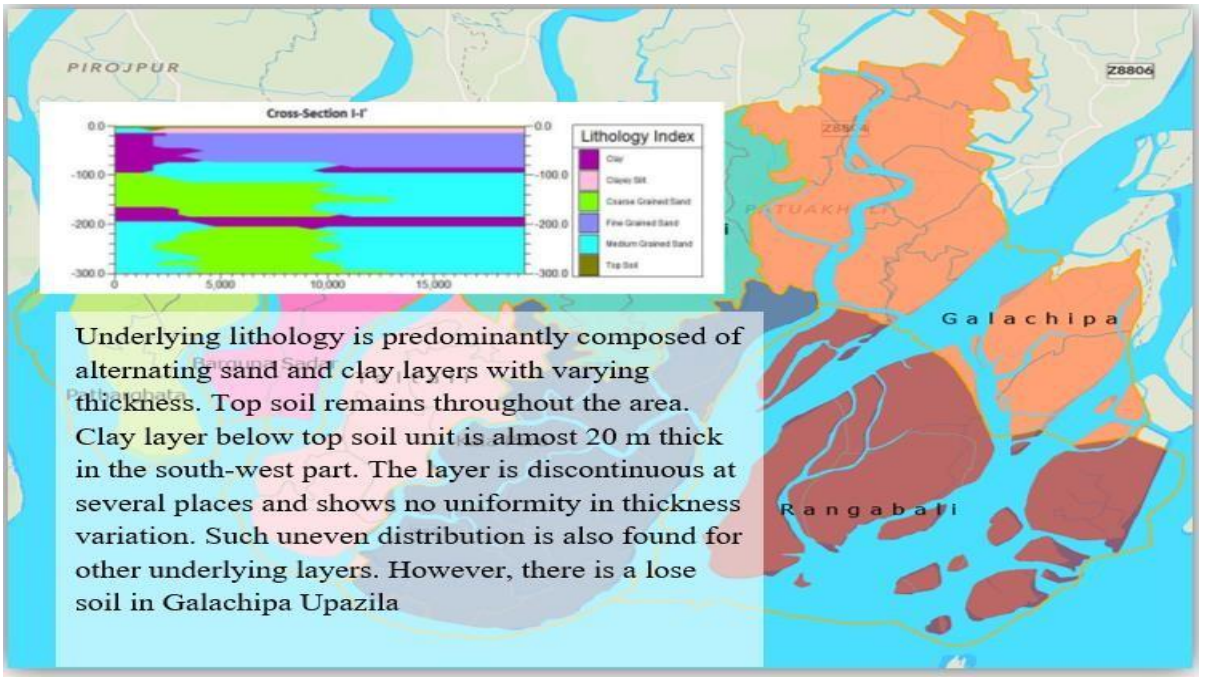


Figure 12 Subsurface lithology of Galachipa Upazila Source: PKCP project, UDD, 2018

The quality of the groundwater in Galachipa Upazila is generally good, but some areas may be affected by salinity intrusion due to the proximity of the Bay of Bengal. The groundwater table is also affected by seasonal variations, with the water table rising during the monsoon season and declining during the dry season.

Top soil is not available throughout the whole area. It is available only in the northern part of the Upazila. Underlying sediments are dominated by fine grained sand layer throughout the Galachipa Upazila. A continuous non-uniform clay layer has been found under 180m depth. Clayey silt layer, Coarse grained sand layer and medium grained sand layer is absent in this area.

2.1.12 Existing Drainage

As the area lies at the southernmost part of Galachipa facing the Bay of Bengal, the area is highly vulnerable due to hydrological hazards, especially monsoon floods and coastal floods. Coastal floods can arise from tidal floods as well as storm surge-induced floods. The area is also vulnerable due to extreme precipitation, especially during cyclones that occur during the pre-monsoon and post-monsoon periods. In the study area, drainage system exists mainly in the Paurashava areas. All small drains are connected to the main drainage network, and the drainage outlets mainly depend on the main river system and adjusted canals near the main drainage site. There are a few storage basins, also notable in the main drainage sites of each upazila. The extreme precipitation and storm surges can cause drainage problems in the area as well. Formal drainage network is only present in Galachipa Paurashava

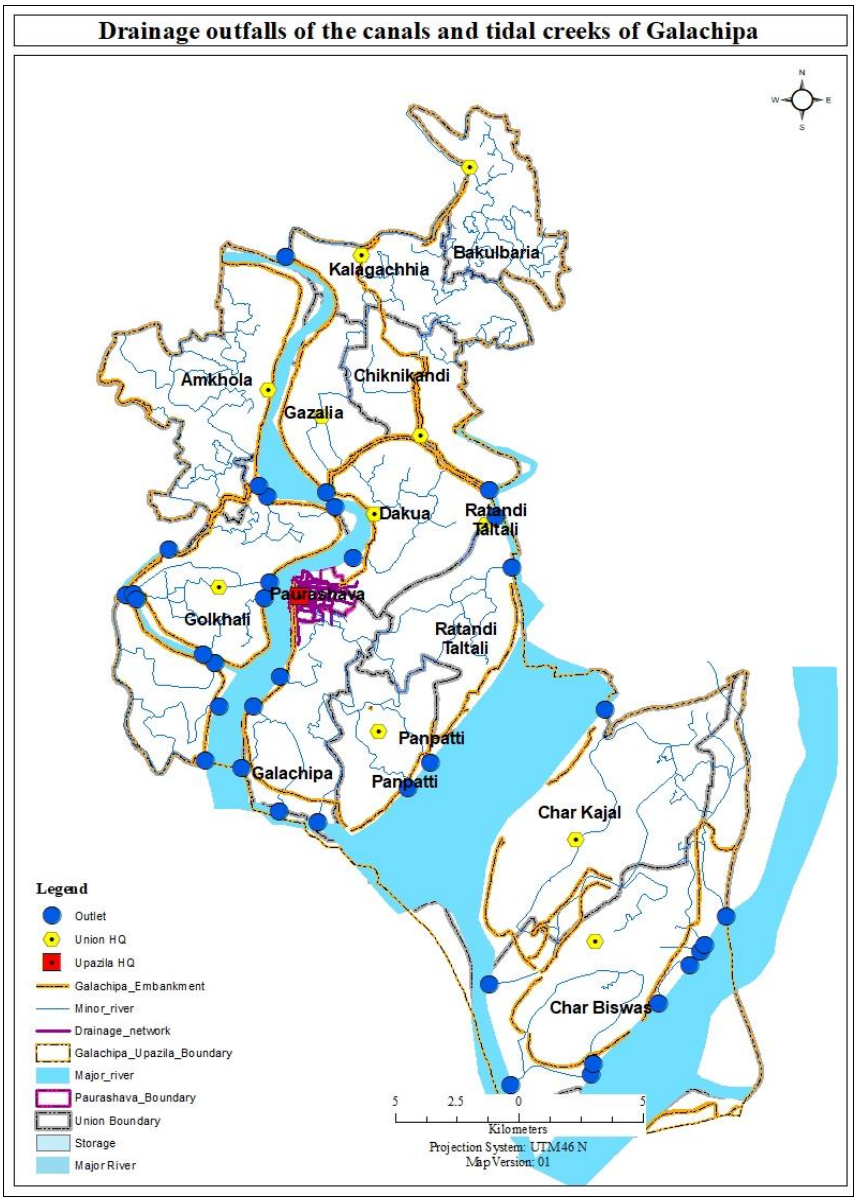


Figure 13 Drainage outfalls of the canals and tidal creeks

2.1.13 Geological Attributes

The study area shows three prominent geomorphological 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.
Geomorphological units of the study area is covered by recent sediments divided into tidal deltaic and mangrove swamp deposits. Layer 4 and Layer 6 are considered the deep foundation layers based on the SPT-N value of boreholes. Seismic hazard maps for the study area are presented showing the spatial distribution of PGA and PSA, with PGA ranging from 0.167g to 0.239g for a 0% probability of exceedance in 50 years and from 0.339g to 0.509g for a 2% probability of exceedance in 50 years. A building height map is produced using PSA, representing low-rise and high-rise buildings.

Foundation Depth of Galachipa Upazila

The structural elements that connect buildings, bridges, and other structures to the ground are called foundations. These elements are very important, because the safety and serviceability ofthe structure depends on the performance of its foundations. Suitable engineering layer identification may reduce the both natural (Earthquake) and anthropogenic (Building Collapse) disaster risk. Geotechnical engineers are routinely involved in both the design and construction of foundations. The study area is not suitable for shallow foundation for heavy infrastructures. From the analysis, it has seen that above 30 m foundation depth is necessary for some portions of Amkhola, Char Biswas and chiknikandi area. Apart from that, only some portions of Dakua and Ratandi Taltali area 7-15 m foundation depth is needed. Moreover, 15-30 m foundation depth is necessary for other parts of the union.
On the other hand, some portions of Golkhali and Galachipa union, 13% shear wave velocityis needed and 20.85% shear wave velocity is necessary for Chiknikandi, Dakua, Ratandi taltali and Char kajal, Char Biswas union.

Table 7 Foundation Depth of Galachipa Upazila

Foundation Depth (m)	Area in Acre	Percentage (%)
7.31 - 15.13	1389.97	1.25
15.14 - 19.29	24231.77	21.83
19.30 - 21.82	29065.77	26.18
21.83 - 25.56	44339.97	39.94
25.57 - 31.36	3320.48	2.99
31.37 - 50.00	8664.13	7.80
Total	111012.09	100.00

Table 8 Shear Wave of Galachipa Upazila

Shear wave	Area in Acre	Percentage (%)
0.442415 - 0.465265	14610.11	13.17
0.465309 - 0.482926	20324.42	18.32
0.482945 - 0.499690	20973.07	18.90
0.499709 - 0.515851	23135.24	20.85
0.515868 - 0.533783	20417.08	18.40
0.533813 - 0.565729	11505.84	10.37
Total	110965.76	100.00

Source: PKCP project, UDD, 2018

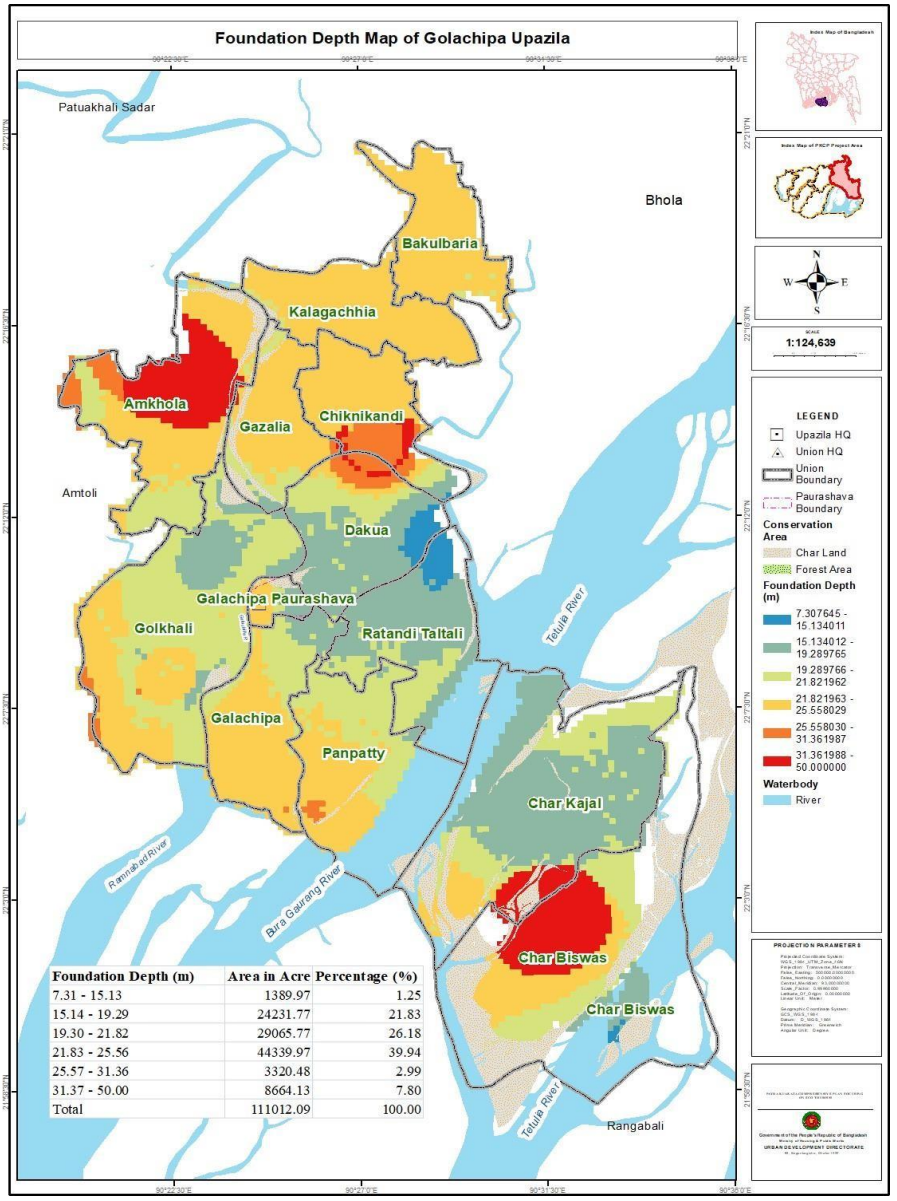
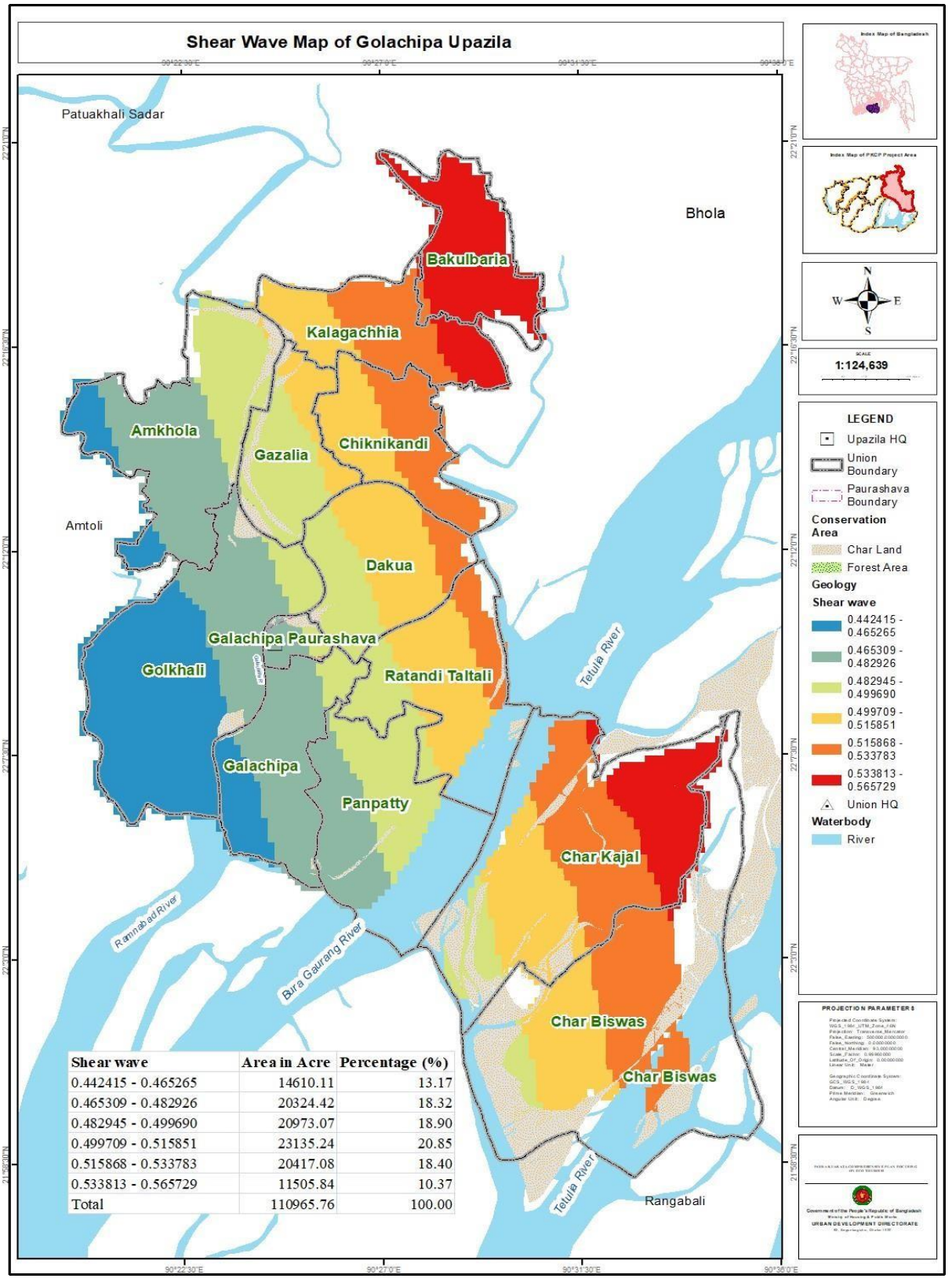


Figure 14 Foundation Depth Map of Galachipa Upazila



Shear wave	Area in Acre	Percentage (%)
0.442415 - 0.465265	14610.11	13.17
0.465309 - 0.482926	20324.42	18.32
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0.499709 - 0.515851	23135.24	20.85
0.515868 - 0.533783	20417.08	18.40
0.533813 - 0.565729	11505.84	10.37
Total	110965.76	100.00

Figure 15 Shear Wave Map of Galachipa Upazila

Source: PKCP project, UDD, 2018

Building Height Recommendation Map

A building height map represent low-rise and high-rise buildings. Low-rise indicates 3 storiesbuilding and high rise represents 10 stories building (Ishiyama, 2011).71% area is not suitable for low rise and high rise buildings and 20% area is comparativelysuitable for low rise and high rise buildings.

Table 9 Sensitivity Type of Galachipa Upazila

SensitivityType	Area In Acre	Percentage(%)
1st Degree Sensative for Lowrise & 1st Degree SensativeforHighrise Building	79583.38	71.69
2nd Degree Sensative for Lowrise & 1st Degree SensativeforHighrise Building	8525.14	7.68
2nd Degree Sensative for Lowrise & 2nd Degree SensativeforHighrise Building	22903.58	20.63
Total	111012.09	100.00

Source: PKCP project, UDD, 2018

Soil Type Map

Soils within the area are soft/loose. From, soil type map. Figure shows that the soil class of theproject area based average shear wave velocity in the top 30 m depth

Ground Water Recharge

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

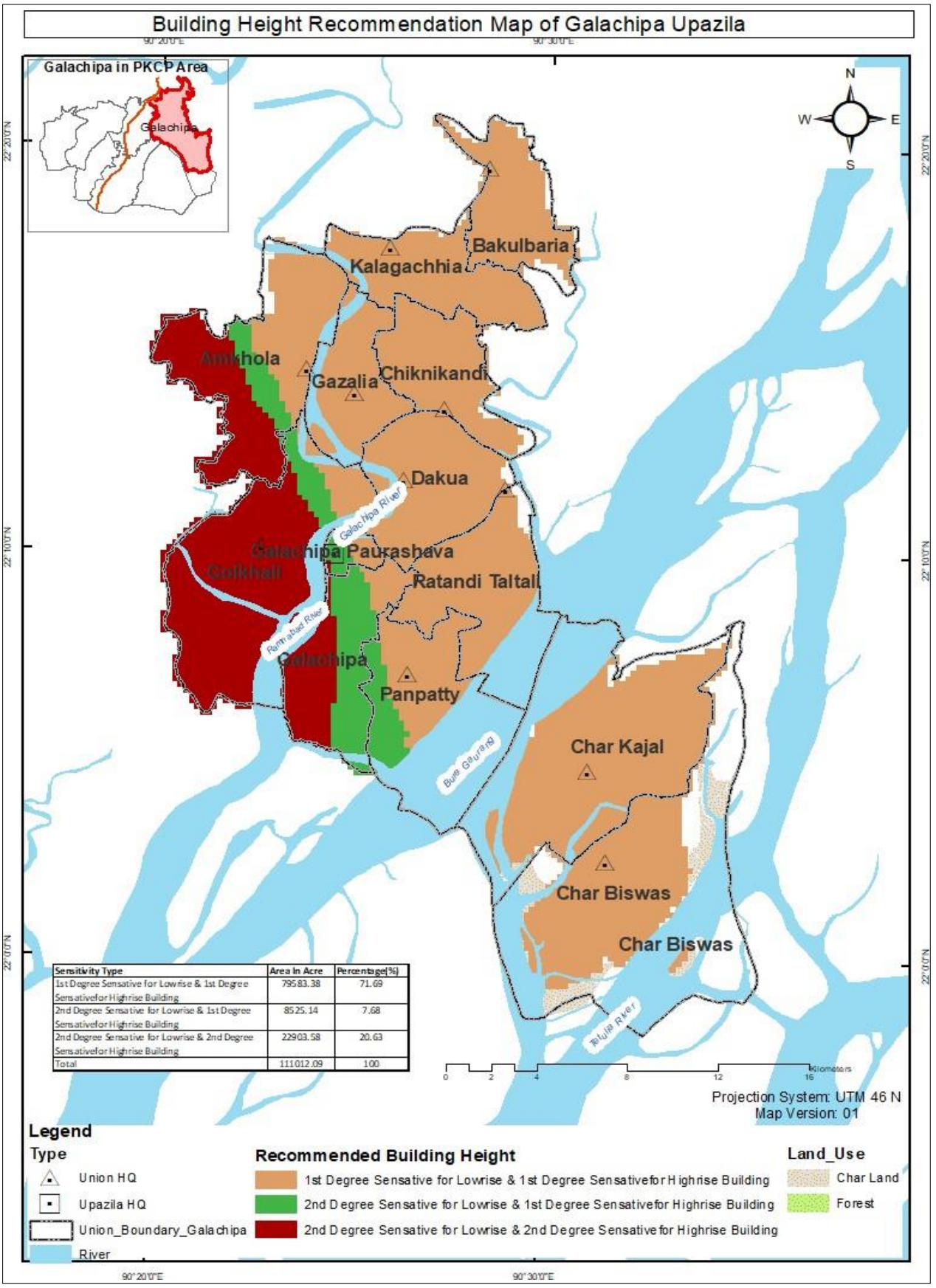


Figure 16 Building Height Recommendation Map
Source: PKCP project, UDD, 2018

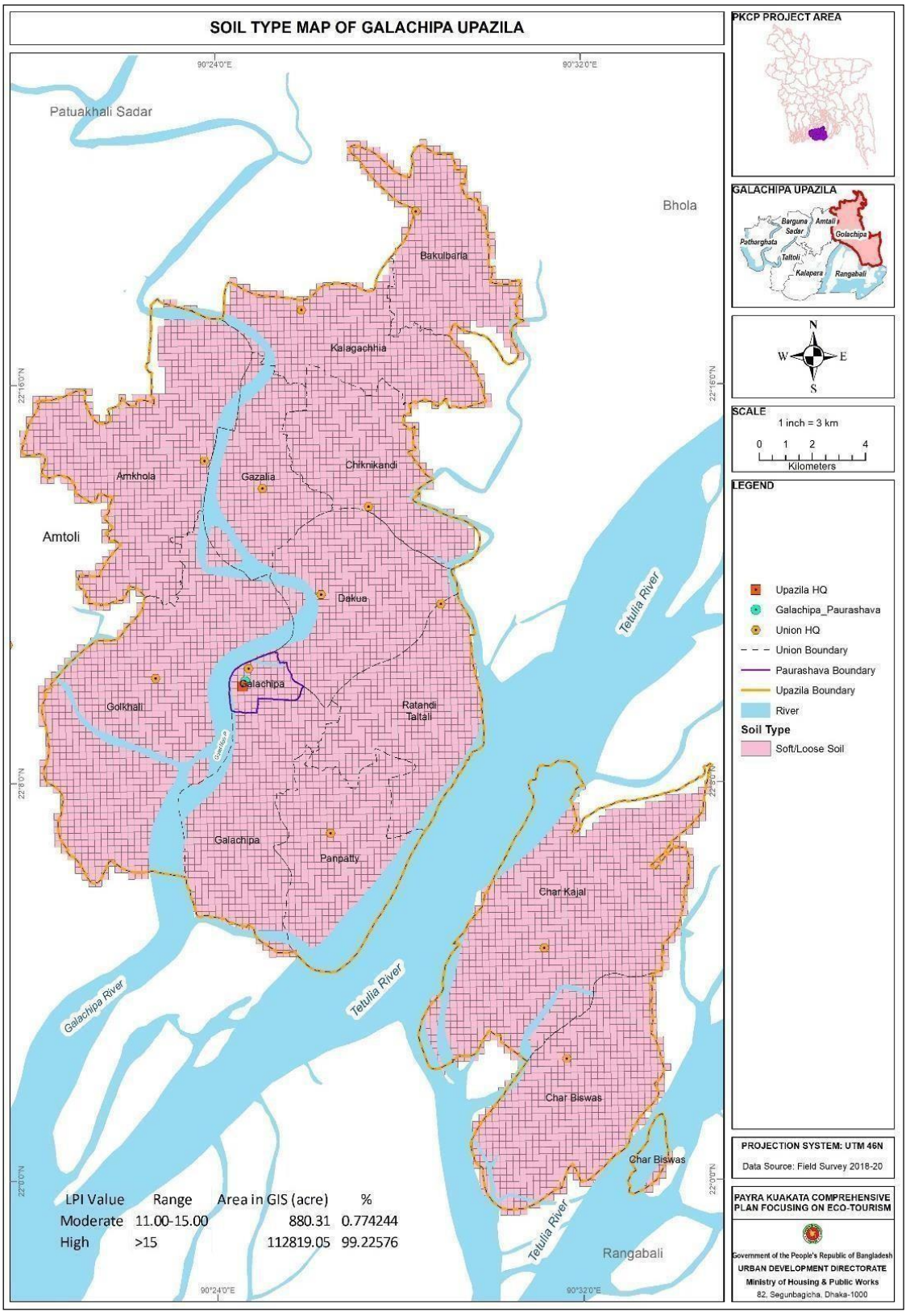


Figure 17 Soil Type Map of Galachipa Upazila
Source: PKCP project, UDD, 2018

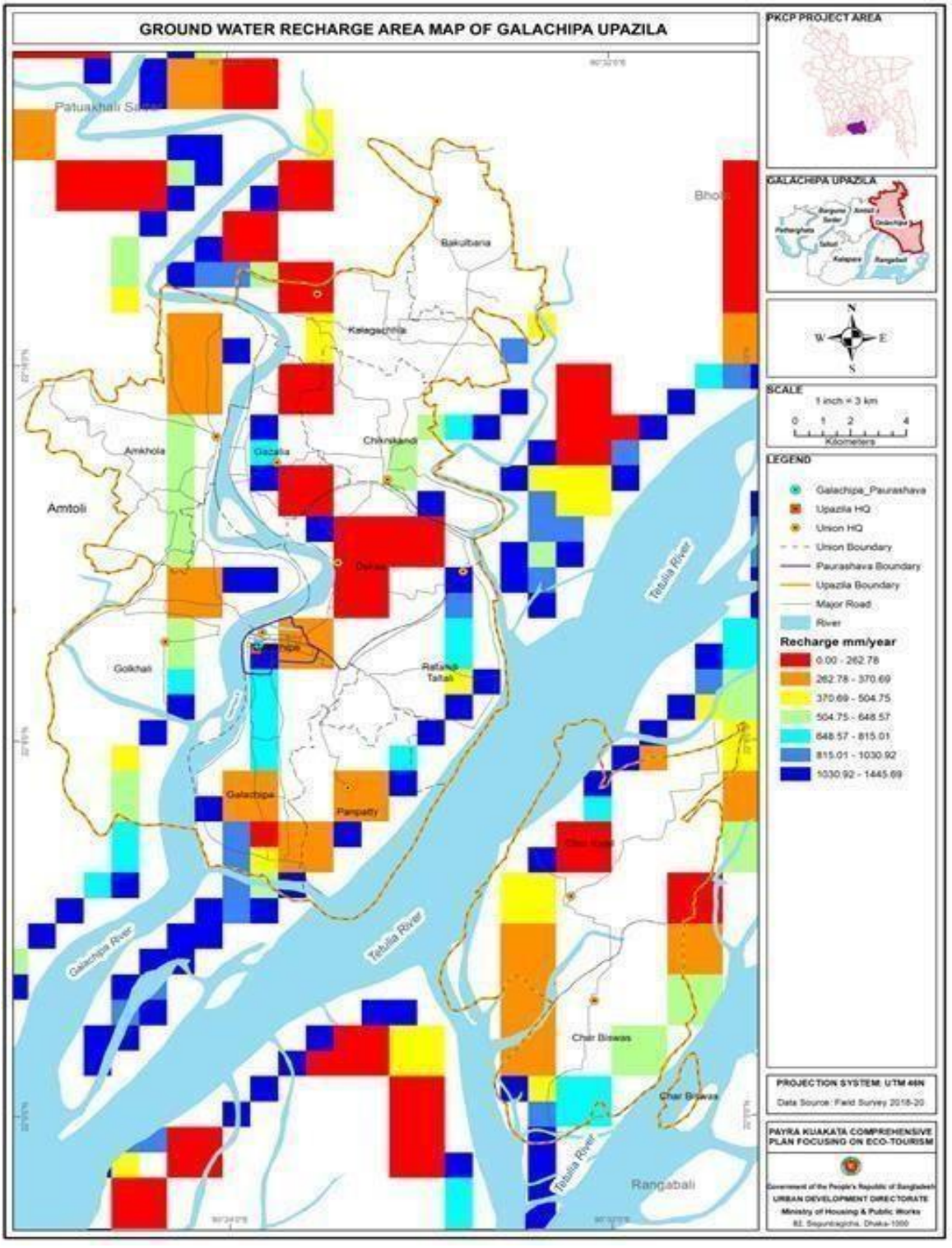


Figure 18 Ground Water Recharge Map

Source: PKCP project, UDD, 2018

2.1.14 Physical feature

Structure use

Total number of structures **72178**. Almost 74% of the structure are being used for Residential purpose where 8.49 % for Commercial purpose and only 0.01% for administrative purpose.

Table 10 Existing Structure Use

Structure Use	Count	%
Abandoned	390	0.54
Administrative	156	0.22
Agriculture	1449	2.01
Commercial	6224	8.62
Community Service	43	0.06
Education & Research	661	0.92
Healthcare	51	0.07
Industrial	160	0.22
Kitchen	5655	7.83
Mixed Use	321	0.44
Religious	991	1.37
Residential	53366	73.94
Service Activity	65	0.09
Toilet	2381	3.30
Transport & Communication	24	0.03
Under Construction	220	0.30
Utility	5	0.01
Vacant	16	0.02
	72178	100.00

Source: PKCP project, UDD, 2018

Structure Type

Almost 85% of the structure are Tin shed. 9.06% are Semi Pucca Structure.Only 4.10% are pucca structure.

Table 11 Structure Type of Galachipa Upazila

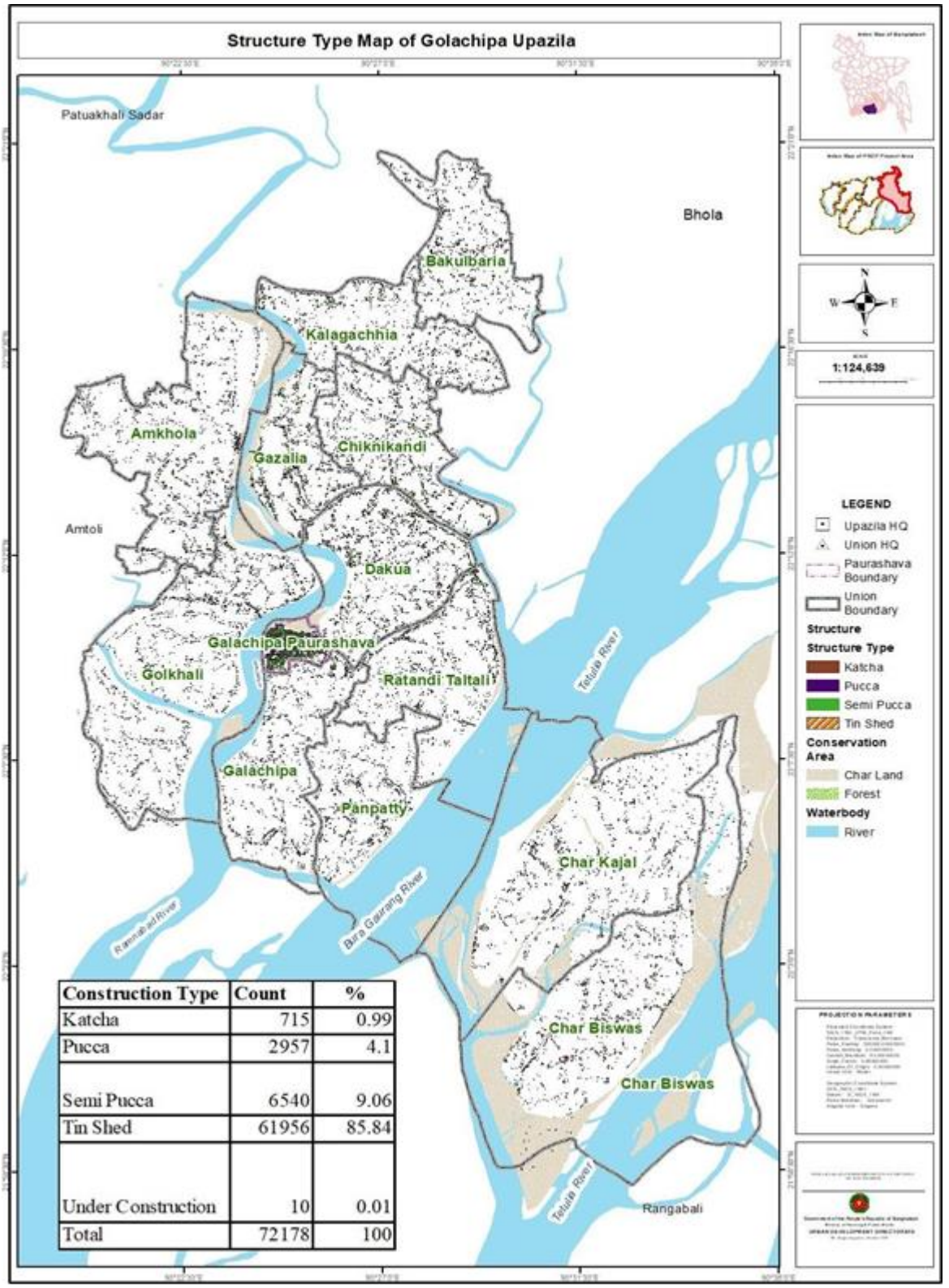
Construction Type	Count	%
Katcha	715	0.99
Pucca	2957	4.10
Semi Pucca	6540	9.06
Tin Shed	61956	85.84
Under Construction	10	0.01
Total	72178	100.00

Source: PKCP project, UDD, 2018

Structure Use	Count	%
Abandoned	390	0.54
Administrative	156	0.22
Agriculture	1449	2.01
Commercial	6224	8.62
Community Service	43	0.06
Education & Research	661	0.92
Healthcare	51	0.07
Industrial	160	0.22
Kitchen, Toilet	5655	7.83
Mixed Use	321	0.44
Religious	991	1.37
Residential	53366	73.94
Service Activity	65	0.09
Toilet	2381	3.30
Transport & Communication	24	0.03
Under Construction	220	0.30
Utility	5	0.01
Vacant	16	0.02
Total	72178	100.00

Figure 19 Structure Use Map of Galachipa Upazila

Source: PKCP project, UDD, 2018



Construction Type	Count	%
Katcha	715	0.99
Pucca	2957	4.1
Semi Pucca	6540	9.06
Tin Shed	61956	85.84
Under Construction	10	0.01
Total	72178	100

Figure 20 Structure Type Map of Galachipa Upazila Source: PKCP project, UDD, 2018

Road

From Physical feature survey, it is found that according to road type around 83.65% Roadsare katcha, 12.49 % roads are Pucca Road. So it has seen that the total length of katcha roadsare longer than others. (Table 2-9).

Table 12 Total Road Network according to Road Type

Road_Type	%
Katcha Road	83.65
Pucca Road	12.49
Semi PuccaRoad	9.64
Grand Total	100

Source: PKCP project, UDD, 2018

In Galachipa Upazila, considering road length, it is found that the majority percent of the roads are tertiary category which area mainly Katcha road. On the other hand, Primary roads directly connect this Upazila with north to south direction and east to west direction (Table 5). About 80.52 % Roads are tertiary roads where only 7.50% roads are primary roads

Table 13 Total Road Network according to Road Class

Road_Classification	Length in KM	%
Primary Road	125.69	7.50
Secondary Road	200.89	11.98
Tertiary Road	1350.14	80.52
Total	1676.72	100.00

Source: PKCP project, UDD, 2018

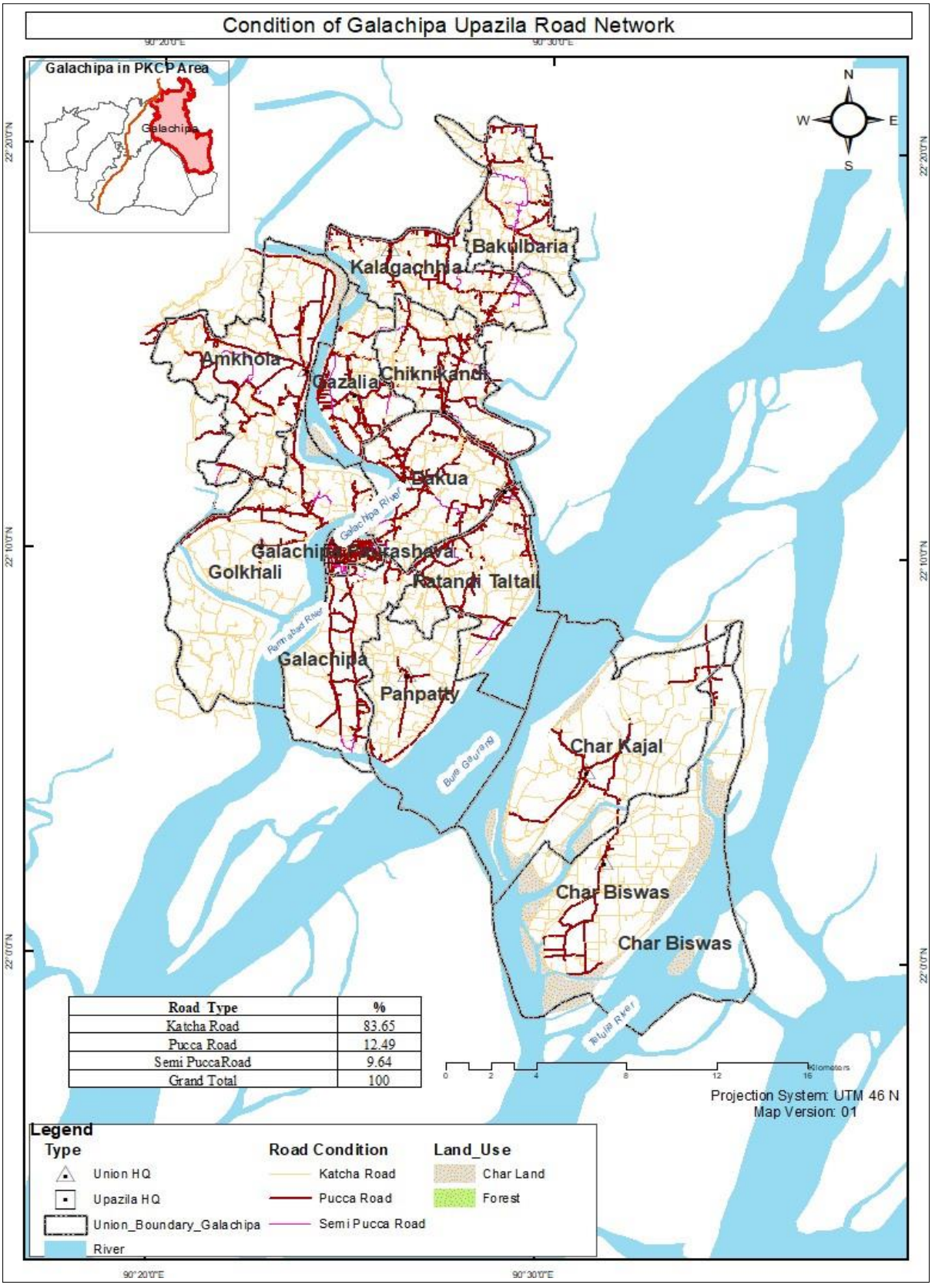


Figure 21 Road Network according to Road Type of Galachipa Upazila

Source: PKCP project, UDD, 2018

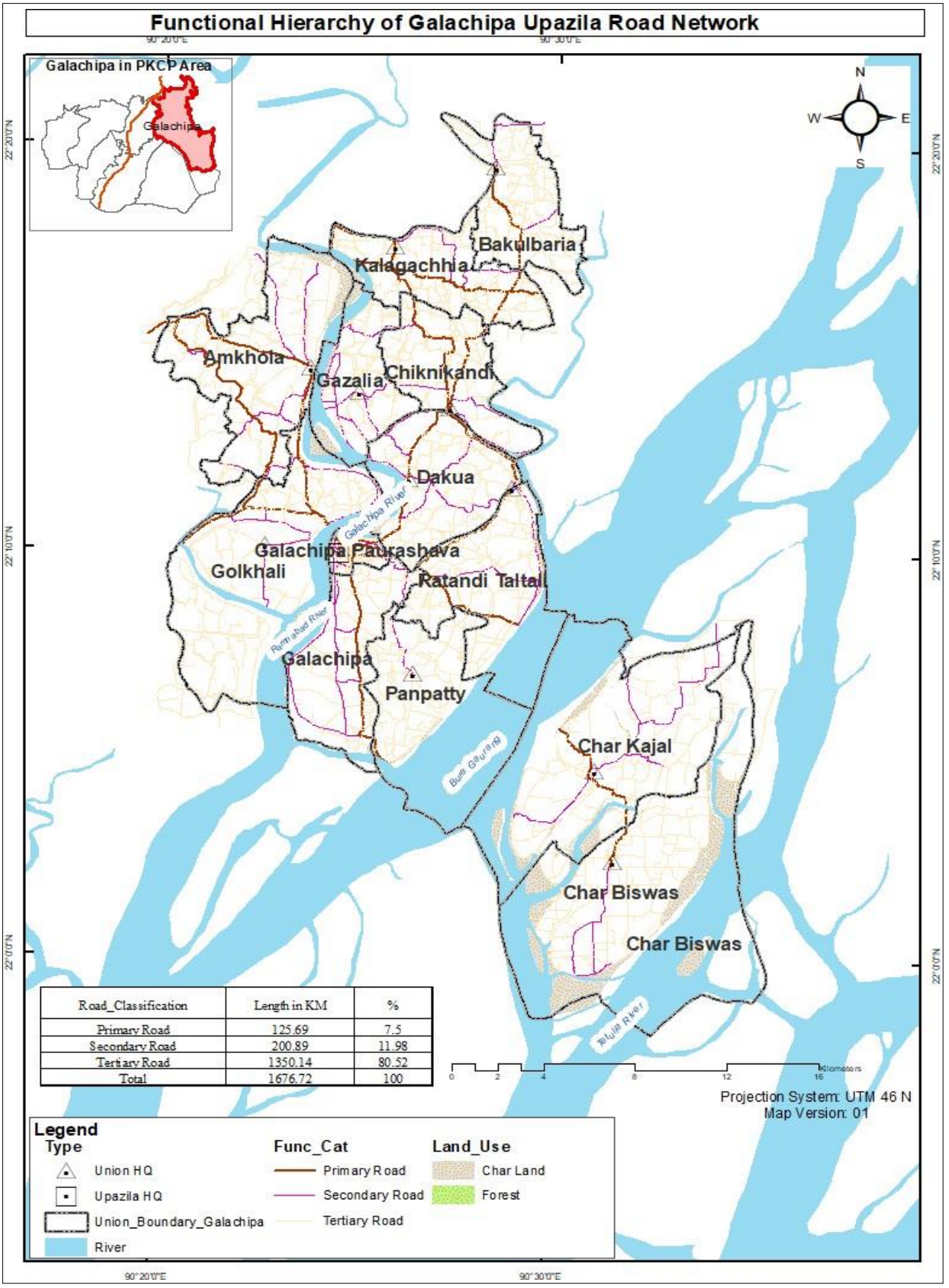


Figure 22 Road Network according to Road Class of Galachipa Upazila

Source: PKCP project, UDD, 2018

2.1.15 Socio-economic Status

A sample socio economic survey was carried out in 818 households (1.4%of total households) during 2018 within the area.

Income Range Distribution

Majority of the higher income group lives in Galachipa Paurashava. Majority of the financial activities are centered within or in proximity to Galachipa Paurashava& Growth centers. About 52% of people monthly income range in between 10000-20000

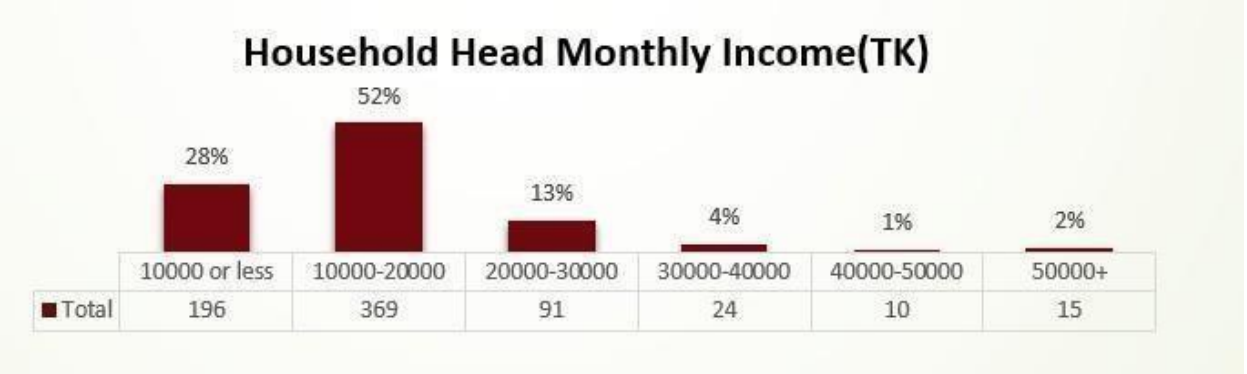


Figure 23 Household Monthly Income Source: PKCP project, UDD, 2018

Expenditure Range Distribution

In galachipa paurashava the expenditure pattern indicates higher in comparison to other rural areas. 54% of People spend money in between 10000- 20000

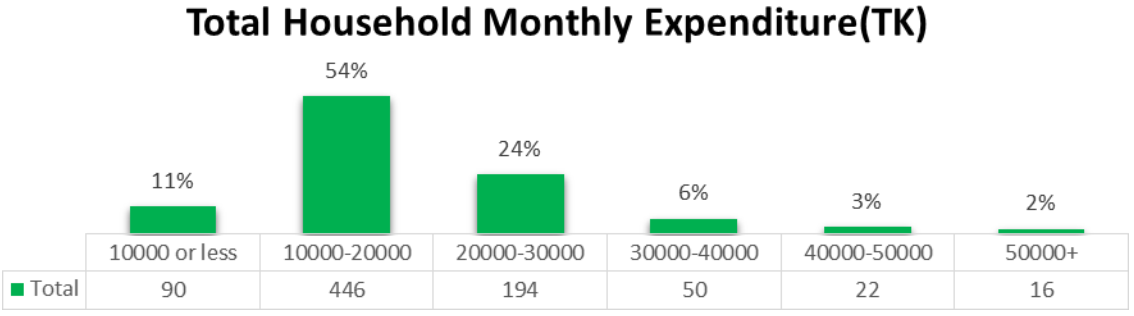


Figure 24 Expenditure Range Distribution Source: PKCP project, UDD, 2018

Family member Distribution

About 49% of family member number is 4-5. Apart from that, 12% of family member ranges from 7 above.

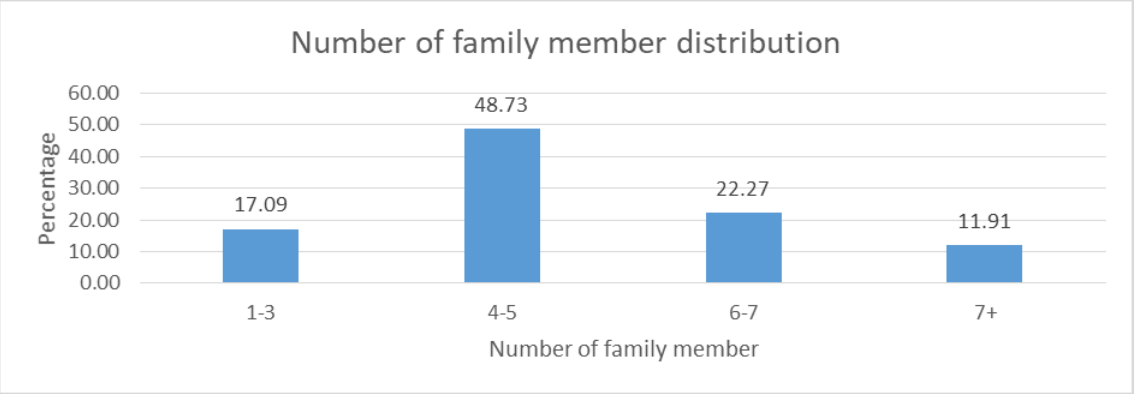


Figure 25 Family member Distribution

Source: PKCP project, UDD, 2018

Migration

Almost 76% of the migrants came from Patuakhali. Maximum migration (47%) occurred in the Galachipa upazila within 1990 to 2010, 5% migrants coming in thelast decade, only 4%migration occurred between 1950 to 1970.

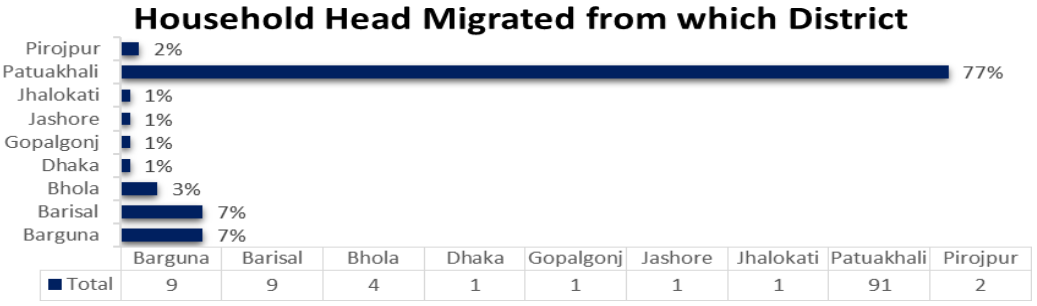


Figure 26 Household Head Migrated from which District

Source: PKCP project, UDD, 2018.

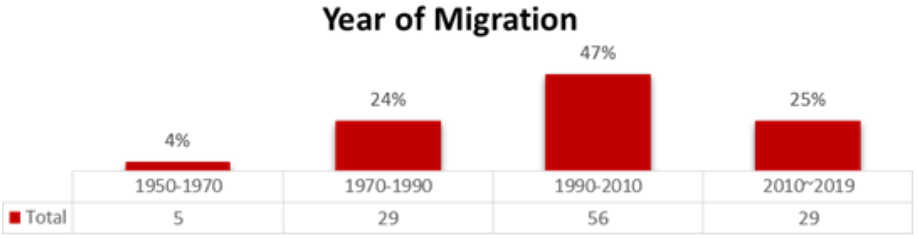


Figure 27 Year of migration

Source: PKCP project, UDD, 2018

Economic Base

In Galachipa, 83% people are engaged in agri product and marketing. It is denoted that thisupazila is agro based.

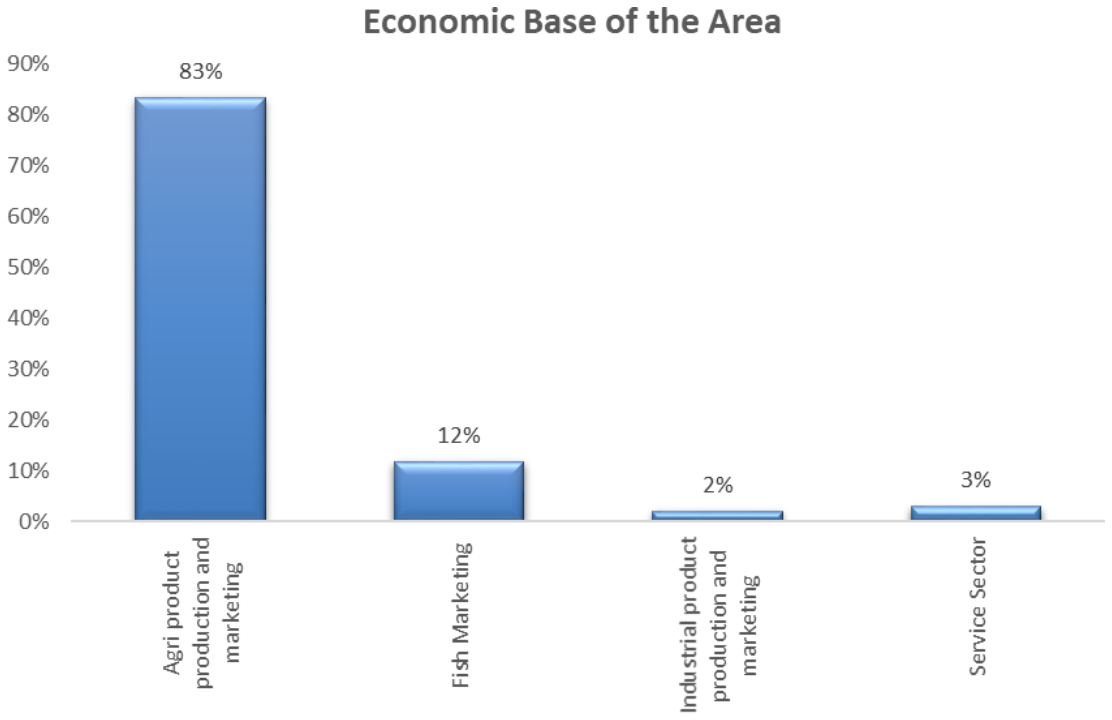


Figure 28 Economic Base of the area

Source: PKCP project, UDD, 2018

Disaster Damage

In galachipa, 70% of houses are damaged in disaster and about 56% agriculatural aredamaged during disaster.

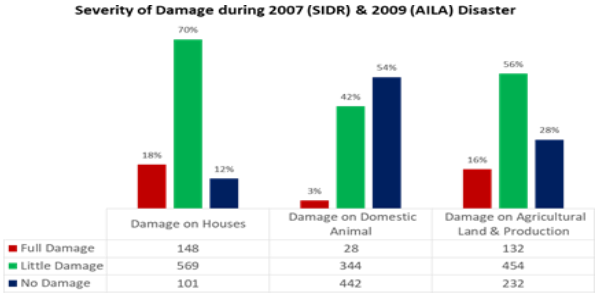


Figure 29 Severity of Damage during SIDR and AILA

Source of Drinking Water

About 93% of water is collected from Tubewell. Only 1% water collected fromtubewell/river/canal

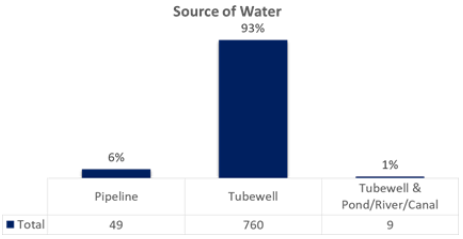


Figure 30 Source of water

2.1.16 Embankment

Total length of existing Embankment in Galachipa Upazila is 193.23 km. As Galachipa Upazila is circled around rivers so embankment is a major element of this upazila to protect inhabitants from storm surge, cyclone.

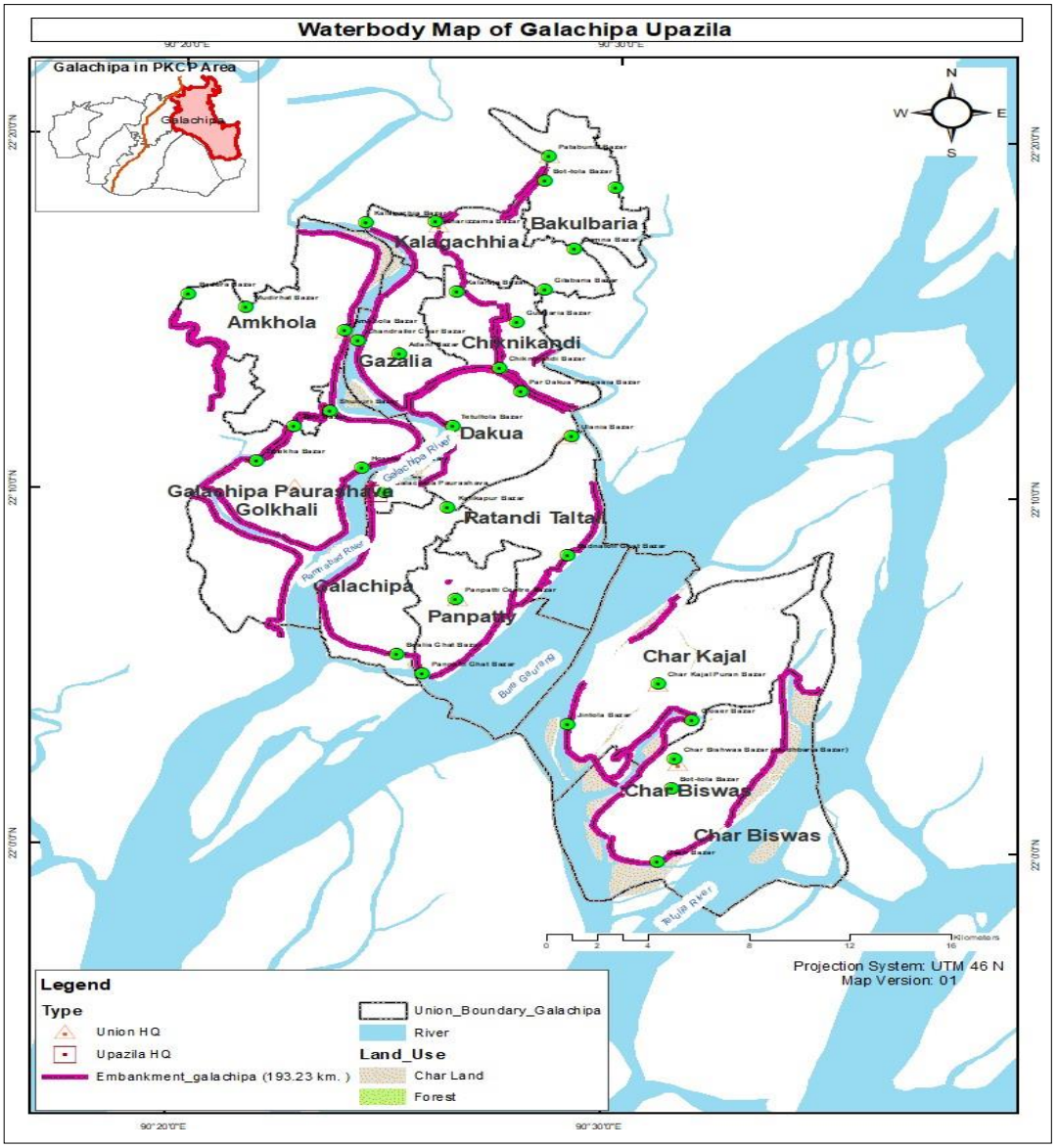


Figure 31 Existing Embankment of Galachipa Upazila

2.1.17 Water bodies

Table 2-11 represents the present scenario of existing waterbody of Galachipa Upazila. There is existence of canal, ditch, gher, pond, low land and river. Majority of water body of this upazila covered with river and canal which is 84.15% and 10.42%. Galachipa and Ramnabad is the major river flowing through this Upazila (Figure 2-28).

Table 14 Existing Waterbodies of Galachipa Upazila

Type	Sq.km	Area_GIS(acre)	%
Canal	20.79	5136.73	10.42
Ditch	0.75	184.55	0.37
Gher	0.21	52.71	0.11
Low Land	0.01	1.66	0.00
Pond	9.87	2438.77	4.95
River	167.86	41479.05	84.15
Grand Total	199.48	49293.47	100.00

Source: PKCP project, UDD, 2018

2.1.18 Critical Habitat

List of Critical habitat in Galachipa Upazila

- Fox
- Wader Birds
- Wild Buffallow

Wader Birds Find in Char area near Golkhali Union and Char kajal union, Near Gazir Bazar hat inChar Biswas fox are found

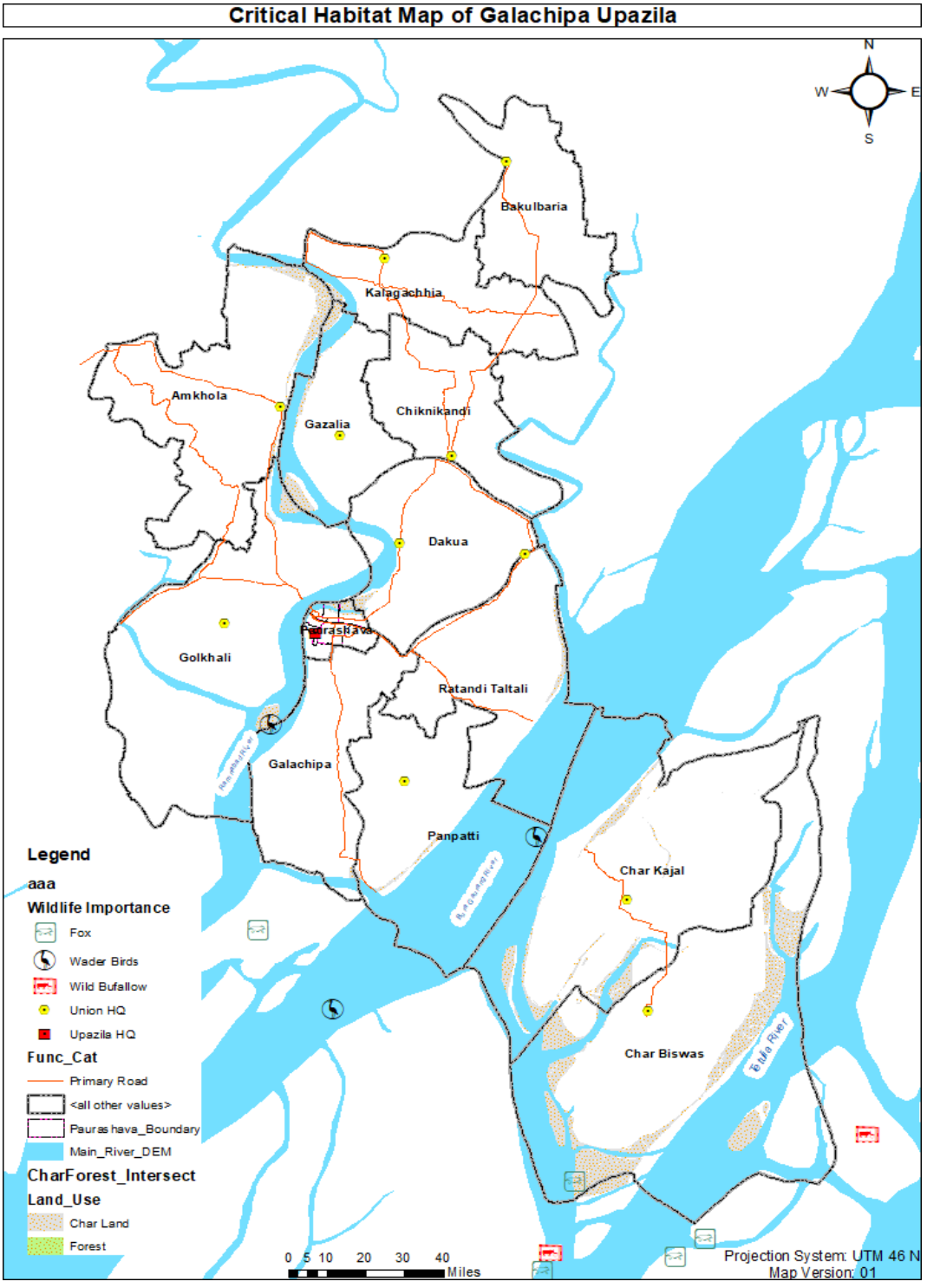


Figure 32 Critical Habitat Map of Galachipa Upazila

Source: PKCP project, UDD,2018

2.1.19 WQI Index

According to the WQI, shallow aquifer water level is not suitable for drinking purpose. Intermediate aquifer contains no excellent or good quality water. And very small portion of Gazalia union containing good quality water. Rest of the union containing poor quality water.

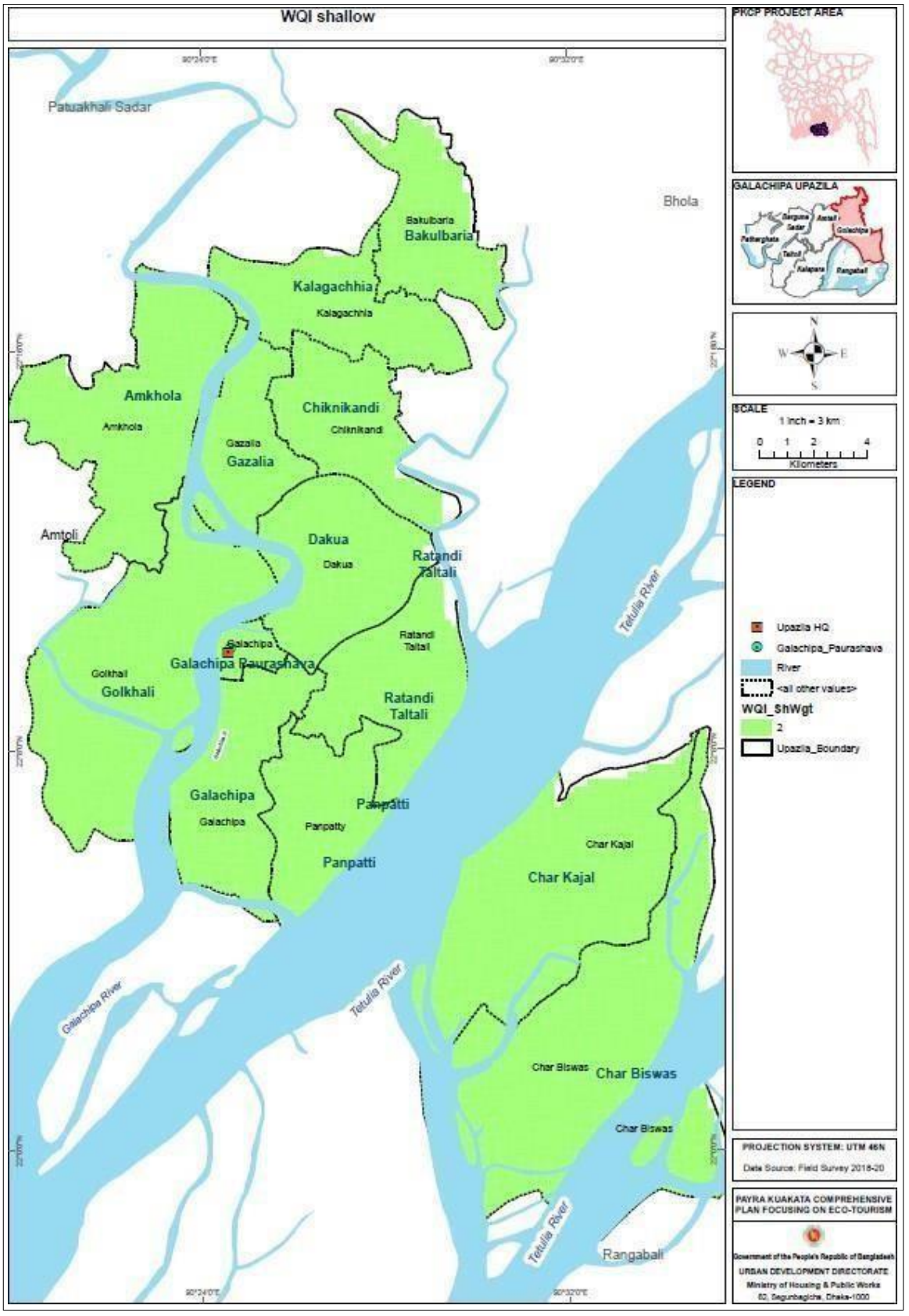


Figure 33 WQI Index Shallow Aquifer Source: PKCP project, UDD,2018

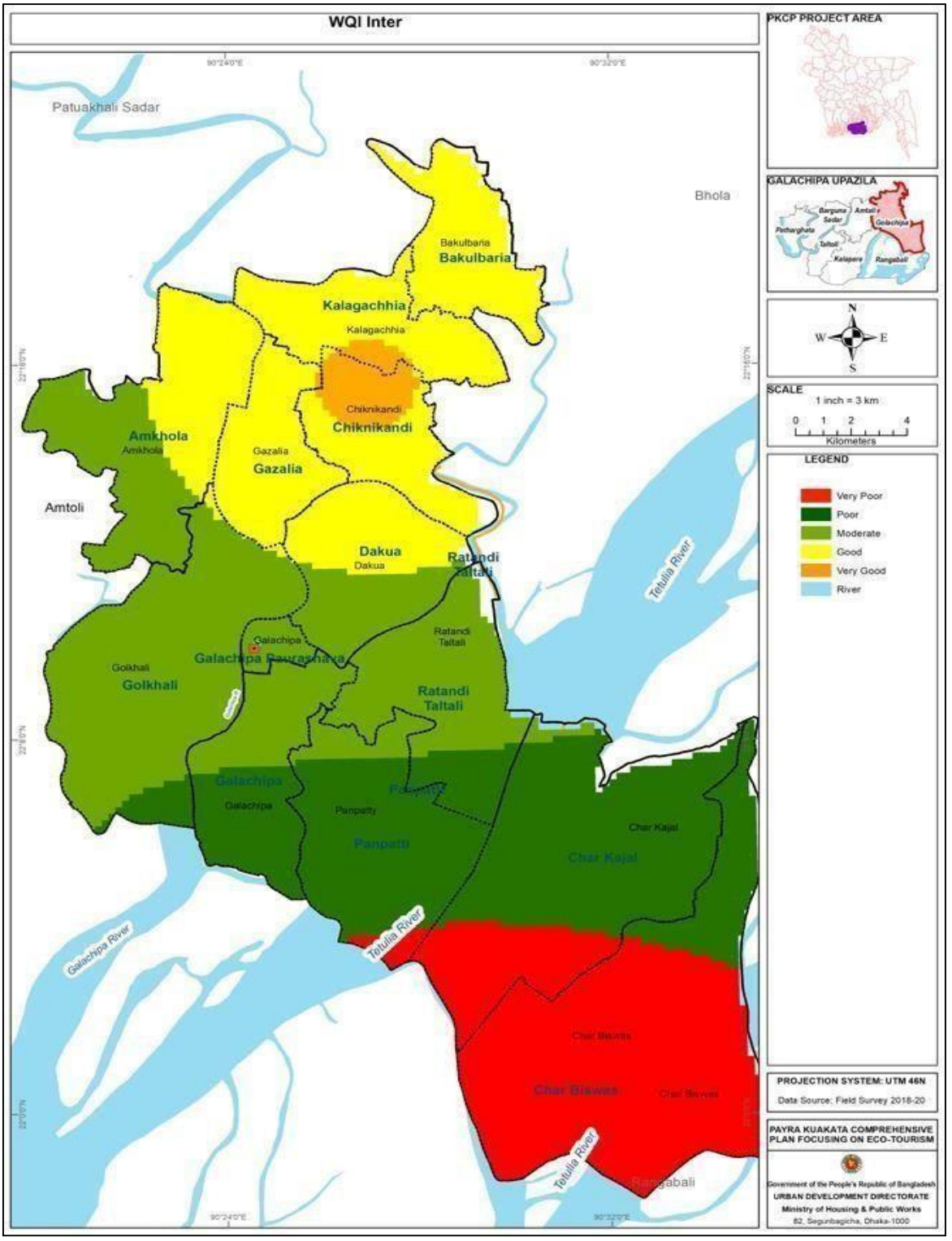


Figure 34 WQI index intermediate aquifer

Source: PKCP project, UDD,2018

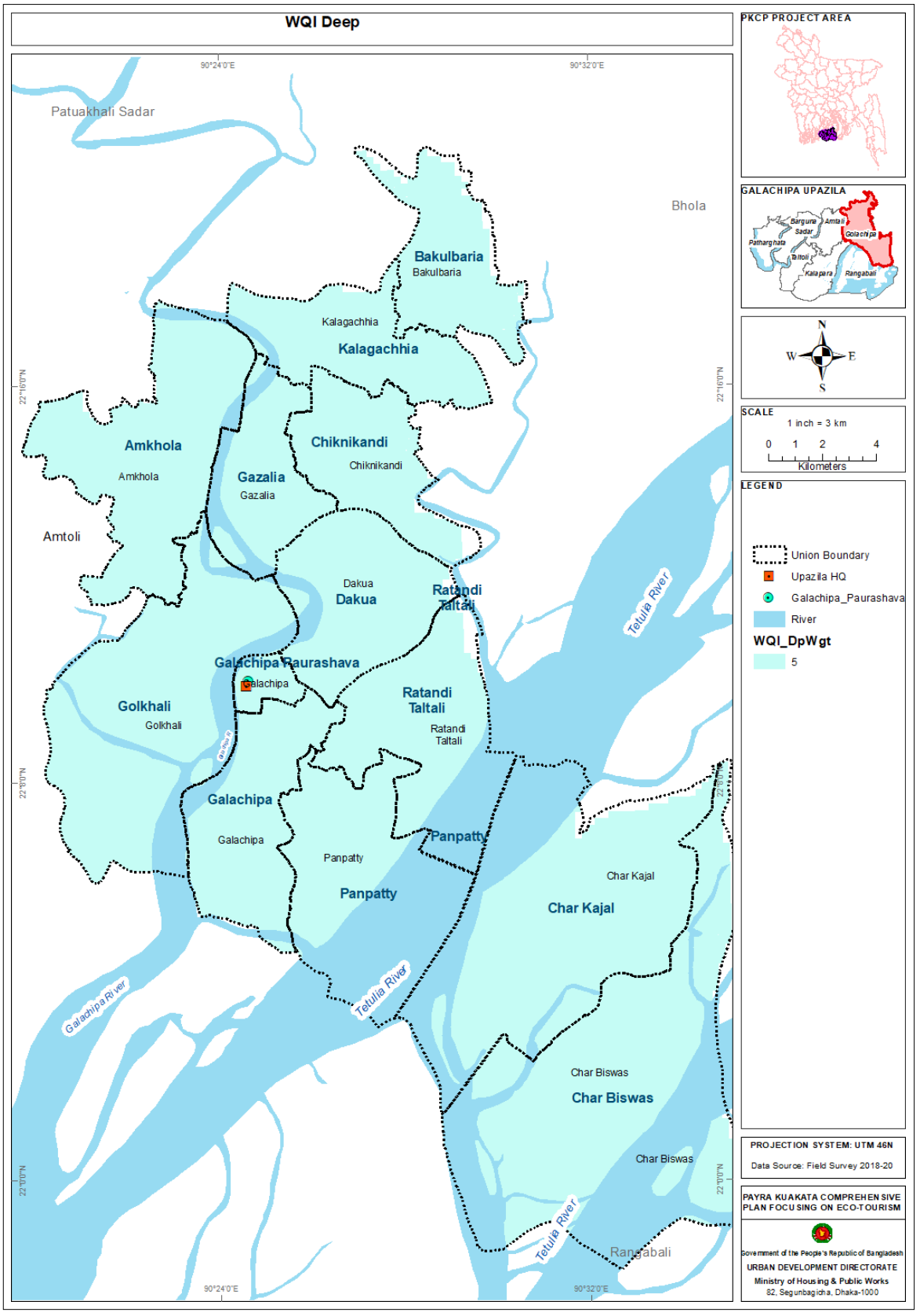


Figure 35 WQI deep aquifer

Source: PKCP project, UDD,2018

2.1.20 Cropping Pattern

The economy of the Galachipa 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, wheat, vegetables, spices, cash crops, pulses and others. Various fruits like Mango, jackfruit, coconut, betel nut, banana etc. are grown. Coconut and betel nut are grown abundantly in the Upazila. Watermelon is widely produced in the whole area of Galachipa 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. Non-agricultural activities mainly include the commercial activities and Government employers.

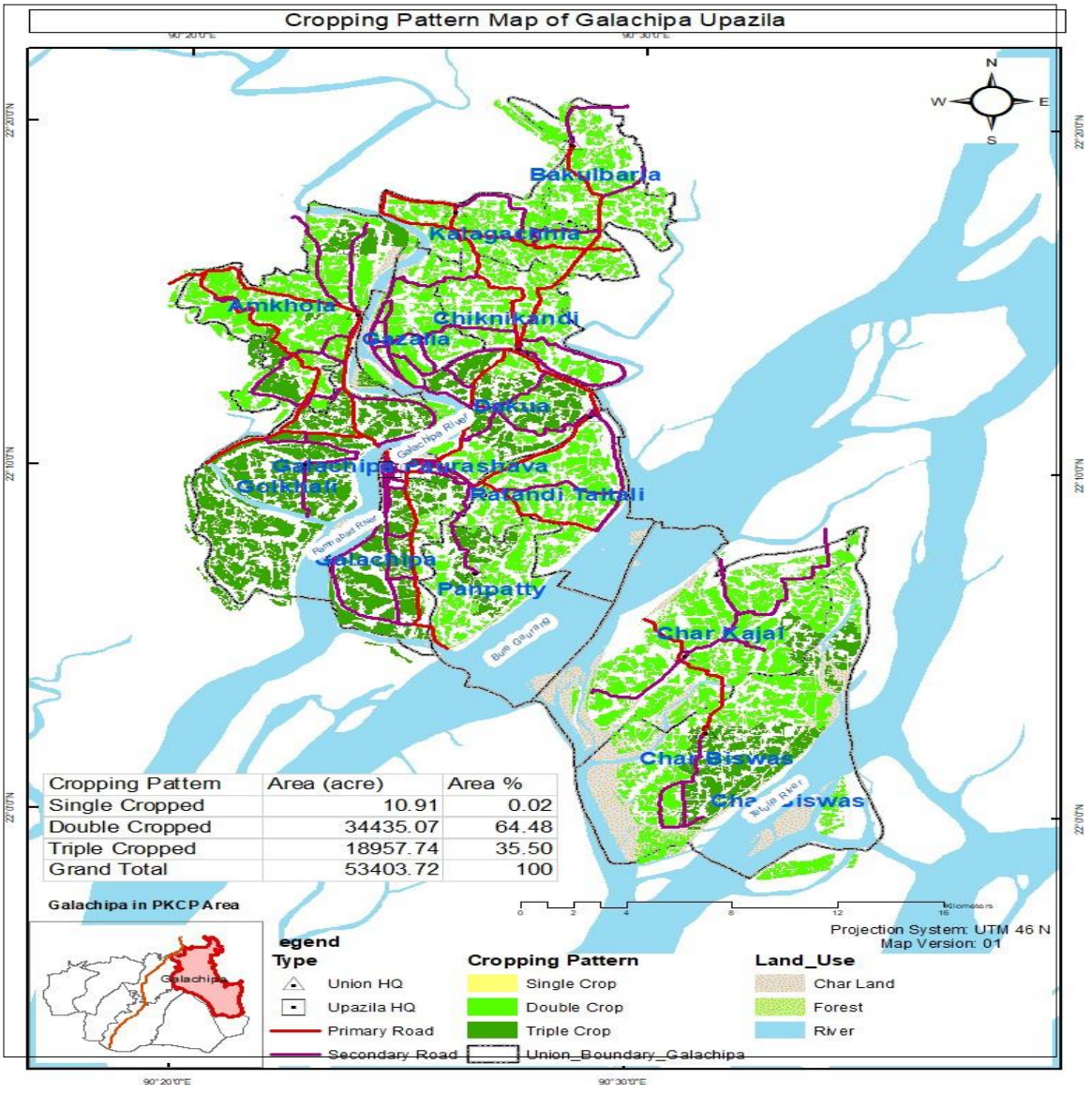


Figure 36 Cropping Pattern Map

Source: PKCP project, UDD,2018

2.1.21 Existing Hat-Bazar

Important het or bazars are those areas where maximum economic growth in a certain region isexpected. For the study area, it is assumed that most economic activities in the present scenario take place in the major growth centers. 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.

Following are some gross findings on existing hat or bazars:

Catchment Area: Existing hat or bazars serve mainly the nearest and surrounding villages andunions.

Road Network: Every growth center is connected with mainly Upazila or union roads. Some hat or bazars 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 road conditions are so bad that it becomes risky for motorized vehicles to move on the roads. Pavement depleted at many points with a lot of holes and shattered. Most of the roads are Katcha which are narrow. During a flood, the road goes under and becomes muddy. The condition of culverts and bridges are not in good condition. Conditionof launch ghat is not also good.

Traffic Congestion: Traffic congestion is noticeable mainly on typical hat days. Most businessactivities are done in hat day/ days. Goods loading and unloading occur on that day, and many people come for different purposes on the hat day, so the growth centre becomes crowded on that day. The volume of vehicles also becomes high. So, traffic congestion occurs on typical hatdays rather than on other days of the week.

Parking Facility: There is no parking facility in existing hat or bazars. Vehicles are parked on the street. There are some bus depots where people can access the growth centre by bus. There are some ghats for goods loading and unloading, especially fish products.

Mode of Travel: The major modes of travel are motorbike, tomtom, easy bike, autorickshaw, three-wheeler, Mahindra, cycle-rickshaw, bicycle, borak, passenger pickup, tempo, bus etc. Inthe waterway, trawler, boat and launch areas are available to travel.

Existing Bazar: There are 54 Bazars or hats in Galachipa Upazila. Following are the list of growth centre within Galachipa upazila:

Table 15 Union Wise Growth Center Map of Galachipa Upazila

Union Name	Bazar Name	Union Name	Bazar Name
Amkhola	Amkhola Bazar	Dakua	Par Dakua Pangasia Bazar
	Badura Bazar		Tetultola Bazar
	Bou Bazar	Galachipa	Boalia Ghat Bazar
	Mudirhat Bazar		Kalikapur Bazar
Bakulbaria			Shombaria Bazar
	Bot-tola Bazar	Gazalia	Adani Bazar
	Patabunia Bazar		Chandrailer Char Bazar
Char Biswas	6 No. Sluice Bazar	Golkhali	Horidevpur Bazar
	Amgachhia Launchghat Bazar		Shuhuri Bazar
	Bot-tola Bazar		Zolekha Bazar
	Char Bishwas Bazar (Budhbaria Bazar)	Kalagachhia	Gilabaria Bazar
	Eunus Miar Bazar		Kalagachia Bazar
	Gazir Bazar		Kharizzama Bazar
	Mujibnagar Bazar		Lamna Bazar
	Nomo Sluice Bazar	Panpatti	Panpatti Centre Bazar
Char Kajal	Bangla Bazar		Panpatti Ghat Bazar
	Char Kajal Launchghat Bazar	Paurashava	Galachipa Paurashava
	Char Kajal Notun Bazar	Ratandi Taltali	Badnatoli Ghat Bazar
	Char Kajal Puran Bazar		Katakhali Bazar
	Char Kapal Bera Bazar		Ulania Bazar
	Chhoto Kajal Shonibaria Bazar		Sombaria Bazar
	Closer Bazar		Chiknikandi Bazar
	Hajir Hat Bazar		Guabaria Bazar
Chiknikandi	Jintola Bazar		Kalaraja Bazar
	Khalgora Bazar		Shukrobaria Bazar
	Shonibaria Bazar		

Source: PKCP project, UDD, 2018

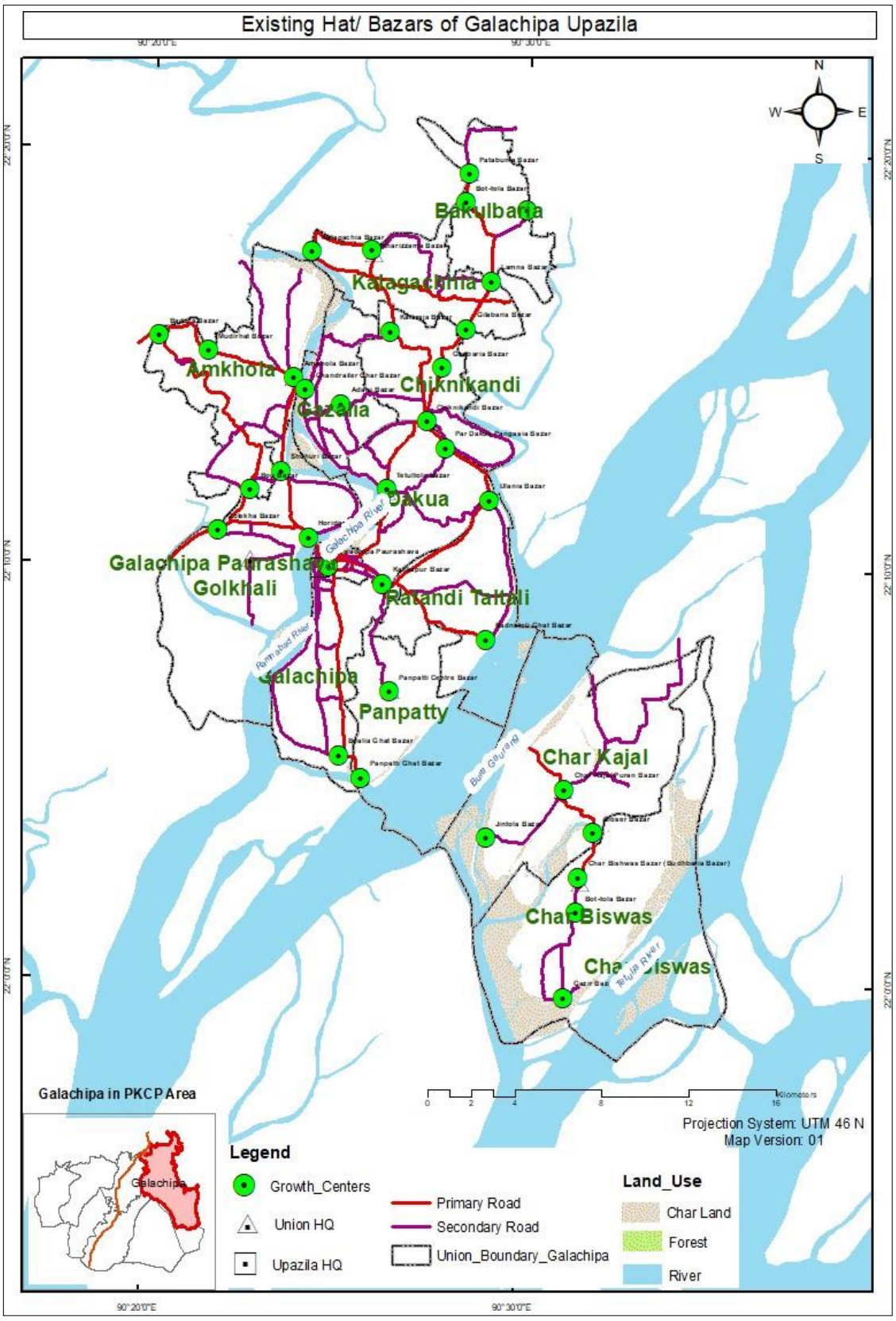


Figure 37 Existing Hat-Bazar of Galachipa Upazila Source: PKCP project, UDD,2018

CHAPTER THREE: SOCIO-SPATIAL FORECASTING AND DEVELOPMENT PROSPECTS

3.1 Population Projection

Population has been forecasted applying cohort method. The cohort-component method segments the population into age-sex groups or birth cohorts and accounts for the fertility, mortality, and migration behaviour of each cohort. Projected Population and annual growth rate. According to BBS, the population of Galachipa Upazila in 2011 was 2,55,815 and annual growth rate was 1.05. Table 1 shows that the population in 2021, 2031 and2041 will be 288109;338427 and 369922 respectively. And Population Projection using Cohort Population Method shows the overall projected population of Galachipa Upazila using cohort method.

Table 16 Projected Population and annual growth rate

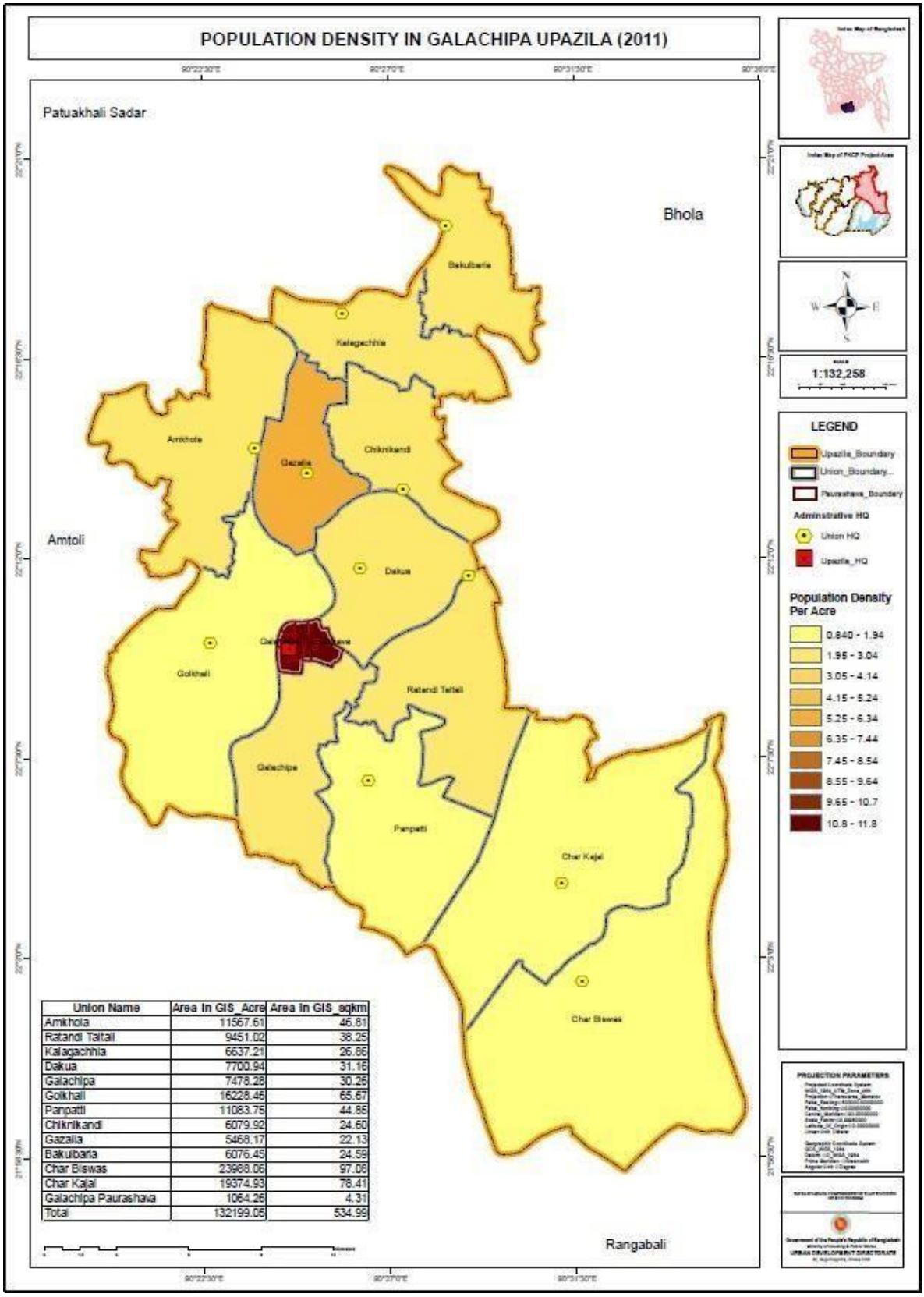
Year	Projected Population	Annual Growth Rate
2021	288109	1.17
2031	338427	1.28
2041	369922	1.29

Source: PKCP project, UDD, 2018

Table 17 Population Projection using Cohort Population Projection Method

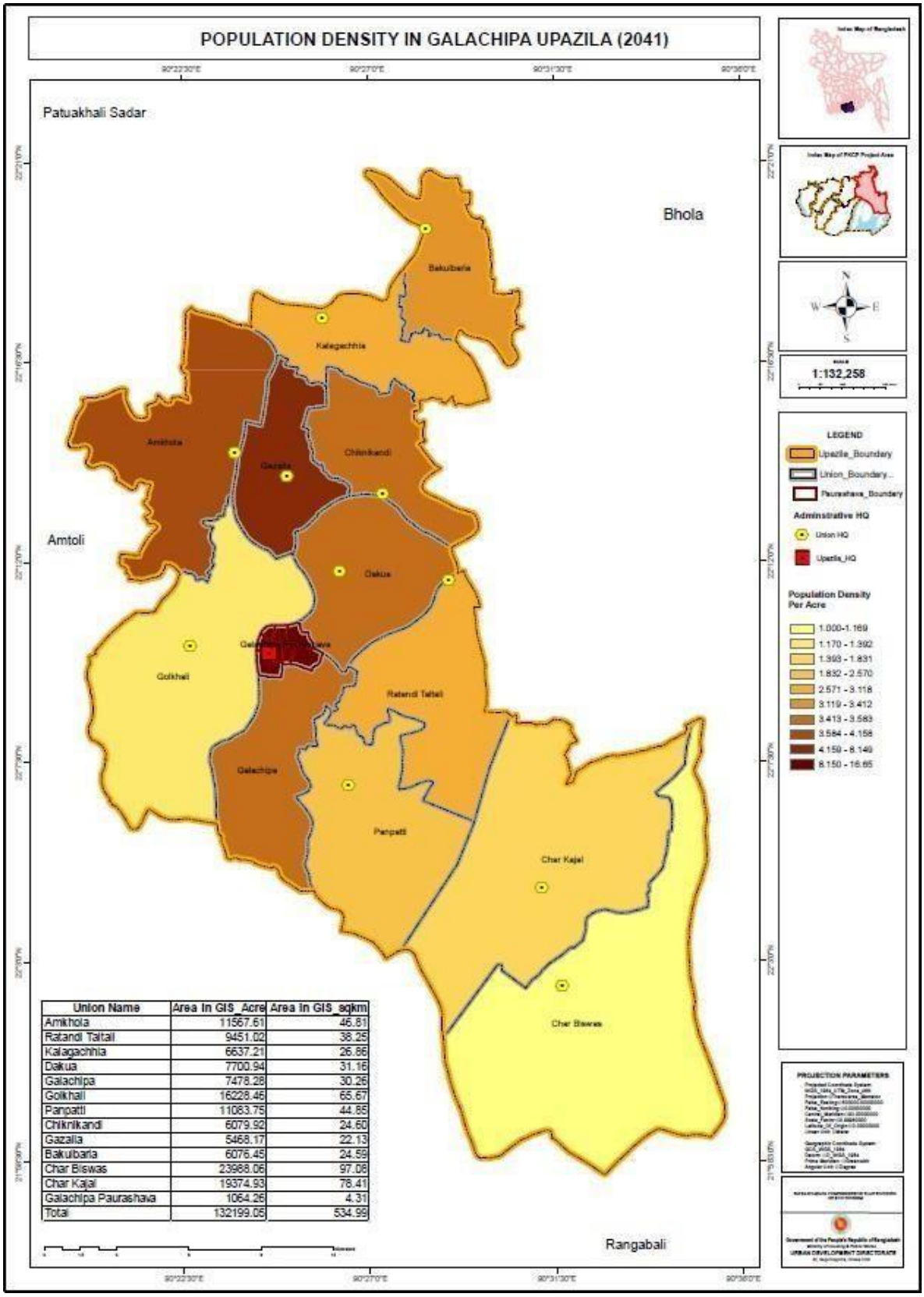
Union Name	2011	2021	2031	2036	2041
Amkhola Union	27178	30285	46104	47253	48099
Bakulbaria Union	14734	16469	18816	19856	20732
Char BiswasUnion	20155	22347	25341	26793	28044
Char Kajal Union	25272	27996	31969	33871	35483
Chiknikandi Union	15578	17597	19884	20911	21785
Dakua Union	19531	22199	25003	26264	27363
Galachipa Union	19043	21204	24039	25367	26520
Gazalia Union	12596	13918	15955	16910	17715
Golkhali Union	32169	35642	40440	42657	44559
Kalagachhia Union	16080	17855	20443	21605	22595
Panpatty Union	14894	16494	18751	19799	20693
Ratandi Taltali Union	20085	22351	25308	26670	27854
Paurashava	21200	23752	26374	27485	28480
Total	258515	288109	338427	355441	369922

Source: PKCP project, UDD, 2018



Union Name	Area in GIS_Acre	Area in GIS_sqkm
Amkhola	11567.61	46.81
Ratandi Taltali	9451.02	38.25
Kalagachhia	6637.21	26.86
Dakua	7700.94	31.16
Galachipa	7478.26	30.26
Golkhali	16228.46	65.67
Panpatti	11083.75	44.85
Chiknikandi	6079.92	24.60
Gazalia	5468.17	22.13
Bakulbaria	6076.45	24.59
Char Biswas	23968.06	97.06
Char Kajal	19374.93	78.41
Galachipa Paurashawa	1064.26	4.31
Total	132199.05	534.99

Figure 38 Population density in Galachipa Upazila (2011) Source: PKCP project, UDD,2018



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Gazalia	5468.17	22.13
Bakulbaria	6076.45	24.59
Char Biswas	23968.06	97.06
Char Kajal	19374.93	78.41
Galachipa Paurashawa	1064.26	4.31
Total	132199.05	534.99

Figure 39 Population density in Galachipa Upazila (2041) Source: PKCP project, UDD,2018

3.2 Housing Demand Projections

The use of Historical data to project future housing demand is known as demand forecasting. It gives an estimate of the number of dwelling units that people are likely to desire in the future over a specific time period. Based on the existing population and number of structures, the threshold population has been calculated. After that, considering the projected population, future demand for housing units has been quantified. From the existing condition in Galachipa Upazila, there 2,55,815 population uses 72178 structures. In 2041, Galachipa Upazila have 369922 populations, there will need 83882 livable building considering the household size is 4.41 (Patuakhali District Dwelling Unit BBS, 2011)

3.3 Economy & Employment/Economic forecasting

Findings from Basic and Non-Basic Employment

From the perspective of the percentage increase from 2003 to 2013, in Galachipa Upazila, basic employment has increased by 122 percent, and total employment has increased by 81 percent. Basic employment contributes to total employment. Basic employment constitutes 30% in Galachipa. So, most of the employment is not export-related, although basic employment contributes to non-basic employment, which can be identified by the economic base multiplier

Table 18 Employment of 2003 and 2013 Comparison among the Upazila

Upazila	Basic Employment 2003	Total Employment 2003	Basic Employment 2013	Total Employment 2013	Increase in Basic Employment	Increase in Total Employment
Galachipa	3400	13821	7542	25079	122%	81%

Source: PKCP project, UDD, 2018

Findings from Economic Base Multiplier: Economic base multiplier is used to evaluate employment as a measure of activities and can be used for projection purposes. The future total employment of a region can be evaluated by estimating the future prospects of the basic activities in the regional economy and by using a multiplier.

Findings from Shift-Share Analysis: The growth of a region can be attributed to a national trend or unique regional factors. The industry combination of the nation or the region itself may play a role in the regional growth also. Shift-Share analysis helps answer these questions by splitting the employment growth between the three shift-share components, namely: National Share, Proportionality Shift, and Differential Shift.

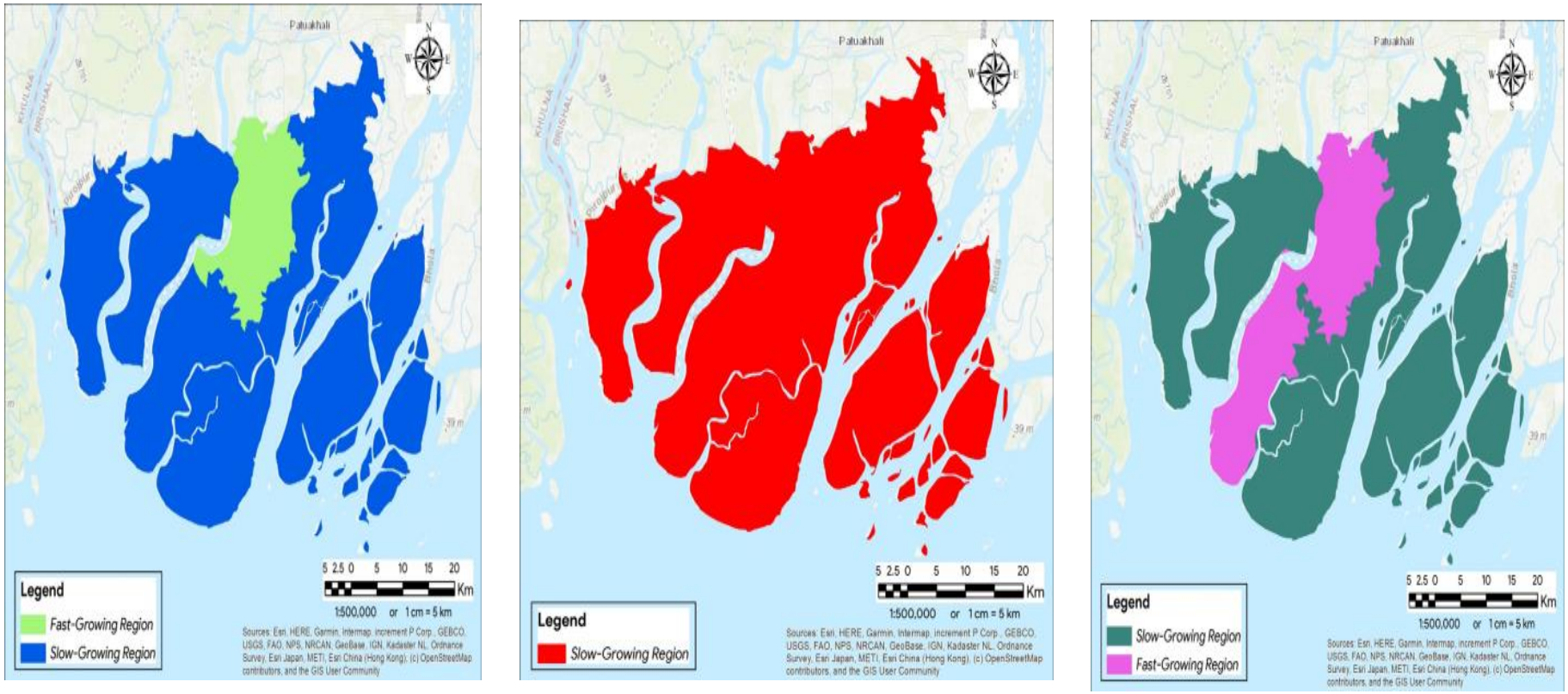


Figure 40 Delineation of Fast Growing and Slow Growing Regions

Source: PKCP Project, UDD, 2018

General findings have been drowned by comparing Galachipa Upazila with other six Upazilas within the project region. It depicts the Upazilas as Fast-Growing or Slow-Growing regions based on the Total Growth of Employment (Gj) in each region with respect to their National Share (NS) delineates the Upazilas in Fast-Growing or Slow-Growing regions based on their Industry Mix (IM). Figure is prepared on the basis of the Regional Shift (RS) component and divides the Upazilas into Fast-Growing or Slow-Growing regions based on local advantages. Galachipa Upazila has fallen under slow-growing in terms of regional/local advantages. This means that the growth rates of employment in a number of sectors in these Upazilas are lowerthan the growth rates in these sectors at the national level.

3.4 Traffic & Transportation

Household Survey and Trip Purpose

From the survey, it is observed that, on average, 6.79 trips per household are generated within the Galachipa area per day. For ease of analysis, the consultant team categorized all purposes into five categories: Educational, Shopping (trips to Bazar are also included), Work, Recreational and others (personal, treatment etc.). Other than these categories, there is another category called Home Based Trip, which includes all trips destined for a household. It is seen that 16% of the trips are made for educational purposes, where 22% of trips are made for work purposes, and shopping trips share 8% of trips.

Table 19 Trip Purpose

Union/Zone	Educational	Work	Shopping	Recreation	Home Based	Others
Amkhola	6%	17%	17%	9%	50%	**2%**
Golkhali	14%	16%	16%	5%	46%	**3%**
Galachipa	16%	28%	5%	1%	50%	**0%**
Panpatty	20%	20%	7%	1%	50%	**1%**
Ratandi Taltali	16%	26%	4%	3%	50%	**1%**
Dakua	24%	25%	1%	1%	50%	**0%**
Chiknikandi	18%	21%	10%	1%	50%	**0%**
Bakulbaria	17%	22%	7%	2%	50%	**2%**
Char Kajal	13%	20%	5%	6%	52%	**5%**
Char Biswas	12%	26%	4%	8%	50%	**1%**
Kalagachia	11%	20%	1%	3%	50%	**0%**
Gazalia	13%	20%	6%	2%	50%	**1%**
Paurashava	**20%**	**17%**	**10%**	**1%**	**50%**	**2%**

Source: PKCP project, UDD, 2018

Trip Purpose– For ease of analysis, the consultant team categorized all purposes into five categories: Educational, Shopping (trips to Bazar are also included), Work, Recreational and others (personal, treatment etc.)

Mode Choice – In the overall scenario for the whole Study area, people make most of the trips by walking, which is 59.0% of total trips. These trips are generally short-distance trips. Again,18.2% are made by Auto-Rickshaw, 9% by Rickshaw/Cycle and 5.9% by Motorbike. Among the other modes, except walking water modes is in total 2.3% (where boat 1.3% and trawler 1%).

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 20 Travel Cost and Time

		Dry Season		Rainy Season	
Zone ID	Union/ Zone	Avg. Trip Length (minutes)	Avg. Travel Cost (tk.)	Avg. Trip Length (minutes)	Avg. Travel Cost (tk.)
41	1. Amkhola	24.80	16.01	30.99	15.65
42	2. Golkhali	23.57	6.30	35.71	6.80
43	3. Galachipa	16.23	11.01	15.95	10.52
44	4. Panpatty	29.23	17.14	29.58	17.07
45	5. Ratandi Taltali	23.77	19.12	23.71	19.12
46	6. Dakua	25.92	12.25	21.92	12.32
47	7. Chiknikandi	14.02	7.37	14.02	7.36
48	8. Bakulbaria	18.68	10.93	18.68	10.96
49	9. Char Kajal	31.63	16.27	39.15	19.58

Source: PKCP project, UDD, 2018

Type of Trip – 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.

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 taken into account to determine the change.

Traffic Volume Count Survey – The major travel mode of Galachipa is mainly Motorbike. 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 motorbike is used. Other important modes are baby taxi, rickshaw, van and tempo. From the survey, it has been found that people are highly dependent on unconventional modes like baby taxis, tempo/ auto- rickshaws and non-motorized vehicles and Motorbikes because of lack of bus service, narrow road network and bad road conditions.

Table 21 Traffic volume of Galachipa

Upazila		**Major Three Modes**				
	Mode- 1		**Mode- 2**		**Mode- 3**	
	Up	**Down**	**Up**	**Down**	**Up**	**Down**
Galachipa	Motor Bike (41.2%)	MotorBike (43.04%)	Rickshaw (23%)	Rickshaw (23.05%)	BabyTaxi (22.15%)	Baby Taxi (22.35%)

Origin Destination Survey: Galachipa 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 Galachipa and Chhota Baisdia. Major vehicular trips are seen within the unions or near the surrounding unions of the same Upazila or other Upazilas. Other than that, most trips were distributed to Barisal, BholaPatuakhali from the study area.

3.5 Basic Services and Facilities Forecasting

Existing Facilities: The distribution of existing socio-economic facilities by Upazilas is presented in the below Table, while it presents the distribution of facilities per 10,000 people, which gives a relative picture of the Upazila in terms of availability of facilities.

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 22 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, 2018

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.

The Table presents the projected requirements of socio-economic facilities in different Upazilas in 2021, while show the projected requirements of facilities in different Upazilas in 2031 and 2041, respectively. It 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 23 Distribution of Existing Facilities by Upazila

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]*
Galachipa	58	265	24	0	15	22	8	43	39	*10*

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 Shelter10=College

Table 24 Existing Facilities per 10,000 People in Different Upazilas

Facility			**Number of Existing Facilities per 10,000People**							
	HS1	PS2	MDSA3	UHC/H4	FWC5	CC6	GC7	RM8	CS9	COL10
Galachipa	2.24	10.25	0.92	0.00	0.58	0.85	0.31	1.66	1.51	0.39

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital5=Family WelfareCentre 6=Community Clinic 7= GrowthCentre 8=Rural Market 9= Cyclone Shelter 10=College

Table 25 Projected Requirement of Facilities by Upazila in 2021

2			Total Number of Facilities Requiredby 2021							
	HS1	PS2	MDSA3	UHC/H4	FWC5	CC6	GC7	RM8	CS9	COL10
Galachipa	40	644	35	1	13	12	8	102	113	9

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital5=Family WelfareCentre 6=Community Clinic 7= GrowthCentre 8=Rural Market 9= Cyclone Shelter 10=College

Table 26 Projected Requirement of Facilities by Upazilas in 2031

Facility			Total Number of Facilities Requiredby 2031							
	HS1	PS2	MDSA3	UHC/H4	FWC5	CC6	GC7	RM8	CS9	COL10
Galachipa	44	707	38	2	14	13	8	112	124	10

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital5=Family WelfareCentre 6=Community Clinic 7=Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College	

Table 27 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]
Galachipa	48	769	42	2	16	14	9	122	13	11

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 28 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]
Galachipa	**1.39**	**22.20**	**1.21**	**0.06**	**0.46**	**0.40**	**0.26**	**3.52**	**1.39**	**0.35**

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, 2018

3.6 Water Demand Projection Based on Aquifer

Scenario prediction: According to the model simulated recharge assessment, the water balance calculation was done for shallow and intermediate aquifers, which are recharged by rainwater. It shows the water demand and water resources calculation summary for the whole PKCP area. The groundwater model was calibrated using aquifer specific storage value of 1x10-4.

Table 29 Water Balance Calculation

Water Balance Calculation for Shallow and Intermediate aquifers in the Payra-Kuakata Project area					
Aquifer	Set Up	Population status	Water Demand Million m3/year	Water Availability	Comments
Shallow and Intermediate	Rural	1,144,505.00	25.06	199.37	Current water abstraction rate is OK
Shallow and Intermediate	Urban	1,144,505.00	83.55	199.37	Current water abstruction rate is OK
Shallow and Intermediate	Rural	2,289,010.00	50.13	199.3662	Double water abstraction also Ok
Shallow and Intermediate	Urban	2,289,010.00	167.10	199.3662	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, 2018

There is no visible recharge area in/near the project area, and it is supposed to be far from there. The water age defines the water in deep aquifers as 10000 years back as per the water age dating of the study area. The plan recommend to use deep aquifer water for drinking purpose only.If the deep water is used for industrial purposes, the water reserve of the deep aquifer will be finished as there is no active recharge area for this aquifer, and the people may face water scarcity of fresh drinking water, which may cause seawater intrusion. The observed groundwater level data indicate that the groundwater level in the deep aquifer in all Upazila decline annually by 0.3 to 0.5 m. Since, sample from shallow and intermediate mostly brackish, water conservation practices should be encouraged, such as implementing rainwater harvesting systems to reduce the demand for water resources. Moreover, water

treatment technologies such as desalination technologies that remove salt from water can be incorporated.

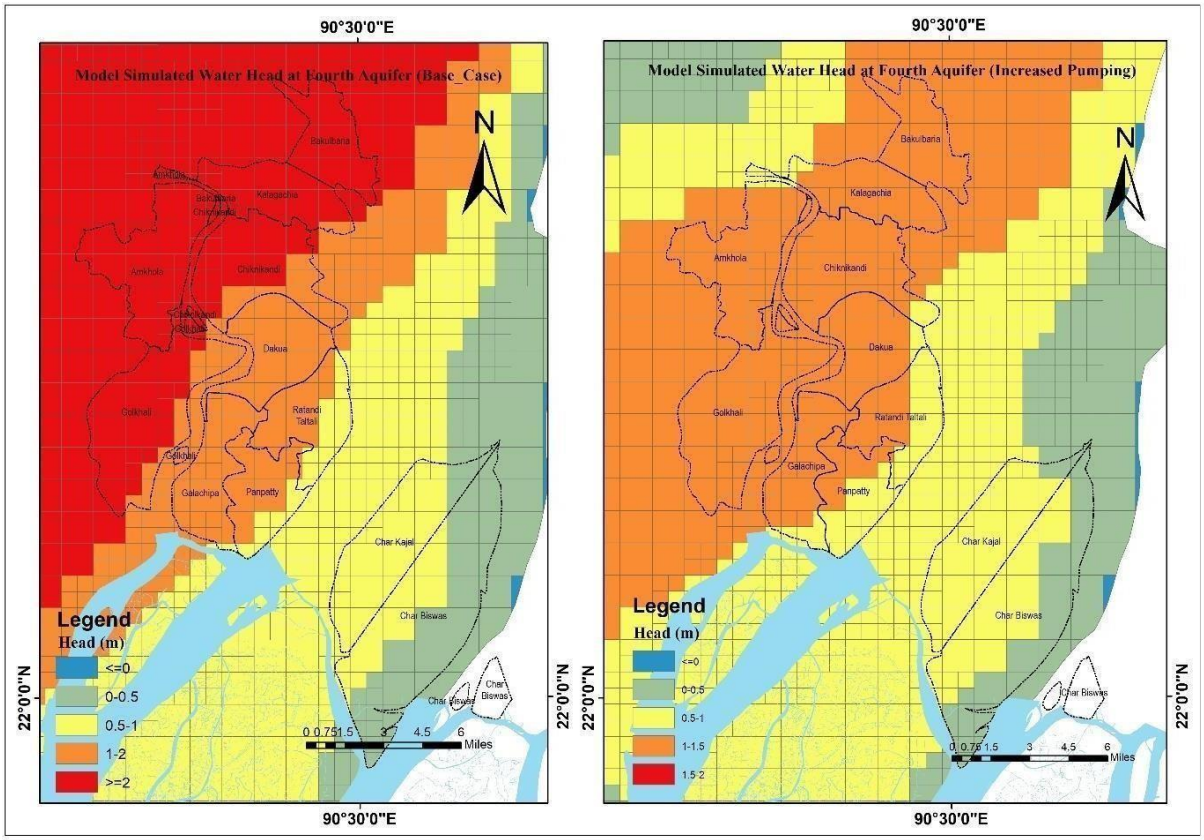


Figure 41 comparison between deep aquifer in Base Case condition in December 2019 (left) and in increased pumping condition in December 2025 (right)

Source: PKCP project, UDD, 2022

3.7 Water Demand based on Population

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 Aus AID 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)

Table 30 Water Demand Projection in Galachipa Upazila

Union Name	Population,2021	Water demand (litre)	Population,2026	Water demand (litre)	Population,2031	Water demand (litre)	Population,2036	Water demand (litre)	Population,2041	Water demand (litre)
Amkhola Union	44616	2740760.88	46104	2832168.72	14001	860081.43	47253	2902751.79	48099	2954721.57
Bakulbaria Union	17632	1083133.76	18816	1155866.88	20971	1288248.53	19856	1219754.08	20732	1273566.76
Char Biswas Union	23799	1461972.57	25341	1556697.63	25388	1559584.84	26793	1645893.99	28044	1722742.92
Char Kajal Union	29915	1837678.45	31969	1963855.67	20134	1236831.62	33871	2080695.53	35483	2179720.69
Chikni kandi Union	18738	1151075.34	19884	1221474.12	20738	1273935.34	20911	1284562.73	21785	1338252.55
Dakua Union	23603	1449932.29	25003	1535934.29	16667	1023853.81	26264	1613397.52	27363	1680909.09
Galachipa Union	22600	1388318	24039	1476715.77	32948	2023995.64	25367	1558294.81	26520	1629123.6
Gazalia Union	14908	915798.44	15955	980115.65	21231	1304220.33	16910	1038781.3	17715	1088232.45
Golkhali Union	38006	2334708.58	40440	2484229.2	33825	2077869.75	42657	2620419.51	44559	2737259.37
Kalagachhia Union	19140	1175770.2	20443	1255813.49	13422	824513.46	21605	1327195.15	22595	1388010.85
Panpatty Union	17603	1081352.29	18751	1151873.93	30282	1860223.26	19799	1216252.57	20693	1271170.99
Ratandi Taltali Union	23820	1463262.6	25308	1554670.44	24837	1525736.91	26670	1638338.1	27854	1711071.22
Paurashava	25119	1543060.17	26374	1620154.82	20364	1250960.52	27485	1688403.55	28480	1749526.4
Total	319499	19626823.57	338427.00	20789570.61	294808.00	18110055.44	355441.00	21834740.63	369922.00	22724308.46

Source: PKCP project, UDD, 2018

Water demand and consumption in the coastal regions of Bangladesh can vary depending on several factors, including population density, economic activities, climatic conditions, and

access to water resources. Coastal regions in Bangladesh face unique challenges due to their vulnerability to natural disasters, such as cyclones and tidal surges, as well as issues related to salinity intrusion into freshwater sources.

3.8 Electricity Demand

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, its assume that every year this demand will increase 3% per year. An estimation of electricity consumption for the Upazila is made.

Table 31 Electricity Demand Projection in Galachipa Upazila

Union name	Population, 2021	Electricity Consumption (kwh)	Population, 2026	Electricity Consumption (kwh)	Population, 2031	Electricity Consumption (kwh)	Population, 2036	Electricity Consumption (kwh)	2041	Electricity Consumption (kwh)
Amkhola Union	27178	13507466	44616	25520352	46104	30290328	47253	35770521	48099	41942328
Bakulbaria Union	14734	7322798	17632	10085504	18816	12362112	19856	15030992	20732	18078304
Char Biswas Union	20155	10017035	23799	13613028	25341	16649037	26793	20282301	28044	24454368
Char Kajal Union	25272	12560184	29915	17111380	31969	21003633	33871	25640347	35483	30941176
Chiknikandi Union	15578	7742266	18738	10718136	19884	13063788	20911	15829627	21785	18996520
Dakua Union	19531	9706907	23603	13500916	25003	16426971	26264	19881848	27363	23860536
Galachipa	19043	94643	22600	12927	24039	15793	25367	19202	2652	23125

Union		71		200		623		819	0	440
Gazalia Union	12596	6260212	14908	8527376	15955	10482435	16910	12800870	17715	15447480
Golkhali Union	32169	15987993	38006	21739432	40440	26569080	42657	32291349	44559	38855448
Kalagachhia Union	16080	7991760	19140	10948080	20443	13431051	21605	16354985	22595	19702840
Panpatty Union	14894	7402318	17603	10068916	18751	12319407	19799	14987843	20693	18044296

Source: PKCP project, UDD, 2018

The electricity demand of an Upazila, which is a subunit of administrative regions in Bangladesh, can vary widely depending on factors such as population, economic activities, industrial development, and energy consumption patterns. According to the BPDB and PGCB report, the Barisal Region's total consumption rate is 2250 MW, whereas Galachipa Upazila's anticipated consumption demand is 31.2 MW to meet the need.

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, Galachipa Upazila produced 13.2 tons of solid waste in 2021 as opposed to 16.3 tons in 2041.

Table 32 Solid Waste Generation Projection in Galachipa Upazila

Union Name	**2011**	**Waste Generation (kg)**	**2021**	**Waste Generation (kg)**	**2031**	**Waste Generation (kg)**	**2036**	**Waste Generation (kg)**	**2041**	**Waste Generation (kg)**
Amkhola Union	27178	2989.6	30285	3331.35	46104	5071.44	47253	5197.83	48099	5290.89
Bakulbaria Union	14734	1620.7	16469	1811.59	18816	2069.76	19856	2184.16	20732	2280.52

Char Biswas Union	20155	2217.1	22347	2458.17	25341	2787.51	26793	2947.23	28044	3084.84
Char Kajal Union	25272	2779.9	27996	3079.56	31969	3516.59	33871	3725.81	35483	3903.13
Chiknikandi Union	15578	1713.6	17597	1935.67	19884	2187.24	20911	2300.21	21785	2396.35
Dakua Union	19531	2148.4	22199	2441.89	25003	2750.33	26264	2889.04	27363	3009.93
Galachipa Union	19043	2094.7	21204	2332.44	24039	2644.29	25367	2790.37	26520	2917.2
Gazalia Union	12596	1385.6	13918	1530.98	15955	1755.05	16910	1860.1	17715	1948.65
Golkhali Union	32169	3538.6	35642	3920.62	40440	4448.4	42657	4692.27	44559	4901.49
Kalagachhia Union	16080	1768.8	17855	1964.05	20443	2248.73	21605	2376.55	22595	2485.45
Panpatty Union	14894	1638.3	16494	1814.34	18751	2062.61	19799	2177.89	20693	2276.23
Ratandi Taltali Union	20085	2209.4	22351	2458.61	25308	2783.88	26670	2933.7	27854	3063.94
Paurashava	21200	2332	23752	2612.72	26374	2901.14	27485	3023.35	28480	3132.8
Total	258515	28437	288109	31692	338427	37227	355441	39098.5	369922	40691.42

Source: PKCP project, UDD, 2018

3.10 Identification of Flood Risk in Different areas and capacity of Drainage System

As the area lies at the southernmost tip of Galachipa facing the Bay of Bengal, the area is highly vulnerable due to hydrological hazards, especially monsoon floods and coastal floods. Coastal floods can arise from tidal floods as well as storm surge-induced floods. The hydrological assessment would be based on flood level analysis as well drainage analysis. The flood analysis would focus on the estimation of the design flood level. The analysis involves the frequency analysis with different probability distributions functions for the selected design return period. The historical data on annual peak water levels are used for the purpose.

3.11 Ecology, Environment and Forest areas

Floral Diversity

The findings from the conducted study on existing flora has been provided information basically on terrestrial and aquatic ecosystems, and mangrove ecosystem (an ecosystem of the inter-tidal zone) with an account of 190 species having different life-forms including herbs, shrubs, climbers and trees. The distribution of these flora species are noted as homestead, cropland, roadside, shorelines, canals, rivers and small water bodies like fish culture ponds.

Faunal Diversity

Species diversity of fauna is low comparative to the other tropical area. Naturally, mangrove does not support a variety of wild fauna on its mangrove ecosystem. Moreover, coastal flooding is a common scenario that destroys the core habitats of the wild fauna. Therefore, habitat disturbance is a question that does not offer suitable habitat to allow betterment of their survival or success of living. While conducting this field work the study team has explored that there are 14 different habitats or ecosystem exist and have been supporting a good number of fauna to provide ecosystem services and or retain integrity of the ecosystem functions. During the recent field visit 201 species of fauna were recorded in this study area.

Conservation initiatives for wildlife and forests

Habitat improvement initiatives

Patuakhali Forest Division has managed four Protected Areas (PAs) to conserve wildlife within there. These four PAs are Kuakata National Park, Sonarchar Wildlife Sanctuary and proposed Laldia Wildlife Sanctuary. Some of the wildlife are Monkey, Wild boar, porcupine, Fox and Jackal, bat, dog, Mongoose, rat, Monitor lizard, Cobra, squirrel, Python, Haldi pakhi, Babui, owl, Bou kotha kao, kyte, shalik, shyama, tuntuni, dove, kingfisher, white stroke, Dahuk, Magpai, robin, nightingale and many others. According to the IUCN list, some species mentioned above are identified as rare and endangered species. During winter many migratory birds make their temporary residence in the sanctuary which attracts the tourists. To enrich these habitats, Patuakhali forest division has taken initiatives of habitat improvement plantation under SUFAL project. Till last financial year, 40.0 ha. of mangrove fodder plantation have been raised in Patuakhali Forest Division.

Awareness build-up

Forest Officers and staffs have been offered training for knowledge and skill development on PA management. Training have been offered to the forest officials and staffs on Wildlife management and wildlife crime control matters. Smart patrolling has been introduced in PA area. Shark and Ray including other species conservation strategy and non-detrimental findings are prepared.

Afforestation and reforestation at degraded land and Newly accreted char land

More than 4,000ha accreted coastal areas have been covered by afforestation to create coastal green belt of trees as a barrier against sea borne storms. Moreover, 1,000ha of reforestation at degraded forest land have been done as restoration program in Patuakhali Forest Division.

Livelihood development of Forest dependent people

Institutionalizing collaborative Forest Management (CFM): The aim of the collaborative forest management is to give forest dependent communities a stake in the management and preservation of the quality of the forests over the long term and to foster local stewardship forests.

3.12 Freshwater and Marine Fisheries

The estimated total fish habitat area is about 172,792 ha, which is an assemblage of open water fishery and aquaculture by about 98% and 2% respectively. The open water fisheries are dominated by floodplain habitat followed by river and canal, and mud flat/inter tidal area. In view of fisheries biodiversity, 47 fish species were listed covering 28 families of which Cyprinidae was found as the most dominant family which contains 9 species under 7 genera followed by Bagridae having 5 species belonging to 3 genera and Engraulidae also containing 3 species under 3 different genera. The study described 7 vulnerable, 5 endangered and 2 critically endangered species out of 42 finfish species. Diversity indexes were calculated for the present finding of which Margalef's index (d) was 5.13 for species available.

Due to unawareness and indiscriminate fish caught with a small mesh size net, diversity of fish species in the river is under threat. Thus, public awareness and adequate knowledge on use of appropriate fishing gear with appropriate mesh size could contribute to sustainable fisheries diversity in the river and the improvement in livelihood of the fishermen in the adjacent area. Some of these fish are dried before being marketed in the dry season while others are sold fresh. With the opening of Padma Bridge, the transport crisis will be over and traders will be able to make more profit by bringing fresh fish to the market. There are six (06) hilsa sanctuaries that have been declared in Bangladesh. Among them, two (02) hilsa sanctuaries were established in the Andharmanik and Tetulia River which are fall in the study area.

CHAPTER FOUR: SECTORAL AND STRUCTURE PLAN POLICIES

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 Galachipa Structure Plan area. Some of the important plans and policies that have been reviewed that are the following: Perspective Plan (2021-2041), 4. 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 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.

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 are the key to ensuring sustainable development of urban areas.

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

Justification

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

Strategies

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

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

US-02: Limiting urban expansion in the Potential Urban Area

Justification

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

Strategies

For Upazila, infill construction is recommended. Every land proposal is made in close proximity to an already developed area. To safe guard urban waterbodies, playgrounds, and high-value urban agriculture, however, due consideration has been provided.

Implementing Agency

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

Rural Sector

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

Justification

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

Strategies

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 taken into account for inclusion in the plan.
- Facilities are often located 500 meters or less from union headquarters or current growth centers.

Implementing Agency

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

Agriculture Sector

For the sake of food production, there is a need to conserve high-yielding agricultural lands against 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.

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; 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 converting 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 agriculture lands free from any kind of encroachments.

Strategies

Keep suitable agriculture 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 such resources through defining them as Agriculture zone.

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 Galachipa Upazila.

Strategies

1. Proposals will be made for widening the existing narrow roads 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. should be developed depending on the needs.
3. Plan should consider integration among road, rail and water way.
4. Establish connectivity with inter-regional highways, economic zone areas, ports, airports, power stations, inland water transport facilities, rail stations and major tourist resorts.
5. Upgrade all inter-district roads to atleast 4 lane facilities and upgrade/extend existing bridges; Upgrade zilla and upazila roads to atleast 2 lanes; Convert village roads to asphalt standard with atleast 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,secondaryandtertiaryroads.

Implementing 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 area, 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 and other urban area. The width of the roads/right of ways for roads should be designed with required planning standards to accommodate the sidewalks and bicycle paths.
2. Proposal of water cruise route from Sonar Char to Sundarbans connecting Kuakata would be considered.

3. Tourist-oriented sightseeing electric bus/ boats etc. would be considered for Kuakata Tourism area and for other tourist area.

Implementing 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.

Implementing Agency
Ministry of Shipping, BIWTA, BIWTC

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 and 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, rainwater harvesting schemes are some of the proposed strategies.

WR-01: Promote rainwater harvesting in coastal areas, Preserving and maintaining the existing natural water bodies for drainage, to save crop and property, flood control and environmental purposes

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 peoples of the study interested about the

rainwater harvesting and do it spontaneously then it will largely decrease the groundwater abstraction pressure from sub surface 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 Harvest systems is the tank location and the distribution technique selected.

Strategy:
Strategies such as wetland conservation, storm water management, watershed management, floodplain management, ecosystem restoration, monitoring and enforcement, and education and outreach can help ensure the sustainability and health of natural water bodies for current and future generations.

Implementing 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 Govt. following IWRM concept (such as examine large-scale O&M activities in embankments and polders to prevent salinity intrusion, identify and implement the best option and undertake 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 analyzing DEM and field survey. In Urban area plan the location of water treatment plant should be located.

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

Implementing Agency
Public health Engineering Department, pourashava, 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 heights recharge area; to maintain the areas unpaved. Coastal Afforestation zone may be proposed in this area.

Implementing Agency

Plan implementing agencies like Implementing Agency like Public Health Engineering Department, pourashava, Development Authority, NGOs/CBOs

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 -1: 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 the required action to transition to renewable energy, solar energy, and wind mills as an alternative national power supply. Engage the private sector to close the supply gap with renewable energy.

Strategies

1. Utilize energy sector NGO's and private commercial agencies to supply homes with solar power.
2. Introduce soft credit facility for users to purchase solar system.
3. In addition to grid supply 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.

Implementing 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.

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 Galachipa 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; identified inundation area and depression area to take 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.

Implementing 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

As proactive action sustainable infrastructure is necessary to tackle climate change impacts.

Multipurpose cyclone shelter should be a solution to comprehensive 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 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, multipurpose cyclone shelter centers.

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 by development of embankments, barriers, water control structures. Expanding and enhancing multifunctional storm shelters. Establish guidelines for the design of climate-resilient infrastructure. Upazila level public sector development agencies are required to adhere to regulations while building infrastructure.

Implementing 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-4: 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. Identified critical habitat areas of crab, crocodile, deer, and dolphins fox migratory duck's reptiles, resident birds, resident water birds, sea turtle's 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-6: 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.

Conservation Zone

CZ-1: Conserve natural/environmental resources like water body, Forest and Char land.
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
River and Khal protection zone has been created to protect existing waterbody.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.

CZ-2: Execute and 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
Conservation Zone has been created in the char is at protecting char area from further development. This zone will preserve the natural condition and attract tourist more.

Implementing 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), Department of Forests (DoF), 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.

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 Galachipa Upazila in the long run, it is required to encourage the industrial establishment within Upazila area.

Strategies

To control the haphazard in the mid to find us trial development, measures will be undertaken as followed

- Following the category of industries as categorized by DOE (GreenCategory) and Bangladesh National Building Code (low and medium category hazards)
- Following Bangladesh National Building Code,1993&2006 and Building Construction Regulation,1952 (amendmentin1996) of or providing Road, setback before construction of any industrial structures

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

Justification

Galachipa Upazila is dependent on agriculture and small business through direct or indirect involvement. In order to restore the economic basis and accelerate the trend of economic development, emphasis is needed. A separate union should develop a small growth centre. Both public and private capital ought to be focused on this hub of growth. Opportunities to promote agro-basic industries in Galachipa Upazila would be created by this policy.

Strategies

By guaranteeing increased capacity, agro-based industries will assist current producers in raising their yields and expanding their employment opportunities.

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

The Upazila will assist the central government in promoting Upazila as a potential location for inward investments. If National Businesses can be encouraged to locate in promoting Upazila, they will

provide earning capacity for their locally recruited employees and the opportunity for services to be offered to support the businesses.

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 sustain economic activity of the Upazila for longer period with proper sustenance, the area is disposed towards Agriculture and small scale business in some extent. Proper planning and coordination among these sectors and future potential sectors would be possible to engage 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 in transferring the wastes from Solid-waste transfer sites, road maintenance, and public sanitation.

Implementing Agency

In Bangladesh, the implementing agency for economic zones is the Bangladesh Economic Zones Authority (BEZA). BEZA is a government agency under the Ministry of Industries, responsible for planning, development, operation, and management of economic zones in Bangladesh.

Forest Area

Policy FA-01: Conserve forest resources and improve bio-diversity, Foster development through conservation, increase forest cover and protect biodiversity; 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 has been proposed as Conservation Zone for forest resources.

2. 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

Implementing Agencies

Several agencies and organizations are involved in forest conservation efforts in Bangladesh. Bangladesh Forest Department (BFD), Local Government Department (LGD), Bangladesh Forest Research Institute (BFRI), and Community-based Organizations (CBOs) are a few of the major organizations that carry out forest conservation in Bangladesh.

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 to 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 above.

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.

Implementing 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.

Conclusion

The policies set for various sectors in this chapter commensurate with the broad national sector policies. The strategic measures suggested are targeted to achieve these policies at Upazila level. The implementing agencies are identified in consideration of direct and indirect involvement in the plan implementation process.

CHAPTER 5 COMPREHENSIVE STRUCTURE PLAN

5.1 Existing Land Use

Except for the core area of paurashava, topographically, Galachipa Upazila is mainly rural in nature and mainly surrounded by agricultural land. Some wards are mainly containing urban characteristics. But in recent years, communication development has already impacted the growth and expansion of activities within the paurashava. The existing land use of the Upazila shows that 44.03 percent of the land is used for agricultural activity, and another mentionable land-use area is 15.88 percent rural settlement, 9.82 percent char land and 29.30 percent water body. Table 30 illustrates existing land use statistics in detail.

Table 33 Existing Land use of Galachipa Upazila

Landuse Category	**Area**	**%**
Administrative	18.60	0.01
Agricultural	67748.44	44.03
Char Land	15111.78	9.82
Commercial	161.76	0.11
Community Service	67.86	0.04
Education & Research	111.07	0.07
Forest	3.46	0.00
Healthcare Service	5.97	0.00
Industrial	7.78	0.01
Miscellaneous	53.64	0.03
Mixed Use	8.74	0.01
Non- Government Services	0.90	0.00
Residential	24434.91	15.88
Service Activities	6.89	0.00
Tilla	2.52	0.00
Transport & Communication	978.99	0.64
Under Construction	3.30	0.00
Vacant Land	52.96	0.03
Waterbody	45090.99	29.30
Grand Total	153870.55	100.00

Figure 42 Existing land use

Source: PKCP project, UDD, 2018

5.2 Suitable Site Ranking-Findings From Suitability Analysis

For the plan preparation of Galachipa Upazila suitability analysis is an essential step. Through analysis of suitable area for agriculture, urban and infrastructure development have been Identified planning.

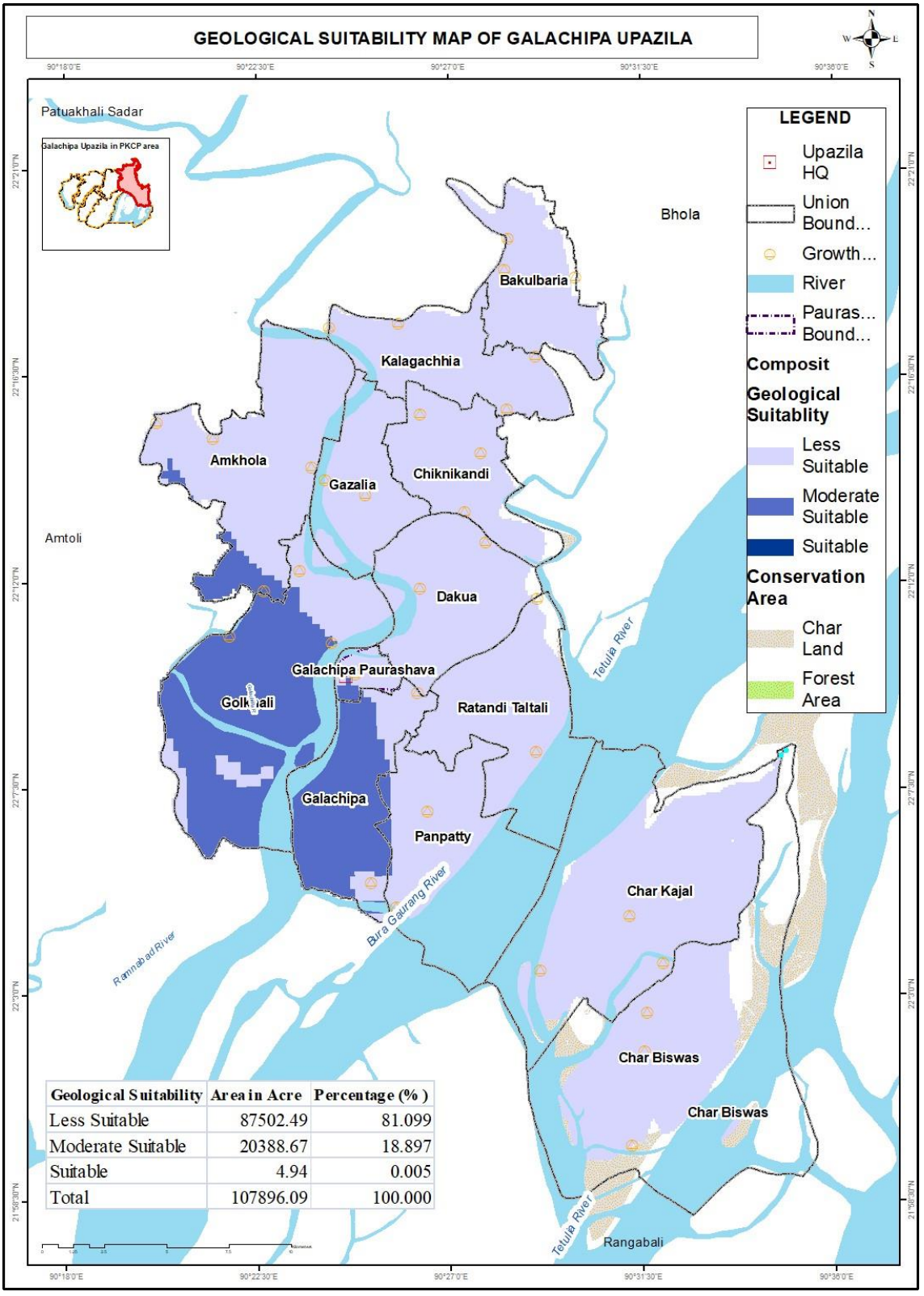
5.2.1 Ranking Suitable Areas based on Geological Attributes

Geological attributes are important to ensure safe, stable and economic design and construction of government's or authorities' project. For example, ground motion is more directly related to damage to buildings and infrastructure in an earthquake than the magnitude of the earthquake itself. Construction technology commonly employees pile foundation in a variety of scenarios such as when there is a 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. Beside earthquake, liquefaction phenomenon which is an unsupportive environment of built structures by altering previously solid ground into a liquefied softened condition. These damages increase during earthquakes. 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 variableand to find out the relative weight of these variable AHP pairwise comparison has been applied. After getting the weighted value, the weighted sum model was applied to find the final suitability map (**Figure 6-2**). 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. Almost 81% of the land is not geologically suitable for infrastructure development. 18.89% is moderately suitable and only 4.94% is suitable.

Table 34 Geological Suitability Area of Galachipa Upazila

Geological Suitability	Area in Acre	Percentage (%)
Less Suitable	87502.49	81.099
Moderate Suitable	20388.67	18.897
Suitable	4.94	0.005
Total	107896.09	100.000

Source: PKCP project, UDD, 2018



Geological Suitability	Area in Acre	Percentage (%)
Less Suitable	87502.49	81.099
Moderate Suitable	20388.67	18.897
Suitable	4.94	0.005
Total	107896.09	100.000

Figure 43 Ranking of suitable sites considering geological attributes

Source: PKCP project, UDD, 2018

5.2.2 Ranking Suitable Areas based on Hydro-geological Attributes

Most natural processes rely on water. It shapes the landscape by transporting silt and solutes to lakes and oceans. 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 groundwater for human use. To rank the water quality, WQI has been taken into account and to rank the availability of freshwater findings from slug tests and water head depth in the dry season 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. 20.13% of the land is hydro-geologically suitable for development.

Table 35 Geological Suitability Area of Galachipa Upazila

Hydrological Suitability	**Area in Acre**	**Percentage (%)**
Less Suitable	86178.00	79.87
Suitable	21718.09	20.13
Total	107896.09	100.00

Source: PKCP project, UDD, 2018

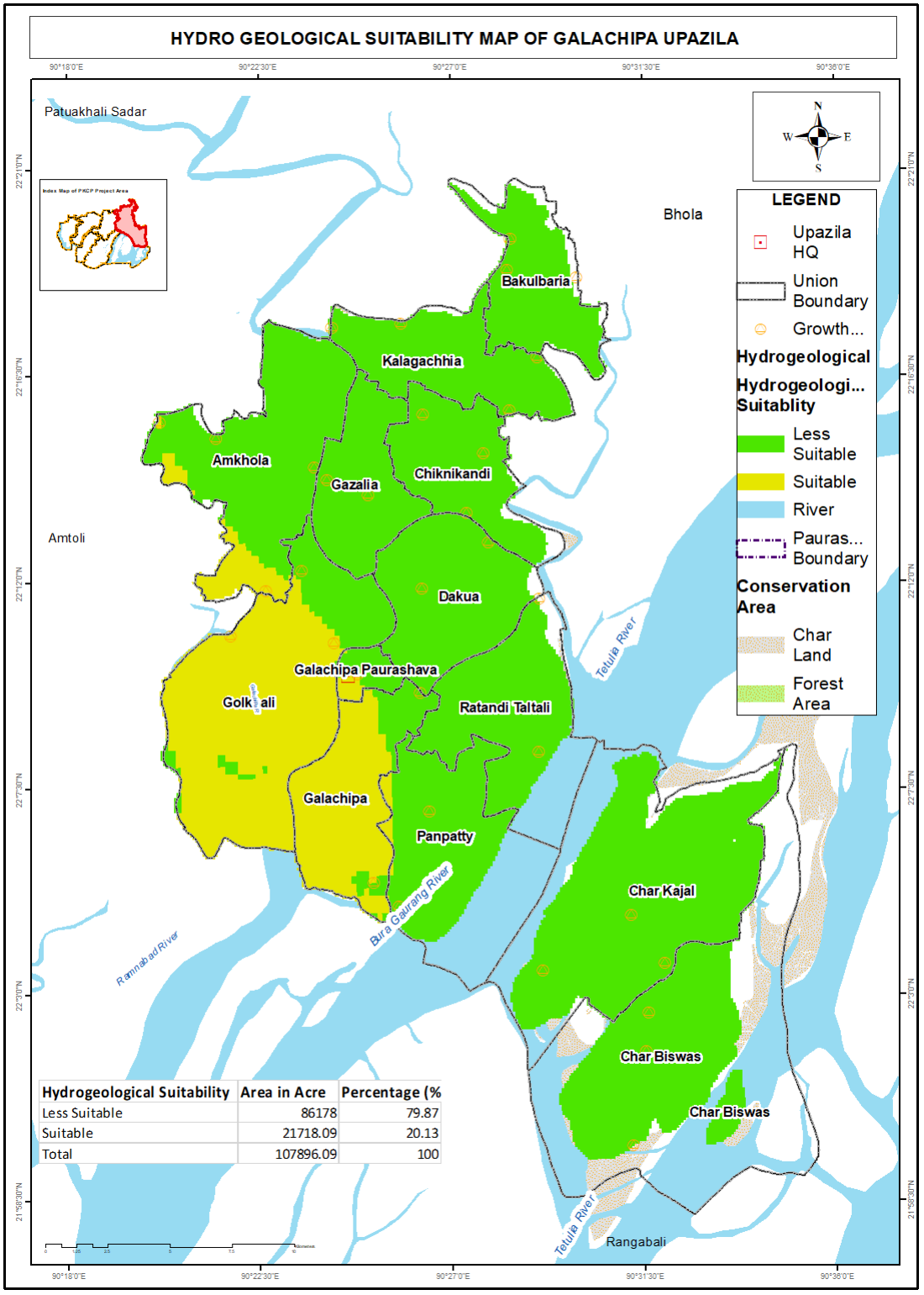


Figure 44 Ranking of suitable sites considering quality and quantity of ground water

Source: PKCP project, UDD, 2018

5.2.3 Ranking Growth Centers considering existing function

Numeric range has been explored to classify growth centers into rural trade and commerce centre, higher order rural service centre, middle order rural service centre and lower order rural service canter based on score. Public services such school, college, health centres etc. will be encouraged within the different level service centres and major economic activities will be encouraged within rural trade and commerce centre.

5.2.3.1 Growth center hierarchy has been determined taking into account functional and geographicalrelevance, as recommended in "My Village, My Town."

5.2.3.2 In Galachipa, There are 5 (Amkhola Bazar, Panpatti Center Bazar, Patagonia Bazar, Chiknikandi bazar) Trade and Commerce Centers, 5 1st Order Strategic Service Centers, 6 2ndOrder Strategic Service Centers, 8 3rd Order Strategic Service Centers in Galachipa Upazila. Proposed urban facilities varies to each centers.

The statistics of Normal Distribution has given below:

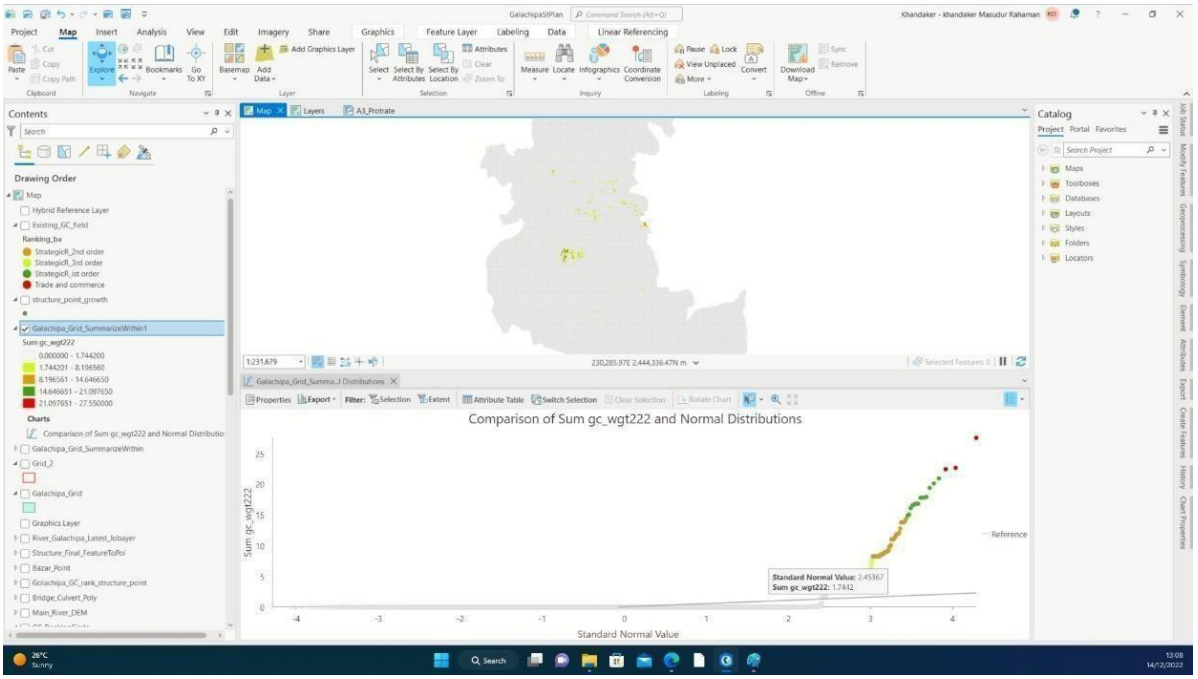


Figure 45 Statistical Analysis of Galachipa Growth Center

Source: PKCP project, UDD, 2018

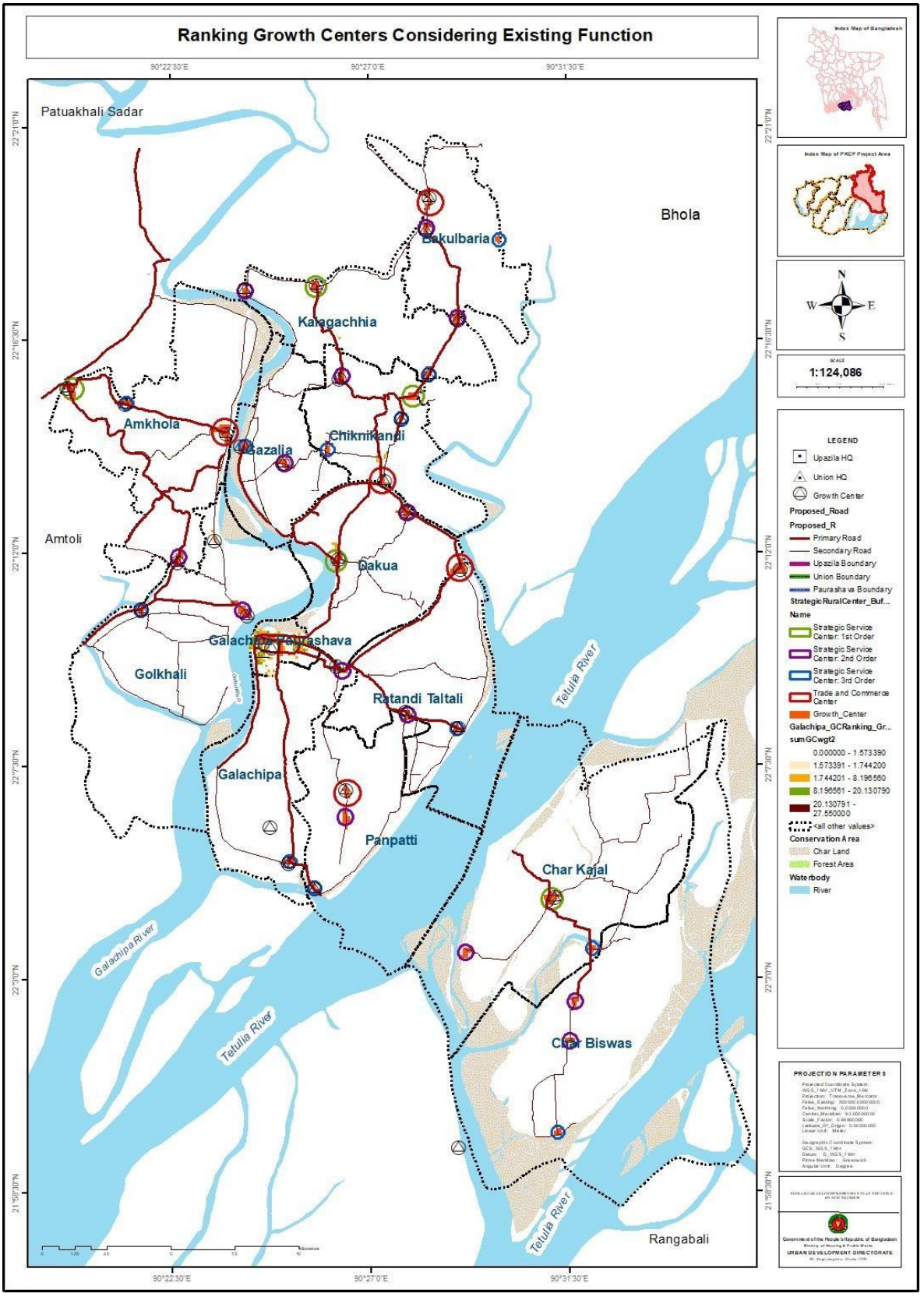


Figure 46 Ranking of growth centres considering existing function

Source: PKCP project, UDD, 2018

5.3 Suitable Site Ranking- Findings From MulticriteriaAnalysis

5.3.1 Ranking Suitable Areas for Infrastructure Development

Infrastructures are the basic facilities and equipment required to produce a product or deliver a service. Infrastructures should supply the necessary conditions and equipment to carry out the necessary business tasks and operations, as well as aid in reaching the intended product and service conformance. As a result, it is intimately linked to the product or service and has a direct bearing on its quality. 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.

Dakua, Chiknikandi, Ratandi Taltali, Panpatty, Char Kajal is not suitable for infrastructure suitable which is about 20%. Apart from that, .50% is suitable for Gazalia, Galachipa Union of Galachipa Upazila

Table 36 Area percentage of ranks and other land uses

Ranks	***Percentage***
Highly Less Suitable	2.09
Less Suitable	19.58
Moderately Suitable	16.40
Suitable	0.50
Waterbody	15.38
Forest	4.43
Agriculture	41.63
	100.00

Source: PKCP project, UDD, 2018

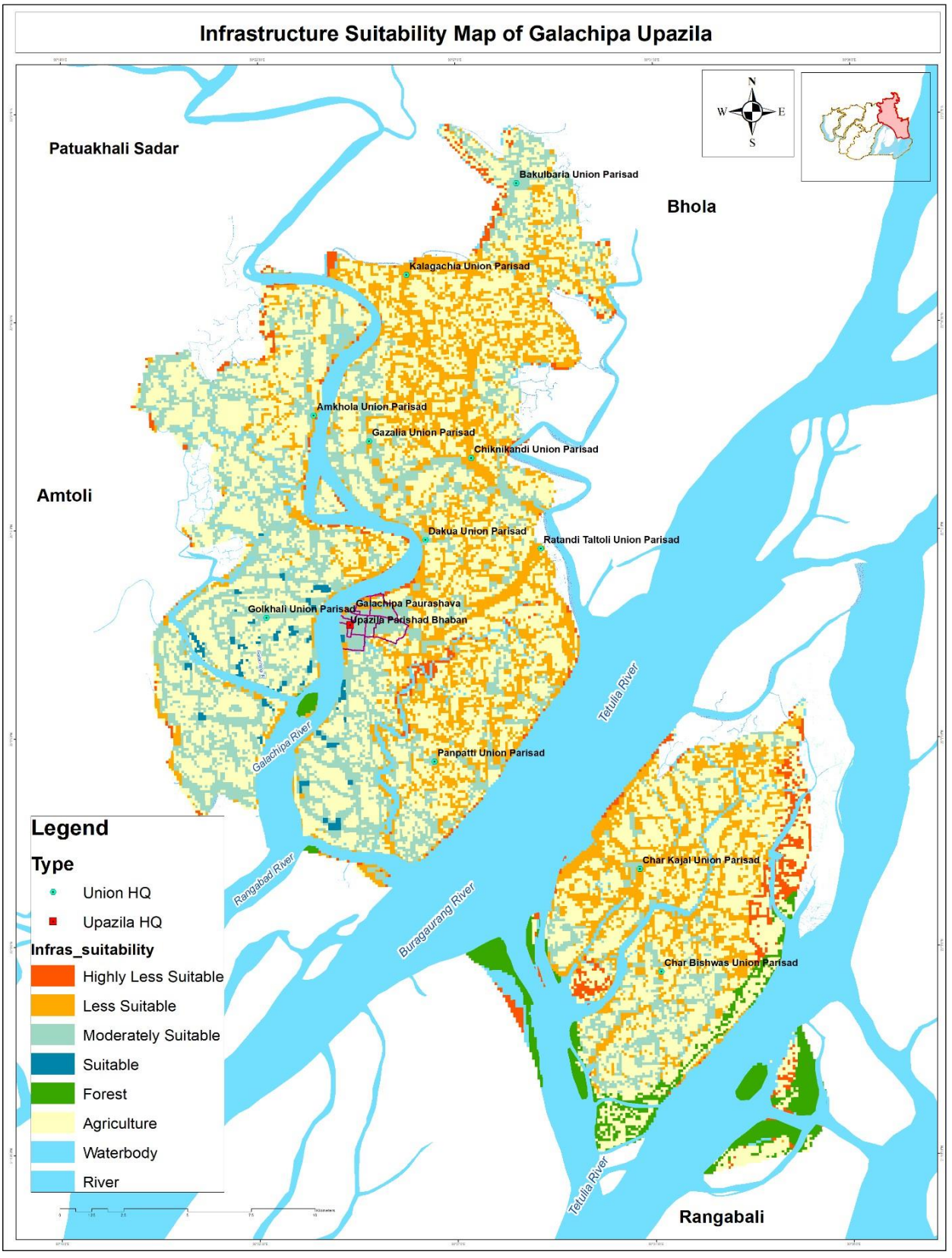


Figure 47 Ranking of Suitable sites for infrastructure development

Source: PKCP project, UDD, 2018

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. However, it comes with a slew of issues, including a scarcity of high-quality water and the threat of disaster. As a result, Weighted Average Method influences are: Geological attribute, Hydro-geology, Road Proximity, Elevation, Disaster risk. From analysis data reflect that the most suitable area of Galachipa Upazila for human settlement is 2.30% which is situated near Galachipa Paurashava, Haridebpur bazar.

Table 37 Area percentage of ranks and other land uses

Ranks	Percentage
Highly Less Suitable	**1.76**
Less Suitable	**13.15**
Moderately Suitable	**21.43**
Suitable	**2.30**
Waterbody	**15.30**
Forest	**4.43**
Agriculture	**41.63**
	100.00

Source: PKCP project, UDD, 2018

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. To rank suitable sites for infrastructure development influences are: geological attribute (15) of the upazila, Hydro-geology (25), Road Proximity (30), and Disaster risk (30) has been considered. From the analysis it has seen that 0.84% area considered as suitable which is situated near Amkhola Bazar.

Table 38 Area percentage of ranks and other land uses

Ranks	%
Highly Less Suitable	**2.72**
Less Suitable	**15.52**
Moderately Suitable	**20.12**
Suitable	**0.84**
Waterbody	**14.74**
Conservation Area	**4.43**
Agriculture	**41.63**
Total	**100.00**

Source: PKCP project, UDD, 2018

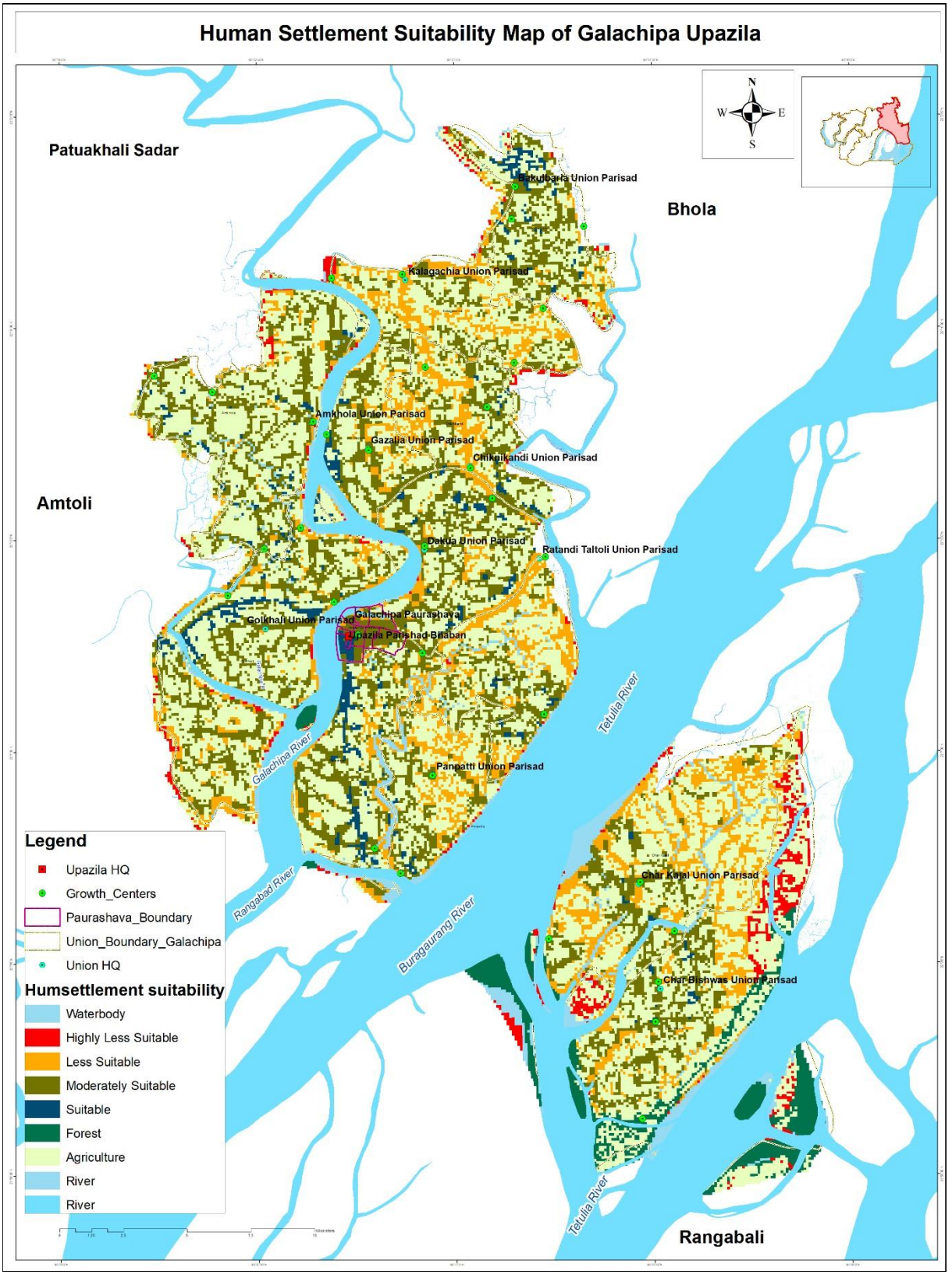


Figure 48 Ranking of suitable sites for Human Settlement *Source: PKCP project, UDD, 2018*

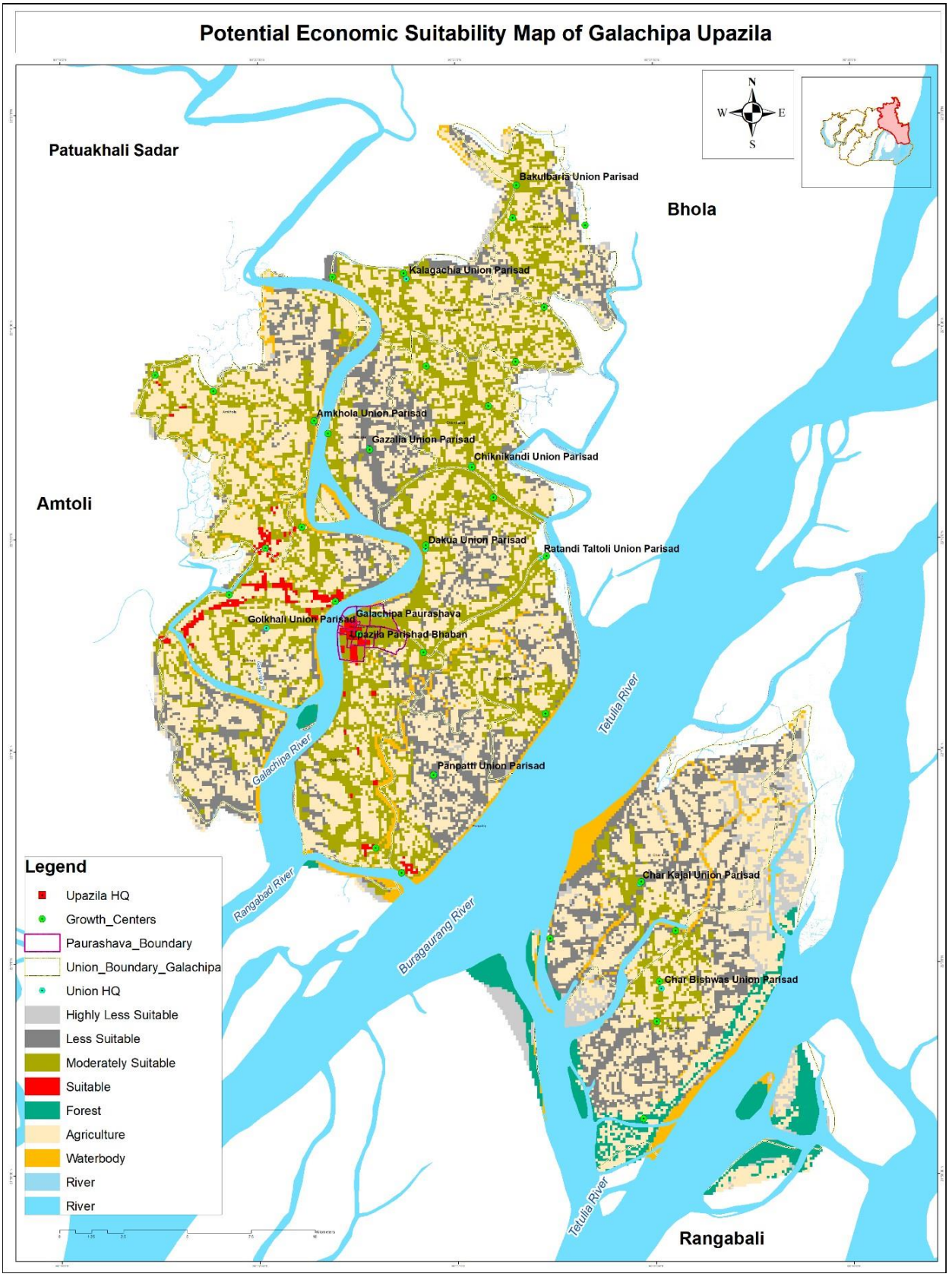


Figure 49 Ranking of suitable sites for potential economic region

Source: PKCP project, UDD, 2018

5.4 Directives From Regional Plan

From regional plan, some proposals are driven and integrate in to structure plan. From analysis, Galachipa was derived from necessary facilities and in structure plan these facilities has incorporated and that's why some zones are proposed as structure plan zones. Below key points are directives from regional plan:

- Conservation of forest resources and protect biodiversity through proposal of Conservation Zone
- Ensure sustainable management of natural resources through proposal of Conservation Zone
- Proposal of wind mills and solar plants to promote sustainable energy sources
- Construct polders and coastal green belt to prevent saline water intrusion
- Preference of temporary structures with local raw materials (like floating hotels, eco-resorts etc.)
- Promote eco-friendly water based transportation for tourists
- Promote employment generation through development of tourism sector

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 11 categories of zones selected in the Galachipa Upazila structure plan. The proposed zones are as following and are shown in structure plan map. It is to be understoodthat preparation of structure plan will only be needed in the Growth center area, as no new urban activities are going to be allowed in the Agriculture and Conservation Areas. The proposal of structure plan descriptions has been given below:

5.5.1 Plan zone definition

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 fruitplantations, and land used for natural grasses and livestock grazing. The permissible activities in the agricultural zone are: Vegetable Cultivation, Livestock, Horticulture, Dairy Farming, Cash Crop Cultivation, Botanical Garden, Aquaculture and Fisheries, Agricultural Shelter and Gazing. In structure plan zones, about 62905.29 acres' area preserved as agriculture.

Potential Urban Area

Urban areas are increasing rapidly across the globe. In 2010, over 0.5% of the earth's surface was covered by urban land. United Nations (2017a) project that around 68% of the total global population will live in urban areas by 2050. Additionally, research has shown that urban areas are expanding at twice the rate of population growth globally. Urban expansion or urbanizationis more intense and complex in the coastal areas.

Adjacent to Galachipa Paurashava areas can be recommend as future urban area for the development. It comprises the area of 556.41 acres. At the same time, this area is the centre pointof communication with other growth centre, hat-bazar and union.

Economic Region

Galachipa Upazila economy is primarily an agro based upazila. 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 agricultural commodities 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. About, 189.88 acres of land proposed as potential 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, kneeting factories, industrial classes 1, industrial classes 2, retail shops, restaurants, and rickshaw stands are all permitted activities in the potential economic zone.

Waterbody

A waterbody 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. About 27683.10 acres of land proposed aswaterbody.

Rural settlement

Rural settlement encompasses rural housing structures and surrounding vacant land and vegetation's- which is the second heights land use. 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 Pourashava 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.

Coastal Afforestation and Foreshore Area

Mangrove afforestation and tree plantation are very much beneficial for environment. Mangroves are a group of trees and shrubs that live in the coastal intertidal zone. These roots allow the trees to handle the daily rise and fall of tides, which means that most mangroves getflooded 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.

Galachipa Upazila is appropriate location for mangrove afforestation as it has huge char area. Bangladesh forest department has already planted mangrove most of the area of Galachipa Upazila. The Structure plan contain 250 m for coastal afforestation to protect from erosion and storm surge.

By stabilising coasts and creating a green belt, coastal afforestation attempts to improve climate-resilient ecosystems and livelihoods. The landmass is also successfully protected fromexcessive 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.

Conservation Zone

Conservation Zone covers char land and forest area of Galachipa Upazila Any deposit in a rivercourse or estuary that is surrounded by the waters of an ocean, sea, lake, or stream is referred to as a "char." Char refers to riverine sand and silt landmasses in Bengali. This is also a landmassthat may be seen in rivers and oceans for a certain amount of time each year. Living in the charsis risky and insecure since these areas are prone to violent and unexpected flooding as well as erosion and land loss. Vegetable cultivation, livestock, dairy farming, cash crop cultivation, agricultural shelter, and gazing fora set length of time in a year are all permitted activities in the char. A sizable area primarily covered in trees and vegetation. It does not included land that predominantly under agricultural use or other use. This could be natural made or man- made.

Circulation Network

It includes major circulation covering primary and secondary roads.

Trade and Commerce center

It is the centre of activities in the established of Galachipa Upazila having its service area in thewhole upazila area. This is the place for high density mixed used structure, public and private structure and services. It is mainly Amkhola Bazar, Panpati Center Bazar and Ulania bazar area of the Galachipa Upazila.

Strategic Service center-1st Order

This type of growth centre is the main retail, business and employment centre for its community. These are Kharizzama bazar, Tetutola Bazar, Char kajal Puran Bazar, and Chiknikandi Bazar.

Strategic Service center-2nd order

It has an economic activities and public gathering place for the local communityThe growth center analysis identify seven place as second order like Kalagachia Bazar, Kalaraja Bazar, Lamna Bazar, Adani Bazar, Bazar, Baila Bunia, Neta, Kachibunia and Mollar Bazar.

Strategic Service center- 3rd order

Centre to support the convenience of residents; designated community centre with considerationof accessibility by transportation, adjacency to other centres. The rest of the hat and bazar are categorizing as third order.

5.5.2 Structure plan of Galachipa Upazila

Agricultural lands are cultivated and cultivable lands that have to be protected for food safety of the country, it is about 47.46 % of the total upazila area; circulation network (0.60%) which includes primary and secondary roads; Conservation area Char area and Forest, covers 6.19 % of land of the upazila. Rural settlement (14.97%) encompasses rural housing structures and surrounding vacant land and vegetations- which is the second heights land use. Urban area covers 1.28% of the urpazila which includes denselydeveloped area named as Core Urban Area (0.50%) area which is pourashava area and Promotional urban area (0.43%), Coastal afforestation and foreshore covers 7.77 % area mainly proposed near river side. This structure plan has proposed 0.57 % land as economic zone. It is expected this zone will assist and encourage government and private investor to invest. Investment for industrial development will help to achieve the objective of the structure plan that is to enhance the residents' socioeconomic position.

Table 39 Percentage of area of proposed zones

Structure Plan Zones	Area (acre)	%
Agriculture	63123.86	44.46
Circulation Network	803.46	2.60
Coastal Afforestation and Foreshore Area	10337.68	7.77
Conservation Zone	8232.78	6.19
Core Urban Area	660.31	0.50
Economic Region	755.04	0.57
Potential Urban Area	576.41	0.43
Rural Settlement	19905.99	14.97
Strategic Service Center: 1st Order	152.75	0.11
Strategic Service Center: 2nd Order	406.32	0.31
Strategic Service Center: 3rd Order	234.89	0.18
Trade and Commerce Center	132.00	0.10
Waterbody	27683.20	20.81
Total	133004.69	100.00

Source: PKCP Project, UDD,2018

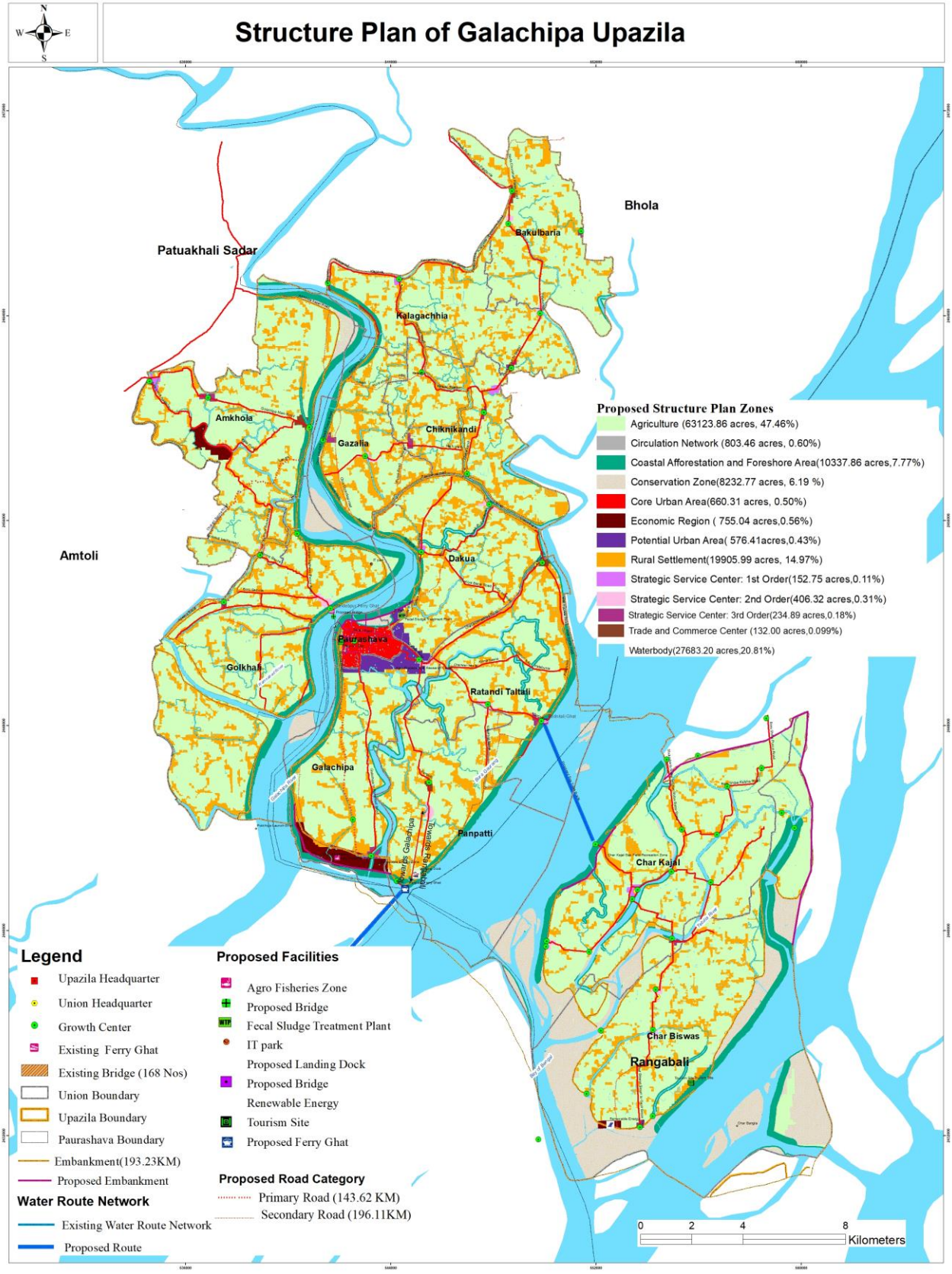


Figure 50 Structure Plan of Galachipa Upazila Source: PKCP Project, UDD,2018

Structure Plan Proposal

Proposed Road Network

From the existing data, it has seen that, the condition of roads are very poor, narrow. And maximumroads are katcha roads in Galachipa Upazila. And according to perspective plan, road proposals has given in ordet to connect growth centers from union to union and upazilato other upazilas.

Table 40 Proposal of Road Network

Proposed Class	**Proposed Width (ft)**	**PlanningDecision**
Primary Road	60-80	Widening
SecondaryRoad	40	Widening

Source: PKCP project, UDD, 2018

Table 41 Proposed Road Network

Road Network	Proposed Width
Primary Road (60 ft)	146.34 km
Secondary Road (40 ft)	196.11 km

Source: PKCP project, UDD, 2018

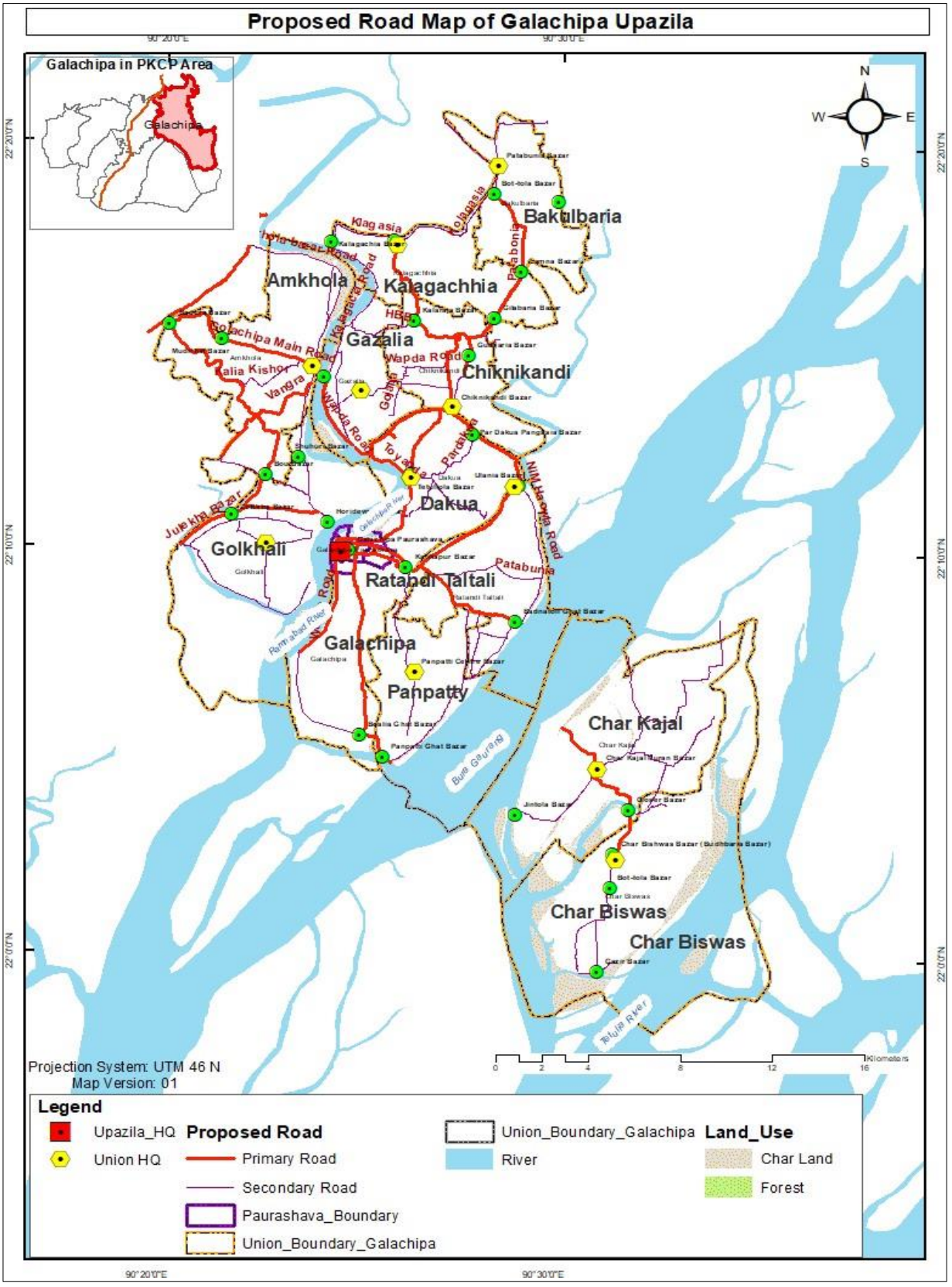


Figure 51 Proposed Road Network of Galachipa Upazila

Source: PKCP project, UDD, 2018

Proposal at a Galance

Structure proposals has given according to the requirement of upazilas people. From worshop, UNO, Upazila chairman proposed different facilities which are broad categories facilities whichwill help toimprove upazilas growth and economic development

Table 42 Structure plan proposals of Galachipa Upazila

Proposals Name	Quantity	Location
Zones		Overall Upazila
Potential Urban Area	1	Near Galachipa Paurashava
Potential Economic Sites	1	Near Mudirhat Bazar in Amkhola
GOVT Projects	1	Bangabandhu Uposohor
Tourist Site	4	Burir Char, Char Biswas, Galachipa Paurashava Embankment Side
Bridge	1	Connecting Horidebpur Bazar and Galachipa Paurashava
Boat Ghat / Landing Deck	1	Panpatti Launch Ghat
Fecal Sludge Treatment Plant	1	Galachipa paurashava (Near Bangabandhu Uposohor)
Energy Generation Sites	2	Wind Energy (Riverside of Char Karfarma), Solar Energy (Near Gazir Bazar)
Coastal Afforestation		250-meter green-belt
Foreshore Area		50 meter from River and 10 meter from canal
Road Network		349.05 Km (3.16 sqkm)
Landing Dock		Near Panpatty

Source: PKCP project, UDD, 2018

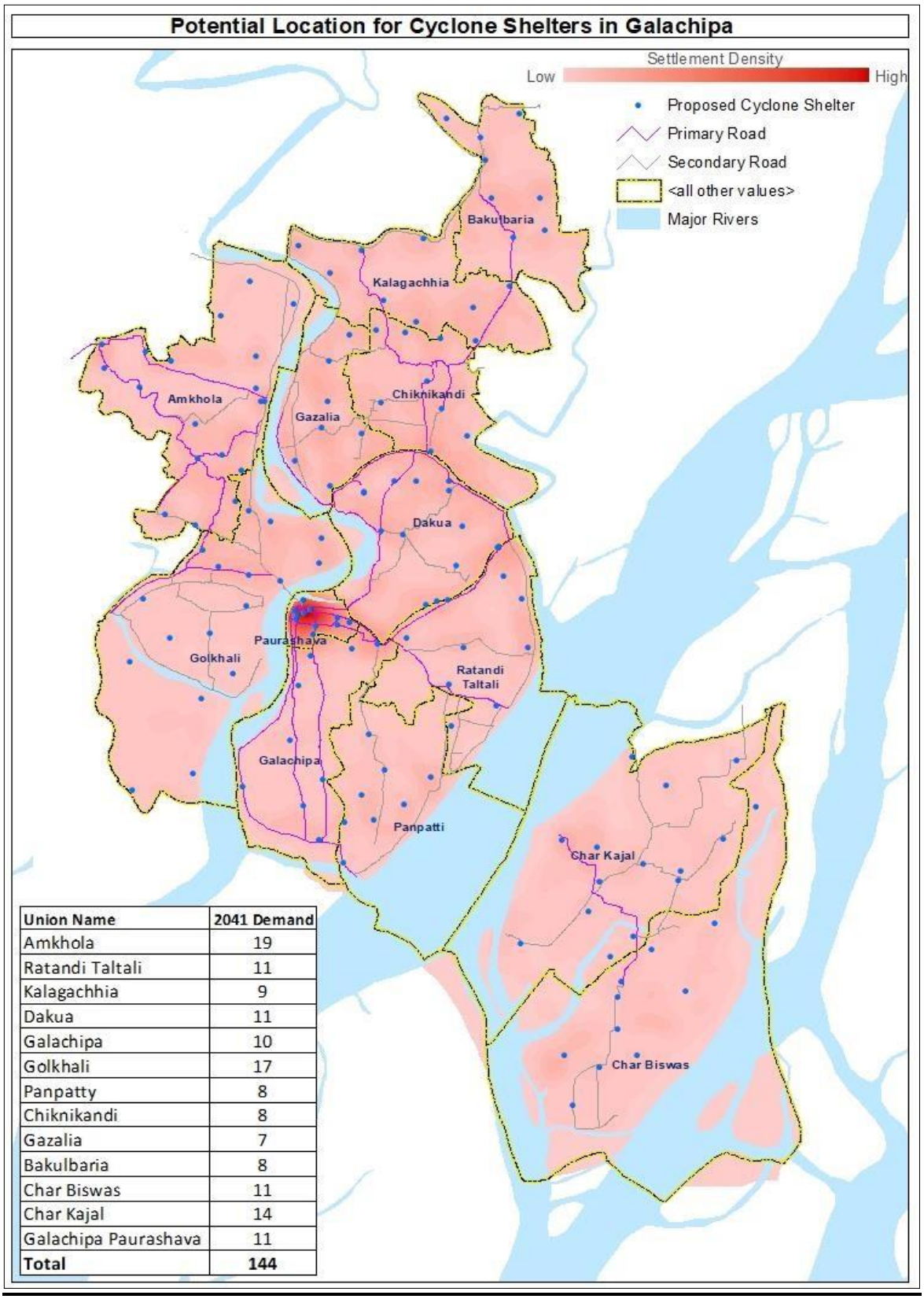
Specific Propsals

To enhance green energy supply, Large Scale Solar Plants has been proposed in areas largely exposedto solar power (mostly Char areas such as Char Biswas, Char Kajal, Galachipa Golkhali Gazalia

1. Emphasis has been given to Haridevpur as regional connectivity hub as it connectstheGalachipaPaurashava to Barisal Sadar via Patuakhali
2. Fish Processing Industrial zone has been proposed in Panpatti because of waterwayconnectivitywith major fish harvesting locations
3. To prevent river erosion, alongside the embankment a 250 meter green belt (treeplantation)hasbeen proposed as a sustainable approach
4. The Badnatali Charkajal ferry service has been proposed to be modernized
5. In erosion prone areas, plantation has been proposed within the river Canalforshore areawhichwill act as a green belt and prevent erosion
6. An agricultural research institute has been proposed in Galachipa Paurashava torevolutionizecultivation of local varieties
7. High tech IT Park has been proposed in Galachipa Paurashava to generate employmentOpportunities

Proposed Cyclone Center

As Galachipa Upazila is surrounded by river, the area has a great threat in the case of life and property loss due to cyclone hazard. On the basis of the local peoples' requirements, location of thepresent cyclone shelters, structure density, disaster risk and future population several cyclone shelters are proposed in different places all over the Upazila. The proposed cyclone shelters are shown in the below map.



Union Name	2041 Demand
Amkhola	19
Ratandi Taltali	11
Kalagachhia	9
Dakua	11
Galachipa	10
Golkhali	17
Panpatty	8
Chiknikandi	8
Gazalia	7
Bakulbaria	8
Char Biswas	11
Char Kajal	14
Galachipa Paurashava	11
Total	**144**

Figure 52 Location of the proposed Cyclone Shelters *Source: PKCP Project, UDD, 2018*

Structure Plan Recommendations

The Structure Plan identified some strategic areas where future development will take place andprovided 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 12 categories of zones selected in Galachipa Upazila structure plan. The proposed zones are as following and are shown in structure plan map. It is to be understood that preparation of structure plan will be needed in the Growth center area, as no new urban activitiesare going to be allowed in the Agriculture and Conservation Areas. The proposal of structure plan descriptions has been given below:

Urban Core Area

As there is an existing paurashava in Galachipa Upazila. So, core urban area has been proposed in paurashava. About 660.31 acre is proposed for core urban area

Potential Urban Area

From Galachipa Paurashava Boundary to Kakchira Bazar and some parts of Galachipa Union are identified as potential future urban area. As there is a proposed residential area called bangabandhu uposohor which is in the Galachipa Paurashava and some parts is in the Dakua Union, So, these areas are considered as potential future urban area. The structure plan recommends the area as future urban area for the development. It comprises the area of 576.41acres. At the same time, these areas are in the center point of communication with other growth center, hat-bazar and union.

Renewable Energy

A reliable, affordable and secure supply of energy is important for socio-economic development. As a country of acute power crisis Bangladesh is now looking forward to develop its renewable energy sources in addition to its traditional sources of fossil fuel. It has very limited non-renewable energy sources of its own but it's endowed with renewable energy sources like wind and solar insolation. Renewable energy is energy that comesfrom a source that won't run out. They are natural and self-replenishing, and usually have a low- or zero-carbon footprint. Examples of renewable energy sources include wind power, solar power. In Galachipa Upazila, below renewable energy sources are proposed:

A. Solar energy.

B. Wind energy.

Solar home system is a success story in Bangladesh and day by day its popularity is increasing in the rural areas, especially in the remote regions. Since Galachipa Upazila is connected with rivers, solar energy is a good choice for this area. In Galachipa union, energy plant site has proposed near Boalia Ghat Bazar.

Potential Economic Region

Galachipa 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 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 agricultural commodities 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 labour intensity characteristic of high value agricultural production, it also provides an opportunity to generate rural employment and raise rural incomes. The main products of Galachipa Upazila is beetle, 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. Near Mudirhat Bazar in Amkhola, potential economic region has proposed. About 189.88 acres area proposed as potential economic region.

Agro-fisheries Zone

Local people catch fish from sea and river during Rainy season. 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 in char karpharma area in Galachipa Union near panpatty and Boalia ghat and is place of abundant supply of fisheries and agricultural products. For thisreason, the structure plan recommends to develop the place as a hub of agro-fisheries area. According to the workshop on divisional agro fisheries zone is proposed in Char karpharma near Haridebpur Ghat

Growth Center

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 growth center 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 like Amkhola and Galachipa paurashava etc. so as to form a functional relationship with these areas.

Trade and Commerce center

It is the centre of activities in the established of Galachipa 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 Amkhola Bazar, Panpati Center Bazar and Ulania bazar area of the Galachipa Upazila. The following facilities can be developed in the Trade and Commerce center.

A. Commerce and Shopping
B. Open Space and Recreation
C. Miscellaneous
D. Utilities
E. Transportation

Strategic Service center-1st Order

This type of growth centre is the main retail, business and employment centre 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. These are Kharizzama bazar, Tetutola Bazar, Char kajal Puran Bazar, and Chiknikandi Bazar.This is the major facilities which have the potentiality for development.

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 identify seven place as second order like Kalagachia Bazar, Kalaraja Bazar, Lamna Bazar, Adani Bazar, Bazar, Baila Bunia, Neta, Kachibunia and Mollar Bazar. The second order service center include the following facilities-

A. Community Facilities
B. Health
C. Education
D. Transportation
E. Open Space and Recreation
F. Residential
G. Miscellaneous
H. Utilities

Strategic Service centre- 3rd order

Centre to support the convenience of residents; designated community centre with consideration of accessibility by transportation, adjacency to other centres. The rest of the hat and bazar are categorizing as third order and include the following categories service.

Coastal Afforestation

Mangrove afforestation and tree plantation are very much beneficial for environment. Mangroves are a group of trees and shrubs that live in the coastal intertidal zone. These roots allow the trees to handle the daily rise and fall of tides, which means that most mangroves 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.Bangladesh forest department has already planted mangrove most of the area of Galachipa

Improvement of Existing Road and Embankment

Bangladesh Water Development Board (BWDB) built coastal embankments along the coast of the Galachipa Upazila for the safety of the people and their property against natural disasters in the early 1970s.Part of the embankment about 350 km embankment is within the study area. The present condition of this embankment is very poor even most of the part is not suitable for walking. 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.
Galachipa Upazila is isolated area of Bangladesh.Only Ferry, and Boat is the medium of communication with mainland. There are well connected internal road network among the union. Most of the road has widening proposal in the plan.

Water Route Network

The river network of Galachipa Upazila as the most important transport artery in the isolated areas communication sector plays a vital role in their daily life. For the betterment of waterways communication system, the structure plan recommends sea truck route from Badnatali Ghat to Char kajal Launch Ghat and also a water route towards Koralia proposed to set up the easy network among local people.

Ferry Ghat and Bridge

Communication is time consuming and difficult in the Galachipa Upazila as the area is cut off from mainland. To ease travelling, their need to introduce new ferries and modern sea truck-cum-ferry services on Boalia and Panpatty routes.
Upazila. Mangrove afforestation is recommended in the suitable location. The proposed mangrove afforestation location is shown in Structure Plan. The recommended area for new mangrove plantation is about 7198 acres. This area is along the bank of the rivea and coast of the sea. Structure plan contain 250 m for coastal afforestation to protect from erosin and storm surge.

DEVELOPMENT CONDITIONS/RESTRICTIONS/PERMISSION TO BE APPLIED FOR THE DEVELOPMENT OF A PARTICULAR AREA- WHEREREQUIRED

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 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 landuses 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 43 Land use Control Table

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

Facilities	Agriculture Zone	Coastal Afforestation and Foreshore Area	Conservation Zone	Circulation Network	Core Urban Area	Potential Urban Area	Urban Fringe Area	Rural Settlement	Economic Region/ Industrial Zone	Trade and Commerce Center	Strategic Rural Center Zone-1st Order	Strategic Rural Center Zone-2nd Order	Strategic Rural Center Zone-3rd Order	Waterbody
Cemetaries/ Graveyard	N	N	N	N	P	P	P	P	N	N	N	N	N	N
Cinema Hall	N	N	N	N	C	C	C	N	N	N	N	N	N	N
Clinics/ Medical	N	N	N	N	P	P	P	P	P	P	P	P	N	N
Clubs, Private	N	N	N	N	N	N	N	N	C	P	C	C	N	N
Colleges/Universities	N	N	N	N	P	P	P	N	N	P	N	N	N	N
Convention Center	N	N	N	N	P	P	P	N	P	P	C	N	N	N
Communication Service Facilities	N	N	N	P	P	P	P	C	P	P	P	P	P	N
Communication Tower with Height	N	N	N	N	C	C	C	C	P	P	P	P	P	N
Community Center	N	N	N	N	P	P	P	N	P	P	P	P	P	N
Cottage Industry	N	N	N	N	P	P	P	N	P	N	P	P	P	N
Cultural Exhibits & Library	N	N	N	N	C	C	C	C	C	C	C	C	C	N
Cyber Café/IT Center	N	N	N	N	P	P	P	N	P	P	P	P	P	N
Dairy Farming	P	C	C	N	P	P	P	P	P	P	P	P	P	N
Deep Tubewell	C	N	N	N	P	P	P	P	P	N	P	P	P	N
Diagonistic Centres	N	N	N	N	P	P	P	P	P	P	P	P	P	N
Docks & Jetties	C	N	N	N	P	P	P	N	P	P	C	C	C	P
Dormitory / NGO Rest House	N	N	N	N	P	P	P	N	P	P	P	P	P	N
Bakery	N	N	N	N	P	P	P	C	P	P	P	P	P	N
Dwellings, Farm	C	N	N	N	N	P	P	C	P	P	P	P	P	N
Dwellings,Minimal Housing	N	N	N	N	P	P	P	P	N	N	N	N	N	N
Dwellings,Single/ MultiFamily	N	N	N	N	P	P	P	P	P	P	P	P	P	N
Educational Facilities	N	N	N	N	P	P	P	P	P	P	P	P	P	N
Electric Sub Station	N	N	N	N	P	P	P	P	P	P	P	P	P	N
Emergency Shelter	C	N	N	N	P	P	P	P	P	P	P	P	P	N
Explosive Manufacture & Storage	N	N	N	N	N	N	N	N	P	N	N	N	N	N
Fire Station	N	N	N	N	P	P	P	N	P	P	P	P	P	N
Food Kiosk	N	N	N	N	P	P	P	P	P	P	P	P	P	N

Facilities	Agriculture Zone	Coastal Afforestation and Foreshore Area	Conservation Zone	Circulation Network	Core Urban Area	Potential Urban Area	Urban Fringe Area	Rural Settlement	Economic Region/ Industrial Zone	Trade and Commerce Center	Strategic Rural Center Zone-1st Order	Strategic Rural Center Zone-2nd Order	Strategic Rural Center Zone-3rd Order	Waterbody
Flood Management Structures	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Freight Transport Facilities	N	N	N	N	P	P	P	C	P	P	P	P	P	N
Garages/ Workshops	N	N	N	N	P	P	P	N	P	P	P	P	P	N
Garments & Kneeting Factory	N	N	N	N	C	P	P	N	P	P	P	P	P	N
Golf Courses & Golf Club	N	N	N	N	C	C	C	N	P	P	P	P	P	N
Government Office / Guest House	N	N	N	N	P	C	C	N	P	P	P	P	P	N
Green Belt/ Green Space	N	P	P	P	P	P	P	P	C	C	C	C	C	N
Hatchery	P	N	N	N	N	P	P	P	P	P	P	P	P	N
Health Facilities	N	N	N	N	P	P	P	P	P	P	P	P	P	N
High School	N	N	N	N	P	P	P	N	N	P	P	P	P	N
Horticulture	P	N	N	N	N	P	P	P	P	P	P	P	P	N
Hospitals/ Health Centers	N	N	N	N	P	P	P	N	P	P	P	P	P	N
Hotel Guest House	N	N	N	N	C	C	C	N	P	P	P	P	P	N
Hotel International Class	N	N	N	N	C	C	C	N	P	P	P	P	P	N
Husking/ Grinding(Rice, Wheat, Pulse)	N	N	N	N	P	P	P	P	P	P	P	P	P	N
Industrial Class 1	N	N	N	N	P	P	P	N	P	N	N	N	N	N
Industrial Class 2	N	N	N	N	P	P	P	N	P	N	N	N	N	N
Institutions	N	N	N	N	C	C	C	N	N	P	P	P	P	N
Irrigation Facilities (Flood Wall/ Canal)	C	N	N	N	C	C	C	C	C	C	C	C	C	P
Livestock	C	C	N	N	P	P	P	P	P	P	P	P	P	N
Major Development	N	N	N	N	P	P	P	N	P	C	C	C	C	N
Multi stored Car park	N	N	N	N	C	C	C	N	C	C	C	C	C	N
Nursery School	N	N	N	N	C	C	C	N	N	N	P	P	P	N
Offices/ Services	N	N	N	N	C	C	C	N	P	P	P	P	P	N
Open Theatre	N	N	N	N	C	C	C	N	P	P	P	P	P	N
Orphanage	N	N	N	N	P	P	P	N	P	P	P	P	P	N
Outdoor Religious Events	N	N	N	N	P	P	P	C	P	P	P	P	P	N

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

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

CHAPTER 6: PLAN IMPLEMENTATION

6.1 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.

6.2 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.

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

6.4 Institutional Strengthening

In Bangladesh, the central Government Grant is an important source of income for the Paurashavas. Such grant supplements the income of a Paurashava 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)

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.

6.4.1 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

6.5 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.

6.5.1 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.

6.5.2 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.

6.5.3 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.

6.5.4 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:

6.5.5 Community-based organizations (CBOs)

These organizations are formed when neighborhood residents get organized and join forces to improve local security, housing quality, basic utilities, social services and the neighborhood 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.

6.5.6 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.

6.5.7 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.

6.6 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.

6.7 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. Urban Development Directorate (UDD) being the custodian of this plan should always monitor 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. The Structure plan documents should be reviewed periodically once in every 10 years. The aim of the review will be to analyse the status of implementation of plan provisions and the changing physical growth pattern. The level of infrastructure development in terms of population and economic growth in particular needs to be assessed for actions during the remaining period of the plan period. For regular updating and changes and plan implementation monitoring, the Upazila should immediately set up a planning section with planners and staff.

6.8 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 by 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.

6.9 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

6.10 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.

6.11 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

6.12 Resource Mobilization for Development

Implementation of development projects proposed in the plan will be a challenging task as they will require huge amount 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.

6.13 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 7: CONCLUSION

7.1 Concluding Remarks

The Structure Plan study summarized the general state of affairs, significant planning concerns, and anticipated population growth in the Upazila. 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 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.

References

Andrews, R. B. (1953). Mechanics of the Urban Economic Base: Historical Development of the Base Concept. In R. B. Andrews, Land Economics (Vol. 2, pp. 161-167). University of Wisconsin Press. Retrieved from http://www.jstor.org/stable/3144408

Bangladesh National Portal. (2022, 3 3). Retrieved from http://Galachipa.patuakhali.gov.bd/

BBS. (2011). Dhaka: Bangladesh Bureau of Statistics.

Indiana Department of Workforce Development. (2006). In Context: Indiana's Workforce and Economy. Indiana. Retrieved November 2017

Isserman, A. M. (1977). The Location Quotient Approach to Estimating Regional Economic Impacts. Journal of the American Institute of Planners, 43(1). doi:10.1080/01944367708977758

Leigh, R. (1970, May). The Use of Location Quotients in Urban Economic Base Studies. Land Economics, 46(2), 202-205.

Siegel, R. A. (1966). The Economic Base and Multiplier Analysis.

UN. (2015, 9 8). INternational Decade for Action 'WATER FOR LIFE' 2005-2015. Retrieved 07 25, 2021, from UN WATER: https://www.un.org/

APPENDIX-A

Water Quality of Major Rivers

Table-A1: Status of Physical and Aggregate Properties

Parameters	Unit	Galachipa-Ramnabad	Tetulia	BD Standards	Remarks
Temp.	^{0}C	31	30	20-30	Within the range
pH	Value	7.4	7.2	6.5-8.5	Within the range
TDS	mg/l	90	340	1000	Complied the standard
EC	µS/cm	180	700	1200	Complied the standard
Salinity	ppt	0.1	0.1	0	Complied the standard
TSS	mg/l	13	22	50-150	Within the range
Turbidity	NTU	94	60	50	Higher than the standard
Alkalinity	mg/l	18	20	20-120	Within the range
Hardness	mg/l	210	200	200-500	Within the range

Source: CEGIS Survey, May 2022

Table-A2: Status of Inorganic Non-metallic Constituents

Parameters	Unit	Galachipa-Ramnabad	Tetulia	BD Standards/WHO*	Remarks
Chloride	mg/l	20	22	250	Complied the standard
Sodium	mg/l	35	20	200*	Complied the standard
Potassium	mg/l	4	5	12*	Complied the standard
Nitrate	mg/l	6.3	1.5	2.5	Higher than the standard
Phosphate	mg/l	0.3	0.6	0.5	Complied the standard
Sulphate	mg/l	18	40	400	Complied the standard

Source: CEGIS Survey, May 2022

Table-A3: Status of Aggregate Organic Constituents

Parameters	Unit	Galachipa-Ramnabad	Tetulia	BD Standards	Remarks
DO	mg/l	6	6	5 or more	Within the standard
BOD	mg/l	1	4	Less than 10	Complied the standard
COD	mg/l	4	11	Less than 25	Complied the standard

Source: CEGIS Survey, May 2022

Table-A4:Status of Metal Constituents

Parameters	Unit	Galachipa-Ramnabad	Tetulia	EPR'86, India	Remarks

Iron	mg/l	1.0	1.0	0.1	Higher than the standard
Zinc	mg/l	0.03	0.03	2	Complied the standard
Manganese	mg/l	0.07	0.24	3	Complied the standard
Lead	mg/l	0.005	0.005	2	Complied the standard
Chromium	mg/l	0.012	0.010	0.05 (BD, Drinking)	Complied the standard
Nickel	mg/l	0.030	0.069	5	Complied the standard
Copper	mg/l	0.030	0.011	1 (BD, Drinking)	Complied the standard
Cadmium	mg/l	0.00015	0.013	0.005 (BD, Drinking)	Complied the standard

Source: CEGIS Survey, May 2022

Table-A6:Status of Oil & Grease and Phenol

Parameters	Unit	Galachipa-Ramnabad	Tetulia	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-A7: Soil pH, EC and Soil Texture of the sampling sites

Sampling site	Soil pH	Electrical conductivity(EC) (dS/m)	Soil Texture			
			Sand	Silt	Clay	Type
Agricultural field	6.3	1.74	39.46	38.34	22.2	Loam
	4.5	1.34	43.61	36.25	20.14	Loam
	8.1	5.26	44.9	44.89	10.2	Loam
	7.7	2.24	41.47	44.4	14.13	Loam
	5.0	6.63	48.15	40.61	18.27	Loam
	8.0	4.30	55.38	34.48	10.14	Sandy Loam
Urban area	7.6	4.69	43.55	28.22	28.23	Clay Loam
	5.5	1.35	44.79	38.85	16.36	Loam
Peri urban area	7.3	5.29	48.51	39.13	12.36	Loam
	8.0	5.23	53.25	36.58	10.16	Sandy Loam
	4.1	0.78	47.1	42.73	10.17	Loam
Mangrove forest	7.3	1.47	57.19	32.62	10.19	Sandy Loam

Source: CEGIS field visit, May 2022

Table-A8: Air Quality of the Study Area

Unit	PM_{10} $\mu g/m^3$	$PM_{2.2}$ $\mu g/m^3$	SO_2 $\mu g/m^3$	NO_x $\mu g/m^3$	CO mg/m^3	VOC $\mu g/m^3$
Averaging Period	24h	24h	24h	24h	8h	-
AAQ-1	82.6	41.6	6.8	32.6	0.75	<4.2
AAQ-2	79.6	39.6	6.2	30.2	0.65	<4.2
AAQ-3	86.2	44.6	7.3	35.6	0.56	<4.2
AAQ-4	75.6	40.8	6.5	32.5	0.65	<4.2

AAQ-5	78.4	42.5	6.2	28.2	0.72	<4.2
AAQ-6	77.3	39.2	<6.0	26.9	0.68	<4.2
AAQ-7	79.4	38.6	<6.0	26.4	0.62	<4.2
AAQ-8	80.7	40.8	6.5	30.2	0.66	<4.2
AAQ-9	83.9	45.2	6.3	30.8	0.73	<4.2
AAQ-10	82.7	42.7	6.2	29.8	0.78	<4.2
AAQ-11	81.2	41.3	6.4	29.7	0.72	<4.2
AAQ-12	86.3	44.7	7.4	36.5	0.69	<4.2
Standard (National)	150	65	80	80 (Annual)	5 (8 Hr)	-
Standard (International)	150	75	125	200 (1Hr)	-	-

Table-A9: Noise Quality of Different Land Use Types in the Study Area

Galachipa					
Location ID	**Zone**	**Morning (dB)**	**Std. (Noise control rules, 2006) (dB)**	**Evening (dB)**	**Std. (Noise control rules, 2006) (dB)**
NL-1	Mixed	82	60	76	50
NL-2	Commercial	57	70	68	60

Source: CEGIS Survey, August - September, 2022

APPENDIX-B

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

This table is an updated table for the Final SEMP, and will require to be further developed, and kept under rolling review throughout the next 20 years.

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 good[1]	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 solid and liquid waste (urban & industrial)	4	Capacity of recycling plants in the PKCP Area	Very good/Good/ Moderate / Poor/ Very poor[2]	0	2022	Local consultations	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	
			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	
	3	Reduce all forms of pollution (air, , water, noise etc.)	6	Dry season water quality (nitrate) in the Galachipa river (Horidebpur Bazar near Ferry ghat)	mg/litre	2.0-3.0	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, NRM, DoE, email: dirnrm@doe.gov.bd, Cell: 01718114188 2. Director, Barishal Divisional Office, DoE,	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.

[2]**Very 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.

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…)
			7	Dry season water quality (phosphate) in the Galachipa river (Horidebpur Bazar near Ferry ghat)	mg/litre	0.5-1.0	2022	CEGIS 2022	Same as above	Same as above	Same as above	Annually	
			8	Dry season water quality (BOD) in the Galachipa river (Horidebpur Bazar near Ferry ghat)	mg/litre	1.0	2022	CEGIS 2022	Same as above	Same as above	Same as above	Annually	
			16	Dry season water quality (phosphate) at Tetulia river (Bonnatoli Kheya Ghat)	mg/litre	0.5	2022	CEGIS 2022	Same as above	Same as above	Same as above	Annually	
			17	Dry season water quality (BOD) at Tetulia river (Bonnatoli Kheya Ghat)	mg/litre	3-4	2022	CEGIS 2022	Same as above	Same as above	Same as above	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 (floods, storm surges, etc.)	26	Storm surge inundation	% of PK Region	Cyclone Sidr: 10	2007	WB, 2011	Ministry of Disaster Management and Relief (MoDMR) Secretary, MoDMR email: secretary@modmr.gov.bd Phone: 9540877	Department of Disaster Management (DDM) Director General, DDM email: dg@ddm.gov.bd, Phone: 8835495	DDM 1. Deputy Director (Research) Disaster Management Division, email: nurulhaquechowdhury@gmail.com, Mobile: 01711399633	Event based – the data are only collected after the event	Storm surge inundation
			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	As above	% of Region:	52.5	As	As above	As above	As above	As above	As above	As above

[3]Bangladesh standard (Environmental Conservation Rule-ECR-1997) for Silent zone (45 dBA)
[4]Discontinuously 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…)
			(b)		5PPT in SW		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
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)	PPP[6] 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.bdPhone (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	
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 &	RPTI 1. Regional Population Training Institute (RPTI), Barishal 2. Director, Census/computer Wing, Bangladesh Bureau of Statistics (BBS), email: mahfuz.bablu@gmail.com, phone:	Annually	

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.

[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…)
										National Institute of Population Research and Training (NIPORT) Director General, NIPORT, email: dg.niport1977@gmail.com, phone: 9662495	02-55007331		
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	
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
Food	11	Improve food security	39 (a)	Status of food security - as measured by availability,	Very good[7]	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	

[7]Very 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

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…)
		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, Development-5, Power Division Mobile: +8801817508251 Email: dev-5@pd.gov.bd	25	
	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	

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…)
Infrastructure, transportation and communications	15	Improve connection of communities, and improve access to infrastructure, services and facilities	44	Number of Educational Institute (Primary School, Secondary school, College, Technical and Vocational institutes)	Nos	1230	2021	UDD, 2021	Ministry of Education (MoEDU) Secretary, MoEDU, email: Secretary@moedu.gov.bd Phone: 9576679 Ministry of Primary and Mass Education (MoPME) Secretary, MoPME, email: scy@mopme.gov.bd Phone: +88-02-55100484 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		Standing figure until new railway is built Update figure	
			45	Density of roads in PK Region	Km roads per 100 Km^2	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 Lighterage/Bulkhead ships handled at Payra Port	Nos	825	2022	PPA website	MoS	Traffic Department, Payra 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.	

[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…)
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	
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 1. 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 1. Director General dg@bwdb.gov.bd, dg.bwdb.bd@gmail.com Phone: 01318234567	Bangladesh Water Development Board (relevant district office)	Daily	

APPENDIX-C: PROJECT TEAM

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