Government of the People's Republic of Bangladesh
Ministry of Housing and Public Works
Urban Development Directorate
82, Segunbagicha, Dhaka- 1000

DRAFT SURVEY REPORT

Preparation of UAV based Physical Feature, Topographic and Landuse GIS Database, Mouza Map Collection. Scanning, Digitization, Editing and Printing under

Preparation of Development Plan for Meherpur Zilla Project

Submitted by
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EXECUTIVE SUMMARY

The Urban Development Directorate (UDD), under the Ministry of Housing and Public Works, Government of the People's Republic of Bangladesh, has initiated the "Preparation of Development Plan for Meherpur Zilla," funded by the Government of Bangladesh. The project seeks to formulate a comprehensive Structure Plan, Urban Area Plan, and Rural Area Plan, covering Pourashavas, Unions, and Growth Centers.

As part of this effort, the consulting team conducted physical feature, land use, and topographic survey, complemented by UAV/Drone-based mapping and satellite imagery in restricted border zones. Data collection included the establishment of benchmark pillars, aerial triangulation, orthophoto generation, and 3D feature extraction to prepare a high-resolution base map. Additional tasks included the preparation of a Digital Elevation Model (DEM), physical feature documentation, and land use surveys. All datasets are integrated into a unified GIS database, ensuring a comprehensive spatial foundation for development planning. The major findings from the field survey are described in the following sections;

Meherpur District comprises a total of 580,006 structures spread across its urban and rural areas. Within Meherpur Municipality, there are 38,205 structures, including 21,706 other structures. The rural parts of Meherpur account for 173,864 structures, while Mujibnagar Upazila has 70,412 structures and Gangni Upazila contains 297,525 structures.

Urban Area:

Meherpur Municipality is characterized predominantly by low-rise residential development, with single-storied buildings comprising 79.75% of all structures. Pucca houses are the most common type, accounting for 48.49% of buildings, followed by semi-pucca and tin-shed structures. Residential buildings dominate the urban landscape (70.51%), with mixed-use and service activity buildings occupying a smaller share. Commercial and institutional structures are concentrated in specific wards, reflecting localized economic and administrative activities. The municipality's road network is dominated by narrow roads (<12 ft), comprising over 80% of the total road length, indicating limited vehicular capacity and potential mobility constraints. Drainage infrastructure is largely covered (81.62%) and primarily pucca (99.72%), supporting effective stormwater management. Waterbodies such as ponds and rivers cover the majority of surface water areas, totaling 199.46 acres, while open spaces, parks, and recreational areas occupy 21.6 acres.

Digital Elevation Model analysis indicates predominantly flat terrain (approximately 3.00 meters to 21.51 meters) with central wards on higher ground, suitable for dense settlements and commercial growth, whereas low-lying southern and southeastern wards are prone to seasonal flooding but suitable for paddy cultivation.

Gangni Municipality's Road network is largely bituminous (BTR), constituting over 63.93% of total roads, facilitating connectivity, though earthen roads remain prominent in secondary routes. Elevation of the municipality varies between 1.34 m and 15 m, with higher central areas supporting dense urban development, while lower zones are susceptible to waterlogging.

Rural Area

In rural areas of Meherpur, housing patterns show a dominance of tinshed structures (40.05%), followed by semi-pucca (26.42%) and pucca houses (26.04%), indicating a transition between traditional and more permanent constructions. Katcha houses represent a smaller portion (7.45%), and steel structures are negligible. The road network of the area extends over 1,012.82 km, with katcha roads comprising

the largest share at 41.98%, followed by pucca roads (38.95%) and semi-pucca roads (19.07%). Regarding waterbodies, ponds and rivers constitute 86% of the total 3,920.24 acres of surface water-covered area.

Gangni Upazila's built environment reflects a mix of housing types, with Semi Pucca houses being the most common (36.96%), followed by Katcha and Pucca structures. Tin shed houses constitute a significant share, highlighting economic diversity in housing construction. Surface water features are dominated by ponds (57.1%), fish ponds (15.2%), and canals (12.7%), emphasizing the importance of water-based land use and aquaculture activities. Roads are primarily bituminous (62.75%), with earthen, HBB, and RCC roads forming smaller proportions.

Mujibnagar Upazila exhibits predominantly residential development across its unions, with residential structures forming nearly 59% of total buildings. Other structures, mixed-use, and service activity buildings account for significant portions, while commercial, institutional, and industrial structures are limited. About 1.42% of structures are under construction, indicating ongoing growth. The total road network (453.07 km) is largely narrow, with 80% of roads below 11 ft in width, emphasizing the need for future widening to improve mobility. Waterbodies are dominated by river (62.20%), and ponds (29%).

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CHAPTER 1: INTRODUCTION

1.1. BACKGROUND OF THE PROJECT

The Urban Development Directorate (UDD), Ministry of Housing and Public Works, Government of the people's Republic of Bangladesh has taken a great initiative to prepare development plan for Meherpur District under the project titled **"Preparation of Development Plan for Meherpur Zilla"** funded by the Government of Bangladesh. The aim of this project is to prepare Structure Plan, Urban Area Plan and Rural Area Plan including Pourashava, Union Level and Growth Center Plan. The preparation of the development plan requires existing situational analysis based on the existing physical, topographic and land supply of the project area. In this context, under the "Preparation of Development Plan for Meherpur District" project, we the consultant has been contracted to conduct **physical feature, land use and topographic survey** and to **assist in preparation of the development plan**. Along with the preparation of physical feature, land use and topographic database, the consultant would integrate data obtained from the other firms for the same project to develop a comprehensive database for the project.

1.2. OBJECTIVES OF THE PROJECT

The objectives of the project include

- To assist in preparing **Development Plan for Meherpur district** by conducting **UAV/Aerial, physical feature, topographic and landuse survey**
- To establish **Bench Mark (BM) pillar** in the project area
- To prepare **3D model** of the project area
- To **relate the output of the surveys and database** with that of other attribute data and activities prepared by other consultants

1.3. UNDERSTANDING THE SCOPE OF SERVICE

To achieve the objectives of this project the consultant will be responsible for the development of GIS Database (spatial and attribute) by conducting physical feature, landuse, and topographic surveys. Apart from the surveys and GIS database preparation, the consultant will be responsible for relating the output of the surveys and database with that of other attribute data and activities, which would be imparted by other consultants e.g., geological study. The **scope of service** under this assignment including detailed breakdown of activities and specifications, has been outlined in the following table:

i. Construction and Establishment of **Bench Mark (BM)** pillar
ii. Preparation of **Base Map** through **using digitized physical features and mouza map**
iii. Physical Feature Survey
iv. Topographic Survey
v. Existing **Land Use Survey**
vi. Relating the output of the surveys and database with that of **other attribute data and activities** prepared by other consultants

1.4. SCOPE OF SURVEY PHASE

The Survey Phase encompassed a series of activities to ensure accurate and comprehensive data collection for the project. This included the establishment of BM (Benchmark) pillars to provide geodetic control for subsequent survey tasks. UAV/Drone surveys were conducted across the project area, except for border zones where UAV operations were not feasible; in such areas, satellite imagery was utilized. Collected UAV data underwent aerial triangulation (AT) and image processing to prepare a high-resolution orthophotos, followed by 3D feature extraction to prepare base map. Physical feature and topographic surveys were conducted to map all existing features and terrain of the study area, while

land use survey documented current land use patterns. Digital Elevation Model (DEM) was generated to support spatial analysis, and all datasets were integrated into a unified database. The phase concluded with the preparation of a draft survey report, consolidating findings for planning and decision-making.

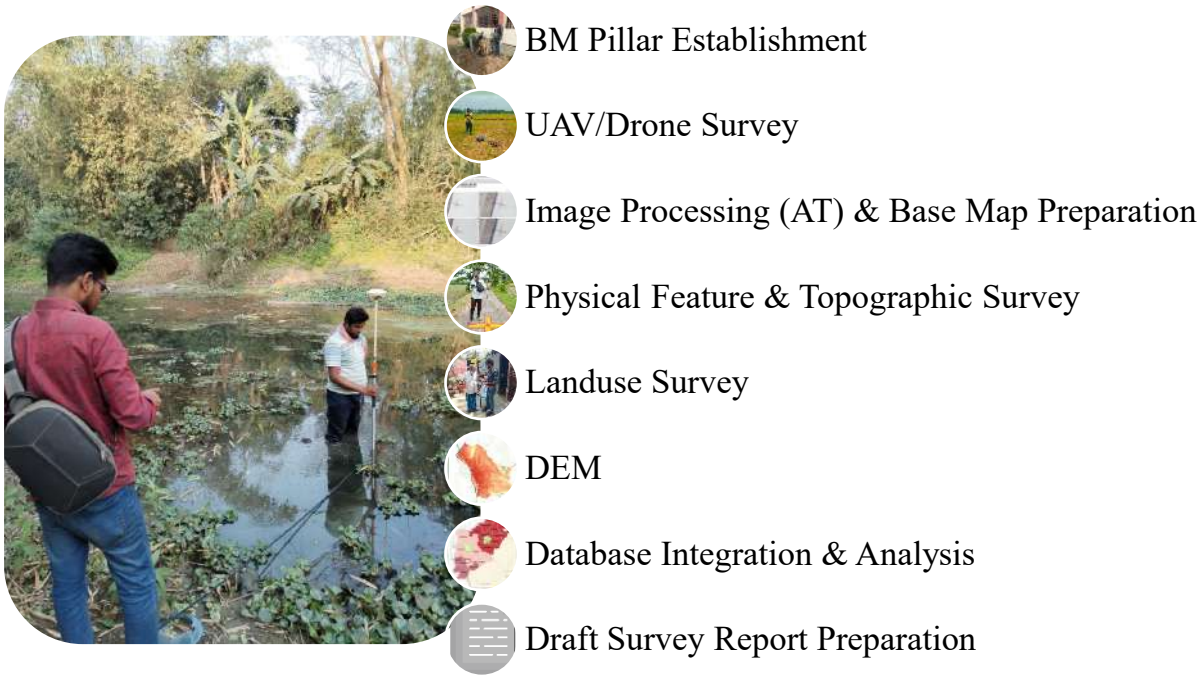

Figure 1-1: Scope of Survey Phase

1.5. PROJECT AREA

The Meherpur district gained its district status on 1984, and later on 2000, Meherpur Sadar Upazila was split to establish Mujibnagar Upazila. Presently, Meherpur district comprises 03 upazilas, 2 municipalities (both 1st class), 18 union, 199 mouzas and 255 villages. The upazilas of Meherpur district are Meherpur Sadar, Gangni and Mujibnagar.

1.5.1. Location

Meherpur district, situated in Bangladesh, is bordered by Kushtia district to the north, Chuadanga district to the east and south, and India to the south and west. It covers a total area of **751.62 sq.km.** (290 sq.miles) and lies between 23°44' and 23°59' north latitude, and 88°34' and 88°53' east longitude. It is the border district of western part of Bangladesh. Before the partition (1947) Meherpur was a part of the Nadia district of India.

Table 1-1: Meherpur District at a glance (Upazila, Union & Municipality)

Sl. No.	Upazila (Area)	Union	Municipality (Area)
1	**Meherpur Sadar** (276.15 sq.km.)	Amjhupi, Baradi, Bhimpur, Gangni, Kutubpur , Pirojpur and Rupdia	Meherpur Municipality (17.60 sq.km.)
2	**Muiibnagar** (111.51 sq.km.)	Dariapur, Monkhali, Baguan, Mahajanpur.	-
3	**Gangni** (363.95 sq.km.)	Kathuli, Tetulbaria, Kazipur, Bamandi, Saharabati, Dhanakhola, Raipur, Matmura,Sholtaka.	Gangni Municipality (16.84 sq.km.)

Source: Bangladesh National Portal, 2024; Gangni Paurashava Master Plan: 2011-2031; Meherpur Paurashava Master Plan: 2017-2037

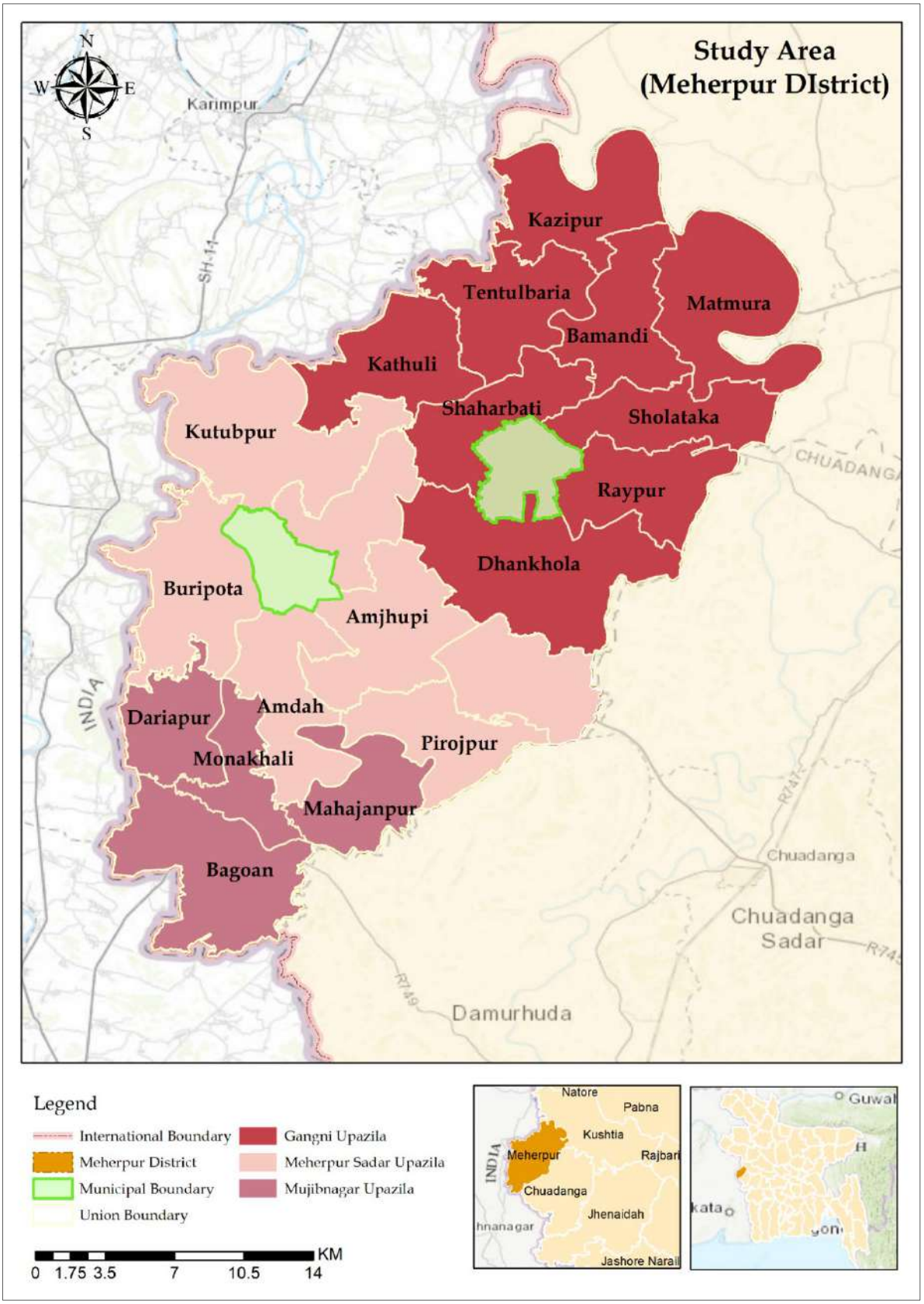

Figure 1-2: Location of Meherpur district

1.5.2. Historical Significance

Meherpur is known as the first capital of Bangladesh as because the first temporary Government of Bangladesh was formed at Mujibnagar, Meherpur on 17 April 1971. The first cabinet of Bangladesh was formed and took their oath at historical "Ambagan" of Boddonathtala (Now Mujibnagar). Some of the **remarkable places of Meherpur District** are mentioned below:

- Mujibnagar Remembrance Complex
- Bhawanandpur Temple
- Amda Architecture of Amda Village
- **Balaram Hari Temple**
- **Amzapi Nilkuthi**
- **Nilkuthi of Bhatpara, Saharbati**
- **Swami Nigamananda Ashram**
- **The Ballolpur Church, Bhabar Para etc.**

1.5.3. Population & Growth rate

It is noted from the census data 2022, the total enumerated population is recorded as 705,330 and the household number, 195,322 in Meherpur district. The average household size in Meherpur district decreased from 3.94 in 2011 to 3.68 in 2022.

Table 1-2: Basic Information of Meherpur District (Population & Household)

Year	Population	Household	Household Size	Density
2011	655,392	166,312	3.94	884
2022	705,330	195,322	3.68	951

Source: Population and Housing Census 2022; Population and Housing Census 2011

The table depicts the figures of the enumerated population for Gangni, Mujibnagar, and Meherpur Sadar Upazilas as recorded in the Population and Housing Census 2022. Notably, Gangni Upazila had the highest enumerated population among the three Upazilas in Meherpur district, with a total of 92,768 residents.

Table 1-3: Basic Information of the Project Area (Household, Population & Household Size)

Area	Total Household	Population			Household Size (General)
		Total	Male	Female	
Meherpur District	195322	705330	340093	365237	3.59
Gangni	92768	322690	154479	168211	3.46
Mujibnagar	27675	105746	51380	54366	3.78
Meherpur Sadar	74879	276894	134234	142660	3.68

Source: Population and Housing Census 2022

1.5.4. Urbanization

The urban area in Meherpur district has a total population of 158,885, with 48.56% being male, 51.43% female, and 0.001% Transgender. Notably, the proportion of females is higher in both urban and rural areas.

Table 1-4: Population of Meherpur District by area and sex

Area	*Total*	*Male*	*Female*	*Transgender*
Rural	*546471*	*262943 (48.12%)*	*283516 (51.88%)*	*12 (0.002%)*
Urban	*158885*	*77150 (48.56%)*	*81721 (51.43%)*	*14 (0.01%)*
Total	*705356*	*340093*	*365237*	*26*

Source: Population and Housing Census 2022

The percentages of population living in the rural and the urban areas are 77.47% and 22.53% respectively.

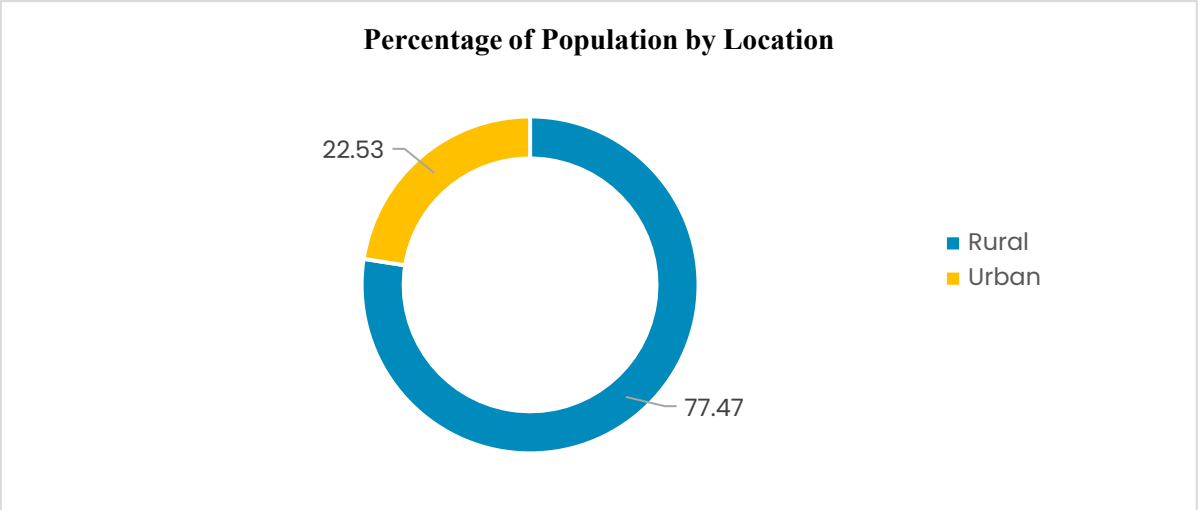

Figure 1-3: Percentage of population in Meherpur district by location

Source: Population and Housing Census 2022

1.5.5. Slum Area in Meherpur District

As per the slum census of 2014, Meherpur District had a total of 26 slums with 816 households. Among the slum population, 51.25% were male, 48.67% were female, and only 0.08% were identified as hijra individuals. In the more recent census data of 2022, the number of households in Meherpur District slums has decreased to 142, accommodating a population of 573.

Table 1-5: Slum Area in Meherpur district

Upazila	Slum Name	Household	Population			
			Total	Male	Female	Hijra
Gangni	Doapara	30	103	50	53	0
Gangni	Bhata Para	83	312	170	142	0
Gangni	Das Para	19	66	38	28	0
Gangni	Gulipara	20	71	37	34	0
Gangni	Doapara	30	92	43	49	0
Mujib Nagar	Ballabhpur Daspara	14	53	26	27	0
Mujib Nagar	Bhabar Para Mukti Gorda Para	8	21	12	9	0
Meherpur Sadar	Court Para	11	51	26	25	0
Meherpur Sadar	Gosh Para	15	52	26	26	0
Meherpur Sadar	Bhayrab School Para	16	60	29	31	0
Meherpur Sadar	Halderpara	20	79	36	43	0
Meherpur Sadar	Methar Para	30	141	75	66	0
Meherpur Sadar	Ghatpara	33	139	73	66	0
Meherpur Sadar	Tantipara	16	71	36	35	0
Meherpur Sadar	Seikh Para	95	373	186	187	0
Meherpur Sadar	Nur Filing Station	33	113	51	62	0
Meherpur Sadar	Hathat Para	126	445	217	227	0
Meherpur Sadar	Wapda Para Basti	18	52	22	30	0
Meherpur Sadar	Mondal Para (Agriculture Offi	10	43	20	23	0
Meherpur Sadar	Mondol Para	12	44	27	17	0

Upazila	Slum Name	Household	Population			
			Total	Male	Female	Hijra
Meherpur Sadar	Pulish Line Para	51	165	72	93	0
Meherpur Sadar	Dighira Para	77	280	151	129	0
Meherpur Sadar	Govt. College	10	17	7	10	0
Meherpur Sadar	Uttar Stadumpara Basti	10	31	12	19	0
Meherpur Sadar	Poshu Hat Dakhin Para	9	33	20	13	0
Meherpur Sadar	Poshu; Hat C&B Road	20	77	36	41	0
Total		**816**	**2984**	**1498**	**1485**	**0**

Source: Slum Census, 2014

1.6. REVIEW OF PREVIOUS MASTER PLAN

According to Bangladesh Delta Plan 2100 Meherpur district is in Barind and drought-prone areas so all kinds of measures should be taken on this consideration. Meherpur Pourashava and Gangni Paurashava both have 20-year period Master Plans (2017- 2037) by Local Government Engineering Department under UGIIP- 3 Project. According to the masterplan main challenges and issues are, scarcity of safe drinking and household water supply, inadequate connecting road and narrow road, no formal dumping site has been declared for both municipalities, hospital and school facilities are limited. From both master plan emphasis on agricultural development on land use perspective.

The preparation of the development plan for the fourteen upazila project, package 3, by UDD encompasses three specific upazilas. Gangni in Meherpur district is one of these upazilas. We will adhere to the guidelines outlined for the development of Gangni upazila and make necessary updates accordingly.

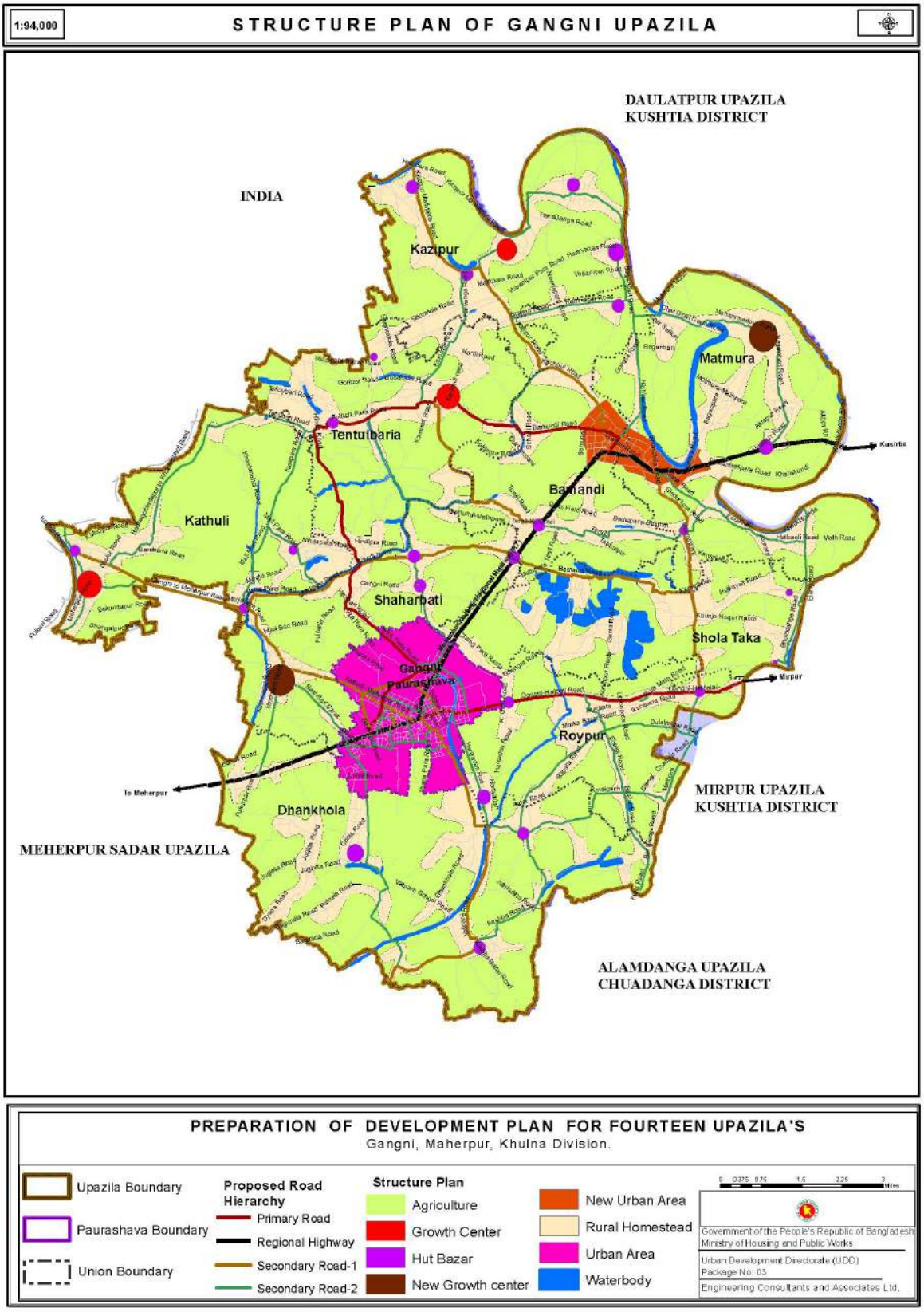

Figure 1-4: Structure Plan of Gangni Upazila

Source: Preparation of Development Plan for Fourteen Upazila's by UDD

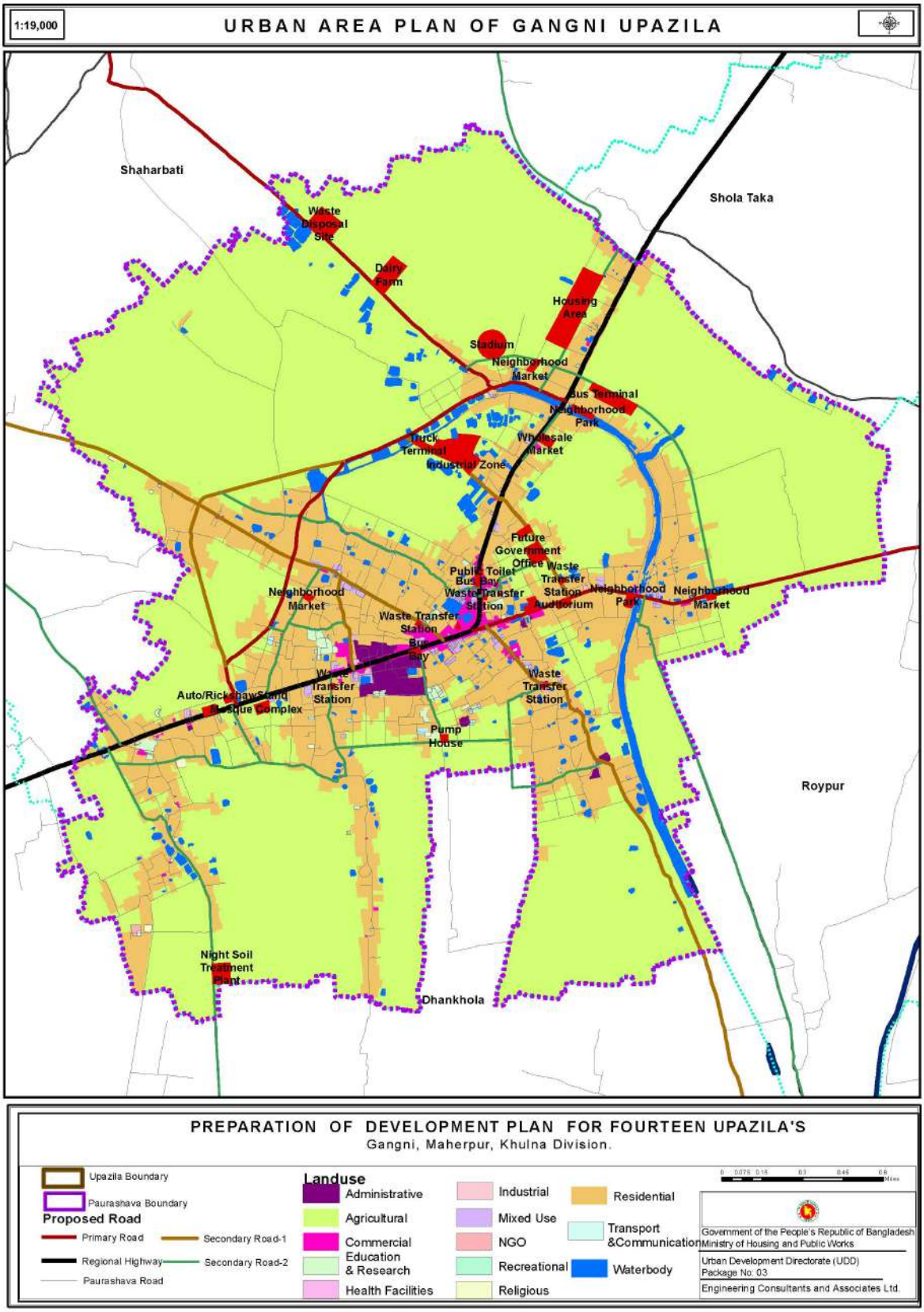

Figure 1-5: Urban Area Plan of Gangni Upazila

Source: Preparation of Development Plan for Fourteen Upazila's by UDD

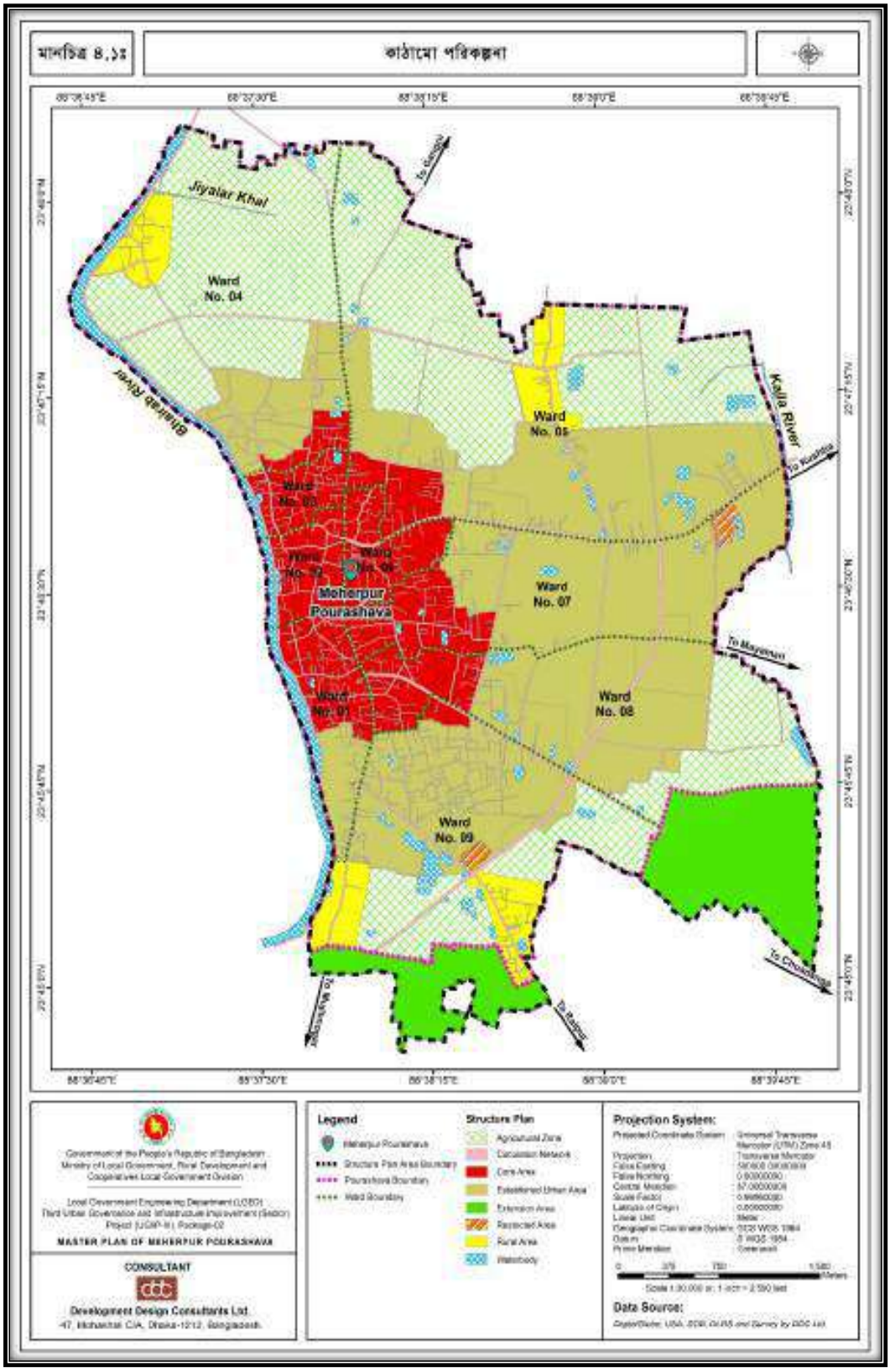

Figure 1-6: Structure Plan of Meherpur Municipality (2017-2037)

Source: Local Government Engineering Department under UGIIP- 3 Project

CHAPTER 2: APPROACH AND METHODOLOGY

2.1. INTRODUCTION

Topographic, physical feature and landuse survey was conducted to assess the existing terrain characteristics and physical infrastructure of the study area. Advanced surveying instruments, including Unmanned Aerial Vehicles (UAVs), Global Positioning System (GPS) units, and Total Stations, were employed to ensure the collection of accurate and geo-referenced data. The primary advantage of utilizing these technologies lies in their ability to generate high-precision datasets in digital format. The processed survey outputs were subsequently integrated into a comprehensive GIS database.

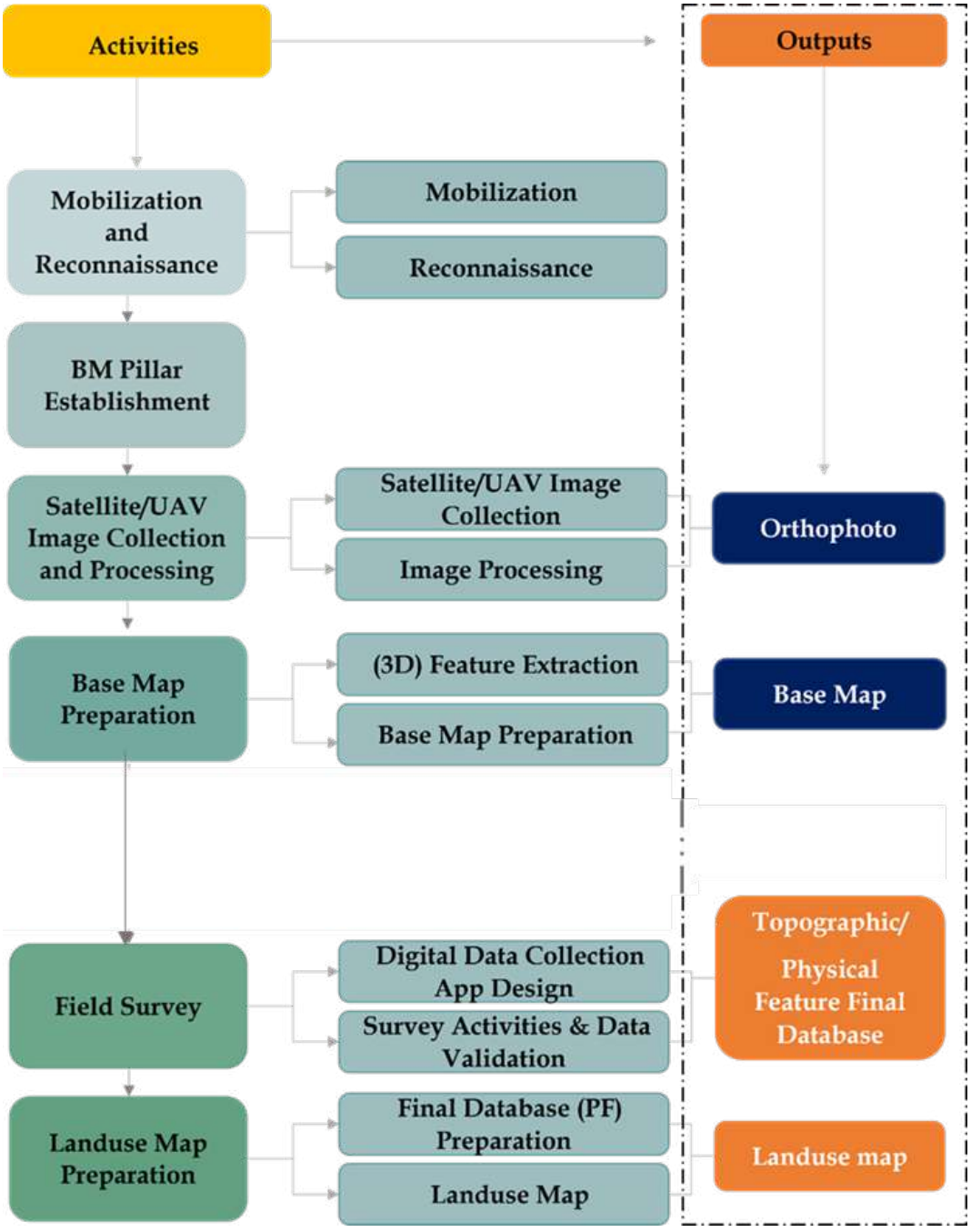

Figure 2-1: Major Activities and Related Output

2.2. DATA FROM SECONDARY SOURCES

From the inception phase of the project until now, we have gathered and reviewed all relevant plans and policies for the project area. We have also compiled and analyzed basic statistics of the study area using BBS reports, journals, and other secondary materials related to Meherpur District. These data sources provide valuable insights into the district's demographic, economic, social, and environmental aspects.

2.3. RECONNAISSANCE SURVEY

During the Mobilization phase, the reconnaissance survey team organized meetings with local representatives and officials of Meherpur District. This stage of engagement aimed to foster collaborative dialogue with key decision-makers and gather essential insights to strengthen the project's planning and execution. In addition, the team conducted tea stall meetings with local residents to better understand their perspectives and knowledge about the locality.

(a) Tea Stall Meeting with Local People

(b) Meeting with Upazilla chairman Gangni (Left), Mujibnagar (Middle) and Meherpur (Right)

(c) Informing Officials of Gangni Paurashava

Figure 2-2: (a) Tea Stall Meeting and FGD with Local People; (b) & (c) Meeting with local govt Officials of project area

Source: Reconnaissance Survey, 2024

2.4. BM PILLAR ESTABLISHMENT

The design of the benchmark pillar was developed following the guidelines provided in the Terms of Reference. Appropriate location for benchmarks in the urban and rural areas of the project area was selected based on their specific purposes and coverage areas. The selection process involves careful consideration to ensure stability, easy accessibility, and representation of the area's terrain.

Figure 2-3: BM Pillar establishment in the project area

Sl No.	Address	Upazila	Image
1	Meherpur Municipal Complex	Meherpur Sadar	
2	Sheikhpara Government Primary School	Meherpur Sadar	
3	Kutubpur Union Council No. 1	Meherpur Sadar	
4	Alampur Government Primary School	Meherpur Sadar	
5	Buripota Government Primary School	Meherpur Sadar	
6	Amdah Government Primary School	Meherpur Sadar	

Sl No.	Address	Upazila	Image
7	Amjhupi Boys Government Primary School	Meherpur Sadar	
8	Baradi Union Complex	Meherpur Sadar	
9	Pirojpur Union Complex	Meherpur Sadar	
10	Komorpur Secondary School	Mujibnagar	
11	Dariapur Union Parishod Complex	Mujibnagar	
12	Monakhali Union Parishad Complex, 2 no.	Mujibnagar	
13	Anandabus Government Primary School	Mujibnagar	

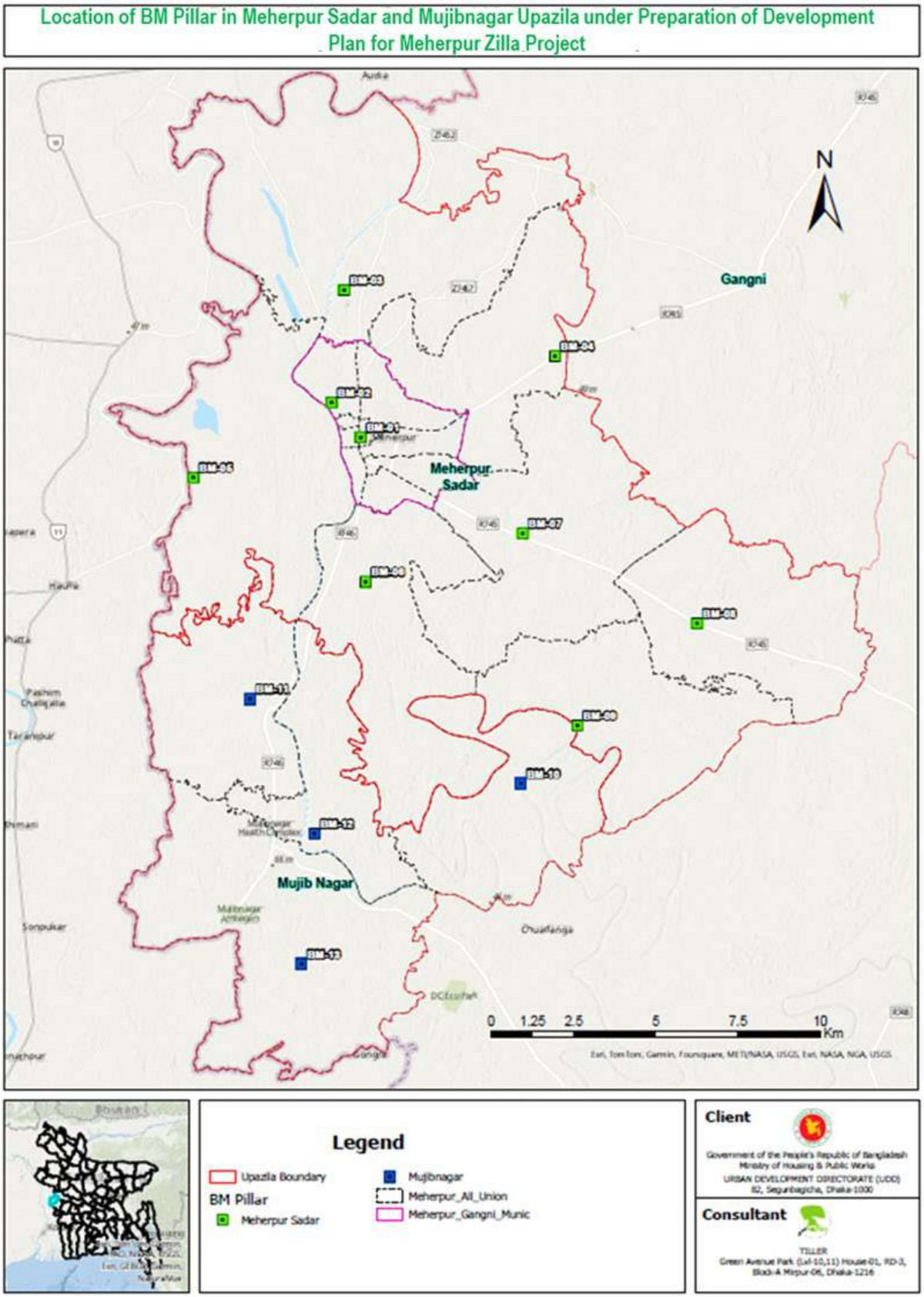

Figure 2-4: Location of BM Pillar in Meherpur Sadar and Mujibnagar Upazila

Table 2-1: Established Value (X, Y, X) of BM Pillars

Name	X	Y	Z
BM-01	666234.8	2630421	15.836
BM-02	665406.3	2631496	15.329
BM-03	665783.2	2634886	15.502
BM-04	672163.3	2632884	13.156
BM-05	661173.5	2629215	14.935
BM-06	666405.7	2626011	15.137
BM-07	671218.3	2627499	14.559
BM-08	676520.3	2624766	13.843
BM-09	672860.5	2621670	13.458
BM-10	671141.3	2619924	12.049
BM-11	662926.1	2622465	14.985
BM-12	664877.1	2618378	13.706
BM-13	664452.2	2614337	12.859

2.5. UAV SURVEY

To support accurate spatial analysis and mapping, UAV/Drone surveys were conducted across the project area. However, in border zones where UAV operations were restricted; in such areas, satellite imagery was utilized. The UAV flights were conducted following a carefully prepared flight plan. Prior to flights, necessary permissions were obtained and all pre-flight checks, including UAV calibration, was also completed. Ground Control Points (GCPs) were strategically established and surveyed using RTK GPS for accurate georeferencing. The captured images were processed using photogrammetric software.

Figure 2-5: UAV Survey in the project area

2.6. BASE MAP PREPARATION

Aerial triangulation was performed to produce 3D reconstruction of the area. From the triangulated images, stereo models were created, enabling the generation of detailed 3D models. Following this, orthophoto mosaics were developed through rectification and seamless image stitching with balanced color and contrast.

Base map has been generated after extraction all of features (roads, buildings, water bodies, vegetation, and other significant elements), to view all extracted 3D features on the same interface. The collected features are processed using drone mapping software to create 3D maps, 2D maps, digital elevation models, from which highly accurate measurements and volumetric calculations are taken. The process began with the georeferencing of orthophotos to ensure spatial accuracy and consistency across datasets. These maps were then mosaicked to cover the entire project area. The georeferenced orthophotos were superimposed with digitized 3D physical features such as roads, buildings, vegetation, and water bodies to create a unified base map interface for data collection and verification.

Figure 2-6: Captured Image- Meherpur Zero Point (College Mor)

Figure 2-7: Sample of Orthophoto (Left) Meherpur Upazila & (Right) Mujibnagar Upazila

2.7. PHYSICAL FEATURE SURVEY

The captured images were processed using photogrammetric software. Aerial triangulation was performed to produce 3D reconstruction of the area. From the triangulated images, stereo models were created, enabling the generation of detailed 3D models. Following this, orthophoto mosaics were developed through rectification and seamless image stitching with balanced color and contrast. After image processing, basemap was prepared. The process began with the georeferencing of orthophotos to ensure spatial accuracy and consistency across datasets. These maps were then mosaicked to cover the entire project area.

(a) Physical Feature Survey by the consultant's survey team

(b) Field Survey checking by the client (UDD)

Figure 2-8: Survey Activities & Field Checking by the client

The georeferenced orthophotos were superimposed with digitized 3D physical features such as roads, buildings, vegetation, and water bodies to create a unified base map interface for data collection and verification. The physical feature survey captured the position, dimension, and condition of various physical structures, including buildings, roads, drains, bridges, culverts, sewerage systems, and utility infrastructure. Using advanced tools such as RTK-GPS, Total Stations, and UAVs, the survey collected 3D coordinates (X, Y, Z) of all existing structures, allowing for accurate spatial representation.

2.8. LAND USE SURVEY

Landuse survey involved recording the existing use of land by its functional activity such as residential, industrial, commercial etc. The activity has been undertaken simultaneously with the physical feature survey. The surveyors visited every site to document the current land use and then the landuse map has been prepared utilizing specific notations and colors.

Figure 2-9: Land use survey in the project area

2.9. DEM

Digital Elevation Model (DEM) (spatial resolution- 10 m) was developed for Meherpur District to represent the terrain surface in three dimensions. The DEM was generated using spot height data collected through detailed field surveys.

2.10. DATABASE INTEGRATION & ANALYSIS

Upon completion of the surveys and subsequent verification by the client, the collected data were systematically integrated into a unified database for further analysis.

CHAPTER 3: SURVEY FINDINGS FOR URBAN & RURAL AREA

3.1. URBAN AREA

3.1.1. Meherpur Municipality

3.1.1.1. Structure Type, Use & Building Height

For the purpose of comparative analysis, building structures in Meherpur Municipality have been categorized into five types: Pucca, Semi-pucca, Tinshed, Steel, and Katcha. The analysis indicates that Pucca structures dominate across the municipality (8,000 in total), followed by Semi-pucca (5,851) and Tinshed (2,425) structures. The number of Steel structures is relatively small (54), while Katcha houses are the least common (169).

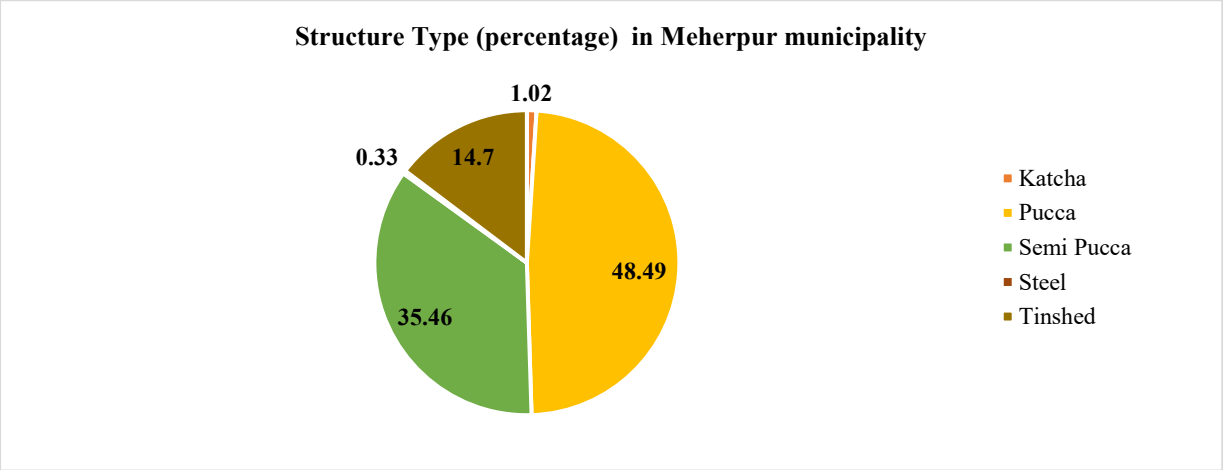

Figure 3-1: Structure Type (Percentage) in Meherpur municipality

At the ward level, Ward No. 09 records the highest overall number of structures (2,489), with the maximum count of Semi-pucca houses (1,032). Ward No. 07 has the largest number of Pucca structures (1,255), while Ward No. 04 stands out with the highest number of Tinshed buildings (526). In contrast, Ward No. 01 has the largest concentration of Katcha houses (14), though the numbers remain generally low across all wards. The presence of Steel structures is scattered, with the highest count observed in Ward No. 09 (13).

Table 3-1: Ward wise distribution of Structure Type in Meherpur municipality

Structure Type						
Ward No.	***Katcha***	***Pucca***	***Semi Pucca***	***Steel***	***Tinshed***	***Total***
Ward 01	14	1139	692	4	142	1991
Ward 02	12	690	504	2	163	1371
Ward 03	14	489	377		91	971
Ward 04	54	999	731	1	526	2311
Ward 05	19	882	697	8	441	2047
Ward 06	6	715	480	10	224	1435
Ward 07	16	1255	860	4	314	2449
Ward 08	13	760	478	12	172	1435
Ward 09	21	1071	1032	13	352	2489
Total	**169**	**8000**	**5851**	**54**	**2425**	**16,499**
Percentage	***1.02***	***48.49***	***35.46***	***0.33***	***14.70***	***100***

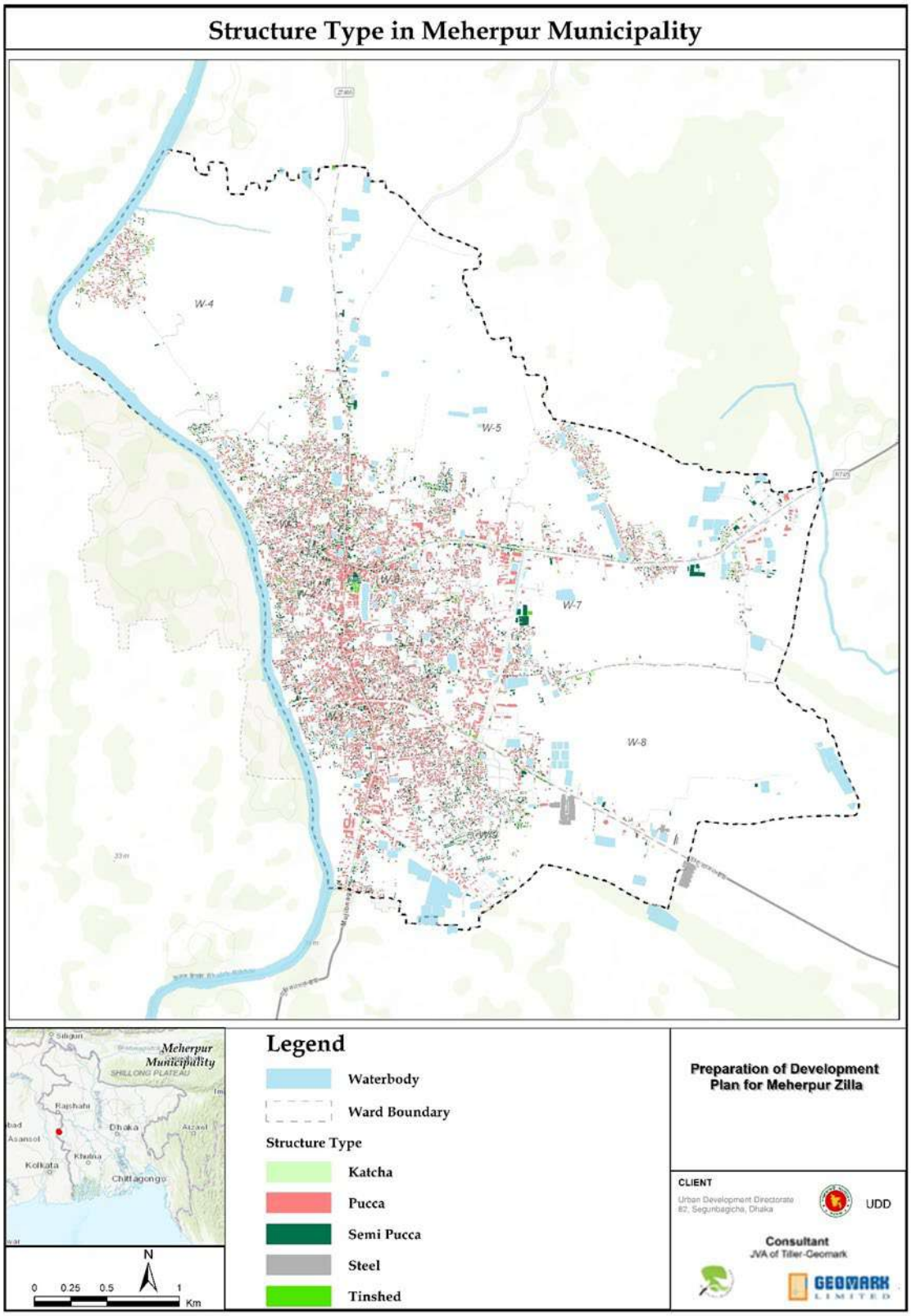

Figure 3-2: Structure Type in Meherpur municipality

Building structures have been categorized into four height groups 1 floor, 2 floors, 3–5 floors, and 6–8 floors. The findings show that single-storied buildings overwhelmingly dominate in all wards about 79.75% of the total, with two-storied buildings forming the next largest share (13.76%). Structures above three floors are comparatively few (6.48%), reflecting that vertical development in the area remains limited.

Within the study area, Ward No. 09 contains the highest total number of structures (2,504), while Ward No. 03 records the lowest (1,188). Among one-storied buildings, Ward No. 09 also leads with 2,057 structures. In terms of two-storied structures, Ward No. 07 leads with 377 buildings, followed by Ward No. 09 (318), highlighting areas where vertical development is relatively more common. For 3–5 storied buildings, Ward No. 07 again ranks highest with 222 structures, while wards such as Ward No. 03 (59) and Ward No. 04 (18) show very few.

Buildings in the 6–8 storied range are extremely limited, with only 35 recorded across all wards. The majority are concentrated in Ward No. 07 (11 buildings), followed by Ward No. 06 (6) and Ward No. 01 (7), while several wards such as Ward No. 03 and Ward No. 04 record none.

Table 3-2: Building Height in Meherpur municipality

Building Height					
Ward No.	***1***	***2***	***3-5***	***6-8***	***Total***
Ward No. 01	1384	331	172	7	1894
Ward No. 02	1203	225	100	4	1532
Ward No. 03	956	173	59	0	1188
Ward No. 04	1819	142	18	0	1979
Ward No. 05	1739	226	71	4	2040
Ward No. 06	1096	226	114	6	1442
Ward No. 07	1830	377	222	11	2440
Ward No. 08	1072	255	151	2	1480
Ward No. 09	2057	318	128	1	2504
Total	**13158**	**2271**	**1035**	**35**	**16499**
Percentage	***79.75***	***13.76***	***6.27***	***0.21***	***100.00***

This ward-wise variation indicates that while most areas remain dominated by low-rise structures, Wards 07 show relatively greater tendencies toward multi-storied development, reflecting localized urban growth.

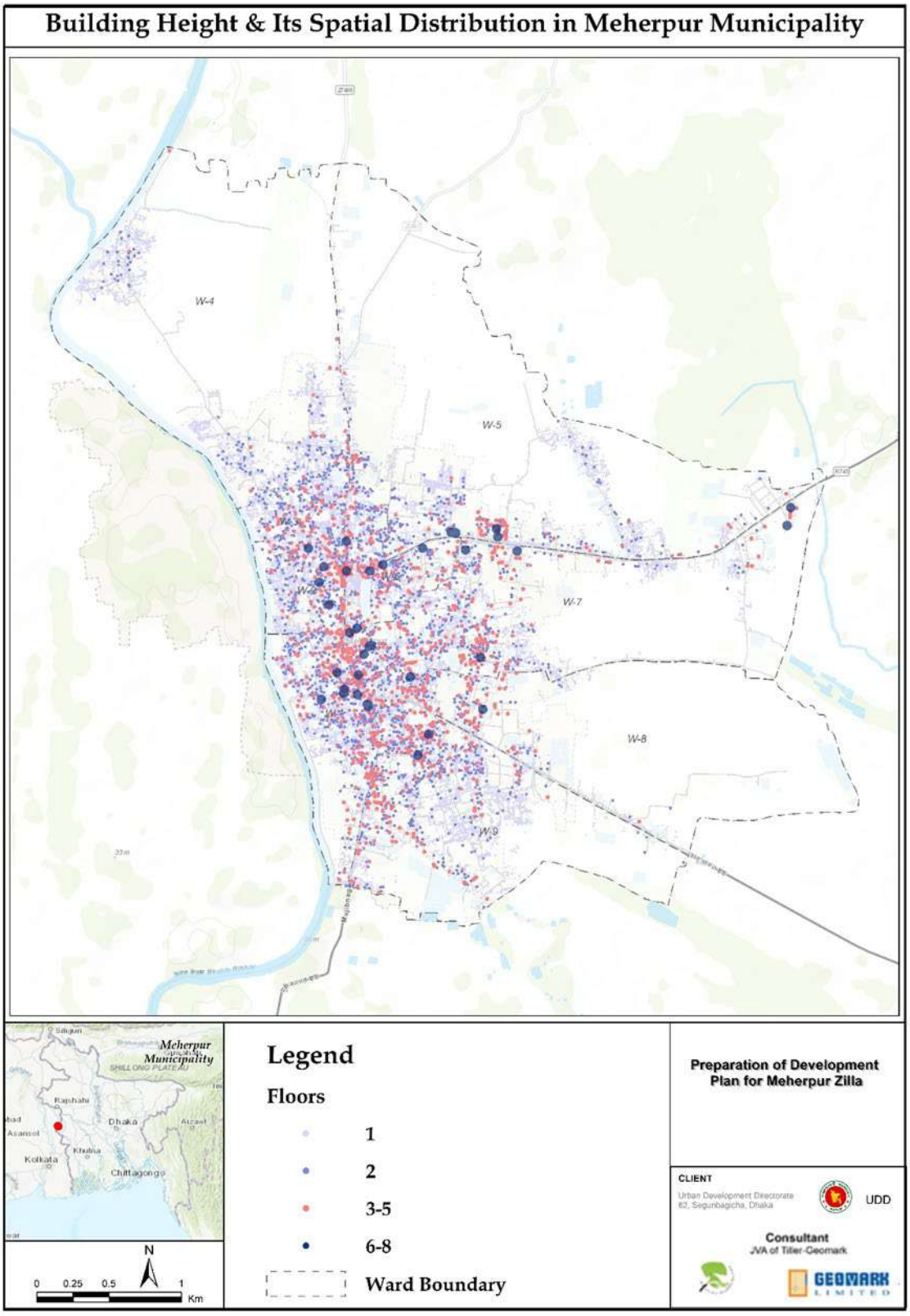

Figure 3-3: Building height and its spatial distribution in Meherpur municipality

Table 3-3: Ward wise Structure Use in Meherpur municipality

Structure Use												
Ward No.	***Administrative/ Public Service***	***Agriculture***	***Commercial***	***Community Service***	***Education and Research***	***Industry***	***Mixed Use***	***Residential***	***Service Activity***	***Transportation and Communication***	***Under Construction***	***Total***
Ward 01	21	3	104	15	15	21	205	1367	129	31	80	1991
Ward 02	7	4	70	14	10	4	154	941	111	6	50	1371
Ward 03	1	9	39	3	5	10	71	743	57	6	27	971
Ward 04	1	25	55	17	18	13	97	1870	106	3	106	2311
Ward 05	14	29	95	16	16	56	95	1423	189	20	94	2047
Ward 06	6	8	166	13	9	31	142	815	161	25	59	1435
Ward 07	14	37	101	21	28	13	159	1760	165	36	115	2449
Ward 08	22	15	71	13	36	21	136	865	158	38	60	1435
Ward 09	14	15	104	19	25	25	126	1849	153	20	139	2489
Total	100	145	805	131	162	194	1185	11,633	1229	185	730	16,499
Percentage	***0.61***	***0.88***	***4.88***	***0.79***	***0.98***	***1.18***	***7.18***	***70.51***	***7.45***	***1.12***	***4.42***	***100***

The analysis shows that the residential category dominates overwhelmingly (11,633 structures, about 70.51% of total), followed by mixed-use structures (1,185) and service activity buildings (1,229). At the ward level, Ward No. 09 has the highest total number of structures (2,489), with a strong concentration of residential houses (1,849). Ward No. 04 also shows a high density of residential use (1,870), whereas Ward No. 07 has the second highest residential count (1,760) alongside a significant number of mixed-use structures (159). Commercial structures are most notable in Ward No. 06 (166), reflecting localized economic activities, while Ward No. 05 (95) and Ward No. 07 (101) also show considerable commercial presence. In terms of institutional and public functions, Ward No. 08 contains the highest number of education and research buildings (36), while Ward No. 01 has the most administrative/public service facilities (21). Industrial buildings are scattered across wards, with Ward No. 05 (56) recording the highest number. Service activity structures are most concentrated in Ward No. 05 (189), while transportation and communication-related structures peak in Ward No. 07 (36). Overall, in Meherpur Municipality, 21706 other structures prevail.

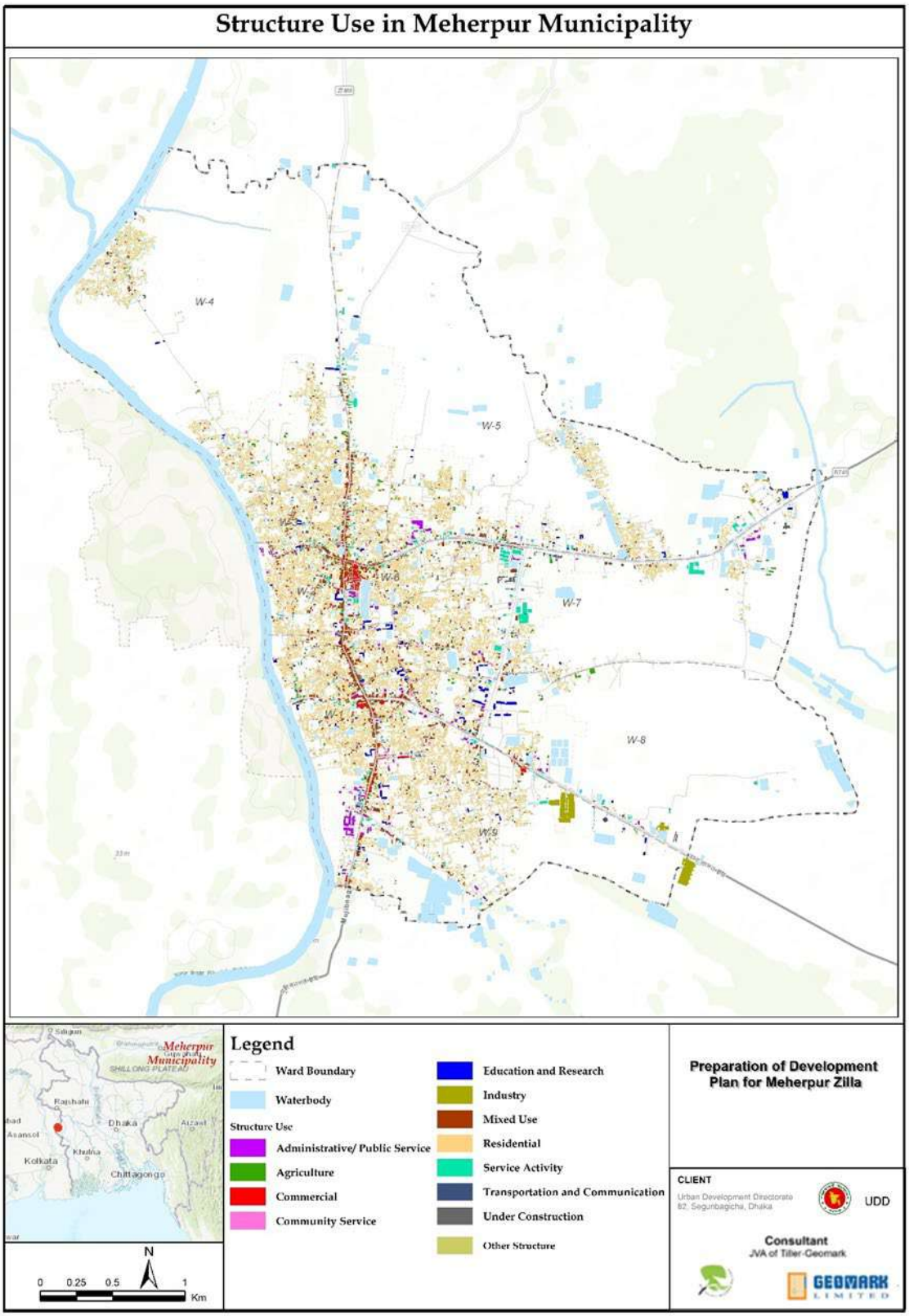

Figure 3-4: Spatial Distribution of Structure Use in Meherpur municipality

3.1.1.2. Health and Educational Facilities

The healthcare facilities in the municipality are distributed unevenly across different wards, with a total of 30 facilities identified. Among them, clinics (12, 40%) and dental clinics (10, 33.33%) form the largest share of services, while physiotherapy centres (3, 10%), government hospitals (2, 6.67%), non-government hospitals (2, 6.67%), and community clinics (1, 3.33%) represent smaller but essential components of the system.

Ward No. 07 has the highest concentration of facilities (13 in total), including 7 clinics, 3 dental clinics, 1 government hospital, and 2 physiotherapy centres, making it the most well-served area. Ward No. 06 follows with 4 facilities, including clinics, dental clinics, and a non-government hospital. Other wards, such as Ward No. 02 (2 facilities), Ward No. 03 (1 facility), Ward No. 08 (5 facilities), and Ward No. 09 (4 facilities), have moderate levels of service. In contrast, Ward No. 01 has only one physiotherapy centre, highlighting a significant service gap.

Table 3-4: Ward wise distribution of Healthcare Facilities in Meherpur Municipality

Healthcare Facilities							
Ward No.	*Clinic*	*Community Clinic*	*Dental Clinic*	*Hospital (Govt.)*	*Hospital (Non-Govt.)*	*Physiotherapy Centre*	*Total*
Ward No. 01						1	1
Ward No. 02	1		1				2
Ward No. 03			1				1
Ward No. 06	1		2		1		4
Ward No. 07	7		3	1		2	13
Ward No. 08	1	1	3				5
Ward No. 09	2			1	1		4
Total	**12**	**1**	**10**	**2**	**2**	**3**	**30**
Percentage	***40.00***	***3.33***	***33.33***	***6.67***	***6.67***	***10.00***	***100.00***

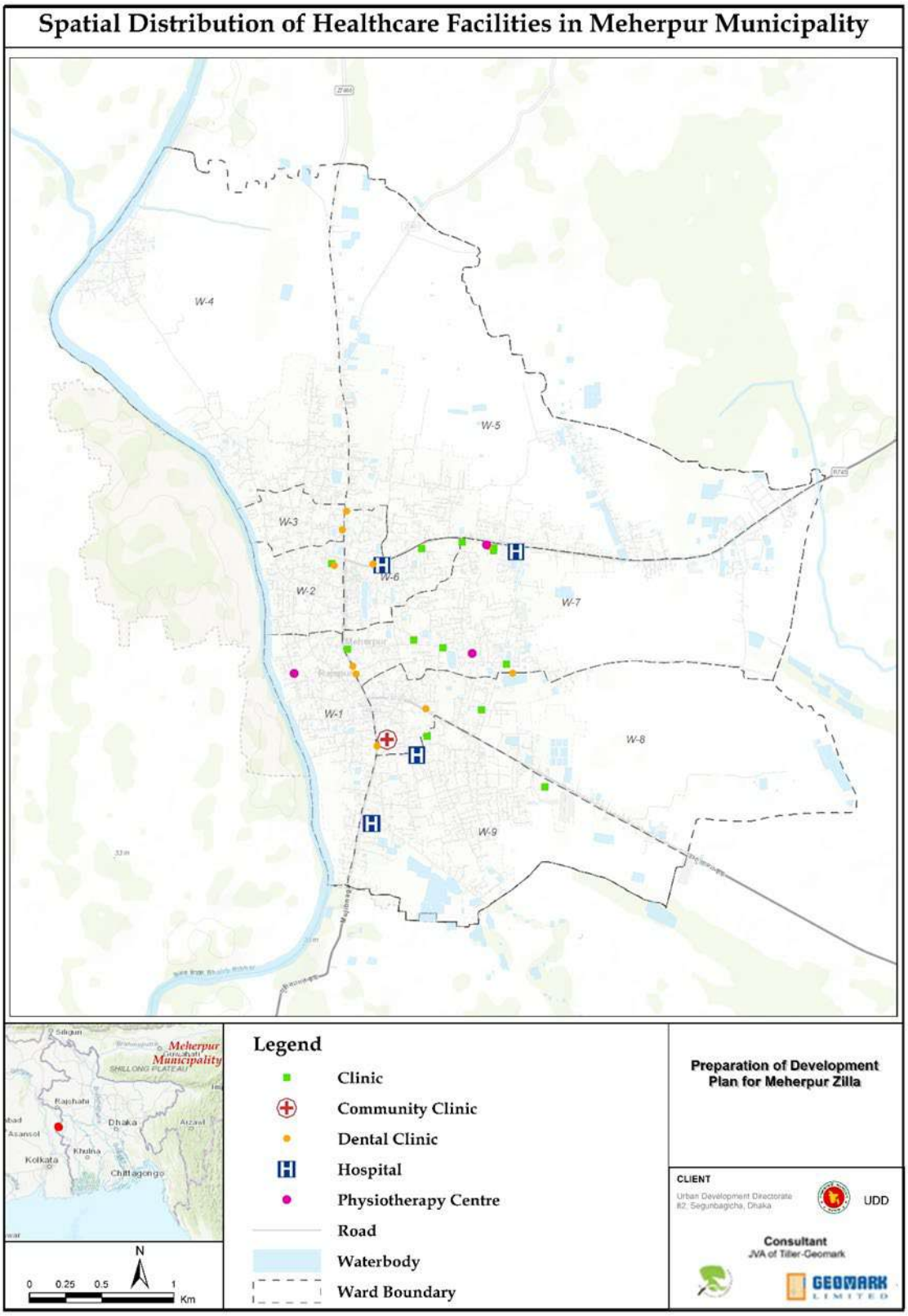

Figure 3-5: Spatial distribution of Healthcare Facilities in Meherpur Municipality

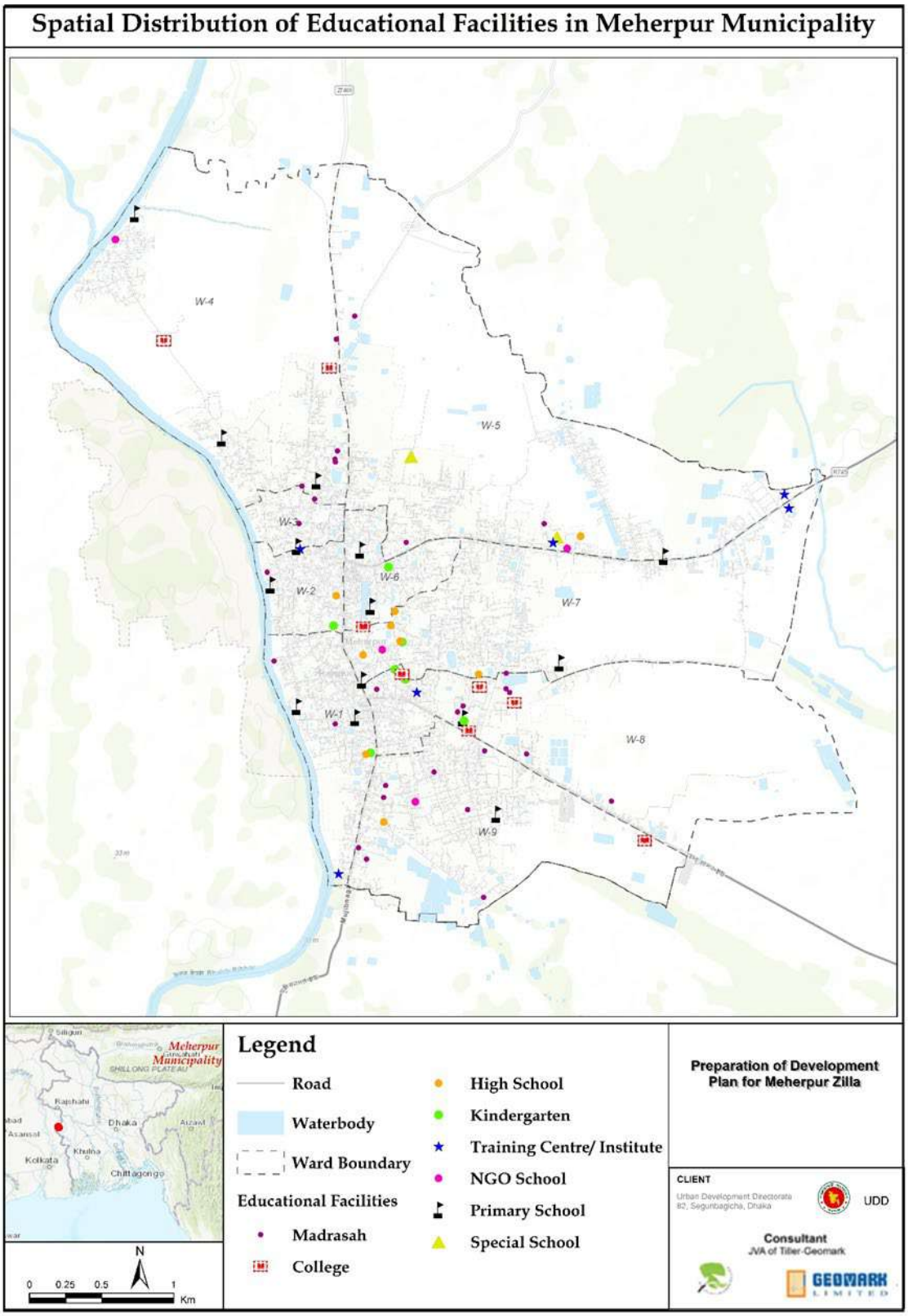

Figure 3-6: Spatial distribution of Educational Facilities in Meherpur Municipality

3.1.1.3. Road Network

The total road network in Meherpur Municipality is distributed across five width categories. The majority of roads fall under the narrowest category (< 8 ft), accounting for 94.79 km (50.95%) of the total. The next most common category is 8.01–12.00 ft (56.53 km, 30.38%), meaning that over 80% of the municipality's roads are less than 12 ft wide. Roads of 12.01–23.00 ft constitute 21.71 km (11.67%), while wider roads are relatively rare: 23.01–33.00 ft (12.14 km, 6.52%) and 33.01–44.64 ft (0.89 km, only 0.48%).

At the ward level, the longest road network is in Ward No. 05 (35.19 km), dominated by narrow roads under 12 ft (29.52 km). Ward No. 07 also has a significant road length (30.84 km), with 16.20 km under 8 ft. By contrast, Ward No. 03 has the shortest road network (9.29 km), though it contains a relatively higher share of roads between 23–33 ft (2.76 km) compared to other wards. The widest road category 33–44.64 ft is extremely limited (0.89), with the maximum found in Ward No. 01 (0.83 km).

Table 3-5: Exiting Road width scenario in Meherpur Municipality

Road Width						
Road Width (Feet)	***< 8***	***8.01 - 12.00***	***12.01 - 23.00***	***23.01 - 33.00***	***33.01 - 44.64***	***Total***
Ward No. 01	12.16	5.75	3.96	1.90	0.83	24.60
Ward No. 02	4.73	1.96	2.97	0.49	0.02	10.18
Ward No. 03	3.24	1.92	1.36	2.76	0.00	9.29
Ward No. 04	11.87	9.65	1.76	0.00	0.00	23.28
Ward No. 05	19.44	10.08	2.90	2.78	0.00	35.19
Ward No. 06	5.17	3.90	1.84	0.12	0.00	11.04
Ward No. 07	16.20	9.24	3.23	2.13	0.04	30.84
Ward No. 08	6.02	6.29	1.33	1.90	0.00	15.54
Ward No. 09	15.95	7.74	2.37	0.06	0.00	26.12
Total	**94.79**	**56.53**	**21.71**	**12.14**	**0.89**	**186.06**
Percentage	***50.95***	***30.38***	***11.67***	***6.52***	***0.48***	***100.00***

From Physical Feature Survey, we have found that, the total road network in Meherpur Municipality extends over 186.06 km, with roads classified into five categories based on construction material: Bituminous Carpeting, Earthen, Herring-Bone-Bond (HBB), Reinforced Cement Concrete (RCC), and Tile. Among these, earthen roads dominate (82.09 km, 44.12%), followed by bituminous carpeting (51.43 km, 27.64%), and RCC roads (38.68 km, 20.79%). Roads constructed with HBB (13.53 km, 7.27%) and tiles (0.33 km, 0.18%) form a very small share of the network. Pucca roads, totaling 90.43 kilometers, make up the largest portion, accounting for over 48.61% of the network, followed by katcha roads 44.12% and semi-pucca roads 7.27%.

Table 3-6: Road Construction Material in Meherpur Municipality

Ward No.	Road Construction Material					
	Bituminous Carpeting	*Earthen*	*Herring-Bone-Bond*	*Reinforced Cement Concrete*	*Tile*	*Grand Total*
Ward 01	7.68	6.28	2.76	7.88		24.60
Ward 02	3.84	2.76	0.37	3.21		10.18
Ward 03	5.20	2.28	0.35	1.46		9.29
Ward 04	7.84	11.98	0.63	2.80	0.03	23.28
Ward 05	10.10	18.97	2.14	3.98		35.19
Ward 06	3.02	4.08	0.85	2.87	0.22	11.04
Ward 07	8.34	14.84	1.82	5.84		30.84
Ward 08	2.84	7.18	0.71	4.73	0.08	15.54
Ward 09	2.56	13.73	3.91	5.91		26.12
Grand Total	51.43	82.09	13.53	38.68	0.33	186.06
Percentage	***27.64***	***44.12***	***7.27***	***20.79***	***0.18***	***100.00***

At the ward level, the longest road network is observed in Ward No. 05 (35.19 km), mainly earthen, while the shortest is in Ward No. 03 (9.29 km). Ward No. 04 has the highest length of bituminous roads (7.84 km), whereas Ward No. 09 stands out for having the most HBB roads (3.91 km). RCC roads are most extensive in Ward No. 01 (7.88 km), closely followed by Ward No. 09 (5.91 km), reflecting better-quality construction in these areas. Tile roads are negligible, recorded only in Ward No. 04 (0.03 km), Ward No. 06 (0.22 km), and Ward No. 08 (0.08 km).

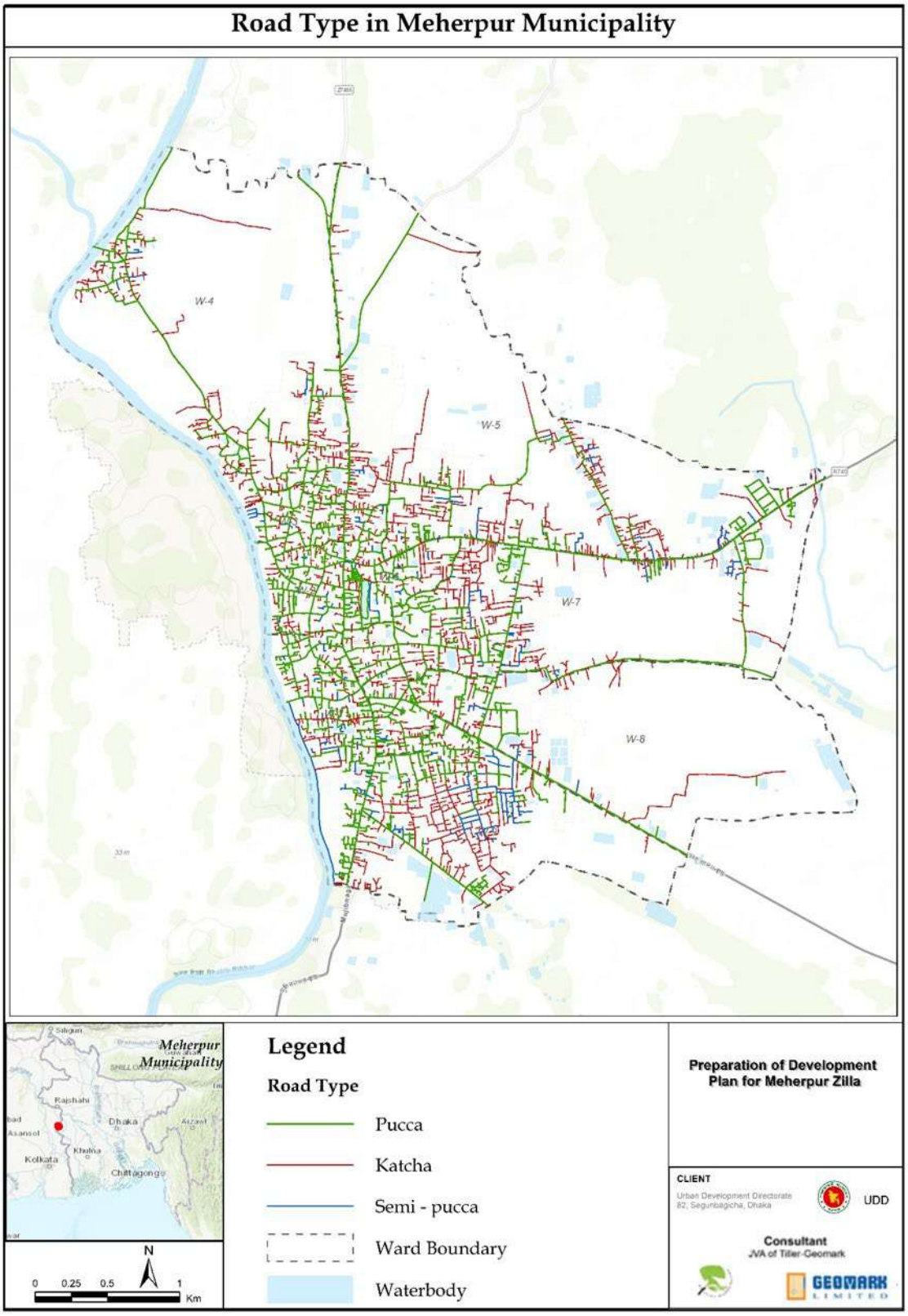

Figure 3-7: Road Type in Meherpur Municipality

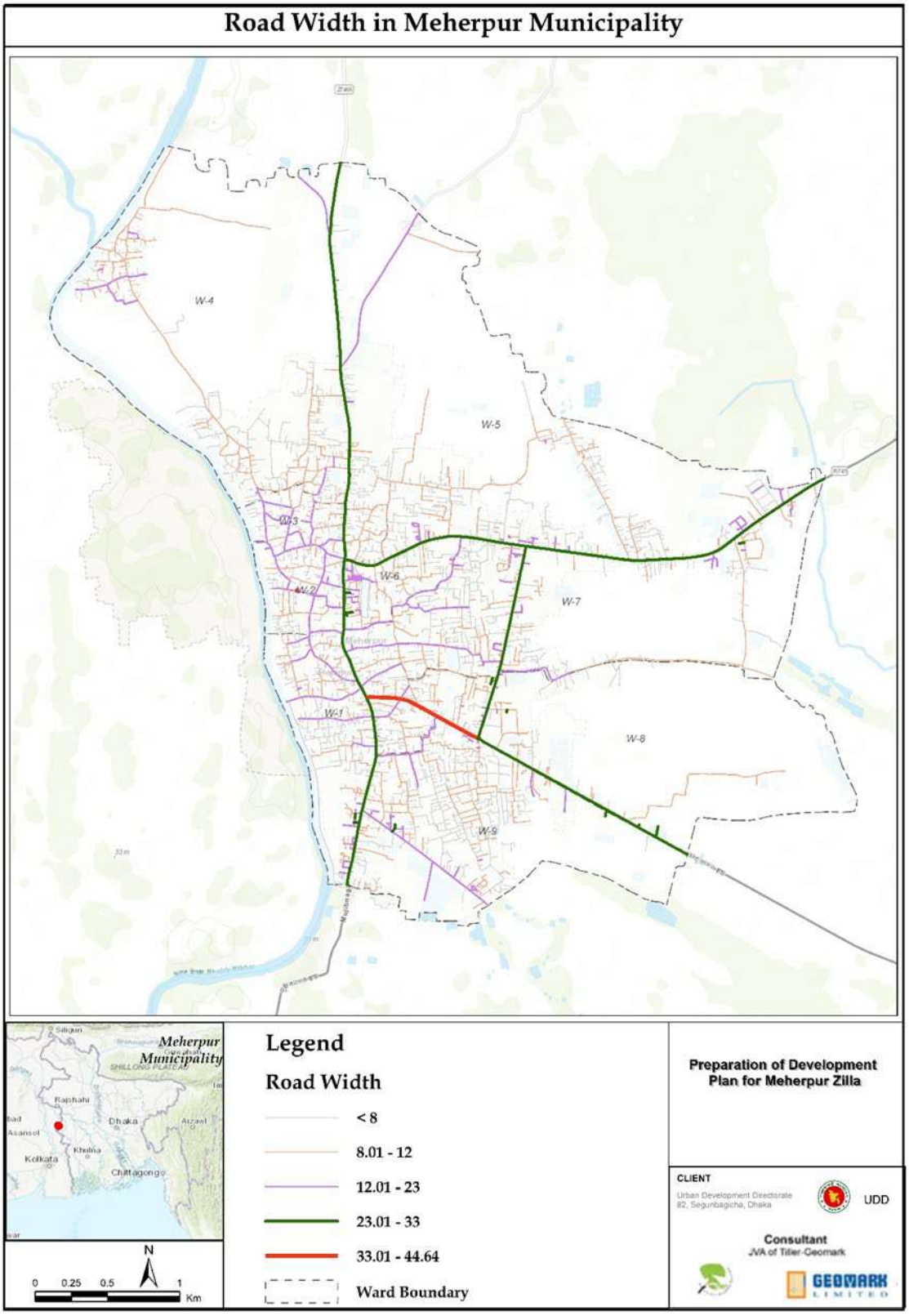

Figure 3-8: Road Width in Meherpur Municipality

3.1.1.4. Drainage Network

The total length of drainage in Meherpur Municipality amounts to 58.91 km, of which 48.08 km (81.62%) is covered and 10.83 km (18.38%) remains uncovered. Ward-wise, the most extensive drainage network is observed in Ward No. 01 (13.61 km), predominantly covered, followed by Ward No. 09 (7.39 km) and Ward No. 07 (6.70 km). Wards such as 03 (3.50 km) and 05 (4.75 km) have relatively shorter drainage networks. Uncovered drains are most prominent in Ward No. 07 (2.22 km) and Ward No. 09 (1.71 km), whereas in several wards like 01, 03, and 08, the uncovered length is less than 1 km. Overall, the drainage system is largely dominated by covered drains.

Table 3-7: Drainage Condition in Meherpur Municipality

Drainage Condition			
Ward No.	***Covered***	***Uncovered***	***Grand Total***
Ward No. 01	13.14	0.47	13.61
Ward No. 02	5.37	1.00	6.37
Ward No. 03	3.31	0.19	3.50
Ward No. 04	4.62	1.51	6.13
Ward No. 05	3.20	1.55	4.75
Ward No. 06	3.90	1.42	5.32
Ward No. 07	4.48	2.22	6.70
Ward No. 08	4.38	0.76	5.14
Ward No. 09	5.68	1.71	7.39
Total	**48.08**	**10.83**	**58.91**
Percentage	***81.62***	***18.38***	***100***

Table 3-8: Drainage Type in Meherpur Municipality

Drainage Type			
Ward No.	***Katcha***	***Pucca***	***Grand Total***
Ward No. 01	0.017	13.596	13.613
Ward No. 02	0.037	6.329	6.366
Ward No. 03		3.501	3.501
Ward No. 04	0.054	6.081	6.135
Ward No. 05	0.058	4.687	4.745
Ward No. 06		5.317	5.317
Ward No. 07		6.700	6.700
Ward No. 08		5.144	5.144
Ward No. 09		7.392	7.392
Grand Total	**0.166**	**58.746**	**58.912**
Percentage	***0.28***	***99.72***	***100.00***

The drainage system in Meherpur Municipality is predominantly pucca (permanent/constructed), accounting for 99.72% (58.746 km) of the total drainage network. In contrast, katcha (temporary/unpaved) drainage is almost negligible, with only 0.28% (0.166 km) of the total length.

Among the wards, Ward No. 01 has the highest share of drainage coverage (13.613 km), followed by Ward No. 02 (6.366 km), Ward No. 07 (6.700 km), and Ward No. 04 (6.135 km). Wards such as 03, 06, 08, and 09 have moderate drainage networks ranging between 3.5 km and 7.4 km, while Ward No. 05

shows relatively less coverage (4.745 km). The very limited presence of katcha drains (only in Wards 01, 02, 04, and 05) highlights the municipality's emphasis on pucca drainage infrastructure.

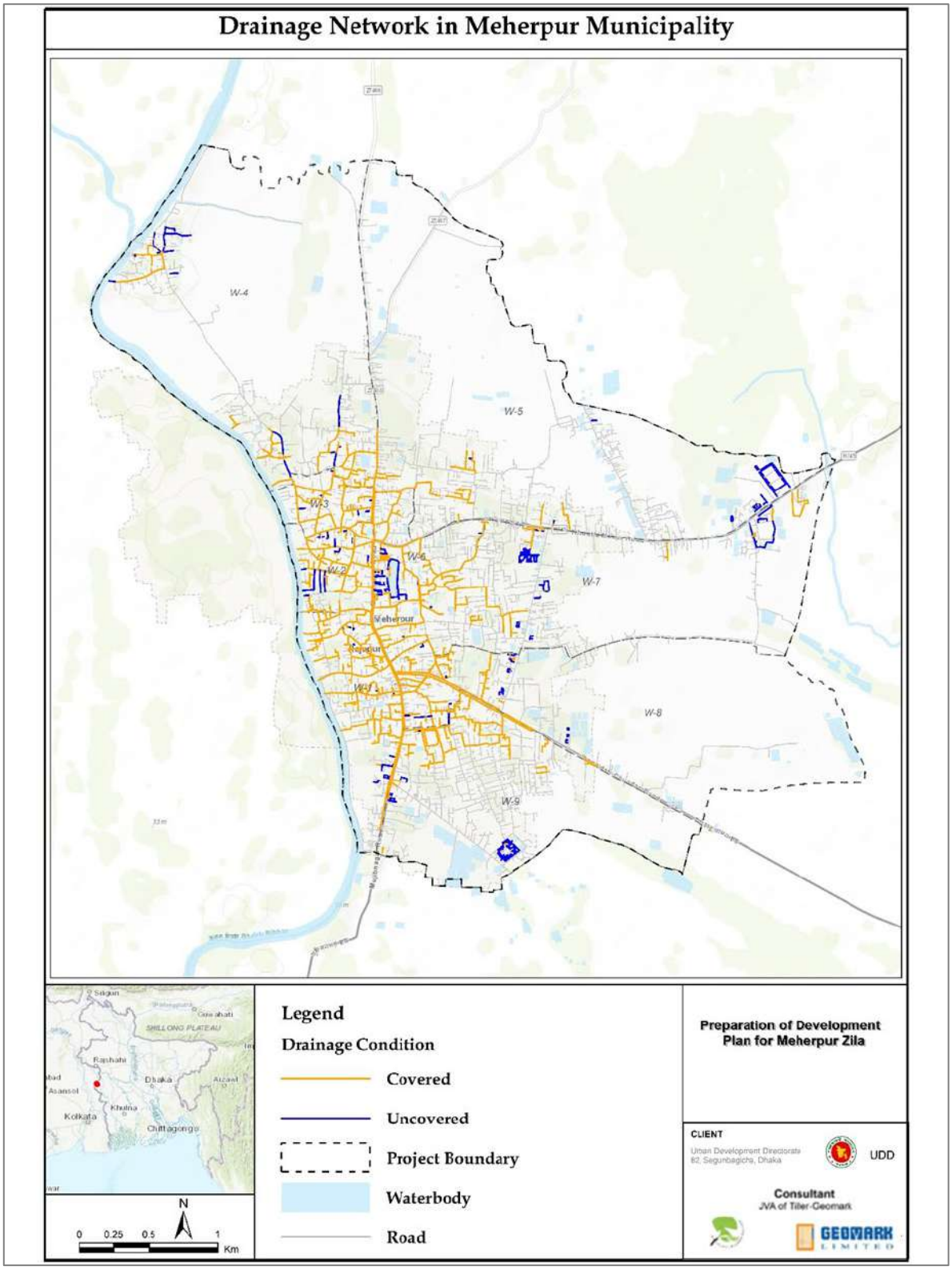

Figure 3-9: Drainage Network in Meherpur Municipality

3.1.1.5. Waterbodies

The Bhairab River flowing alongside or near Meherpur Municipality and is the most prominent local waterbody. The river crossess across Ward no. 1. Additionally, the Kajla River in nearby areas like Amjhupi flows through Ward no. 05, further highlights the presence of water systems influencing the region's geography.

The total waterbody area in Meherpur Municipality covers 199.46 acres, with ponds covering 45.60% (90.55 acres) and rivers 38.36% (76.51 acres) accounting for the majority, while dighis 6.25% (12.47 acres), canals 1.37% (2.74 acres), ditches 7.09% (14.14 acres), lakes 1.41% (2.80 acres), and marshland 0.12% (0.25 acre) occupy comparatively smaller areas. Ward-wise distribution shows that Ward No. 01 contains the largest river stretch (75.59 acres), and Ward No. 05 showa the lowest (0.91 acres). Additionally, Ward No. 05 has the highest pond area (32.83 acres), and Ward No. 09 is notable for its large dighi (12.47 acres). Canals are confined to Ward No. 04, lakes to Ward No. 06, and ditches are most prominent in Ward No. 08 totalling 14.14 acres.

Table 3-9: Ward wise distribution of Waterbodies in Meherpur Municipality

Waterbody Type (Area: Acre)								
Ward No.	***Canal***	***Dighi***	***Ditch***	***Lake***	***Marshland***	***Pond***	***River***	***Grand Total***
Ward No. 01			1.20			1.53	75.59	78.32
Ward No. 02			0.40			0.57		0.98
Ward No. 03			0.15		0.11	0.45		0.71
Ward No. 04	2.74		0.69		0.14	7.77		11.35
Ward No. 05			2.51			32.83	0.91	36.26
Ward No. 06			1.17	2.80		1.52		5.50
Ward No. 07			3.07			14.74		17.82
Ward No. 08			4.64			18.89		23.52
Ward No. 09		12.47	0.30			12.24		25.01
Total	**2.74**	**12.47**	**14.14**	**2.80**	**0.25**	**90.55**	**76.51**	**199.46**
Percentage	***1.37***	***6.25***	***7.09***	***1.41***	***0.12***	***45.40***	***38.36***	***100.00***

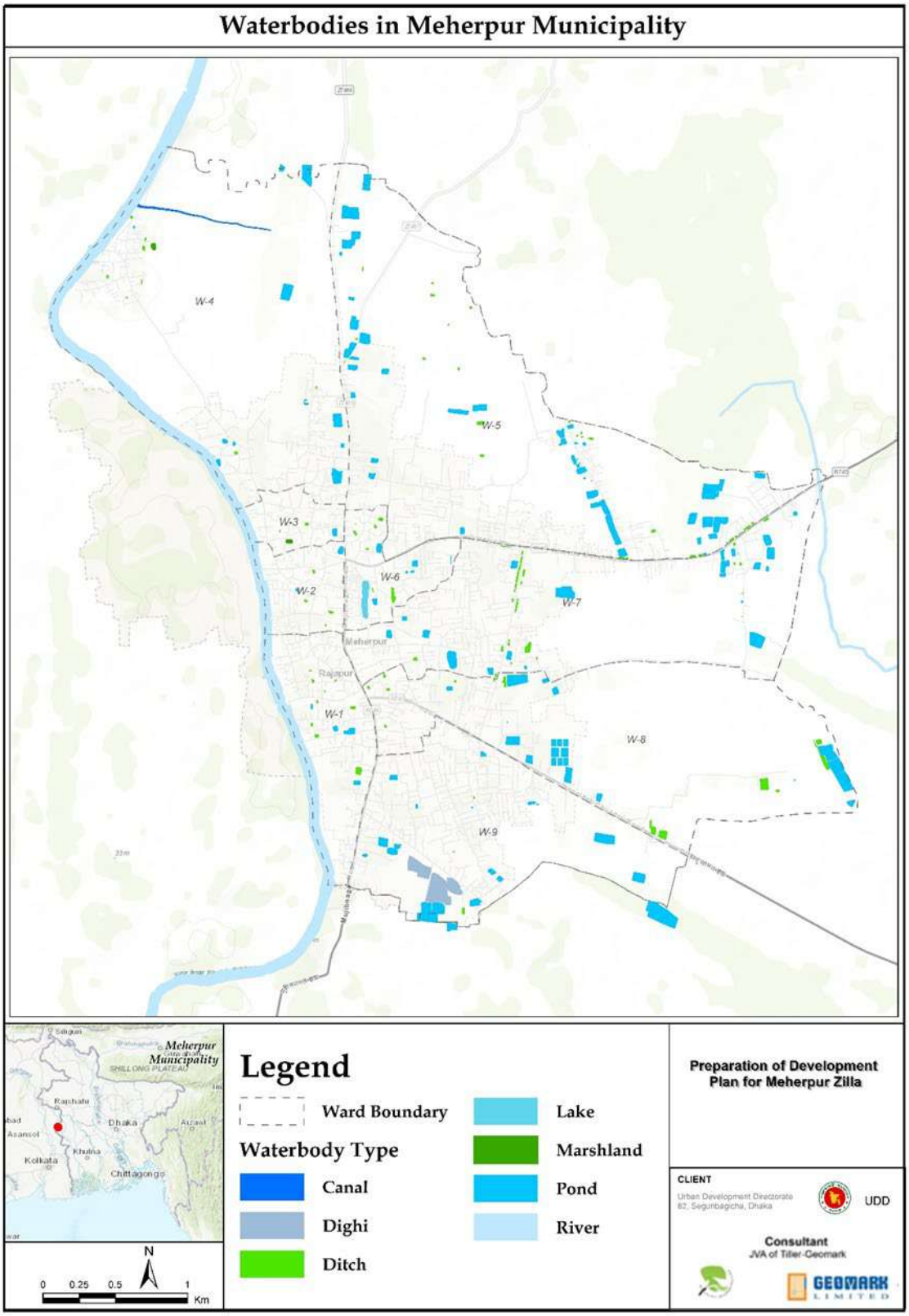

Figure 3-10: Waterbodies in Meherpur Municipality

3.1.1.6. Utilities

The total number of urban public utility points in Meherpur Municipality stands at 1,199, distributed across categories such as community taps, fire hydrants, formal dustbins, high-tension electricity poles (EP), informal disposal points, overhead water tanks, public toilets, and secondary transfer stations (STS). Among these, informal disposal points dominate with 526 numbers, followed by formal dustbins, 388, and community taps, 114. Public toilets (12), overhead water tanks (4), STS (4), and fire hydrants (2) are extremely limited, highlighting gaps in essential service infrastructure.

Community taps are most numerous in Ward No. 07 (30), followed by Ward No. 01 (24) and Ward No. 02 (22), while Wards 03 and 09 have only 2 each, and none are recorded in Ward 04. Fire hydrants are critically scarce, with only 2 units located in Ward No. 07, highlighting a serious gap in firefighting infrastructure. Overhead water tanks are also limited, found only in Ward No. 06 (2) and Ward No. 09 (2), while public toilets are present in five wards, Wards 01, 02, 06 and 08 (2 each) and Ward 09 has 4 totaling 12 public toilets in the municipality. STS facilities exist in only two wards, Ward No. 07 (2) and Ward No. 09 (2).

Table 3-10: Ward wise distribution of Utilities in Meherpur Municipality

Ward No.	Type of Utilities								
	Community Tap	*Fire Hydrant*	*Formal Dustbin*	*High Tension EP*	*Informal Disposal Point*	*Overhead Water Tank*	*Public Toilet*	*STS*	*Grand Total*
Ward 01	24		84		34		2		161
Ward 02	22		50		54		2		157
Ward 03	2		16		18				37
Ward 04			4		12				17
Ward 05	4		10		60	2			76
Ward 06	14		100		74	2	2		235
Ward 07	30	2	34	2	102			2	186
Ward 08	16		60		52		2		147
Ward 09	2		30		120		4	2	183
Total	114	2	388	2	526	4	12	4	1199
%	***9.51***	***0.17***	***32.36***	***0.17***	***43.87***	***0.33***	***1.00***	***0.33***	***100***

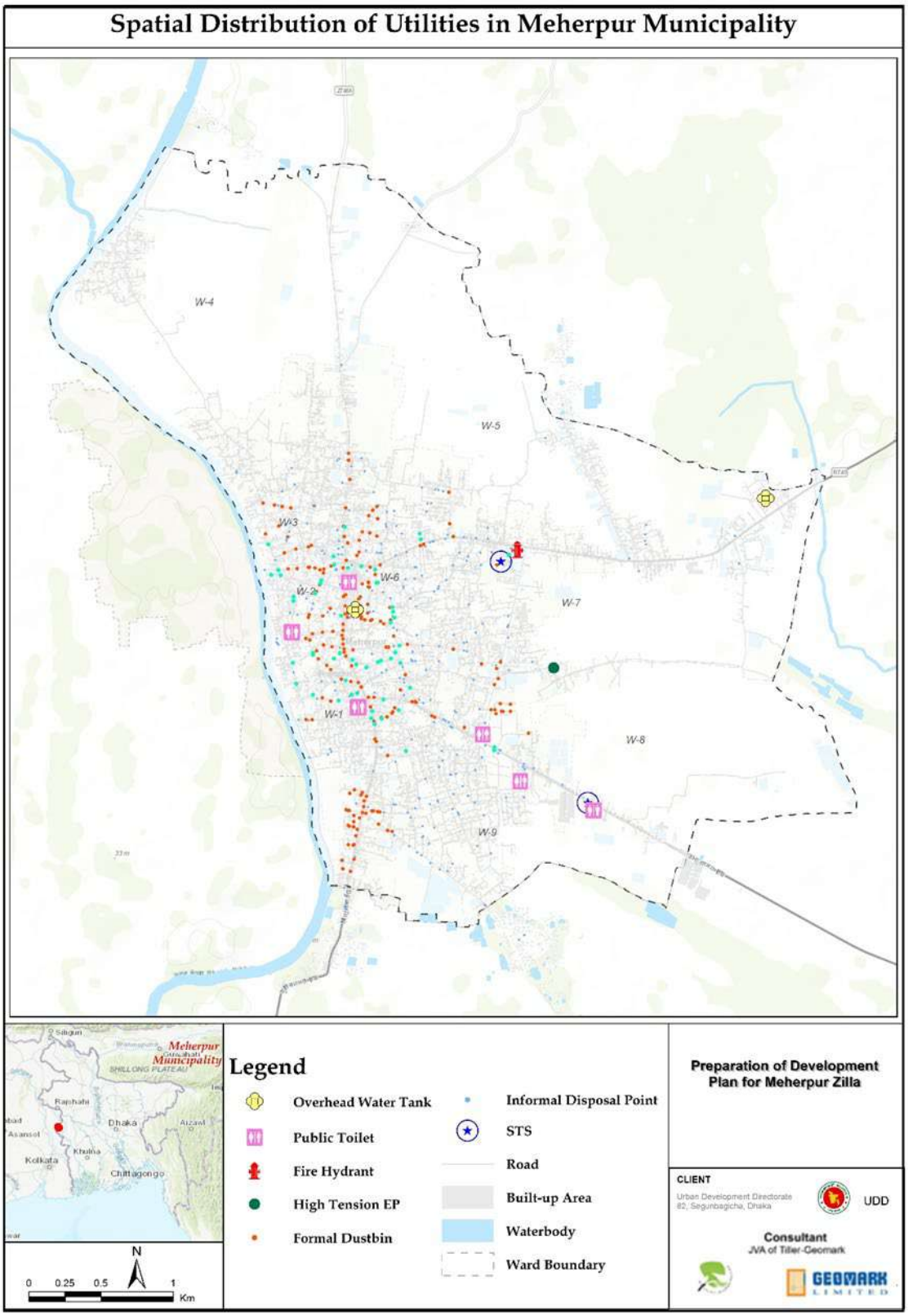

Figure 3-11: Spatial Distribution of Utilities in Meherpur Municipality

3.1.1.7. Recreational Facilities

The municipality has a total of 21.60 acres of open space dedicated to parks, playgrounds, memorials, and recreational facilities. The majority of this area is occupied by institutional playgrounds (11.86 acres, 54.91%), followed by Eid Ghah/Minar grounds (4.27 acres, 19.77%) and community playgrounds (3.18 acres, 14.72%). Other facilities include parks (1.07 acres, 4.95%), the stadium (1.03 acres, 4.76%), and Shahid Minars (0.19 acres, 0.89%).

At the ward level, Ward No. 09 has the largest share (6.07 acres, 28.1% of total), supported by community and institutional playgrounds along with the only stadium in the municipality. Ward No. 08 (5.26 acres) and Ward No. 06 (5.14 acres) also have significant recreational areas, primarily due to large institutional playgrounds. In contrast, Ward Nos. 01, 02, and 07 have less than 1.2 acres each, reflecting limited recreational opportunities.

Park Area (Area-Acre)							
Ward No.	***Eid Ghah/ Minar***	***Park***	***Playground (Community)***	***Playground (Institutional)***	***Shahid Minar***	***Stadium***	***Grand Total***
Ward 01			0.52	0.21			0.73
Ward 02			0.05		0.02		0.06
Ward 03	1.27			0.71	0.01		1.99
Ward 04	0.42			0.73			1.14
Ward 06	1.27	0.71	0.03	3.12	0.01		5.14
Ward 07	0.29			0.88	0.02		1.20
Ward 08		0.36	0.35	4.49	0.05		5.26
Ward 09	1.01		2.24	1.72	0.08	1.03	6.07
Grand Total	**4.27**	**1.07**	**3.18**	**11.86**	**0.19**	**1.03**	**21.60**
Percentage	***19.77***	***4.95***	***14.72***	***54.91***	***0.89***	***4.76***	***100.00***

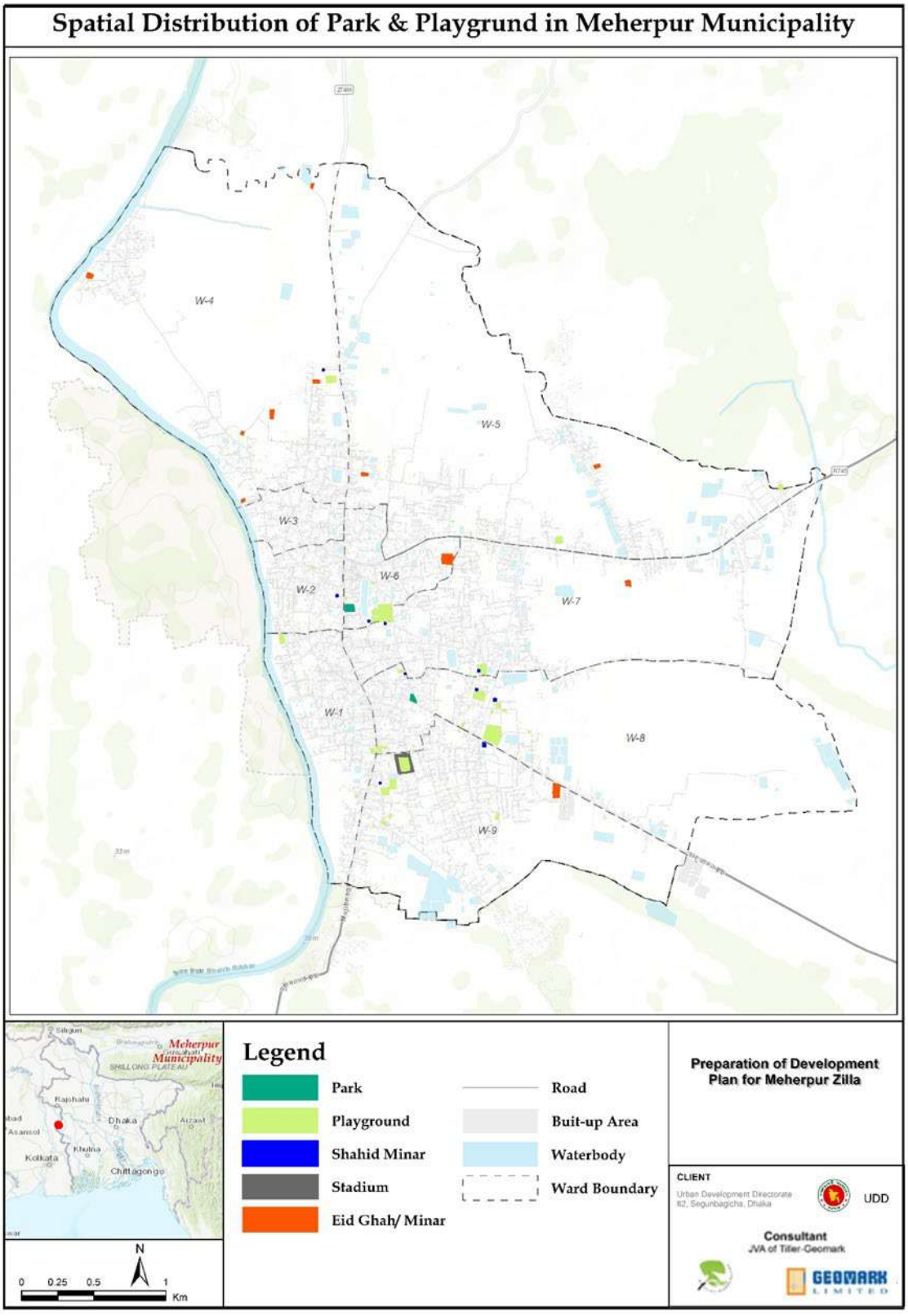

Figure 3-12: Recreational and Community Spaces in Meherpur Municipality

3.1.1.8. Topography

Meherpur Municipality, located in the southwestern region of Bangladesh, is characterized by relatively flat terrain with minor variations in elevation. The municipality lies close to the Indian border, and its landscape is influenced by the adjoining lowland plains and river systems. The Digital Elevation Model (DEM) of Meherpur Municipality, as illustrated in the following figure, highlights an elevation range from approximately 3.00 meters to 21.51 meters.

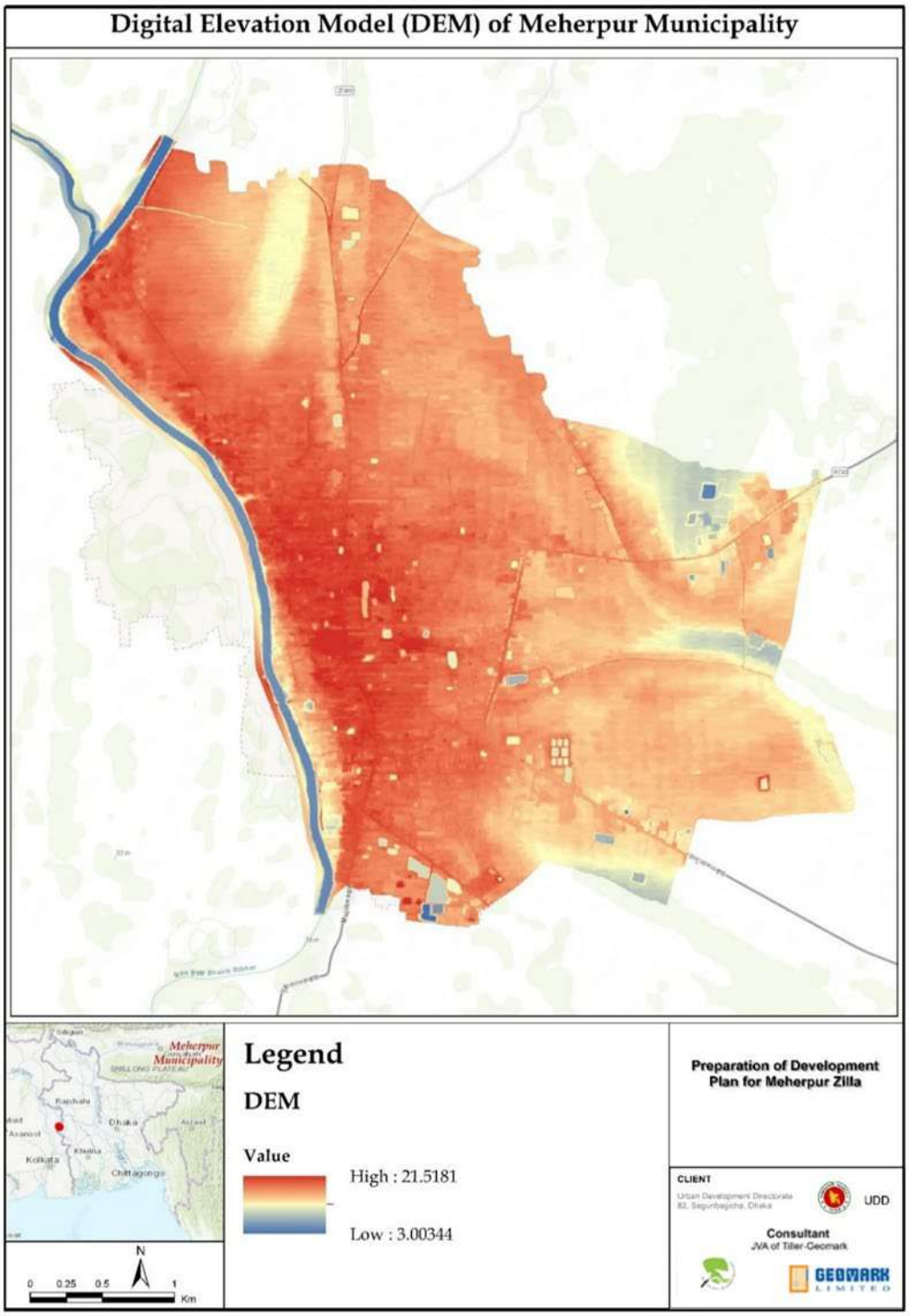

Figure 3-13: Digital Elevation Model (DEM) of Meherpur municipality

The central and western portions of the municipality exhibit comparatively higher elevations, while the southern and southeastern areas appear lower and more susceptible to seasonal waterlogging and flood risks. The DEM clearly shows that the variation in height is not very sharp, indicating a predominantly plain topography with gentle gradients. This flat relief makes the area suitable for urban expansion and agricultural activities but also exposes it to drainage congestion and localized flooding during heavy rainfall.

3.1.1.9. Vendor

The municipality accommodates a total of 147 vendors, distributed across fixed, mobile, seasonal, and semi-fixed categories. The largest shares are held by fixed vendors (48, 32.65%) and semi-fixed vendors (48, 32.65%), followed by mobile vendors (38, 25.85%) and seasonal vendors (13, 8.84%). At the ward level, Ward No. 06 has the highest concentration of vendors (43, 29.25% of the total), dominated by fixed (19) and semi-fixed (20) vendors. This indicates its role as a major commercial hub. Ward No. 02 (29 vendors) and Ward No. 09 (25 vendors) also host a significant number of vendors, with Ward 09 showing the highest number of mobile vendors (15).

In contrast, Ward Nos. 03 and 04 have very limited vendor presence (only 1 each), suggesting low commercial activity or informal vending opportunities in these areas. Other wards, such as 01, 07, and 08, have moderate vendor activity ranging from 14 to 17 vendors.

Table 3-11: Vendor activity in Meherpur municipality

Ward No.	Fixed Vendors	Mobile Vendors	Seasonal Vendors	Semi Fixed Vendors	Grand Total
Ward 01	7	6	2	2	17
Ward 02	8	3	3	15	29
Ward 03	1				1
Ward 04			1		1
Ward 06	19	2	2	20	43
Ward 07	4	7		3	14
Ward 08	2	5	4	6	17
Ward 09	7	15	1	2	25
Grand Total	**48**	**38**	**13**	**48**	**147**
Percentage	***32.65***	***25.85***	***8.84***	***32.65***	***100.00***

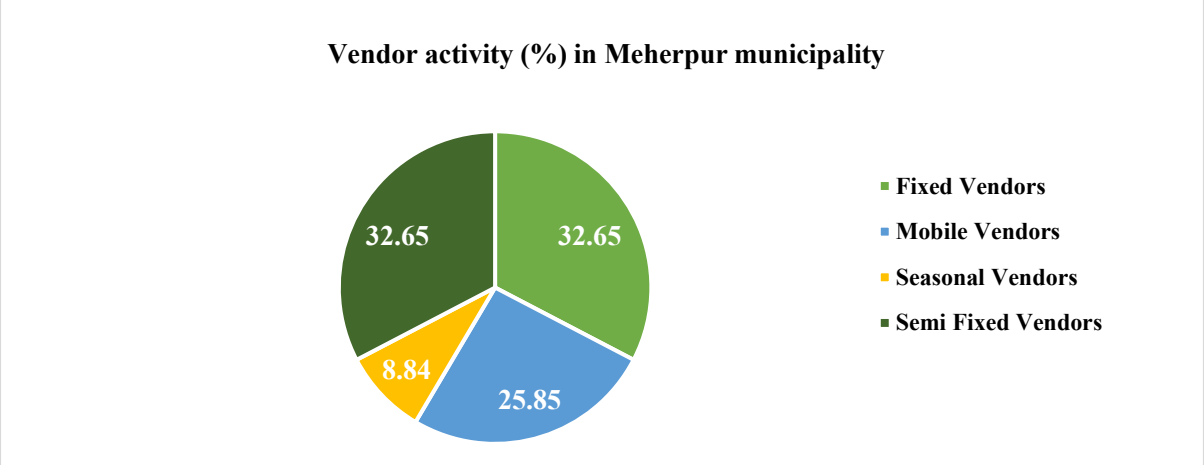

Figure 3-14: Vendor activity (%) in Meherpur municipality

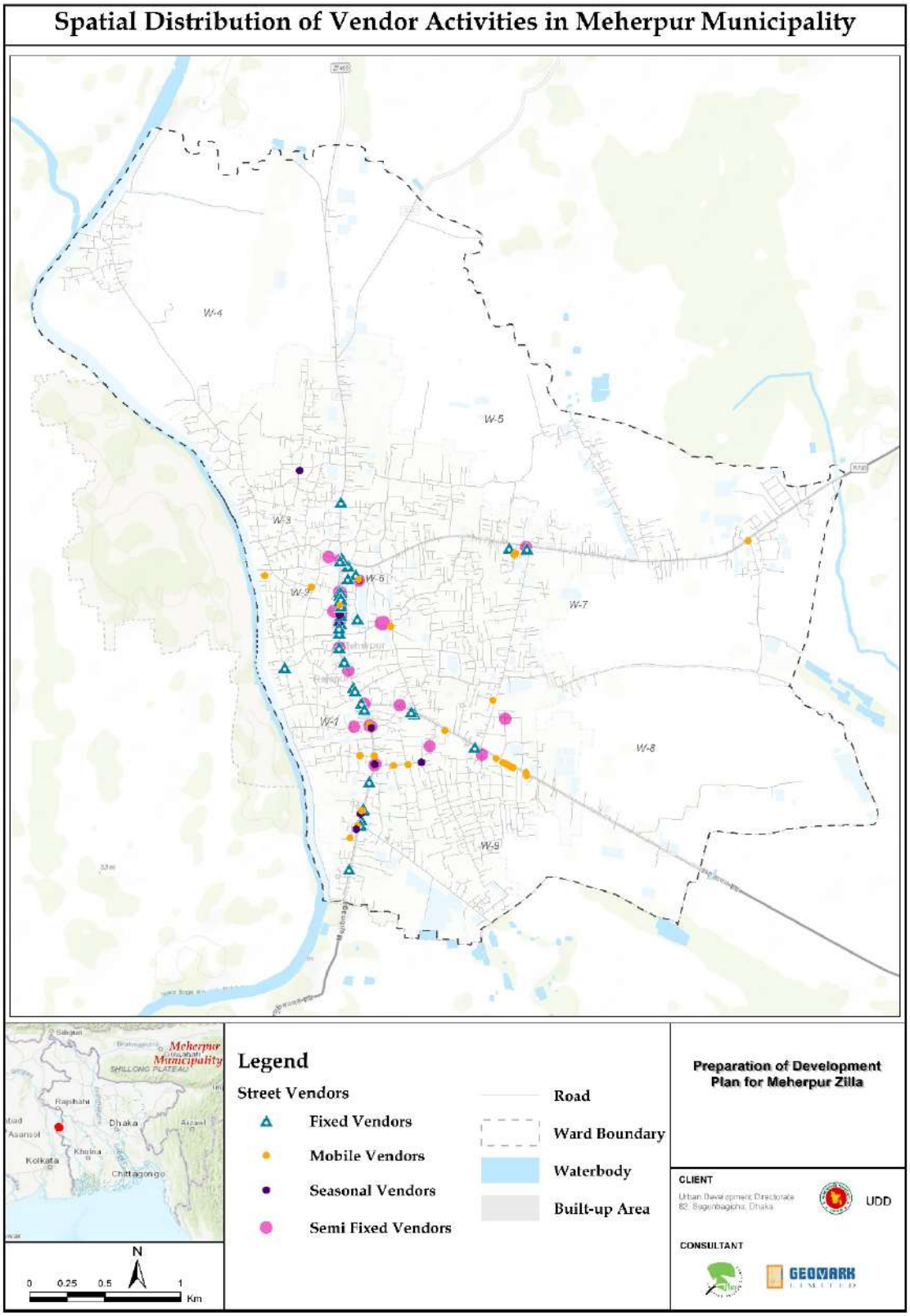

Figure 3-15: Spatial Distribution of Vendor activity in Meherpur municipality

Table 3-12: List of Vendor Goods

Ward No.	Vendor Goods																																
	Acher Seller	*Bakery Food Seller*	*Betel Leaf Seller*	*Cake Seller*	*Chop Seller*	*Cigarette Seller*	*Cloth Seller*	*Cobbler*	*Coconut Seller*	*Cosmetics Seller*	*Dry Fish Seller*	*Egg Seller*	*Electronics Product*	*Fast Food Seller*	*Fish Seller*	*Food Seller*	*Friuts Seller*	*Fuska Seller*	*Jhalmuri Seller*	*Kalai Ruti Seller*	*Meat Seller*	*Mobile Sim Seller*	*Nut Seller*	*Pani Puri Seller*	*Papor, Pitha Seller*	*Pizza Seller*	*Popcorn Shop*	*Shoe Seller*	*Street Food Seller*	*Sugarcane Juice Seller*	*Tea Seller*	*Vegetable Seller*	*Grand Total*
Ward 01		1					2	2						1			5				1		2							1		2	17
Ward 02							3	1				1		4		3	2	2	2	1	1	2	1		2	1		1		1		1	29
Ward 03																	1																1
Ward 04																									1								1
Ward 06	1			1	1	1	3	5			2		1	4			4	3	4	1			1	1	3					2	5		43
Ward 07																2	2		2			1					1	1	1	3	1		14
Ward 08												1		1			3	1	1		3	1			3					1	1	1	17
Ward 09			1				7	1	2	1	1			1	1		5		2			1			1						1		25
Grand Total	**1**	**1**	**1**	**1**	**1**	**1**	**15**	**9**	**2**	**1**	**3**	**2**	**1**	**11**	**1**	**5**	**22**	**6**	**11**	**2**	**5**	**5**	**4**	**1**	**10**	**1**	**1**	**2**	**1**	**8**	**8**	**4**	**147**

3.1.2. Gangni Municipality

3.1.2.1. Road Network

The road network of Gangni Paurashava is predominantly composed of bituminous roads (BTR), which cover 76.58 km, accounting for about 64% of the total road length. This indicates that the majority of the road infrastructure is relatively well-developed and paved, supporting smoother vehicular movement and better connectivity across the urban area.

The second-largest category is earthen roads, with a total length of 18.23 km (about 15%). These roads are generally unpaved and prone to seasonal damage, particularly during the monsoon. Their presence highlights the need for gradual upgrading to more durable surfaces in order to ensure year-round accessibility.

HBB (Herringbone Brick Bond) roads constitute 17.01 km (about 14%) of the network. These semi-paved roads serve as an intermediate type between earthen and fully paved roads, often found in residential or less-trafficked areas. Finally, RCC/CC (Reinforced Cement Concrete / Cement Concrete) roads cover 7.96 km, representing about 6.6% of the total. These roads are usually constructed in high-density where durability is essential, though their overall share remains relatively small. The distribution is shown in the following table and map.

Table 3-13: Gangni Paurashava Road Construction Type

Sl No.	Road Construction Material	Length (m)	Percentage (%)
1.	Bituminous Road (BTR)	76.58	63.93
2.	Earthen	18.23	15.22
3.	HBB	17.01	14.20
4.	RCC/CC Road	7.96	6.64
Total		**119.78**	**100.00**

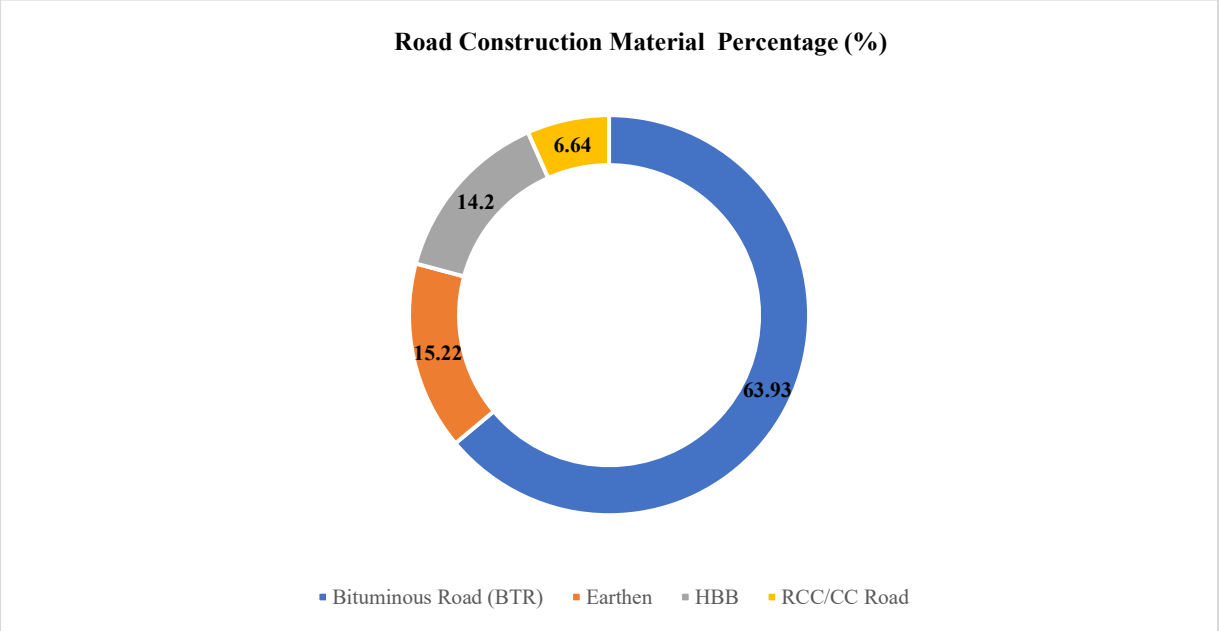

Figure 3-16: Road Construction Material in Gangni municipality

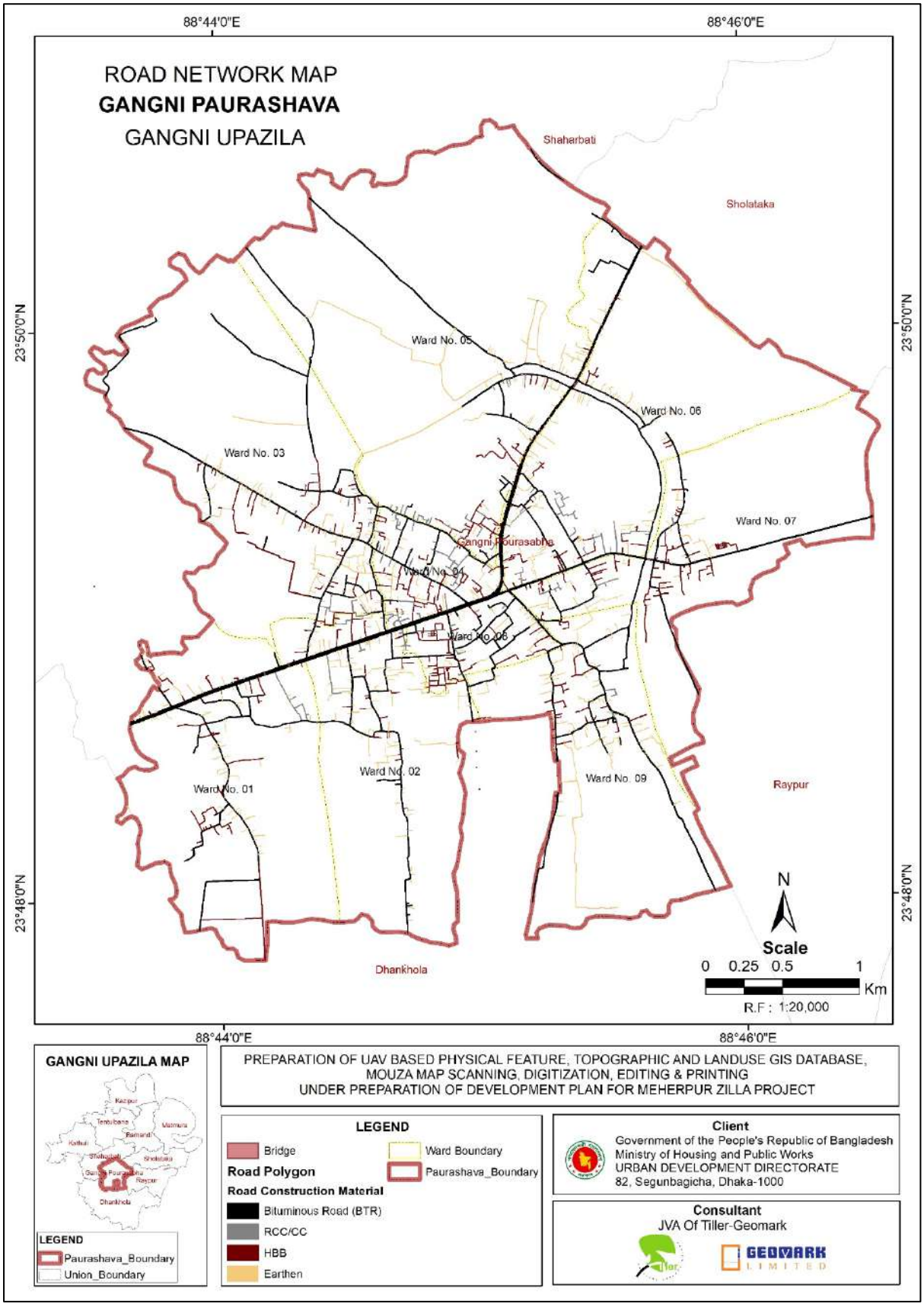

Figure 3-17: Gangni Paurashava Road Construction Type Map

3.1.2.2. Utilities

The utility service facilities in Gangni Paurashava illustrate the essential infrastructure supporting urban life. The most notable facility is the deep tube well, with 1,137 units, which ensures a dependable source of water supply for residents across the town. This is complemented by one community tap and six overhead water tanks, which contribute to localized and stored water distribution.

The electricity network is supported by one electric substation and three high-tension electricity poles, forming the foundation for energy supply and distribution. In terms of solid waste management, the Paurashava has one formal dustbin and 24 informal disposal points, which serve the community for maintaining cleanliness and sanitation.

Public safety facilities include two fire hydrants, ensuring readiness for emergency situations. For communication and connectivity, five mobile towers and one telephone substation provide stable telecommunication coverage. Additionally, 385 street lights illuminate the town, promoting both mobility and public safety during nighttime. The distribution is shown in the following table and map.

Table 3-14:Gangni Paurashava Utility Services

Sl No.	Utility Type	Quantity
1.	Community Tap	1
2.	Deep Tube Well	1137
3.	Electric Substation	1
4.	Fire Hydrant	2
5.	Formal Dustbin	1
6.	High Tension EP	3
7.	Informal Disposal Point	24
8.	Mobile Tower	5
9.	Overhead Water tank	6
10.	Street Light	385
11.	Telephone Substation	1
Total		**1566**

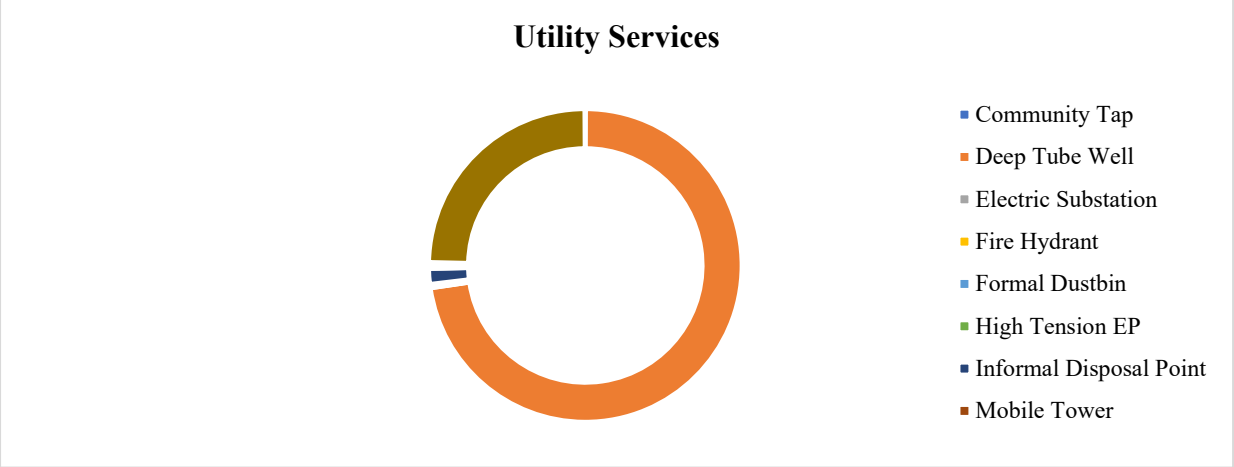

Figure 3-18: Utility Services in Gangni Paurashava

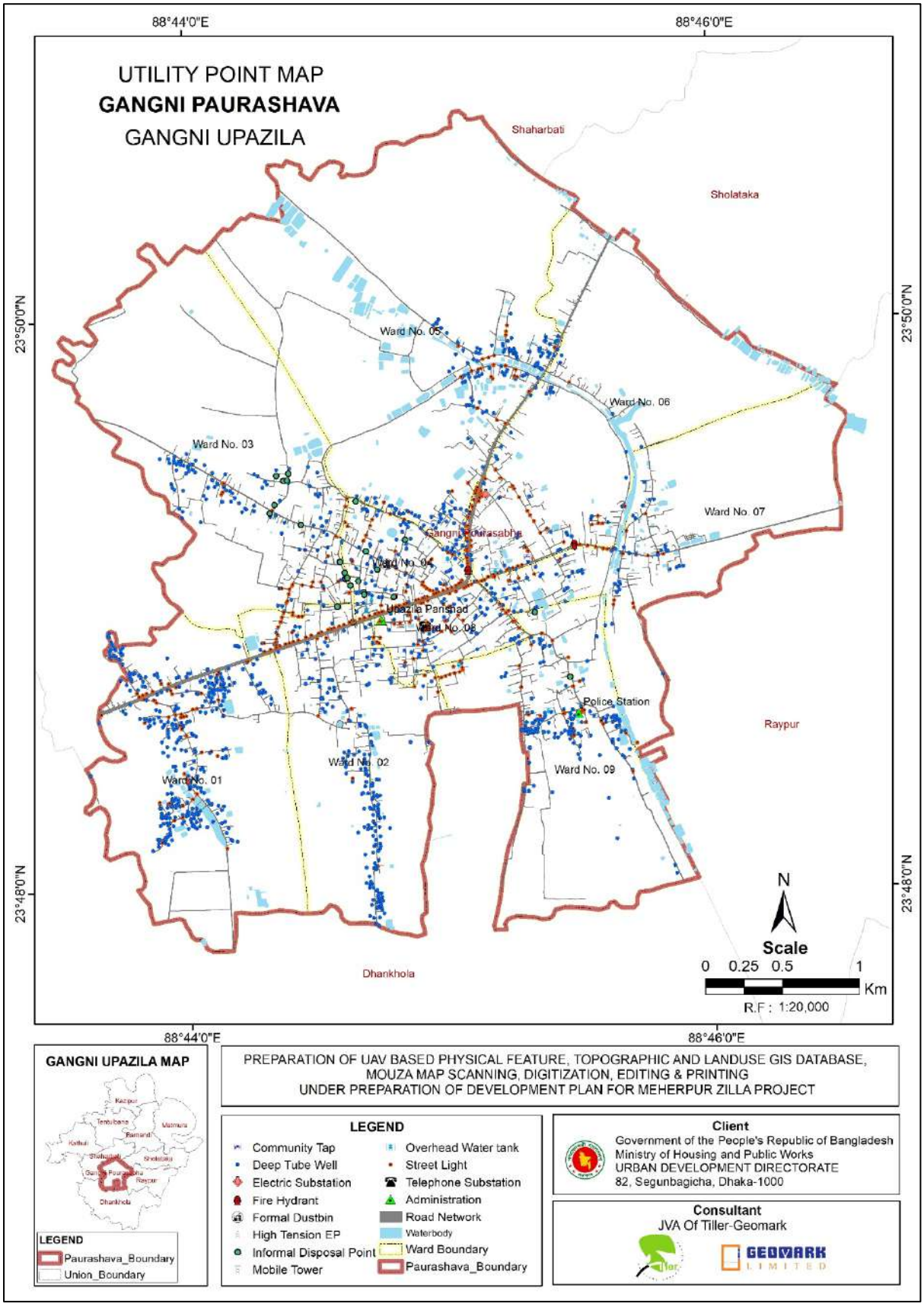

Figure 3-19: Gangni Paurashava Utility Service Map

3.1.2.3. Community Facility

Gangni Paurashava is enriched with a variety of community facilities that support education, health, culture, and social well-being. Among them, **mosques** form the largest category, with **34 establishments**, serving as important religious and community gathering places. **Madrasahs** also play a significant role, with **22 institutions**, contributing to education and moral development.

The Paurashava has a strong foundation in **education facilities**, including **6 colleges**, **5 high schools**, **7 primary schools**, **7 general schools**, **1 kindergarten school**, and **1 pre-cadet school**, ensuring educational opportunities from the early years up to higher levels.

Health services are represented by **2 health complexes**, **1 clinic**, and **1 veterinary hospital**, which provide medical support to residents and also cater to livestock needs.

For cultural and recreational purposes, there are **10 playgrounds**, **4 Eidgahs**, **3 associations/clubs**, and **3 Shaheed Minars**, which strengthen social harmony, sports, and community identity.

The Paurashava also maintains **6 graveyards** and **3 temples**, reflecting respect for religious and cultural diversity within the community. The distribution is shown in the following table and map.

Sl No.	Community Facility	Quantity
1.	Association/Club	3
2.	Clinic	1
3.	College	6
4.	Eidgah	4
5.	Graveyard	6
6.	Health Complex	2
7.	Veterinary Hospital	1
8.	High School	5
9.	Kinder Garten School	1
10.	Madrasah	22
11.	Mosque	34
12.	Playground	10
13.	Pre cadet School	1
14.	Primary School	7
15.	School	7
16.	Shahid Minar	3
17.	Temple	3
Total		**116**

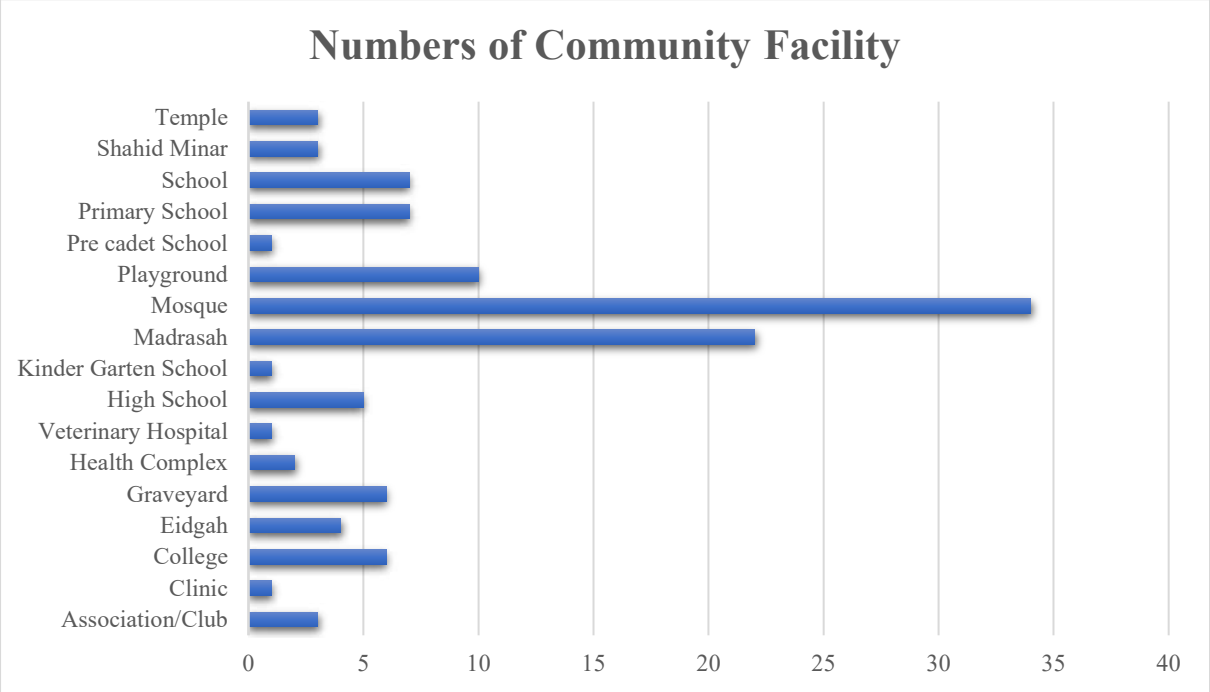

Figure 3-20: Numbers of Community Facility in Gangni municipality

3.1.2.4. Digital Elevation Model (DEM)

The Digital Elevation Model (DEM) of Gangni Paurashava shows clear variations in land height, ranging from 1.34 m to 15 m. The central wards (04, 08, parts of 09) are located on higher ground (red zones), making them more suitable for dense settlements, commercial growth, and infrastructure development. In contrast, the southwestern and southern wards (01 and 02) fall within the lowest elevation zones (blue areas), which are prone to seasonal flooding and waterlogging, but remain favorable for paddy cultivation and other water-dependent crops.

Most of the eastern and northern wards (03, 05, 06, 07) lie in moderate elevation zones (yellow–orange), forming transitional areas that connect agriculture-dominated lowlands with the urbanized highlands. These patterns highlight the need for flood protection in low areas, zoning control for urban expansion in higher areas, and integrated land use planning to balance agriculture, settlement, and transport infrastructure. The Digital Elevation Model is shown in the following map.

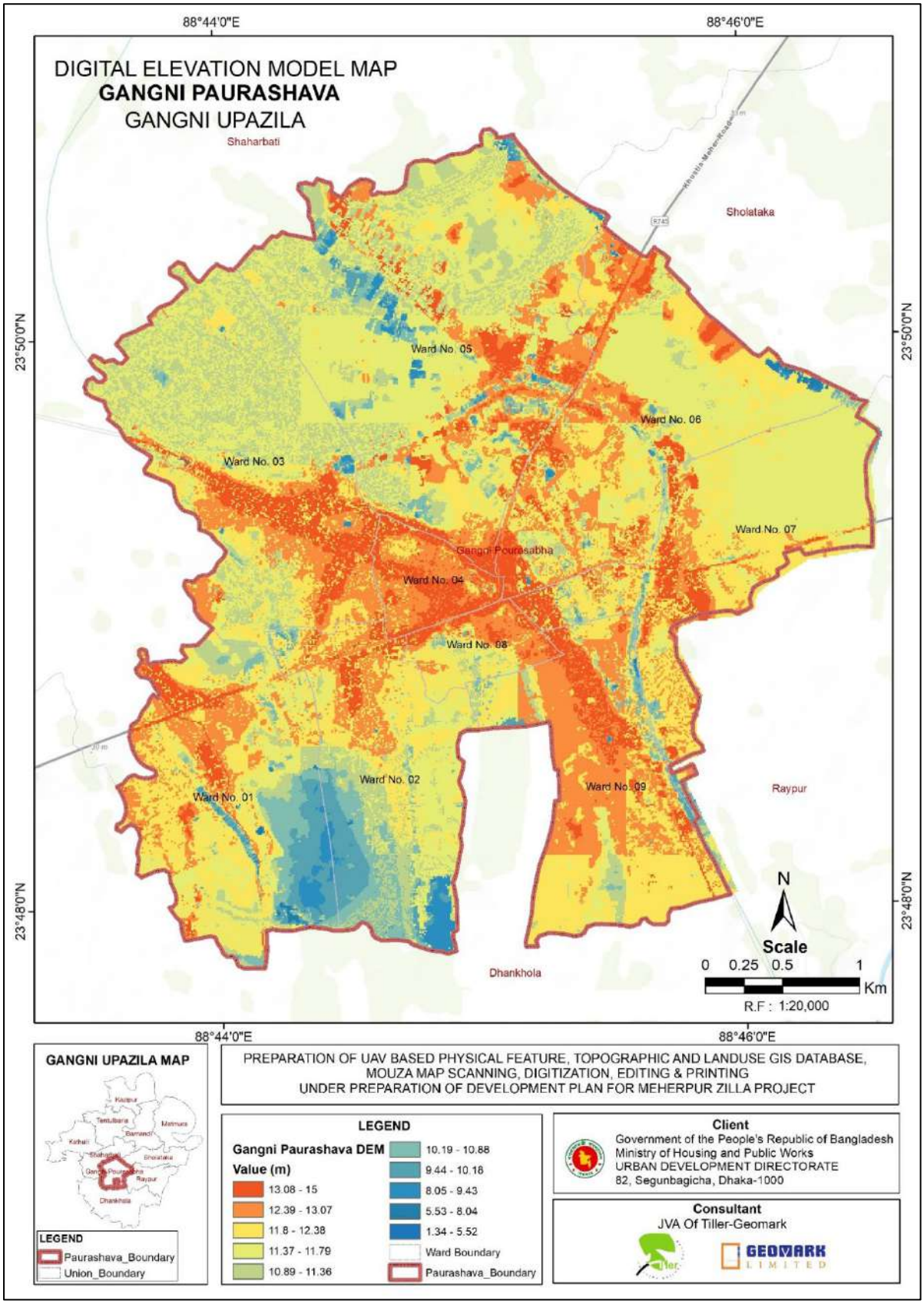

Figure 3-21: Gangni Paurashava Digital Elevation Model Map

3.2. RURAL AREA

3.2.1. Gangni Upazila

3.2.1.1. Structure Type & Use

In Gangni Upazila area, the majority of the houses (36.96%) are Semi Pucca. Katcha and Pucca houses account for 25.88% and 18.62% respectively, while Tin Shed structures make up 17.15%. Thatched and Under Construction houses are relatively rare, comprising only 0.43% and 0.95% of the total.

Table 3-15: Gangni Structure Type

Structure Type	Number of Structures	Percentage (%)
Katcha	77,013	25.88
Pucca	55,397	18.62
Semi Pucca	1,09961	36.96
Thatched	1284	0.43
Tin Shed	51,027	17.15
Under Construction	2843	0.96
Grand Total	**2,97525**	**100**

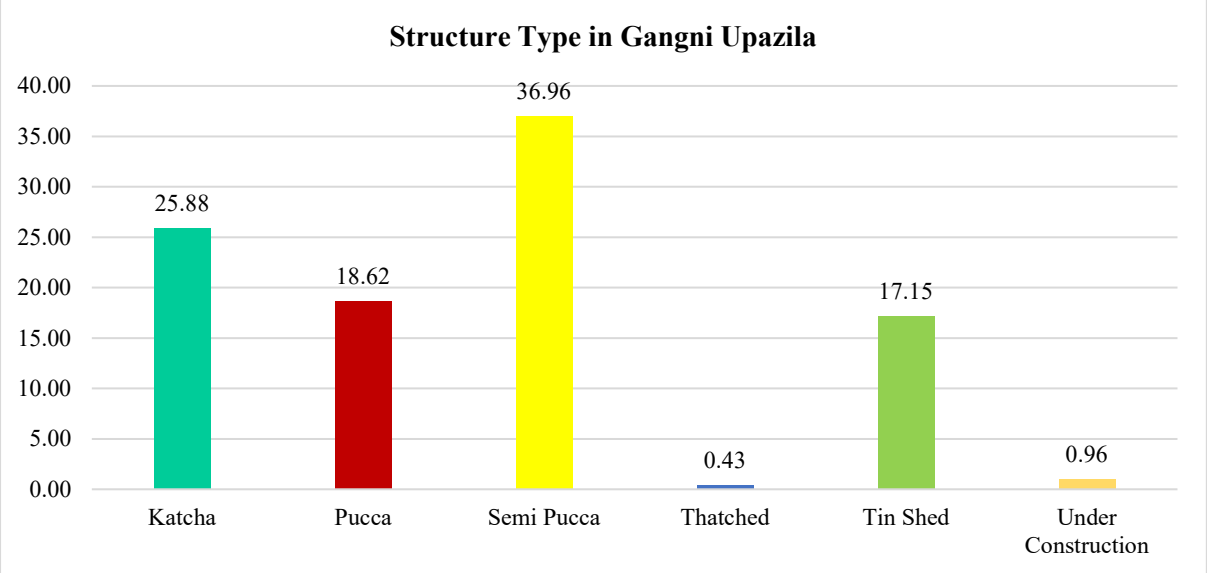

Figure 3-22: Structure Type Distribution of Gangni Upazila

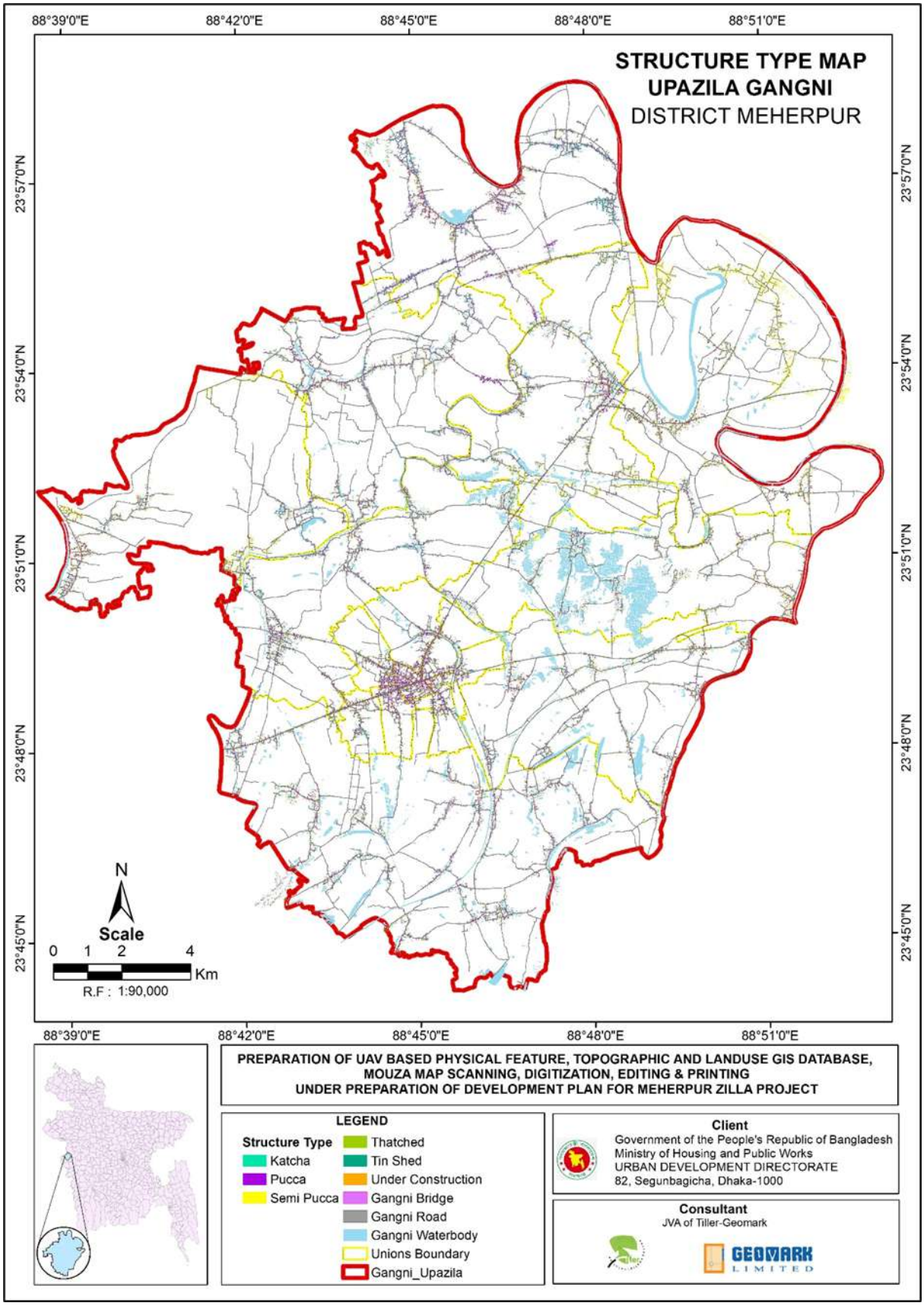

Figure 3-23: Structure Type Map of Gangni upazila

In Gangni upazila, almost 84.37 percent of the structures are being used as residential purposes. The second dominating use is Agriculture (10.73%), followed by Commercial use (3.35%). Other categories such as Education & Research, Community Services, Industrial, Administrative, and Health Facilities collectively account for less than 2%. Very small shares are observed in Tourist Spot, Archeological Site, and Transport & Communication, which are almost negligible in comparison.

Table 3-16: Gangni Structure Use

Structure Use	Number of Structures	Percentage (%)
Administrative	114	0.038
Agriculture	31935	10.734
Archeological Site/History	3	0.001
Commercial	9954	3.346
Community Services	825	0.277
Education & Research	912	0.307
Health Facility	82	0.028
Industrial	187	0.063
Mixed Use	1364	0.458
Non-Government Services	42	0.014
Residential	2,51032	84.373
Services Activities	365	0.123
Tourist Spot	6	0.002
Transport & Communication	4	0.001
Under Construction	700	0.235
Grand Total	**2,97525**	**100**

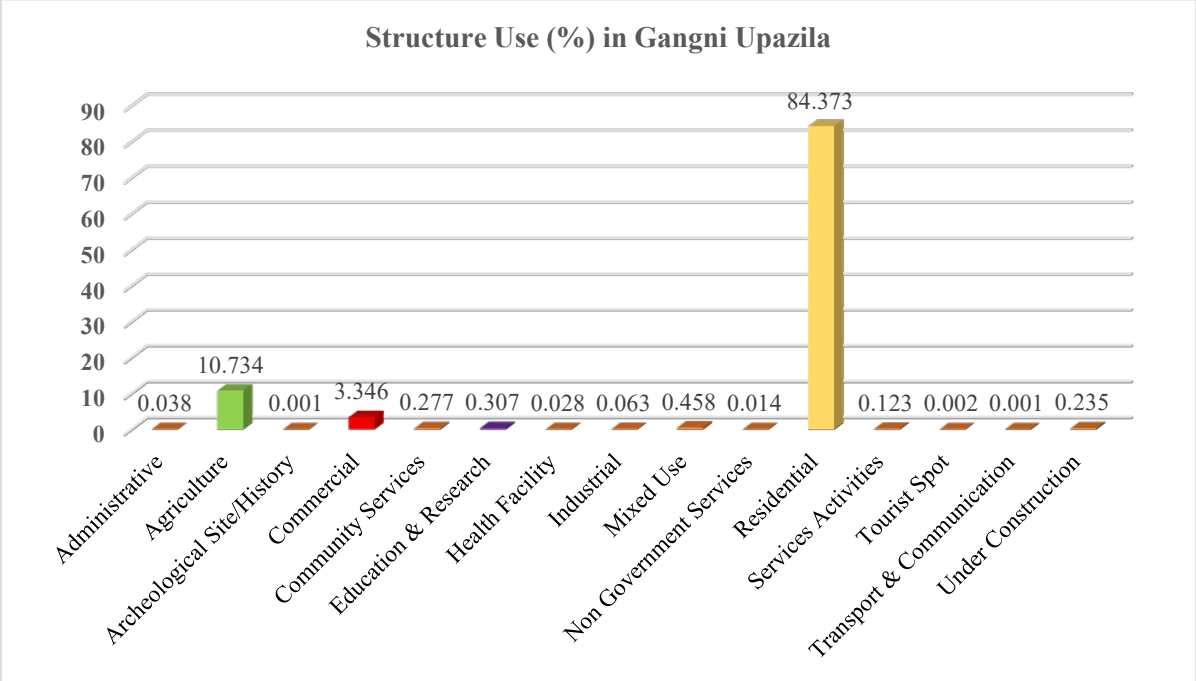

Figure 3-24: Structure Use Distribution of Gangni Upazila

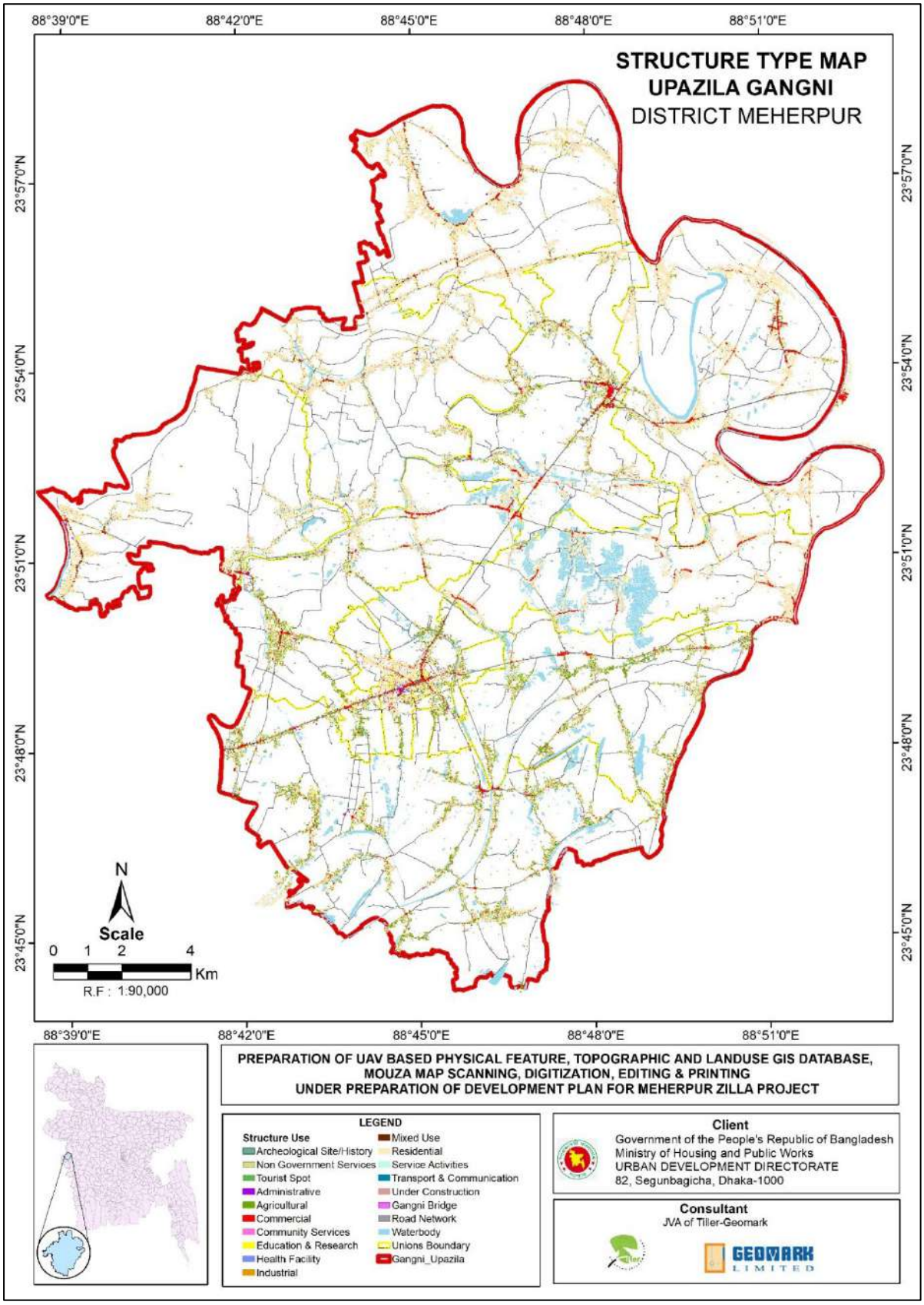

Figure 3-25: Structure use Map of Gangni Upazila

3.2.1.2. Road Network

The road network within in Gangni Upazila Area is primarily composed of Bituminous Road (BTR), which constitutes **62.75%** of the total length. The second most common surface type is Earthen (**27.74%**). Paved surfaces using HBB (**7.96%**) and RCC/CC concrete (**1.55%**) represent a smaller fraction of the infrastructure.

Table 3-17: Gangni Road Type

Road Type	Road Length (Km)	Percentage (%)
RCC/CC Road	16.35	1.55
HBB	84.28	7.96
Earthen	293.54	27.74
Bituminous Road (BTR)	664.03	62.75
Total	**1,058.20**	**100**

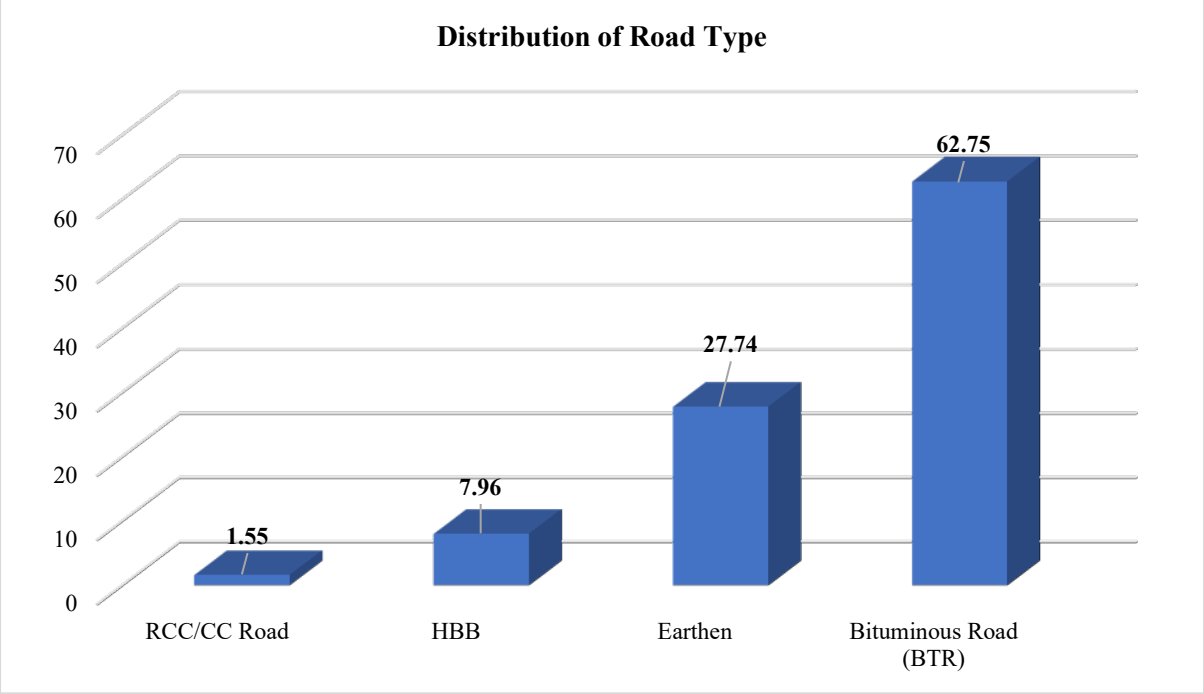

Figure 3-26: Road Type Distribution in Gangni Upazila

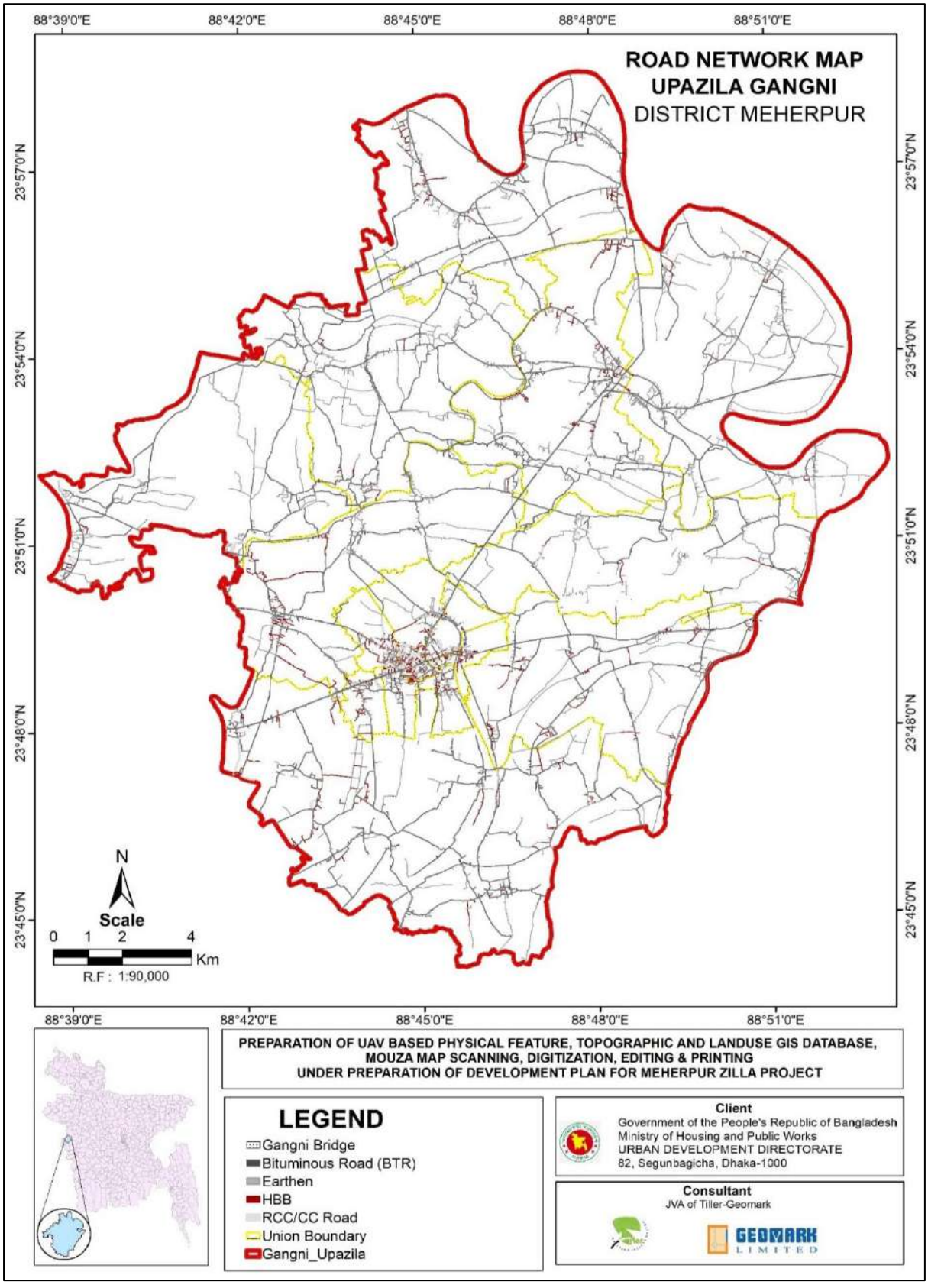

Figure 3-27: Road Type Map of Gangni Upazila

3.2.1.3. Waterbodies

In Gangni upazila,the primary surface water feature in the region is **Ponds**, which make up **57.1%** of the total area. **Fish Ponds (15.2%)** and **Canals (12.7%)** are also major components. Together, these three types account for over 85% of all surface water. The remaining area is composed of Rivers (**7.5%**), Ditches (**6.9%**), and other minor water bodies that individually constitute less than 1% of the total.

Table 3-18: Waterbody Type in Gangni Upazila

Type	Area	Percentage (%)
Fish Pond	508.02	15.172
Lake	1.28	0.038
Pond	1911.90	57.098
Ditch	230.81	6.893
Marsh Land	0.27	0.008
River	252.75	7.548
Dighi	18.24	0.545
Beel	0.19	0.006
Canal	425.01	12.693
Total	**3348.48**	**100.000**

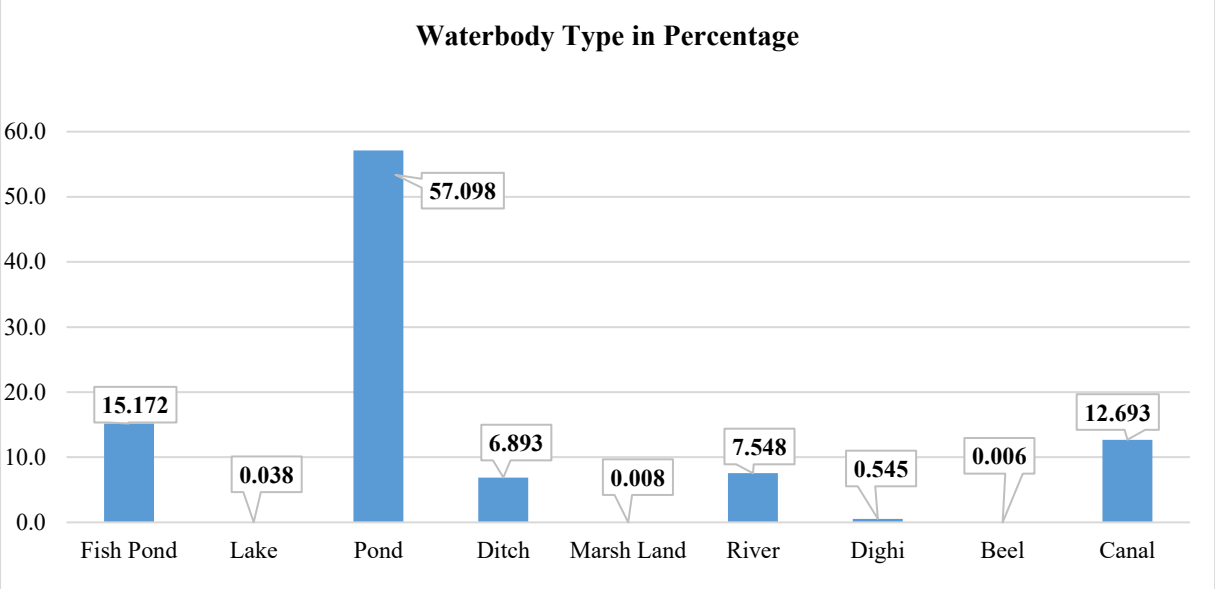

Figure 3-28: Waterbody Type Distribution of Gangni Upazila

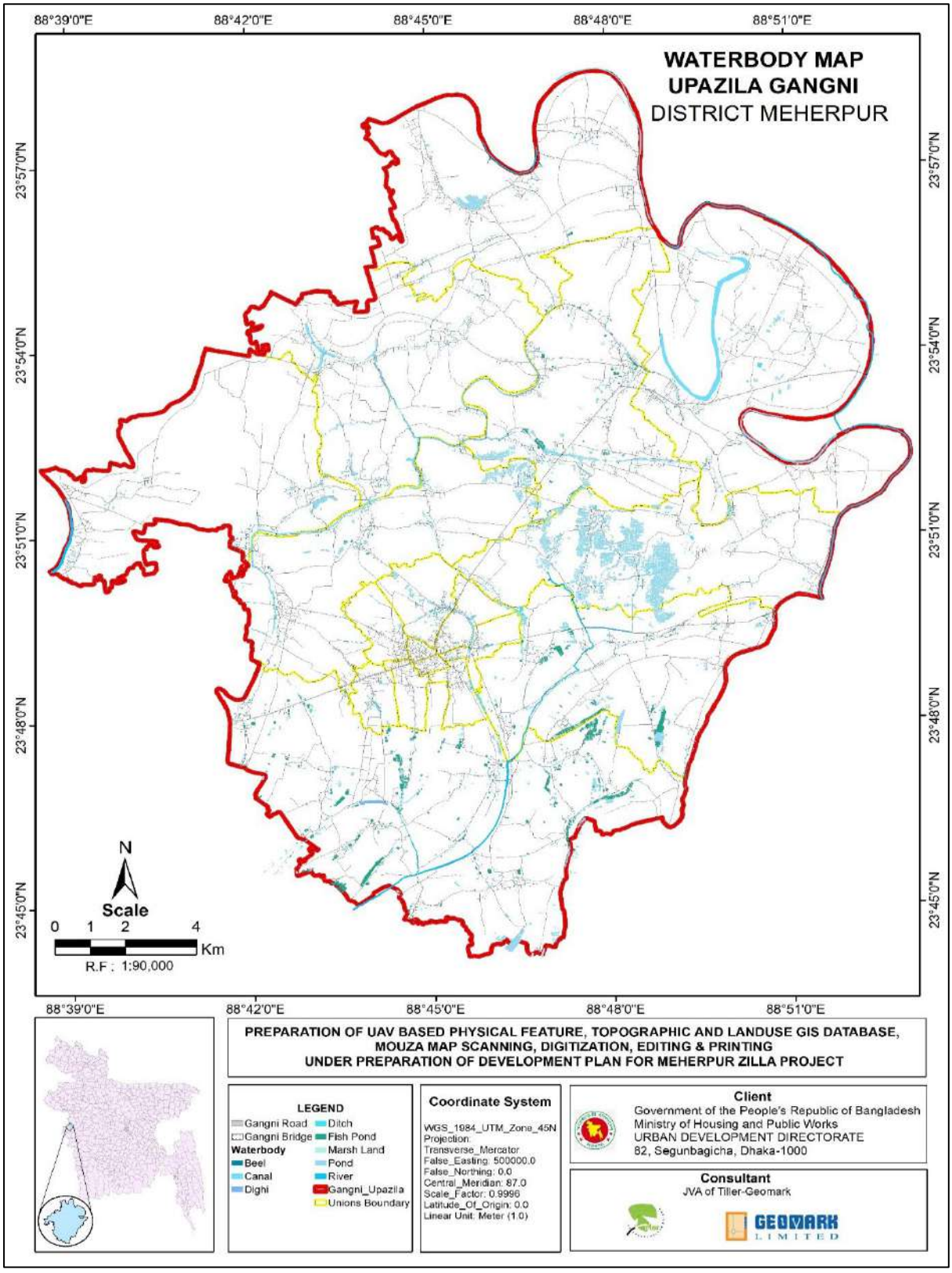

Figure 3-29: Waterbody Type Map of Gangni upazila

3.2.2. Meherpur Upazila

3.2.2.1. Structure Type, Use & Building Height

The housing and structure distribution across the unions of Meherpur shows that tinshed houses constitute the largest share, accounting for 40.05% (69,639 structures) of the total 173864 structures. This is followed by semi-pucca houses, which make up 26.42% (45,933 structures), and pucca houses, contributing 26.04% (45,271 structures). Katcha houses are relatively fewer, standing at 7.45% (12,956 structures), while steel structures remain marginal at 0.04% (65 structures).

Union-wise patterns show interesting variations. **Amjhupi** has the highest number of structures (30974) with the largest share of semi-pucca houses (9,518) among all unions, indicating an ongoing shift towards durable housing, while also recording the largest share of tinshed (12,452). **Kutubpur** follows closely with 12,333 tinshed houses and a fairly balanced mix of pucca (7574) and semi-pucca (6780) structures, making it the second largest housing clusters overall (29,664). **Amdah** also demonstrates significant pucca development (7,927), accounting for nearly one-third of its housing stock, while still maintaining a large share of tinshed (9923). Smaller unions such as **Pirojpur** record fewer structures overall, but tinshed (7834) houses remain dominant there as well. Overall, the findings reveals that a considerable proportion of households (over 52%) live in **pucca or semi-pucca houses**.

Table 3-19: Union wise Structure Type in Meherpur Rural Area

Union	Structure Type					
	Katcha	*Pucca*	*Semi Pucca*	*Steel*	*Tinshed*	*Grand Total*
Amdah	2248	**7927**	7551	9	9923	27658
Amjhupi	1820	7157	9518	27	**12452**	**30974**
Baradi	1382	5125	6533	4	8784	21828
Buripota	1818	7727	5387	3	8390	23325
Kutubpur	2969	7574	6780	8	12333	29,664
Pirojpur	1445	5719	4776	2	**7834**	19,776
Shyampur	1274	4042	5388	12	9923	20,639
Grand Total	**12,956**	**45,271**	**45,933**	**65**	**69,639**	**1,73,864**
Percentage	***7.45***	***26.04***	***26.42***	***0.04***	***40.05***	***100.00***

The findings also highlight a clear dominance of residential (60.83%) and other structures (32.14%), together accounting for over 93% of the total structures. In comparison, commercial (1.19%), mixed use (1.31%), and service activities (1.65%) represent only a small share. Agriculture (0.24%), education and research (0.28%), industry (0.21%), administrative/public service (0.02%), and transportation and communication (0.04%) occupy minimal portions of the total structures. This indicates that the area is overwhelmingly residential in character, with limited space dedicated to institutional, industrial, and commercial functions.

The Composition of Structure Use in Meherpur Rural Area has been depicted in the following table:

Table 3-20: Composition of Structure Use in Meherpur Rural Area

Union	Structure Use													
	Administrative/ Public Service	*Agriculture*	*Commercial*	*Community Service*	*Education and Research*	*Industry*	*Mixed Use*	*New Use*	*Other Structure*	*Residential*	*Service Activity*	*Transportation and Communication*	*Under Construction*	*Grand Total*
Amdah	4	60	298	65	67	71	476	31	17653	8175	423	12	323	27,658
Amjhupi	7	90	419	83	96	99	354	194	18986	9634	596	13	403	30,974
Baradi	8	42	314	67	62	42	238	66	13659	6565	446	11	308	21,828
Buripota	3	71	275	84	61	57	356	88	12852	8870	222	6	380	23,325
Kutubpur	6	53	305	100	88	38	400	319	17094	10394	469	14	384	29,664
Pirojpur	2	6	237	50	54	29	253	109	12169	6193	390	8	276	19,776
Shyampur		91	219	61	54	34	202	27	13357	6051	315	7	221	20,639
Grand Total	**30**	**413**	**2067**	**510**	**482**	**370**	**2279**	**834**	**105770**	**55882**	**2861**	**71**	**2295**	**17,3864**
Percentage	***0.02***	***0.24***	***1.19***	***0.29***	***0.28***	***0.21***	***1.31***	***0.48***	***60.83***	***32.14***	***1.65***	***0.04***	***1.32***	***100.00***

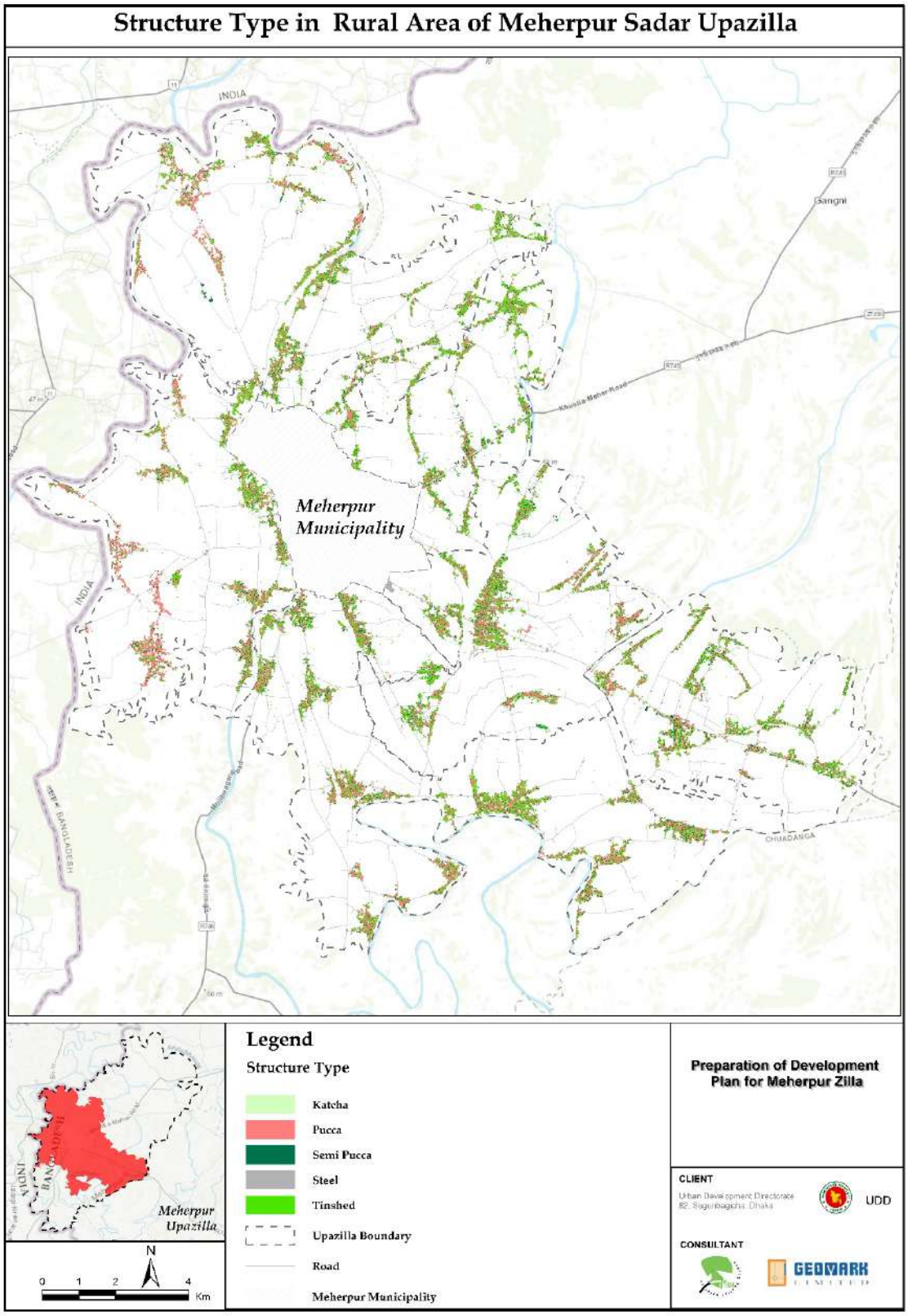

Figure 3-30: Spatial Distrubution of Structure type in Meherpur Rural Area

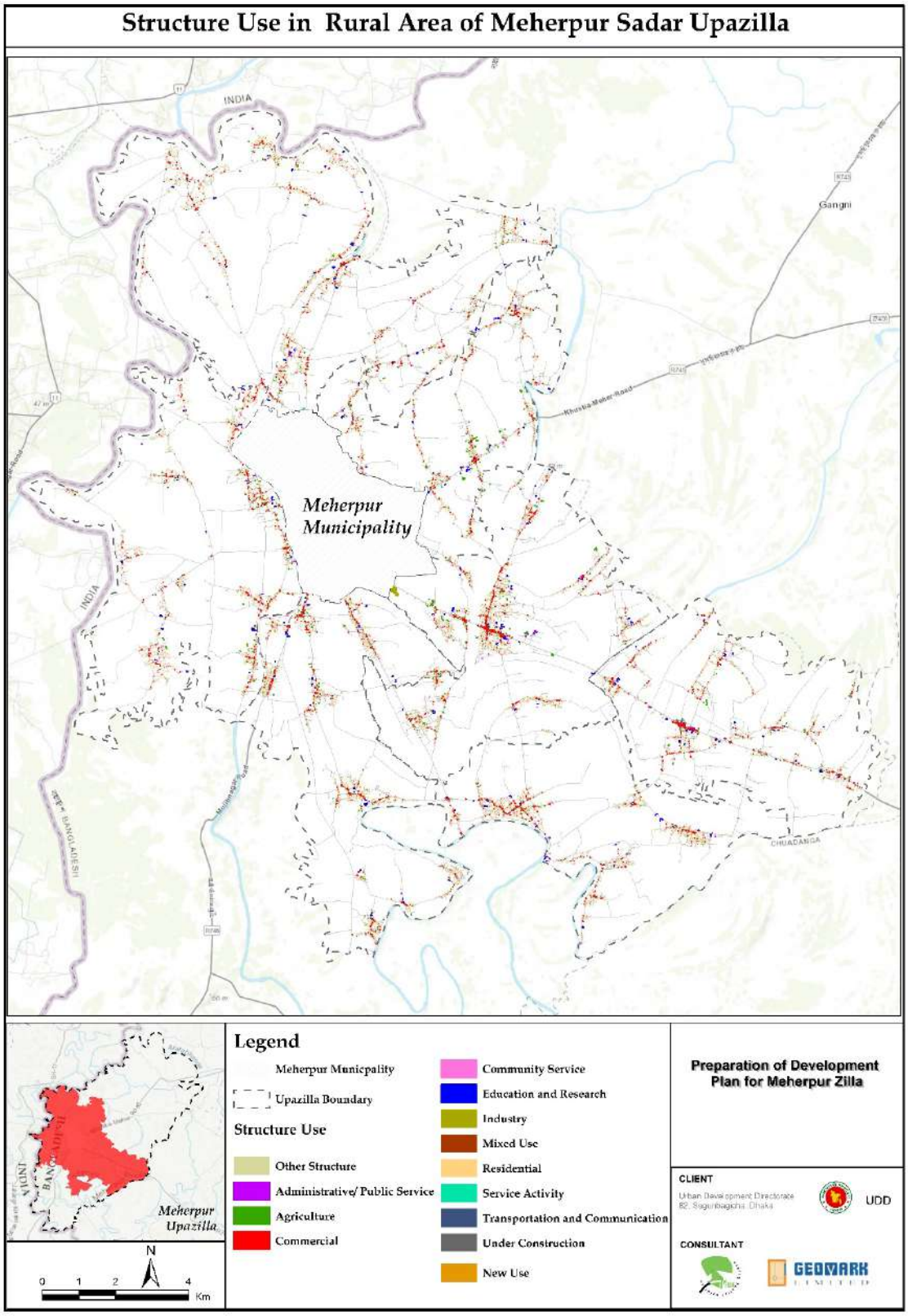

Figure 3-31: Spatial Distribution of Structure use in Meherpur Rural Area

The floor distribution of structures across the unions shows a clear dominance of single-story buildings, which account for 97.72% (169,894 out of 173,864 structures). This overwhelmingly indicates a low-rise settlement pattern. Two-story buildings make up only 2.15% (3,734 structures), while 3–5 story buildings (0.14%) and 6–7 story buildings (0.002%) are negligible in number. The very low share of multi-storied structures suggests that vertical urbanization has not yet significantly taken place in these unions. At the union level, Amdah and Amjhupi together contribute the largest share of multi-storied buildings, with 798 and 642 non-single-story structures respectively, while unions like Baradi and Shyampur show very minimal vertical development.

Table 3-21: Building Height and its distribution in Meherpur Rural Area

Union	Floor				
	1	2	3-5	6-7	Grand Total
Amdah	26860	749	47	2	27658
Amjhupi	30332	579	62	1	30974
Baradi	21408	387	33		21828
Buripota	22629	662	34		23325
Kutubpur	28993	640	31		29664
Pirojpur	19339	423	14		19776
Shyampur	20332	294	13		20639
Grand Total	**1,69,894**	**3734**	**234**	**3**	**1,73,864**
Percentage	***97.717***	***2.148***	***0.135***	***0.002***	***100.00***

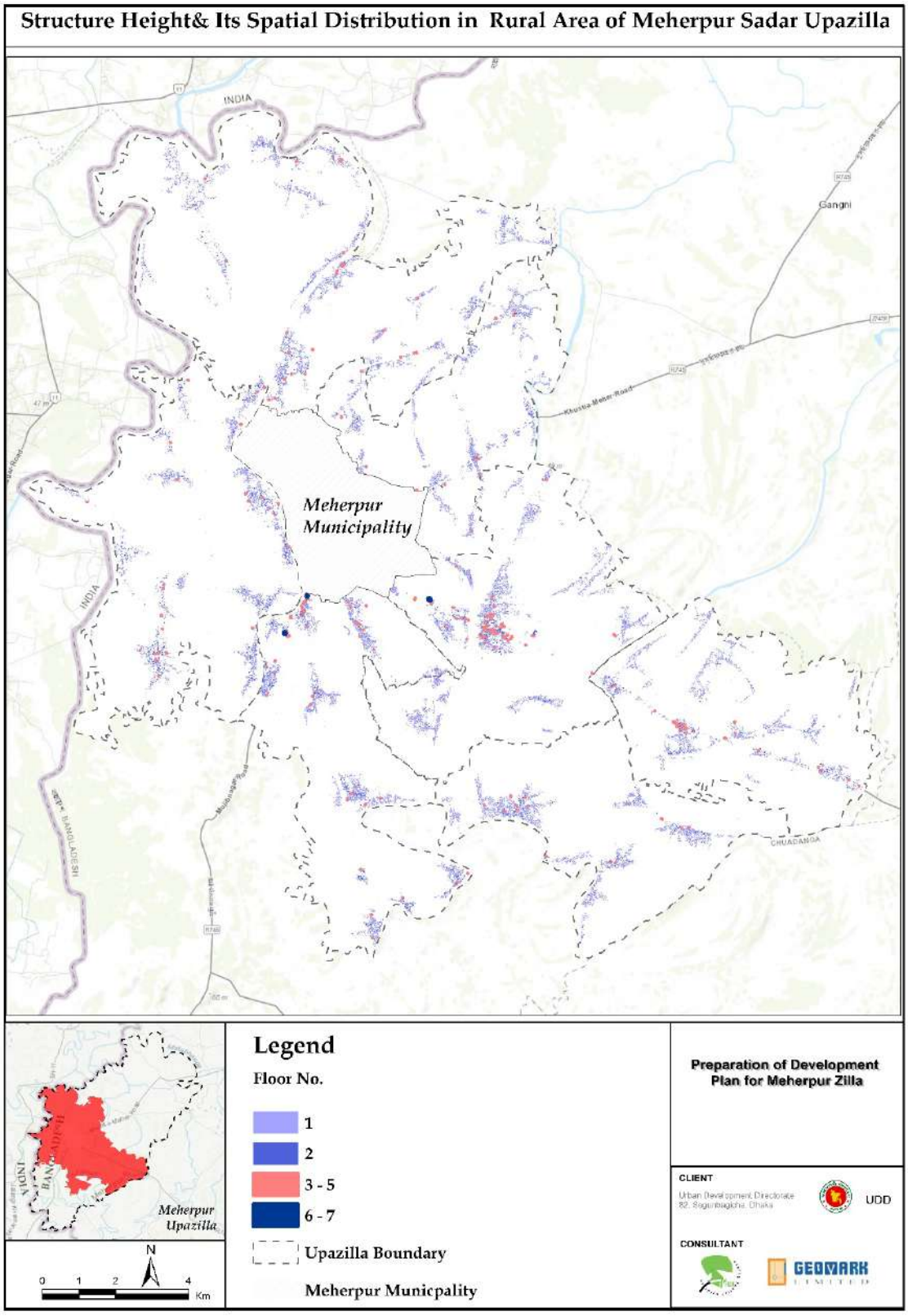

Figure 3-32: Building Height & Its spatial distribution in Meherpur Rural Area

3.2.2.2. Road Network

The total road length in the unions of Meherpur Sadar Upazila amounts to 1,012.82 km, constructed with a mix of Bituminous Carpeting (BCC), Earthen, Herringbone Brick (HBB), and Reinforced Cement Concrete (RCC) materials. Among these, Earthen roads dominate (425.18 km, 41.98%), followed by BCC roads (380.22 km, 37.54%), HBB roads (193.13 km, 19.07%), and a very small proportion of RCC roads (14.29 km, 1.41%).

Union-wise distribution shows that Kutubpur Union has the highest total road length (208.31 km), with a notable concentration of earthen roads (108.99 km). Amjhupi Union (185.09 km) and Amdah Union (160.11 km) also contain significant networks, whereas Pirojpur Union (89.31 km) and Shyampur Union (95.67 km) have the lowest total lengths but their shares of BCC are relatively lower. Besides, RCC roads almost absent across unions like Buripota (0.76 km), Kutubpur (0.71 km) and Shyampur (0.54 km). Notably Amdah union has highest share of pucca roads constructed by BCC (79.03 km) and RCC (6.61 km) materials.

Table 3-22: Road Construction Material in Meherpur Rural Area

Union	Road Construction Material				
	BCC	*Earthen*	*HBB*	*RCC*	*Grand Total*
Amdah	**79.30**	47.93	26.27	**6.61**	160.11
Amjhupi	72.61	76.92	33.39	2.18	185.09
Baradi	53.05	42.17	18.74	1.65	115.62
Buripota	44.23	70.66	43.07	0.76	158.71
Kutubpur	58.51	**108.99**	40.10	0.71	**208.31**
Pirojpur	35.46	31.32	20.68	1.84	89.31
Shyampur	37.05	47.20	10.88	0.54	95.67
Grand Total	**380.22**	**425.18**	**193.13**	**14.29**	**1012.82**

Table 3-23: Union wise Road Type in Meherpur Rural Area

Union	Road Type			
	Pucca	*Katcha*	*Semi-pucca*	*Total*
Amdah	85.91	47.93	26.27	160.11
Amjhupi	74.78	76.92	33.39	185.09
Baradi	54.71	42.17	18.74	115.62
Buripota	44.99	70.66	43.07	158.71
Kutubpur	59.22	**108.99**	40.10	208.31
Pirojpur	37.30	31.32	20.68	89.31
Shyampur	37.60	47.20	10.88	95.67
Grand Total	394.51	425.18	193.13	1012.82
Percentage	***38.95***	***41.98***	***19.07***	***100.00***

The road network across the seven unions covers a total of 1,012.82 km, of which 38.95% are Pucca (394.51 km), 41.98% are Katcha (425.18 km), and 19.07% are Semi-pucca (193.13 km). Among the unions, Kutubpur (208.31 km) has the longest road length, but more than half of it (108.99) is still Katcha, highlighting a strong need for upgradation. Amjhupi (185.09 km) also has a significant share of Katcha roads (41.5%), while Buripota (158.71 km) shows a similar trend. In contrast, Amdah (160.11 km) and Baradi (115.62 km) have relatively higher shares of Pucca roads. The smaller unions, Pirojpur

(89.31 km) and Shyampur (95.67 km), also face challenges. However, semi-pucca roads are relatively higher in Buripota (43.07 km) and lower in Shyampur (10.88 km).

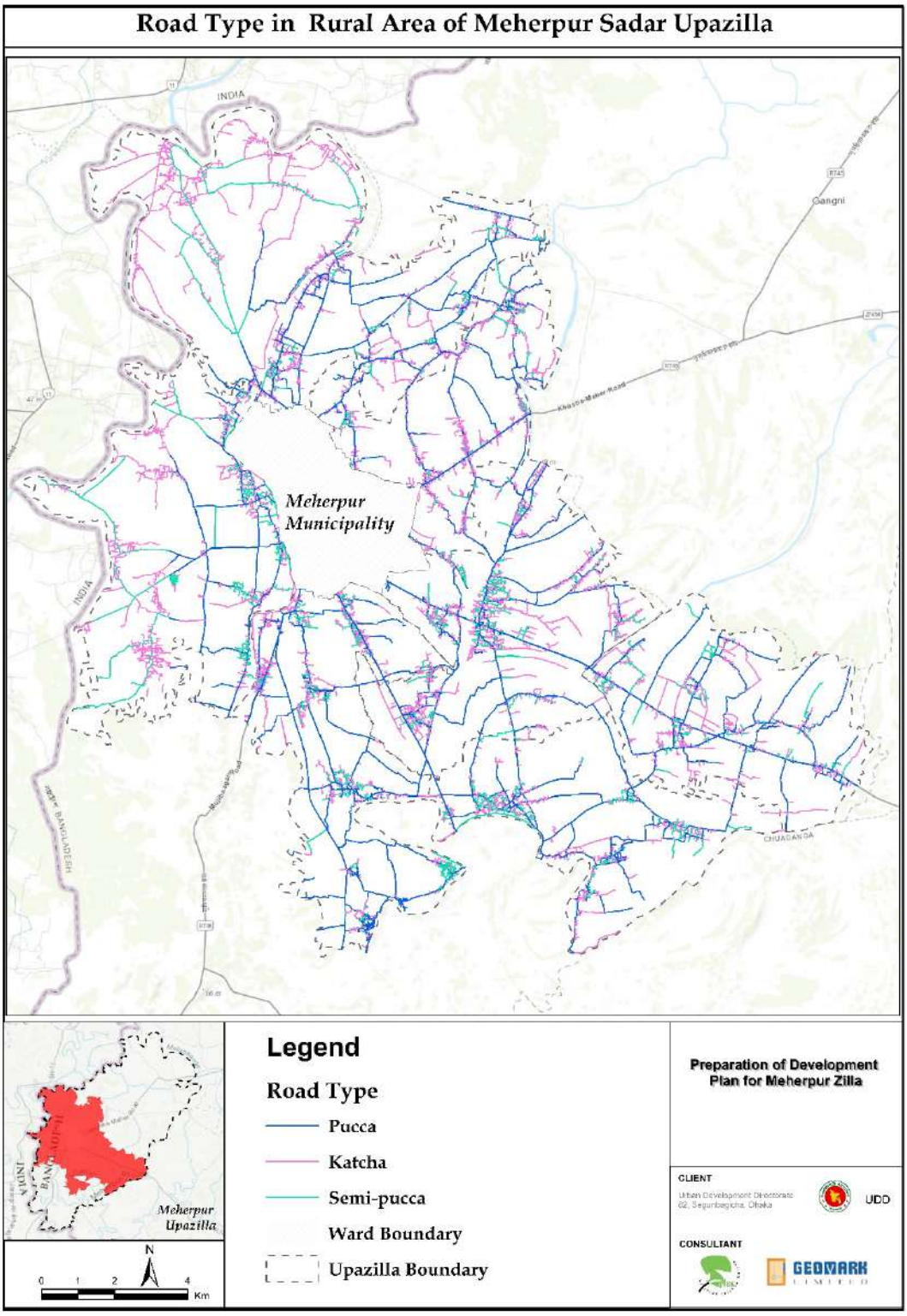

Figure 3-33: Road Type in Meherpur Rural Area

3.2.2.3. Waterbodies

The total waterbody area across all unions amounts to 3,920.24 acres, with ponds and rivers overwhelmingly dominating the landscape. Together, they cover 3,393.15 acres, representing over 86% of the total waterbody area. Specifically, rivers occupy 1,701.50 acres (43.40%), while ponds account for 1,691.65 acres (43.15%). In contrast, other categories are relatively minor in scale, such as beels (112.73 acres, 2.88%), borrow pits (0.48 acres, 0.01%), canals/khals (11.07 acres, 0.28%), dighis (217.77 acres, 5.56%), ditches (147.22 acres, 3.76%), and marshland (37.82 acres, 0.96%).

Amdah union has the largest total waterbody area with 1,436.78 acres, heavily dominated by rivers (1,199.25 acres) and ponds (130.66 acres). Amjhupi follows with 762.85 acres, where rivers (495.75 acres) and ponds (249.67 acres) are also the major contributors. Kutubpur ranks third with 580.30 acres, with a mix of ponds (471.59 acres), rivers (6.49 acres), and smaller shares of dighi, ditch, beel, and marshland. Baradi (437.75 acres) and Buripota (398.75 acres) have moderate waterbody coverage, mostly consisting of ponds and dighi. Shyampur (234.70 acres) and Pirojpur (69.12 acres) have the smallest total waterbody areas, with ponds as the dominant type in both cases.

Table 3-24: Union wise waterbody type in Meherpur Rural Area

Union	Waterbody Type-Area (Acre)								
	Beel	***Borrow pits***	***Canal/ Khal***	***Dighi***	***Ditch***	***Marshland***	***Pond***	***River***	***Grand Total***
Amdah	90.77			0.08	9.57	6.44	130.66	1199.25	1436.78
Amjhupi			0.94	0.85	14.76	0.88	249.67	495.75	762.85
Baradi				176.70	44.15		216.90		437.75
Buripota			1.76	18.96	23.43	7.75	346.85		398.75
Kutubpur	21.96	0.48	8.37	20.72	30.32	20.36	471.59	6.49	580.30
Pirojpur					15.81	1.28	52.02		69.12
Shyampur				0.46	9.17	1.11	223.96		234.70
Grand Total	**112.73**	**0.48**	**11.07**	**217.77**	**147.22**	**37.82**	**1691.65**	**1701.50**	**3920.24**
Percentage	***2.88***	***0.01***	***0.28***	***5.56***	***3.76***	***0.96***	***43.15***	***43.40***	***100.00***

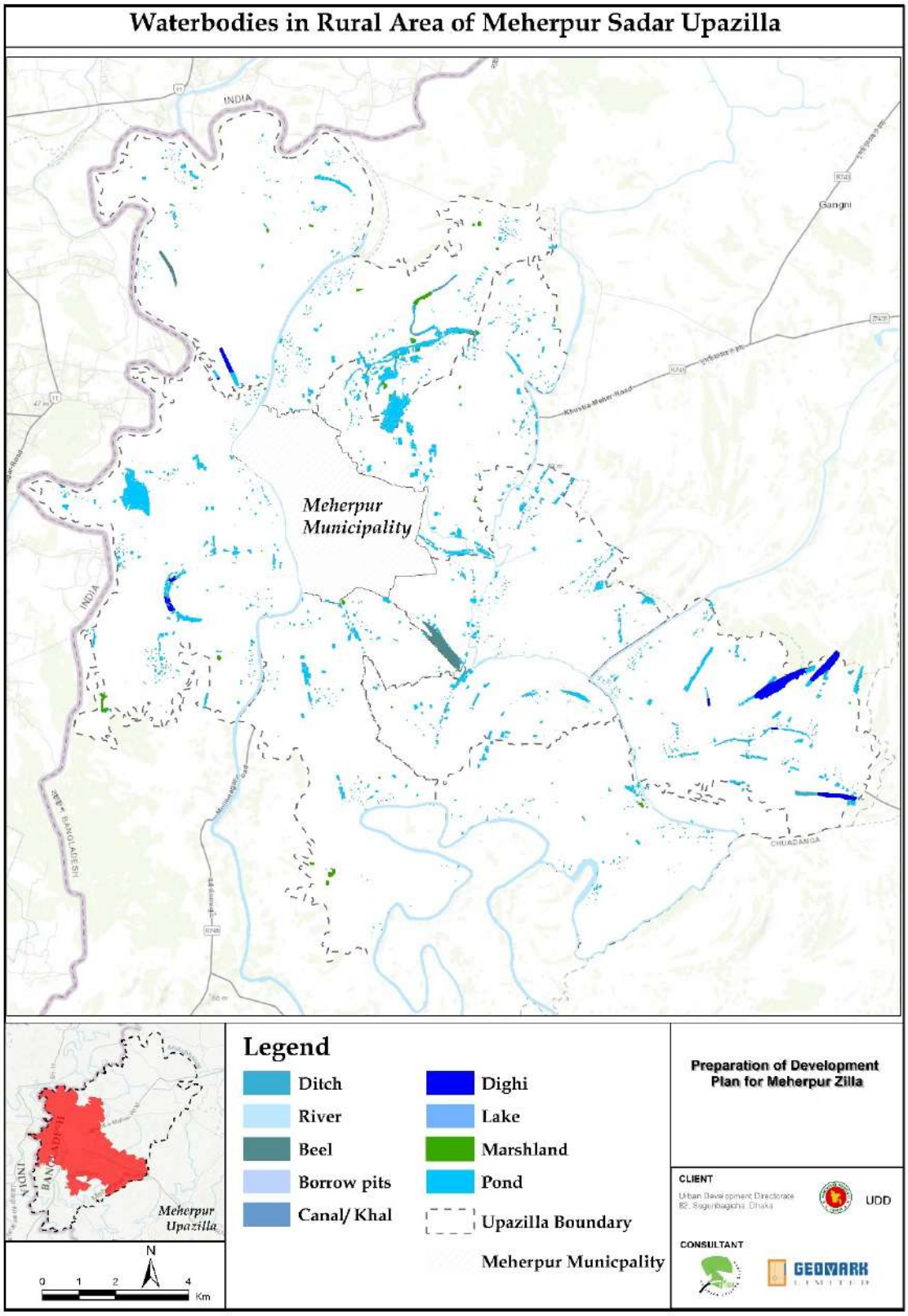

Figure 3-34: Distribution of waterbodies in Meherpur Rural Area

3.2.3. Mujibnagar Upazila

3.2.3.1. Structure Type, Use & Building Height

Across the four unions, Bagoan, Dariapur, Mahajanpur, and Monakhali, a total of 70,412 structures have been identified, distributed across different uses. The overwhelming majority are residential, with 41,174 units making up nearly 59% of the total area. The next largest category is other structures, accounting for 24,095 units or about 34.22%. Smaller but notable shares include mixed-use structures with 1,210 units (1.72%) and service activity structures with 1,179 units (1.67%). Commercial use is limited to 912 units, about 1.3 percent of the total, while community service and education & research facilities are very few, together contributing less than 1%. Administrative/public service (0.03%), industry (0.24%), transportation and communication (0.06%), and agriculture-related structures (0.24%) are almost negligible in proportion. A further 1,001 structures (about 1.42%) are under construction, indicating ongoing development.

At the union level, Bagoan has the largest number of structures (19839). Whereas, Monakhali has the largest residential concentration with 10,729 houses, while Bagoan stands out for its high number of other structures (8,330). Dariapur and Mahajanpur show similar patterns, with strong residential dominance and a modest share of mixed and service activities.

Table 3-25: Composition of structure use in Mujibnagar upazila

Union Name	Structure Use												
	Administrative/ Public Service	*Agriculture*	*Commercial*	*Community Service*	*Education and Research*	*Industry*	*Mixed Use*	*Other Structure*	*Residential*	*Service Activity*	*Transportation and Communication*	*Under Construction*	*Total*
Bagoan	11	36	318	80	94	55	401	9774	8330	394	20	326	19,839
Dariapur	4	28	249	51	39	45	266	10290	5194	201	5	195	16,567
Mahajanpur	3	15	191	47	43	47	272	10381	4993	324	7	210	16,533
Monakhali	2	92	154	37	49	23	271	10729	5578	260	8	270	17,473
Total	**20**	**171**	**912**	**215**	**225**	**170**	**1210**	**41,174**	**24,095**	**1179**	**40**	**1001**	**70,412**
Percentage	***0.03***	***0.24***	***1.30***	***0.31***	***0.32***	***0.24***	***1.72***	***58.48***	***34.22***	***1.67***	***0.06***	***1.42***	***100***

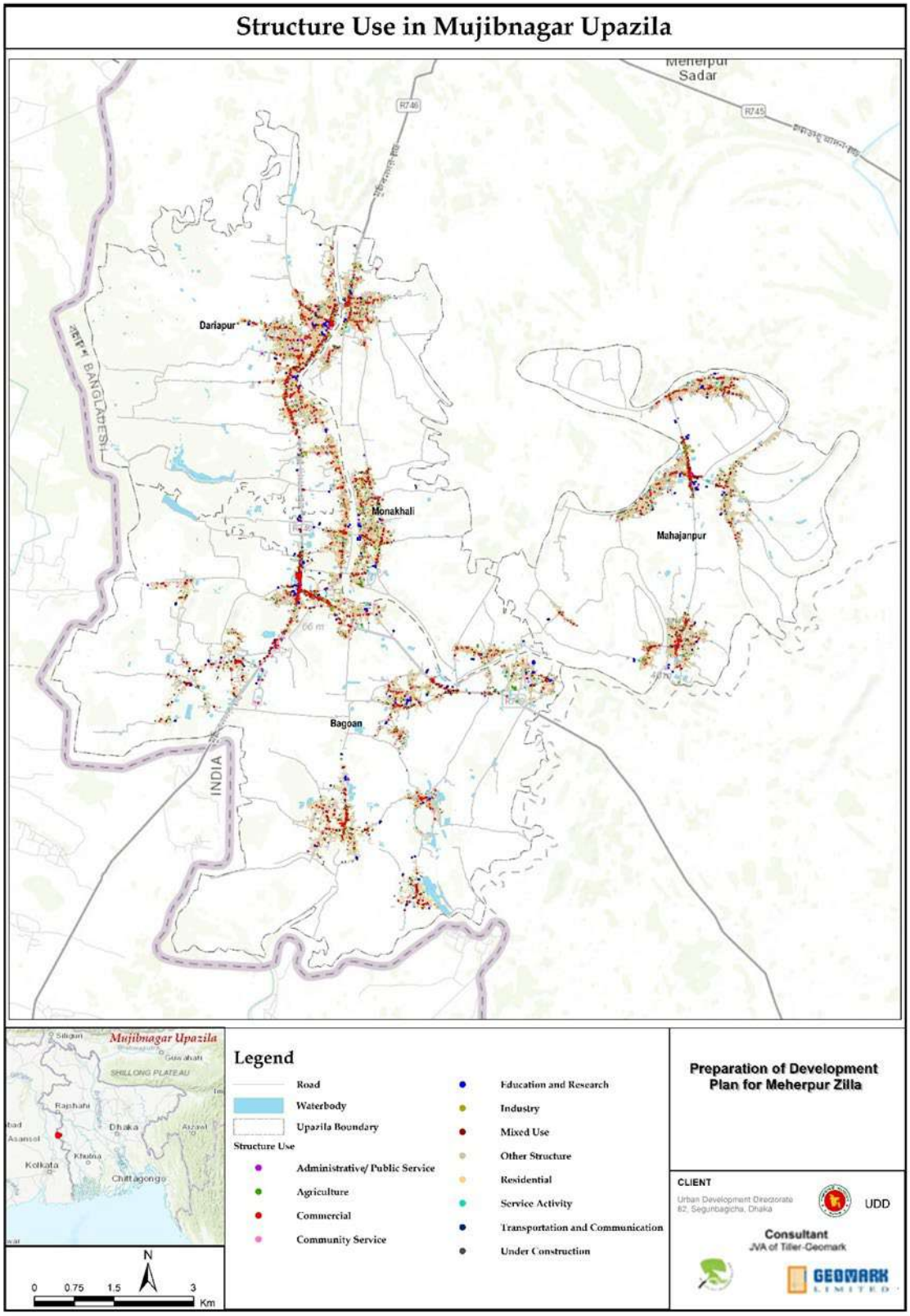

Figure 3-35: Spatial Distribution of Structure Use in Mujibnagar Upazila

Table 3-26: Structure Type in Mujibnagar upazila

Union Name	Structure Type					
	Katcha	*Pucca*	*Semi Pucca*	*Steel*	*Tinshed*	*Grand Total*
Bagoan	1854	6565	5469	5	5946	19,839
Dariapur	1512	5131	5007	2	4915	16,567
Mahajanpur	1145	6006	3549	1	5832	16,533
Monakhali	2314	5573	5004	2	4580	17,473
Grand Total	**6825**	**23,275**	**19,029**	**10**	**21,273**	**70,412**
Percent	***9.69***	***33.06***	***27.03***	***0.01***	***30.21***	***100***

For the purpose of comparative analysis, data on building structures have been categorized into five types: Pucca, Semi-pucca, Tinshed, Katcha, and Steel. The analysis reveals that Pucca structures dominate in all unions, totalling about 33.06 % of overall structures, followed by Tinshed 30.21%, Semi-pucca structures 27.03%, and Katcha 9.69%. While Steel structures are extremely limited, with only 10 recorded across the study area.

Among the unions, Bagoan has the highest number of total structures (19,839), with a predominance of Pucca houses (6,565) and Tinshed houses (5,946). In Dariapur, the total number of structures is 16,567, where Pucca (5,131) and Semi-pucca (5,007) houses are almost equally significant, along with a large share of Tinshed (4,915). Mahajanpur Union records a total of 16,533 structures, with Pucca houses (6,006) forming the highest share, closely followed by Tinshed (5,832). Monakhali Union, on the other hand, contains 17,473 structures, led by Pucca houses (5,573) and Semi-pucca houses (5,004), while Tinshed houses (4,580) also constitute a considerable portion.

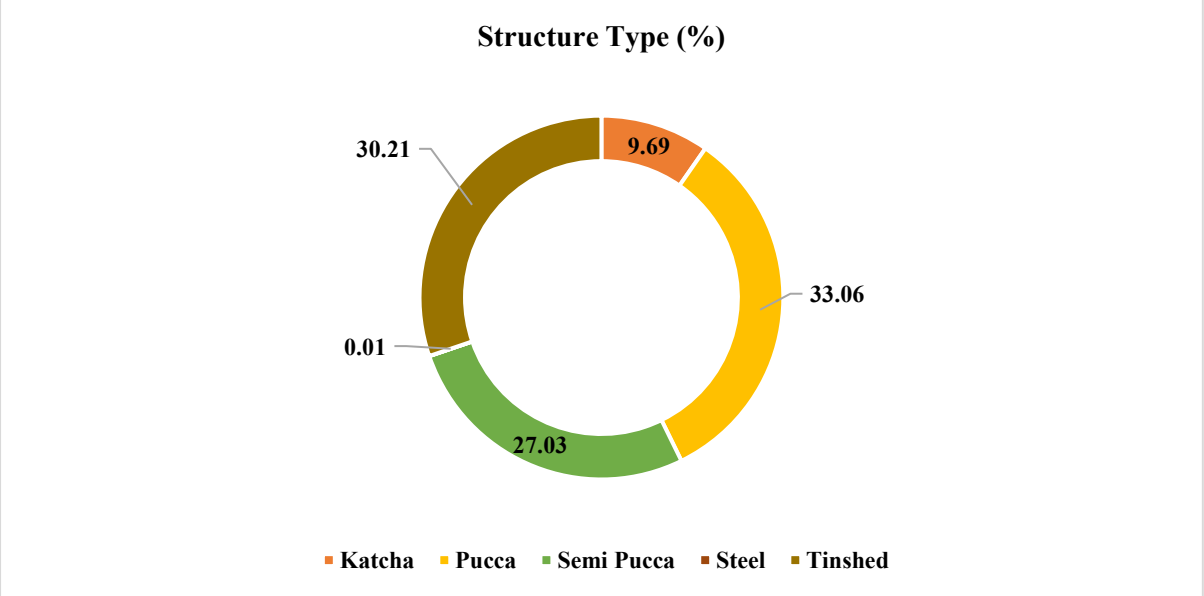

Figure 3-36: Structure Type in Mujibnagar upazila

Overall, the study area comprises 70,412 structures, of which Pucca houses account for the largest share (23,275), followed by Tinshed (21,273) and Semi-pucca houses (19,029). Katcha houses (6,825) form a smaller proportion of the total, while Steel structures remain negligible. This distribution indicates that while permanent and semi-permanent housing types dominate, traditional Katcha structures still exist in notable numbers across all unions.

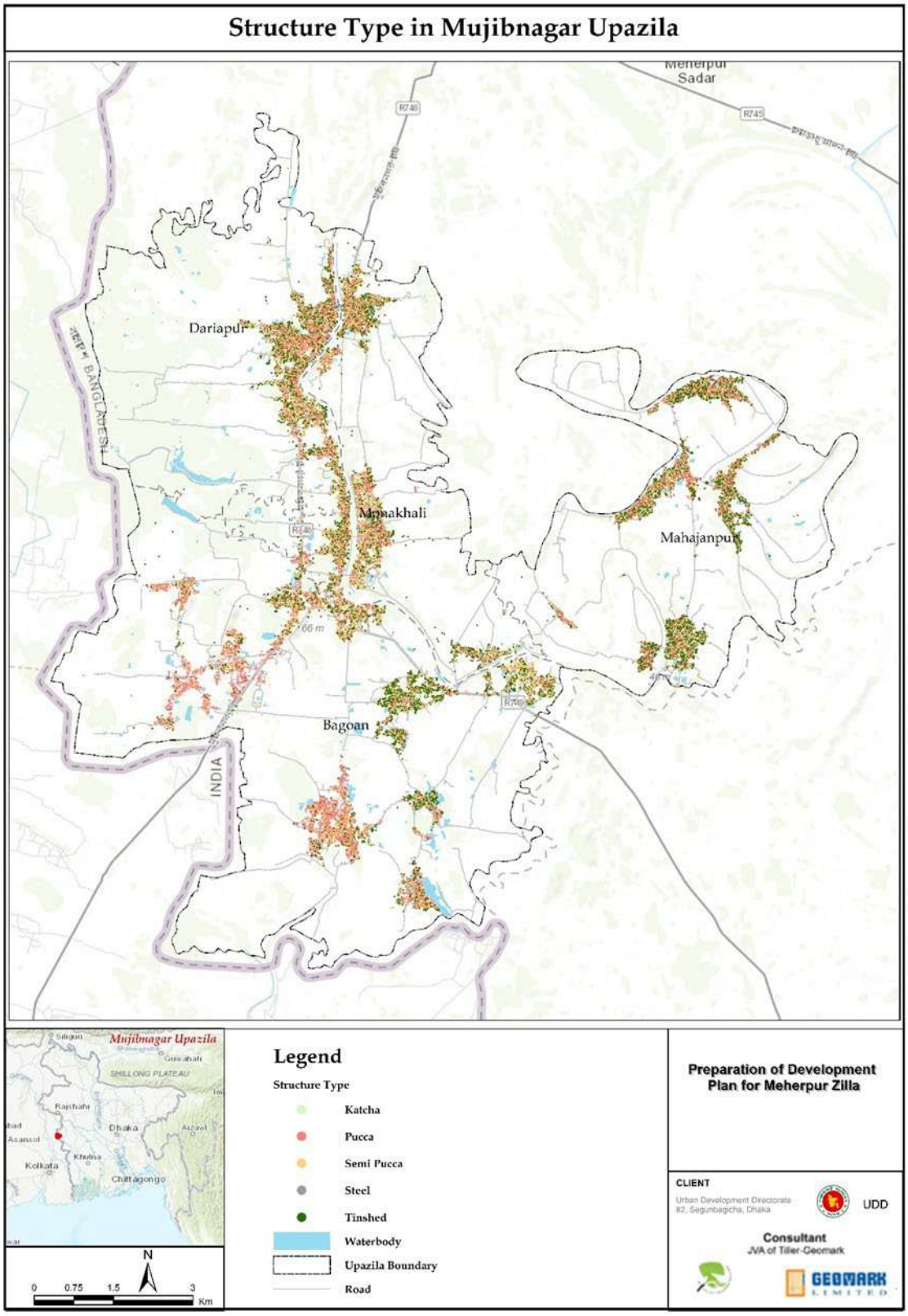

Figure 3-37: Structure Type Map of Mujibnagar Upazila

The building patterns across the four unions is overwhelmingly single-storey, with 67,466 units, making up nearly 95.82% of all structures. Multi-storey buildings are rare, highlighting a predominantly low-rise settlement pattern. Two-storey structures make up the next largest category, with 2,791 units or just under 4 percent. Three-storey buildings are very limited, only 116 units (0.16%), while four- and five-storey buildings are almost negligible, together totaling 39 units, less than 0.1 percent of the overall structures.

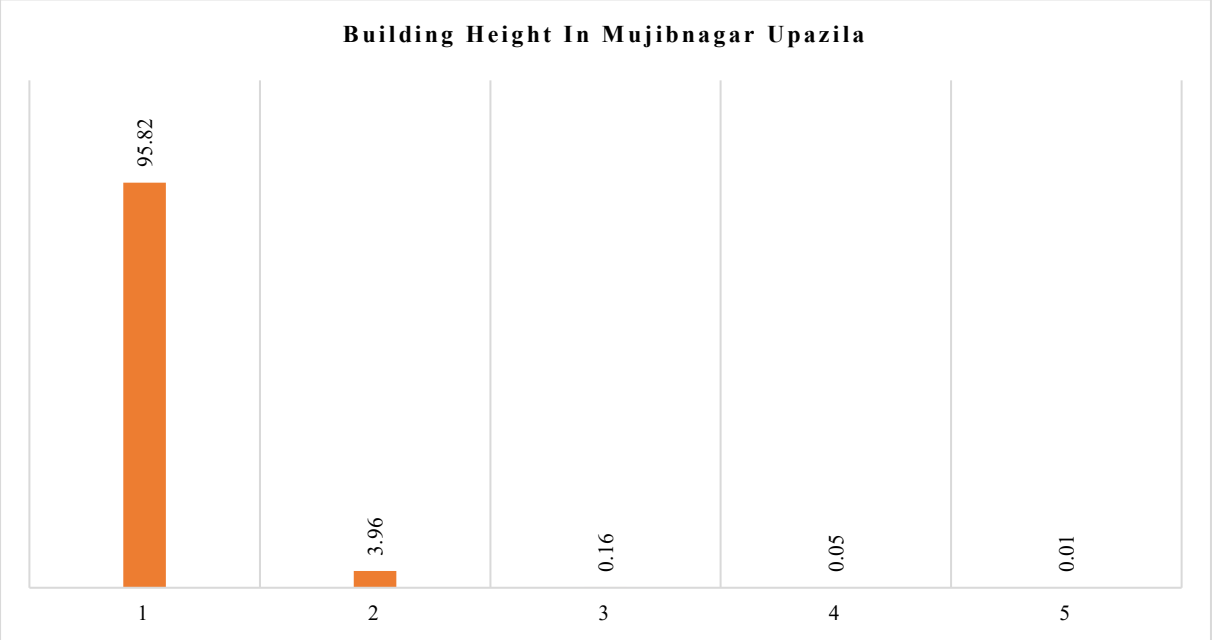

Figure 3-38: Building Height (percentage) in Mujibnagar Upazila

At the union level, Bagoan has the highest number of one-storey buildings (18,918), followed by Monakhali (16,868), Dariapur (15,879), and Mahajanpur (15,801). Higher-rise buildings (3–5 floors) are scattered in small numbers. Notably, five-storey buildings are present in each union, with Monakhali having the highest count of 3 such structures, while the others contain only one each.

Table 3-27: Building Height in Mujibnagar Upazila

Union Name	Floor No.					
	1	*2*	*3*	*4*	*5*	*Grand Total*
Bagoan	18,918	858	43	19	1	19,839
Dariapur	15,879	665	19	3	1	16,567
Mahajanpur	15,801	696	31	4	1	16,533
Monakhali	16,868	572	23	7	3	17,473
Grand Total	**67,466**	**2791**	**116**	**33**	**6**	**70,412**
Percentage	***95.82***	***3.96***	***0.16***	***0.05***	***0.01***	***100.00***

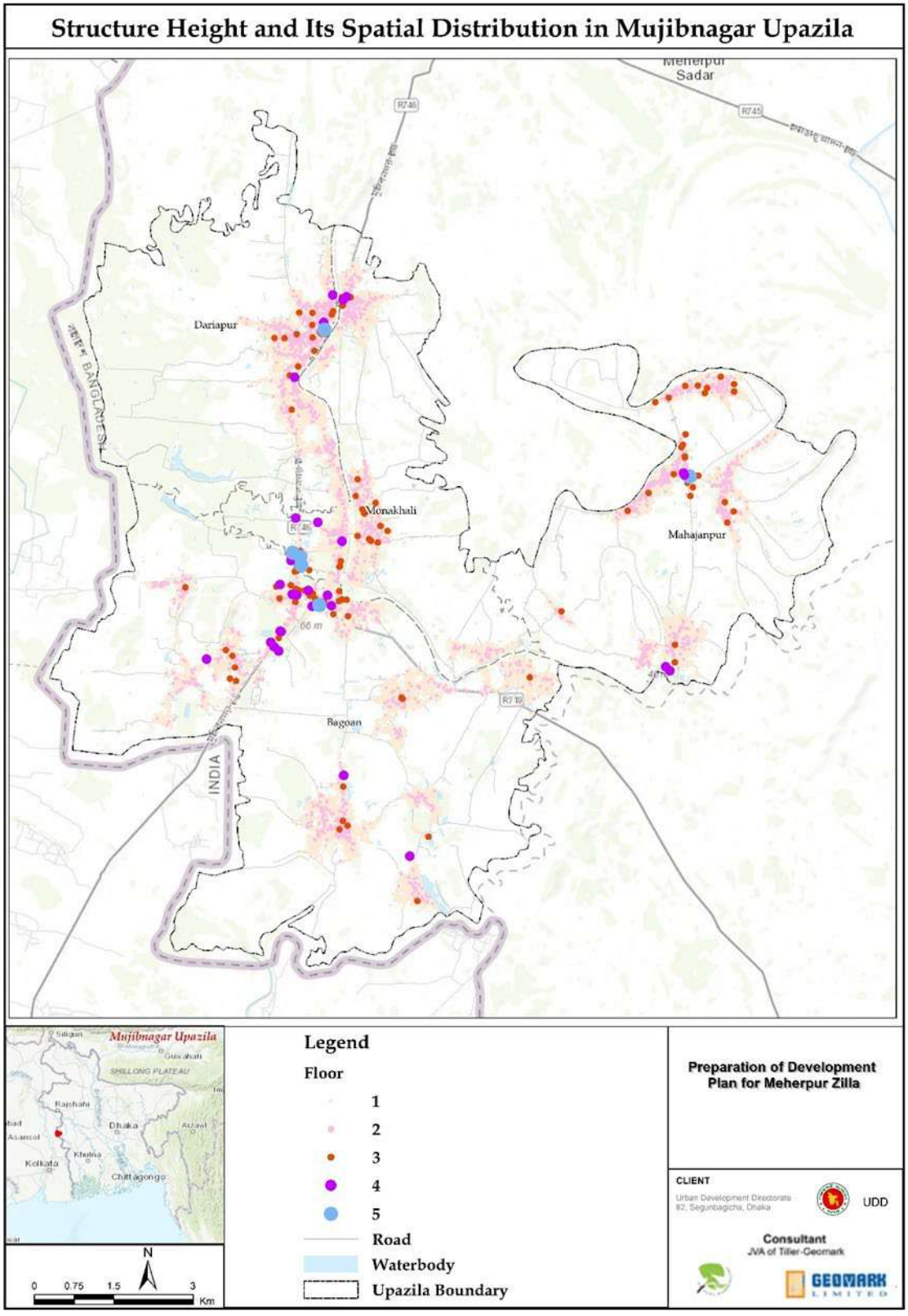

Figure 3-39: Building height and its spatial distribution in Mujibnagar upazila

3.2.3.2. Road Network

The combined road network across the four unions measures 453.07 km in length. Most roads fall within the 8–11 ft range, totaling 209.44 km and accounting for about 46.23% of the network. The second most common category is roads less than 8 ft wide, which extend 156.70 km or nearly 34.59 % of the total. Together, these narrow roads represent more than four-fifths of the overall network, reflecting a strong dominance of small roads. Roads with widths between 11.01–16 ft cover 61.65 km (13.61%), while wider roads between 16.01–38 ft are very limited at 25.27 km, making up just 5.58% of the total road network.

At the union level, Bagoan has the largest road coverage (169.57 km), dominated by 8–11 ft wide roads (87.52 km) also benefitting from the highest share (22.23 km) of wider 16.01- 38 ft roads. Mahajanpur follows with 109.22 km, showing a relatively higher share of 11–16 ft wide roads (19.16 km) and 2.54 km in the widest category. Dariapur (85.05 km) and Monakhali (89.23 km) both have smaller networks, with extremely limited coverage in the wider road categories. These wider roads, however, play a critical role as potential arterial and connector roads., while the two unions have only marginal lengths, Dariapur with just 0.40 km, and Monakhali with a mere 0.11 km. This imbalance shows that wider roads are concentrated in Bagoan, while the rest of the unions are largely underserved in terms of high-capacity road infrastructure.

Table 3-28: Exiting Road width scenario in Mujibnagar upazila

Union Name	Road Width				
	< 8	*8 - 11*	*11.01 - 16*	*16.01 - 38*	*Total*
Bagoan	46.89	87.52	12.93	22.23	169.57
Dariapur	27.71	42.08	14.86	0.40	85.05
Mahajanpur	44.82	42.69	19.16	2.54	109.22
Monakhali	37.27	37.15	14.70	0.11	89.23
Grand Total	**156.70**	**209.44**	**61.65**	**25.27**	**453.07**
Percentage	***34.59***	***46.23***	***13.61***	***5.58***	***100***

Table 3-29: Road Construction material in Mujibnagar upazila

Union Name	Construction Material				
	Bituminous Carpeting	*Earthen*	*Herring-Bone-Bond*	*Reinforced Cement Concrete*	*Grand Total*
Bagoan	88.26	42.16	31.70	7.44	169.57
Dariapur	29.63	28.19	26.55	0.67	85.05
Mahajanpur	52.86	32.55	22.64	1.16	109.22
Monakhali	29.15	31.10	23.40	5.59	89.23
Grand Total	**199.91**	**134.01**	**104.29**	**14.86**	**453.07**
Percentage	***44.12***	***29.58***	***23.02***	***3.28***	***100.00***

The total road length across the four unions is 453.07 km, constructed with a mix of materials. The majority of the network is bituminous carpeting, covering 199.91 km or about 44.12% of the total. This indicates a relatively high standard of paved roads compared to many rural areas. The second most

common type is earthen/ katcha roads, measuring 134.01 km or about 29.58%, Herring-Bone-Bond (HBB) roads make up 104.29 km indicating that semi-pucca roads cover nearly 23.02%. Reinforced Cement Concrete (RCC) roads, though the most durable, are very limited, totaling 14.86 km or just over 3.28% reflecting that pucca roads comprising nearly 47.70% of the overall road network

At the union level, Bagoan has the most extensive paved network with 88.26 km of bituminous carpeting, along with a significant share of earthen (42.16 km) and HBB (31.70 km) roads. Mahajanpur shows a similar pattern, with 52.86 km of bituminous roads and 32.55 km of earthen roads. Dariapur and Monakhali both have smaller networks, but Monakhali stands out for its 5.59 km of RCC roads, the highest among all unions, while Dariapur lags behind with only 0.67 km of RCC.

Table 3-30: Road Condition in the unions of Mujibnagar upazila

Union Name	Road Condition			
	Pucca	***Katcha***	***Semi-pucca***	***Total***
Bagoan	95.71	42.16	31.70	169.57
Dariapur	30.30	28.19	26.55	85.05
Mahajanpur	54.02	32.55	22.64	109.22
Monakhali	34.74	31.10	23.40	89.23
Grand Total	**214.77**	**134.01**	**104.29**	**453.07**
Percentage	***47.40***	***29.58***	***23.02***	***100.00***

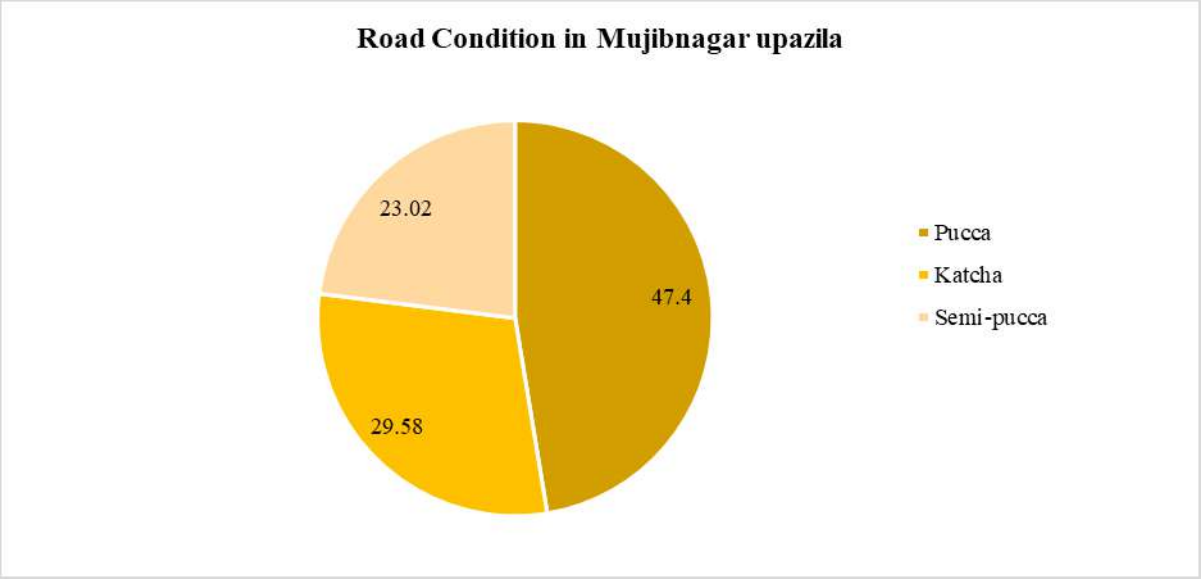

Figure 3-40: Road Condition in Mujibnagar upazila

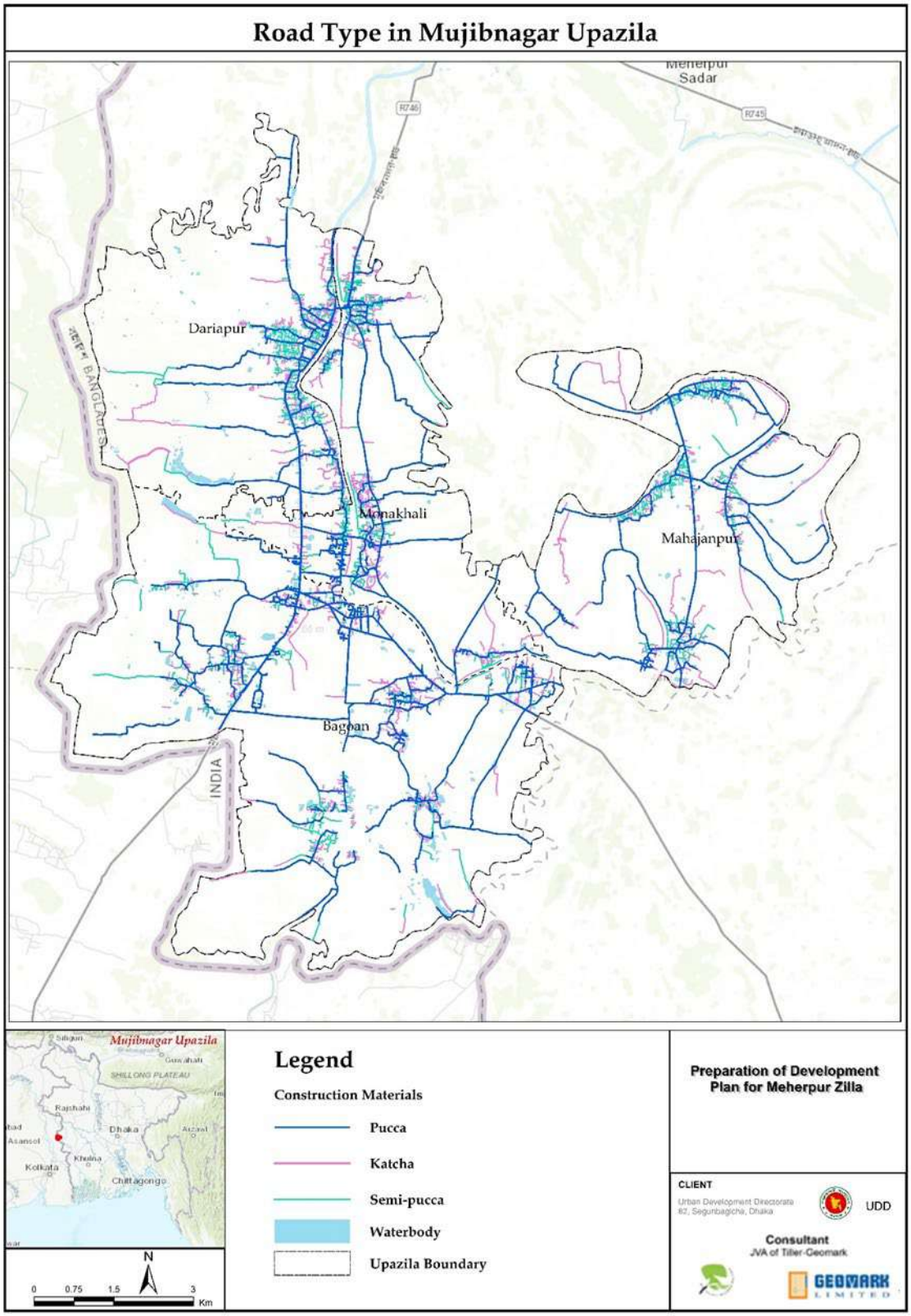

Figure 3-41: Road Type in Mujibnagar upazila

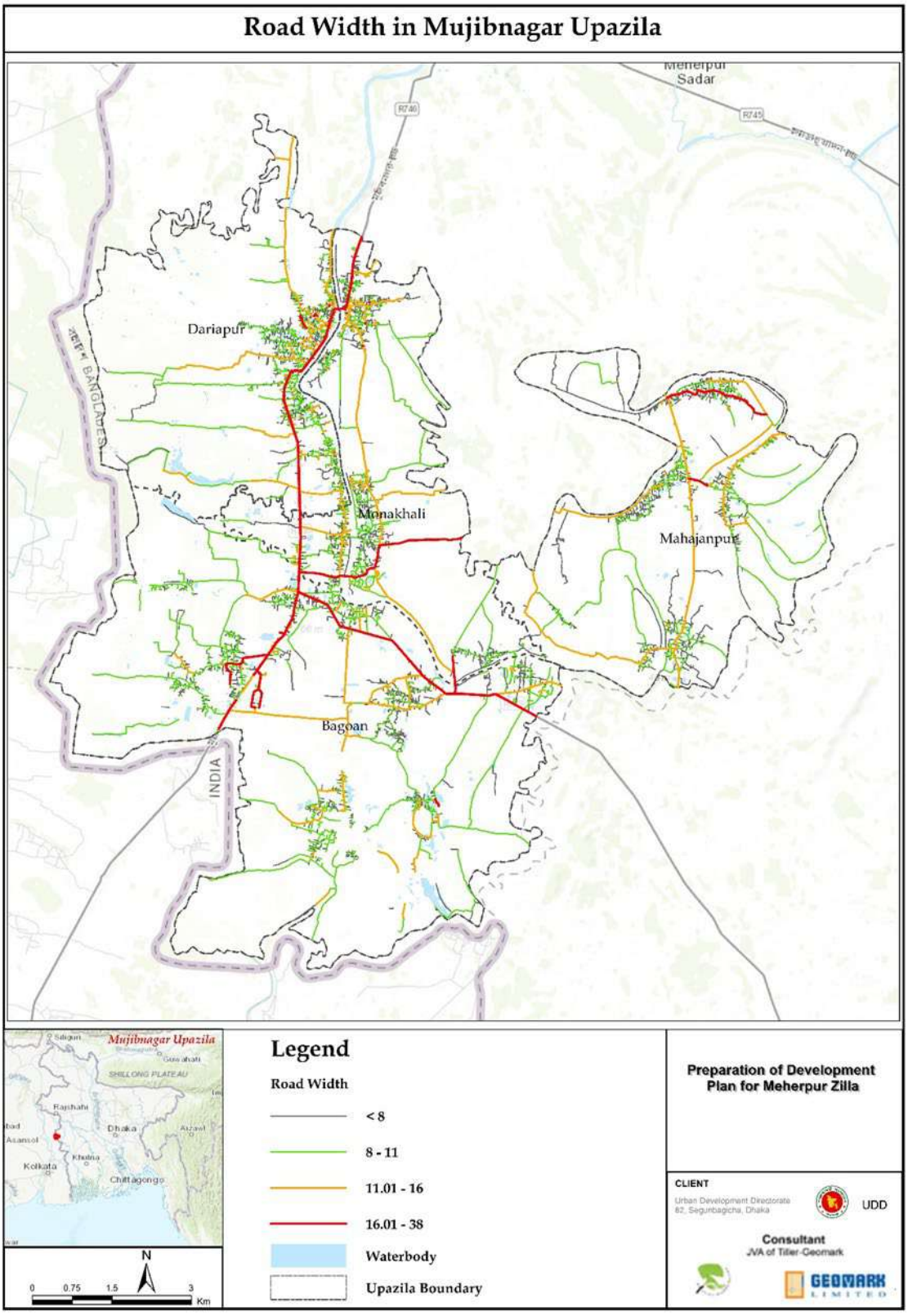

Figure 3-42: Road Width in Mujibnagar upazila

3.2.3.3. Waterbodies

The total waterbody area across the four unions amounts to 1203.58 acres, with ponds being the second most dominant feature, covering 349.02 acres (approximately 29% of the total). The majority of these ponds are concentrated in Bagoan Union. Ditches are the next largest category after river and pond, occupying 99.40 acres or about 8.25% having the largest share in Dariapur union. Dighis and marshlands are very limited, together accounting for only 6.6 acres or just under 0.55% of the total waterbody area. Marshlands are particularly scarce, at 1.56 acres (0.13%), suggesting limited natural wetland areas within the unions.

Table 3-31: Waterbody Type in Mujibnagar Upazila

Union Name	Waterbody Type					
	Dighi	***Ditch***	***Marshland***	***Pond***	***River***	***Grand Total***
Bagoan	0.03	33.54		195.03	38.745	267.35
Dariapur	0.61	51.29	1.28	66.40	46.36	165.94
Mahajanpur	1.44	10.67	0.27	47.27	470.30	529.95
Monakhali	2.96	3.90		40.32	193.17	240.35
Grand Total	**5.04**	**99.40**	**1.56**	**349.02**	**748.57**	**1203.58**
Percentage	***0.42***	***8.26***	***0.13***	***29.00***	***62.20***	***100.00***

At the union level, Bagoan has the largest total waterbody area (228.60 acres), mainly due to its extensive pond coverage (195.03 acres). Dariapur follows with 119.58 acres, showing a more balanced distribution between ponds (66.40 acres) and ditches (51.29 acres). Mahajanpur (59.65 acres) and Monakhali (47.18 acres) have smaller waterbody areas, with Monakhali having slightly more dighis (2.96 acres) relative to other unions.

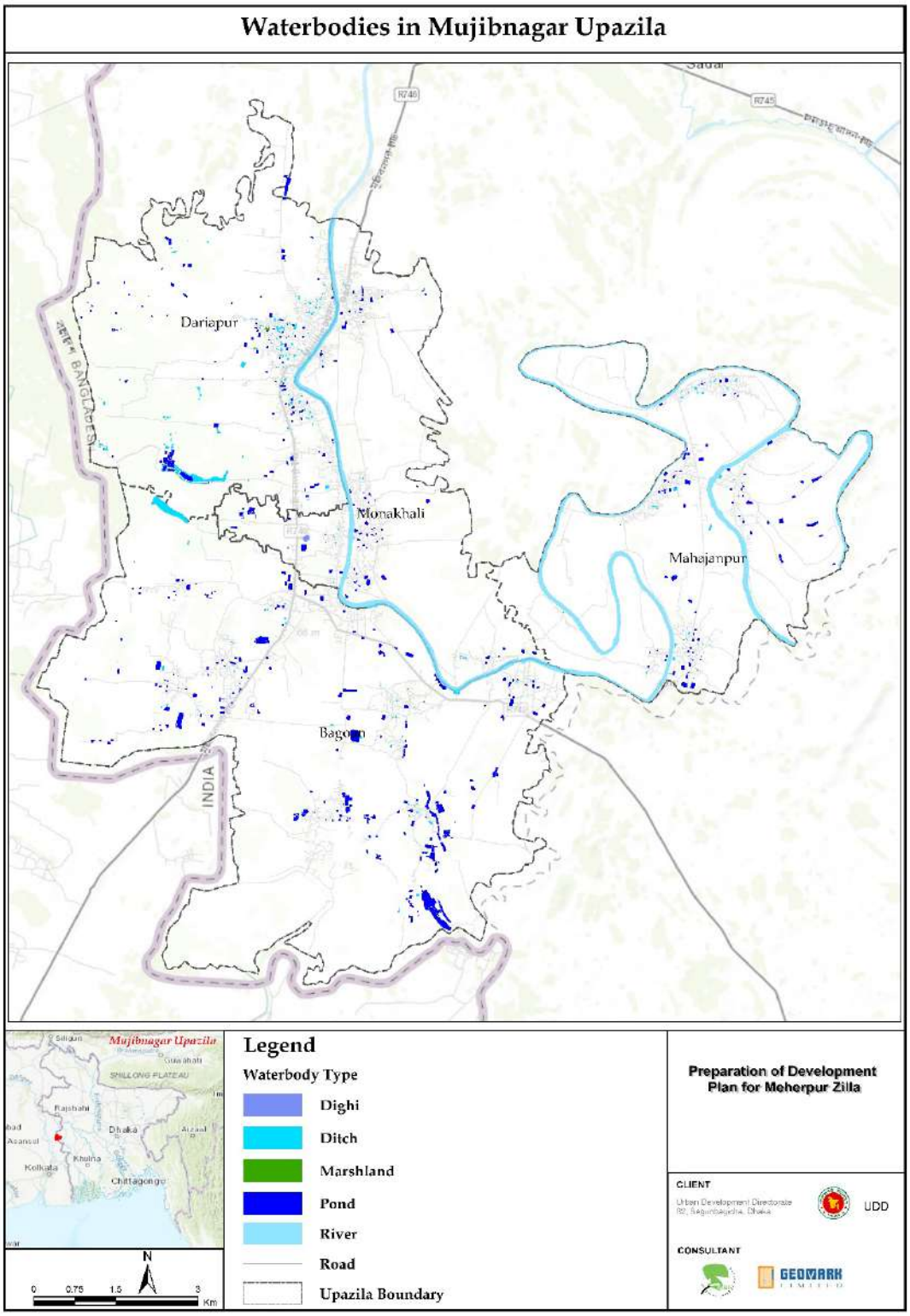

Figure 3-43: Spatial Distribution of waterbodies in Mujibnagar upazila

CHAPTER 4: CONCLUSION

The survey phase has successfully documented the existing physical, topographic, and land use conditions of Meherpur District through modern techniques, including UAV-based mapping, DEM preparation, and GIS integration. The findings underline the dominance of low-rise residential structures, limited vertical growth, narrow road networks, uneven healthcare distribution, and constrained open spaces.

Overall Observations:

- **Housing:** Single-storied and semi-permanent structures dominate, reflecting socio-economic patterns.
- **Infrastructure:** Road networks are mostly narrow; drainage and waterbody management are crucial for flood mitigation.
- **Water Resources:** Ponds and rivers dominate surface water
- **Elevation & Flood Risk:** Central wards in municipalities are better suited for dense settlements, while low-lying areas remain vulnerable to seasonal flooding.
- **Development Potential:** Central and higher-elevation wards are well-suited for commercial and institutional development, whereas low-lying areas require climate-resilient planning.

This UAV based physical feature survey establishes a comprehensive spatial database that will guide the formulation of Structure, Urban, and Rural Area Plans under the Meherpur Zilla Development Plan Project. The outputs not only provide an accurate portrayal of the current urban and rural landscape but also identify critical gaps in infrastructure, services, and land management. By leveraging this evidence-based foundation, planners and policymakers can develop targeted strategies to promote resilient urban growth and sustainable resource management in Meherpur District.